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Groundwater Remedial Investigation Report

Volume 3: Technical Appendixes

Reynolds Metals Company
TROUTDALE FACILITY

CH2MHILL

June 1999

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Contents

Volume 1	Technical Report
Volume 2	Figures
Volume 3	**Technical Appendixes**

Volume 3: Technical Appendixes

A South Plant Groundwater/Surface Water Interaction
B Summary of 1998 Field Data Collection at South Landfill, Scrap Yard, and East Potliner
C Onsite Well Logs
D Oregon Water Resources Department Well Logs for Offsite Water Supply Wells
E Summary of Analytical Data
F Water Level Response at the RMC Site to Pumping at the City of Portland's Columbia South Shore Wellfield
G Fluoride Transport Assessment at the RMC Site

APPENDIX A

South Plant Groundwater/Surface Water Interaction

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APPENDIX A

Groundwater/Surface Water Interaction in the South Plant Area

A.1 Introduction

This appendix summarizes an analysis of the interaction between groundwater and each of four surface water features located in the South Plant area: Salmon Creek, south wetlands, west South Ditch, and south landfill, including adjoining surface water depressions to the southwest. (See Figure A-1 for the locations of these surface water features.) Evaluation of groundwater/surface water relationships in the South Plant area was performed in partial fulfillment of data needs identified in the *Draft South Wetlands Addendum to the RI/FS Work Plan* (CH2M HILL, May 8, 1996). Data needs identified in the south wetlands addendum and addressed in this appendix include:

- Refinement of our understanding of groundwater/surface water interactions in case a containment alternative is considered
- Expansion of the conceptual model to include groundwater/surface water interactions (vertical gradients)
- Evaluation of shallow flow characteristics (vertical and horizontal) in the south wetlands vicinity

Previous documents have described groundwater/surface water interactions for Salmon Creek and South Ditch.[1] This appendix focuses on groundwater/surface water interactions in the area shown in Figure A-1 from south landfill west to Salmon Creek and West Drainage.

The appendix is organized as follows:

- A.2: A summary of the conclusions generated from this analysis
- A.3: A summary of the approach that was used to evaluate groundwater/surface water interactions
- A.4: Summary discussions of the hydrologic setting, including descriptions of surface water features and the groundwater flow system in the South Plant area
- A.5: Hydraulic analyses of groundwater/surface water interactions

[1] For a detailed analysis of south wetlands interactions with Salmon Creek and the extent and quality of groundwater moving to offsite areas such as Salmon Creek, refer to *Draft Surface Water and Sediment Areas Addendum to the RI/FS Work Plan* (CH2M HILL, April 3, 1998). Appendix E of this same document focuses on the reach of Salmon Creek extending from Graham Road to the southeast corner of Fairview Farms. For a detailed description of groundwater/surface water interaction along South Ditch, refer to *Technical Memorandum DS No. 18: Data Summary for the Wastewater Discharge Areas Addendum to the RI/FS Work Plan, Part 2*, Attachment A (CH2M HILL, June 17, 1998).

A.2 Summary of Conclusions

Summarized below are conclusions generated from the evaluation of water level monitoring data collected in the South Plant area to assess groundwater/surface water interactions. These data indicate that interactions between surface water and groundwater are as follows:

- Groundwater contour maps suggest that shallow groundwater in the vicinity of south landfill flows westerly towards south wetlands during the dry season. However, stratigraphic data and differences in seasonal water levels trends between monitoring wells at south landfill and south wetlands indicate that there may be limited hydraulic connection and therefore limited groundwater movement between the two areas.
- Silt unit groundwater is recharged by Salmon Creek throughout most of the year, as indicated by comparisons of surface water stage data at staff gage SG08 and groundwater elevation data at MW18-016.
- There appears to be poor hydraulic connection between the groundwater in the upper gray sand (UGS) and the South Plant surface water bodies, which only partially penetrate the silt unit. Groundwater levels decline more quickly and substantially in the UGS than in the silt unit during the dry season.

A.3 Evaluation Approach

Interactions between surface water and groundwater in the South Plant area were evaluated using hydraulic information. Groundwater elevations in South Plant area monitoring wells were compared with surface water elevations in South Ditch (at the South Ditch pump station and at staff gauges SG03, SG04, SG05), south wetlands (staff gauge SG06), and Salmon Creek (staff gauge SG08). Horizontal and vertical gradients were calculated to estimate rates and directions of flow.

A.4 South Plant Area Hydrologic Setting

The four surface water features in the South Plant area are shallow systems that partially penetrate the uppermost soils of the surficial geologic unit at the site (the silt unit, described in Volume 1, Section 3 of this report). The four surface water features and the hydrology of the groundwater system are summarized in the subsections that follow.

A.4.1 Surface Water Features

A.4.1.1 South Ditch

South Ditch is the primary surface water drainage feature for the portion of the RMC facility that lies east and northeast of south wetlands. South Ditch is a manmade ditch that conveys stormwater, seasonal groundwater seepage, and facility wastewater. The ditch extends from the open area north and east of the plant site [just inside the U.S. Army Corps of Engineers (COE) dike] to an elevation-activated pump station located near the southwestern corner of the plant. The pump station discharges to Company Lake via an underground pipeline. East South Ditch primarily carries surface water runoff and groundwater seepage during seasonal high water table conditions for only a portion of the year, then goes dry. In

contrast, west South Ditch remains wet year-round because it receives permitted wastewater discharges.

A.4.1.2 Salmon Creek

Salmon Creek is a former natural waterway that has been rerouted several times and is now dredged and controlled by the Sandy Drainage Improvement Company for flood control. It flows along a section of the southwest border of the RMC property and is pumped into the Columbia River from an equalization pond west of Fairview Farms.

Salmon Creek water quality may be affected by urban, industrial, and Troutdale Airport stormwater, by groundwater, and by past and current discharges from RMC. Salmon Creek provides conveyance for parts of the City of Troutdale, the City of Wood Village, and the City of Fairview. The creek also receives stormwater runoff from the south wetlands via the West Drainage on RMC property and shallow groundwater discharge.

A.4.1.3 Ponded South Landfill Surface Water Depressions

South landfill is a flat, poorly vegetated area located southwest of the scrap yard and south of the bakehouse. The boundaries of the landfill are generally defined by a lack of vegetation and by the presence of debris. Stormwater infiltrates to shallow groundwater or drains via surface runoff to the south or west. Surface water collecting in depressions to the west and south of the landfill may percolate into shallow groundwater or enter south wetlands via the old Salmon Creek channel.

A.4.1.4 South Wetlands

The south wetlands area (including West Drainage) is located east of south landfill and immediately to the south and southwest of west South Ditch (see Figure A-1). South wetlands is a depression that was used as a wastewater settling basin from 1941 to 1965. Evidence of this former practice is found throughout much of the area in the form of a gray to charcoal colored layer of process residue that is present at the ground surface and was deposited as the wastewater settled. As shown in Figure A-1, the northern two-thirds of the wetlands is owned by RMC and the Port of Portland owns the southern third.

Today, surface water is present in south wetlands only during the rainy season (from late fall or early winter through approximately June or early July during a typical year). The primary source of water into south wetlands appears to be direct precipitation. Discharge of shallow groundwater may contribute limited amounts of water to south wetlands during the rainy season. Three features (the Graham Road catch basin, the Graham Road culvert, and the old Salmon Creek channel) drain into south wetlands but are not thought to contribute significant quantities of water.

A.4.1.4.1 West Drainage

West Drainage flows seasonally and is a primary conduit for discharge of surface water from south wetlands to Salmon Creek. Water from Salmon Creek has been observed to backflow into West Drainage when water levels are low in south wetlands. During unusually heavy storm events, when South Ditch flows have exceeded the pumping capacity to Company Lake or when pump failure occurs, overflows from South Ditch into south wetlands have occasionally been observed to occur via an overflow weir located south

of the South Ditch pump station. Overflow from South Ditch can make its way to West Drainage via south wetlands.

A.4.2 Groundwater Features

Groundwater is present in the surficial geologic unit at the site (the silt unit, described in Volume 1, Section 3 of this report). The silt unit extends to depths of between approximately 20 and 30 feet and in places consists of both silty horizons and a surficial sand unit. The silt unit is underlain by the upper gray sand, which consists of well-sorted sands. Flow directions and gradients within the silt unit are discussed below.

A.4.2.1 Flow Direction and Horizontal Gradients

Water levels were measured on May 1, 1997, and August 6, 1997, to study the potential effects of seasonal change in groundwater elevations and flow directions. Groundwater elevation contours for shallow monitoring wells screening the silt unit in the vicinity of south wetlands and south landfill are shown in Figure A-2 for wet season conditions (May 1, 1997) and in Figure A-3 for dry season conditions (August 6, 1997). Because no wells are completed in the UGS in the vicinity of south landfill or South Ditch, UGS groundwater elevations were not contoured.

The following observations can be made at south wetlands from the contour maps:

- During the wet season (May 1997), groundwater in the silt unit near MW17 appears to flow west toward the south wetlands. Groundwater then discharges from the wetlands in a west-northwesterly direction toward Salmon Creek and West Drainage (see Figure A-2). The estimated horizontal hydraulic gradient across south wetlands during the wet season is approximately 0.0014 foot per foot (ft/ft). The hydraulic gradient near the eastern boundary of south wetlands is steeper (approximately 0.013 ft/ft). The steeper hydraulic gradient east of south wetlands versus beneath south wetlands may be related to differences in permeability within subsurface sediments. Specifically, fine silt materials are present directly beneath south wetlands, whereas sands are located directly beneath the ground surface in areas east and northeast of south wetlands (for example, near south landfill).
- Figure A-3 shows dry season conditions (August 1997). Groundwater flows from east to west into the south wetlands and discharges to the north-northwest toward South Ditch, with an estimated horizontal hydraulic gradient of 0.0012 ft/ft across south wetlands. The estimated hydraulic gradient near the eastern boundary is steeper than during May 1997 (approximately 0.012 ft/ft) because groundwater levels decline and the water demand increases within the south wetlands ecosystem.

The following observations can be made at south landfill from the contour maps:

- Groundwater during the wet season appears to flow to the northwest toward South Ditch with an estimated horizontal hydraulic gradient of 0.0125 ft/ft (see Figure A-2).
- During the dry season, groundwater beneath south landfill flows westerly towards South Ditch with an estimated horizontal hydraulic gradient of 0.004 ft/ft (see Figure A-3).

A.4.2.2 Vertical Gradients

Table A-1 lists the vertical hydraulic gradients between well pairs screened in the silt unit and the top of the underlying UGS in the vicinity of south wetlands (MW18 and MW37) and Salmon Creek (MW38). Water level data from well cluster MW17 was not evaluated because both wells in this well cluster are screened in the same unit. Because no well pairs exist in the vicinity of south landfill or South Ditch, vertical gradients could not be calculated in these locations. Negative numbers indicate that the hydraulic gradient is downward; positive numbers indicate an upward vertical gradient. Vertical gradient estimates for the three well pairs located in south wetlands indicate the following:

- Between May 29, 1997, and July 1, 1997 (wet season), the average vertical hydraulic gradient was upward and ranged in magnitude from 0.119 to 0.314 ft/ft.
- A transition occurred during July as groundwater levels began a seasonal decline.
- During August and September 1997 (dry season), the average vertical hydraulic gradient was downward and ranged from 0.169 to 0.271 ft/ft.

A.5 Hydraulic Analyses of Groundwater/Surface Water Interactions

Geologic data and groundwater level data were used to evaluate groundwater/surface water interactions. Geologic cross sections were constructed to allow conclusions to be drawn based on comparisons of groundwater and surface water elevations with the subsurface stratigraphy. Hydrographs were constructed to evaluate changes in the directions and magnitudes of flux rates between groundwater and surface water over time. These analyses are presented below.

A.5.1 Cross Section Analysis

Two cross sections (A-A′ and B-B′, as shown in Figures A-4 and A-5, respectively) were constructed using hydrogeologic data from monitoring wells and piezometers drilled in the South Plant area. Cross section locations are presented on Figure A-1. Cross section A-A′ (Figure A-4) was constructed to illustrate the subsurface soil profile and groundwater/surface water interface between Salmon Creek and south wetlands. Cross section B-B′ (Figure A-5) was constructed to illustrate the subsurface soil profile and groundwater/surface water interface between south landfill and South Ditch.

Groundwater elevations during seasonal wet conditions (as measured during May 1997) and during seasonal dry conditions (as measured during August 1997) are indicated for each well shown in the cross sections. This allows for visual inspection of both horizontal flow and vertical hydraulic gradients.

A.5.1.1 West-East Cross Section A-A′ (South Wetlands/Salmon Creek)

Cross-section A-A′ (Figure A-4) shows that groundwater/surface water interactions in the vicinity of south wetlands and Salmon Creek are seasonally variable.

A.5.1.1.1 Wet Season Conditions

During the wet season, shallow groundwater appears to discharge into the south wetlands and Salmon Creek. There also appears to be limited hydraulic connection between groundwater beneath south wetlands and groundwater that is discharging to Salmon Creek. This is indicated by the fact that Salmon Creek lies in a surficial sand unit, while south wetlands is underlain by a 10-foot-thick silt unit. Based on results reported in the *Draft Surface Water and Sediment Areas Addendum to the RI/FS Work Plan*, groundwater flow into Salmon Creek is estimated to be approximately 1.27 x 10-4 cubic feet per second (cfs) during the May wet season.

A.5.1.1.2 Dry Season Conditions

During the summer and fall, Salmon Creek becomes a losing stream and discharges to groundwater. Beneath south wetlands, the August 1997 groundwater elevation contour map (Figure A-3) indicates that groundwater flow during the dry season is toward the north and northwest. Cross section A-A′ (Figure A-4) suggests that groundwater near the eastern boundary of the south wetlands (near MW17) flows beneath south wetlands from east to west. Most surface water (for example, from precipitation and stormwater drainage) collecting in the south wetlands during the dry season evaporates or is used by the vegetation in the wetlands. However, limited quantities of surface water may also infiltrate to the shallow groundwater system beneath the wetlands.

A.5.1.2 Southwest-Northeast Cross Section B-B′ (South Landfill/South Ditch)

Cross-section B-B′ (Figure A-5) shows that south landfill is underlain by a 10-foot to 15-foot thick surficial sand unit which overlies the silt unit. The surficial sand unit terminates east of well cluster MW17, located on the eastern border of the south wetlands. The cross section shows that groundwater elevations are substantially lower at MW17 than in the monitoring wells further east, which are completed in the surficial sand. This difference in groundwater level elevations indicates that groundwater in the surficial sand unit is perched on top of the underlying silt unit and is in only limited hydraulic communication with the portion of the silt unit located farther to the west (including at MW17 and south wetlands). Consequently, the shape of the contours on the groundwater elevation contour maps (Figures A-2 and A-3) between south landfill and south wetlands is more likely indicating differences in stratigraphy and permeability across this area than significant rates of groundwater flow between these two areas.

As discussed in *Technical Memorandum DS No. 18: Data Summary for the Wastewater Discharge Areas Addendum to the RI/FS Work Plan, Part 2*, Attachment A, west South Ditch becomes a "losing stream" (that is, surface water discharges to groundwater) around the end of June to mid-July as groundwater levels drop below the surface water levels in the ditch. Because this portion of the ditch receives stormwater, process water, and wastewater from several outfalls, the ditch does not go dry and continues to recharge groundwater throughout the early summer and fall.

A.5.2 Hydrograph Analysis

Weekly surface water and groundwater elevations were collected at six staff gauges, 15 monitoring wells, 11 temporary piezometers adjacent to South Ditch, and at the South Ditch pump station from the end of May through September 1997. (See Figure A-1 for locations of

each sampling station.) Both wet (late winter/spring) and dry (late summer/fall) conditions were encompassed in this time period. Water elevation data are provided in the attachment to this appendix.

Dataloggers and pressure transducers were also used for brief periods (two weeks) to collect surface water and groundwater data at greater frequency during wet conditions. Manual water level elevations were measured twice daily for one week in September 1997 (during dry conditions). The electronic and manual water elevation data were plotted as hydrographs to evaluate groundwater/surface water interactions (see Figures A-6 through A-9).

A.5.2.1 Hydrograph Analysis for South Wetlands and South Landfill

Figure A-6 plots the south wetlands stage and silt unit groundwater elevations at south landfill. The figure shows that silt unit groundwater levels are higher than the water level in south wetlands during May 1997 and exhibit a seasonal decline beginning in June. While south wetland groundwater levels drop below the bed of the wetlands by mid to late July, south landfill groundwater levels decline at a slower rate and remain 10 to 15 feet above the bed of the wetlands.

The wells at south landfill are completed in the surficial sand unit. These wells show higher groundwater elevations than south wetlands wells and notably less of a water level decline during the transition period from the wet season to the dry season. Such conditions indicate that surface water and groundwater are consumed in the highly vegetated south wetlands owing to both plant transpiration and direct evaporation from the water surface in the wetlands. By comparison, south landfill surface topography is relatively unvegetated, resulting in reduced evapotranspiration rates. In addition, well logs suggest the silt layer beneath south landfill is thicker and more homogeneous than the silt beneath the south wetlands. Therefore, the silt layer beneath south landfill is likely acting as a more effective aquitard, or barrier to downward percolation, which could also cause the slower seasonal decline in shallow water levels beneath the south landfill. The noticeable difference in the seasonal shallow groundwater response between south wetlands and south landfill also suggests limited or poor hydraulic connection between the areas.

Compared with the silt unit, groundwater levels in the UGS are higher in May 1997 but exhibit seasonal declines earlier than the silt unit (see Figure A-7). The magnitudes of the seasonal water level changes for MW18-031, MW37-030, and MW38-035 are substantially greater than in the silt unit, declining 14 feet from mid-May to September 1997. In comparison, groundwater elevations for the silt wells at these locations (MW18-016, MW37-012, and MW38-007) declined only 1 to 4 feet during the same time interval. As in the silt unit, UGS groundwater elevations appear to drop below the ground surface elevation of south wetlands by mid to late July.

A.5.2.2 Hydrograph Analysis for South Wetlands and Salmon Creek

Hydrographs in the vicinity of south wetlands and Salmon Creek (Figure A-8) indicate that silt unit groundwater discharged into south wetlands during the wet season until mid-July 1997. After mid-July, the groundwater level data indicate that any surface water that was introduced into the wetlands likely infiltrated downward into the shallow silt unit. Figure A-8 also shows that silt unit groundwater levels were above the bed of Salmon Creek at each well throughout the monitoring period, but were below the measured stage in staff

gage SG08. This indicates that groundwater was recharged by Salmon Creek throughout the monitoring period.

Figure A-9 compares UGS groundwater levels with stages and bed elevations in south wetlands, West Drainage, and Salmon Creek. The figure indicates that groundwater levels in the UGS were substantially higher than the stages and beds of the surface water features. By late September 1997, UGS groundwater levels dropped to approximately 3½ feet below the bottom elevation of Salmon Creek. As shown in the cross sections (Figures A-4 and A-5), the UGS is in limited (if any) hydraulic communication with south wetlands and Salmon Creek, which both partially penetrate the silt unit.

Table A-1
South Wetlands Shallow Zone (Silt to Top of Gray Sand Unit)
Vertical Hydraulic Gradient Estimates

Reynolds Metals Company - Troutdale, Oregon

Date	MW18 Well Group				MW37 Well Group				MW38 Well Group			
	MW18-016	MW18-031			MW37-012	MW37-030			MW38-007	MW38-035		
	Groundwater Elevation (feet)		Elevation Difference (feet)	Vertical Gradient (foot/foot) (b, c)	Groundwater Elevation (feet)		Elevation Difference (feet)	Vertical Gradient (foot/foot) (b, c)	Groundwater Elevation (feet)		Elevation Difference (feet)	Vertical Gradient (foot/foot) (b, c)
Vertical Separation (a)	15.5 feet				18 feet				27.5 feet			
5/29/1997	15.84	20.66	4.82	0.311	17.60	21.02	3.42	0.190	15.98	20.56	4.58	0.167
6/4/1997	16.08	22.84	6.76	0.436					16.15	22.79	6.64	0.241
6/11/1997	15.85	22.05	6.20	0.400					15.99	21.92	5.93	0.216
6/19/1997	16.56	22.02	5.46	0.352					16.04	21.05	5.01	0.182
6/25/1997	15.65	20.51	4.86	0.314	17.63	20.52	2.89	0.161	15.84	20.35	4.51	0.164
7/1/1997	15.83	16.97	1.14	0.074	16.89	16.98	0.09	0.005	15.95	16.92	0.97	0.035
8/6/1997	14.08	11.54	-2.54	-0.164	13.74	11.55	-2.19	-0.122	15.21	11.63	-3.58	-0.130
8/21/1997					13.65	11.49	-2.16	-0.120	15.06	11.61	-3.45	-0.125
8/26/1997					13.76	11.04	-2.72	-0.151	15.00	11.13	-3.87	-0.141
9/3/1997					12.80	10.09	-2.71	-0.151	14.91	11.03	-3.88	-0.141
9/8/1997					12.72	8.87	-3.85	-0.214	14.89	9.03	-5.86	-0.213
9/15/1997	13.39	8.74	-4.65	-0.300	12.32	8.69	-3.63	-0.202	14.84	8.85	-5.99	-0.218
9/25/1997	14.12	8.73	-5.39	-0.348	13.41	8.77	-4.64	-0.258	14.77	8.87	-5.90	-0.215
Minimum				0.074				0.005				0.035
Maximum				0.436				-0.258				0.241
Average (Wet Season)				0.314				0.119				0.168
Average (Dry Season)				-0.271				-0.174				-0.169

Notes:

Elevations are referenced to 1929 National Geodetic Vertical Datum (NGVD).

(a) Vertical separation is the vertical distance (feet) between the midpoints of the screened intervals of the monitoring wells.

(b) Vertical gradient (feet/feet) is calculated as the water level elevation difference divided by the vertical separation.

(c) Positive values of vertical gradient indicate an upward gradient; negative values indicate a downward gradient.

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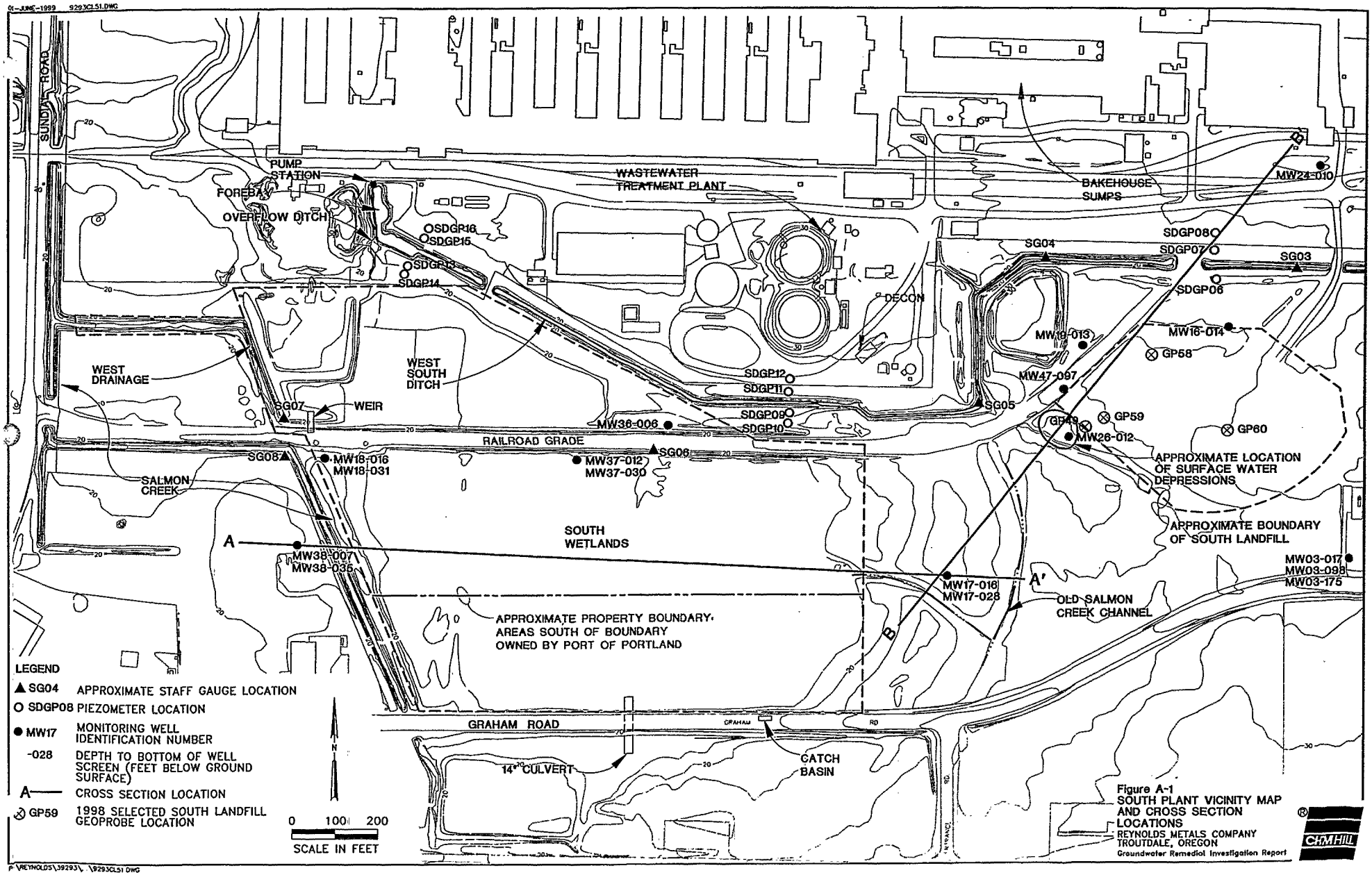

Figure A-1
SOUTH PLANT VICINITY MAP AND CROSS SECTION LOCATIONS
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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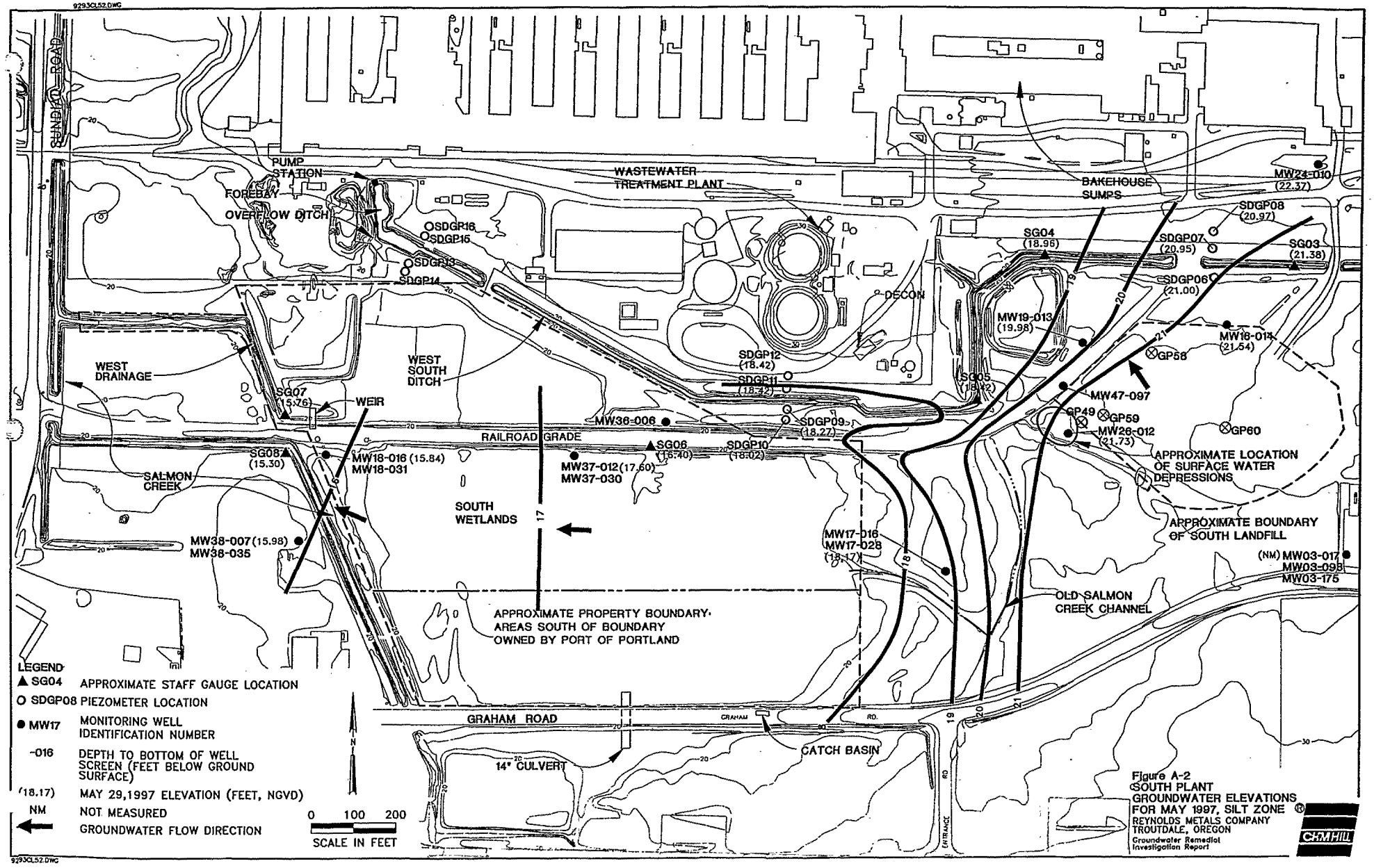

Figure A-2
SOUTH PLANT
GROUNDWATER ELEVATIONS
FOR MAY 1997, SILT ZONE
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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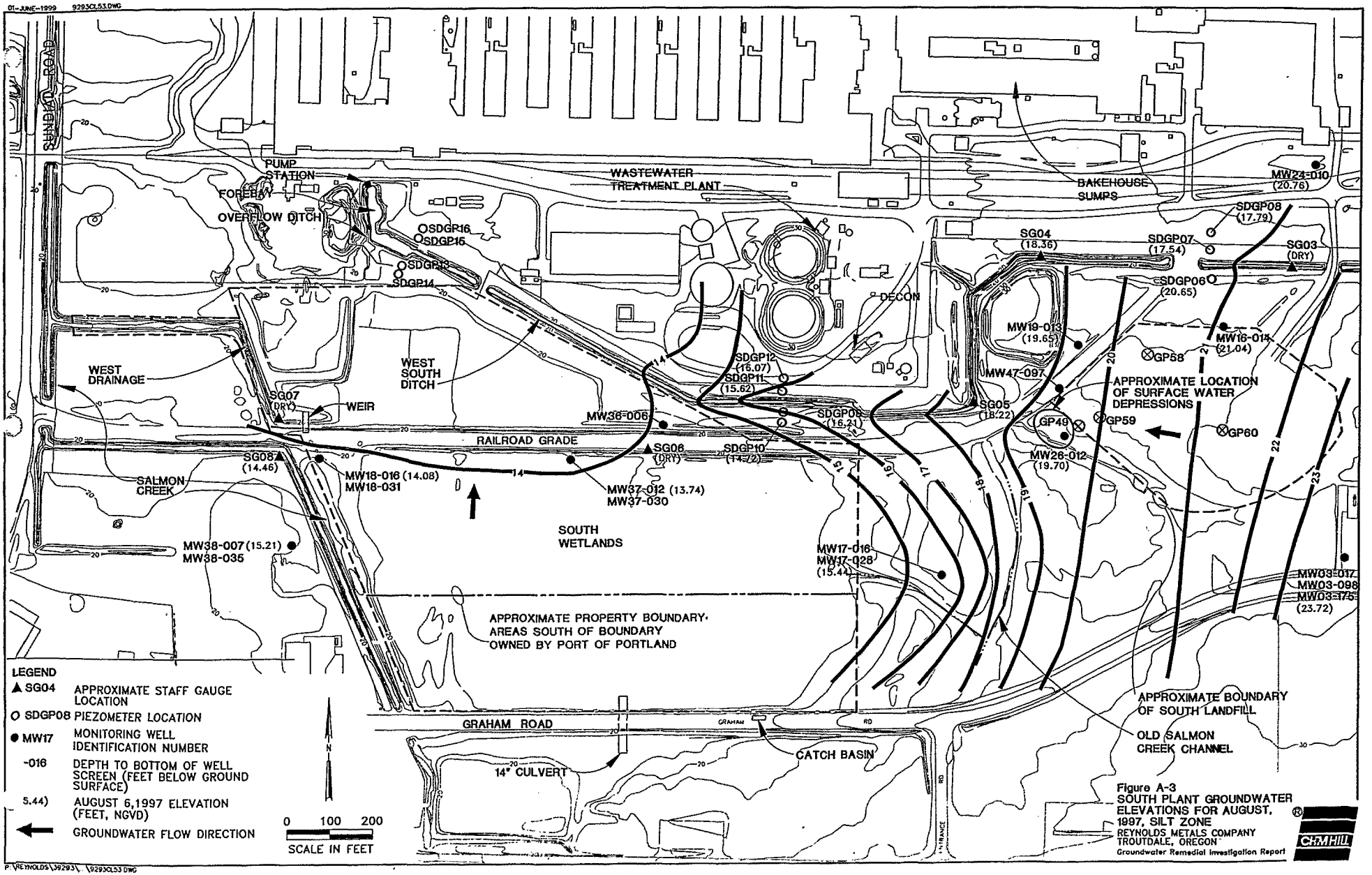
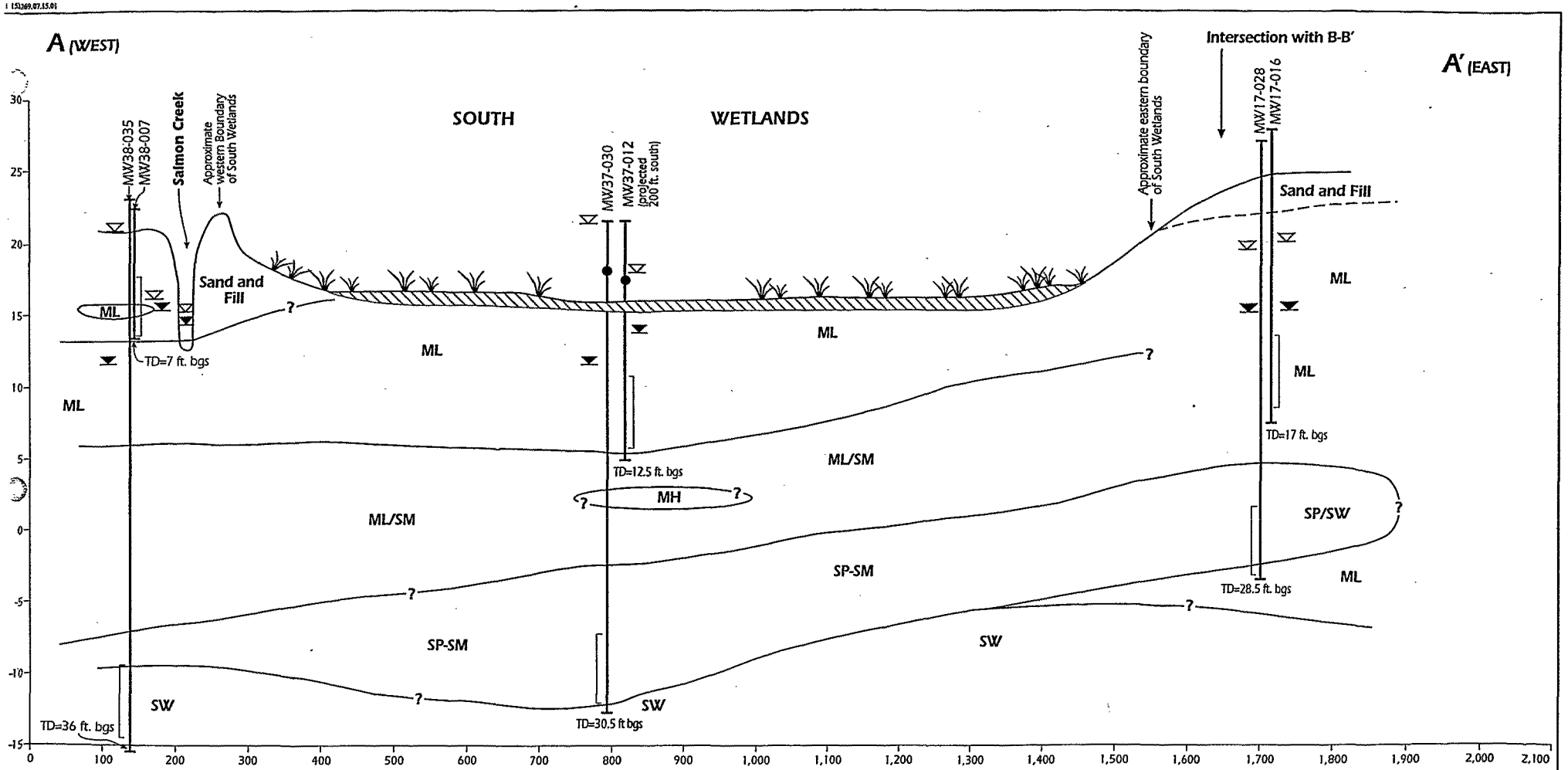


Figure A-3
SOUTH PLANT GROUNDWATER ELEVATIONS FOR AUGUST, 1997, SILT ZONE
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report



LEGEND

MW17-016 — Monitoring well number

Cased interval

Screened interval

TD=17 ft. bgs — Total well depth (feet below ground surface)

Wet Season Groundwater elevation (feet, NGVD 1929) for May 1, 1997

Dry Season Groundwater elevation (feet, NGVD 1929) for August 6, 1997

Process Residue

MH/ML = Silt

SP = Poorly-graded sand

SW = Well-graded sand

SM = Silty sand

0 2.5 5 Feet — Approximate Vertical Scale

0 50 100 Feet — Approximate Horizontal Scale

Vertical Exaggeration = X20

Figure A-4

SOUTH WETLANDS: WEST-EAST SCHEMATIC HYDROGEOLOGIC CROSS SECTION A-A'

Reynolds Metals Company—Troutdale, Oregon
Groundwater Remedial Investigation Report

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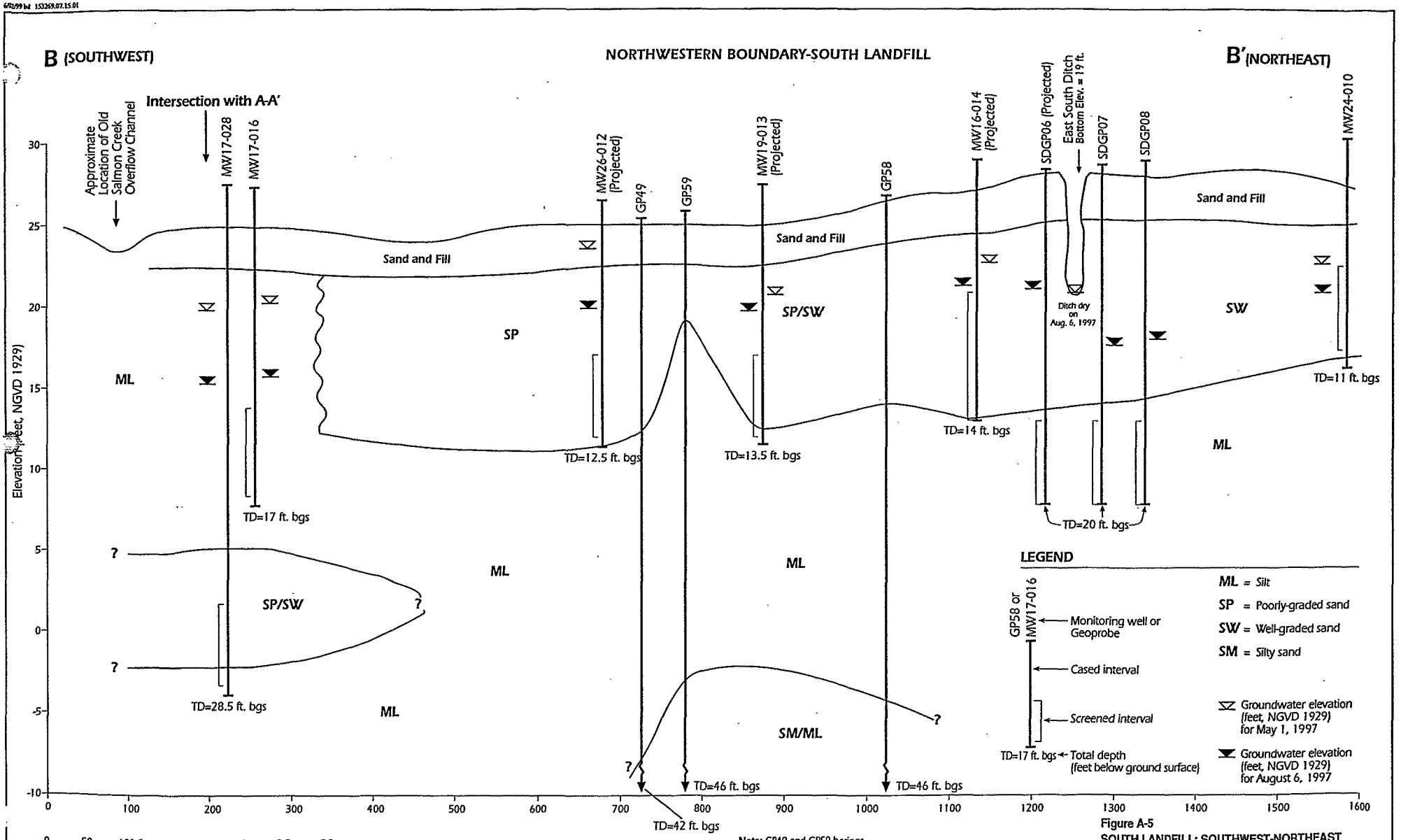

Figure A-5
SOUTH LANDFILL: SOUTHWEST-NORTHEAST SCHEMATIC HYDROGEOLOGIC CROSS SECTION B-B'

Reynolds Metals Company—Troutdale, Oregon
Groundwater Remedial Investigation Report

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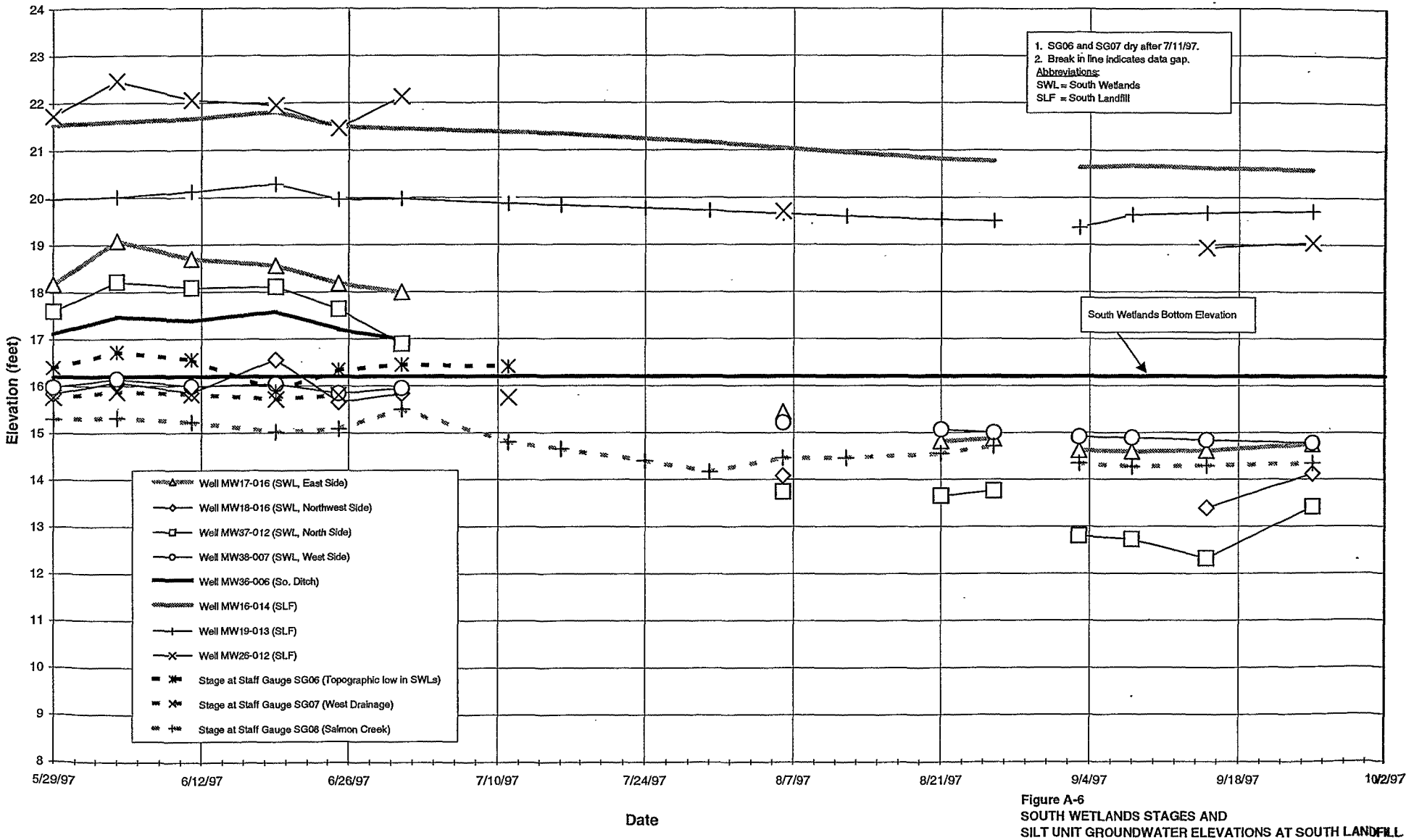

Figure A-6
SOUTH WETLANDS STAGES AND SILT UNIT GROUNDWATER ELEVATIONS AT SOUTH LANDFILL
Reynolds Metals Company - Troutdale, Oregon
Groundwater Remedial Investigation Report

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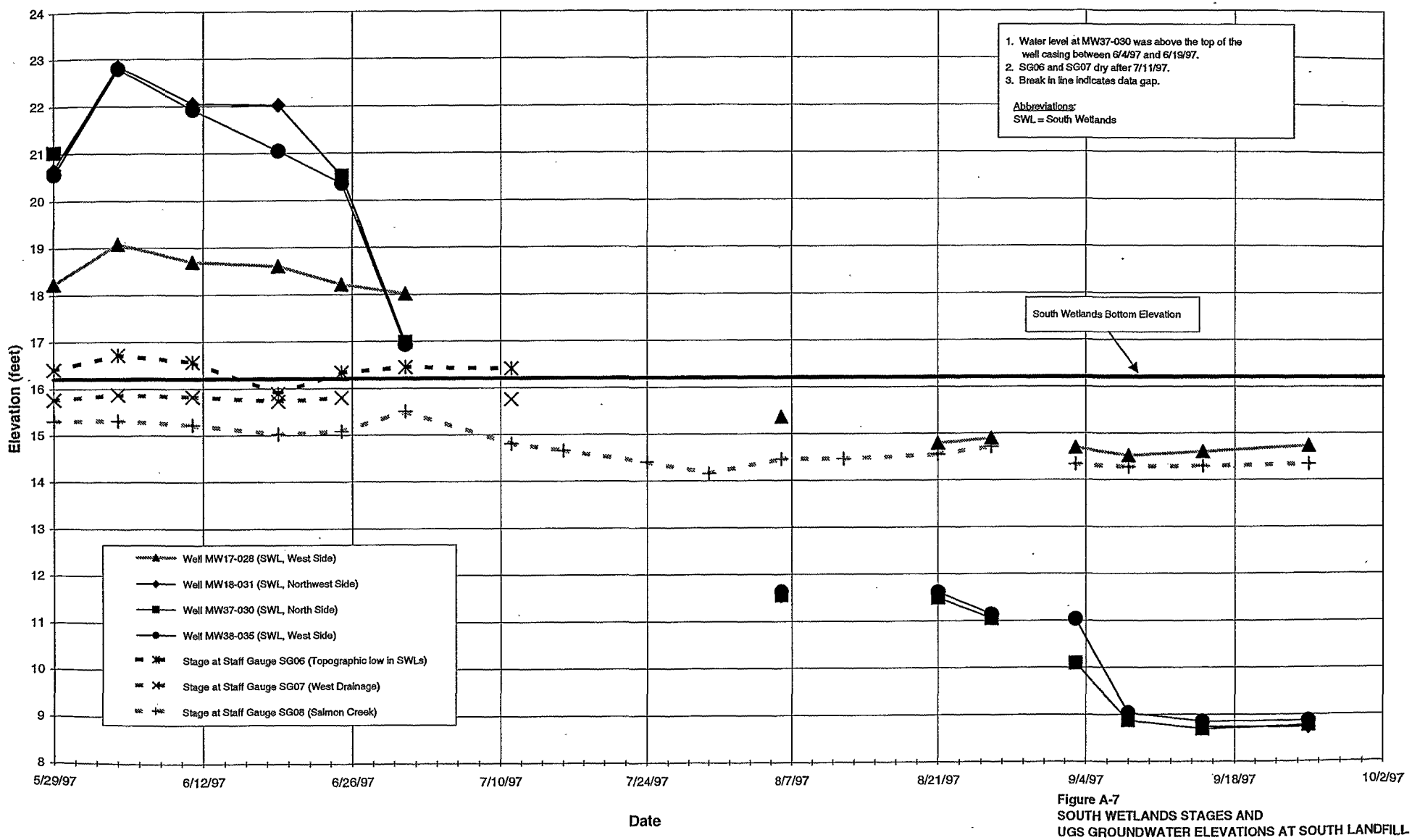

Figure A-7
SOUTH WETLANDS STAGES AND UGS GROUNDWATER ELEVATIONS AT SOUTH LANDFILL
Reynolds Metals Company - Troutdale, Oregon
Groundwater Remedial Investigation Report

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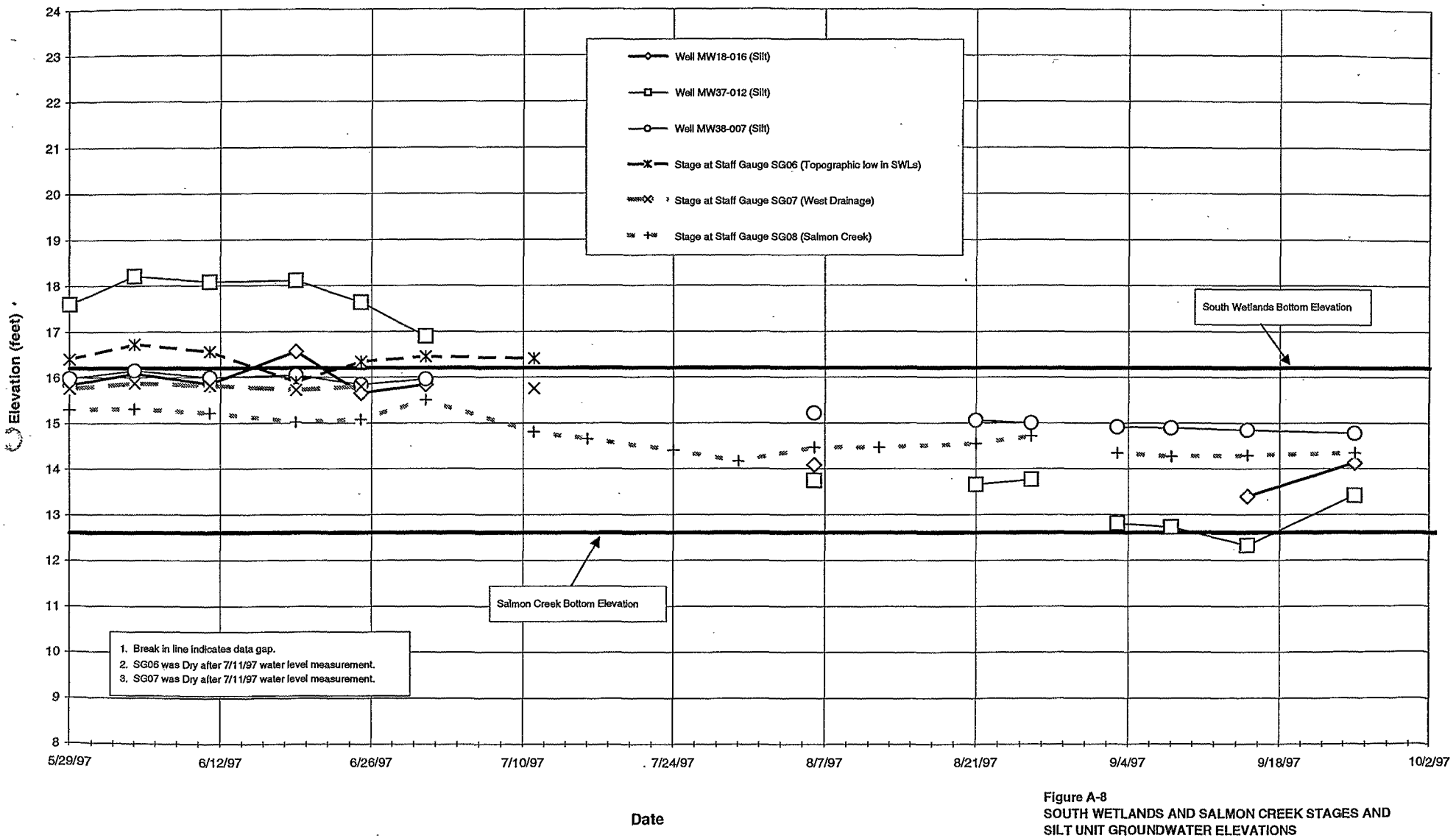

Figure A-8
SOUTH WETLANDS AND SALMON CREEK STAGES AND SILT UNIT GROUNDWATER ELEVATIONS
Reynolds Metals Company - Troutdale, Oregon
Groundwater Remedial Investigation Report

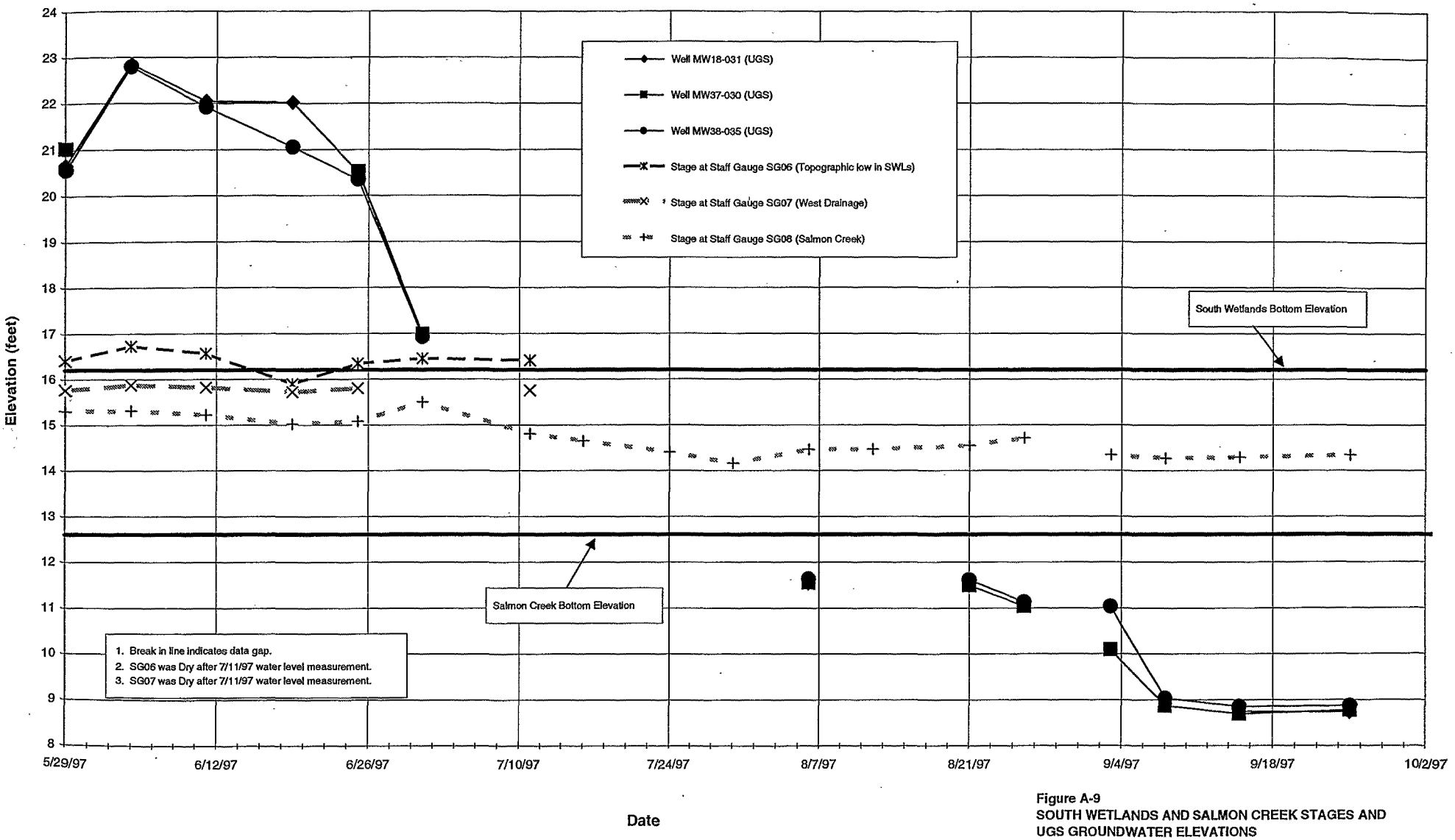

Figure A-9
SOUTH WETLANDS AND SALMON CREEK STAGES AND UGS GROUNDWATER ELEVATIONS
Reynolds Metals Company - Troutdale, Oregon
Groundwater Remedial Investigation Report

ATTACHMENT

South Ditch Manual Water Level Data Summary

(May 1997 through September 1997)

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Attachment

South Ditch Manual Water Level Data Summary (May 1997 through September 1997)

Reynolds Metals Company - Troutdale, Oregon

Monitoring Wells

Well ID	MW01-019		MW02-012		MW02-034		MW03-017		MW03-098		MW03-175		MW04-019		MW11-017		MW12-021		MW14-015		MW16-014		MW17-016		MW17-028	
MPE / SM	28.25	S	31.10	S	30.64	UGS	29.69	S	30.65	IGS	30.72	DGS	26.91	S	31.61	S	22.53	S	30.88	S	28.91	S	27.13	S	27.30	S/UGS
Date	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)
5/29/97	8.90	19.35	8.04	23.06	9.43	21.21							9.52	17.39	6.04	25.57			5.86	25.02	7.37	21.54	8.96	18.17	9.08	18.22
6/4/97	8.56	19.69	7.93	23.17	6.99	23.65	3.31	26.38	7.13	23.52	7.19	23.53	9.40	17.51	5.94	25.67	5.46	17.07	8.73	22.15	7.31	21.60	8.05	19.08	8.22	19.08
6/11/97	8.66	19.59	7.44	23.66	7.99	22.65	4.13	25.56	8.15	22.50	8.20	22.52	9.35	17.56	5.84	25.77			5.44	25.44	7.25	21.66	8.44	18.69	8.61	18.69
6/19/97	8.29	19.96	7.36	23.74	8.12	22.52	4.54	25.15	8.30	22.35	8.34	22.38	9.61	17.30	6.07	25.54			5.29	25.59	7.10	21.81	8.57	18.56	8.70	18.60
6/25/97	8.85	19.40	7.59	23.51	9.72	20.92	4.43	25.26	9.88	20.77	9.94	20.78	9.61	17.30	6.16	25.45			5.91	24.97	7.41	21.50	8.95	18.18	9.09	18.21
7/1/97	8.72	19.53	8.23	22.87	13.40	17.24	3.77	25.92	13.60	17.05	13.66	17.06	10.04	16.87	6.44	25.17	7.04	15.49	6.11	24.77	7.46	21.45	9.14	17.99	9.29	18.01
7/11/97	8.85	19.40											10.59	16.32	6.68	24.93					7.53	21.38				
7/16/97	8.99	19.26											10.76	16.15	6.77	24.84					7.57	21.34				
7/24/97	9.10	19.15	11.00	20.10	16.00	14.64							11.17	15.74	7.08	24.53			6.90	23.98	7.67	21.24				
7/30/97	9.21	19.04	11.44	19.66	17.37	13.27							11.52	15.39	7.37	24.24					7.75	21.16				
8/6/97	9.33	18.92	11.94	19.16	18.65	11.99	5.97	23.72	18.89	11.76	18.94	11.78	12.10	14.81	7.74	23.87	9.31	13.22	7.41	23.47	7.87	21.04	11.69	15.44	11.94	15.36
8/12/97	9.41	18.84											11.80	15.11	8.04	23.57					7.96	20.95				
8/21/97	9.47	18.78	12.63	18.47	18.88	11.76	6.13	23.56	19.08	11.57	19.15	11.57	14.73	12.18							8.10	20.81	12.32	14.81	12.51	14.79
8/26/97	9.48	18.77	12.79	18.31	19.33	11.31	5.97	23.72	19.49	11.16	19.54	11.18	12.21	14.70	8.80	22.81					8.14	20.77	12.26	14.87	12.41	14.89
9/2/97																	9.83	12.70								
9/3/97	9.73	18.52	13.08	18.02	20.04	10.60	6.20	23.49	20.20	10.45	20.27	10.45	12.27	14.64	8.98	22.63					8.28	20.63	12.51	14.62	12.61	14.69
9/8/97			13.19	17.91	21.17	9.47	6.61	23.08	21.34	9.31	21.43	9.29	12.7	14.21	9.51	22.10					8.24	20.67	12.54	14.59	12.78	14.52
9/15/97	9.23	19.02	13.53	17.57	21.39	9.25	6.32	23.37	21.58	9.07	21.64	9.08	13.35	13.56	9.93	21.68			8.53	22.35	8.29	20.62	12.52	14.61	12.70	14.60
9/25/97	9.19	19.06	13.83	17.27	21.16	9.48	6.64	23.05	21.4	9.25	21.43	9.29	12.37	14.54	10.02	21.59					8.33	20.58	12.38	14.75	12.57	14.73

Attachment

South Ditch Manual Water Level Data Summary (May 1997 through September 1997)

Reynolds Metals Company - Troutdale, Oregon

Monitoring Wells

Well ID	MW18-016		MW18-031		MW19-013		MW24-010		MW25-024		MW25-035		MW26-012		MW34-038		MW35-038		MW36-006		MW37-012		MW37-030		MW38-007	
MPE / SM	23.98	S	23.95	UGS	27.10	S	30.13	S	31.14	S	30.89	UGS	26.26	S	32.12	UGS	31.56	UGS	21.68	S	21.48	S	21.32	UGS	22.56	S
Date	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)	DTW (feet BMP)	WLE (feet)
5/29/97	8.14	15.84	3.29	20.66	7.12	19.98	7.76	22.37	8.06	23.08	9.68	21.21	4.53	21.73	10.67	21.45	10.13	21.43	4.56	17.12	3.88	17.60	0.30	21.02	6.58	15.98
6/4/97	7.90	16.08	1.11	22.84	7.09	20.01	7.66	22.47	7.63	23.51	7.26	23.63	3.80	22.46	7.84	24.28	7.34	24.22	4.21	17.47	3.27	18.21	TOC [1]		6.41	16.15
6/11/97	8.13	15.85	1.90	22.05	6.98	20.12	7.44	22.69	7.42	23.72	8.22	22.67	4.20	22.06	9.18	22.94	8.65	22.91	4.30	17.38	3.40	18.08	TOC [1]		6.57	15.99
6/19/97	7.42	16.56	1.93	22.02	6.82	20.28	7.27	22.86	7.38	23.76	8.48	22.41	4.31	21.95	8.14	23.98	7.60	23.96	4.10	17.58	3.37	18.11	TOC [1]		6.52	16.04
6/25/97	8.33	15.65	3.44	20.51	7.14	19.96	7.48	22.65	7.82	23.32	9.97	20.92	4.80	21.46	11.15	20.97	10.56	21.00	4.48	17.20	3.85	17.63	0.80	20.52	6.72	15.84
7/1/97	8.15	15.83	6.98	16.97	7.13	19.97	7.77	22.36	8.48	22.66	13.66	17.23	4.13	22.13	15.64	16.48	14.90	16.66	4.69	16.99	4.59	16.89	4.34	16.98	6.61	15.95
7/11/97					7.23	19.87			9.55	21.59							7.00	24.56								
7/16/97					7.27	19.83			9.95	21.19							17.04	14.52								
7/24/97					7.33	19.77	8.60	21.53	10.39	20.75	16.26	14.63					17.22	14.34								
7/30/97					7.38	19.72	9.17	20.96	10.90	20.24	17.63	13.26					18.81	12.75								
8/6/97	9.90	14.08	12.41	11.54	7.45	19.65	9.37	20.76	11.58	19.56	18.89	12.00	6.56	19.70	20.62	11.50	19.94	11.62	7.04	14.64	7.74	13.74	9.77	11.55	7.35	15.21
8/12/97					7.50	19.60			11.91	19.23							20.52	11.04								
8/21/97					7.57	19.53			12.36	18.78	19.13	11.76					20.02	11.54			7.83	13.65	9.83	11.49	7.50	15.06
8/26/97					7.60	19.50			12.58	18.56	19.58	11.31					20.60	10.96			7.72	13.76	10.28	11.04	7.56	15.00
9/2/97																										
9/3/97					7.74	19.36			12.98	18.16	20.37	10.52					20.80	10.76			8.68	12.80	11.23	10.09	7.65	14.91
9/8/97					7.47	19.63			13.45	17.69	21.43	9.46					22.22	9.34			8.76	12.72	12.45	8.87	7.67	14.89
9/15/97	10.59	13.39	15.21	8.74	7.43	19.67	10.41	19.72	13.88	17.26	21.65	9.24	7.33	18.93	22.96	9.16	22.37	9.19	7.42	14.26	9.16	12.32	12.63	8.69	7.72	14.84
9/25/97	9.86	14.12	15.22	8.73	7.39	19.71			14.33	16.81	21.41	9.48	7.22	19.04			21.98	9.58			8.07	13.41	12.55	8.77	7.79	14.77

Attachment

South Ditch Manual Water Level Data Summary (May 1997 through September 1997)

Reynolds Metals Company - Troutdale, Oregon

					Piezometers																					
Well ID	MW38-035		S. Ditch @ Pump		SDGP01		SDGP02		SDGP03		SDGP04		SDGP05		SDGP06		SDGP07		SDGP08		SDGP09		SDGP10		SDGP11	
MPE / SM	23.07	UGS	21.87		28.46	S	29.17	S	28.59	S	29.2	S	28.80	S	28.11	S	28.49	S	28.83	S	21.51	S	21.84	S	22.65	S
	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE	DTW	WLE
Date	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)
5/29/97	2.51	20.56			5.53	22.93	7.03	22.14	5.98	22.61	6.59	22.61	6.17	22.63	7.11	21.00	7.54	20.95	7.86	20.97	3.24	18.27	3.82	18.02	4.23	18.42
6/4/97	0.28	22.79			5.10	23.36	5.52	23.65	5.33	23.26	6.10	23.10	5.77	23.03	7.11	21.00	7.31	21.18	7.53	21.30	2.91	18.60	3.31	18.53	3.69	18.96
6/11/97	1.15	21.92			4.25	24.21	5.69	23.48	5.26	23.33	6.06	23.14	5.64	23.16	7.02	21.09	7.20	21.29	7.37	21.46	2.60	18.91	3.38	18.46	3.80	18.85
6/19/97	2.02	21.05			3.90	24.56	4.07	25.10	5.13	23.46	5.95	23.25	5.51	23.29	7.11	21.00	7.10	21.39	6.62	22.21	3.23	18.28	3.30	18.54	4.02	18.63
6/25/97	2.72	20.35	7.15	14.72	4.31	24.15	4.13	25.04	5.84	22.75	6.58	22.62	6.16	22.64	7.16	20.95	7.17	21.32	7.60	21.23	2.72	18.79	3.79	18.05	3.83	18.82
7/1/97	6.15	16.92	6.73	15.14	5.80	22.66	4.56	24.61	6.79	21.80	7.78	21.42	7.31	21.49	7.19	20.92	8.25	20.24	8.67	20.16	4.46	17.05	4.10	17.74	4.71	17.94
7/11/97			5.72	16.15	7.46	21.00	5.35	23.82	8.20	20.39	8.83	20.37	8.35	20.45	7.23	20.88	9.23	19.26	9.40	19.43	4.79	16.72	5.31	16.53	5.58	17.07
7/16/97			6.81	15.06	7.63	20.83	5.67	23.50	8.69	19.90	9.12	20.08	8.73	20.07	7.25	20.86	9.68	18.81	9.73	19.10	4.98	16.53	5.65	16.19	5.79	16.86
7/24/97			6.78	15.09	8.40	20.06	5.94	23.23	9.22	19.37	9.50	19.70	9.06	19.74	7.30	20.81	9.92	18.57	10.00	18.83	5.17	16.34	5.97	15.87	6.06	16.59
7/30/97			6.70	15.17	8.82	19.64	6.25	22.92	9.88	18.71	9.62	19.58	10.01	18.79	7.40	20.71	10.31	18.18	10.40	18.43	5.13	16.38	6.44	15.40	6.45	16.20
8/6/97	11.44	11.63	6.35	15.52	9.49	18.97	6.74	22.43	10.47	18.12	10.83	18.37	10.38	18.42	7.46	20.65	10.95	17.54	11.04	17.79	5.30	16.21	7.12	14.72	7.03	15.62
8/12/97			6.07	15.80	9.92	18.54	7.02	22.15	10.82	17.77	11.21	17.99	10.76	18.04	7.55	20.56	11.21	17.28	11.37	17.46	5.40	16.11	7.33	14.51	7.22	15.43
8/21/97	11.46	11.61	6.69	15.18	10.46	18.00	7.42	21.75	11.13	17.46	11.53	17.67	11.09	17.71	7.67	20.44	11.55	16.94	11.35	17.48	5.53	15.98	7.40	14.44	7.30	15.35
8/26/97	11.94	11.13	6.72	15.15	10.66	17.80	7.59	21.58	14.92		11.63	17.57	11.18	17.62			11.55	16.94	14.38		5.49	16.02	7.33	14.51	7.28	15.37
9/2/97																										
9/3/97	12.04	11.03	6.75	15.12	10.82	17.64	7.68	21.49	15.01		11.68	17.52	11.07	17.73	7.78	20.33	11.62	16.87	14.16		5.34	16.17	7.21	14.63	7.19	15.46
9/8/97	14.04	9.03	7.12	14.75	11.35	17.11	8.24	20.93	12.41	16.18	12.52	16.68	12.06	16.74	7.81	20.30	11.81	16.68	11.93	16.90	5.27	16.24	7.89	13.95	7.58	15.07
9/15/97	14.22	8.85	4.71	17.16	11.77	16.69	8.56	20.61	14.95	13.64	12.91	16.29	12.46	16.34	15.09	13.02	13.83	14.66	14.3	14.53	5.11	16.40	8.06	13.78	7.70	14.95
9/25/97	14.20	8.87	6.77	15.10	12.09	16.37	8.61	20.56	13.12	15.47	12.94	16.26	12.48	16.32	15.05	13.06	11.81	16.68	12.27	16.56	5.03	16.48	7.55	14.29	7.34	15.31

Attachment

South Ditch Manual Water Level Data Summary (May 1997 through September 1997)

Reynolds Metals Company - Troutdale, Oregon

	Piezometers										Staff Gauges									
Well ID	**SDGP12**		**SDGP13**		**SDGP14**		**SDGP15**		**SDGP16**		**Columbia River [2]**		**SG01**	**SG02**	**SG03**	**SG04**	**SG05**	**SG06**	**SG07**	**SG08**
MPE / SM	24.07	S	22.49	S	22.27	S	23.21	S	24.30	S	32.63	NA	NA	NA	NA	NA	NA	NA	NA	NA
	DTW	**WLE**	**DTW**	**WLE**	**DTW**	**WLE**	**DTW**	**WLE**	**DTW**	**WLE**	**DTW**	**Stage**	**Elevation**							
Date	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet BMP)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
5/29/97	5.65	18.42	6.71	15.78	5.49	16.78	7.39	15.82	8.27	16.03			25.20	25.52	21.38	18.96	18.42	16.40	15.76	15.30
6/4/97	5.15	18.92	6.63	15.86	5.27	17.00	7.23	15.98	8.16	16.14	7.83	24.80	25.43	25.58	21.44	18.40	18.04	16.72	15.87	15.31
6/11/97	5.20	18.87	6.47	16.02	5.18	17.09	7.28	15.93	8.11	16.19	9.77	22.86	25.30	25.54	21.42	18.40	19.18	16.56	15.82	15.22
6/19/97	5.30	18.77	6.51	15.98	5.36	16.91	7.32	15.89	8.10	16.20			25.16	25.44	21.56	18.53	18.32	15.89	15.72	15.02
6/25/97	5.53	18.54	6.41	16.08	5.40	16.87	7.44	15.77	8.29	16.01	12.03	20.60	25.16	25.36	21.76	18.50	18.25	16.34	15.80	15.08
7/1/97	6.04	18.03	6.45	16.04	5.82	16.45	7.61	15.60	8.42	15.88	18.65	13.98	25.19	25.26	21.40	18.50	18.30	16.45		15.50
7/11/97	6.73	17.34	6.59	15.90	6.61	15.66	7.74	15.47	8.86	15.44	19.44	13.19	25.12	25.00	21.45	18.39	18.15	16.41	15.75	14.80
7/16/97	6.93	17.14	6.61	15.88	6.82	15.45	7.94	15.27	8.92	15.38	19.04	13.59	Dry	24.76	21.34	18.38	18.14	Dry	Dry	14.65
7/24/97	7.19	16.88	6.66	15.83	7.09	15.18	8.03	15.18	9.02	15.28	20.10	12.53	Dry	Dry	21.29	18.38	18.17	Dry	Dry	14.40
7/30/97	7.53	16.54	6.71	15.78	7.44	14.83	8.19	15.02	9.21	15.09	22.21	10.42	Dry	Dry	Dry	18.37	18.18	Dry	Dry	14.16
8/6/97	8.00	16.07	6.75	15.74	8.00	14.27	8.40	14.81	9.50	14.80	21.91	10.72	Dry	Dry	Dry	18.36	18.22	Dry	Dry	14.46
8/12/97	8.19	15.88	6.77	15.72	7.87	14.40	8.73	14.48	9.51	14.79			Dry	Dry	Dry	18.37	18.24	Dry	15.93	14.46
8/21/97	8.29	15.78	6.81	15.68	7.89	14.38	8.39	14.82	9.56	14.74	22.35	9.53	Dry	Dry	Dry	18.37	18.28	Dry	Dry	14.55
8/26/97	8.28	15.79	6.83	15.66	7.82	14.45	8.31	14.90	9.38	14.92	23.25	8.63	Dry	Dry	Dry	18.56	18.47	Dry	Dry	14.71
9/2/97																				
9/3/97	8.54	15.53	6.82	15.67	7.97	14.30	8.65	14.56	9.76	14.54	23.41	8.47	Dry	Dry	Dry	18.32	18.16	Dry	Dry	14.34
9/8/97	8.39	15.68	6.87	15.62	8.47	13.80	8.56	14.65	9.80	14.50			NM [3]	Dry	Dry	19.08	19.08	Dry	Dry	14.27
9/15/97	8.42	15.65	6.91	15.58	8.79	13.48	8.40	14.81	9.90	14.40	25.46	6.42		Dry	Dry	19.09	19.09	Dry	Dry	14.29
9/25/97	8.17	15.90	6.88	15.61	7.68	14.59	8.82	14.39	9.92	14.38				Dry	Dry	19.05	19.05	Dry	Dry	14.34

Notes:

[1] TOC = Water level above top of casing at MW37-030 between 6/4/97 and 6/19/97.

[2] Columbia River MPE changed from 32.63 to 31.88 feet on 8/15/97. MPE changed from 31.88 feet to 30.90' in 10/97.

[3] NM = Not measured because SG01 was removed on 9/8/97.

Abbreviations:

WLE = Water level elevation = MPE (feet) minus DTW (feet below ground surface).

BMP = Below measuring point elevation.

DTW = Depth to water is measured in feet below the measuring point elevation.

MPE = Measuring point elevation; in feet, NGVD 1929.

SM = Screened material.

S = Silt.

UGS = Upper gray sand.

IGS = Intermediate-depth well screened in gray sand.

DGS = Deep well screened in sand.

APPENDIX B

Summary of 1998 Field Data Collection at South Landfill, Scrap Yard, and East Potliner

APPENDIX B

Summary of 1998 Field Data Collection at South Landfill, Scrap Yard, and East Potliner Areas

1.0 Introduction

This appendix presents the results of the data collection field effort conducted by CH2M HILL at Reynolds Metals Company (RMC) in Troutdale, Oregon during the summer of 1998. Data collection focused on addressing data needs at three soil and debris areas: south landfill (SLF), scrap yard (SY), and east potliner (EPL).

The appendix is organized as follows:

- Section 1 is an introduction.
- Section 2 identifies data needs during the collection effort.
- Section 3 describes the rationale for data collection.
- Section 4 describes the field exploration and sampling methodology.
- Section 5 outlines the laboratory analysis performed.
- Section 6 summarizes the analytical results.

The Attachment contains soil boring logs for the Geoprobe and hollow stem auger investigations at south landfill, east potliner, and scrap yard.

2.0 Data Needs

The data needs identified were:

- The mass and distribution of fluoride in the waste material and underlying soil
- The vertical and horizontal distribution of fluoride in the silt and upper gray sand (UGS)
- The analytical/physical parameters of the silt and upper gray sand (UGS) and laboratory vertical hydraulic conductivity (silt only)
- A range of estimated, site-specific, fluoride partitioning coefficients values

These data are needed for the evaluation and selection of source control and groundwater early action alternatives.

3.0 Rationale for Data Collection

The data identified in Section 3.1 will be used in the Sitewide Feasibility Study Report (CH2M HILL, In Progress) to evaluate selected source control and groundwater early action

alternatives and estimate relative time to compliance at south landfill, scrap yard, and east potliner. Data use is broken out as follows:

- 3.1: Estimated mass and distribution of fluoride
- 3.2: Vertical and horizontal distribution of fluoride in silt
- 3.3: Soil classification data, analytical data, and hydraulic conductivity
- 3.4: Estimated range of partitioning coefficients values

3.1 Estimated Mass and Distribution of Fluoride

Additional fluoride concentration data for the waste materials and underlying soils (shallow sand above the silt, silt, and UGS) will be used to estimate the mass of fluoride in each hydrogeologic unit, and better define its distribution. This data will be used to assess the effectiveness of excavation of the waste material and relative time to compliance.

3.2 Vertical and Horizontal Distribution of Fluoride in Silt

Geoprobe borings were located near each of the soil and debris areas to further define the horizontal distribution of fluoride in, and beneath, the silt. This data will support the evaluation of groundwater fluoride concentration trends in the UGS, and be used to assess the effectiveness of early action alternatives on groundwater.

3.3 Soil Classification Data, Analytical Data, and Vertical Hydraulic Conductivity

Soil classification data (grain size distribution, clay fraction, moisture content, organic content, unit weight), analytical data, and laboratory vertical hydraulic conductivity data (for silt only) were obtained for the following purposes:

- Compare site-specific soil properties to soils used in various sorption studies documented in the literature
- Estimate the relative mass of fluoride contained in the soil pore water, and the mass adsorbed onto the soil
- Estimate the site-specific partitioning coefficient
- Estimate a range of literature-derived and site-specific retardation factors for the soil underlying the waste material.

3.4 Estimated Range of Partitioning Coefficients Values Relevant to the Site

Using collected or calculated data described above, an estimate of the range of partitioning coefficients values relevant to the site will be derived. These values will be used in the site-specific groundwater flow model and in estimating time to compliance.

4.0 Field Exploration and Sampling Methodology

Figures B-1 through B-4 show the locations of Geoprobe and hollow stem auger (HSA) boreholes advanced during this field event, and indicate whether soil or groundwater was

collected at each location. Borehole drilling methods and sample collection approach are discussed below.

4.1 Geoprobe Sampling Methodology

Geoprobe direct push technology [described in detail in the *Draft Sampling and Analysis Plan* (SAP), CH2M HILL, July 1997] was used to collect soil and groundwater samples for chemical analysis at specified locations in south landfill, scrap yard, and east potliner. A general description of Geoprobe direct push equipment and sampling procedures is presented in Appendix B of the SAP. Soil sampling is discussed in Section 2.5.5 of the SAP; groundwater sampling is detailed in Section 2.7.2.

Geoprobe borings were used to collect soil samples. Soil samples were collected at 5-foot intervals from ground surface to approximately 5 feet into the top of the UGS. The Geoprobe boring locations by area included:

- **South Landfill.** Six Geoprobe locations were advanced to collect soil samples in south landfill. The total depth of each borehole was approximately 45 feet below ground surface (bgs).
- **East Potliner.** Similarly, four Geoprobes were advanced to depths of approximately 40 feet bgs in east potliner.
- **Scrap Yard.** Five Geoprobes were completed to depths of approximately 35 feet bgs in scrap yard. Geoprobe GP50 met refusal at approximately 1 foot bgs during advancement. This boring was completed using a hollow stem auger drill rig and renamed SB11.

Separate Geoprobe borings were advanced to collect groundwater samples in each of the source areas. The groundwater Geoprobe borings were co-located with selected soil Geoprobe locations, and groundwater samples were collected at intervals matching the soil samples to allow direct comparison of soil and groundwater data. Total depth of the groundwater Geoprobe borings were determined using the following criteria:

- Groundwater samples were collected at 5-foot intervals from the point where water was first encountered to a minimum depth of 5 feet into the UGS.
- If field-measured fluoride concentrations in groundwater fell below 10 mg/L, advancement of the boring was terminated.
- If field-measured fluoride concentrations remained at or above 10 mg/L, the 5-foot interval advancement continued. If fluoride levels remained at or greater than 10 mg/L at a depth of 20 feet into the UGS, sampling was continued at 10-foot intervals until concentrations fell below 10 mg/L or a maximum depth of 80 feet bgs was reached.

Three groundwater Geoprobe borings were completed in south landfill, two in east potliner, and three in scrap yard. One of the three Geoprobes in the scrap yard area (GP56) was actually located north of the scrap yard to evaluate the connection between fluoride concentrations observed at MW33-095 and scrap yard.

4.2 Hollow Stem Auger Sampling Methodology

In addition to Geoprobe sampling, a HSA drill rig was used to advance a single borehole at each of the three soil and debris areas (south landfill, scrap yard, and east potliner) to collect larger undisturbed soil samples for geotechnical analysis. Boring depths were approximately 49, 40, and 45 feet bgs, respectively. Hollow stem auger soil sampling was performed as described in Section 2.5.3 of the SAP.

Each boring (whether Geoprobe or HSA) was geologically logged during drilling by the field hydrogeologist. Soil samples were classified in accordance with *ASTM D2488-90: Standard Practice for Description and Identification of Soils* (see Appendix B of the SAP). Geoprobe and hollow stem auger soil boring logs for south landfill, scrap yard, and east potliner are located in the attachment to this appendix. Weather, personnel, equipment calibration, field fluoride measurements, soil and water sample information, and field observations were recorded daily in a field logbook.

Sample handling and custody procedures were conducted in accordance with Section 5.0 of the SAP. At the end of the field effort, the vertical and horizontal control of each boring location was established by surveying. Boring locations were surveyed to the National Geodetic Vertical Datum (NGVD) of 1929. The North American Datum 1988 (with a 1991 adjustment) was used for horizontal control.

5.0 Laboratory Analysis

Table B-1 summarizes the soil and groundwater sample collection effort, including the analytical methods, the sample locations, and number of samples analyzed by area.

5.1 Soil

5.1.1 Chemical Analysis

A total of 216 soil samples were collected from 19 Geoprobe and HSA borings and submitted to Oregon Analytical Laboratory (OAL) in Beaverton, Oregon. Each sample was analyzed for total fluoride (EPA Method 340.1/340.2) and moisture content. Approximately half of the samples were also analyzed for soluble fluoride (EPA Method 300.0).

5.1.2 Geotechnical Analysis

Soil samples in sands were collected using Dames and Moore samplers lined with six 1-inch brass liners. All but one of the HSA boreholes in scrap yard and south landfill had samples collected from the sandy soil horizons in the overlying sand (shallow sand above the silt), and from the top of the UGS. The overlying sand was not present at east potliner (EPL-SB01) and the north-central portion of scrap yard (SY-SB11). Consequently, only one sand sample (at the top of the UGS) was collected using the Dames and Moore method. A shelby tube sample was collected from the silt unit at each of the three source areas.

Samples from the overlying sand, silt, and UGS were submitted to Advanced Terra Testing in Lakewood, Colorado for vertical hydraulic conductivity testing, analysis of grain size distribution, clay fraction, unit weight, moisture content, and organic content. Samples from these same horizons were submitted to CH2M HILL Analytical Services (CAS) in Corvallis,

Oregon and analyzed for oxalate-extractable aluminum and iron, dithionite-extractable aluminum and iron, pH, and total aluminum and iron. Additional sample volumes were also archived at CAS for future analytical work, if needed.

5.2 Groundwater

Groundwater fluoride concentrations were measured in the field using an Orion 9609BN Selective Ion Combination Fluoride Electrode attached to an Orion 290A meter. The equipment was calibrated and used according to the procedures outlined in Appendix C of the SAP. The detection limit for the field fluoride probe is 0.40 mg/L with an upper limit of approximately 100 mg/L. Groundwater samples with field-measured fluoride concentrations greater than 100 mg/L were sent to CAS in Redding, California for soluble fluoride analysis (EPA Method 300.0).

A total of 92 groundwater samples were collected from nine locations and analyzed in the field for soluble fluoride using the selective ion fluoride probe. Field measurements indicated sixteen of these samples had fluoride concentrations exceeding 100 mg/L. These samples were submitted to CAS in Redding, California for soluble fluoride analysis (EPA Method 300.0).

6.0 Summary of Results

6.1 Analytical Results

Table B-2 summarizes field and laboratory fluoride analytical results by borehole location, sample depth, and media. Table B-3 summarizes the soil physical parameter data.

Oxalate- and dithionite-extractable aluminum and iron, total aluminum and iron, and pH data were used to select an applicable range of literature partitioning coefficient values for site soils. Refer to Appendix G of this report for detailed discussions of this procedure.

6.2 Horizontal and Vertical Distribution of Fluoride in Soil and Groundwater

Figures B-1 through B-4 are plan view maps showing borehole and cross-section locations. Figures B-5 through B-10 depict the vertical distribution of fluoride in groundwater in cross section. Figures B-11 through B-15 portray the vertical distribution of fluoride in soils in cross section. The cross sections were constructed using the following information:

- Soil descriptions from soil boring logs were used to approximate geologic contacts beneath each source area (Figures B-5 through B-15)
- Field and laboratory groundwater fluoride concentration results from the 1998 data collection effort and from the August 1997 groundwater monitoring event were used to contour groundwater concentrations (Figures B-5 through B-10)
- Fluoride data from 1998 Geoprobe and HSA samples, and total or soluble fluoride soil data from samples collected during monitoring well installation of MW01-019, MW03-017, MW11-017, MW26-012, and well group MW33-033/-095/-165, were used to contour fluoride concentrations in soil (Figures B-11 through B-15).

6.2.1 Distribution of Fluoride in Groundwater by Area

South Landfill. Cross section 3-3′ (Figure B-5) shows the vertical distribution of fluoride in groundwater in south landfill. Shallow groundwater flow in this area is to the northwest. In general, cross section 3-3′ illustrates the following:

- The highest groundwater fluoride concentrations range between 200 and 1030 mg/L in the silt at Geoprobes GP49, GP59, and GP60. Geoprobe GP49 was advanced during the 1997 Geoprobe Field Investigation.
- The highest fluoride concentrations are located in the silt 15 to 20 feet bgs, rather than in the overlying sand, possibly indicating that the most concentrated material leached from the waste some time in the past. The horizontal extent of fluoride in the down-gradient direction likely terminates somewhere between the southwest perimeter of south landfill and the eastern perimeter of south wetlands (upgradient of MW17-016).
- The fluoride in the UGS appears to be localized with a maximum detected concentration of 61 mg/L at GP59.

Cross section 4-4′ (Figure B-6) is perpendicular to cross section 3-3′ in south landfill. Observations include:

- The highest concentrations of fluoride appear within the silt (see GP59 and GP60).
- Fluoride was not detected at well group MW03 in August of 1997, indicating the horizontal extent of fluoride does not extend upgradient beyond the southeastern boundary of south landfill. This observation is consistent with the northwesterly groundwater flow direction observed in this portion of the site.
- The northwestern extent of the fluoride plume between MW19-013 and MW01-019 is fully defined.
- Fluoride appears to be localized in the UGS with relatively low concentrations observed to the west and east of GP59 at MW47-095 and GP60.

East Potliner. Cross section 5-5′ (Figure B-7) crosses east potliner from northwest to southeast. Groundwater was sampled in only the western half of this area. Observations include:

- Both GP65 and GP66 show elevated (>100 mg/L) fluoride concentrations within the silty sand/silt and at the top of the UGS.
- The horizontal extent of fluoride (above 4 mg/L) appears to terminate somewhere between MW35 and GP27 northwest of east potliner.
- The horizontal extent of fluoride southeast of east potliner cannot be fully evaluated based on the existing groundwater data. However, the corresponding soil fluoride cross section (Figure B-13) shows fluoride concentrations up to 1,900 mg/kg (30 feet bgs) at GP67.
- The reduction in fluoride concentration at the bottom of Geoprobes GP56 and GP66 suggests the vertical extent of fluoride beneath east potliner is limited to depths of approximately 60 feet bgs (that is, limited to the upper portion of the UGS).

Scrap Yard. Figure B-4 shows the location of three cross sections constructed for scrap yard. General observations regarding each cross section are provided below.

West-East Cross Section 6-6′ (Figure B-8):

- Fluoride concentrations in the 20 to 40 mg/L range appear to extend beyond a depth of approximately 80 feet in the UGS at GP47 (advanced during the 1997 Geoprobe field investigation) and GP50/SB11. Soil data from GP55 and GP50/SB11 indicate high concentrations of fluoride (13,000 mg/kg) above the silt.
- Fluoride concentrations appear to decline east of GP50/SB11. The horizontal extent of fluoride west of GP47 is uncertain.

North-South Cross Section 7-7′ and Northwest-Southeast Cross Section 8-8′ (Figures B-9 and B-10):

- Elevated fluoride concentrations appear to be limited to the northern portion of scrap yard. The fluoride plume beneath the northern portion of scrap yard appears to extend to a depth greater than 80 feet and to depths greater than 165 feet north of scrap yard (see MW33-165). The fluoride appears at shallower depths (25 feet or less) and at lower concentrations in the southern portion of scrap yard.
- The fluoride data from Geoprobe GP56 strongly suggest that the shallow fluoride at the northern portion of scrap yard is contributing to the fluoride detected in monitoring wells MW33-095 and MW33-165. Plant production well pumping is the likely hydraulic influence causing the downward fluoride movement and creating the fluoride distribution presented in this cross section.
- The highest concentrations of fluoride may have leached from the scrap yard historically. This is suggested by the higher concentrations downgradient of scrap yard than beneath scrap yard.

6.2.2 Distribution of Fluoride in Soil by Area

South Landfill. Cross section 3-3′ (Figure B-11) shows the vertical distribution of fluoride in soil at south landfill. Shallow groundwater flow in this area is to the northwest. In general, cross section 3-3′ illustrates the following:

- The highest soil fluoride concentrations were found in the waste material, ranging from 9,000 to 48,000 mg/kg. Concentrations in the overlying sand were considerably lower, generally ranging from 350 to 700 mg/kg, with one sample directly below the landfilled material containing 4,100 mg/kg of fluoride.
- Fluoride concentrations in the silt were somewhat higher than in the overlying sand, but still much lower than in the waste materials. Silt concentrations ranged from 190 to 3,300 mg/kg. The highest silt concentrations were found in GP59 at depths of 15 to 25 feet bgs.
- Unlike groundwater concentrations, soil fluoride concentrations tend to decrease with depth. This may indicate that groundwater concentrations in the silt represent historic leaching of fluoride from materials with higher solubility limits than the material leaching more recently.

- The horizontal extent of fluoride in the southwest direction was not evaluated during this investigation.
- The fluoride levels in the UGS soils are relatively low, and approach background concentrations (assumed to be ~200 mg/kg) in some areas.

Cross section 4-4′ (Figure B-12) is perpendicular to cross section 3-3′ in south landfill. Observations include:

- The highest concentrations of fluoride appear within the waste material, generally decreasing with depth, with a localized area of elevated concentrations in the silt.
- Fluoride concentrations beneath the southeast portion of the landfill are considerably lower than those near the center or northwest portion.
- With some exceptions, samples collected from the UGS had fluoride concentrations approaching background.

East Potliner. Cross section 5-5′ (Figure B-13) crosses east potliner from northwest to southeast. Observations include:

- Soil concentrations near the existing ground surface were relatively low, approaching background in some areas. These samples were collected in the overlying sand, which was directly below the waste materials removed during a time-critical-action. These low fluoride concentrations indicate that an improvement has occurred as a result of the removal action.
- Elevated fluoride concentrations were detected in samples collected in the silt unit, with concentrations ranging from 380 to 2,700 mg/kg.
- Soil samples collected from the UGS had generally low concentrations of fluoride, with the exception of samples from GP66, which had concentrations of 700 and 1,200 mg/kg within the UGS, and 2,700 mg/kg at the contact between the silt and the UGS.
- The southeastern extent of elevated fluoride in the silt was not assessed.

Scrap Yard. Figure B-4 shows the location of three cross sections constructed for scrap yard. Observations include:

West-East Cross Section 6-6′ (Figure B-14):

- The highest fluoride concentrations in soil samples were found just below the upper boundary of scrap yard, ranging from 12,000 to 13,000 mg/kg at depths from near surface to 5 feet bgs.
- Concentrations decrease rapidly with depth, with highest concentrations near the center of scrap yard (GP50/SB11). Concentrations in the overlying sands ranged from 190 to 13,000 mg/kg.
- Soil concentrations in the silt range from 260 mg/kg to 670 mg/kg, with the exception of the sample collected from GP50/SB11 at 10 feet bgs, which had a concentration of 2,200 mg/kg. The sample collected from this boring at 15 feet bgs had a concentration of 490 mg/kg.

- Samples collected in sandy silt and the UGS were relatively low in fluoride concentration, ranging from 210 to 590 mg/kg.

North-South Cross Section 7-7′ (Figure B-15):

- Similar to the groundwater findings, elevated fluoride concentrations in soil appear to be limited to the northern portion of scrap yard. The fluoride concentrations beneath the southern portion of scrap yard range from 180 to 510 mg/kg, reflecting a different historical use of the north and south areas.

Table B-1
Summary of Samples Collected for Fluoride Analysis from South Landfill, East Potliner, and Scrap Yard
Reynolds Metals Company - Troutdale, Oregon

Exploration Method	Media	Sample Analysis / Collection Method	South Landfill		East Potliner		Scrap Yard		Total No. of Samples
Total Geoprobe Stations in Each Area			6		4		6		
			No. of Borings	No. of Samples	No. of Borings	No. of Samples	No. of Borings	No. of Samples	
Borings Used for Soil / Water	Soil	Total fluoride (Method 340.1/340.2) and soluble fluoride (Method 300.0)	6	89	4	52	5 (a)	61	202
	Water	Soluble field fluoride (b) / Soluble laboratory fluoride - (Method 300.0)	3	36	2	30	3 (a)	30	96
Total Hollow Stem Auger Stations in Each Area			1		1		2		
			No. of Borings	No. of Samples	No. of Borings	No. of Samples	No. of Borings	No. of Samples	
HSAs Used for Soil / Water	Soil	Total fluoride (Method 340.1/340.2) and soluble fluoride (Method 300.0) (c)		12		9		22	43
		Soil physical parameters (d) (D & M), and vertical conductivity (Shelby tubes)	1	3	1	2	2	5	10
		Literature Kd, (D & M): pH, oxalate and dithionite, extractable aluminum and fluoride		3		2		5	10
	Water	Field fluoride (b)	0	0	0	0	1	12	12

Notes:
(a) Six soil and four groundwater geoprobe sample locations were originally planned. However, GP50 hit refusal and was redrilled (GP50/SB11) in adjacent location using HSA drilling equipment in one borehole.
(b) *Field fluoride is measured using an Orion 9609BN Selective Ion Combination Fluoride Electrode in combination with an Orion 290A pH meter.*
(c) HSA soil samples were collected using Dames & Moore samplers lined with 6" brass-liners. Soil was extruded from rings at the target sample depth into sample jars.
(d) Soil physical parameters include grain size distribution, percent clay, moisture content, unit weight, organic content.

Table B-2
Analytical Results for Geoprobe Samples Collected during Summer 1998
Reynolds Metals Company - Troutdale, Oregon

Station ID	Depth	Soil				Groundwater	
		Fluoride (soluble) by 300.0		Fluoride (total) by 340.1/340.2	Moisture Content	Fluoride (soluble) Lab by 300.0	Fluoride (soluble) Field
	(ft bgs)	mg/Kg		mg/Kg	% w/w	mg/L	mg/L
South Landfill Area							
GP58-000	0			5300	13		
GP58-005	5	39		210	15		
GP58-010	10			230	20.5		
GP58-015	15	1900	D	1800	37.2		
GP58-020	20			630	32.4		
GP58-025	25	6		470	28.9		
GP58-030	30			570	27.8		
GP58-035	35	2		240	28.9		
GP58-040	40			250	23.1		
GP58-045	45	1		170	22.2		
GP59-000	0			18000	16.1		
GP59-005	5	150		520	27.5		65
GP59-010	10			680	35.5	265	130
GP59-015	15	1200	D	3300	28.5	772	750
GP59-020	20			2400	33.1	1030	1100
GP59-025	25	110		790	26.4		14
GP59-030	30			600	28.3		21
GP59-035	35	20	U	390	29.2		1.7
GP59-040	40			230	20.6		6.6
GP59-045	45	38		300	20.7		45
GP59-050	50						61
GP59-055	55						3.8
GP60-000	0			48000	21.1		
GP60-005	5	1200	D	4100	11.8		53
GP60-010	10			530	19.3		72
GP60-015	15	21	I	290	30.7		23
GP60-020	20			960	31.9	202	160
GP60-025	25	160	I	680	29.3	542	310
GP60-030	30			430	28.4		7
GP60-035	35	7		500	28		7.5
GP60-040	40			370	27.8		2.1
GP60-045	45	2		210	21.4		1.9
GP60-050	50						1.2
GP61-000	0			9000	15.2		
GP61-005	5	110		450	21		
GP61-010	10			350	24.2		
GP61-015	15	2		190	26.7		
GP61-020	20			390	31.9		
GP61-025	25	30	U	490	29.3		
GP61-030	30			510	27.5		
GP61-035	35	20	U	430	29.4		
GP61-040	40			370	27.3		
GP61-045	45	1	U	510	22.5		

Table B-2
Analytical Results for Geoprobe Samples Collected during Summer 1998
Reynolds Metals Company - Troutdale, Oregon

Station ID	Depth	Soil			Groundwater	
		Fluoride (soluble) by 300.0	Fluoride (total) by 340.1/340.2	Moisture Content	Fluoride (soluble) Lab by 300.0	Fluoride (soluble) Field
	(ft bgs)	mg/Kg	mg/Kg	% w/w	mg/L	mg/L
GP62-000	0		19000	9.8		
GP62-005	5	110	530	24.5		
GP62-010	10		270	19		
GP62-015	15	2	250	25.7		
GP62-020	20		450	34.1		
GP62-025	25	1 U	530	30.1		
GP62-030	30		480	30.5		
GP62-035	35	1 U	460	29.5		
GP62-040	40		310	24.2		
GP62-045	45	1	160	19.5		
GP63-000	0		710	15.4		
GP63-005	5	44	290	26.9		30
GP63-010	10		370	27.7		9.8
GP63-015	15	1 U	450	33		0.88
GP63-020	20					5.1
GP63-025	25	1 U	330	30.1		3.5
GP63-030	30		440	31.8		2.6
GP63-035	35	1 U	630	32.3		1.0
GP63-040	40		290	18.8		0.48
GP63-045	45	1 U	160	20.3		0.87
GP63-050	50					1.55
GP Samples for SLF Area		***30***	***59***	***59***	***5***	***31***
SL-SB61	5	200 D	920	18.8		
SL-SB61	10		280	17.1		
SL-SB61	15	850 D	1100	32.8		
SL-SB61	25		410	29.9		
SL-SB61	30	5	560	30.5		
SL-SB61	35		390	28.6		
SL-SB61	40	1 U	320	26.1		
SL-SB61	45		160	21.9		
HSA Samples for SLF Area		***4***	***8***	***8***	***0***	***0***
East Potliner Area						
GP64-000	0		400	20.6		
GP64-005	5	110	740	24.4		
GP64-010	10		1300	29.3		
GP64-015	15	160	660	27.2		
GP64-020	20		350	28.7		
GP64-025	25	3	260	33.4		
GP64-030	30		380	27.9		
GP64-035	35	1	230	16.4		
GP64-040	40		230	22.1		
GP65-000	0		230	14.4		
GP65-005	5	28	260	21.7	115	110

Table B-2
Analytical Results for Geoprobe Samples Collected during Summer 1998
Reynolds Metals Company - Troutdale, Oregon

Station ID	Depth	Soil			Groundwater	
		Fluoride (soluble) by 300.0	Fluoride (total) by 340.1/340.2	Moisture Content	Fluoride (soluble) Lab by 300.0	Fluoride (soluble) Field
	(ft bgs)	mg/Kg	mg/Kg	% w/w	mg/L	mg/L
GP65-010	10		1200	23.1	440	446
GP65-015	15	670 D	2400	25.6	267	220
GP65-020	20		1500	29	388	240
GP65-025	25	99	660	27.4	174	165
GP65-030	30		540	32.2		3.8
GP65-035	35	2	220	25		9.73
GP65-040	40		350	23.5	343	328
GP65-045	45				264	256
GP65-050	50					94.6
GP65-060	60					5.6
GP66-000	0		470	14.9		
GP66-005	5	120	2400	26		22.2
GP66-010	10		800	25.1		51.5
GP66-015	15	60	1100	27.3		79.7
GP66-020	20		760	31		92.6
GP66-025	25	140	940	31.1	210	108
GP66-030	30		2700	29.9	602	538
GP66-035	35	800 D	1200	32.7	570	450
GP66-040	40		700	24		26.1
GP66-045	45					6.79
GP67-000	0		330	16.2		
GP67-005	5	18	220	28		
GP67-010	10		350	22.4		
GP67-015	15	460 D	1500	34.2		
GP67-020	20		1100	31.1		
GP67-025	25	450 D	1200	31.2		
GP67-030	30		1900	28.8		
GP67-035	35	34	440	25.3		
GP67-040	40		270	19.5		
GP Samples for EPL Area		***16***	***36***	***36***	***10***	***20***
EP-SB01	5	54	710	27.1		
EP-SB01	10		890	28.3		
EP-SB01	15	140	580	28		
EP-SB01	25		860	29.1		
EP-SB01	30	200 D	770	26.9		
EP-SB01	35		430	19.1		
HSA Samples for EPL Area		***3***	***6***	***6***	***0***	***0***
Scrap Yard Area						
GP51-000	0		12000	14.4		
GP51-005	5	40	390	14.9		
GP51-010	10		190	14.6		
GP51-015	15	41	260	30.2		
GP51-020	20		510	28.5		

Table B-2
Analytical Results for Geoprobe Samples Collected during Summer 1998
Reynolds Metals Company - Troutdale, Oregon

Station ID	Depth	Soil					Groundwater		
		Fluoride (soluble) by 300.0		Fluoride (total) by 340.1/340.2		Moisture Content	Fluoride (soluble) Lab by 300.0	Fluoride (soluble) Field	
	(ft bgs)	mg/Kg		mg/Kg		% w/w	mg/L	mg/L	
GP51-025	25	20	U	480		27.6			
GP51-030	30			480		32.1			
GP51-035	35	1	U	240		21.1			
GP52-000	0			230		12.7			
GP52-005	5	2		150	U	12.3		0.74	
GP52-010	10			150		12.6		3.6	
GP52-015	15	1	U	150	U	14.9		0.4	U
GP52-020	20			440		29.5		0.4	U
GP52-025	25	4		350		24.1		0.4	U
GP52-030	30			170		16.2		0.4	U
GP52-035	35	1	U	160		22.8		0.4	U
GP52-040	40							0.4	U
GP53-000	0			330		17			
GP53-005	5	6		350		30			
GP53-010	10			460		18.3			
GP53-015	15	14		160		21.4			
GP53-020	20			250		22.3			
GP53-025	25	14		270		21			
GP53-030	30			250		23.7			
GP53-035	35	1	U	180		21			
GP54-000	0			560		17.4			
GP54-005	5	25		340		28		21	
GP54-010	10			510		29.9		1.5	
GP54-015	15	4		360		28.3		0.4	
GP54-020	20			360		28.3		0.4	U
GP54-025	25	6		220		26.6		0.4	U
GP54-030	30			180		21.5		0.4	U
GP54-035	35	3		150	U	20.5		0.4	U
GP54-040	40							0.41	
GP55-000	0			13000		12			
GP55-005	5	65		390		27.1			
GP55-010	10			670		20			
GP55-015	15	74		480		21.8			
GP55-020	20			390		22.1			
GP55-025	25	41		280		16.6			
GP55-030	30			250		18.6			
GP55-035	35	6		220		15.7			
GP55-040	40			210		14.5			
GP56-005	5							0.4	U
GP56-010	10							1.2	
GP56-015	15							2	
GP56-020	20							0.56	
GP56-025	25							0.42	
GP56-030	30							0.4	U

Table B-2
Analytical Results for Geoprobe Samples Collected during Summer 1998
Reynolds Metals Company - Troutdale, Oregon

Station ID	Depth	Soil				Groundwater	
		Fluoride (soluble) by 300.0		Fluoride (total) by 340.1/340.2	Moisture Content	Fluoride (soluble) Lab by 300.0	Fluoride (soluble) Field
	(ft bgs)	mg/Kg		mg/Kg	% w/w	mg/L	mg/L
GP56-035	35						2
GP56-040	40						9.4
GP56-045	45						38
GP56-050	50						82
GP56-055	55					131	130
GP56-060	60						61
GP56-070	70						98
GP Samples for SY Area		***20***		***41***	***41***	***1***	***29***
SY-SB10	5	1600	D	50000	20.2		
SY-SB10	10			990	18.2		
SY-SB10	15	250	D	500	31.2		
SY-SB10	20			840	33.1		
SY-SB10	25	8		330	28.9		
SY-SB10	30			210	22.4		
SY-SB10	35	3		210	24.2		
SY-SB11	5	1200	D	13000	17.1		
GP50-010	10 (a)			2200	26.6		10.1
GP50-015	15 (a)	49		490	19.7		22.3
GP50-020	20 (a)			430	19.1		50.6
GP50-025	25 (a)	74		590	22.8		20.6
GP50-030	30 (a)			370	22.4		49.7
GP50-035	35 (a)	52		530	19.9		48.3
GP50-040	40						49.1
GP50-045	45						45
GP50-050	50						38.1
GP50-060	60						35.4
GP50-070	70						31.4
GP50-080	80						24.5
HSA Samples for SY Area		***8***		***14***	***14***	***0***	***12***

Notes:

(a) Soil (SY-SB11) and Groundwater (GP50) samples were collected using hollow stem auger drilling equipment in same borehole.

"SB" Station Ids from shelby tube samples.

ft bgs = feet below ground surface.

mg/kg = milligrams per kilograms. mg/L = milligrams per liter. % w/w = percent water by weight.

Fluoride by 300.0 method = soluble fluoride; Fluoride by 340.1 / 340.2 = total fluoride.

D = sample dilution.

U = not detected at or above the laboratory method reporting limit.

I = matrix interference.

Fluoride samples in soil and groundwater are shown by depth. Note that samples were collected from adjacent (within 5 feet) boreholes.

Table B-3
Physical Parameters Data Summary for HSA Soil Samples Collected during Summer 1998
Reynolds Metals Company - Troutdale, Oregon

Station ID	Sampling Date	Approx. Depth or Sample Interval	Specific Gravity	Organic Matter Content (b)		Falling Head (Fixed Wall) Test (c) *Sand Matrix*					Triaxial (Flexible Wall) Test (d) *Silt Matrix*							Triaxal Compression Test - Saturation Data (d)		
				Moisture Content	Organic Content	Wet Density (AT)	Dry Density (AT)	Porosity (AT)	Vertical Hydraulic Conductivity (e)		Wet Density (BT)	Dry Density (BT)	Wet Density (AT)	Dry Density (AT)	Porosity (AT)	Vertical Hydraulic Conductivity (e)		Cell Pressure	Back Pressure	$\overline{B}$
		(ft bgs)	(a)	%	%	PCF	PCF	%	cm/sec	ft/day	PCF	PCF	PCF	PCF	%	cm/sec	ft/day	PSI	PSI	(f)
South Landfill Area																				
SL-SB61-005	6/23/98	6.5 to 7	2.68	19.1	1.0	122.7	99.5	37.1	1.6E-03	4.5	--	--	--	--	--	--	--	--	--	--
SL-SB61-017	6/23/98	19 to 21	2.77	42.8	2.6	--	--	--	--	--	110.9	76.8	118.5	86.9	50.60	9.8E-08	2.8E-04	50	38.0	1.00
SL-SB61-045	6/23/98	45.5 to 46	2.69	20.3	0.7	124.3	101.6	36.21	1.5E-03	4.4	--	--	--	--	--	--	--	--	--	--
East Potliner Area																				
EP-SB01-014	6/24/98	14 to 16	2.72	37.3	1.4	--	--	--	--	--	119.3	92.8	140.7	112.3	45.39	2.2E-07	6.2E-04	50	38.0	0.99
EP-SB01-040	6/24/98	42 to 42.5	2.69	20.7	0.6	126.4	101.7	39.64	1.5E-03	4.3	--	--	--	--	--	--	--	--	--	--
Scrap Yard Area																				
SY-SB10-005	6/24/98	6 to 6.5	2.74	14.4	0.5	127.7	108.5	30.79	5.6E-04	1.6	--	--	--	--	--	--	--	--	--	--
SY-SB10-017	6/24/98	21 to 23	2.71	38.6	2.2	--	--	--	--	--	114.5	81.6	121.6	89.9	50.81	1.4E-07	3.9E-04	50	38	0.99
SY-SB10-035	6/24/98	39 to 39.5	2.69	21.9	0.7	121.8	95.0	42.87	1.7E-03	4.7	--	--	--	--	--	--	--	--	--	--
SY-SB11-005	6/24/98	7 to 9	2.73	41.2	2.1	--	--	--	--	--	108.7	77.4	115.8	81.5	54.91	2.0E-06	5.8E-03	60	48	0.97
SY-SB11-040	6/24/98	40.5 to 41	2.71	22.8	0.5	126.8	98.2	45.89	4.2E-03	11.9	--	--	--	--	--	--	--	--	--	--

Notes:
(a) Specific gravity by ASTM D 854.
(b) Organic Matter Content (Physical) by ASTM D 2974.
(c) Permeability Test - Falling Head by COE Method. (AT) = After test.
(d) Triaxial, Back Pressure Permeability/Compatibility Testing TX/PBP, ASTM D 5084. (BT) = Before test, (AT) = After test.
(e) Vertical hydraulic conductivity is average of values from Falling Head Fixed Wall Test and Triaxial, or Flexible Wall Test.
(f) B (bar) = Pore pressure change / total stress change.

ft bgs = feet below ground surface.
% = percent.
PCF = pounds per cubic foot.
cm/sec = centimeters per second.
ft/day = feet per day.
PSI = pounds per square inch.

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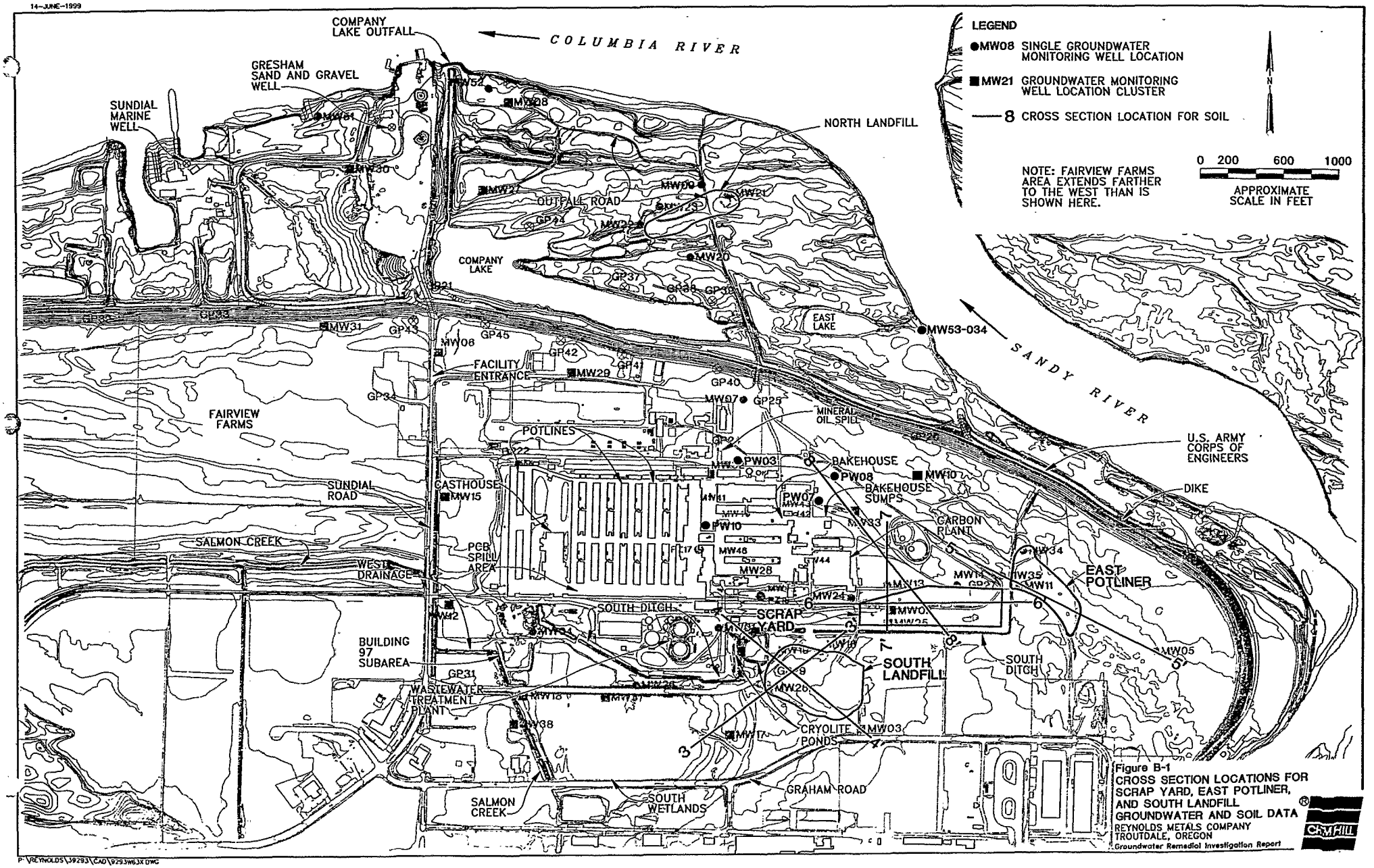

Figure B-1
CROSS SECTION LOCATIONS FOR SCRAP YARD, EAST POTLINER, AND SOUTH LANDFILL GROUNDWATER AND SOIL DATA
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

CH2M HILL

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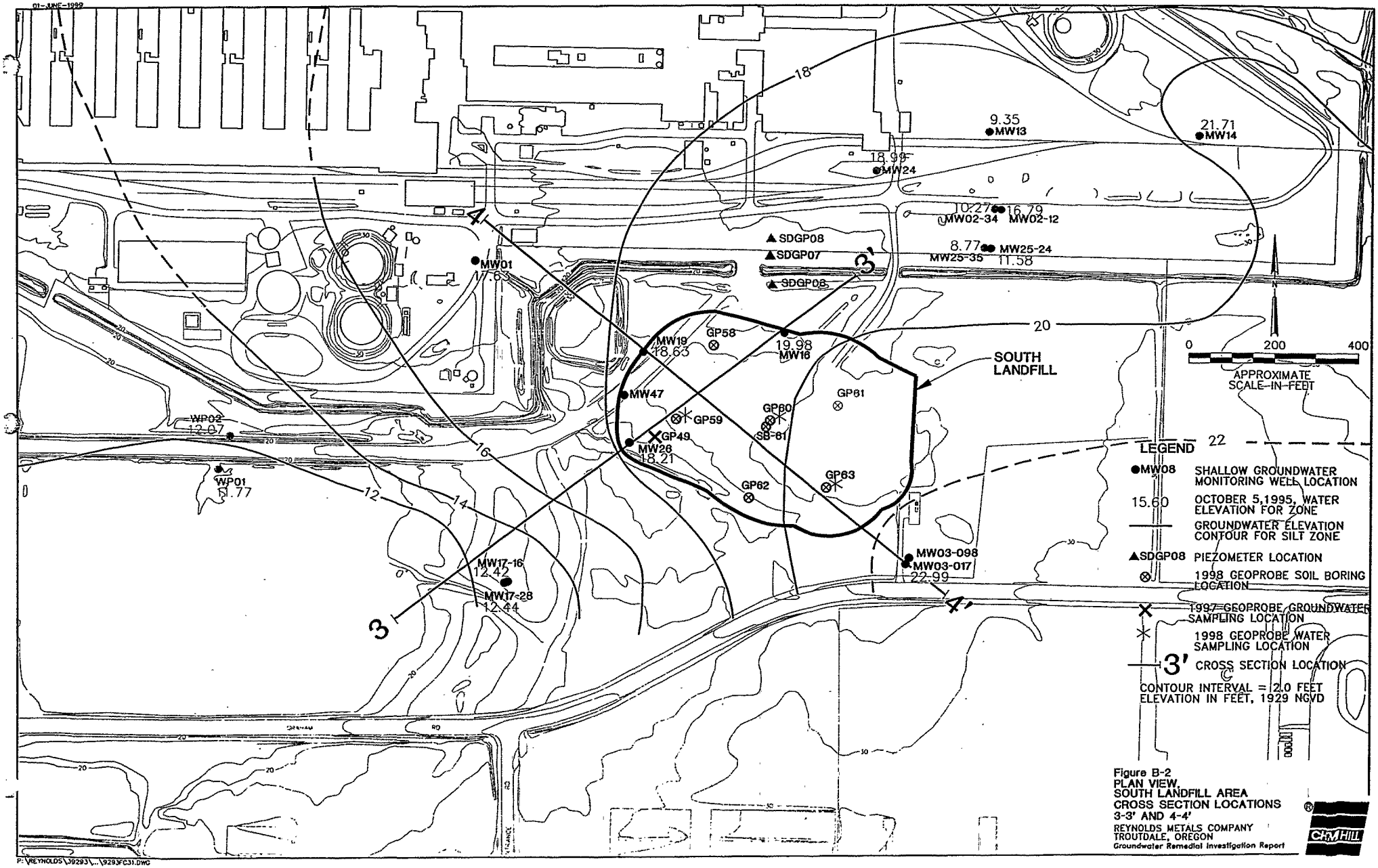

Figure B-2
PLAN VIEW,
SOUTH LANDFILL AREA
CROSS SECTION LOCATIONS
3-3' AND 4-4'
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

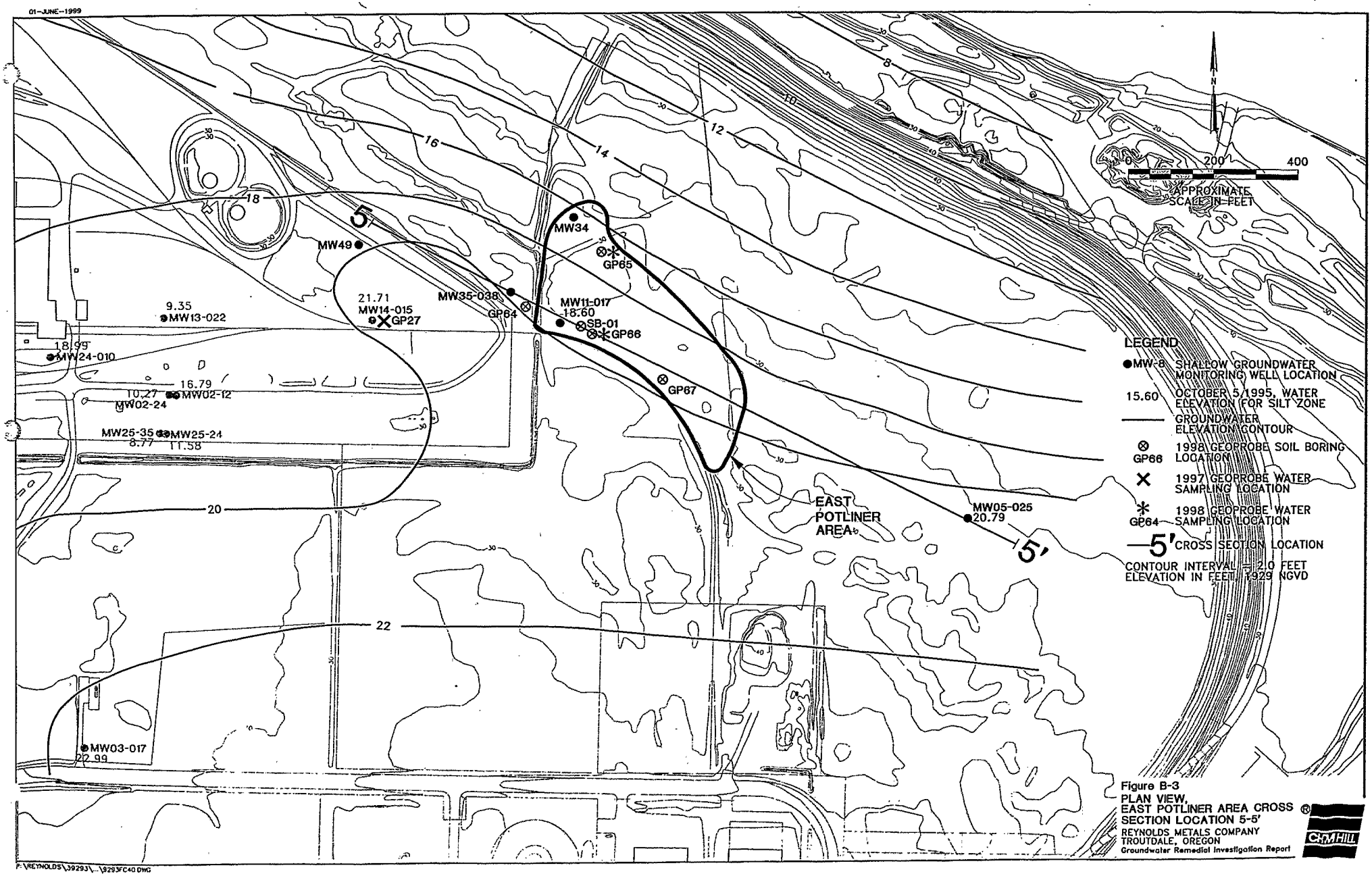

Figure B-3
PLAN VIEW,
EAST POTLINER AREA CROSS SECTION LOCATION 5-5'
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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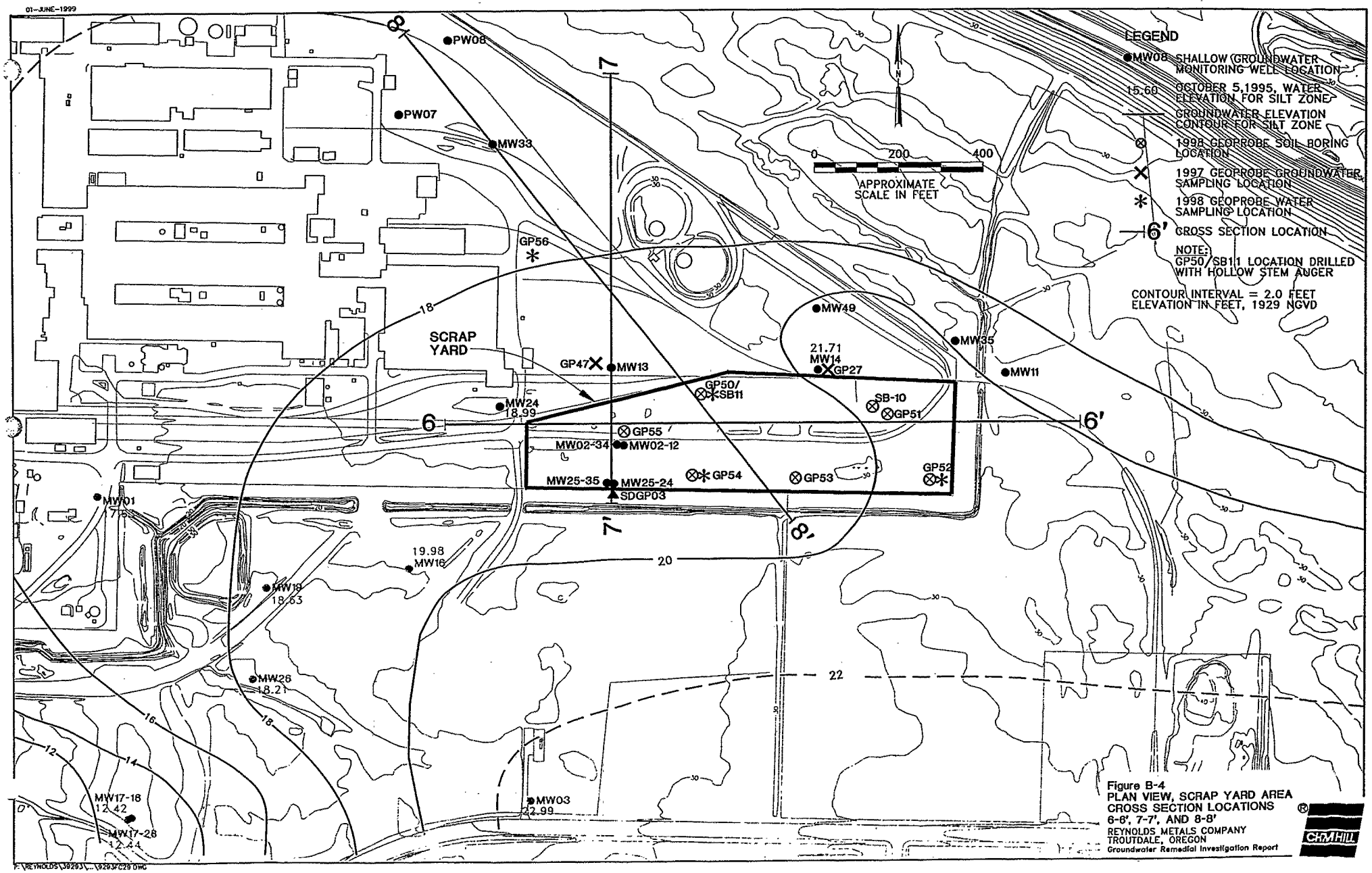

Figure B-4
PLAN VIEW, SCRAP YARD AREA
CROSS SECTION LOCATIONS
6-6', 7-7', AND 8-8'
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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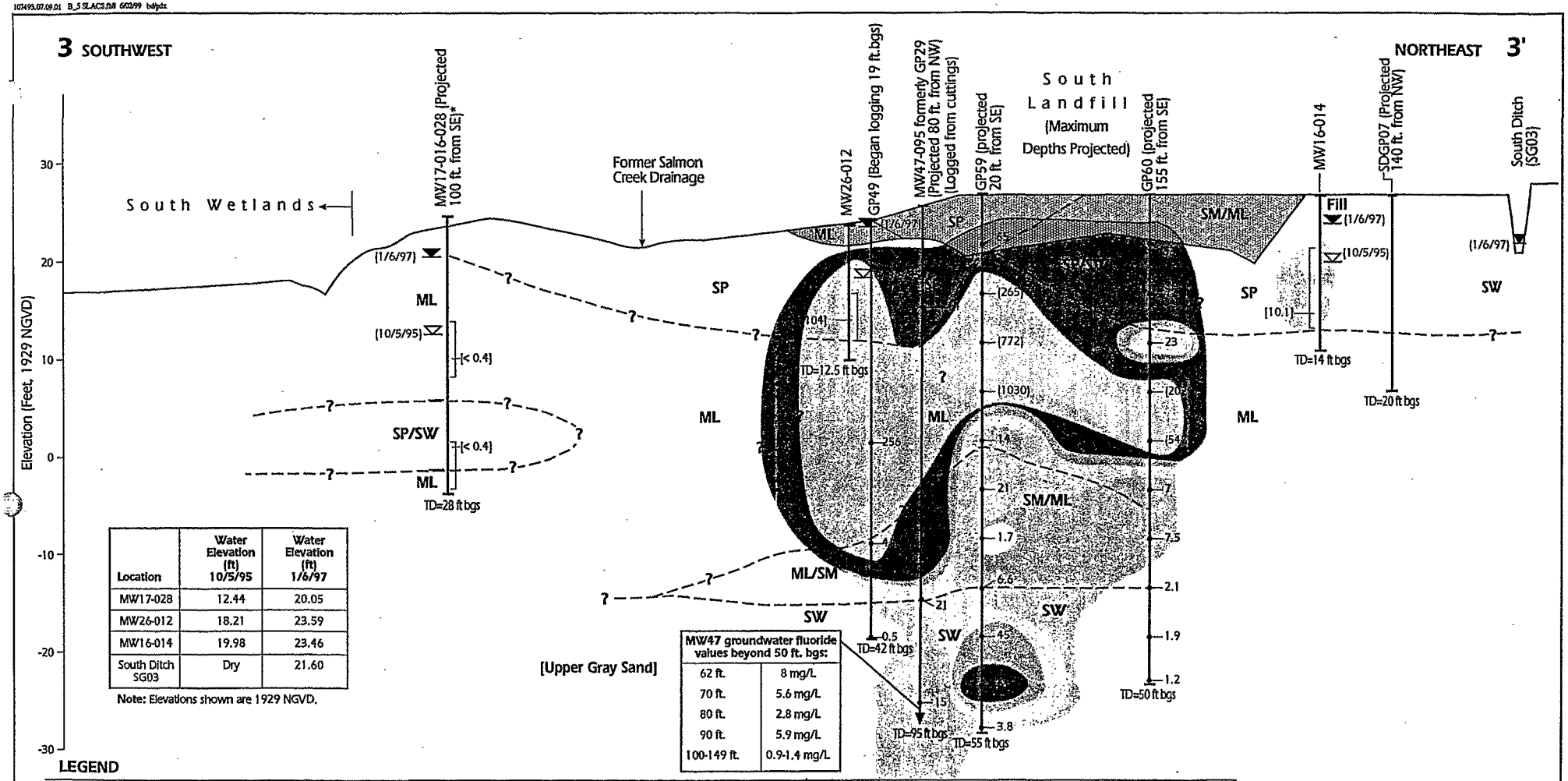

Location	Water Elevation (ft) 10/5/95	Water Elevation (ft) 1/6/97
MW17-028	12.44	20.05
MW26-012	18.21	23.59
MW16-014	19.98	23.46
South Ditch SG03	Dry	21.60

Note: Elevations shown are 1929 NGVD.

MW47 groundwater fluoride values beyond 50 ft. bgs:	
62 ft.	8 mg/L
70 ft.	5.6 mg/L
80 ft.	2.8 mg/L
90 ft.	5.9 mg/L
100-149 ft.	0.9-1.4 mg/L

LEGEND

MW09 ← Monitoring well number
Cased interval
Screened interval
TD=95 ft bgs ← Total depth

GP66 ← Geoprobe ID number (Locations are approximate)
110 ← Field fluoride value, mg/L
TD=45 ft bgs ← Total Geoprobe depth in feet below (approx.) ground surface elevation

1/6/97 water level elevation
10/5/95 water level elevation
Landfill material

ML = Silt
SP = Poorly graded sand
SW = Well-graded sand
SM = Silty sand
[ ] = Laboratory fluoride values (mg/L) (August 1997 quarterly sampling)
( ) = Laboratory fluoride value (mg/L) (June 1998 field sampling)

0 50 100 Feet
Approximate Horizontal Scale
0 5 10 Feet
Approximate Vertical Scale
Vertical exaggeration = 10x

Fluoride Concentration Ranges
4-15 mg/L
16-25 mg/L
26-45 mg/L
46-100 mg/L
101-500 mg/L
501-1,100 mg/L

Figure B-5
SOUTH LANDFILL AREA CROSS SECTION 3-3' VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE IN GROUNDWATER
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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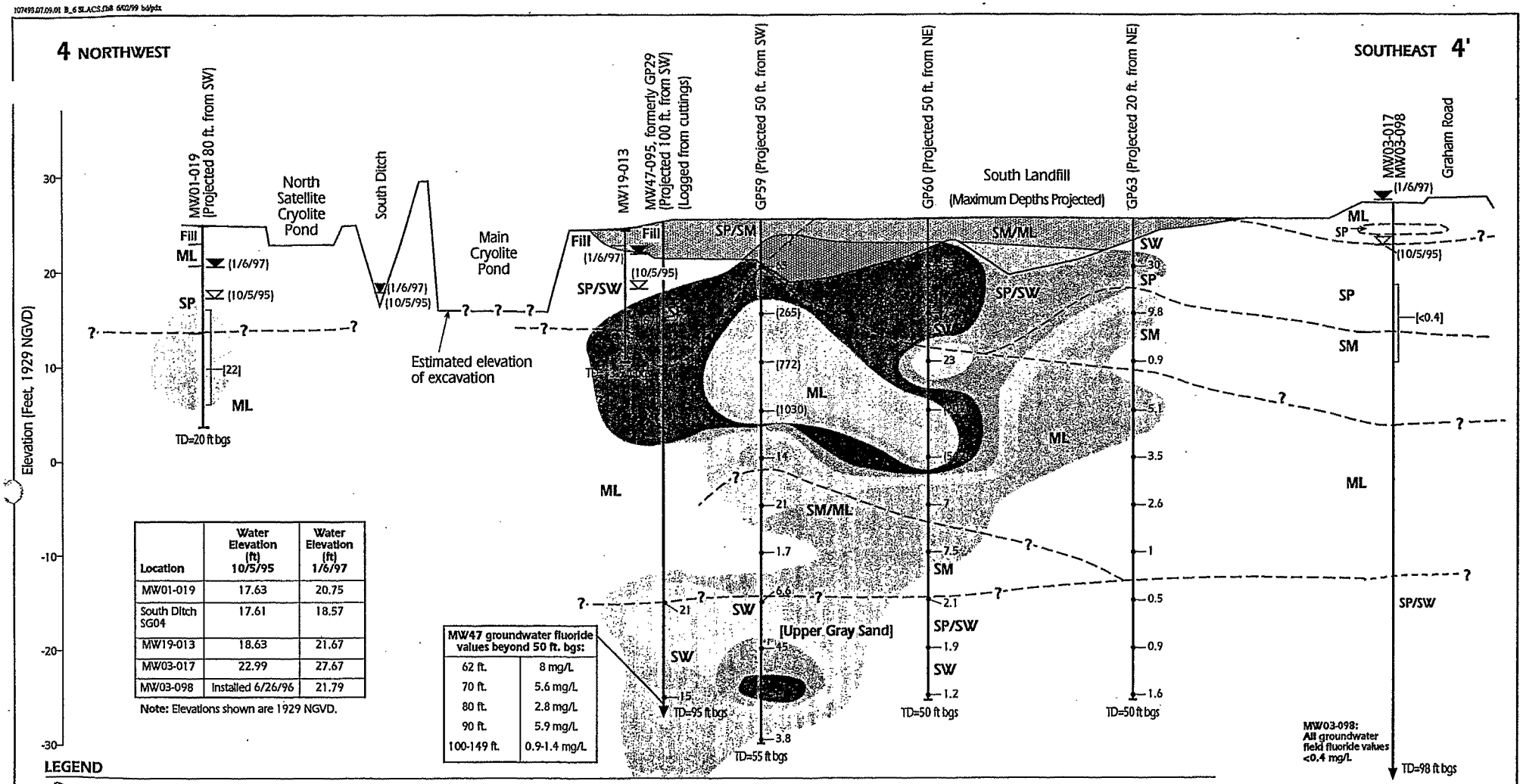

Location	Water Elevation (ft) 10/5/95	Water Elevation (ft) 1/6/97
MW01-019	17.63	20.75
South Ditch SG04	17.61	18.57
MW19-013	18.63	21.67
MW03-017	22.99	27.67
MW03-098	Installed 6/26/96	21.79

Note: Elevations shown are 1929 NGVD.

MW47 groundwater fluoride values beyond 50 ft. bgs:	
62 ft.	8 mg/L
70 ft.	5.6 mg/L
80 ft.	2.8 mg/L
90 ft.	5.9 mg/L
100-149 ft.	0.9-1.4 mg/L

LEGEND

MW09 ← Monitoring well number

← Cased interval

← Screened interval

TD=95 ft bgs ← Total depth

GP54 ← Geoprobe ID number (Locations are approximate)

1.5 ← Field fluoride value, mg/L

TD=80 ft bgs ← Total Geoprobe depth in feet below (approx.) ground surface elevation

1/6/97 water level elevation

10/5/95 water level elevation

Landfill material

ML = Silt

SP = Poorly graded sand

SW = Well-graded sand

SM = Silty sand

[ ] = Laboratory fluoride values (mg/L) (August 1997 quarterly sampling)

( ) = Laboratory fluoride value (mg/L) (June 1998 field sampling)

0 50 100 Feet
Approximate Horizontal Scale

0 5 10 Feet
Approximate Vertical Scale

Vertical exaggeration = 10x

Fluoride Concentration Ranges

4-15 mg/L

16-25 mg/L

26-45 mg/L

46-100 mg/L

101-500 mg/L

501-1,100 mg/L

Figure B-6
SOUTH LANDFILL AREA CROSS SECTION 4-4' VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE IN GROUNDWATER

REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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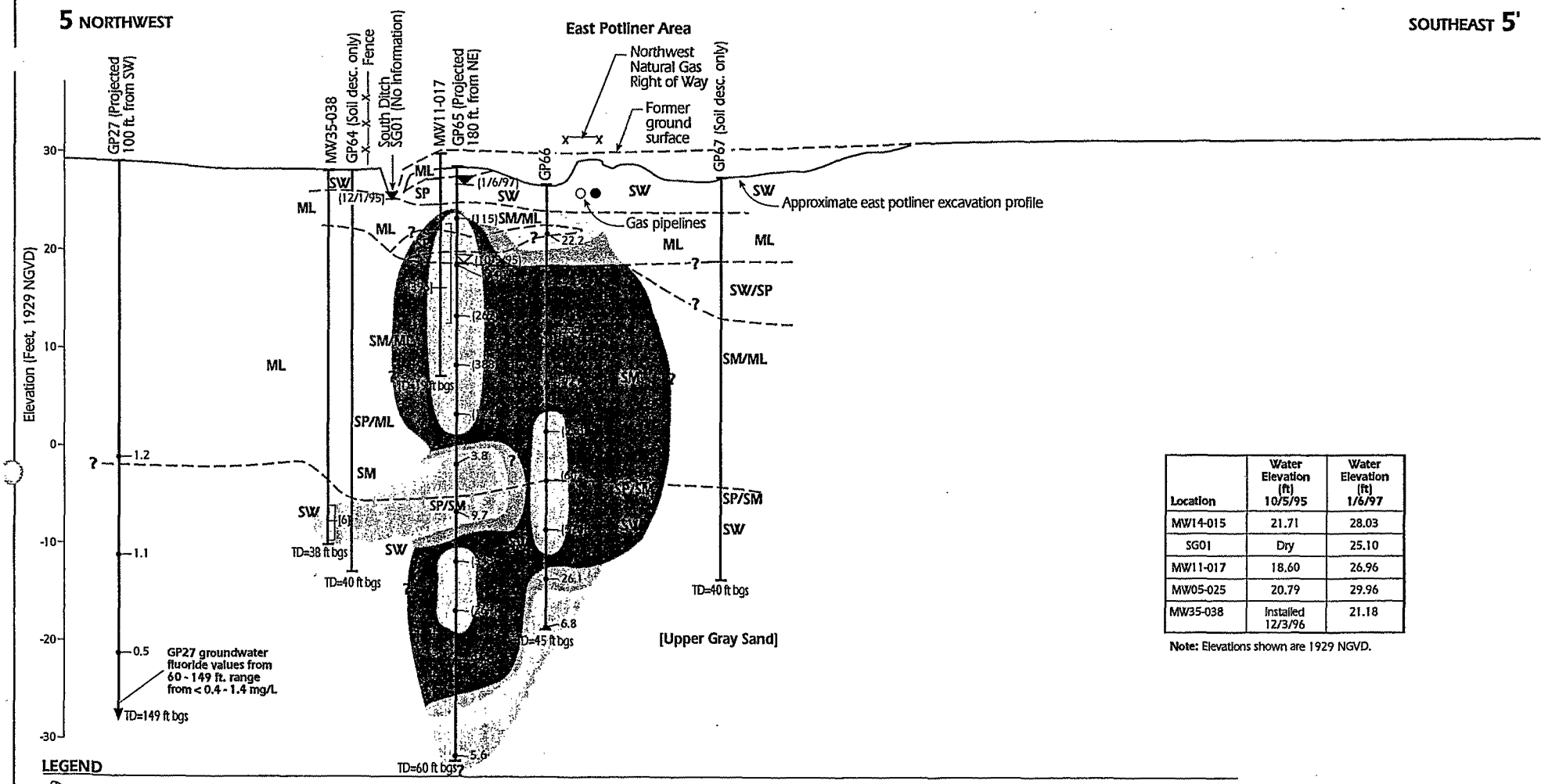


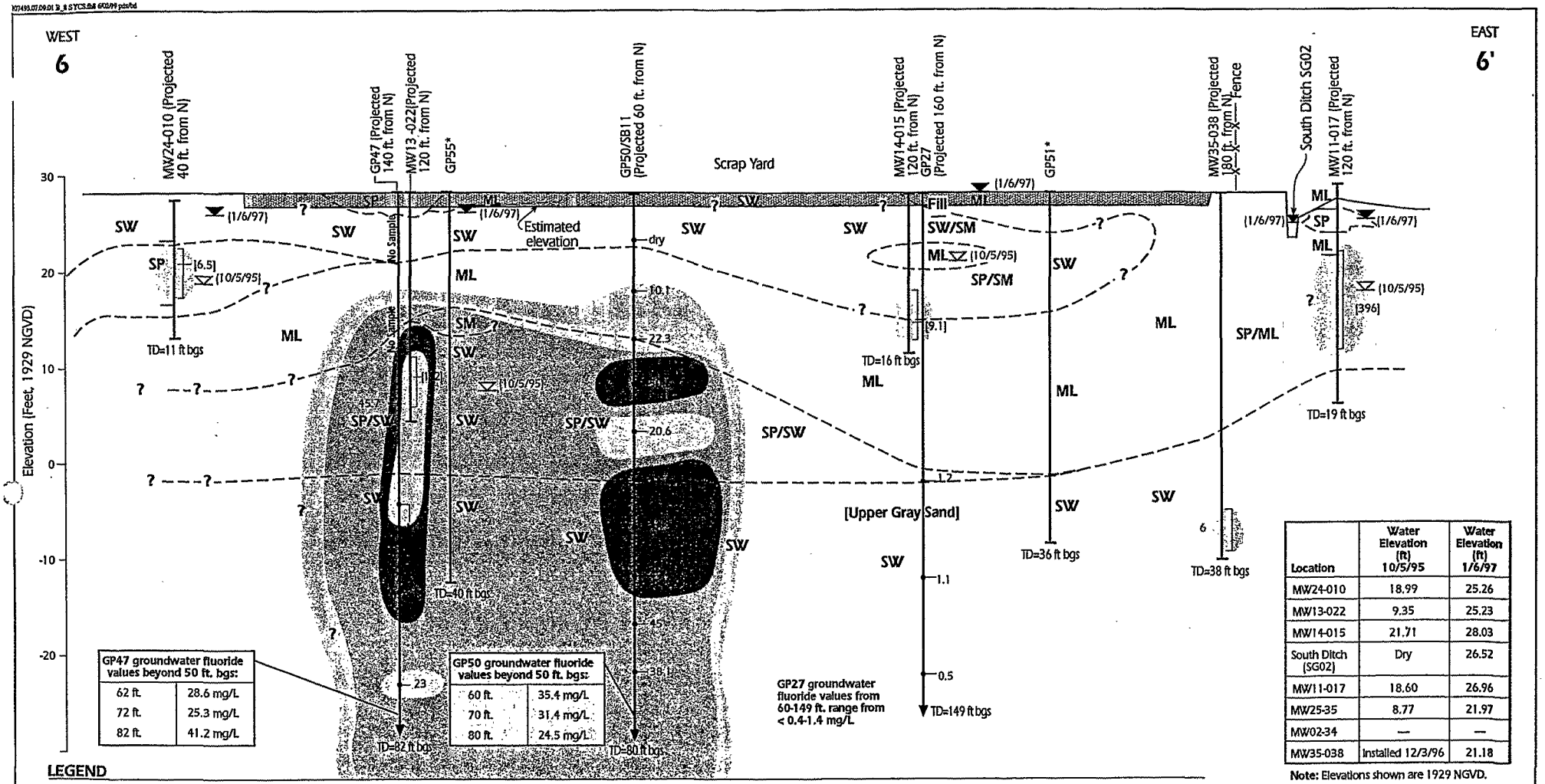
Location	Water Elevation (ft) 10/5/95	Water Elevation (ft) 1/6/97
MW14-015	21.71	28.03
SG01	Dry	25.10
MW11-017	18.60	26.96
MW05-025	20.79	29.96
MW35-038	Installed 12/3/96	21.18

Note: Elevations shown are 1929 NGVD.

Figure B-7
EAST POTLINER AREA CROSS SECTION 5-5' VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE IN GROUNDWATER

REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

CH2MHILL



Location	Water Elevation (ft) 10/5/95	Water Elevation (ft) 1/6/97
MW24-010	18.99	25.26
MW13-022	9.35	25.23
MW14-015	21.71	28.03
South Ditch (SG02)	Dry	26.52
MW11-017	18.60	26.96
MW25-35	8.77	21.97
MW02-34	—	—
MW35-038	Installed 12/3/96	21.18

Note: Elevations shown are 1929 NGVD.

Figure B-8
SCRAP YARD CROSS SECTION 6-6' VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE IN GROUNDWATER
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

CH2MHILL

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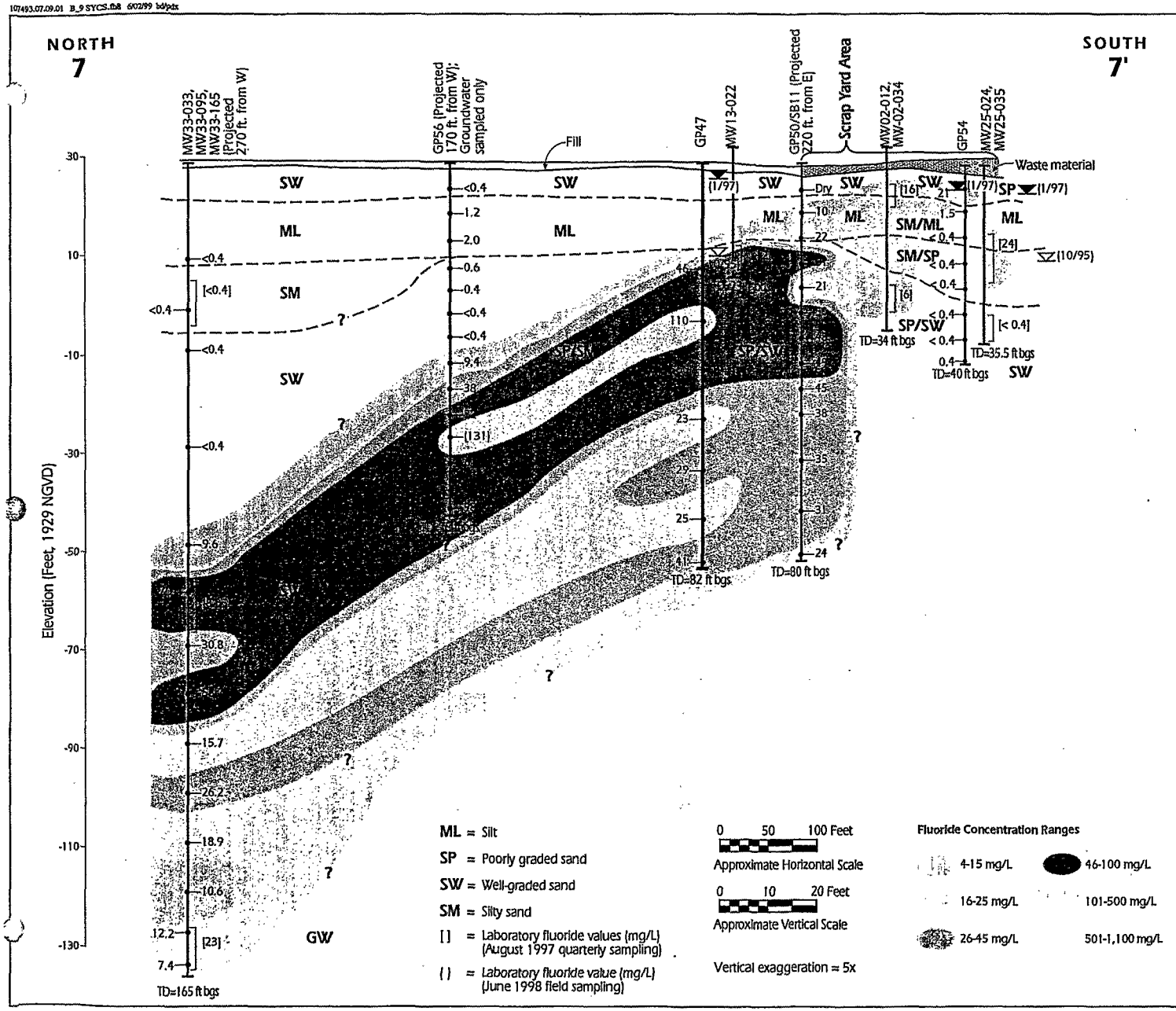

LEGEND

MW09 — Monitoring well number

Cased interval

Screened interval

GP52 — Geoprobe ID number (Locations are approximate)

0.74 — Field fluoride value, mg/L

3.6

TD=40 ft bgs — Total Geoprobe depth in feet below (approx.) ground surface elevation

Location	Water Elevation (ft) 10/5/95	Water Elevation (ft) 1/6/97
MW25-035	8.77	21.97
MW02-034	N/A	21.99
MW13-022	9.35	25.23

Note: Elevations shown are 1929 NGVD.

1/6/97 water level elevation

10/5/95 water level elevation

Waste material

Note: MW33 well column represents a group of wells, whose screened intervals are indicated by a bracket to the right of the column.

Figure B-9
SCRAP YARD
CROSS SECTION 7-7'
VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE IN GROUNDWATER

REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

CH2MHILL

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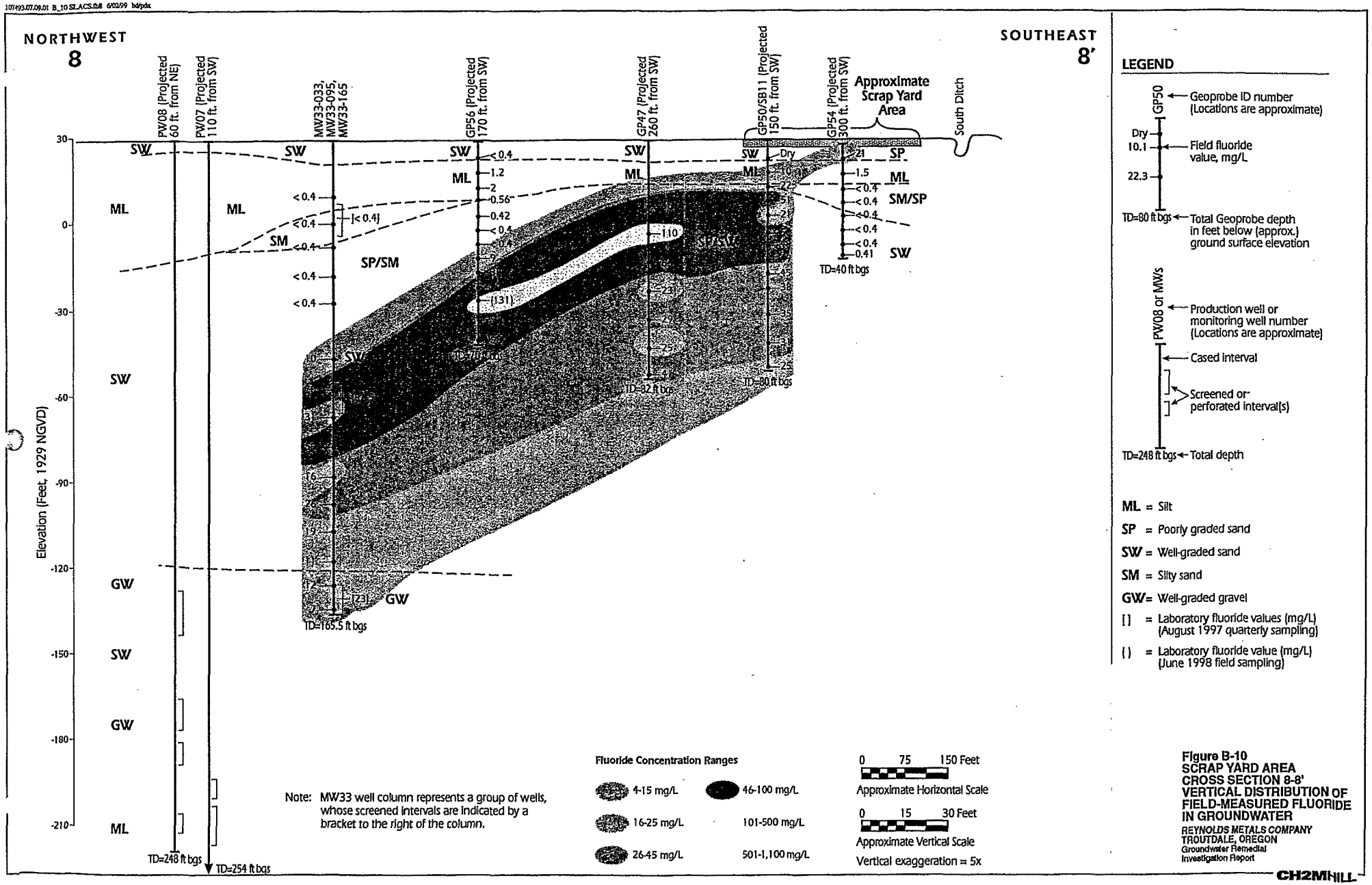

Figure B-10
SCRAP YARD AREA CROSS SECTION 8-8' VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE IN GROUNDWATER

REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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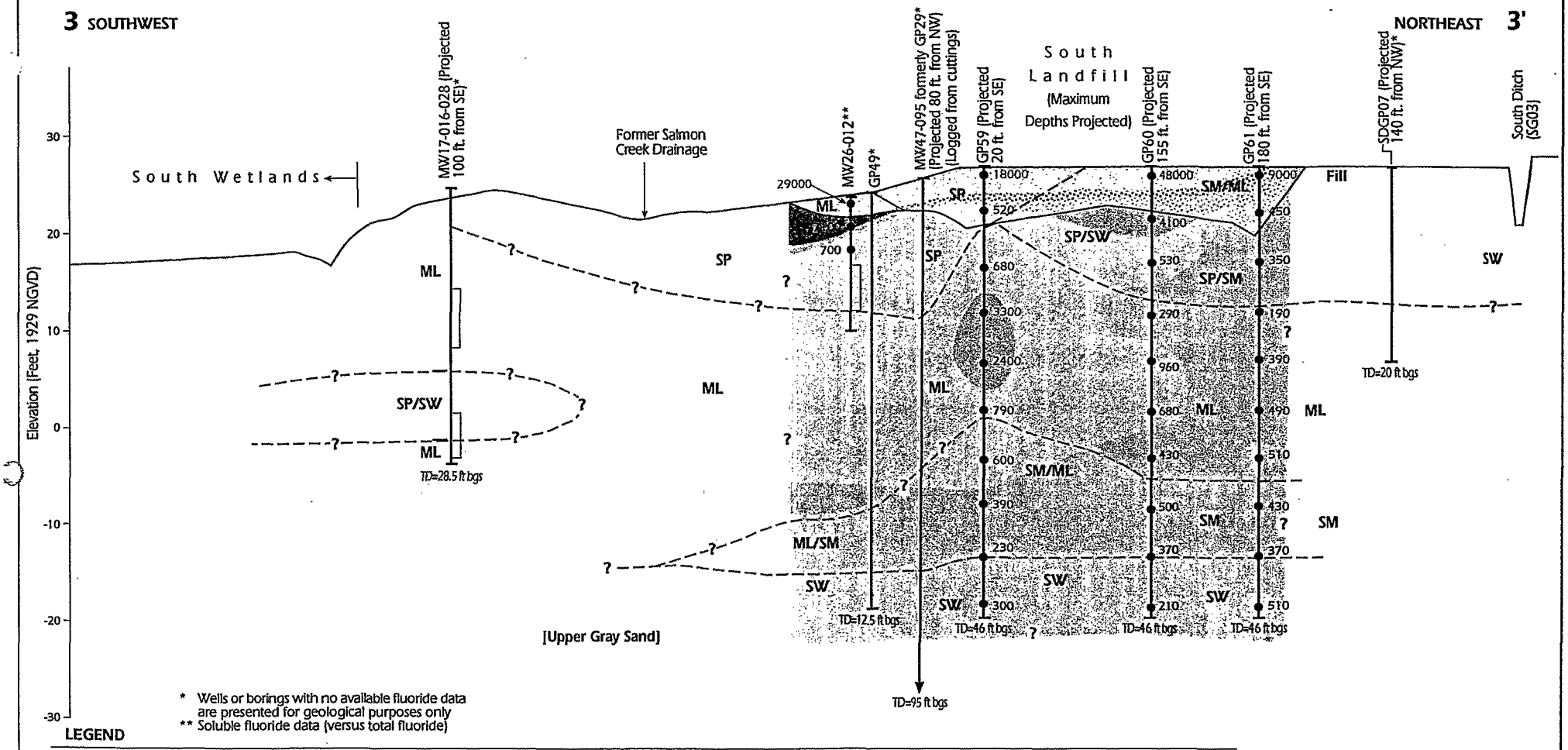

Figure B-11
SOUTH LANDFILL AREA CROSS SECTION 3-3' VERTICAL DISTRIBUTION OF FLUORIDE IN SOIL

REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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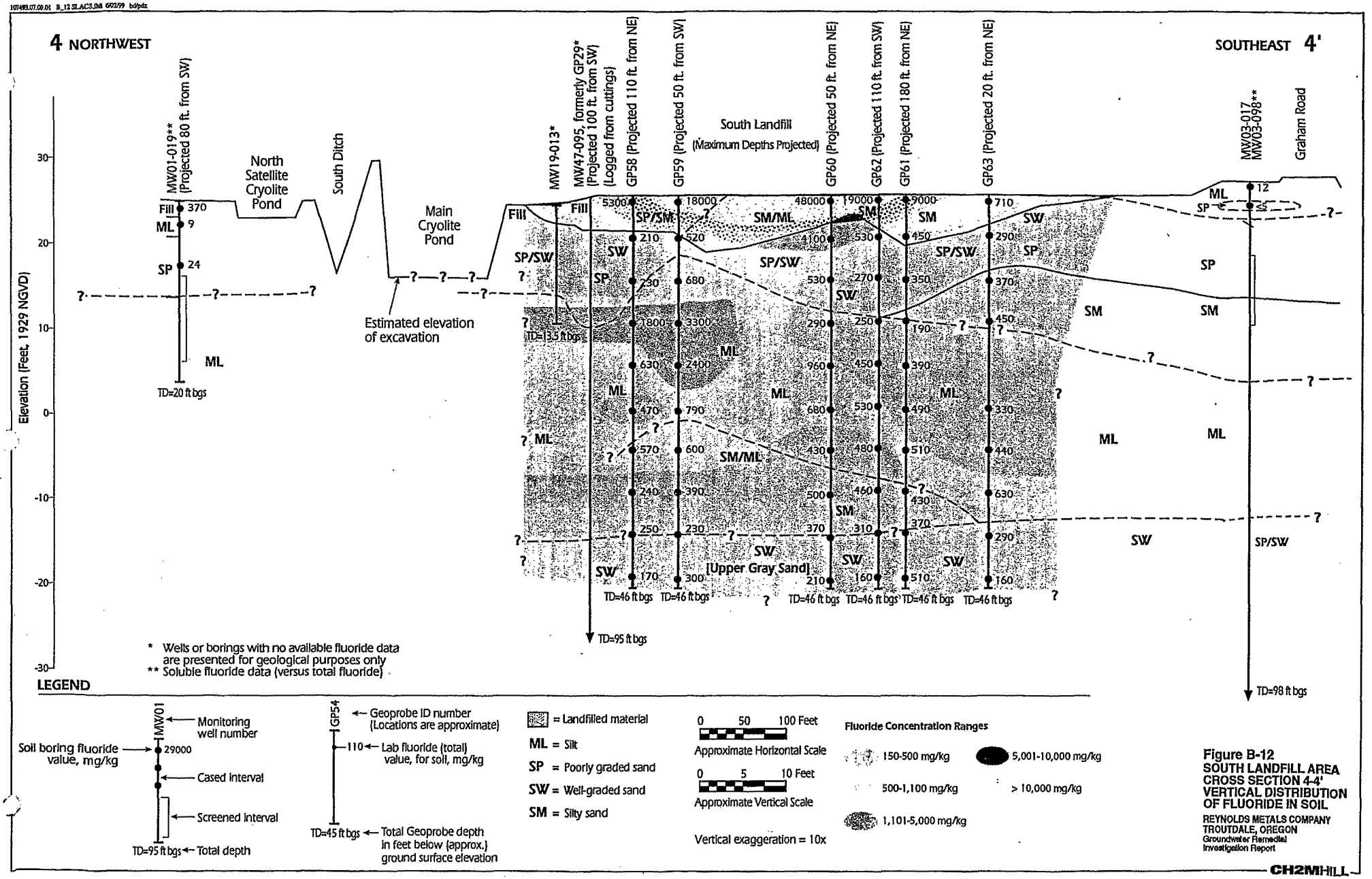

Figure B-12
SOUTH LANDFILL AREA CROSS SECTION 4-4' VERTICAL DISTRIBUTION OF FLUORIDE IN SOIL
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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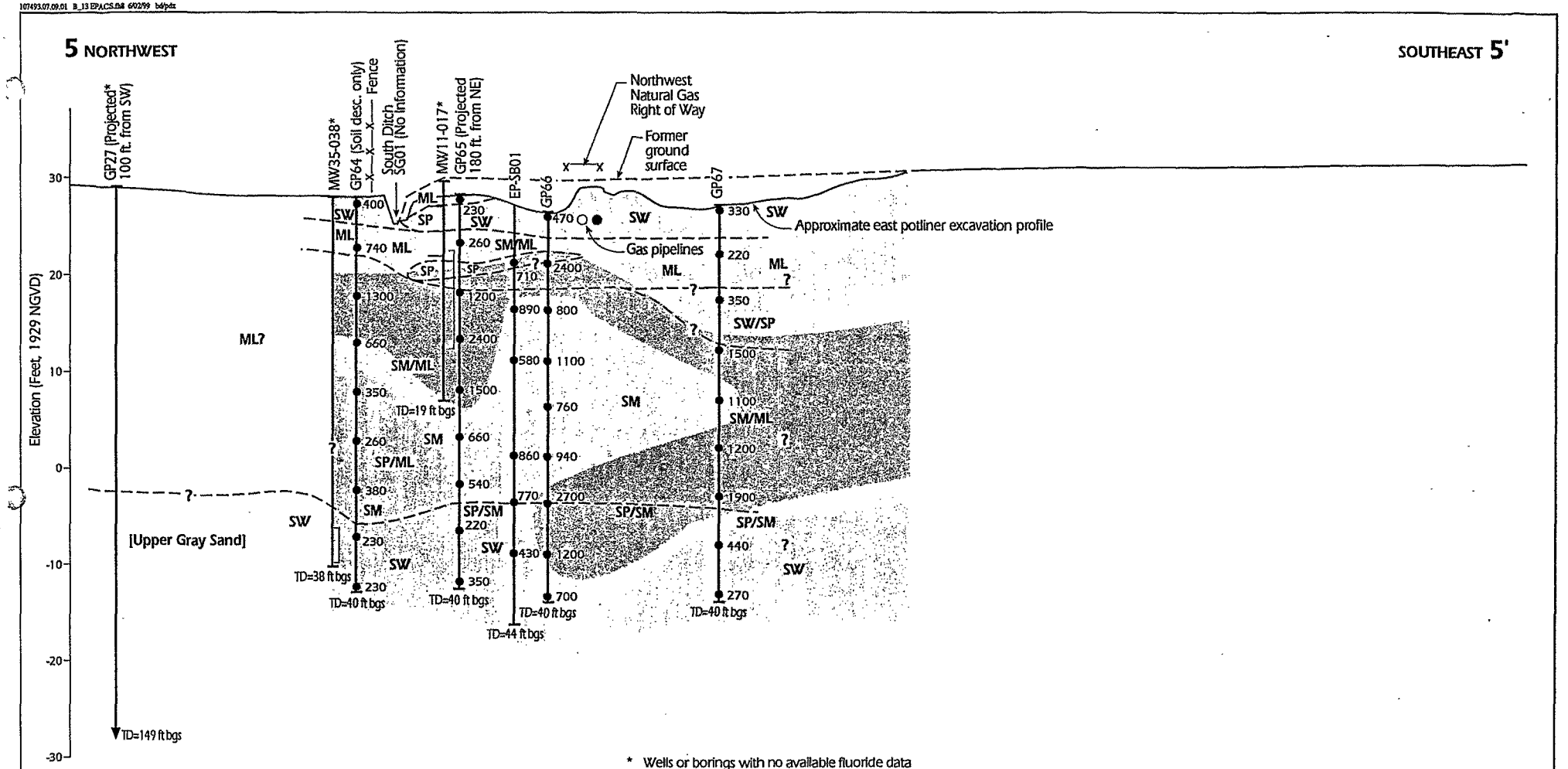

* Wells or borings with no available fluoride data are presented for geological purposes only

LEGEND

MW09 ← Monitoring well number

Soil boring fluoride value, mg/kg → 29000

← Cased interval

← Screened interval

TD=95 ft bgs ← Total depth

GP66 ← Geoprobe ID number (Locations are approximate)

110 ← Lab fluoride (total) value, for soil, mg/kg

TD=45 ft bgs ← Total Geoprobe depth in feet below (approx.) ground surface elevation

ML = Silt

SP = Poorly graded sand

SW = Well-graded sand

SM = Silty sand

0 50 100 Feet

Approximate Horizontal Scale

0 5 10 Feet

Approximate Vertical Scale

Vertical exaggeration = 10x

Fluoride Concentration Ranges

150-500 mg/kg

500-1,100 mg/kg

1,101-5,000 mg/kg

5,001-10,000 mg/kg

> 10,000 mg/kg

Figure B-13
EAST POTLINER AREA CROSS SECTION 5-5' VERTICAL DISTRIBUTION OF FLUORIDE IN SOIL

REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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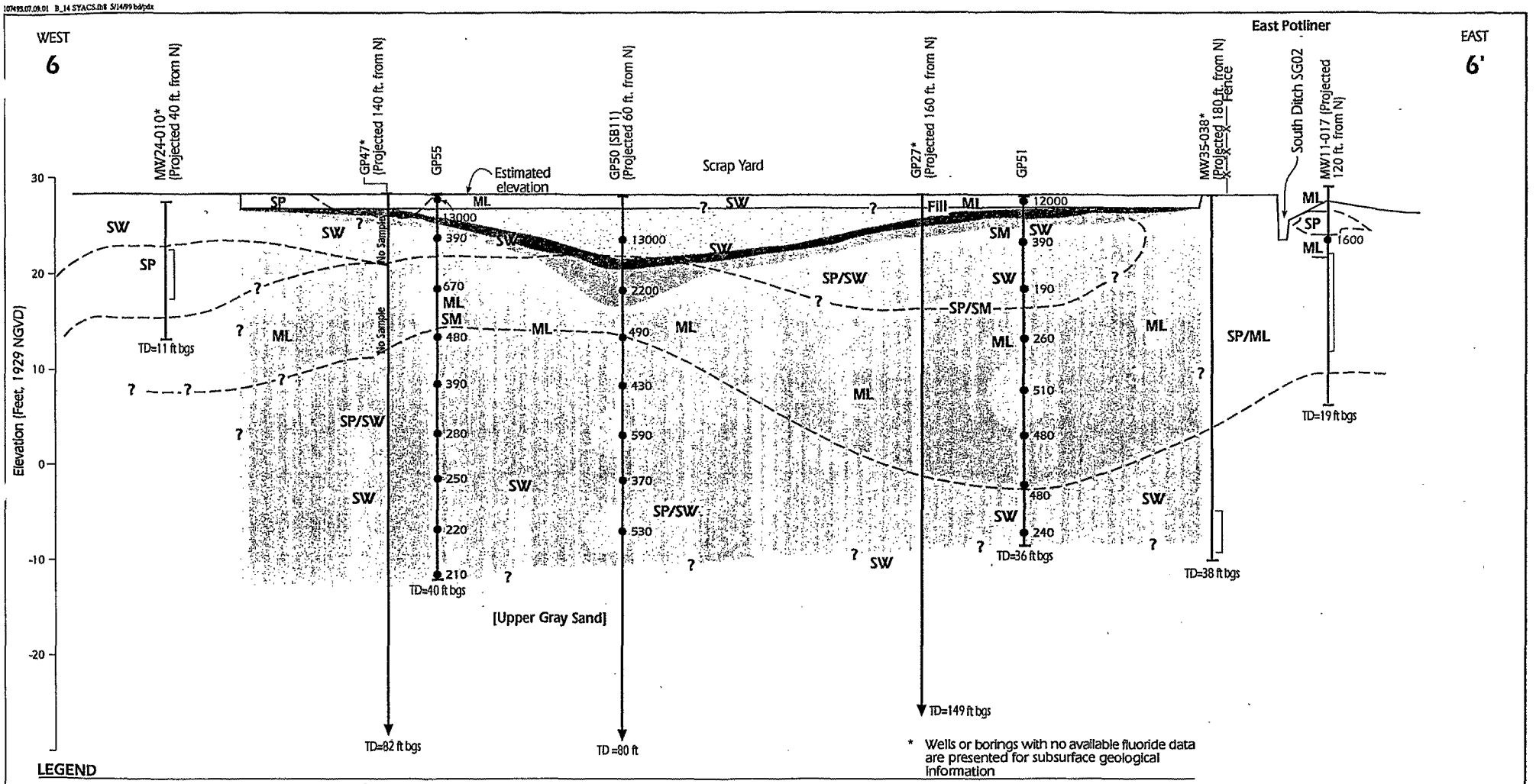

Figure B-14
SCRAP YARD AREA CROSS SECTION 6-6' VERTICAL DISTRIBUTION OF FLUORIDE IN SOIL

REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

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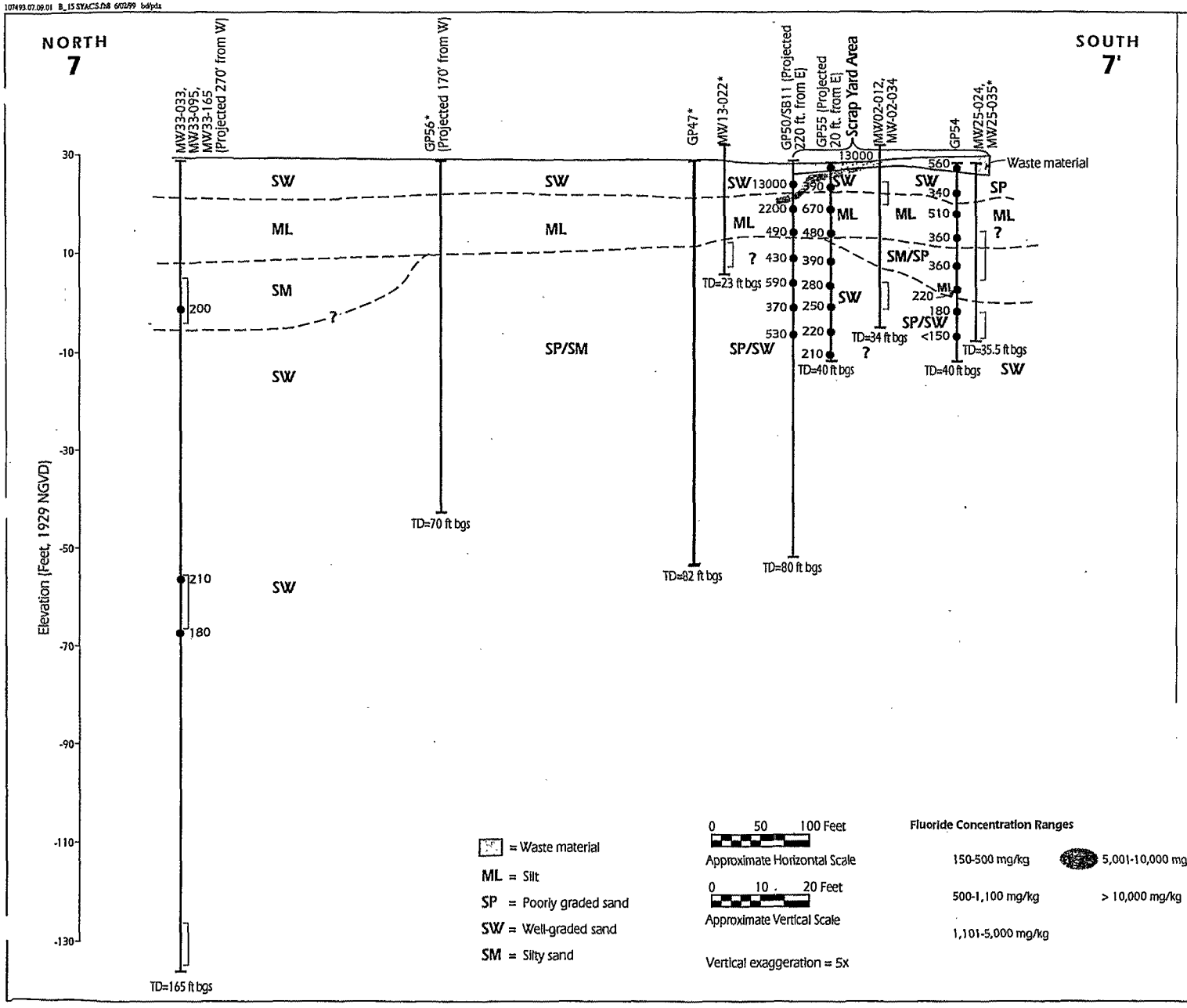
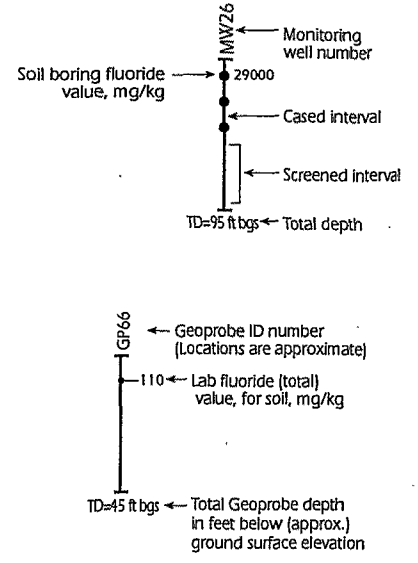


LEGEND



Notes: MW33 well column represents a group of wells, whose screened intervals are indicated by a bracket to the right of the column.

Soil fluoride (total) concentrations = mg/kg

* Wells or soil borings with no available soil fluoride data are presented for subsurface geological information only

Figure B-15
SCRAP YARD AREA
CROSS SECTION 7-7'
VERTICAL DISTRIBUTION OF FLUORIDE IN SOIL

REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

CH2MHILL

ATTACHMENT

Soil Boring Logs (Geoprobe and Hollow Stem Auger)

South Landfill Area

Geoprobe Soil Boring Logs

for

Summer 1998 Data Needs Soil and Groundwater Geoprobe Investigation

at

South Landfill, East Potliner, and Scrap Yard Areas

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP58	SHEET 1 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT Geoprobe 2&4' Sampler

WATER LEVELS _____ START 6-3-98 FINISH 6-3-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
4	4		3ft		TOP .5 ft. Cobbles, backfill, Silt, Sand dry, loose Bottom 2.5. Sand (SW) Dark Yellow Brown (10YR4/2) loose, moist, <5% fines	GP58-ØØØ-Ø698-Ø
8	8		3ft		Sand (SW) (10YR4/2 → 5YR4/1) wet loos med-fine grained, Little to No fines	GP58-ØØ5-0698-Ø
10 12	12		3.5ft		TOP 3 ft Sand (SW) as above Bottom .5 ft. Silt (ML) Dark Yellow Brown (10YR4/2) wet, stiff, Low plasticity <5% v fine grained sand	GP58-Ø10-Ø698-Ø
14	14		1		SILT (ML) Brownish Gray (5YR4/1) wet-moist - med stiff, med plastic little to No sand.	
15 16	16		1		Silt (ML) as above (N4)	GP58-Ø15-Ø698-Ø
18	18		1		Silt (ML) med dark Gray (N4) soft, wet, plastic	
20	20		2		Silt (ML) as above	GP58-Ø2Ø-Ø698-Ø
22	22		2		Silt (ML) as above, med plastic	
24	24		—		No Recovery	
25 26	26		2		Silt (ML) as above	GP58-Ø25-Ø698-Ø
28	28		2		Silt (ML) as above	
30	30		2		TOP 1.5 Silt (ML) as above .5 Sand w/ 10% Silt (SM) sand (SP) very fine grained, loose, wet. (N4)	GP58-Ø3Ø-Ø698-Ø

(8.30)

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GPS8	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC Trautdale LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations / K Vicks

DRILLING METHOD AND EQUIPMENT Geoprobe - 2x4' Sampler

WATER LEVELS _____ START 6-3-98 FINISH 6-3-98 LOGGER J. Barker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32		2		Sand (SP) wet (N4) loose, (heaving) fine grained	~~GP58-035-068~~
	34		2		Sand w silt (SM-SP) (N4) 10-15% fines fine grained, wet, mod stiff	
35	36		2		Sand (SM-SP) as above Sand coarsening w/ depth	GP58-035-0698-0
	38		2		Sand (SM-SP) as above	
40	40		2		Sand (SP-SW) 5% fines. wet, loose, 80% fine grained sand.	GP58-040-0698-0
	42		2		Sand (SW) (N4) wet, loose, little to no fines, red grain present, subangular to med-fine grained.	
	44		2		Sand (SW) as above	
45	46		2		Sand (SW) as above	GP58-045-0698-0
					END of Boring 46 ft BGS.	

REV 11/89 FORM D1585

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP59	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co. LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Exploration / Kieth Vicks.

DRILLING METHOD AND EQUIPMENT Geo Probe 2+4' Sampler

WATER LEVELS _____ START 6-3-98 FINISH 6-4-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	4		3ft		TOP 1 ft Rock, Brick Silt+Sand (N2) Dry Middle 1 ft Sand, Silt, white material wet, loose Bottom 1 ft. Sand (SP) 5% Fine (10YR 4/2) Fine grained, wet, loose	
5	8		4ft		TOP 1 ft Sand w Silt (SM) black, soft plastic. Mid 1 ft Silt (SM) (N4) w/ 15% fine grained sand wet Bottom 2 ft Silt (ML) (SM) (N4) 15% sand	
10	12		3ft		TOP 2 ft Silt w/ Sand (SM-ML) as above Bottom 1 ft Silt (ML) N4, wet, stiff. friable, Trace fine grained sand (trace roots) med. plasticity	
	14		2ft		Silt (ML) as above	
15	16		2ft		Silt (ML) as above	
	18		2ft		Silt (ML) as above	
	20		2ft		Silt (ML) as above	
	22				No Recovery	
	24		2ft		Silt (ML) as above	
	26		2ft		Silt (ML) as above	
	28		2ft		Silt + Sand (SM→ML) (N4) 15% fine grained sand, wet, med stiff, trace organics. roots.	
	30		.5ft		Silt w Sand as above	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP59	SHEET 2 OF

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR Geo Tech Exploration

DRILLING METHOD AND EQUIPMENT Geo Probe. 2 & 4' Sampler

WATER LEVELS _____ START 6-3-98 FINISH 6-4-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32		.5		Silt + Sand as above	GP59-Ø32-0698-Ø
	34		2		Silt + Sand (SM-ML) as above	
35	36		2		Silt + Sand (ML-SM) as above bottom .5 ft. Silt + Sand (SM) 40% Fine grained sand (N4) wet, med stiff.	GP59-Ø35-0698-Ø
	38		1.5		TOP .75 ft Silt w/ Sand as above bottom .75 ft Sand w/ Silt (SM) - 20% (N4) Silt wet, Fine grained sand, med dense	
40	40		2		Sand w/ Silt (SM) as above	GP59-Ø40-0698-Ø
	42		1.5		Sand (SW) Med dark Gray (N4) wet, loose, Trace fines. Red grains present	
	44		2		Sand (SW) as above Little to no fines	
45	46		2		Sand (SW) as above	GP59-Ø45-0698-Ø
					END of Boring 46 ft BGS.	

REV 11/89 FORM D1526

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP60	SHEET 1 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR GeoTech Exploration / K Vidos

DRILLING METHOD AND EQUIPMENT Geoprobe 2¼' Sampler

WATER LEVELS _____ START 6-4-98 FINISH 6-4-98 LOGGER J. Bowlin

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	4		3		.5 ft. Rock, Roots, Silt. (N2) loose Dry .2 ft Silt(ML) + white hard material .05 ft Sand+Silt(SM) Dusky Red dry, orange.. 1.8 ft Silt(ML) Brownish gray(5YR4/1) moist med stiff. Black mottling.	
5	8		3.5		TOP .5 Silt + Sand(SM) Brownish Black(5YR2/2) Sand (SP-SW) Brownish gray(5YR4/1) wet, loose, fine to med grained 5% fines	
10	12		4		TOP 2.5 ft Sand as above middle 1 ft Sand+Silt(SM)(5YR 6/1) wet, stiff. 20 to 25% fines. fine grained sand Bottom .5 ft Sand(SW) (5YR6/1) Light Brown wet, loose, fine to med grained.	
	14		2		1.5 Sand(SW) as above .05 Silt(ML) (5YR6/1) wet, med stiff, Low plastic	5% v. fine grained sand
15	16		1		Silt ML) as above, trace organics (roots)	
	18		1.5		Silt (ML) As above w med plasticity	
20	20		1.5		Silt(ML) as above w med stiff → soft	
	22		1		Silt(ML) as above	
	24		2		TOP 1 ft Silt(ML) as above Bottom 1 ft. Silt(ML) w/ Black staining + Liquid present. wet, soft, and plastic	
25	26		2		Silt(ML) (N4) wet, med stiff - soft, med plastic Little to No sand. Trace organics.	
	28		2		Silt(ML) as above	
	30		2		Silt(ML) as above	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP60	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC Trautdale LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR Geo Tech Explorations/K Vidos

DRILLING METHOD AND EQUIPMENT GeoProbe 2+4' Sampler

WATER LEVELS _____ START 6-4-98 FINISH 6-4-98 LOGGER J. Boothe

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32		2		Silt(ML) as above w/ 15% v fine grained sand	
	34		2		Silt + Sand (SM) Silt as above w 30% v fine grained sand	
	36		2		Silt + Sand (SM) as above 20% v fine grained sand	
	38		2		Silt + Sand (SM) as above	
	40		2		Silt + Sand (SM) as above 40% v fine grained sand	
	42		2		Sand (SP-SW) (N4) wet, loose, v. fine grained <10% silt.	
	44		2		Sand (SW) (N4) wet, loose, fine to med grained <5% silt	
	46		2		Sand (SW) Med Dark Gray (N4) wet, loose Med to fine grain. coarsening w depth subangular grains	
					END of Boring 46 ft.	

REV 11/89 FORM D1525

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP61	SHEET 1 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION South Landfill

ELEVATION DRILLING CONTRACTOR Geo Tech Explorations

DRILLING METHOD AND EQUIPMENT Geo Probe 2 & 4 Sampler

WATER LEVELS START 6-4-98 FINISH 6-5-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	4		3ft		0-1 Rock, brick, sand, silt, wood 1-2 Sand(SW) dry loose (N3) .5 ft Silt+Sand(SM) (N3) dry loose, friable .5 ft Sand w silt(SM) 15% fines Brownish gray (5YR4/1) moist - loose.	
5	8		3ft		TOP .5 Sand w silt (SM) as above 1 ft Sand (SP) Lt. Br. gray (5YR6/1) wet, loose. Fine grained <10% fines .5 ft. Sand (SW) (5YR6/1) wet, loose, fine + med grained 1 ft Sand (SP) (5YR6/1) wet, loose, Fine grained.	
	12		4ft		Sand + Silt (SM) 15% fines, wet, loose v. fine grained sand Pale Brown (6" layer of silt, stiff wet, med plastic) (10YR 6/2)	
	14		2ft		Sand (SP) Pale yellowish Brown (10YR6/2) wet, loose, V. fine grained, Trace fines.	
	16		1.5		TOP .75 Sand (SP) as above Bottom .75 Silt (ML) (10YR6/2) Wet, stiff, low plastic friable, organics trace roots	
	18		—		No Recovery	
	20		1.5		Silt (ML) as above (10YR6/2) - (N4)	
	22		—		No Recovery	
	24		2		Silt (ML) Med gray (N5) wet, med stiff, med plastic Trace fine grained sand + organics (roots)	
	26		2		Silt (ML) As above (N4)	
	28		2		Silt (ML) As Above soft	
	30		2		Silt BAL as above med stiff	

REV 11/89 FORM D1526

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP61	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC- Troutdale LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT Geo Probe 2+4' Sampler

WATER LEVELS _____ START 6-4-98 FINISH 6-5-98 LOGGER J. Bowlder

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32		—		No Recovery	
	34		2		Silt + Sand (SM) Med Dark Gray (N4) wet, 20-25% v. fine grained sand. Silt. med stiff.	
	36		1.5		Silt + Sand (SM) as above	
	38		1.5		Silt + sand (SM) as above	
	40		2		Silt + Sand (SM) as above 35% v. fine grained sand	
	42		2		Sand (SP-SW) (N4) wet, loose fine grained sand <10% silt.	
	44		2		Sand (SW) wet, loose, fine-med grained sand, Red grain present. subangular grain	
	46		2		Sand (SW) as above	
					46 Ft END of Borings	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP62	SHEET 1 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations / K Vidor

DRILLING METHOD AND EQUIPMENT Geoprobe 2+4' Sampler

WATER LEVELS _____ START 6-5-98 FINISH 6-8-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	4		3 ft		1 ft Rock, Silt, Sand, backfill 1 ft. Rock, white material, loos dry 1 f. Rock, orange dry loose hard	
5	8		4 ft		.5 ft. white Rock as above .5 ft Sand+Silt (SM) (5YR4/1) wet, Med stiff. 20% silt. 3 ft Sand (SP) (NS) wet, loose, fine grained,	
10	12		4 ft		3.5 Sand (SP-SW) as above Bottom .5 ft. Sand (SW) (10YR4/2) Dr. Yel. Brown.	
	14		2 ft		Silt (ML-SM) 15% v fine grained sand. Med. gray (NS) wet, stiff. friable, low Plastic	
15	16		1.5		Silt (ML) as above	
	18		1		Silt (ML) as above w/ 5% v fine grained sand	
20	20		—		No Recovery	
	22		1		Silt (ML) as above med stiff. med plastic	
	24		1.5		Silt (ML) as above	
25	26		2		Silt (ML) as above	
	28		1.5		Silt (ML) as above	
30	30		1.5		Silt (ML) as above	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP62	SHEET 2 OF

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION South Landfill

ELEVATION DRILLING CONTRACTOR GeoTech Explorations/K Vidor

DRILLING METHOD AND EQUIPMENT Geoprobe 2x4' Sampler

WATER LEVELS START 6-5-98 FINISH 6-8-98 LOGGER J. Bowthen

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32		2		Silt (ML) as above	
	34		2.75		Silt w/ Sand (SM) (NA) 40% fine grained Sand, wet, soft	
35	36		2		as Silt w Sand as above 1.5ft Silt (ML) (5Y 4/1) wet, med stiff, 10% fine grained sand, Mid plastic	
	38		2		TOP 1 ft. Silt (ML) as above Bottom 1 ft. Silt w/ Sand (SM) 30% fine grained sand (NA) wet, soft,	
40	40		2		TOP .5 as above Bottom 1.5 ft. Sand w Silt (SP-SM) 15% silt. wet, loose fine grained sand	
	42		2		TOP 1 ft. (SP-SW) vfine - fine grained sand wet, loose 1 ft. Sand (SW) - wet (NA) med-fine grained. loose, Red grains present	
	44		2		Sand (SW) as above	
45	46		2		Sand (SW) as above	

REV 11/89 FORM D1526

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP63	SHEET 1 OF 2

SOIL BORING LOG

PROJECT BMC-Trostdale LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR GeoTech Exploration

DRILLING METHOD AND EQUIPMENT GeoTech Probe 2+4' Sampler

WATER LEVELS _____ START 6-5-98 FINISH 6-5-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	4		3ft		TOP 0.5 Silt+Sand (10YR4/2) Bottom 2.5ft. Sand (SW) wet-moist, (5YR4/4) Fine-med grained loose. sub angular grains	GP63-000-0698-0
5	8		4		Sand (SP) w Silt 10% Silt wet (N4) v. fine grained sand, Loose-med dense	GP63-005-0698-0
10	12		2		Silt w/ Sand (SM) 20% fine grained sand ~~wet~~ (5YR 5/2) wet, stiff, med plastic friable	GP63-010-0698-0
	14		2		Silt w/ sand (SM) 10% fine grained sand (5YR 5/2) wet, med stiff, med plastic	
15	16		2		Silt w/ sand (SM) as above	GP63-015-0698-0
	18		—		No recovery	
20	20		—		No recovery	
	22		—		No recovery	
	24		—		No recovery	
25	26		2		Silt (ML) w 5% fine grained sand (N4) - moist, med plastic, trace organics	GP63-020-0698-0 (roots)
	28		2		Silt (ML) as above	
30	30		2		Silt (ML) as above	GP63-025-0698-0

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP63	SHEET 2 OF 2

SOIL BORING LOG

PROJECT BMC - Troutdale LOCATION South Landfill

ELEVATION DRILLING CONTRACTOR GeoTech Explorations / K Vidor

DRILLING METHOD AND EQUIPMENT Geoprobe 2x4' Sampler

WATER LEVELS START 6-5-98 FINISH 6-5-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32				Silt (ML) as above	
	34				Silt (ML) as above	
35	36				Silt (ML) as above	GP63-Ø3Ø-Ø698-Ø
	38				Silt (ML) as above	
40	40				Top 1 ft. Sand (SP) (W4) wet, loose, fine grained. Bottom 1 ft Sand (SW) (W4) wet, loose, med-fine grained, Red grains.	GP63-Ø35-Ø698-Ø
	42				Sand (SW) as above	
	44				Sand (SW) as above	
45	46				Sand (SW) as above	GP63-Ø4Ø-Ø698-Ø
					END of Boring 46 ft	

REV 11/89 FORM D1586

East Potliner Area

Geoprobe Soil Boring Logs

for

Summer 1998 Data Needs Soil and Groundwater Geoprobe Investigation

at

South Landfill, East Potliner, and Scrap Yard Areas

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP64	SHEET 1 OF 6

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION East Potliner Area

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations / K. Vidos

DRILLING METHOD AND EQUIPMENT Geo Probe 2+4' Sampler

WATER LEVELS _____ START 6-9-98 FINISH 6-9-98 LOGGER J. Bowlen

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	4		3ft		TOP 1.5 ft. Silt, Rocks, Cobbles, (10YR4/2) moist-dry MID 1.0 Sand (SW) Drk. Yel. Brown (10YR4/2) loose, ~~dry~~-moist-wet. med-fine grained Bottom .5 Silt (ML) Pale Yellow brown (10YR6/2) w/5% fine grained sand, low plasticity orange mottling. med stiff.	
	8		4		TOP 2 ft. Silt (ML) Drk Yellowish Brown (10YR4/2) moist-med stiff. med plastic. Bottom 2 ft Sand + Silt (SM) 40% Silt. Mod Yellow Brown (10YR5/4) loose, wet, fine grained.	
	12		4		Silt w/ sand (SM) (10YR5/4) wet, med stiff. 30% fine grained sand. med plastic	
	14		1.5		Silt w/ sand (SM) as above	
	16		.5		Silt w/ sand (SM) as above	
	18		—		NR	
	20		—		NR	
	22		.5		Silty Sand (SM) as above	
	24		1.5		top .5 Silt (ML) (10YR5/4) wet, soft, 1.5 ft. Silt (ML) Med Gry (N5) → (5Y4/1) wet, soft. 15% fine grained sand	
	26		1.5		TOP 1 ft. Sand + Silt (SM) 25% Silt (N5) wet loose Bottom .5 ft Silt + Sand (SM) 20% f. grained sand. wet. med plastic trace organics (roots)	
	28		2		TOP 1 ft Sand (SP) (N4-N5) wet, loose, (15% silt) Bottom 1 ft. Silt + Sand (SM) (N5) wet, soft, med plastic 30% fine grained sand	
	30		2		Sand + Silt (SM) wet, loose, (N5) 35% silt.	

REV 11/89 FORM D1585

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP64	SHEET 2 OF 6

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION East Portland

ELEVATION DRILLING CONTRACTOR Geo Tech Exploration

DRILLING METHOD AND EQUIPMENT Geoprobe 2 & 4' Samplers

WATER LEVELS START 6-8-98 FINISH 6-9-98 LOGGER T. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32		2		TOP 1.5 ft. Silt & Sand (SM) 10-15% Fine grained sand (N4) soft, wet, med plastic Bottom 5 ft Sand (SP) (N4) wet, loose, 15% Silt fine grained sand	
	34		2		Silt w/ Sand (SM) Grayish Brown (5YR 4/1) wet med plastic, soft.	
	36		2		Sand (SW) (N4) wet, loose, med-fine grained 10% silt	
	38		2		Sand (SW) as above w/ Little to No fines	
	40		2		Sand (SW) as above w/ Little to No fines	
					END of Boring 40 ft	

REV 11/89 FORM D1526

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP65	SHEET 1 OF

SOIL BORING LOG

PROJECT BMC - Troutdale LOCATION East Potliner Area
ELEVATION DRILLING CONTRACTOR Geo Tech Exploration
DRILLING METHOD AND EQUIPMENT Geoprobe 2 & 4' Sampler
WATER LEVELS START 6-9-98 FINISH 6-9-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
			3		TOP 1 ft Silt Light Brown (5YR5/6) Rock, gravel, dry, friable Bottom 2 ft. Sand (SW) (5YR6/1) wet loose 10% Silt	
			4		TOP 1 ft Sand (SW) as above Mid .5 ft. Silt (ML) (NS) moist, friable, med stiff orange mottling Mid .5 ft Sand (SW) as above Bottom 2 ft Silt (ML) as above	
			2.5		TOP 1.5 ft Sand (SW) wet, loose (NS). Med-Fine grained. Bottom 1 ft. Silt (ML) Dark Yellowish Brown (10YR4/2) stiff, moist-wet. orange mottling Trace organics 5% f. grained sand	
			—		NR	
			.5		Silt + Sand (ML) (10YR4/2) stiff. moist-wet 15% fi grained sand.	
			—		NR	
			—		NR	
			.5		Silt w Sand (SM) (10YR4/2) wet, no consistency	
					NR	
			.5		Silt w/ Sand (SM) (N4) 35% fine grained sand. wet, soft. med plastic	
			2		Silt w/ sand (M) as above	
					Sand w/ Silt (SM) 30% Silt (N4) Wet, loose, fine grained.	

REV 11/89 FORM D1526

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP65	SHEET 2 OF 6

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION East Potliner Area

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Exploration

DRILLING METHOD AND EQUIPMENT Geoprobe 2 & 4' Sampler.

WATER LEVELS _____ START 6·9·98 FINISH 6·9·98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32		2		TOP 1.25 Ft Sand w Silt (SM) (N4). Wet, loose Bottom. 75 Ft. Silt w/Sand (SM) 30% f. grained sand wet med stiff. trace organics. wood roots.	
	34		2		Sand (SP-SM) 15% silt (N4). wet, loose. med-fine grained sand	
	36		1		Sand (SW) (N4) to wet, loose, med-fine grained. Red grains 5% silt	
	38		1.5		Sand (SW) as above	
	40		2		Sand (SW) as above w/ Little to No fines	
					END of Boring 40 Ft BGS.	

REV 11/89 FORM D1526

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP66	SHEET 1 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION East Potliner Area

ELEVATION DRILLING CONTRACTOR Geotech Explorations / K. Vickos

DRILLING METHOD AND EQUIPMENT Geo Probe w/ 2+4' Sampler

WATER LEVELS START 6-8-98 FINISH 6-8-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	4		3 ft		Top 1 ft Silt, sand, Rock (5YR 6/1) dry. Mid 1.5 ft Sand (SW) Brownish gray (5YR 4/1) wet, loose, med-fine grained. Bottom .5 ft Silty sand (SM) Mod yellow Brown (10YR 5/4) wet, friable, med stiff.	GP66-ØØØ-Ø698-Ø
5	8		4 ft		Top 1 ft Sand (SP) Mod yellow Brown (10YR 5/4) wet, loose, med → fine grained. Mid 2 ft Silt (ML) Dark yellow Brown (10YR 4/2) moist-wet, stiff, low plastic. orange mottling. Bottom 1 ft Silty sand (SM) ~~wet~~ (10YR 4/2) wet med stiff. 30% fine grained sand.	GP66-Ø5-Ø698-Ø
10	10		2		Sand w/ silt (SM) (5YR 4/1) wet, 30% silt fine grained sand.	GP66-Ø1Ø-0698-Ø
	12		2		Sand w/ silt (SM) (5YR 4/1) wet, loose fine grained sand. silt, soft. 40% silt.	
	14		2		Sand w/ silt (SM) As above	
15	16		2		Sand w/ silt (SM) As above	GP66-Ø15-Ø698-Ø
	18		2		Sand w/ silt (SM) As above	
20	20		2		Sand w/ silt (SM) As Above	GP66-Ø2Ø-Ø698-Ø
	22		.5		Sand w/ silt (SM) As Above	
	24		2		Sand w/ silt (SM) As Above	
25	26		2		As Above	GP66-Ø25-Ø698
	28		2		As Above	
30	30		2		Silty sand (SM) Med Dark Gray (N4) silt wet soft med plastic. 40% fine grained loose sand	GP66-Ø3Ø-Ø698

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP66	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION East Potliner Area

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations / K Vidor

DRILLING METHOD AND EQUIPMENT Geo Probe w/ 2+4' Sampler

WATER LEVELS _____ START 6.8.98 FINISH 6.9.98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32		2		Silt w/ Sand (SM) As above	
	34		2		1.5 ft. Sand (SW) Med dark Gray (N4) wet loose, Fine grained .5 ft Silt w/ Sand (SM) (N4) wet, med stiff. med plastic. 35% fine grained sand.	
35	36		1.5		1 ft Silt w/ Sand (SM) as above w 15% sand .5 ft. Sand (SW) ~~wet~~, (N4) wet, loose, med-fine grained (USCS)	GP66-Ø35-Ø698-Ø
	38		2		1.5 ft Sand (SW) as above .5 ft Silt w/ Sand (SM) (N4) wet, med stiff. med plastic 15% fine grained sand	
40	40		2		Sand (SW) (N4) wet, loose, med to fine grained	GP66-Ø40-Ø698-Ø
					END of Boring 40 ft.	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP67	SHEET 1 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION East Potliner Area

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations / K Vidal

DRILLING METHOD AND EQUIPMENT Geoprobe w/2x4' Sample

WATER LEVELS _____ START 6-9-98 FINISH 6-9-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	4		3		TOP 1 Ft Silt, Rock, sand Light brown (5YR 5/6) Dry, friable Bottom 2 Ft Sand (SW) Pale Brown (5YR 5/2) wet, loose, med-fine grained	GP67-Ø4Ø-Ø698-Ø
5	8		4		TOP 1.5 Ft Sand (SW) As above Bottom 2.5 Ft Silt (ML) Dark Yellowish Brown (10YR 4/2) moist-wet - med plastic Orange mottling. <2% Fine grained sand	GP67-Ø05-Ø698-Ø
10	12		4		Sand (SW) Pale Brown (5YR 5/2) wet loose, fine to med grained, sub rounded	GP67-Ø1Ø-Ø698-Ø
	14		2		TOP .5 Ft Sand w Silt (SM) (10YR 4/2) wet loose, fine grained 30% silt. Bottom 1.5 Ft Sand (SP) wet, loose, 10% silt.	
15	16		2		Silt w Sand (SM) (10YR 4/2) wet, soft-med stiff. med plastic. 40% fine grained sand loose.	GP67-Ø15-Ø698-Ø
	18		2		Silt w/ Sand (SM) As Above	
20	20		—		No Recovery	GP67-Ø2Ø-Ø698-Ø
	22		.5		Silt w/ Sand As Above	
	24		2		Sand w Silt (SM) 10YR (4/2) wet, loose v fine grained sand. saturated-soupy. 30% silt.	
25	26		1.5		.75 Ft Silt w/ Sand (SM) 10YR (4/2) wet, soft, med plastic 40% fine grained sand .75 Ft Sand w/ Silt (SM) (10YR 4/2) wet, loose, med-fine grained. 30-40% silt. wet, soft med-plastic	GP67-Ø25-Ø698-Ø
	28				No Recovery	
30	30				Silt w/ Sand (SM) (N4) wet, soft, med plastic 40% v fine grained sand.	GP67-Ø3Ø-Ø698-Ø

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP67	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION East Potliner Area

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Exploration / K Vidor

DRILLING METHOD AND EQUIPMENT Geoprobe w/ 2+4' Sampler

WATER LEVELS _____ START 6-9-93 FINISH 6-9-93 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	22		2		1ft Silty Sand (SM) (N4) wet, soft med plastic w/ 30% or fine grained sand 1ft Sand w Silt (SM) (N4) wet, loose, med-fine grained 30% silt soft wet, med plastic	
	34		2		1.5ft Sand w/ Silt (SM) As above .5 Sand (SW) (N4) wet med-fine grained loose <10% silt.	
	36		2		Sand (SW) (N4) wet, loose, med-fine grained sand, subrounded grains (USS)	GP67-Ø35-Ø698-Ø
	38		2		Sand (SW) As above	
	40		2		Sand (SW) As above	GP67-Ø40-Ø698-Ø
					END of Boring 40 ft BGS	

REV 11/89 FORM D1586

Scrap Yard Area

Geoprobe Soil Boring Logs

for

Summer 1998 Data Needs Soil and Groundwater Geoprobe Investigation

at

South Landfill, East Potliner, and Scrap Yard Areas

CH2MHILL

PROJECT NUMBER	BORING NUMBER GPS1	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co. Troutdale LOCATION Scrap Yard
ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Exploration Kieth Vidos
DRILLING METHOD AND EQUIPMENT Geoprobe w 4ft + 2ft samplers
WATER LEVELS _____ START 6/1/98 FINISH 6/1/98 LOGGER J Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	4		3ft		TOP 2 feet, Silt(ML) w/ trace fine grained sand. Dark yellowish Brown (10YR 4/2) dry, friable, very stiff. Bottom .5 ft. Fine grained sand w <10% silt (SM) Dark yellowish Brown (10YR 4/2)	GPS1-ØØØ-Ø698-Ø 0-4'
5	8		4ft		Sand(SW) Dark Yellowish Brown (10YR 4/2) moist, loose. Little to No fines fine to medium grained sand. subangular grains	GPS1-ØØ5-Ø698-Ø 4-12
10	12		4ft		Sand(SW) as above	GPS1-Ø1Ø-Ø698-Ø
	14		1ft		Silt(ML) Brownish Gray (5YR 4/1) moist-wet med→low plasticity, medium stiff. Trace fine grained sand.	ML 12-
15	16		1ft		Silt(ML) as above	GPS1-Ø15-Ø698-Ø
	18		2ft		Silt(ML) Medium Dark Gray (N4) wet, soft, medium plastic. Trace fine grained sand	
20	20		2ft		Silt(ML) as above	GPS1-Ø2Ø-Ø698-Ø
	22		2ft		Silt(ML) as above except medium stiff	
	24		2ft		Silt(ML) as above	
25	26		2ft		Silt(ML) as above	GPS1-Ø25-Ø698-Ø
	28		2ft		Silt(ML) as above	
	30		2ft		TOP 1.5 ft. Silt(ML) as above. Bottom .5 ft. Silt w/ Sand(SM) Medium Dark Gray (N4) wet, medium stiff. 20% fine grained sand	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP51	SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co. Troutdale LOCATION Scrap Yard
ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations
DRILLING METHOD AND EQUIPMENT Geoprobe w/ 4+2 ft Samplers.
WATER LEVELS _____ START 6/1/98 FINISH 6/1/98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32		.5ft		Sand(SW) Dark Gray(N3) Wet loose fine to medium grains, subangular, Red grains present	GP51-Ø3Ø-Ø698-Ø
	34		2ft		Sand(SW) as above w/ higher % of medium grained sand	
35	36		2 ft.		Sand(SW) as above	GP51-Ø35-0698-Ø
					END OF BORING 36 ft BGS.	

REV 11/89 FORM D1585

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP52	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co Troutdale LOCATION Scrap Yard
ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations / Kieth Vidos
DRILLING METHOD AND EQUIPMENT Geoprobe 4' and 2" ft sampler
WATER LEVELS _____ START 6/1/98 FINISH 6/2/98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
Ø	Ø 4		3 ft		TOP 1 ft Silt(ML) Dark Yellowish Brown (10YR4/2) Dry, med stiff, friable. organics present (roots) 2-3 ft. Sand (SW) Brownish Gray (5YR4/1) wet loose <5% fines, Med → fine grained sand	GP52-ØØØ-Ø698-Ø
5	8		4 ft		Sand (SW) as above	GP52-ØØ5-Ø698-Ø
10	12		4 ft		Sand (SW) as above Bottom .5 ft Silt (ML) Moderate Yellow Brown (10YR5/4) wet-moist, med stiff, friable 5% fine grained sand, orange mottling.	GP52-Ø1Ø-Ø698-Ø
15	16		1 ft		Silt (ML) as above	GP52-Ø15-Ø698-Ø
20	20		1 ft		Silt (ML) Light Olive gray (5GY4/1) wet, med stiff, med plastic. organics (trace) present (roots)	GP52-Ø2Ø-Ø698-Ø
	24		2 ft		Silt (ML) Dark Greenish Gray (5GY4/1) wet, med stiff. organics (roots) present.	
25	28		1 ft		(Silt (ML) as above Bottom .5 ft. Silt w/ Sand (ML) 30% fine grained sand. Dark Greenish Gray (5GY4/1) wet, med stiff.	GP52-Ø25-Ø698-Ø
30	30				Sand (SW) (Med Dark Gray N4) wet, loose little to no fines, Red grains present.	GP52-Ø3Ø-Ø698

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP52	SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co. Troutdale LOCATION Scrap Yard
ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations
DRILLING METHOD AND EQUIPMENT Geoprobe 4 +2' Sampler
WATER LEVELS _____ START 6/1/98 FINISH 6/2/98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30 – 32				Sand (SW) as above	
	32 – 34				Sand (SW) as above	
35	34 – 36				Sand (SW) as above	GP52-Ø35-Ø698
					END OF BORING 36 ft.	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP53	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co LOCATION Scrap Yard
ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations / Kieth Vidor
DRILLING METHOD AND EQUIPMENT Geoprobe 2+4' sampler.
WATER LEVELS _____ START 6-2-98 FINISH 6-2-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0		3ft		TOP 1ft Silty Sand (SM) Dry Dark Yellow Brown (10YR 4/2) Friable Bottom 2ft. Sand (SW) Brownish Gray (5YR 4/1) moist, loose, subangular grains.	GP53-0000-0698-0
	4					
5			4ft		TOP 1.5ft. Silt (ML) w/ 5% fine grained sand Light Brownish gray (5YR 6/1) moist-wet stiff orange mottling. Bottom 2.5ft. Silt (ML) Pale yellowish brown (10YR 6/2) moist-wet, soft, ~~fine~~ trace fine grained sand.	GP53-0005-0698-0
	8					
10			4ft		Sand (SW) Olive gray (5Y 4/1) wet loose, fine grained, trace fines	GP53-0010-0698-0
	12					
			2ft		Sand SW as above with light brown mottling.	
	14					
15			2ft		Sand (SW) as above	GP53-0015-0698-0
	16					
			1ft		Sand (SW) as above	
	18					
			2ft		Sand (SW) as above	
20	20					GP53-0020-0698-0
			1ft		Sand (SW) Light olive gray (5Y 5/2) loose, wet, fine grained, trace fines	
	22					
			1.2ft		Top 1ft Sand (SW) as above Bottom .2ft. Sand SW w/ 10% Silt. Moderate Yellow Brown (10YR 5/4) ~~loose~~ wet, loose	
	24					
25			1ft		Top .8 Sand (SW) as above Bottom .2ft Sand w Silt (SM) 25% fines. Brownish gray mottling.	GP53-0025-0698-0
	26					
			1.5ft		Sand (SW) olive gray (5Y 4/1) interspersed w/ 3 1" layers of Sand + Silt. 20%-30% Silt wet, loose, Mod yellow brown (10YR 5/4)	
	28					
			1ft		Sand (SW) olive gray (5Y 4/1) wet, loose, contains 1" layer of Sand + Silt, 20-30% Silt. Moderate Yellow Brown (10YR 5/4)	GP53-0030-0698-0
30	30					

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP53	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION Scrap Yard

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations / Keith Vidal

DRILLING METHOD AND EQUIPMENT Geoprobe 2+4" Sampler

WATER LEVELS _____ START 6/2/98 FINISH 6/2/98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: NUMBER AND TYPE	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Sand (SW) Med Gray (N4) wet loose med-fine grained. Little to No fines, Subangular grains. Coarsening	
					END of Boring 36 ft BGS	

REV 11/89 FORM D1525

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP54	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co Troutdale LOCATION Scrap yard
ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations / Kieth Vidas
DRILLING METHOD AND EQUIPMENT Geoprobe w/ 2+9' sampler
WATER LEVELS _____ START 6-2-98 FINISH 6-3-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0–4		3ft		TOP 1ft. Silt w Sand (ML) Dark Yellow Brown (10YR 4/2) Dry friable. Bottom 2 ft Sand (SW) Dark Yellowish Brown (10YR 4/2) dry-moist. loose	GP54-ØØØ-0698-Ø
5	4–8		3.5ft		TOP 1ft. Sand w Silt (SM) 10% fines. Dark Yellowish brown (10YR 4/2) wet loose, fine grained sand. Bottom 2.5 Silt w Sand (SM) 20-30% fine grained sand wet. orange mottling (10YR 4/2)	GP54-ØØ5-Ø698-Ø
	8–12		2ft		Silt (ML) Pale Yellowish brown (10YR 6/2) moist-wet. Trace fine grained sand orange mottling med plasticity	GP54-Ø1Ø-Ø698-Ø
	12–14		1.5		Silt (ML) (10YR 6/2) > Med Dark Gray (N4) wet. med plastic, trace fine grained sand. orange brown mottling	
15	14–16		1.5		Silt w Sand (ML-SM) Dark Gray (N4) 10% fine grained sand, wet, stiff, med plasticity	GP54-Ø15-Ø698-Ø
	16–18		2		TOP 1.5 Silt (ML) (N4) - wet, med plastic orange mottling. Bottom .5 Sand (SP) w/ 10% Silt. fine grained sand, wet, loose	
20	18–20		2		TOP .5 Sand SP as above. Bottom 1.5 Silt w/ Sand (ML) as above	GP54-Ø2Ø-Ø698-Ø
	20–22		2		Silt (ML) w 10% fine grained sand (N4) wet, soft, med plasticity.	
	22–24		2		Sand (SP)/(SW) Dark Gray (N4) saturated loose, 5% fine grained sand	heaving sand
25	24–26		2		Sand (SW) Dark Gray (N4) wet, loose 5% silt. fine to med-grained	GP54-Ø25-Ø698-Ø
	26–28		2		Sand (SW) Dark Gray (N4) as above w/ Little to No. fines.	
30	28–30		2		Sand (SW) as above w/ small layers of silt 1" thick	

REV 11/89 FORM D1526

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP54	SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co. Troutdale LOCATION Scrap Yard
ELEVATION DRILLING CONTRACTOR Geo tech Explorations / K. Vidas
DRILLING METHOD AND EQUIPMENT Geoprobe 2+4' Samplers.
WATER LEVELS START 6-2-98 FINISH 6-3-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
			2 ft		Sand (SW) Dark Gray (N4) wet, loose, med to fine grained sand. Little to no fines	
			1 ft		Sand (SW) as above	
35			1.5 ft		Sand (SW) as above	GP54-Ø35-0698-Ø
					END OF BORING 36 ft.	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP-55	SHEET 1 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION Scrap Yard
ELEVATION DRILLING CONTRACTOR Geo Tech Exploration
DRILLING METHOD AND EQUIPMENT Geoprobe 2 & 4' Sampler
WATER LEVELS START 6/1/98 FINISH 6/1/98 LOGGER J. Bowlin

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0–4		3ft		TOP 1ft. Sand(SW) Brownish Gray(5YR4/1) dry, loose, ~~fine~~ Bottom 2ft. Sand (SW) (10YR5/4 - 10YR4/2) moist, loose, Little to no fines.	GP55-~~0900~~-0698-0
5	4–8		4ft		TOP 1ft. Sand (SW) Dark Yellowish Brown (10YR4/2) moist, loose little to no fines Mid 1ft. Silty Sand (ML) mod Yellow Brown. (10YR5/4) 5-10% fine grained sand, wet. med stiff. Bottom 2ft. Silt (ML) (10YR 5/4) wet, med stiff. orange mottling.	GP55-~~0905~~-0698-0
10	8–12		1ft		Silt (ML) as above	GP55-~~0910~~-0698-0
15	12–16		3.5ft		TOP 2ft Silty Sand (SM) 20% fine grained sand Mod Yellow brown (10YR5/4), med stiff. med plastic. ~~fine grained sand~~ Mid 1ft Sand w/ Silt (SM) 10% fines. (10YR5/4) Bottom 1ft Sand (SW) ~~w/ silt~~ Light brown (5YR5/4) wet, loose, med to fine grained sand. <5% fines	12-15 GP55-~~0915~~-0698-0
20	16–20		4ft		TOP 1.5 Sand (SW) as above Mid 1ft. Sand (SW) (5YR 5/6 → 10R3/4) Bottom 1.5 Sand (SW) Med Gray (N5) wet, loose fine grained, subangular grains:	GP55-~~0920~~-0698-0
	20–24		4ft		TOP 2 ft Sand (SW) Pale Yellow brown (10YR6/2) wet, loose, fine to med grained Little to no fines Bottom 2ft Sand (SW) Brownish gray (5YR4/1) wet loose. med-fine grained Small 3" layer of Silt (10YR5/4) → (N5) med stiff, wet, med plastic	
25	24–28		4ft		TOP 3ft Sand (SW) Brownish gray (5YR4/1) fine grained, wet, loose, coarsening downward Bottom 1ft Sand (SW) Dark Yellowish Brown (10YR4/2) wet, loose, Little to no fines, fine grained.	GP55-~~0925~~-0698-0
30	28–30				TOP 2ft Sand (SW) as above	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP55	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC - Troutdale LOCATION Scrap Yard

ELEVATION DRILLING CONTRACTOR Geo Tech Exploration

DRILLING METHOD AND EQUIPMENT Geoprobe 2+4' Sampler

WATER LEVELS START 6/1/98 FINISH 6/1/98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32				Bottom 2ft Sand (SW) Brownish Gray (5YR 4/1) small 1" layer of silt (10YR 5/4) per foot	
35	36				TOP 1ft Sand (SW) as above Bottom 3ft Sand (SW) Med Dark Gray (N4) wet, loose, fine to med grained, 1" silt layer Med Gray (N5)	GP55-Ø35-0698-Ø
40	40				TOP 2ft Sand (SW) as above with 1" silt layer Bottom 2ft Sand (SW) (N4) wet, loose, little to no fines, fine to med grained - subangular grains	GP55-Ø40-Ø698
					END of BORING 40 ft BGS	

REV 11/89 FORM D1526

Hollow Stem Auger

Soil Boring Logs for Scrap Yard (GP50/SB11 and SB-10), East Potliner (SB-01), and South Landfill (SB-61) Areas

Summer 1998 Data Needs Soil and Groundwater Geoprobe Investigation

at

South Landfill, East Potliner, and Scrap Yard Areas

CH2M HILL

PROJECT NUMBER	BORING NUMBER GPSO(SB11)	SHEET 1 OF 3

SOIL BORING LOG

PROJECT Reynold Metals Co Troutdale LOCATION Scrap Yard

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech explorations

DRILLING METHOD AND EQUIPMENT HSA 4¼' ID Augers

WATER LEVELS _____ START 6/24/98 FINISH 6/24/98 LOGGER J. Bowker / T. Gehwe

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0				Sand (SW) Brownish Gray (5YR 4/1) dry loose, Little to No Fin	
	2					
5	5				TOP .5 Sand (SW) (5YR 4/1) to wet-moist loose,	SB11-005-0698-0 Collected geotechnical Samples
	7				Bottom .5 Silt (ML) Brown (5YR 4/1) wet-moist friable, stiff, orange → gray mottling	
10	10				Silt (ML) mod yellow brown (10YR 5/4) 10% fine grained sand wet → saturated stiff, med plastic	SB11-010-0698-0 F = 10.1
	12					
15	15				Sand (SP) (10YR 5/4) w/ 10% silt wet, loose, fine grained,	SB11-015-0698-0 F = 22.3
	17					
20	20				Sand (SW-SP) Light gray-brown, wet loose, Little to No fines <5%	SB11-020-0698-0 F = 50.6
	22					
25	25				Sand (SP) as above med dense	SB11-025-0698-0 F = 20.6
	27					
30						SB11-030-0698-0 F = 49.7

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP50(SB11)	SHEET 2 OF 3

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION Scrap Yard

ELEVATION DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA 4 1/4' Augus ID

WATER LEVELS START 6/24/98 FINISH 6/24/98 LOGGER J. Bowker T. Gehrke

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32				Sand (SP-SW) as above	
35					Sand (SP-SW) as above	SB11-Ø35-Ø698-Ø F=46.3
37	37					
40	40					SB11-Ø40-Ø698-Ø F=49.1 Collect geotechnical samples
	42				Lithology same as above to 80 ft. based on observed drill cuttings	
45						F=45
50						F=38.1
55						
60						F=35.4

CH2M HILL

PROJECT NUMBER	BORING NUMBER GP 50 (SB11)	SHEET 3 OF 3

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION Scrap Yard

ELEVATION _____ DRILLING CONTRACTOR Geo Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA 4 1/4" ID Augers

WATER LEVELS _____ START 6/24/98 FINISH 6/24/98 LOGGER J. Boulter/TGd.

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: NUMBER AND TYPE	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65						
70						F = 31.4
75						
80						F = 24.5
					END OF BORING 80 ft BGS	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER SB-1Ø	SHEET 1 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION Scrap Yard

ELEVATION _____ DRILLING CONTRACTOR Geo Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA 4 1/4 ID Augers

WATER LEVELS _____ START 6/24/98 FINISH 6/24/98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5	5				Sand (SW)	SY-SB1Ø-Ø5S-0698-Ø
	7		2		Sand (SW) as above	Shelby TUBE
	9		2			Shelby TUBE
10	10				Sand (SW) as above	SY-SB1Ø-Ø1Ø-0698-Ø
	12		2			
15	15				Silt (ML) Light Gray (N4) moist stiff, Low plasticity	SY-SB1Ø-Ø15-0698-Ø
	17					
	19					Shelby TUBE
20	21					Shelby TUBE SY-SB1Ø-020-0698
	23					Shelby TUBE
25	25				SILT (ML) Med dark Gray (N4) wet med soft-med plastic. Light orange mottling.	SY-SB1Ø-Ø25-0698-Ø
2	27					

REV 11.89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER SB-10	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION Scrap Yard

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Exploration

DRILLING METHOD AND EQUIPMENT HSA 4 1/4 ID Augers

WATER LEVELS _____ START 6/24/98 FINISH 6/24/98 LOGGER J. Bowlby

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30	32		2		Sand (SW) Med Dark Gray (N4) wet, loose, fine to med grained	SY-SB10-030-0698-0
35	35				Sand (SW) as above	
	37					Shelby TUBE
	39				Sand (SW) as above	Shelby TUBE
					END of Boring 39 ft BGS.	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER SB-Ø1	SHEET 1 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION East Potliner

ELEVATION _____ DRILLING CONTRACTOR Geo Tech exploration (Pete)

DRILLING METHOD AND EQUIPMENT HSA w/ 4 1/4 ID Augers

WATER LEVELS _____ START 6/23/98 FINISH 6/23/98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5	5					
	7		2	2/4/3	Silt(ML) Mod yellow Brown (10YR5/4) moist, mod stiff. friable orange mottling	EP-SBØ1-005-0698-Ø
10	10					
	12		2	2/3/5	Top 5 ft. Silt(ML) as above Bottom 1.5 ft Silt w/ Sand (SM) Light olive gray (5Y6/1) moist-wet Soft-mod stiff. 30% loose to fine grained sand	EP-SBØ1-010-0698-Ø
15	15					
	17		2		Silt + Sand as above w/ 40% fine grained sand	EP-SBØ1-015-0698-Ø
	19		2			Collect shelby tube
20	21				No Recovery	
25	25					EP-SBØ1-Ø25-0698-Ø
	27		1		Silt + Sand as above very soupy.	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER SB-01	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION East Potliner

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA w/ 4 1/4 ID Auger

WATER LEVELS _____ START 6/23/98 FINISH 6/23/98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30						
35	35					
	37		1.5		TOP .5 as above Bottom 1 Ft. Sand (SW) Dark Gray (N3) Wet, loose, Fine to med grained Subangular grains.	
40	40					
	42		2		Sand (SW) as above	Shelby Tube
	44		2		Sand (SW) as above	Shelby TUBE.
45					END of Boring 44 Ft BGS.	

(8.30)

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER SB-61	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co. Troutdale LOCATION South Landfill
ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations
DRILLING METHOD AND EQUIPMENT HSA 4 1/4 ID Augers
WATER LEVELS _____ START 6/23/98 FINISH 6/23/98 LOGGER J. Bowlher

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5	5					
					TOP. 3 ft Silt (ML) Brown (10YR 5/4) moist Bottom 1.7ft Sand (SW) Gray (N3) moist loose, fine-med grained.	SL-SB61-005-0698
	7		2	23/25/29		Shelby TUBE
	9		2	19/15/14	Sand (SW) Brownish Gray (5YR 4/1) wet loose, med-fine grained	Shelby Tube
10	10					SL-SB61-010-0698
	12		2	5/5/13	Sand (SW) as above	
15	15					
					TOP. 5 ft. Sand (SW) as above bottom 1.5 Silt (ML) Med Dark Gray (N4) wet, med soft, med plastic.	SL-SB61-015-0698
	17		2			
	19		2		Silt (ML) as above	Shelby Tube
20	21		2		Silt (ML) as above	Shelby TUBE.
	23		2		Silt (ML) as above	Shelby TUBE
25	25					
	27		2		Silt (ML) as above	SL-SB61-025-0698-0

CH2M HILL

PROJECT NUMBER	BORING NUMBER SB-61	SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals Co. Troutdale LOCATION South Landfill

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA 4 1/4 ID Augers

WATER LEVELS _____ START 6/23/98 FINISH 6/23/98 LOGGER J. Bowles

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30–32		2	2/4/4	Top 1 ft Silt (ML) as above Bottom 1 ft (SM-ML) Silt as above w/ 20% fine grained sand	SL-SB061-030-0698-0
35	35–37		2	2/3/4	Silty Sand (SM) Silt Med Dark Gray (N4) wet, med soft, med Plastic, w/ 50% fine grained sand	SL-SB61-035-0698-0
40	40–42		2		Top 1 ft Sand (SM) + Silt as above Bottom 1 ft Sand (SW) Med Dark Gray (N4) wet, loose, med-fine grained	SL-SB61-040-0698-0
45	45–47				Sand (SW) as above	SL-SB61-045-0698-0 Shelby Tube
	49					Shelby Tube
					END of Boring 49 ft BGS	

APPENDIX C

Onsite Well Logs

Table C-1
Construction Summary of Groundwater Monitoring Wells and Other Wells
Reynolds Metals Company - Troutdale, Oregon *(Revised 6/9/99)*

Well ID	Unit (a)	Installation Date	Total Depth (b)	Casing Diameter (c)	Borehole Diameter	Screen Length (feet)	Screened Interval (b)	Top of Filter Pack (b)	MPE (d)	GSE (e)	Screened Material (f)	Well Location (g)	Comments
MW01-019	S	7/12/94	20	4-inch	12-inch	10	9 to 19	7	28.25	25.2	Sand (SP), Silt (ML)	Along South Ditch	
MW02-012	S	7/25/95	12.5	2-inch	10-inch	5	7 to 12	6	31.10	28.3	Silt (ML)	Scrap yard	
MW02-034	UGS	1/18/96	34	2-inch	10-inch	5	28 to 33	27	30.64	28.6	Sand (SP, SM)	Scrap yard	
MW03-017	S	7/9/94	18	2-inch	10-inch	8	9 to 17	7	29.69	27.4	Sand (SP, SM)	Perimeter	
MW03-098	I	6/26/96	100	2-inch	6-inch	10	88 to 98	87	30.65	28.7 *(h)*	Sand (SP)	Perimeter	
MW03-175	D	6/17/96	175.5	2-inch	6-inch	10	165 to 175	163.5	30.72	28.7 *(h)*	Sand (SP)	Perimeter	Borehole backfilled from 200 ft bgs
MW04-019	S	7/12/94	20	2-inch	12-inch	10	9 to 19	7	26.91	24.3	Silt (ML), Clay (CL)	South wetlands	
MW05-025	S	7/8/94	25	2-inch	10-inch	10	15 to 25	12	33.99	31.6	Silt (ML), Sand (SM)	Background	
MW06-024	S	7/8/94	25	2-inch	10-inch	10	14 to 24	11.5	26.81	24.1	Silt (ML), Sand (SP, SM)	Perimeter	
MW06-094	I	9/20/96	96	2-inch	6-inch	10	84 to 94	83.5	27.85	25.5	Sand (SW)	South of dike	
MW06-176	D	5/3/96	178	2-inch	6-inch	10	166 to 176	165	27.74	25.4 *(h)*	Sand (SW-SP)	Perimeter	Borehole backfilled from 197 ft bgs
MW07-024	S	7/9/94	25	4-inch	12-inch	10	14 to 24	12	28.38	28.7	Sand (SM), Silt (ML)	South of dike	
MW08-027	UGS	7/7/94	28	2-inch	10-inch	10	17 to 27	14	25.32	22.8	Sand (SP)	Perimeter	
MW08-127	I	7/10/96	129	2-inch	6-inch	10	117 to 127	116.5	25.62	23.5 *(h)*	Sandy gravel (GW)	Perimeter	Borehole backfilled from 134 ft bgs
MW08-169	D	5/23/96	170.5	2-inch	6-inch	10	159 to 169	158	25.88	23.7 *(h)*	Sand (SW) / Gravel (GW)	Perimeter	Borehole backfilled from 200 ft bgs
MW09-030	UGS	8/4/94	32	2-inch	10-inch	10	20 to 30	18	29.27	27.0	Sand (SP)	North landfill	
MW10-023	S	8/5/94	25	4-inch	10-inch	15	8 to 23	7	30.28	27.9	Silt (ML)	South of dike	
MW10-090	I	9/12/96	91	2-inch	6-inch	10	80 to 90	79	31.03	28.4	Sand (SW)	South of dike	
MW10-165	D	7/31/96	166	2-inch	6-inch	10	155 to 165	154	31.24	28.6	Gravel (GW)	South of dike	Borehole backfilled from 199 ft bgs
MW11-017	S	8/5/94	19	2-inch	10-inch	10	7 to 17	6	31.61	29.5	Sand/Silt (SP/ML)	East potliner	
MW12-021	S	8/4/94	23	2-inch	10-inch	5	16 to 21	14	22.53	20.2	Sand (SP) Silt (ML)	Perimeter	Borehole backfilled from 25 ft bgs
MW12-092	I	9/24/96	92	2-inch	6-inch	10	80 to 90	79	22.57	20.6	Sand (SW)	Perimeter	
MW12-184	D	5/21/96	184.5	2-inch	10-inch to 8.5 feet; 6-inch to 200 feet	10	174 to 184	171	23.04	20.7 *(h)*	Sand (SW)	Perimeter	Borehole backfilled from 200 ft bgs
MW13-022	S	7/12/95	23	2-inch	10-inch	5	17 to 22	15.5	30.88	28.3	Sand/silt (SP, SM) Sand (SP)	Scrap yard	
MW14-015	S	7/11/95	16	2-inch	10-inch	10	5 to 15	4	30.88	28.3	Silt (ML) Sand/silt (SP, SM)	Scrap yard	
MW15-024	S	7/13/95	24	2-inch	10-inch	10	14 to 24	11.5	22.75	20.9	Silt (ML) Sand/silt (SP, SM)	Perimeter	Borehole backfilled from 25 ft bgs
MW15-086	I	9/23/96	87	2-inch	6-inch	10	76 to 86	75	23.88	21.5	Sand (SW)	Perimeter	Borehole backfilled from 92 ft bgs
MW15-175	D	6/4/96	175.8	2-inch	6-inch	10	165 to 175	164	23.88	21.8 *(h)*	Sand (SW)	Perimeter	Borehole backfilled from 200 ft bgs
MW16-014	S	7/13/95	14	2-inch	10-inch	8	6 to 14	4	28.91	26.7	Sand (SP)	South landfill	
MW17-016 **	S	7/21/95	17	2-inch	10-inch	5	11 to 16	10	27.13	24.8	Silt with sand (ML)	South wetlands	
MW17-028	S	7/21/95	28.5	2-inch	10-inch	5	23 to 28	22	27.30	24.8	Sand (SW), Silt (ML)	South wetlands	
MW18-016	S	7/20/95	16.5	2-inch	10-inch	5	11 to 16	9.5	23.98	21.5	Sand (SP)	South wetlands	

Table C-1
Construction Summary of Groundwater Monitoring Wells and Other Wells
Reynolds Metals Company - Troutdale, Oregon *(Revised 6/9/99)*

Well ID	Unit (a)	Installation Date	Total Depth (b)	Casing Diameter (c)	Borehole Diameter	Screen Length (feet)	Screened Interval (b)	Top of Filter Pack (b)	MPE (d)	GSE (e)	Screened Material (f)	Well Location (g)	Comments
MW18-031	UGS	7/20/95	32	2-inch	10-inch	5	27 to 32	25	23.95	21.5	Silt (ML) Sand/silt (SP, SM)	South wetlands	
MW19-013	S	7/21/95	13.5	2-inch	10-inch	5	8 to 13	6.5	27.10	24.8	Sand (SW), Silt (ML)	South landfill	
MW20-026	UGS	9/1/95	26.5	2-inch	10-inch	10	16 to 26	15	28.46	25.8	Sand (SP)	North landfill	
MW21-012 **	S	9/5/95	12	2-inch	10-inch	5	7 to 12	6	24.54	22.4	Silt (ML)	North landfill	
MW21-025	UGS	9/5/95	25	2-inch	10-inch	5	19 to 24	17	24.60	22.0	Sand (SP)	North landfill	
MW21-063	I	10/1/96	65	2-inch	6-inch	10	53 to 63	51	26.76	23.8	Sand (SW)	North landfill	
MW21-176	D	8/14/96	177	2-inch	6-inch	10	166 to 176	165	26.01	23.3	Sand (SW)	North landfill	Borehole backfilled from 364 ft bgs
MW22-027	UGS	9/6/95	27	2-inch	10-inch	10	17 to 27	15	25.35	22.6	Sand (SP)	North landfill	
MW23-025	UGS	9/1/95	25	2-inch	10-inch	10	15 to 25	14	26.43	24.9	Sand (SP)	North landfill	
MW24-010	S	7/12/95	11	2-inch	10-inch	5	5 to 10	4	30.13	27.3	Sand/silt (SP, SM) Sand (SP)	Scrap yard	Borehole backfilled from 12.5 ft bgs
MW25-024	S	7/12/95	24	2-inch	10-inch	10	13 to 23	11.5	31.14	28.5	Silt (ML) Silty sand (SM)	Scrap yard	Borehole backfilled from 30 ft bgs
MW25-035	UGS	7/24/95	35.5	2-inch	10-inch	5	30 to 35	29	30.89	28.4	Sand (SW, SP)	Scrap yard	
MW26-012	S	7/24/95	12.5	2-inch	10-inch	5	7 to 12	6	26.26	23.9	Sand (SP)	South landfill	
MW27-045	UGS	11/1/96	45	2-inch	10-inch	10	35 to 45	32	31.66	29.6	Sand (SW)	Adjacent to Company Lake	
MW27-081	I	8/28/96	80.5	2-inch	6-inch	10	69 to 79	67.5	31.93	29.4	Sand (SW)	Adjacent to Company Lake	Borehole backfilled from 175 ft bgs
MW27-176	D	8/26/96	176.5	2-inch	6-inch	10	164 to 174	163	31.94	29.5	Gravel (GW)	Adjacent to Company Lake	Borehole backfilled from 260 ft bgs
MW28-160	D	10/10/96	161	2-inch	10-inch to 27 feet 6-inch to 161 feet	10	150 to 160	148.7	28.62	28.8	Sand (SW)	Bakehouse	
MW29-033	UGS	10/31/96	33.5	2-inch	10-inch	10	23 to 33	21	29.75	27.9	Sand (SW)	South of dike	Borehole backfilled from 38.5 ft bgs
MW29-090	I	9/18/96	91	2-inch	6-inch	10	80 to 90	78	30.65	28.1	Sand (SW)	South of dike	
MW29-179	D	5/9/96	182	2-inch	10-inch to 18 feet 6-inch to 182 feet	10	168 to 178	168	30.66	28.5 *(h)*	Gravel (GW-GM)	South of dike	Borehole backfilled from 200 ft bgs
MW30-030	UGS	12/5/96	30	2-inch	10-inch	10	20 to 30	18	34.07	31.9	Sand (SW)	Near Gresham Sand & Gravel	
MW30-100	I	12/17/96	101	2-inch	6-inch	10	90 to 100	87	34.06	31.9	Sand (SW)	Near Gresham Sand & Gravel	
MW31-034	UGS	11/26/96	34	2-inch	10-inch	10	24 to 34	22	25.60	23.8	Sand (SW)	Fairview Farms	
MW31-095	I	12/9/96	96	2-inch	6-inch	10	85 to 95	82	25.00	22.8	Sand (SW)	Fairview Farms	Borehole backfilled from 120 ft bgs
MW32-040	UGS	12/6/96	41	2-inch	10-inch	10	30 to 40	28	28.44	28.4	Sand (SW)	Bakehouse	
MW32-095	I	12/6/96	95	2-inch	6-inch	10	85 to 95	82	28.31	28.4	Sand (SW)	Bakehouse	
MW32-165	D	12/2/96	165	2-inch	6-inch	10	155 to 165	151	28.40	28.4	Sand (SW)	Bakehouse	
MW33-033	UGS	12/4/96	33.5	2-inch	10-inch	10	23 to 33	22	29.92	28.5	Sand (SW)	Scrap yard	
MW33-095	I	11/25/96	95.5	2-inch	6-inch	10	85 to 95	82	30.56	28.5	Sand (SW)	Scrap yard	

Table C-1
Construction Summary of Groundwater Monitoring Wells and Other Wells
Reynolds Metals Company - Troutdale, Oregon *(Revised 6/9/99)*

Well ID	Unit (a)	Installation Date	Total Depth (b)	Casing Diameter (c)	Borehole Diameter	Screen Length (feet)	Screened Interval (b)	Top of Filter Pack (b)	MPE (d)	GSE (e)	Screened Material (f)	Well Location (g)	Comments
MW33-165	D	12/30/96	165.5	2-inch	6-inch	10	155 to 165	152	30.68	28.7	Sand (SW), Gravel (GW)	Scrap yard	
MW34-038	UGS	12/3/96	38	2-inch	10-inch	5	33 to 38	31	32.12	30.3	Sand with silt (SW-SM) Sand (SW)	East potliner	
MW35-038	UGS	12/3/96	38	2-inch	10-inch	5	33 to 38	31	31.56	29.3	Sand (SW)	East potliner	
MW36-006 **	S	10/22/96	6.5	2-inch	9-inch	3	3 to 6	2	21.68	21.2	Silt (ML)	South wetlands	Borehole backfilled from 8 ft bgs
MW37-012	S	10/23/96	12.5	2-inch	9-inch	5	7 to 12	5	21.48	17.8	Silt (ML)	South wetlands	Borehole backfilled from 16 ft bgs
MW37-030	UGS	12/9/96	30.5	2-inch	9-inch	5	25 to 30	23	21.32	17.8	Sand with silt (SW-SM)	South wetlands	
MW38-007	S	11/1/96	7	2-inch	10-inch	4	3 to 7	2	22.56	20.6	Sand (SW)	Along Salmon Creek	
MW38-035	UGS	12/2/96	36	2-inch	10-inch	5	30 to 35	28.5	23.07	20.7	Sand (SW)	Along Salmon Creek	
MW39-095	I	6/26/97	95	2-inch	6.5-inch	10	85 to 95	82	25.18	22.3	Sand (SW)	Fairview Farms	
MW40-018	S	6/11/97	18.3	2-inch	11-inch	5	13 to 18	10	28.42	28.8	Silt (ML)	Bakehouse	
MW40-030	UGS	6/11/97	32	2-inch	11-inch	5	25 to 30	23	28.29	28.7	Sand (SW)	Bakehouse	
MW41-020	S	6/13/97	20.3	2-inch	11-inch	5	15 to 20	12	28.63	29.1	Silt (ML)	Bakehouse	
MW41-033	UGS	6/12/97	35	2-inch	11-inch	5	28 to 33	26	28.71	29.1	Sand (SM)	Bakehouse	
MW42-013	S	6/11/97	13.3	2-inch	11-inch	5	8 to 13	6	30.08	29.1	Silt (ML)	Bakehouse	
MW42-027	UGS	6/11/97	27.5	2-inch	11-inch	5	22 to 27	20	30.17	29.3	Sand (SW)	Bakehouse	
MW43-015	S	6/13/97	15.3	2-inch	11-inch	5	10 to 15	8	30.91	29.7	Silt (ML)	Bakehouse	
MW43-027	UGS	6/13/97	29	2-inch	11-inch	5	22 to 27	20	30.72	29.7	Sand (SW)	Bakehouse	
MW44-011	S	6/12/97	12	2-inch	11-inch	5	6 to 11	4	31.11	29.2	Sand (SW-SM) / Silt (ML)	Bakehouse	
MW44-027	UGS	6/12/97	27.5	2-inch	11-inch	5	22 to 27	20	30.88	29.2	Sand (SW)	Bakehouse	
MW45-017	S	6/17/97	17.8	2-inch	11-inch	5	12 to 17	10	30.61	28.7	Silt (ML)	Bakehouse	
MW45-042	UGS	6/16/97	43	2-inch	11-inch	5	37 to 42	35	30.26	28.9	Sand (SW)	Bakehouse	
MW46-018	S	6/16/97	18.8	2-inch	11-inch	5	14 to 19	11.5	31.48	29.6	Sand (SW) / Silt (ML)	Bakehouse	
MW46-043	UGS	6/16/97	43.3	2-inch	11-inch	5	38 to 43	36	30.99	29.4	Sand (SW)	Bakehouse	
MW47-094	I	7/1/97	95	2-inch	6.5-inch	10	84 to 94	82	29.71	27.0	Sand (SW)	South landfill	
MW48-055	I	9/2/97	56	2-inch	6-inch	10	45 to 55	42	28.19	28.4	Sand	No. Side Casthouse	
MW48-165	D	8/27/97	199	2-inch	6-inch	10	155 to 165	151	28.12	28.3	Sand	No. Side Casthouse	Backfilled to 165 ft
MW49-095	I	10/29/97	95	2-inch	6-inch	10	84 to 94	81	30.52	28.7	Sand	Scrap Yard	
MW49-145	D	10/24/97	173	2-inch	6-inch	10	135 to 145	131	30.85	28.9	Sand	Scrap Yard	Backfilled to 146 ft
MW50-094	I	10/31/97	95	2-inch	6-inch	10	84 to 94	81	27.06	24.9	Sand	So. Side Casthouse	
MW51-069	I	11/3/97	69	2-inch	6-inch	10	58 to 68	55	26.17	23.4	Sand	Adjacent to River	Near Gresham S & G
MW52-045	UGS	10/30/97	45	2-inch	6-inch	10	35 to 45	31	26.43	23.8	Sand	Adjacent to River	Near MW08
MW53-034	UGS	10/31/97	35	2-inch	6-inch	10	24 to 34	21	23.80	20.6	Sand	Adjacent to River	East of East Lake
PZ17-019	S	10/29/97	19.3	1/2-inch	2-inch	3	16 to 19	14	28.73	NM	Silt	Bakehouse	
PZ17-039	UGS	10/29/97	40	1/2-inch	2-inch	3	36 to 39	34	28.69	NM	Sand	Bakehouse	
PZ18-023	S	10/31/97	23.3	1/2-inch	2-inch	3	20 to 23	18	27.87	NM	Silt	Bakehouse	
PZ18-040	UGS	10/30/97	42	1/2-inch	2-inch	3	37 to 40	35	27.81	NM	Sand	Bakehouse	
PZ19-014	S	10/31/97	14.3	1/2-inch	2-inch	3	11 to 14	9	29.30	NM	Silt	Bakehouse	
PZ19-040	UGS	10/31/97	40	1/2-inch	2-inch	3	37 to 40	35	29.43	NM	Sand	Bakehouse	
PW03		6/42	281	12-inch	12-inch	11	Perforated: 253 to 264	Not Known	NA	28.5	Gravel; coarse gray sand		Production well

Table C-1
Construction Summary of Groundwater Monitoring Wells and Other Wells
Reynolds Metals Company - Troutdale, Oregon *(Revised 6/9/99)*

Well ID	Unit (a)	Installation Date	Total Depth (b)	Casing Diameter (c)	Borehole Diameter	Screen Length (feet)	Screened Interval (b)	Top of Filter Pack (b)	MPE (d)	GSE (e)	Screened Material (f)	Well Location (g)	Comments
PWO7		1948	254	24-inch from 0 to 40 feet; 18-inch from 0 to 203 feet; 12-inch from 190 to 254 feet	12-inch to 24-inch	NA	Perforated: 223 to 230; 232 to 246	Not Known	NA	28.5	Clay; Loose sand & gravel		Production well
PW08		1948	248	18-inch to 160 feet; 12-inch (152 to 248 feet)	12-inch	NA	158 to 174; 195 to 206; 210 to 218	Not Known	30.50	28.5	Loose sand & gravel; Loose sand & gravel; Loose & cemented sand/gravel		Production well
PW10		1949	625	20-inch to 140 feet; 12-inch from 0 to 625 feet	12-inch	NA	144 to 185; 440 to 482; 522 to 530; 538 to 558	Not Known	31.18	28.5	Sandy clay & gravel; Sand & gravel; Sand & gravel		Production well
PW18		1970	300	11-inch to 270 feet	Not Known	NA	148 to 189; 229 to 260	Not Known	30.57	28.0	Sand Sand & gravel		Production well
Fairview Farms Well No. 4		1943 Well use: Irrigation	281	24-inch from 0 to 55 feet; 12-inch from 55 to 230 feet; 8-inch from 209 to 281 feet	Not Known	13	237 to 250	Not Known	22.41	19.1	Sand & gravel	~ 1,300 feet west of Sundial Road	Former irrigation well
Sundial Marine		12/19/79	233	6-inch from 0 to 227 feet	Not Known	5	228 to 233	Not Known	NA	NA	Sand & gravel	Northwest of Sundial Road, adjacent to Columbia River	Domestic well
Gresham Sand & Gravel		11/10/67	127	6-inch from 0 to 120 feet	Not Known	10	120 to 130	Not Known	NA	NA	Sand & gravel	Northwest of Sundial Road, adjacent to Columbia River	Domestic well

Notes:

(a) S = Shallow well screened in silt.
UGS = Shallow well screened in the upper gray sand.
I = Intermediate-depth well screened in sand.
D = Deep well screened in sand/gravel.

** Well abandoned in June 1998.

(b) Feet below ground surface (ft bgs).
(c) Casing and screen constructed with flush-threaded Schedule 40 or 80 polyvinyl chloride with 0.010-inch machine-slotted screen.
(d) MPE = Measuring point elevation, feet 1929 National Geodetic Vertical Datum (NGVD).
(e) GSE = Ground surface elevation, feet 1929 NGVD.
(f) For explanation of soil classification codes, refer to ASTM D 2488, Standard Practice for Description and Identification of Soils (American Society for Testing and Materials, August 1990).
(g) Refer to Figure 2-2 for well locations.
(h) Reference point is top of concrete pad (feet 1929 NGVD), not ground surface elevation.
NA = information not available.

CH2M HILL

PROJECT NUMBER	WELL NUMBER	
OPE39293.B1.01	MW-01	SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION Old Cryolite Plant

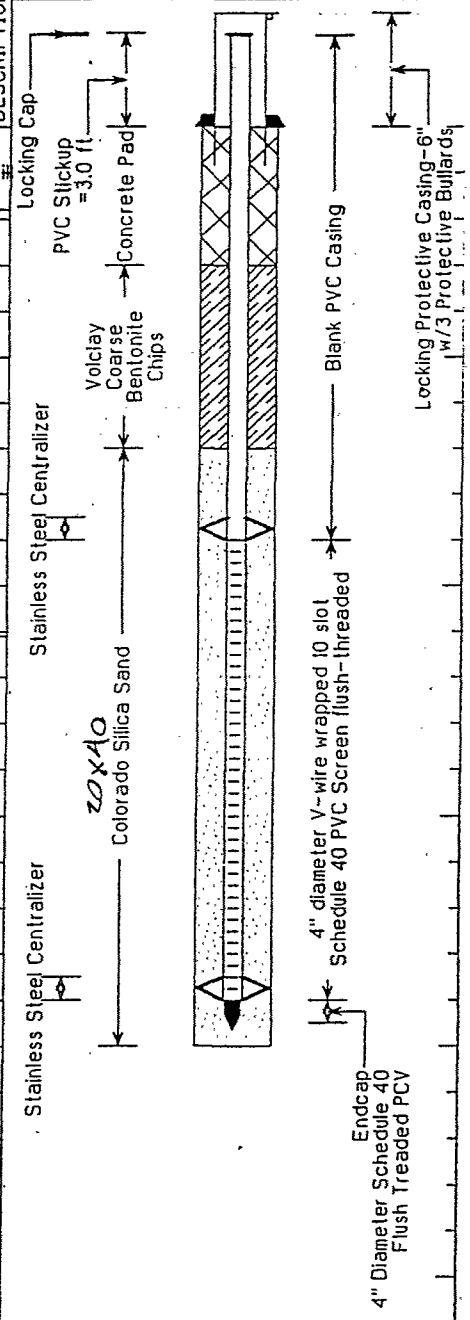
MEASURING POINT ELEV (NGVD) 28.25 DRILLING CONTRACTOR GeoTech-Mickey

DRILLING METHOD AND EQUIPMENT HSA 8-1/4" Augers, Canterra 250

WATER LEVEL ELEV/DATE 10.56 7-18-94 START 7-12-94 FINISH 7-12-94 LOGGER Heidi Hoffmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
					SILTY SANDY GRAVEL, GM, brown, angular gravel, dry, fill.	GM/FI
	2.5–4.0	S-1	1.5	12-13-20 (33)	SILT, ML, v. dk gray, (10YR 3/1), dry, hard, wood pieces. OVM=0.0, HCN=0.0.	ML
5.0	5.0–6.5	S-2	1.5	10-22-23 (45)	SAND, SP, dk grayish brown, (10YR 4/2), moist, medium sand, 5% silt, dense, Fe-oxide staining. OVM=0.0, HCN=0.0.	
	7.5–9.0	S-3	1.5	8-20-23 (43)	SAND, SP, dk grayish brown, (10YR 4/2), coarse sand, 5-10% silt, dense, moist-wet. OVM=0.0, HCN=0.0.	SP
10.0	10.0–11.5	S-4	0.6	7-8-6 (14)	SAND, SP, dk grayish brown, (10YR 4/2), wet, coarse sand, 5% silt. At 11.2': SILT, ML, grayish brown, wet, stiff. OVM=0.0, HCN=0.0.	
	12.5–14.0	S-5	1.0	2-3-1 (4)	SILT, ML, v. dk gray, (2.5YN 3), wet, soft, plastic. OVM=0.0, HCN=0.0.	
15.0	15.0–16.5	S-6	0.8	2-2-3 (5)	SILT, ML, v. dk gray, (2.5YN 3), wet, firm, plastic. OVM=0.0, HCN=0.0. Drillers smell NH3 downhole.	ML
	17.5–19.0	S-7	0.6	3-4-3 (7)	SILT, ML, v. dk gray, wet, plastic, firm, lense of brown plastic, silt, 3" thick. OVM=0.0, HCN=0.0.	
20.0	20.0–21.5	S-8	1.3	2-3-5 (8)	SILT, ML, black, (5Y 2.5/1), wet, firm, plastic. OVM=0.0, HCN=0.0.	
25.0					BOH=20'	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.H1.02	MW02-12 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum, RMC - Troutdale, OR LOCATION Scrap Yard by MW02

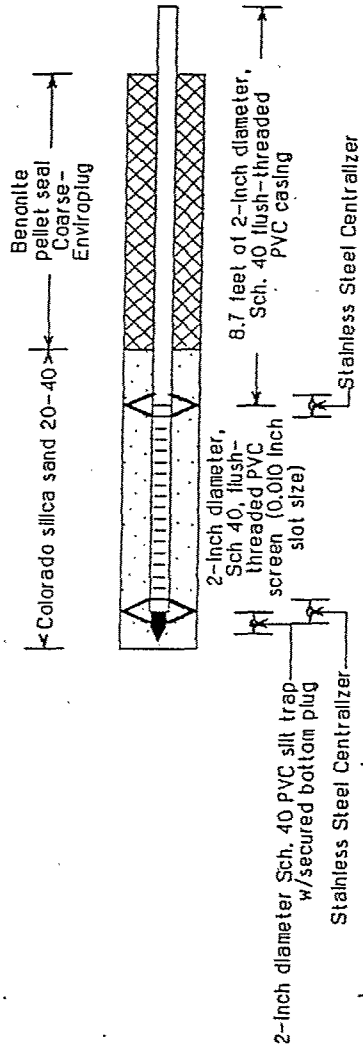
MEASURING POINT ELEV (NGVD) [illegible] DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT 8-1/4" IS HSA Mobile Drill B-59

WATER LEVEL ELEV/DATE _____ START 7/25/95 FINISH 7/25/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Sand, (SP), Gray, loose, dry, fine to med.-grained Comment: TMW05-0000-0*	SP
	4.0		1.4	2-3-3 (8)	Sand, (SP), Red-brown, loose, dry, fine- to med.-grained Comment: TMW05-0025-0*	
5.0	5.0					ML
	6.5		1.1	2-2-3 (7)	Silt, (ML), Gray-brown, firm, damp, 5 - 10% v. fine sand, orange mottling TMW05-0050-0*	
	7.5					
	9.0		1.0	4-2-2 (8)	Silt, (ML), Gray-green to pink-tan w/orange mottling, very firm, wet, 5 - 10% v. fine sand	
10.0	10.0					
	11.5		1.0	1-1-1 (3)	Silt, (ML), Gray w/orange mottling, firm, wet, slightly elastic	
	12.5					
	14.0		1.2	1-1-1 (3)	Silt, (ML), Gray-green w/orange mottling to gray, firm, wet, some sandy laminations w/10% fine sand	
15.0					* = Soil Samples	
20.0						
25.0						

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
OPE39293.B1.01	MW-02-24 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION Between Scrap Area & Former Mercury Spill

MEASURING POINT ELEV (NGVD) 31.65 DRILLING CONTRACTOR GeoTech-Mickey

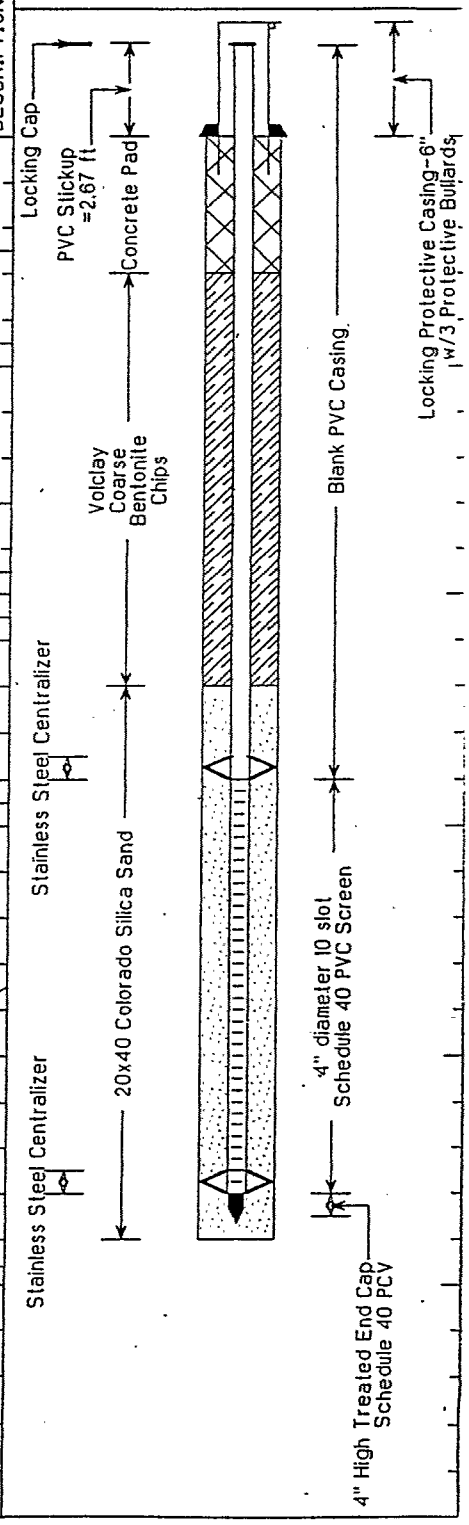
DRILLING METHOD AND EQUIPMENT HSA 8-1/4" Augers, Canterra 250

WATER LEVEL ELEV/DATE 21.0 7-18-94 START 7-11-94 FINISH 7-11-94 LOGGER Heidi Hoffmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
	2.5				SILT, ML, v. dk gray, (7.5YRN 3/1), dry.	ML
	4.0	S-1	1.5	3-8-17 (25)	SILTY SAND, SM, brown, (10YR 4/3), dry, slightly moist at top of fine sand, medium. OVM=0.0, HCN=0.0.	SM
5.0	5.0					
	6.5	S-2	0.8		SAND, SP, brown, (10YR 4/3), v. sl. moist, fine sand, well-sorted. OVM=0.0, HCN=0.0.	SP
	7.5					
	9.0	S-3	1.5	7-9-10 (19)	SAND, SP, brown, wet, medium, fine sand. At 8':SILTY SAND, SM, brown, wet. OVM=1.0, HCN=0.0.	SM
10.0	10.0					
	11.5	S-4	1.5	1-2-3 (5)	SILT, ML, grayish brown, wet, soft. At 10.5':CLAY, CL, v. dk (7.5YRN 3/1), wet, plastic, firm, Fe-oxide staining. OVM=0.5, HCN=0.0.	ML CL
	12.5					
	14.0	S-5	1.5	3-3-4 (7)	SILTY CLAY, CL, v.dk gray, Fe-oxide staining, wet, firm. SILTY SAND, SM, brown w/gray mottled, wet. OVM=0.0, HCN=0.0.	SM
15.0	15.0					
	16.5	S-6	1.5	3-4-6 (10)	SANDY SILT, ML, dk gray, wet, loose, fine sand, 20-30% sand, Fe-oxide staining. OVM=0.0, HCN=0.0.	ML
	17.5					
	19.0	S-7	1.5	3-3-4 (7)	SAND, SP, gray, (7.5YR 4/N3), fine sand. Middle 6",SILTY SAND, SM, wet, loose. OVM=0.0, HCN=0.0.	SP SM SP
20.0	20.0					
	21.5	S-8	1.5	4-4-5 (9)	SILT SAND, SM, dk gray, (7.5YR 4/N3), wet, lenses of fine sand, loose. OVM=0.0, HCN=0.0.	SM
	22.5					
	24.0	S-9	1.5	4-4-6 (10)	SILTY SAND, SM, dk gray, (5YR 4/1), wet, loose, Fe-oxide.	
25.0					Bottom 6":SAND, SP, dk gray, wet, medium sand, well-sorted. OVM=0.0, HCN=0.0.	
					BOH-24'	SP

Overdrilled to MW02-034 in January 1996

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER	
107493.H1.02	MW-02-34	SHEET 1 OF 2

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION Between Scrap Area & Former Mercury Spill

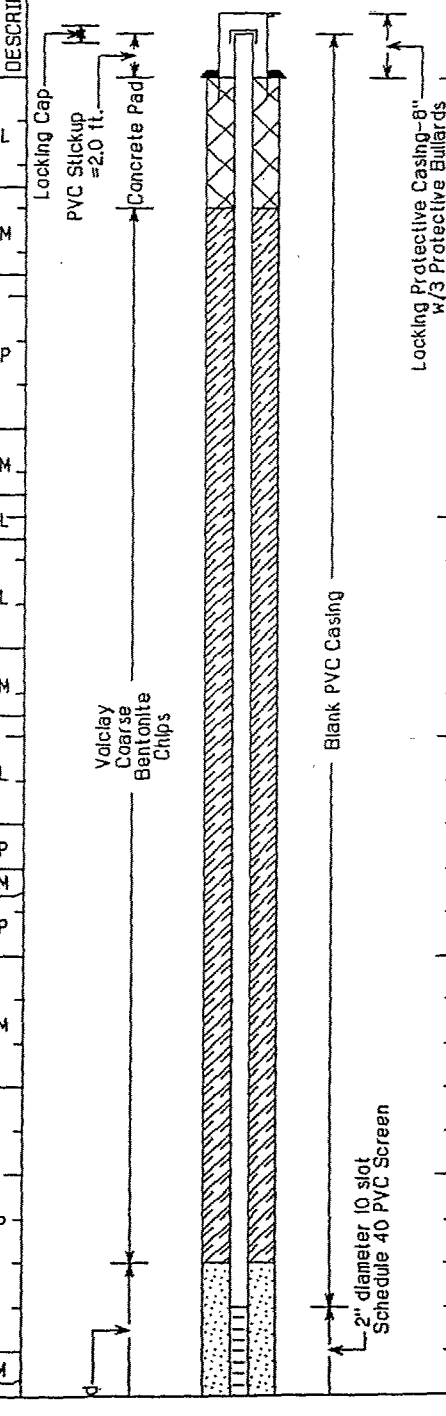
MEASURING POINT ELEV (NGVD) 31.85 DRILLING CONTRACTOR GeoTech-Robert Rodgers

DRILLING METHOD AND EQUIPMENT HSA 8-1/4" Augers, Canterra 250

WATER LEVEL ELEV/DATE 11.17 1/18/98 START 1/18/98 FINISH 1/18/98 LOGGER Heidi Hoffmann/Joel Bo

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				SILT, ML, v. dk gray, (7.5YRN 3/1), dry.	ML
	4.0	S-1	1.5	3-8-17 (25)	SILTY SAND, SM, brown, (10YR 4/3), dry, slightly moist at top of fine sand, medium. OVM=0.0, HCN=0.0.	SM
	5.0					
5.0	8.5	S-2	0.8		SAND, SP, brown, (10YR 4/3), v. sl. moist, fine sand, well-sorted. OVM=0.0, HCN=0.0.	SP
	7.5					
	9.0	S-3	1.5	7-9-10 (19)	SAND, SP, brown, wet, medium, fine sand. At 8":SILTY SAND, SM, brown, wet. OVM=1.0, HCN=0.0.	SM
	10.0					
10.0	11.5	S-4	1.5	1-2-3 (5)	SILT, ML, grayish brown, wet, soft. At 10.5":CLAY, CL, v. dk (7.5YRN 3/1), wet, plastic, firm, Fe-oxide staining. OVM=0.5, HCN=0.0.	ML
	12.5					CL
	14.0	S-5	1.5	3-3-4 (7)	SILTY CLAY, CL, v.dk gray, Fe-oxide staining, wet, firm.	
	15.0				SILTY SAND, SM, brown w/gray mottled, wet. OVM=0.0, HCN=0.0.	SM
15.0	18.5	S-6	1.5	3-4-8 (10)	SANDY SILT, ML, dk gray, wet, loose, fine sand, 20-30% sand, Fe-oxide staining. OVM=0.0, HCN=0.0.	ML
	17.5					
	19.0	S-7	1.5	3-3-4 (7)	SAND, SP, gray, (7.5YR 4/N3), fine sand. Middle 6 in.,SILTY SAND, SM, wet, loose. OVM=0.0, HCN=0.0.	SP SM
	20.0					SP
20.0	21.5	S-8	1.5	4-4-5 (9)	SILT SAND, SM, dk gray, (7.5YR 4/N3), wet, lenses of fine sand, loose. OVM=0.0, HCN=0.0.	SM
	22.5			–		
	24.0	S-9	1.5	4-4-6 (10)	SILTY SAND, SM, dk gray, (5YR 4/1), wet, loose, Fe-oxide.	
	25.0				Bottom 6 in. Sand, (SP), dark gray, wet medium sand, well-sorted. OVM=0.0, HCN=0.0	
25.0	26.5	S-1	0.8	10-11-11 (32)	Sand, (SP), Med. dark gray (N4) poorly graded. Med. fine grained, loose, wet. OVM=0 ppm, LEL=0%, H_2S=0 ppm, 02=20.8%	SP
	28.5					
	30.0	S-2	1.5	8-11-16 (35)	Top .8 ft. same as above Middle .5 ft. Sand, (SM) fine grained w/trace silt, dark gray- green (5GY	SM

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.H1.02	MW-02-34 SHEET 2 OF 2

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION Between Scrap Area & Former Mercury Spill

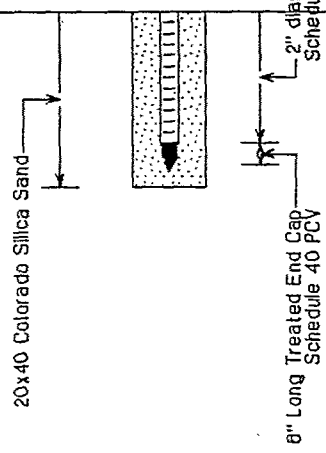
MEASURING POINT ELEV (NGVD) 31.85 DRILLING CONTRACTOR GeoTech-Robert Rodgers

DRILLING METHOD AND EQUIPMENT HSA 8-1/4" Augers, Canterra 250

WATER LEVEL ELEV/DATE 11.17 1/18/98 START 1/18/98 FINISH 1/18/98 LOGGER Heidi Hoffmann/Joel Bo

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	30.5					
	32.0	S-3	0.9	6-3-8 (17)	Top .7 ft. same as in S-1 Bottom .2 ft. same as middle .5 ft. of S-2	SP
	32.5					SM
	34.0	S-4	0.5	9-14-15 (38)	Same as Sand in S-1	SP
35.0					END OF BORING 34 FT.	
40.0					Note: Top 24 ft. logged by Heidi Hoffmann on 7/11/94	
45.0					Bottom 25-34 ft. logged by Joel Bowker on 1/18/98	
50.0					4" well overdrilled and replaced w/2" PVC at 34' depth bgs. 1/18/98	
55.0						

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
OPE39293.B1.01	MW-03

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION Graham Road

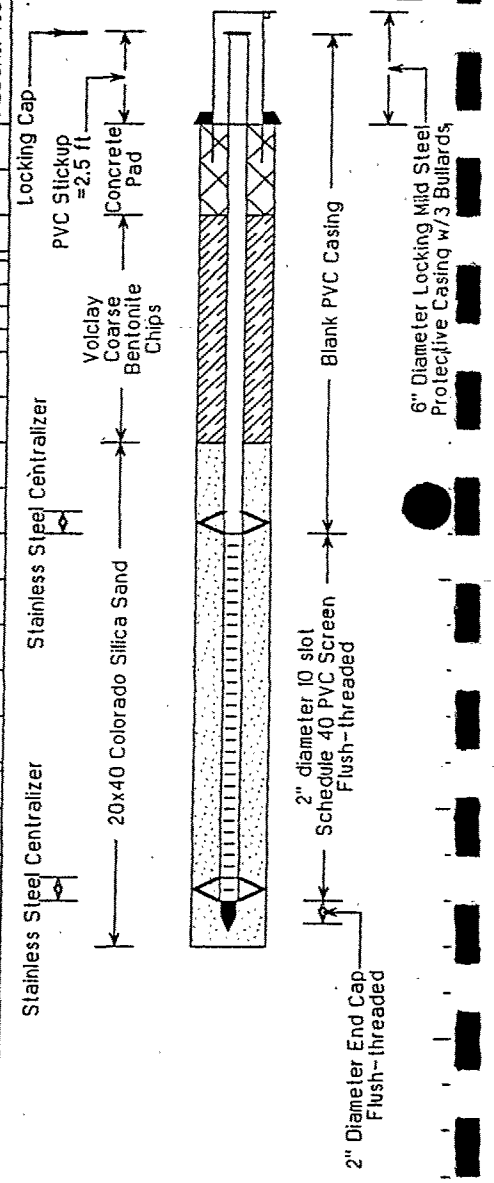
MEASURING POINT ELEV (NGVD) 29.69 DRILLING CONTRACTOR GeoTech-Mickey

DRILLING METHOD AND EQUIPMENT HSA 6 1/4" Augers Canterra 250

WATER LEVEL ELEV/DATE 7.19 START 7-9-94 FINISH 7-9-94 LOGGER Heidi Hoffmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				SILTY, ML, dk brown, dry.	ML
	4.0	S-1	0.6	17-18-16 (34)	SAND, SP, strong brown, (7.5YR 4/6), wet, fine, dense. At 3.5': SILT, ML, v. dk gray, (10YR 3/1), wet. OVM=0.0, HCN=0.0.	SP
	5.0					ML
5.0	6.5	S-2	1.5	8-9-17 (26)	SAND, SP, v. dk gray, (10YR 3/1), wet, medium, fining downward from medium to fine sand. OVM=0.0, HCN=0.0.	
	7.5					
	9.0	S-3	1.5	6-8-12 (20)	SAND, SP, v. dk gray, (10YR 3/1), wet, medium, fine sand, ~10% silt, Fe-oxide in top of spoon. OVM=0.0, HCN=0.0.	SP
	10.0					
10.0	11.5	S-4	1.5	7-12-14 (26)	SAND, SP, v. dk gray, (10YR 3/1), wet, medium v. fine sand, well-sorted. OVM=0.0, HCN=0.0.	
	12.5				SAND, SP, v. dk grayish brown, (10YR 3/2), wet, medium, v. fine sand, well-sorted. OVM=0.0, HCN=0.0.	
	14.0	S-5	1.5	6-12-6 (18)		
	15.0					
15.0	16.5	S-6	0.6	1-2-3 (5)	SILTY SAND, SM, dk grayish brown, (10YR 3/2), wet, loose, wood chunks. OVM=0.0, HCN=0.0.	SM
	17.5					
	19.0	S-7	1.5	1-3-2 (5)	SILTY SAND, SM, v.dk grayish brown, (10YR 3/2), wet, loose. OVM=0.0, HCN=0.0.	
20.0					BOH=18'	
25.0						

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107483.08.02	MW03-098	SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approximately 15 feet North of MW03 & MW03-175

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ START 8-25-98 FINISH 8-26-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-2.0 feet: Crushed basalt fill for drill pad	
5.0						Driller adds 10 gallons of water.
10.0	10.0					
	11.5		1.2	9-9-9 (18)	SAND, (SP), brownish gray (5 yr 4/1), wet, loose, fine-grained, 5 percent silt, trace of organic material, homogeneous, sub-angular to sub-rounded.	Drilling adds 10 gallons of water.
15.0	17.0					
	18.5		1.0	1-1-1 (2)	SILTY SAND with GRAVEL, (SM), dark yellowish brown (10 yr 4/2), wet, very loose, 15 percent gravel (to 0.5-inch maximum size), sand coarse-grained, 5 percent wood fragments (to 2-inch maximum size).	Sediment very disturbed.
20.0	23.5					
	25.0		0.6	1-3-3 (6)	SILT, (ML), dark greenish gray (5 gy 4/1), wet, soft, slightly plastic, homogeneous.	
25.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW03-098

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approximately 15 feet North of MW03 & MW03-175

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ START 8-25-98 FINISH 8-28-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Driller adds 10 gallons of water.
	35.0					
35.0	38.5		1.5	4-4-3 (7)	SILT, (ML), as above.	Driller adds 5 gallons of water.
	39.0					
40.0	41.5		1.2	13-16-19 (35)	SAND, (SW), dark greenish gray (5 gy 4/1), wet, medium dense, thin silt laminae (less than 0.5 inch), fine-to-medium grained sand, coarsens downward.	
45.0	48.0					
	49.5		1.1	15-23-24 (47)	SAND, (SP), dark greenish gray (5 gy 4/1), wet, medium dense, fine-grained, 5 percent silt, trace organic material, sand moderately well rounded to sub-angular, homogeneous.	48 feet bgs water sample collected: T=18 degrees C pH=7.25 cond=300 F-=0.23
50.0						
55.0	58.0				SAND, (SW), dark gray (N3), wet, medium dense, fine to medium- grained, sand sub-angular, homogeneous.	
	59.5		1.4	16-18-20 (39)		Driller reports 10 feet sand heaved into casing. Driller add 15 gallons of water.

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW03-098 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Approximately 15 feet North of MW03 & MW03-175

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ **START** 8-25-98 **FINISH** 8-28-98 **LOGGER** Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65.0						
	68.0					
	69.5		1.4	12-17-17 (34)	SAND, (SW), dark gray (N3), wet, medium dense, fine-to-medium grained, sand subangular, homogeneous, trace wood fragments.	68 feet bgs water sample collected: T=13.5 degrees C pH=7.81 cond=320 F-=0.35
70.0						Driller reports 25 feet of sand heaved into casing.
75.0						Driller add 25 gallons of water.
	78.0					
	79.5		1.4	13-20-28 (48)	SAND, (SW), dark gray (N3), wet, medium dense, fine-grained, sand subangular, homogeneous, trace wood fragments.	
80.0						
85.0						
	87.0				SAND, (SP), as above except dense.	
	88.5		1.5	13-30-50 (80)		Driller add 25 gallons of water.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW03-088 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Approximately 15 feet North of MW03 & MW03-175

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ **START** 8-25-88 **FINISH** 8-26-88 **LOGGER** Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95.0						
100.0	100.0					
	101.5		0.8	2-2-2 (4)	SAND, (SP), as above except very loose.	100 feet bgs water sample collected: T=12.8 degrees C pH=7.80 cond=250 F-=.50 100 feet total depth.
105.0						
110.0						
115.0						

PROJECT NUMBER	BORING NUMBER	
107493.08.02	MW03-098	SHEET 1 OF 1

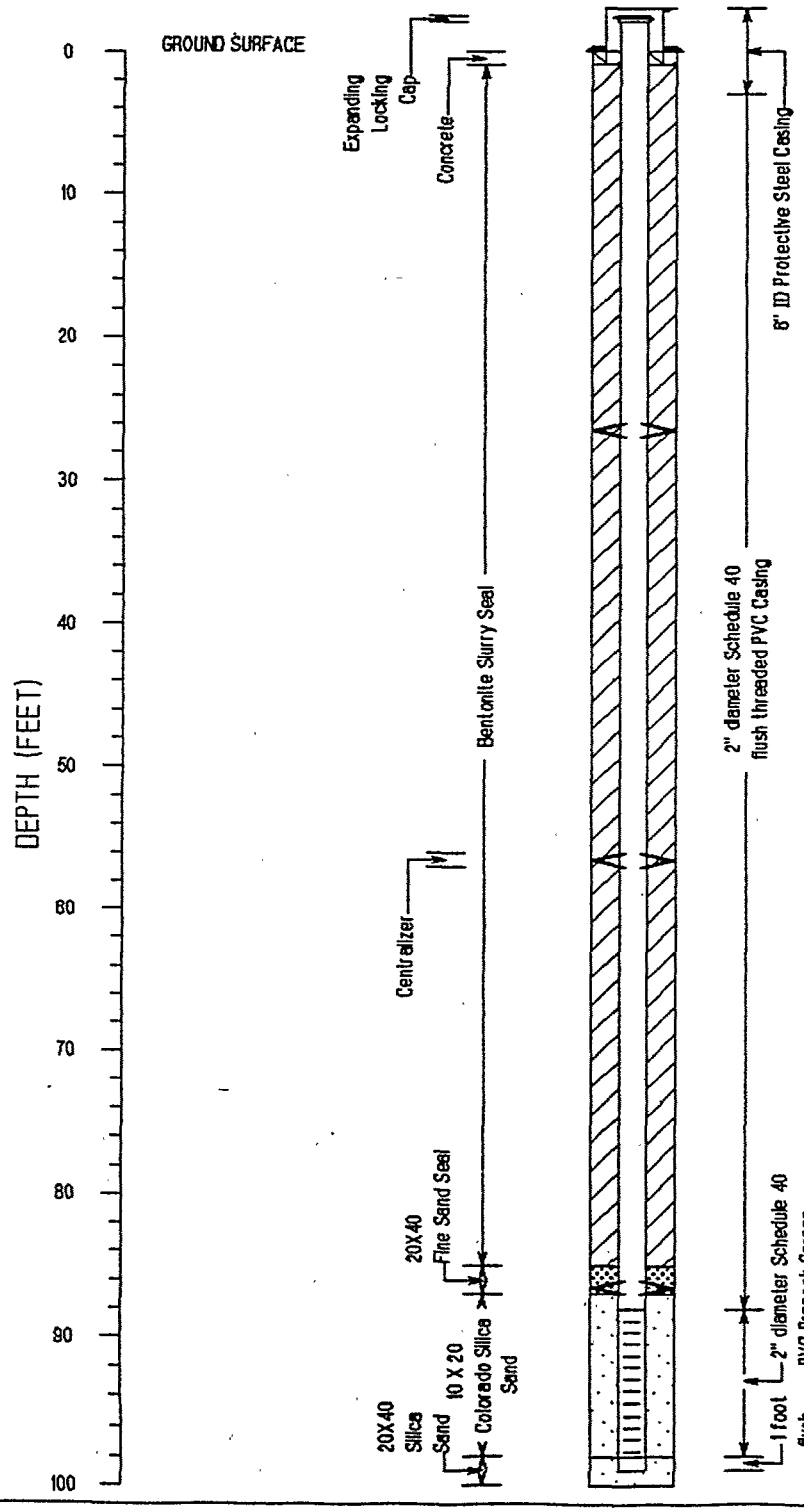
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Approximately 15 feet North of MW03 & MW03-175

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ **START** 6-25-98 **FINISH** 6-26-98 **LOGGER** Ivan Gall



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D6.02	MW03-175	SHEET 1 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW03

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 6-13-96 FINISH 6-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-2.0 feet: Crushed basalt fill for drill pad	
5.0	5.0–6.5		1.0	13-11-11 (22)	SAND, (SP), brownish gray (5 yr 4/1), wet, medium dense, fine- grained, 5 percent silt, trace organic material, homogeneous sand sub- angular to sub-rounded.	Driller adds 5 gallons water; easy drilling and driving casing.
10.0	10.0–11.5		1.0	7-12-12 (24)	SAND, (SP), as above, with 10 percent silt.	
15.0	15.0–16.5		2.5	2-2-2 (4)	SAND, (SP), as above, with 10 percent silt.	Easy drilling and driving casing.
20.0	20.0–21.5		1.1	2-2-2 (4)	SILTY SAND with GRAVEL, (SM), dark yellowish brown (10 yr 4/2), wet, very loose, 30 percent gravel (up to 0.5 inches) and organic material, sand (medium- coarse-grained), 5 percent wood fragments.	Sediment very disturbed, with debris flow sorting. Driller adds 5 gallons of water.
25.0	25.0–26.5		1.5	2-3-4 (7)	SILT, (ML), dark greenish gray (5 yr 4/1), with gray mottling, wet, soft, slightly plastic, 5 percent very fine sand.	
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW03-175 SHEET 2 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW03

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 6-13-96 FINISH 6-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0–31.5		1.5	3-4-6 (10)	SILT, (ML), as above.	Driller adds 15 gallons of water.
35.0	35.0–37.0		2.0	3-4-5-5 (10)	SILT, (ML), as above.	
40.0	40.0–41.5		1.3	7-13-15 (28)	SAND, (SW), dark greenish gray (5 yr 4/1), wet, loose, thin silt laminae, (less than 0.5 inch), fine-to-medium-grained.	Driller reports increased water production 40 feet bgs water sample: T=16 degrees C pH=6.98 cond=195 F-=0.29
45.0	45.0–46.5		1.4	6-7-16 (23)	SAND, (SW), dark gray (N3), wet, medium dense, fine-to-coarse- grained trace of wood fragments.	Driller adds 10 gallons of water.
50.0	50.0–51.5		–	5-10-15 (25)	SAND, (SW), as above, with one 0.2 foot thick silt/organic laminae at 50.5 feet.	
55.0	55.0–56.5		1.5	15-16-25 (41)	SAND, (SP), dark gray (N3), wet medium dense,fine-grained, silt- rich layer (0.2 foot thick) at 151.2	
	60.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW03-175 SHEET 3 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW03

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 6-13-96 FINISH 6-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 61.5		1.5	6-15-30 (45)	SAND, (SP), dark gray (N3), wet, medium dense, medium-grained.	60 feet bgs water sample: T=17 degrees C pH=6.91 cond=360 F-=0.23
65.0					SAND, (SP), as above, trace wood fragments.	Driller reports 16 feet of sand heaved into casing; sample from bailer.
70.0					SAND, (SW), dark gray (N3), wet, medium dense, fine-to-medium grained, trace wood fragments, sand subangular, homogeneous.	Sample from bailer.
						Driller add 30 gallons of water.
75.0					SAND, (SP), dark gray (N3), wet, medium dense, fine-grained, trace wood fragments, sand subangular to sub-rounded, homogeneous.	Sample from bailer; driller reports 5 feet heaving sand in casing.
80.0					SAND, (SP), as above.	80 feet bgs water sample: T=16.5 degrees C pH=7.07 cond=240 F-=0.38 Driller adds 40 gallons of water.
85.0					SAND, (SP), as above.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW03-175 SHEET 4 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW03

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 6-13-96 FINISH 6-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SP), as above, trace of gravel, wood fragments, and mica flakes,	Casing drives slowly from 90-92 feet bgs; sample from bailer.
95.0					SAND, (SP), as above.	Sample from bailer.
100.0					SAND, (SP), as above.	Driller reports rate of sand heaving into casing slowing; sample from bailer.
105.0					SAND, (SP), as above, no wood fragments.	105 feet bgs water sample: T=14.3 degrees C pH=8.30 cond=700 F-=.38
110.0					GRAVEL, (GW), dark gray (N3), wet, dense; well-rounded, 1-2 inch diameter.	
115.0					SAND, (SP), dark gray (N3), wet, medium dense, fine-grained, trace wood fragments, trace mica flakes.	Sample from bailer; driller reports 8 feet sand heaved into casing- driller add 15 gallons of water.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW03-175

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW03

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 6-13-96 FINISH 6-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SP), as above.	Driller reports 8 feet heaving sand in casing. Sample from bailer.
125.0					SAND, (SP), as above, trace coarse sand, gravel, and wood fragments (less than 2 percent).	125 feet bgs water sample: T=14 degrees C pH=7.2 cond=600 F-=0.39 Driller reports 30 feet sand heaved into casing. Sample from bailer.
130.0					SAND, (SP), as above.	Sample from bailer.
135.0					SAND, (SP), as above.	Sample from bailer.
140.0					SAND, (SP), as above.	Sample from bailer.
145.0					SAND, (SP), as above, no gravel.	Sample from bailer; 145 feet bgs water sample: T=14.1 degrees C pH=7.19 cond=700 F-=0.35 Driller reports 40 feet of sand heaved into casing.

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW03-175 SHEET 6 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW03

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 6-13-96 FINISH 6-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SP), as above.	Sample from bailer; driller reports 4 feet heaving sand in casing.
155.0					SAND, (SP), as above, 5-10% gravel (up to 1.5-inch diameter).	Sample from bailer; driller reports 3 feet heaving sand in casing, and water production less than 2 gpm.
160.0					SAND, (SP), dark gray (N3), wet, medium dense, fine-grained.	Sample from bailer.
165.0	165.0					
	166.5		1.2	4-15-40 (55)	SAND, (SP), dark gray (N3), wet, medium dense, fine grained.	Driller reports 7 feet heaving sand in casing. 165 feet bgs water sample: T=12.3 degrees C pH=7.64 cond=750 F--=0.36
	170.0					
170.0	171.5		1.3	5-10-35 (45)	SAND, (SP), as above.	Driller adds 15 gallons of water.
	175.0					
175.0	176.5		1.2	5-8-9 (17)	SAND, (SP), as above.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW03-175 SHEET 7 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW03

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 6-13-96 FINISH 6-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Sample from bailer.
					SAND, (SP), as above.	
						182 feet: Bailed gravel and one 3-inch cobble.
						Sample from bailer.
185.0					SAND, (SP), as above, trace coarse-grained sand.	185 feet bgs water sample:
						T=14 degrees C pH=8.10 cond=410 F-=0.24
						Driller adds 70 gallons of water.
190.0					SAND, (SP), as above.	Sample from bailer.
195.0						Driller reports 4 feet of sand heaving in casing.
						196 feet: Trace gravel and coarse sand
					SAND, (SW), dark gray (N3), wet, medium dense, fine-to-coarse- grained, trace gravel (up to 1-inch diameter), subrounded.	Sample from bailer - driller reports increased permeability.
					SILT, (MH) as above from 197.5-198.5	Sand coarsens downward from 196-200 feet bgs.
200.0						200 feet bgs water sample:
						T=13.4 degrees C pH=7.96 cond=400 F-=0.37
205.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107483.06.02	MW03-175	SHEET 1 OF 1

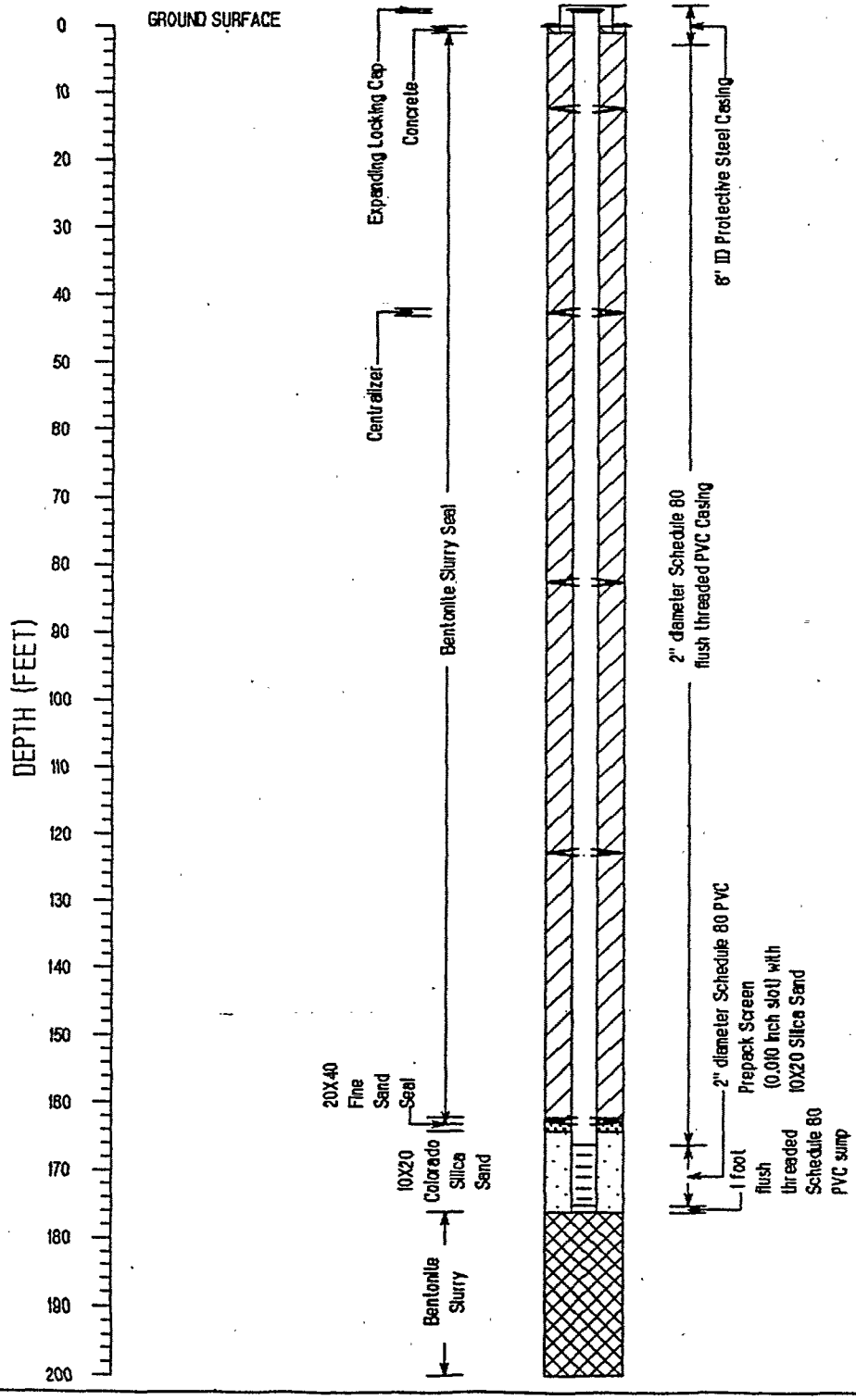
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW03

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ START 6-13-96 FINISH 6-17-96 LOGGER Ivan Gall



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	WELL NUMBER
OPE39293.B1.01	MW-04 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION Near drainage ditch SW portion of site

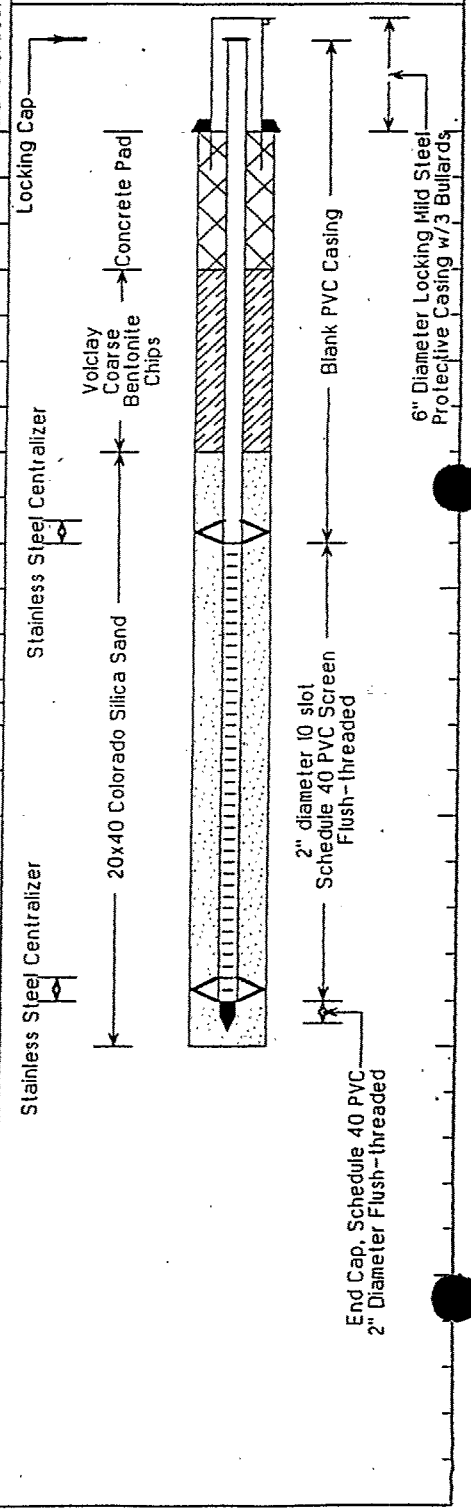
MEASURING POINT ELEV (NGVD) 26.91 DRILLING CONTRACTOR GeoTech-Stan

DRILLING METHOD AND EQUIPMENT HSA 8 1/4" Augers Conterra 250

WATER LEVEL ELEV/DATE 16.45 7-15-94 START 7-12-94 FINISH 7-12-94 LOGGER Heidi Hoffmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
	2.5					
	4.0	S-1	1.2	7-7-10 (17)	SILT, ML, grayish brown, (10YR 5/2), dry, black carbon staining plus black carbon pieces, stiff. OVM=0.0, HCN=0.0.	
	5.0					
5.0	6.5	S-2	1.5	5-6-7 (13)	SILT, ML, grayish brown, (10YR 5/2), sl. moist, black carbon staining, stiff, Fe-oxide. OVM=0.0, HCN=0.0.	ML
	7.5					
	9.0	S-3	1.5	4-5-6 (11)	SILT, ML, black, moist, stiff, abundent roots and wood, appears to be a recent surface. OVM=0.0, HCN=0.0.	
	10.0					
10.0	11.5	S-4	1.2	7-13-14 (27)	SILT, ML, dk gray, (10YR 4/1), wet, v. stiff, well-graded. OVM=0.0, HCN=0.0.	
	12.5					
	14.0	S-5	0	5/1.5'	No recovery.	
	15.0					
15.0	16.5	S-6	1.5	7-8-7 (15)	CLAY, CL, v. dk gray, wet, stiff, plastic. OVM=0.0, HCN=0.0	CL
	17.5					
	19.0	S-7	1.5	5-6-7 (13)	CLAY, CL, v. dk gray, (10YR 4/1), wet, stiff, plastic. OVM=0.0, HCN=0.0.	
	20.0					
20.0	21.5	S-8	1.5	5-6-9 (15)	CLAY, CL, v. dk gray, (10YR 4/1), wet, stiff, plastic, siltier at bottom.	
25.0					BOH=20'	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
OPE39293.B1.01	MW-05 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION Near Sandy River

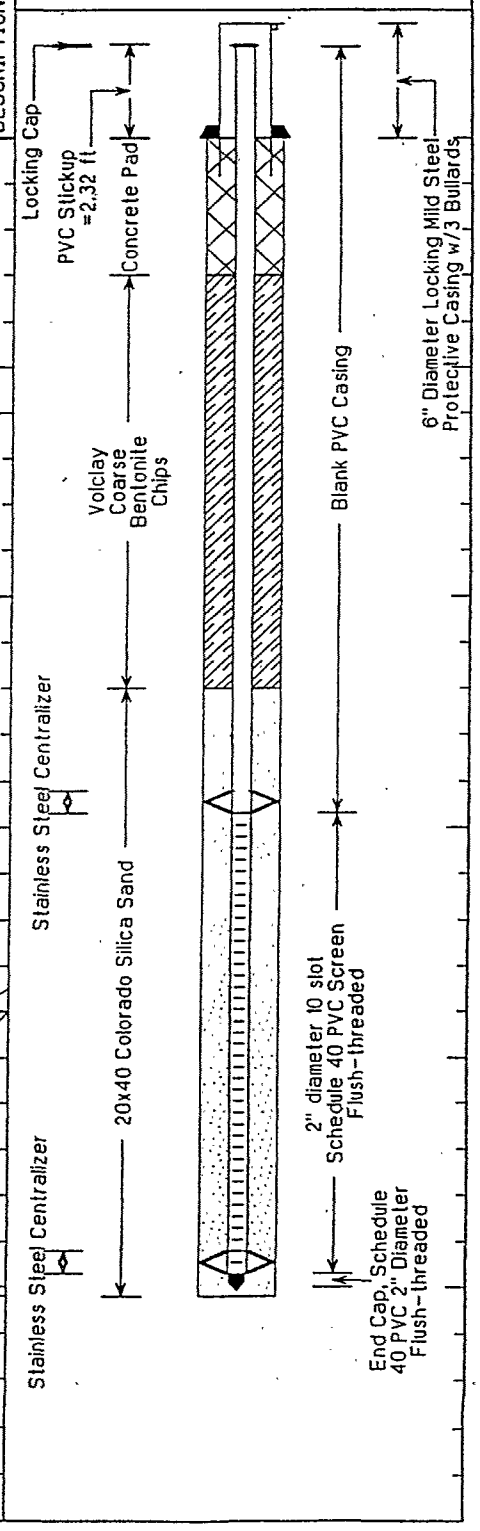
MEASURING POINT ELEV (NGVD) 33.99 DRILLING CONTRACTOR GeoTech-Mickey

DRILLING METHOD AND EQUIPMENT HSA 6 1/4" Augers Canterra 250

WATER LEVEL ELEV/DATE 12.65 7-18-94 START 7-8-94 FINISH 7-8-94 LOGGER Heidi Hoffmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
	2.5–4.0	S-1	1.5	7-8-14 (22)	SAND, SP, dk grayish brown, (10YR 4/2), dry, medium, medium- coarse, sandy, loose. OVM=0.0, HCN=0.0.	SP
5.0	5.0–6.5	S-2	1.5	7-10-9 (19)	SAND, SP, dk grayish brown, (10YR 4/2), v. sl. moist, loose. OVM=0.0, HCN=0.0. At 6": SILT, ML, gray and Fe-stained, mottled, v. moist.	SP / ML
	7.5–9.0	S-3	1.5	5-6-5 (11)	SILT, ML, gray and Fe-oxided staining, mottled, v. moist to wet, plastic, stiff. OVM=0.0, HCN=0.0.	ML
10.0	10.0–11.5	S-4	1.5	3-9-3 (12)	SILTY CLAY, ML/CL, dk brown w/gray and Fe-oxide staining, mottled, plastic, wet, stiff. OVM=0.0, HCN=0.0.	ML
	12.5–14.0	S-5	1.5	2-1-2 (3)	SILT, ML, dk grayish brown, wet, soft, Fe-oxide and gray mottled vertical streaks. OVM=0.0, HCN=0.0.	ML
15.0	15.0–16.5	S-6	1.5	3-4-7 (11)	SILT, ML, dk grayish brown, wet, stiff, 10-20% fine sand, less Fe-oxide. OVM=0.0, HCN=0.0.	ML
	17.5–19.0	S-7	1.5	7-2-8 (10)	SILT, ML, dk grayish brown, wet, stiff, plastic, stringers of SILTY SAND, SM, fine-medium sand.	ML / SM
20.0	20.0–21.5	S-8	1.5	4-5-4 (9)	SANDY SILT, SM, dk grayish brown, orange, Fe-oxide and gray reduction staining, wet.	SM
	22.5–24.0	S-9	1.5	5-6-6 (12)	SILTY SAND, SM, dk grayish brown, wet, medium, fine-medium sand.	SM
25.0					BOH=25.2'	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
OPE39293.B1.01	MW-06 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION Field on NE corner of Sundial & Reynolds Plants

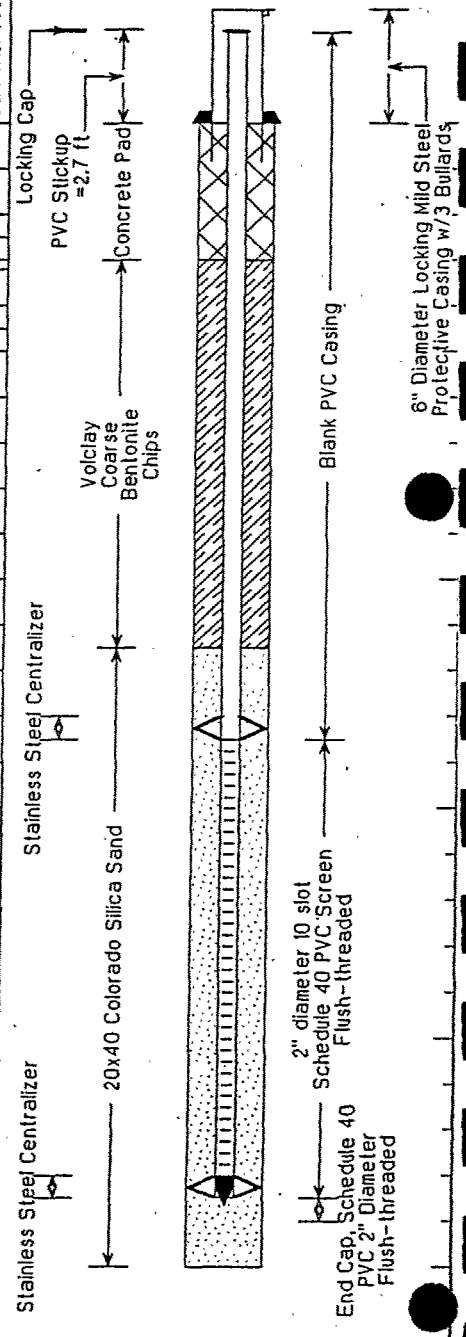
MEASURING POINT ELEV (NGVD) 26.81 DRILLING CONTRACTOR GeoTech-Mickey

DRILLING METHOD AND EQUIPMENT HSA 6 1/4" Augers Conterra 250

WATER LEVEL ELEV/DATE 11.79 7-13-94 START 7-8-94 FINISH 7-8-94 LOGGER Heidi Hoffmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
	2.5–4.0	S-1	1.5	5-7-8 (15)	SAND, SP, dk grayish brown, (2.5Y 4/2), dry, medium, fine-medium sand, lenses of SILTY SAND, SM. OVM=0.0, HCN=0.0	SP, SM, SP
5.0	5.0–6.5	S-2	1.5	1-4-2 (6)	SILTY SAND, SM, dk brown, (10YR 3/3), wet. At 6' SILT, ML, dk grayish brown, (10YR 4/2), v. moist, Fe-oxide staining, stiff. OVM=0.0, HCN=0.0.	SM
	7.5–9.0	S-3	1.5	3-4-5 (9)	SILT, ML, dk grayish brown, (10YR 4/2), v. moist, Fe-staining, root casts, plastic, stiff. OVM=0.0, HCN=0.0.	ML
10.0	10.0–11.5	S-4	1.5	3-3-3 (6)	SILT, ML, dk grayish brown, wet, firm, 5-10% fine sand in stringers, Fe-oxide staining. OVM=0.0, HCN=0.0.	ML
	12.5–14.0	S-5	1.5	2-5-6 (1)	SILT, ML same as above.	ML
15.0	15.0–16.5	S-6	1.5	4-4-5 (9)	SILT, ML, same as above.	ML
	17.5–19.0	S-7	1.5	3-3-4 (7)	SILT, ML, same as above.	ML
20.0	20.0–21.5	S-8	1.5	4-4-9 (13)	SAND, SP, v. dk grayish brown, (2.5YR 3/2), wet, medium sand. SILTY SAND, SM, center of spoon.	SP, SM
	22.5–24.0	S-9	1.5	2-3-3 (6)	SAND, SP, v. dk grayish brown, (2.5YR 3/2), wet, medium sand, loose, 10-15% silt.	SP
25.0					BOH=25'	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107483.D8.02	MW08-094	SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch I.D. Steel Casing

WATER LEVELS _____ START 8-18-98 FINISH 8-20-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0						
10.0	10.0					
	11.5		1.5	2-2-5 (7)	SILT, (MH), moderately yellow brown (10 yr 5/4), with orange mottling, damp, soft, 20-30 percent clay fraction, trace of very fine sand.	
15.0						
	18.0					
20.0	20.5		1.5	2-3-8 (9)	SILT, (MH), as above, to 20.3 feet.	
					Sharp contact with SAND, (SW), dark gray (N3), wet, loose, fine to medium grained, trace red grains.	
25.0						
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-094 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 6-inch I.D. Steel Casing

WATER LEVELS _____ START 9-18-96 FINISH 9-20-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	30.0 – 31.5		1.3	19-23-23 (46)	SAND, (SW), moderate yellowish brown (10 yr 5/4) wet, medium dense, fine to medium grained, trace of silt.	30 feet bgs water sample: T=18.5 degrees C pH=8.57 cond=188 F-=NA
35.0						
40.0	40.0 – 41.5		1.4	15-9-23 (32)	SAND, (SW), as above, to 41 feet bgs. Sharp contact with SAND, (SW), medium dark gray (N4), wet, loose to medium dense, fine to medium grained, with silt and organic-rich layers (0.1 feet thick).	
45.0						
50.0					SAND, (SW), medium dark gray (N4), wet, loose, very fine to fine grained, with silt layers (to 0.1 feet thick), trace mica and red grains.	50 feet bgs water sample: T=13.7 degrees C pH=8.85 cond=180 F-=0.19
55.0						
	60.0					

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-094 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 6-inch I.D. Steel Casing

WATER LEVELS _____ START 9-18-98 FINISH 9-20-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 – 61.5		0.1	1-1-1 (2)	SAND, (SW), as above except very loose.	Driller adds 20 gallons of water to control heaving sand.
65.0						
70.0	70.0 – 71.5		0.7	3-6-6 (12)	SAND, (SW), as above except loose, mica flakes larger, trace of organics.	70 feet bgs water sample: T=14.2 degrees C pH=7.15 cond=190 F-=0.39
75.0						
80.0	80.0 – 81.5		0.8	8-9-4 (13)	SAND, (SW), as above.	
85.0						
	90.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-094 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 6-inch I.D. Steel Casing

WATER LEVELS _____ START 9-18-98 FINISH 9-20-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0 91.5		1.0	9-18-18 (35)	SAND, (SW), as above, except medium dense.	
95.0					SAND, (SW), as above.	95 feet bgs water sample: T=14.2 degrees C pH=7.30 cond=220 F-=1.3
						98 feet total depth. Soil sample from bailer.
100.0						
105.0						
110.0						
115.0						

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW08-094	SHEET 1 OF 1

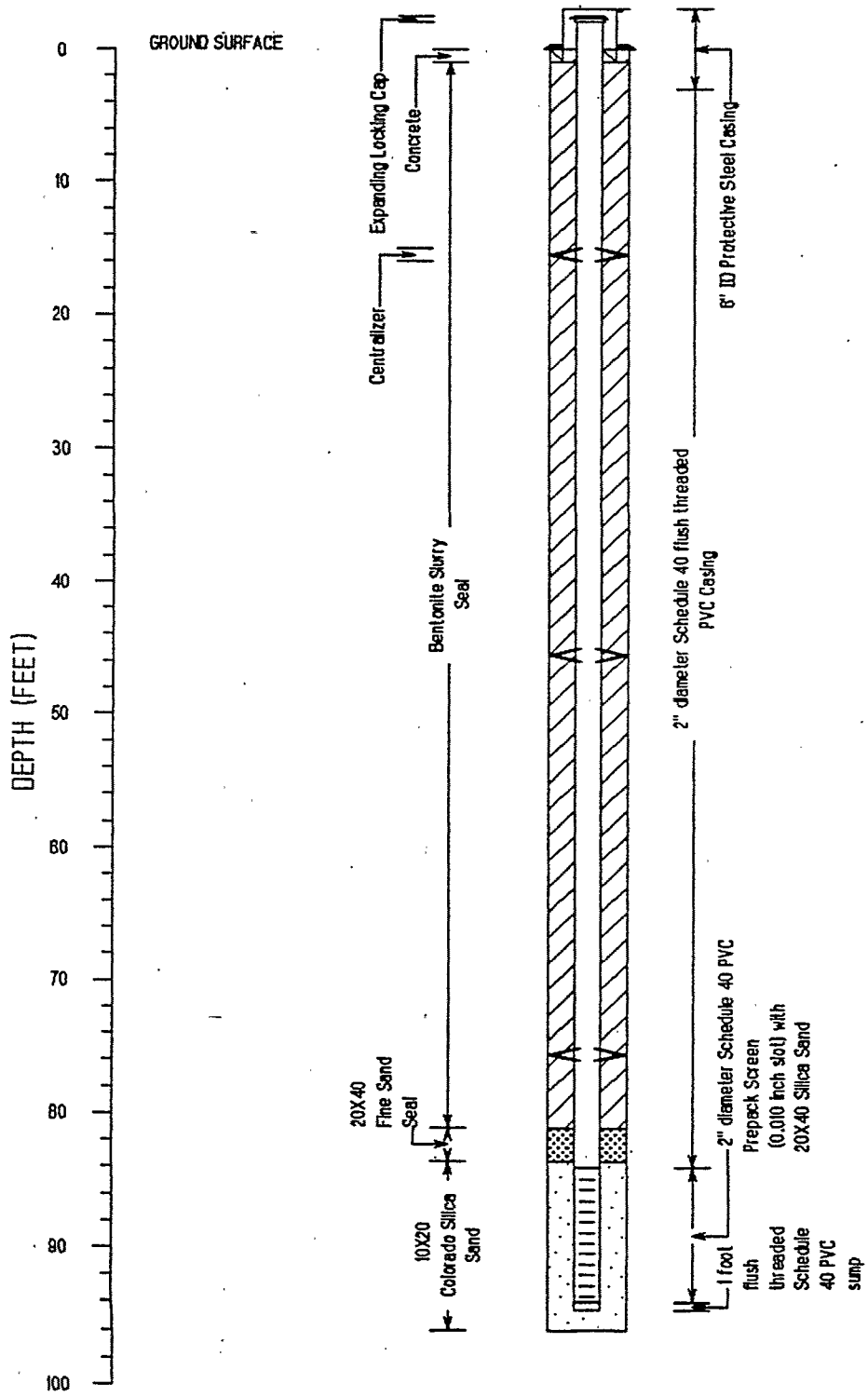
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** MW08 Along Sundial Road

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch I.D. Steel Casing

WATER LEVELS _____ **START** 9-19-98 **FINISH** 9-20-98 **LOGGER** Ivan Gall



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107483.D8.02	MW08-178	SHEET 1 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Foremost Drill DR24 Air Rotary

WATER LEVELS _____ START 4-29-98 FINISH 5-3-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1.5 feet SILTY SANDY GRAVEL, (GM), gray, moist, loose, fill placed for drilling pad.	
	5.0					
5.0	6.5		1.5	2-2-5 (7)	SAND, (SP), brown, moist, loose, fine grained, well-sorted, SILT, (MH), brown from 6.87-7.0 feet bgs, firm, slighty plastic, 20 to 30% clay.	
	10.0					
10.0	11.5		1.5	2-4-13 (17)	SILT, (MH), light brown, moist to wet, firm to stiff plastic, 20 to 30% clay, 10% fine to medium sand.	
	15.0					
15.0	16.5		1.5	2-3-4 (7)	SILT, (MH), as above, except soft.	
	20.0					
20.0	21.5		1.5	5-20-25 (45)	SAND with SILT, (SW-SM), gray brown, wet, medium dense, fine to medium-grained (15% silt), sand subangular to subrounded.	
	25.0					
25.0	26.5		1.3	3-3-6 (9)	SAND, (SW), gray brown, wet, very loose, fine to medium grained, subangular, trace of silt.	
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW08-178 SHEET 2 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Foremost Drill DR24 Air Rotary

WATER LEVELS _____ START 4-29-98 FINISH 5-3-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0–31.5		1.5	25-50-25/1" (75)	SAND, (SW), as above, except medium dense to dense.	
35.0	35.0–36.5		1.5	9-20-25 (45)	SAND, (SW), as above, except medium dense, no silt.	
40.0	40.0–41.5		1.1	25-35-40 (75)	SAND, (SW), gray wet dense, fine to medium-grained, subrounded to subangular. Becomes medium to fine-grained from 41.7-42 feet bgs. Some red sand grains observed.	Driller reports sand heaving into casing at 40 feet bgs. water sample collected with s.s. bailer after blowing out hole at 40 feet. 40 feet bgs water sample: T=11 degrees C pH=6.39 cond=130 F-=0.15
45.0	45.0–46.5		1.4	3-3-9 (12)	SAND, (SW), gray, wet, very loose to loose, medium to fine- grained, subrounded to subangular, with some red sand grains.	
50.0	50.0–51.5		0.75	5-10-12 (22)	SAND, (SW), as above except loose.	
55.0	55.0–56.5		0.8	2-3-5 (8)	SAND, (SW), as above except very loose.	
	60.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-178 SHEET 3 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Foremost Drill DR24 Air Rotary

WATER LEVELS _____ START 4-29-98 FINISH 5-3-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	80.0 – 81.5		0.25	1-1-1 (2)	SAND, (SW), as above, except greater percentage of fine-grained sand.	Driller reports sand heaving at 80 feet bgs.
	85.0 – 88.5		1.5	2-2-2 (4)	SAND, (SW), as above.	Driller reports significant volume of sand heaving into casing each time soil samples are collected.
85.0						
	70.0 – 71.5		0.2	2-2-2 (4)	SAND, (SW), as above.	
70.0						
	75.0 – 78.5		0.0	1 for>6"	No Sample	Samples sand-locked in casing.
75.0						
	80.0 – 81.5		0.4	3-3-6 (9)	SAND, (SW), as above at 70 feet.	80 feet bgs water sample: T=13 degrees C pH=7.35 cond=420 F-=0.30.
80.0						
	85.0 – 88.5		1.5	10-25-25 (50)	SAND, (SW), dark gray to black, wet, medium dense, medium to fine- grained, subrounded to subangular, trace mica flakes.	
85.0						
	90.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW08-178 SHEET 4 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Foremost Drill DR24 Air Rotary

WATER LEVELS _____ START 4-28-98 FINISH 5-3-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0 – 91.5		1.5	1-3-3 (8)	SAND, (SW), black, wet, very loose, coarse to fine grained, subrounded.	Driller reports continuing difficulty with heaving sands.
	91.5 – 95.0					
95.0	95.0 – 98.5		1.5	10-13-18 (31)	SAND, (SW), as above except medium dense.	
	98.5 – 100.0					
100.0	100.0 – 101.5		1.3	5-12-12 (24)	SAND, (SW), as above.	100 feet bgs water sample: T=13 degrees C pH=8.58 cond=440 F-=4.89
	101.5 – 105.0					
105.0	105.0 – 108.5		0.0	6-6-7 (13)	No Sample	
	108.5 – 110.0					
110.0	110.0 – 111.5		0.0		No Sample	
	111.5 – 115.0					
115.0	115.0 – 118.5		1.5	4-4-8 (10)	SAND, (SW), as above at 100 feet.	118 feet bgs water sample: T=10 degrees C pH=8.73 cond=500 F-=0.38
	118.5 – 120.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-178

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Foremost Drill DR24 Air Rotary

WATER LEVELS _____ START 4-29-98 FINISH 5-3-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	120.0–121.5		1.5	3-6-8 (12)	SAND, (SW), dark gray to black, wet, loose, with some small (less then 0.25-inch) rounded to subangular gravel.	
125.0	125.0–128.5		1.5	3-6-12 (18)	SAND, (SW), dark gray to black, wet, loose to medium dense, medium to fine-grained, subangular to subrounded, no gravel.	
130.0	130.0–131.5		1.5	6-8-12 (20)	SAND, (SW), as above with trace small (less than 0.25 inch), subrounded gravel.	
135.0	135.0–138.5		1.2	1-1-9 (10)	SAND, (SW), as above except no gravel.	137 feet bgs water sample: T=13.5 degrees C pH=7.01 cond=502 F-=0.28
140.0	140.0–141.5		0.75	50/5"	SAND, (SW), as above.	Partial retrieval.
145.0	145.0–148.5		1.5	14-50/3"	SAND, (SW), as above.	
	150.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW06-178 SHEET 6 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW06 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Foremost Drill DR24 Air Rotary

WATER LEVELS _____ START 4-29-96 FINISH 5-3-96 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	150.0 – 151.5		1.5	2-2-5 (7)	SAND, (SW), as above except no gravel.	
	155.0					
155.0	158.5		1.5	15-50/2"	SAND, (SW), as above except coarser grain.	Gravel present in material being pumped from borehole. Fine rounded gravel. 157 feet bgs water sample: T=11.3 degrees C pH=8.5 cond=550 F--=0.18
	160.0					
160.0	161.5		1.5	15-25-50/6"	SAND with GRAVEL, (SW), gray brown, wet, medium dense, coarse sand, small gravel (less than 0.25-inch), gravel subrounded, primarily black and green.	
	165.0					
165.0	166.5		1.0	50/6"	SAND with GRAVEL, (SW), as above.	
	170.0					
170.0	171.5		0.5	50/5"	SAND with GRAVEL, (SW), as above.	
	175.0					
175.0	176.5		0.0	50/3"	No Sample	
	180.0					177 feet bgs water sample: T=12.1 degrees C pH=7.8 cond=850 F--=0.27

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-178

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Foremost Drill DR24 Air Rotary

WATER LEVELS _____ START 4-29-98 FINISH 5-3-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	180.0–181.5		1.2	50/4"	SAND with GRAVEL, (SW), gray brown, wet, very dense, higher percentage of fine to medium grained sand, slightly larger gravel than sample at 170 feet.	
185.0	185.0–188.5		1.5	20-50/4"	SAND with GRAVEL, (SW), as above.	
190.0	190.0–191.5		0.8	25-25-25 (50)	SILT, (ML), medium gray, wet, very stiff, homogeneous, with trace fine grained sand.	
195.0	197.0–198.5		1.5	12-25-25 (50)	SAND, (SP), medium gray, wet, medium dense, 197.0-197.5 feet fine grained.	Bottom of borehole 197 feet. Split-spooned to 198.5 feet. 197 feet bgs water sample: T=13.3 degrees C pH=7.4 cond=700 F-=0.25
200.0					SILT, (ML) as above at 189 feet, from 197.5-198.5.	
205.0						

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW08-178	SHEET 1 OF 1

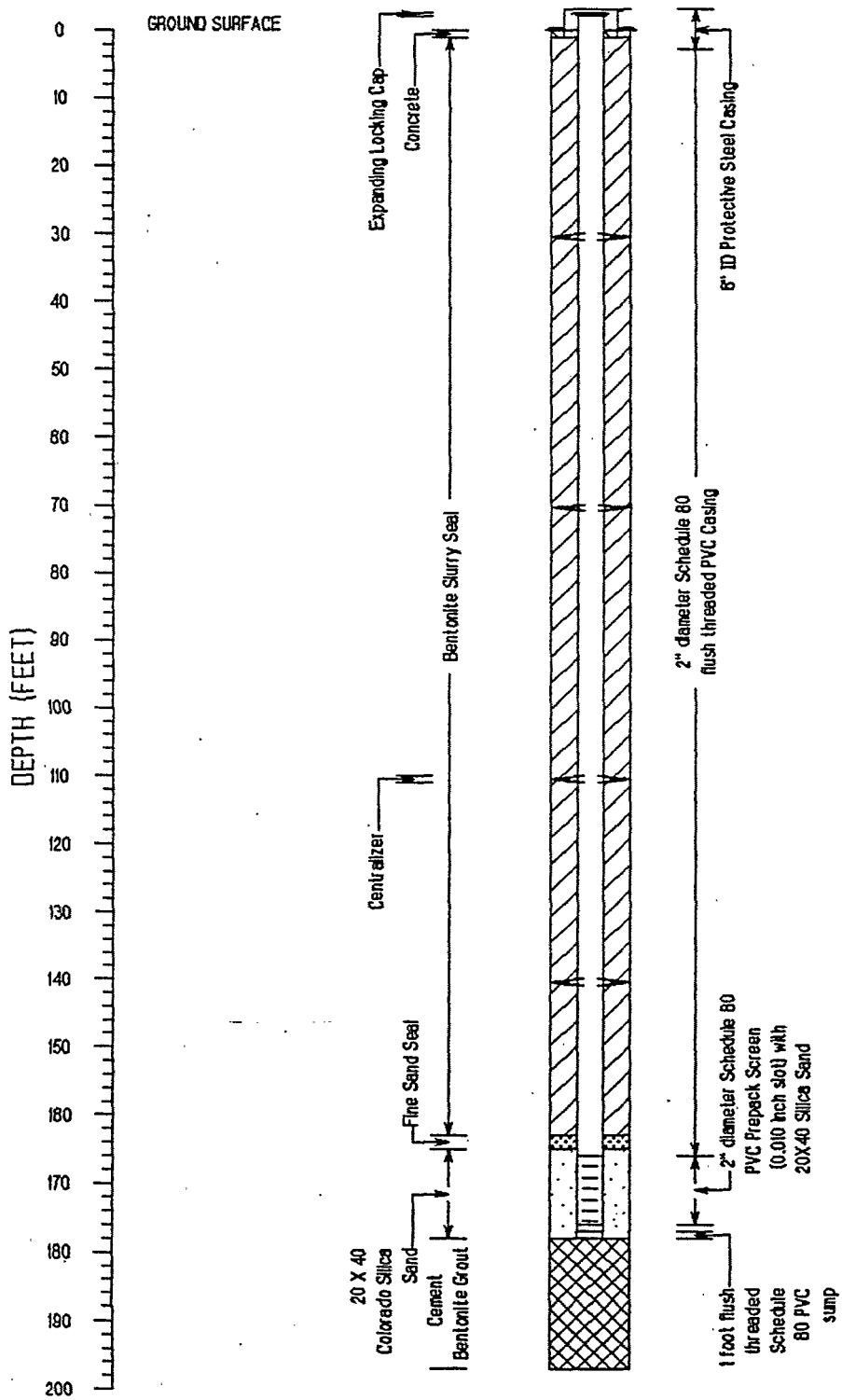
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08 Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Foremost Drill DR24 Air Rotary

WATER LEVELS _____ START 4-29-98 FINISH 5-3-98 LOGGER K. Gehweiler



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	WELL NUMBER
OPE39293.B1.01	MW-07

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION North Parking Lot

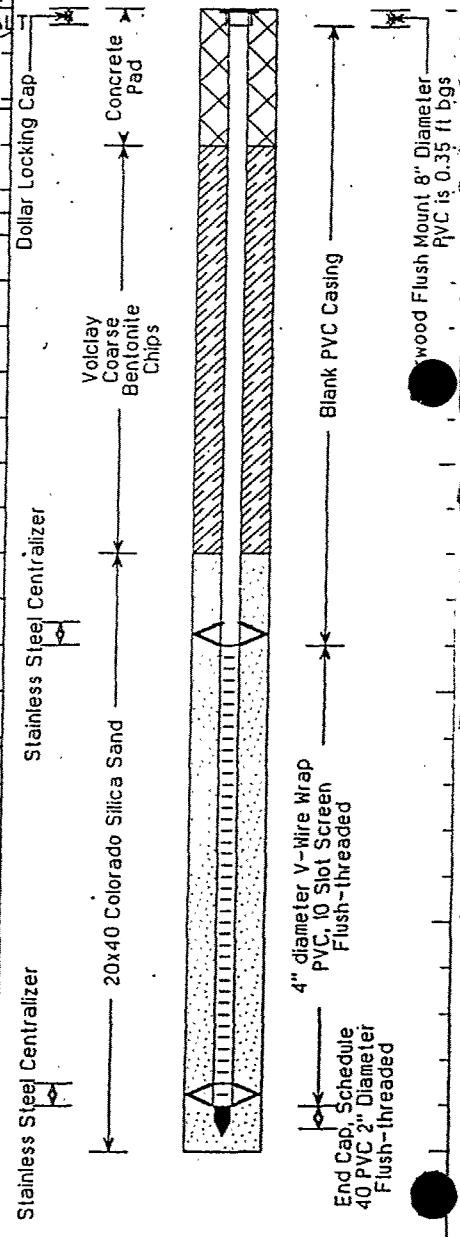
MEASURING POINT ELEV (NGVD) 28.38 DRILLING CONTRACTOR GeoTech-Mickey

DRILLING METHOD AND EQUIPMENT HSA 8 1/4" Augers Conterra 250

WATER LEVEL ELEV/DATE 13.13 7-14-94 START 7-9-94 FINISH 7-9-94 LOGGER Heidi Hoffmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
					Asphalt	ASPHALT
	2.5				SILTY SANDY GRAVEL, GM, v. dk brown, dry.	GM
	4.0	S-1	0.8	9-9-6 (15)	SILTY SAND, SM, v. dk grayish brown, (10YR 3/2), wet at bottom of ss, medium. OVM=0.0, HCN=0.0. Collect duplicate sample.	SM
	5.0					
5.0	6.5	S-2	1.0	4-6-11 (17)	SILT W/SAND, ML, v. dk grayish brown, (10YR 3/1), moist-wet in sand stringers, medium, sand is fine, silt is plastic. OVM=0.0, HCN=0.0.	ML
	7.5					
	9.0	S-3	1.4	5-9-9 (18)	SILTY SAND, SM, v. dk grayish brown, (10YR 3/2), v. sl. moist sand is fine, medium, mica flakes. OVM=0.0, HCN=0.0.	
	10.0					
10.0	11.5	S-4	1.3	4-5-6 (11)	SILTY SAND, SM, brown, (10YR 3/3), moist, wet at bottom of ss, medium, mica. OVM=0.0, HCN=0.0.	SM
	12.5					
	14.0	S-5	1.5	2-2-6 (8)	SILTY SAND, SM, brown, (10YR 3/3), wet, loose, mica. OVM=0.0, HCN=0.0.	
	15.0					
15.0	16.5	S-6	1.5	2-3-5 (8)	SILTY SAND, SM, brown, mottled with brown gray reduced areas, wet, loose. OVM=0.0, HCN=0.0.	
	17.5					
	19.0	S-7	1.5	4-3-3 (6)	SILT W/SAND, ML, dk. grayish brown, (10YR 3/2), wet, firm, mottled gray. ~10% Fe-oxide staining. OVM=0.0, HCN=0.0.	
	20.0					
20.0	21.5	S-8	1.5	2-2-6 (8)	SILT, ML, mottled gray and rust (Fe-oxide), wet, firm, interbedded with thin layers of fine silty sand and sandy silt, silt is stiff. OVM=0.0, HCN=0.0.	ML
	22.5					
	24.0	S-9	1.5	3-3-5 (8)	SANDY SILT, ML, mottled as above, wet, firm, sand is fine.	
25.0					BOH=25'	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
OPE39293.B1.01	MW-08

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Metals LOCATION Near Columbia River by Outlet of Company Lake

MEASURING POINT ELEV (NGVD) 25.32 DRILLING CONTRACTOR GeoTech-Mickey

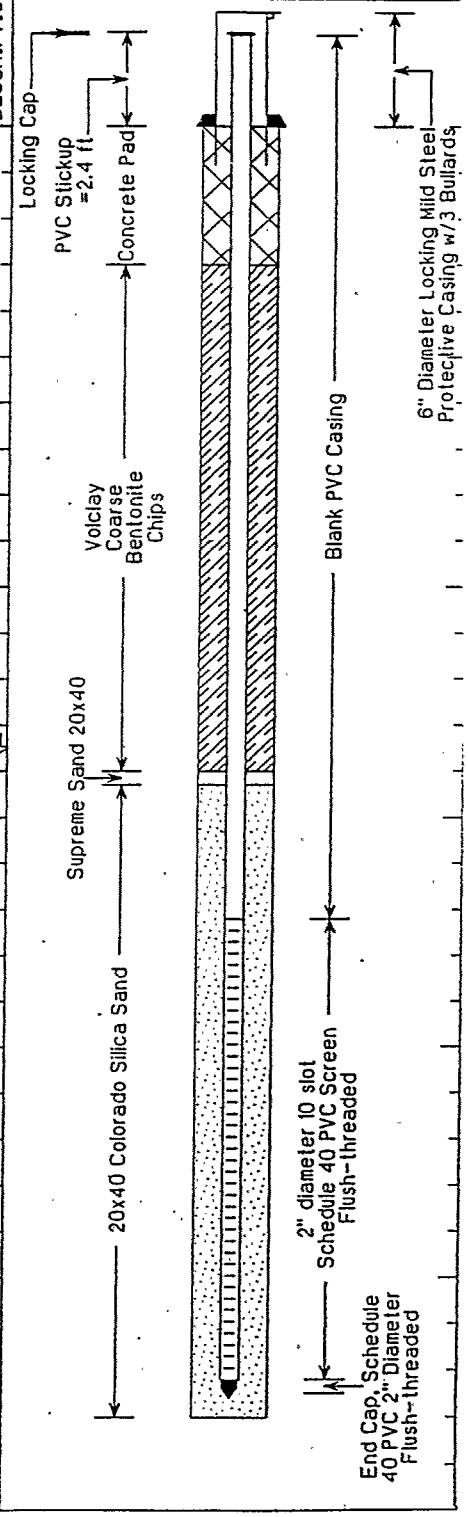
DRILLING METHOD AND EQUIPMENT HSA 6 1/4" Augers Canterra 250

WATER LEVEL ELEV/DATE 17.24 7-12-94 START 7-7-94 FINISH 7-7-94 LOGGER Heidi Hoffmann

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5–4.0	S-1	1.5	Spoon broke	SILTY SAND, SM, dk brown, (10YR 3/3), v. sl. moist. OVM=0.0.	SM
5.0	5.0–6.5	S-2	1.5	7-8-12 (20)	SILTY SAND, SM, dk brown, (10YR 3/3), sl. moist, medium. At 6.2': SAND, SP, salt & pepper, sl. moist, medium-coarse sand. OVM=0.0.	SP
	7.5–9.0	S-3	1.2	7-6-9 (15)	SAND, SP, salt & pepper, v. sl. moist, medium-coarse, medium. OVM=0.0.	SP
10.0	10.0–11.5	S-4	1.3	4-5-5 (10)	SAND, SP, salt & pepper w/red, v. sl. moist, loose. OVM=0.0.	SP
	12.5–14.0	S-5	1.3	5-7-8 (15)	SAND, SP, salt & pepper, moist-wet, medium, 6" of SM/ML, dk brown, (10YR 4/3), wet. OVM=0.0.	SM/ML
15.0	15.0–16.5	S-6	1.3	6-6-14 (20)	SAND, SP, salt & pepper, wet, medium, ~5% silt. OVM=0.0.	SP
	17.5–19.0	S-7	1.2	5-6-6 (12)	SAND, SP, salt & pepper, wet, medium, medium-coarse, loose. OVM=0.0.	SP
20.0	20.0–21.5	S-8	1.2	4-6-5 (11)	SAND, SP, same as above. OVM=0.0.	SP
	22.5–24.0	S-9	1.2	5-5-6 (11)	SAND, SP, same as above. OVM=1.1.	SP
25.0	25.0–26.5	S-10	1.1	7-7-14 (21)	SAND, SP, salt & pepper, wet, medium, ~5% subrounded pebbles. OVM=0.0.	SP

BOH=28'

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW08-127 SHEET 1 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 8-27-88 FINISH 7-10-88 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1.0 feet bgs: Rock fill for drill pad crushed basalt.	
5.0					SAND with SILT, (SW-SM), brown, wet, loose, fine to medium grained sand.	8 feet bgs water sample: T=17.1 degrees C pH=8.74 cond=200 F-=.318
10.0					SAND, (SW), brown, wet, loose, fine to medium grained.	
15.0					SAND, (SW), as above.	
20.0					SAND, (SW), as above, with red and gray volcanics from Sandy River Basins, fine to coarse grained sand.	
25.0	25.0 – 28.5		1.5	34-84-82 (148)	SAND, (SW), as above with chunk of wood, dense, gray.	25 feet bgs water sample: T=20 degrees C pH=8.7 cond=800 F-=4.08 High blow counts due to heaving sands.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.06.02	MW08-127 SHEET 2 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 6-27-88 FINISH 7-10-88 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND with GRAVEL, (SW), as above except fine gravel (up to 3/4 inch across), subrounded to angular, (gravel 10-15%).	Heaving sands.
35.0					SAND with GRAVEL, (SW), as above. Wood fragments at 38 feet bgs. Becoming coarser, gravel up to 1.5-inches across.	
40.0					SAND, (SW), as above with a trace of fine gravel, no wood fragments.	
45.0	45.0					
	46.5		1.5	2-10-50 (60)	SAND, (SW), gray, wet, medium dense to dense, fine to coarse grained, sand with trace of fine (1/4 inch) gravel, micaceous.	Heaving sands. 45 feet bgs water sample: T=24.3 degrees C pH=8.98 cond=730 F-=1.30
50.0					SAND, (SW), as above.	
55.0					SAND, (SW), as above.	Still heaving.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW08-127 SHEET 3 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 8-27-98 FINISH 7-10-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	
	65.0					
65.0	68.5		1.1	27-35-38 (73)	SAND, (SW), as above, except dense, trace fine to coarse (1 inch) rounded gravel.	65 feet bgs water sample: T=20.1 degrees C pH=7.28 cond=750 F-=0.35
70.0					SAND, (SW), as above.	
75.0					SAND, (SW), as above.	
80.0					At 78 feet start seeing increased percentage of coarse rounded gravel (up to 2 inches).	Harder balling from 78 feet on.
					SILT, (ML), gray, wet, firm, with rounded to subangular fine gravel (up to 1 inch).	
	84.0					
85.0	85.5		0.2	75/2.5"	SILTY GRAVEL, (GM), wet, very dense.	Contact with hard gravel at 84 feet. 85 feet bgs water sample: T=18.2 degrees C pH=7.37 cond=900 F-=0.24

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW08-127 SHEET 4 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 6-27-98 FINISH 7-10-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SANDY GRAVEL, (GW), gray-green, wet, dense, 20 percent fine to coarse sand, coarse gravel, rounded to angular up to 1 1/2 inches, evidence of cementing more obvious at 91-92 feet. Can smell napthalene in air at top of cyclone (22 ppm) but not at bottom of cyclone where collect soil. Napthalene being volatized.	22 ppm FID at top of cyclone.
	94.5					93 feet bgs water sample: T=14.2 degrees C pH=7.81 cond=150 F-=0.48
95.0	98.0		0.25	50/2"	SANDY GRAVEL, (GW), as above.	Soil sample at 94.5 mostly gravel (up to 1 1/2 inches) with some cementation. Strong napthalene odor. Could only fill (1) 8 ounce jar.
100.0					SANDY GRAVEL, (GW), as above.	
105.0					SANDY GRAVEL, (GW), as above, larger (up to 2 inches) rounded gravel, smaller broken angular pieces of gravel, medium to coarse sand, greater than or equal to 15 percent sand.	
110.0					SANDY GRAVEL, (GW), as above.	110 feet bgs water sample: T=15.3 degrees C pH=7.75 cond=140 F-=0.51
	115.0					
115.0	118.5			50/0"	No sample recovery with 3 inch spoon. Try driving 2 inch spoon. No recovery.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-127 SHEET 5 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 6-27-98 FINISH 7-10-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SANDY GRAVEL, (GW), as above.	
					Becoming finer at 122 feet bgs.	
125.0					SANDY GRAVEL, (GW), as above except very fine sand, some silt.	125 feet bgs water sample: T=15.2 degrees C pH=7.78 cond=220 F-=0.35
130.0					At 127.4 feet bgs SILT with SAND, (MH), gray, wet, firm, more fine gravel than sand, sand is coarse, sand and gravel are subangular to rounded. Silt becomes less gravelly with depth.	Producing less water at top of silt layer. Lift up casing a little to get water sample at top of silt. Water smells like napthalene. Strong odor from top of cyclone. Driller reports sheen on water. Water drys up at 131 feet bgs.
	134.0					
135.0	135.5		1.45	25-45-50/4"	SILT, (MH), gray, dry, very hard, no odor.	
140.0						
145.0						

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW08-127 SHEET 1 OF 1

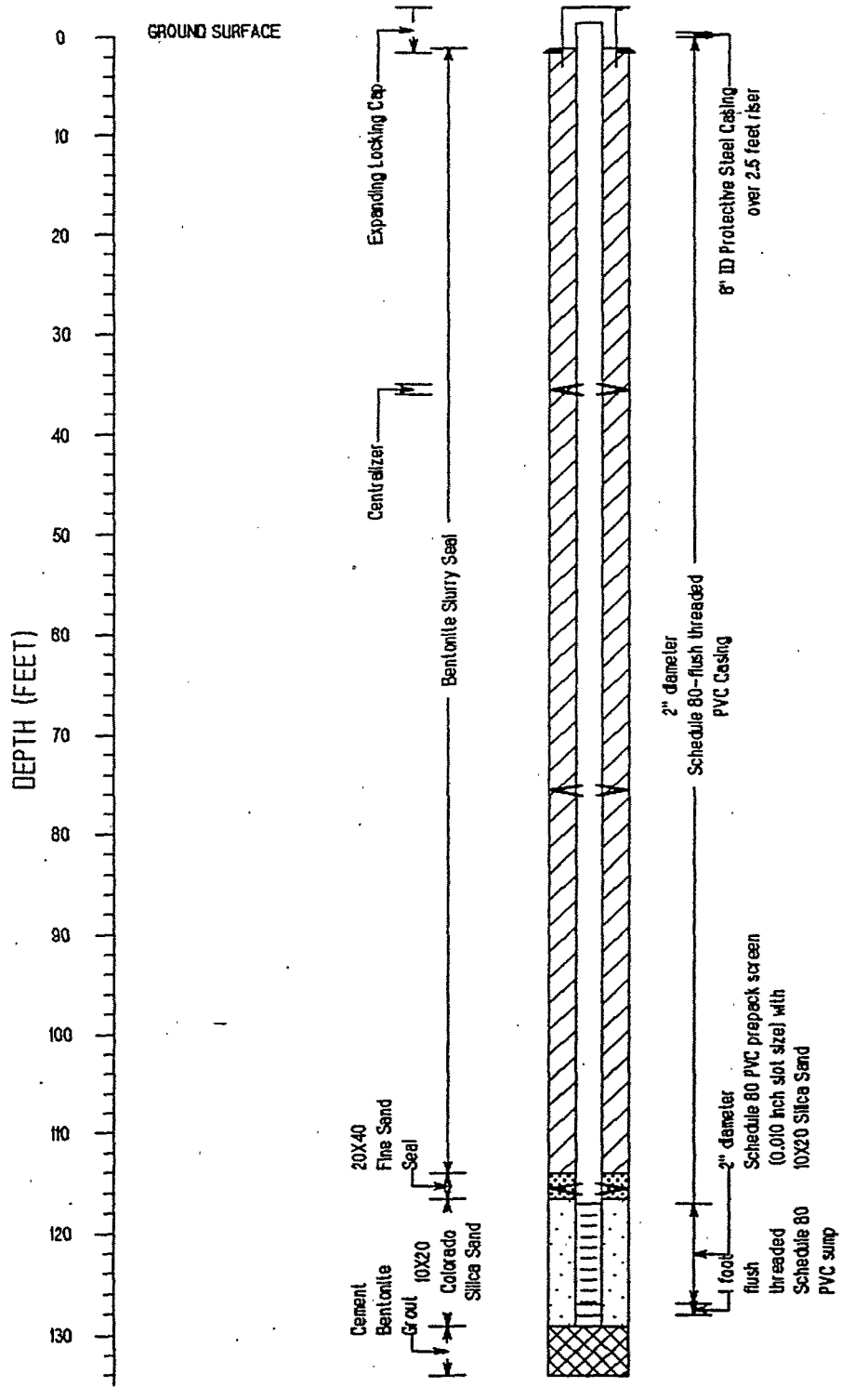
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 6-27-86 FINISH 7-10-86 LOGGER K. Gehweiler



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW08-189	SHEET 1 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT 8" Cabletool to 85 ft, 8" air rotary to 200 ft

WATER LEVELS _____ START 5-1-98 FINISH 5-9-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1.5 feet bgs: Rock fill for drill pad crushed basalt.	Driller adds 15 gallons of water.
5.0	5.0					
	6.0		1.0	4-5-6 (11)	SAND with SILT, (GW-GM), dark yellowish brown (10 yr 4/2), wet, loose; sharp contact at 5.5. feet bgs with SAND, (SW), brownish gray (5 yr 4/1), wet, loose, poorly-rounded, fine to medium grained.	Casing advancing easily.
10.0	10.0					
	10.5		0.5	4-4-3 (7)	SAND, (SW), as above.	
15.0					SAND, (SW), as above.	Driller adds 10 gallons of water. Sample with strainer. Sand heaving into casing.
20.0					SAND, (SW), as above.	Sample: check strainer. Add 15 gallons water.
						28 feet bgs water sample:
25.0					SAND, (SW), as above.	T=18.5 degrees C pH=8.7 cond=480 F--=3.38. Sample: Check strainer. Heaving sand in casing.
	28.0				SAND, (SW), as above with gravel (15%), gravel poorly rounded, up to 1.5-inch diameter, red and gray colored gravel.	1-inch thick silt layer 27 feet bgs - gravel (15%) up to 1-inch at 28 feet bgs - red & gray volcanics from sandy river basin.
	29.0		0.9	2-8-10 (18)		

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-168 SHEET 2 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT 8" Cabletool to 85 ft, 8" air rotary to 200 ft

WATER LEVELS _____ START 5-1-98 FINISH 5-9-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Add 5 gallons water.
35.0					SAND, (SW), with gravel, as above.	Add 15 gallons water heaving sand in casing; sample from strainer.
40.0					SAND, (SW), dark yellowish brown (10 yr 4/2), wet, loose, fine-to medium grained, poorly rounded. SILTY SAND, (SM), dark yellowish brown (10 yr 4/2), 15-20% silt, with SILT, (ML), dark gray (N3), layer 6-inch thick, 10% organic fragments (plant/wood debris) at 45 feet bgs.	Wood fragments 0.2-inch diameter.
45.0	46.0					
	47.0		1.0	2-2-2 (4)		No heaving sand in casing; Driller reports higher permeability. 46 feet bgs water sample:
	48.0					T=18.0 degrees C pH=7.0 cond=800 F-=0.4
	49.0		1.0	4-11-12 (23)	48 feet: SAND, (SW), dark gray, (N3), wet, very loose, fine-medium grained. 47 feet: SAND, (SW), as above except loose.	
50.0						Driller add 10 gallons of water. Bailing silt fragments with sand; wood fragments (<1%)
	55.0					
55.0	56.0		0.8	1-1-2 (3)	SAND, (SW), as above, except very loose, with SILT, (ML), layers 1-2 inches thick, dark gray (N3), wet, very soft.	Driller reports no heaving sand in casing (55 feet).
					SAND, (SW), dark yellowish brown (10 yr 4/2), wet, loose, fine-to coarse-grained, poorly rounded.	58 feet: Driller reports 15 feet heaving sand in casing. 58 feet bgs water sample: T=11.3 degrees C pH=8.77 cond=520 F-=0.34

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW08-169 SHEET 3 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT 8" Cabletool to 85 ft, 8" air rotary to 200 ft

WATER LEVELS _____ START 5-1-96 FINISH 5-9-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW) as above.	Driller reports 8 feet heaving sand in casing - sample collected from bailer with strainer.
65.0					SAND, (SW), as above, with trace gravel (to 0.5-inch; 2%).	Sample from strainer.
70.0					SAND, (SW), as above, no gravel.	Sample from strainer driller reports heaving sand in casing.
75.0					SAND, (SW), as above.	75 feet bgs water sample: T=11.2 degrees C pH=6.8 cond=580 F-=0.31 Sample from strainer driller reports 20 feet of heaving sand in casing bailing out pebbles (<1%) & silt fragments (<1%).
80.0					SAND, (SW), as above with pebbles to 81 feet.	Sample from strainer - driller reports slower casing advance at 83 feet bgs.
					SILT, (ML), olive gray (5 y 4/1), wet, firm, trace wood fragments.	Note: Drilling with cabletool ends at 85 feet - not a permeable zone- air rotary on 5-9-96.
					SILTY GRAVEL, (GM), olive gray (5 y 4/1), wet, dense, silt approximately 20%, gravel to 2-inches (basalt).	
85.0						85 feet bgs water sample: T=11.4 degrees C pH=6.86 cond=370 F-=0.41
					SILTY GRAVEL, (GM), as above.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-169 SHEET 4 OF 7.

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT 8" Cabletool to 85 ft, 8" air rotary to 200 ft

WATER LEVELS _____ START 5-1-98 FINISH 5-8-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), olive black (5 y 2/1), wet, dense, partially cemented, cement tan, gravel moderately well rounded, primarily	Samples collected in strainer. Driller reports increased permeability percent of cement varies higher permeability corresponds to less cement.
95.0					GRAVEL, (GW), as above.	Sample collected in strainer cement visible on gravel.
100.0					GRAVEL, (GW), as above.	100 feet bgs water sample: T=12.2 degrees C pH=7.30 cond=110 F-=0.39 102 feet: Cement color change to light gray - 103 feet: Cement tan. Formation producing constant water less than 20 gpm.
105.0					GRAVEL, (GW), as above.	
110.0					GRAVEL, (GW), as above.	110 feet bgs water sample: T=11.9 degrees C pH=7.81 cond=110 F-=0.36 Formation producing approximately 35 gpm.
115.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW08-188 SHEET 5 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT 8" Cabletool to 85 ft, 8" air rotary to 200 ft

WATER LEVELS _____ START 5-1-98 FINISH 5-9-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	Sample from cyclone into strainer.
						122 feet bgs water sample: T=11.7 degrees C pH=7.62 cond=140 F-=0.38
125.0					GRAVEL, (GW), as above.	125 feet: Driller reports decreased permeability.
130.0					SILT, (ML), dark yellowish brown (10 yr 4/2), wet, firm.	No water discharging from cyclone.
135.0					GRAVEL, (GW), same as at 125 feet.	
						138 feet bgs water sample: T=12.5 degrees C pH=7.99 cond=212 F-=0.25
					138-137 feet SAND, (SW), olive gray (5y 3/2), wet, dense, partially cemented, 15% gravel. 137: GRAVEL, (GW), olive black (5y 2/1), wet, dense, cement light olive brown (5y 5/8) gravel moderately well rounded.	Driller reports higher permeability.
140.0						
						Driller reports approximately 80 gpm from cyclone.
						142 feet bgs water sample: T=12.2 degrees C pH=7.99 cond=212 F-=0.25
145.0						
					GRAVEL, (GW), as above, cement dark yellowish orange (10 yr 6/6).	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW08-188 SHEET 8 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT 8" Cabletool to 85 ft, 8" air rotary to 200 ft

WATER LEVELS _____ START 5-1-98 FINISH 5-8-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above, cement dusky yellow green (5gy 5/2), some silt.	Driller reports lower permeability. Water is very silty.
155.0					GRAVEL, (GW), as above, greenish black (5gy 2/1).	Driller reports harder drilling. 155 feet bgs water sample: T=14.0 degrees C pH=8.23 cond=240 F-=0.26
160.0					SAND, (SW), dusky yellowish green (10gy 3/2), wet, loose, fine to very coarse-grained, poorly rounded, trace pebbles.	Driller reports sand heaving into casing and high permeability 60 gpm from cyclone. 162 feet bgs water sample: T=12.7 degrees C pH=8.42 cond=250 F-=0.25
165.0					GRAVEL, (GW), as above, weakly cemented, 5% silt. Weathered basalt, very dusky red purple (5rp 2/2), very dense.	Lower permeability reported (approximately 30 gpm). 167 feet: 5 percent sand, 5 percent silt.
170.0					Weathered basalt, very dusky red purple (5rp 2/2), very dense.	Driller reports very low permeability (no water), hard drilling, sample from strainer and cyclone.
175.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW08-189 SHEET 7 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION MW08

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT 8" Cabletool to 85 ft, 8" air rotary to 200 ft

WATER LEVELS _____ START 5-1-98 FINISH 5-9-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Weathered basalt, as above.	
185.0						
					Weathered basalt, as above, color now grayish purple (5p 4/2).	
190.0						183-190 feet bgs water sample: T=14.0 degrees C pH=8.47 cond=280 F-=0.18
195.0						Driller reports harder drilling - low permeability (1-3 gpm).
					198 feet: basalt, grayish black (N2), wet, very dense.	183.0-200 feet bgs water sample: T=14.0 degrees C pH=8.37 cond=280 F-=0.18
200.0					200 feet total depth bgs.	Total depth = 200 feet bgs.
205.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D6.02	MW08-169	SHEET 1 OF 1

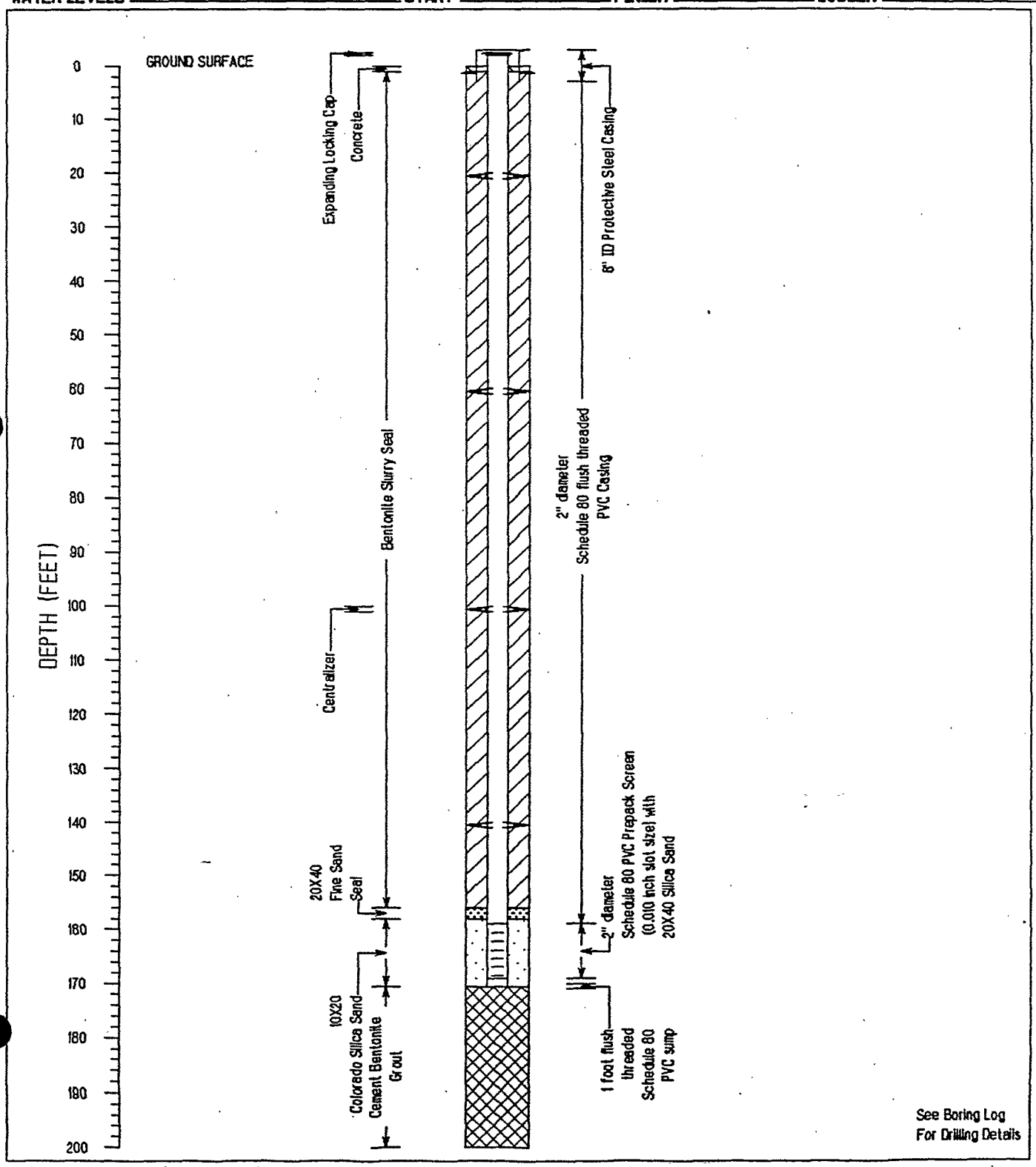
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** MW08

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT 8" Cabletool to 85 ft, 8" air rotary to 200 ft

WATER LEVELS _____ **START** 5-22-98 **FINISH** 5-23-98 **LOGGER** Ivan Gall



CH2M HILL

PROJECT NUMBER	WELL NUMBER	
OPE39293.B1.01	MW-09	SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT RMC Troutdale LOCATION N. Landfill

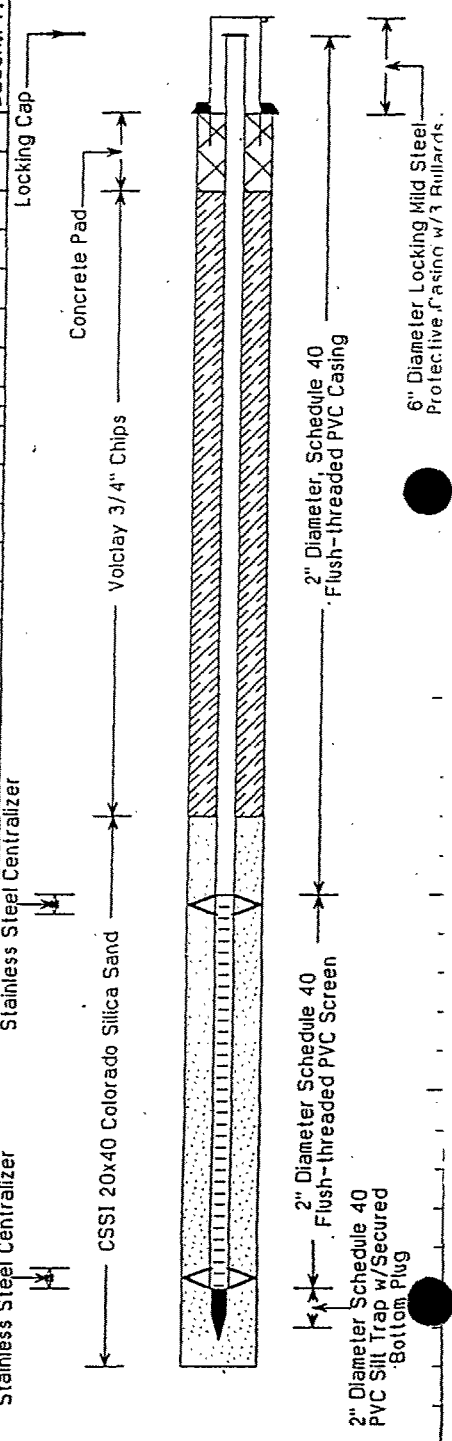
MEASURING POINT ELEV (NGVD) 29.27 DRILLING CONTRACTOR GeoTech Exploration

DRILLING METHOD AND EQUIPMENT 6 3/4" ID HSA

WATER LEVEL ELEV/DATE _____ START 8/4/94 8:30 AM FINISH [illegible] LOGGER Phil Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
	2.5				SANDY SILT W/GRAVEL, SM, loamy. 5% gravel to 1" angular, basaltic, dry, lt. gray/brown, firm.	
	5.0			5-6-7 (13)	SILTY SAND, SM, lt. brown, damp, medium fine, some minor coarse salt and pepper sand.	SM
5.0	7.5			5-10-10 (20)	As above 6"; then coarser to med. Less silt, SM/SP, mottled reduction at base, some clay nodules (5%).	
	10.0			4-5-7 (12)	4" SM as above, then SAND, SP, medium, lt. brown, damp, loose.	
10.0	12.5			8-12-10 (22)	4" SM, brown/gray, mottled, damp firm. Then SAND, SP, salt & pepper, s. moist, medium-coarse, loose.	SP
	15.0			4-6-8 (14)	As above; moist to wet.	
15.0	17.5			9-9-8 (17)	SAND, SP, darker, coarser salt and pepper, more angular. Columbia River sand (?), v. moist.	
	20.0			6-8-9 (17)	As above. Wet at base, minor fine layer at 19.5'.	
20.0	22.5			3-6-7 (13)	As above, wet.	
	25.0			4-9-11 (20)	As above. 0.5" silt layer at 24', red staining below silt.	SP
25.0	27.5			3-4-5 (9)	As above. Silty clay layer=1.5' thick.	
30.0					SP as above. 6" recovery.	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER	
OPE39293.B1.01	MW-10	SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT RMC Troutdale LOCATION Tank Area

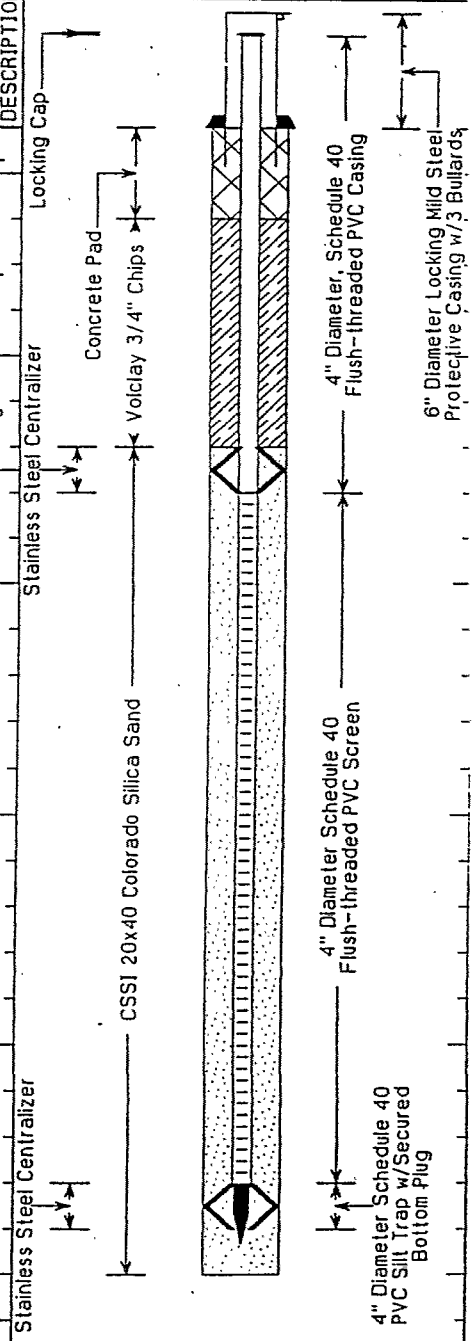
MEASURING POINT ELEV (NGVD) 30.28 DRILLING CONTRACTOR GeoTech Exploration

DRILLING METHOD AND EQUIPMENT 6 3/4" ID HSA

WATER LEVEL ELEV/DATE _____ START 8/5/94 8:30 AM FINISH _____ LOGGER Phil Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
					Silty loam gray, dry, firm, roots and organic matter.	ML
	2.5					
				5-5-5 (10)	SILT W/SAND, ML, brown w/gray mottling, dry to damp, medium, roots, 30-40% very fine sand.	ML
5.0	5.0					
				3-7-5 (12)	SAND, SP, brown w/gray mottling, damp, loose, very fine, 30% silt.	SP
	7.5					
				4-3-3 (6)	SILT W/SAND, ML, brown w/gray mottling, moist, medium, increasing fine and plastic at 9'.	
10.0	10.0					
				1-3-2 (5)	SILT, ML, brown, moist to wet, medium, plastic, 10% very fine sand, 10% CL.	
	12.5					
				1-1-1 (3)	Same as above, wet, plastic, 10-20% CL.	
15.0	15.0					
				1-1-2 (3)	SILT, ML, as above, grayer, <5% sand, 10% clay.	ML
	17.5					
				0-0-2 (2)	SILT, ML, as above, some macro-pores, very wet.	
20.0	20.0					
				0-0-3 (3)	SILT, ML, as above.	
	22.5					
				1-2-3 (5)	SILT, ML, as above, gray w/brown mottling, 20% v. fine sand.	
25.0	25.0					
				1-2-4 (6)	SILT, ML, grading to sand (SP) at base, gray, wet, loose, sand very fine, 20% silt.	
	27.5					
						SP

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW10-090 SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Between Scrapyard and Dike

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ START 9-10-98 FINISH 9-12-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0						Driller adds 5 gallons of water.
10.0	10.0					
	11.5		1.5	1-1-1 (2)	SILT, (ML), dark yellowish brown (10 yr 4/2) with orange mottling, damp, very soft, trace of very fine-grained sand.	
15.0						
20.0	20.0					
	21.5		1.5	1-1-1 (2)	SILT, (ML), as above.	
25.0						
	30.0				SAND with silt, (SW-SM), dark greenish gray (5 yr 4/1), wet, loose, very fine-grained, 15% silt	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW10-090 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Between Scrapyard and Dike

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ START 9-10-98 FINISH 9-12-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.4	5-9-13 (22)	SAND, (SW), grayish black (N2), wet, loose, fine-coarse-grained, moderately well-rounded, trace of red grains and mica flakes.	30 feet bgs water sample: T=18.5 degrees C pH=6.88 cond=180 F-=NA
35.0						
40.0	40.0 – 41.5		1.4	8-9-13 (22)	SAND, (SW), as above, except silt and organic rich layer 1-inch thick at 41 feet bgs.	
45.0						Driller adds 10 gallons of water.
50.0	50.0 – 51.5		1.5	3-10-10 (20)	SAND, (SW), as above, except fine-medium-grained.	50 feet bgs water sample: T=19.3 degrees C pH=7.01 cond=210 F-=NA
55.0						Driller adds 15 gallons of water.
	60.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW10-090 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Between Scrapyard and Dike

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ START 9-10-98 FINISH 9-12-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	80.0 – 81.5		1.4	18-21-30 (51)	SAND, (SW), as above, except medium dense.	Driller adds 15 gallons of water.
65.0						
70.0	70.0 – 71.5		1.4	20-29-30 (59)	SAND, (SW), as above.	
75.0						
80.0	80.0 – 81.5		1.5	23-35-34 (69)	SAND, (SW), as above, except dense.	80 feet bgs water sample: T=15.0 degrees C pH=7.02 cond=230 F--=NA
85.0						
	90.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW10-090 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Between Scrapyard and Dike

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ START 9-10-98 FINISH 9-12-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0 91.0			16-17-30 (47)	SAND, (SW), as above, except medium dense, large mica flakes.	91 feet bgs total depth.
95.0						
100.0						
105.0						
110.0						
115.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107.493.08.02	MW10-090	SHEET 1 OF

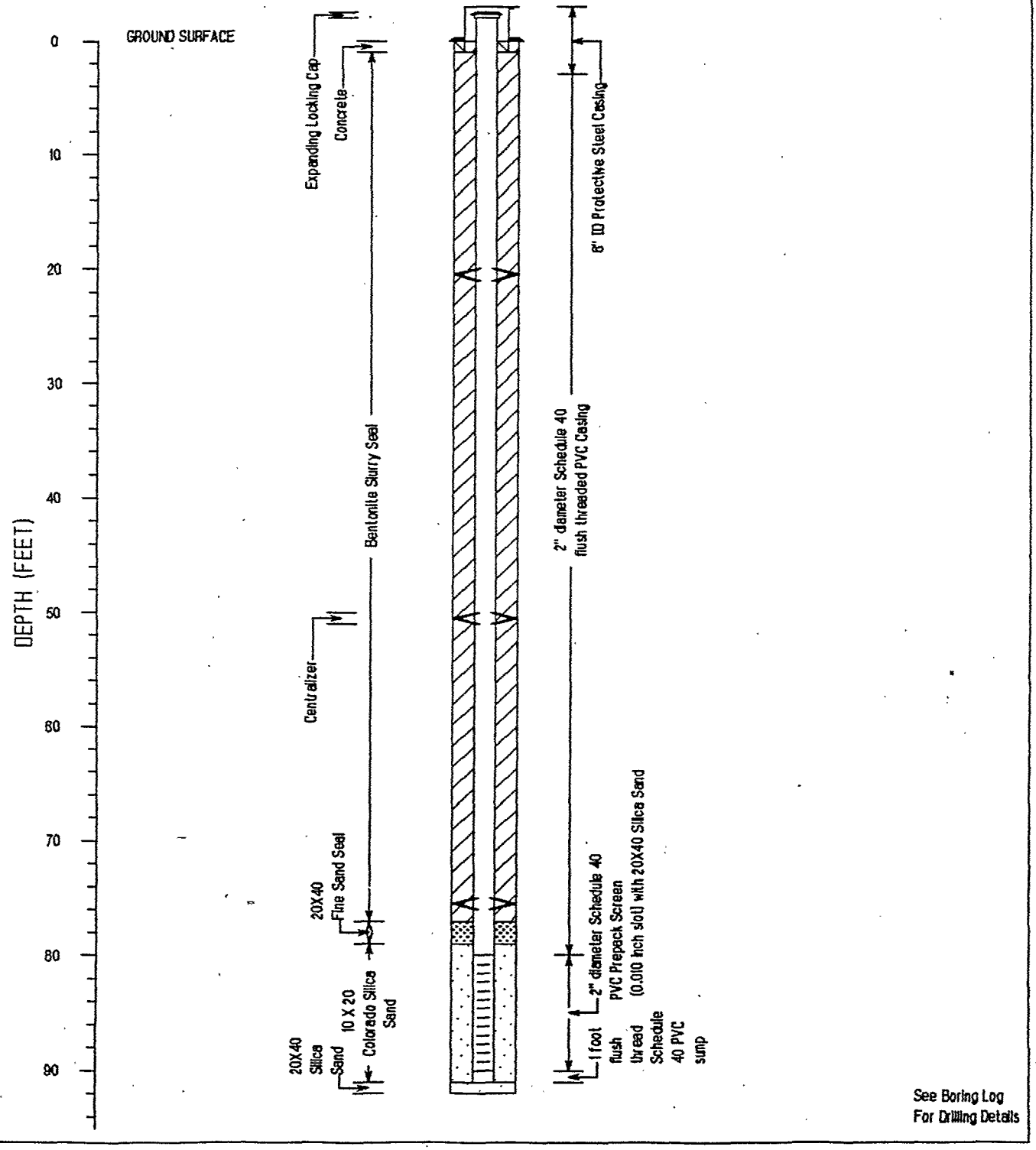
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Between Scrapyard and Dike

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ **START** 9-12-88 **FINISH** 9-12-88 **LOGGER** Ivan Gall



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW10-185 SHEET 1 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Between Scrap Yard and Dike

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing; Welded Joints

WATER LEVELS Approximately 3 feet bgs START 5-28-98 FINISH 7-28-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0	5.0–8.5		0.5	3-3-5 (8)	SILT, (ML), dark yellowish brown (10 yr 4/2) with orange mottling, damp, soft, trace of very fine sand.	Driller adds 5 gallons of water.
10.0	10.0–11.5		1.2	1-1-2 (3)	SILT, (ML), as above.	Driller reports some water entering casing (less than 2 gpm); casing advancing without hammering.
15.0	15.0–18.5		1.5	3-3-6 (9)	SILT, (ML), as above.	15 feet bgs water sample: T=12.3 degrees C pH=8.10 cond=120 F-=0.19
20.0	20.0–22.0		2.0	3-6-7-7 (14)	SILT, (ML), grayish olive (10 yr 4/2) with orange mottling, wet, medium stiff, slightly plastic, trace worm burrows.	Driller reports decreased water production.
25.0	25.0–27.0		2.0	2-2-2-6 (8)	SILT, (ML), dark greenish gray (5 yr 4/1), wet, soft, sand-rich layers with 10-15 percent very fine sand to 28.8 feet.	Driller reports increased water production.
	30.0				SAND with SILT, (SW-SM), dark greenish gray (5 yr 4/1), wet, loose, very fine grained, 15 percent silt.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW10-185 SHEET 2 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Between Scrap Yard and Dike

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing; Welded Joints

WATER LEVELS Approximately 3 feet bgs START 5-28-98 FINISH 7-28-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.2	6-13-18 (31)	SAND, (SW), grayish black (N2), wet, medium dense, fine-to-coarse- grained, moderately well rounded.	30 feet bgs water sample: T=12.3 degrees C pH=8.12 cond=115 F-=0.20 Driller reports increased water production.
35.0	35.0 – 36.5		1.3	13-16-18 (34)	SAND, (SW), as above.	Casing advancing easily; driller reports 7 feet heaving sand in casing.
40.0					SAND, (SW), as above, except trace of wood fragments.	Sample from bailer.
45.0	45.0 – 46.5		1.5	8-9-24 (33)	SAND, (SW), grayish black (N2), wet, loose, fine-medium grained, 5-10 percent silt, with interbeds approximately 0.1 feet thick.	45 feet bgs water sample: T=12.4 degrees C pH=8.11 cond=185 F-=0.21
50.0					SAND, (SW), as above, except no silt interbeds, trace of gravel.	Driller reports several feet of heaving sand in casing.
55.0	55.0 – 56.5		1.5	3-13-50 (63)	SILT, (ML), olive gray (5 yr 4/1), wet, stiff, 10 percent very fine sand, to 58.2 feet: Sharp contact with SAND, (SW), grayish black (N2), wet, dense, fine to medium grained.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW10-185 SHEET 3 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Between Scrap Yard and Dike

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing; Welded Joints

WATER LEVELS Approximately 3 feet bgs START 5-28-98 FINISH 7-28-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above, except large mica flakes.	Driller reports several feet of heaving sand in casing. Sample from bailer.
	65.0					
65.0	66.5		1.2	5-5-5 (10)	SAND, (SW), dark gray (N3), wet, loose, fine to coarse-grained, moderately well rounded, large mica flakes.	65 feet bgs water sample: T=13.3 degrees C pH=6.50 cond=380 F-=0.28 Driller reports 3 feet heaving sand in casing.
70.0					SAND, (SW), as above.	Driller reports 10 feet heaving sand in casing. Sample from bailer- driller adds 25 gallons of water.
	75.0					
75.0	76.5		1.0	6-5-6 (11)	SAND, (SW), as above.	
						Driller report 13 feet heaving sand in casing.
80.0					SAND, (SW), as above.	80 feet bgs water sample: T=13.4 degrees C pH=6.54 cond=480 F-=0.30
	85.0					
85.0	86.5		0.2	2-3-6 (9)	SAND, (SW), as above.	Sample likely composed of heaving sand.
						Driller adds 15 gallons of water.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW10-185

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Between Scrap Yard and Dike

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing; Welded Joints

WATER LEVELS Approximately 3 feet bgs START 5-28-88 FINISH 7-28-88 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above, except trace of gravel.	Sample from bailer.
	95.0					
95.0	98.5		1.0	6-4-4-4 (8)	SAND, (SW), as above, except no gravel.	Driller adds 10 gallons water. Driller reports 5 feet heaved sand in casing.
100.0					SAND, (SW), as above.	
	105.0					
105.0	108.0		0.8	4-6 (Heave)	SAND, (SW), as above, except trace of wood fragments (to 2-inch length).	105 feet bgs water sample: T=12.2 degrees C pH=8.72 cond=470 F-=0.28 Driller reports 35 feet of sand heaved into casing following groundwater sampling/purging.
110.0					SAND, (SW), as above.	Sample from bailer.
	115.0					
115.0	118.0			10-20 (Heave)	SAND, (SW), as above, except medium dense.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW10-185 SHEET 5 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Between Scrap Yard and Dike

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing; Welded Joints

WATER LEVELS Approximately 3 feet bgs **START** 5-28-98 **FINISH** 7-28-98 **LOGGER** Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above, except trace of wood fragments.	Sample from bailer.
	125.0					
125.0					SAND, (SW), as above.	125 feet bgs water sample:
	128.5		1.0	2-3-7 (10)		T=12.2 degrees C pH=8.88 cond=800 F-=0.34
						Driller adds 20 gallons of water.
					GRAVEL, (GW), dark gray (N3), wet, dense, moderately well rounded, 1-3 inch diameter maximum size, primarily basalt, approximately 10 percent sand (medium-coarse-grained).	Bailed gravel to 1-inch (10 percent) and 2 3-inch cobbles. Casing driving more slowly.
130.0						Driller reports poor water production, likely due to silt in gravel. No cement evident.
						133 feet bgs water sample:
						T=15.0 degrees C pH=8.75 cond=850 F-=0.34
135.0					GRAVEL, (GW), as above, except maximum size up to 1.5-inch diameter.	Sample from strainer, no cement evident, slow drilling and casing advancement.
140.0					GRAVEL, (GW), as above, except maximum size up to 3-inch diameter, 10 percent sand.	Sample from strainer, no cement evident, drilling and casing advancement slow. 140 feet bgs water sample:
						T=15.4 degrees C pH=7.87 cond=270 F-=0.31
						8/4/98 Stop cable tool drilling at 140.5 feet total depth.
145.0					GRAVEL, (GW), as above.	Casing producing approximately 100 gpm. Slow drilling rate at 145 feet.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW10-165 SHEET 8 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Between Scrap Yard and Dike

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing; Welded Joints

WATER LEVELS Approximately 3 feet bgs **START** 5-28-98 **FINISH** 7-28-98 **LOGGER** Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	Drilling rate increases at 151 feet
155.0					GRAVEL, (GW), as above.	Casing producing approximately 100 gpm. Some cement on gravel 155-158 feet. Air rig off well on 7/18/98; Cable Tool on well 7/24/98
						158 feet bgs water sample: T=13.7 degrees C pH=7.85 cond=145 F-=0.38
160.0					GRAVEL with SAND, (GW), dark gray (N3), wet, dense, moderately well rounded, 15-20 percent sand, fine-to-coarse-grained, maximum gravel size 3-inches, primarily basalt, partially cemented (cement yellow green silt).	Driller reports firm very permeable difficult/slow to drive casing samples from bailer.
165.0						
	168.5				SAND, (SW), dusky yellowish green (10 yr 3/2), wet, medium dense, medium-coarse-grained, moderately well rounded, trace gravel and mica flakes, 10-15 percent silt (gray in laminae less than 0.5-inch thick).	Casing advancing easier, driller reports good permeability.
	168.0		1.0	10-20-25 (45)		
						169 feet bgs water sample: T=14.8 degrees C pH=8.15 cond=155 F-=0.35 Driller adds approximately 30 gallons of water, driller reports 20 feet heaving sand in casing.
170.0						
175.0						Driller reports lower permeability
	178.0					
	178.5		0.5	11-50/5"	SAND, (SW), as above, except no gravel.	

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW10-185 SHEET 7 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Between Scrap Yard and Dike

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing; Welded Joints

WATER LEVELS Approximately 3 feet bgs START 5-28-98 FINISH 7-28-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above, except trace gravel (to 1-inch).	Driller reports low permeability. Samples from bailer.
185.0					SAND, (SW), dusky yellowish green (5 yr 5/2), wet, medium dense, with gravel (25 percent), up to 3-inches moderately well rounded, primarily basalt-sand contains 15-20 percent quartz, sand fine-very coarse, moderately well rounded.	185 feet bgs water sample: T=23.8 degrees C pH=8.78 cond=280 F-=0.37 Driller adds approximately 40 gallons of water. Driller reports approximately 25 feet heaving sand in casing - able to drill open hole at approximately 187 feet.
190.0					SAND with SILT, (SW-SM), light olive gray (5 yr 5/2), wet, dense, sand fine-very-coarse, moderately well rounded, 10-15 percent silt, 5 percent small gravel (primarily basalt, moderately well rounded).	Driller reports sand with silt has low to moderate permeability. Driller reports 2-3 feet heaving sand in casing. Sample from bailer.
195.0					SAND with SILT, (SW-SM), moderate olive brown (5 y 4/4), wet, dense, sand fine-medium-grained, 10-15 percent silt, 5-10 percent gravel (to 1-inch), gravel moderately well rounded).	
	199.0					
200.0	200.0		1.0	10-100/6"	199: SAND with SILT and GRAVEL, (SW-SM), as above, 10-15 percent silt, 15-20 percent pea gravel (to 1/2 inch; moderately well rounded). 199.5-199.8: GRAVEL with SILT and SAND, (GW-GM), light olive gray (5 yr 5/2), wet, dense, 15-20% silt and fine sand, gravel sub-rounded to 0.5-inch. 199.8-200: SAND, (SW), medium dark gray, (N4), wet, dense, fine- coarse-grained, moderately well rounded, 10-15 percent gravel (to 1-inch).	199 feet bgs water sample: T=17.1 degrees C pH=7.83 cond=280 F-=0.23 Total depth = 199 feet bgs Split spoon driven from 199-200.
205.0						

CH2M HILL

PROJECT NUMBER	WELL NUMBER
OPE39293.B1.01	MW-11

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT RMC Troutdale LOCATION East Gate

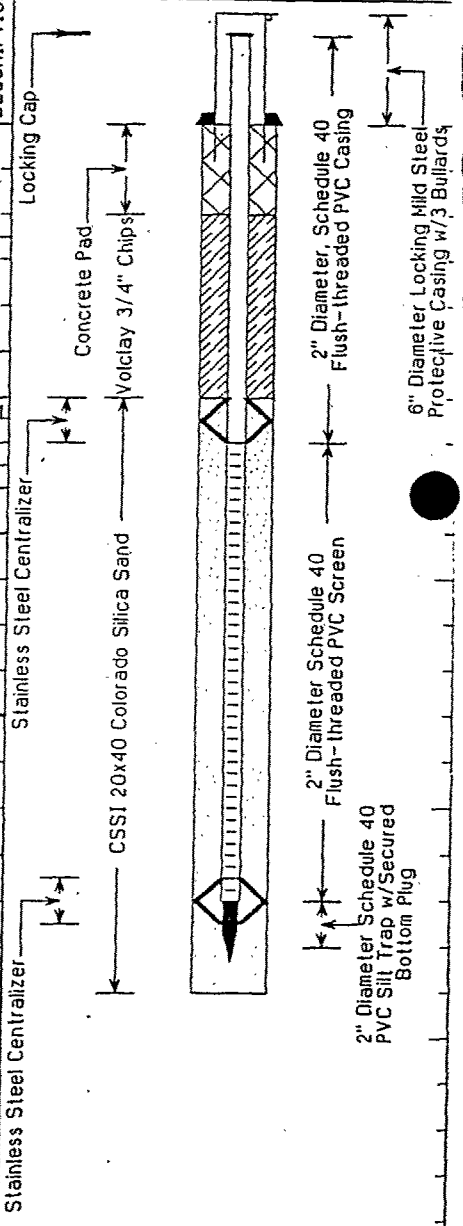
MEASURING POINT ELEV (NGVD) 31.61 DRILLING CONTRACTOR GeoTech Exploration

DRILLING METHOD AND EQUIPMENT 6 3/4" ID HSA

WATER LEVEL ELEV/DATE _____ START 8/4/94 FINISH 8/5/94 LOGGER Phil Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
	2.5				SAND W/SILT AND GRAVEL, ML/SP/GW, fill, lt. gray to tan, dry, loose.	ML
	5.0			7-7-8 (15)	SAND, SP, brown damp, loose, no layering, medium-loose (fill).	SP
5.0	7.5			3-4-4 (8)	SILTY CLAY/CLAYEY SILT, ML/CL, brown w/red mottling, damp, dense. 5% fine sand.	ML/CL
	10.0			2-3-4 (7)	SAND W/SILT, SP, brown, wet, medium. 25% silt.	
10.0	12.5			2-2-2 (4)	SAND W/SILT, SP, as above; finer, closer to SP-ML.	
	15.0			1-2-3 (5)	SAND W/SILT, brown to gray, variable silt layering soft to medium gray.	SP/ML
15.0	17.5			2-2-2 (4)	Same as above.	
	20.0			1-2-3 (5)	Same as above. Last 6"=ML.	ML
20.0	22.5			2-4-3 (7)	Same as above; 1st 6" ML.	SP/ML
25.0						

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
OPE39293.B1.01	MW-12

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT RMC Troutdale LOCATION SW Field

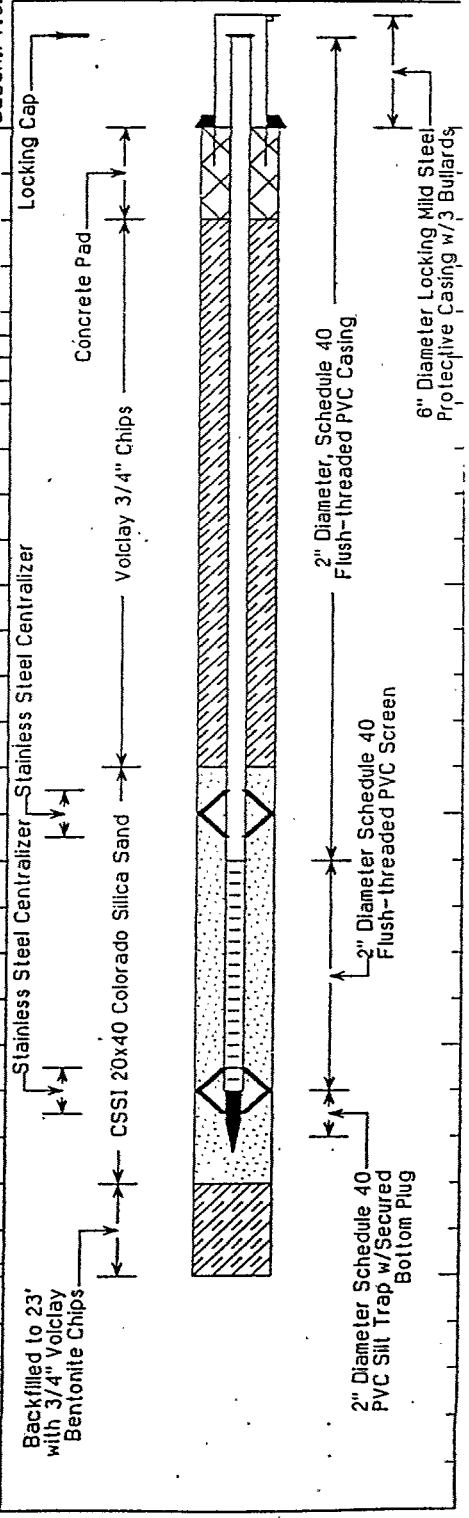
MEASURING POINT ELEV (NGVD) 22.53 DRILLING CONTRACTOR GeoTech Exploration

DRILLING METHOD AND EQUIPMENT 6 3/4" ID HSA

WATER LEVEL ELEV/DATE _____ START 8/4/94 FINISH _____ LOGGER Phil Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
	2.5				LOAMY SILT W/GRAVEL, ML, dry, lt. gray/brown, firm. <5% gravel. Angular basalt to 3/4" diameter.	
	5.0			4-7-9 (16)	SILT, ML, dk. gray to lt. gray/brown, dry to damp, firm. Some red staining, roots and organic debris. 5% very fine sand.	
5.0	7.5			6-6-3 (9)	Top 6": SAND, SP, fine to medium, lt. gray, moist, loose. Bottom 6": SILT, ML, gray, v. fine, wet, firm.	SP
	10.0			1-2-1 (3)	SILT, ML, gray, wet, soft, some root debris, 10-20% clay.	
10.0	12.5			1-2-1 (3)	SILT W/SAND, ML, gray, wet, soft. 20% v. fine black sand.	ML
	15.0			1-1-2 (3)	SILT, ML, as above. 20-25% clay, firmer.	
15.0	17.5			0-1-2 (3)	SAND W/SILT, SP, dk. gray, wet, soft to medium, v. fine sand, 30% silt (coarser).	SP
	20.0			1-2-2 (4)	1' same as above. Bottom 6": SAND, SP, medium to coarse, dk. gray, wet, soft, interlayered w/silt.	
20.0	22.5			1-1-2 (3)	SILT, ML, dk. gray, wet, firm, 15% v. fine sand, slightly plastic at base.	ML
	25.0			1-3-2 (5)	CLAYEY SILT, ML/CL, gray w/lt. green mottling, wet, soft to medium, much root debris and vegetation.	ML/CL
25.0					1' same as above. Bottom 6": SAND W/SILT, SP, dk. gray, wet, soft, medium to fine.	SP

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW12-082 SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 6-inch I.D. Steel Casing

WATER LEVELS _____ START 9-5-98 FINISH 9-24-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1 feet: Crused basalt pad	
						Driller adds 10 gallons of water.
5.0						
10.0	10.0					
	11.5		1.5	1-1-1 (2)	SILT, (MH), grayish olive green (5 GY 3/2), damp, soft, gray mottling, elastic.	Driller adds 10 gallons of water. Casing advancing easily while drilling.
15.0						
	19.0					
20.0	20.5			1-1-2 (3)	SILT, (MH), as above, wet, trace of fine sand, elastic.	Driller adds 10 gallons of water.
25.0						
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW12-092 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch I.D. Steel Casing

WATER LEVELS _____ START 9-5-98 FINISH 9-24-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.0	1-1-3 (4)	SILT, (MH), as above, approximately 10 percent very fine sand	Driller reports low permeability.
					SAND, (SW), medium dark gray (N4), wet, loose, very fine to fine grained.	
35.0	35.0 – 36.5		1.4	23-28-25 (53)	SAND, (SW), as above, medium dense, some siltier layers (up to 1-inch thick).	35 feet bgs water sample: T=18 degrees C pH=8.75 cond=700 F-=0.45, Eh=-230
40.0						
45.0	45.0 – 46.5		1.5	3-8-15 (23)	SAND, (SW), medium dark gray (N4), wet, loose, fine to medium grained, (5-10 percent medium grained) trace silt and pebbles, trace red grains and mica.	
50.0						
55.0	55.0 – 56.5		0.8	1-3-8 (11)	SAND, (SW), as above.	55 feet bgs water sample: T=14.1 degrees C pH=7.13 cond=190 F-=0.43, Eh=-170

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW12-092 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch I.D. Steel Casing

WATER LEVELS _____ START 8-5-86 FINISH 8-24-86 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	85.0					
65.0	88.5		1.3	6-10-18 (28)	SAND, (SW), as above, no silt or pebbles.	85 feet bgs water sample: T=14.3 degrees C pH=7.25 cond=175 F-=0.49, Eh=-287
						Driller reports 25 feet sand heaved into casing.
70.0						
	75.0					
75.0	78.5		1.4	6-9-20 (29)	SAND, (SW), as above.	Driller adds approximately 20 gallons of water.
80.0						
	82.0					
	83.5			15-26-50 (76)	SAND, (SW), as above, except medium dense.	82 feet bgs water sample: T=18.1 degrees C pH=7.30 cond=220 F-=0.42, Eh=-285
85.0					SAND, (SW), as above.	
	90.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW12-092 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch I.D. Steel Casing

WATER LEVELS _____ START 9-5-98 FINISH 9-24-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0			22-21-50 (71)	SAND, (SW), as above, except medium dense.	
	92.0				Stop at 92 feet.	92 feet bgs water sample: T=15.8 degrees C pH=7.38 cond=250 F-=0.4, Eh=-189
95.0						
100.0						
105.0						
110.0						
115.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW12-092	SHEET 1 OF 1

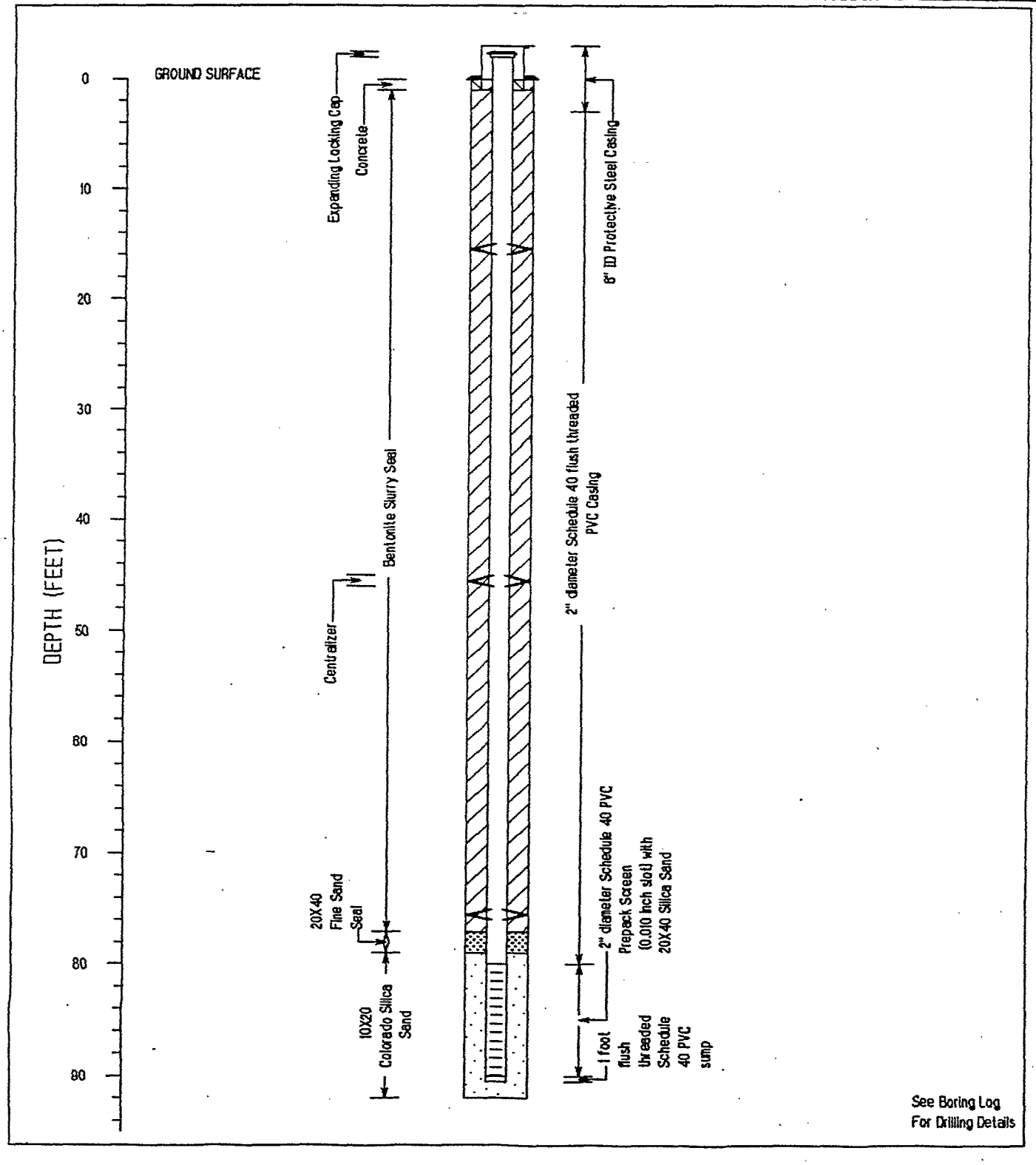
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** West Side of Site Along Sundial Road

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch I.D. Steel Casing

WATER LEVELS _____ **START** 9-24-98 **FINISH** 9-24-98 **LOGGER** Ivan Gall



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW12-184 SHEET 1 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 10"ID Steel Casing to 8.5 ft, 6"ID-200

WATER LEVELS _____ START 5-10-88 FINISH 5-17-88 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					2-3 inch rock fill over geotextile liner drill pad. SILTY SANDY GRAVEL, (GM), brown, damp, loose, medium to coarse sand, fine gravel, approximately 20 percent silt, less than 15 percent sand.	Drive 10 inch diameter casing to 8.5 feet bgs, then drive 8 inch casing.
5.0					SILT, (MH), gray, moist, soft, elastic.	
	10.0					
10.0	11.5		1.5	2-2-3 (5)	SILT, (MH), gray, moist, soft, elastic.	
15.0					SILT, (MH), as above except with sand, medium grained.	
	20.0					
20.0	21.5		1.5	6-5-5 (10)	SILT with SAND, (MH), as above except firm.	20 feet bgs water sample: T=14 degrees C pH=8.58 cond=390 F-=0.81
25.0					SILT with SAND, (MH), as above, increased percentage of sand.	Increased percentage of sand.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW12-184

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 10"ID Steel Casing to 8.5 ft, 8"ID-200

WATER LEVELS _____ START 5-10-98 FINISH 5-17-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SILT with SAND, (MH), as above.	30 feet bgs water sample: T=15 degrees C pH=8.37 cond=800 F-=0.20
35.0					SILT with SAND, (MH), as above.	
	40.0					
40.0	41.5		1.5	10-12-20 (32)	SAND, (SW), gray, wet, medium dense, fine to medium grained with a trace of silt.	40 feet bgs water sample: T=15 degrees C pH=8.81 cond=810 F-=0.30
45.0					SAND, (SW), as above.	Driller reports sand heaving into casing.
50.0					SAND, (SW), as above.	50 feet bgs water sample: T=16.5 degrees C pH=8.23 cond=750 F-=0.51
55.0					SAND, (SW), as above.	Driller reports sand heaving into casing.
	60.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW12-184 SHEET 3 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 10"ID Steel Casing to 8.5 ft, 8"ID-200

WATER LEVELS _____ START 5-10-98 FINISH 5-17-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 61.5		1.5	10-50-60/1"	SAND, (SW), gray, wet, medium dense to dense, fine to medium grained, no silt. Trace of micaceous flakes and red grains of sand.	60 feet bgs water sample: T=18 degrees C pH=6.54 cond=620 F--=0.48
65.0					SAND, (SW), as above.	Driller reports sand heaving into casing. At approximately 70 feet bgs driller notices sheen and change in water color to brown from gray. Brown sudsy bubbles on water surface.
70.0					SAND, (SW), as above.	70 feet bgs water sample: T=17 degrees C pH=6.5 cond=500 F--=0.55
75.0					SAND, (SW), as above.	Collected soil sample at 80 feet from bailer with strainer. Driller reports sand heaving into casing.
80.0					SAND, (SW), as above.	80 feet bgs water sample: T=18.5 degrees C pH=6.72 cond=600 F--=0.58
85.0					SAND, (SW), as above.	No more brown foam observed at 87 feet bgs.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW12-184 SHEET 4 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 10"ID Steel Casing to 8.5 ft, 8"ID-200

WATER LEVELS _____ START 5-10-98 FINISH 5-17-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above except a little coarse grained.	90 feet bgs water sample: T=17.1 degrees C pH=6.88 cond=580 F-=0.347.
95.0					SAND, (SW), as above with trace fine subangular gravel, coarser to fine grained sand, still micaceous.	95 feet bgs water sample: T=16.8 degrees C pH=6.78 cond=460 F-=0.382
100.0					SAND, (SW), as above.	Drilling reports harder drilling.
105.0					SAND, (SW), as above except no coarse sand or fine gravel.	105 feet bgs water sample: T=16.3 degrees C pH=6.87 cond=600 F-=0.48
110.0					SAND, (SW), as above except some coarse sand and fine gravel.	
115.0					SAND, (SW), as above with a trace of light weight white pumice or ash.	115 feet bgs water sample: T=21.4 degrees C pH=7.17 cond=800 F-=0.33

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW12-184 SHEET 5 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 10"ID Steel Casing to 8.5 ft, 8"ID-200

WATER LEVELS _____ START 5-10-88 FINISH 5-17-88 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above with rounded fine to coarse gravel.	Driller reports sand heaving into casing.
	125.0					
125.0			0.0	30-30-30/3"	No recovery	125 feet bgs water sample: T=18 degrees C pH=8.47 cond=720 F-=0.48
	128.5					
130.0					SAND, (SW), as above.	Collected sample with strainer from bailer.
	135.0					
135.0			1.0	6-12-60 (72)	SAND, (SW), gray, wet, medium dense to dense, fine to medium grained, no gravel, some mica and red sand grains.	135 feet bgs water sample: T=15 degrees C pH=8.34 cond=590 F-=0.34
	138.5					
140.0					SAND, (SW), as above. Some gravel starting to appear in cuttings along with some coarse sand.	Drilling becomes harder at 140 feet.
145.0					SAND, (SW), as above with some coarse sand and fine black gravel, angular to subrounded.	145 feet bgs water sample: T=15 degrees C pH=8.92 cond=700 F-=0.48

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW12-184 SHEET 8 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 10"ID Steel Casing to 8.5 ft, 6"ID-200

WATER LEVELS START 5-10-88 FINISH 5-17-88 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	Driller reports difficulty driving casing.
155.0					SAND, (SW), as above.	155 feet bgs water sample: T=18 degrees C pH=7.47 cond=800 F-=0.52
160.0					SAND, (SW), as above. Some fine gravel.	
165.0					SAND, (SW), as above.	165 feet bgs water sample: T=14 degrees C pH=7.25 cond=420 F-=0.24
170.0					SAND, (SW), as above.	
175.0					SAND, (SW), as above with some fine subangular gravel, wood fragments.	175 feet bgs water sample: T=18 degrees C pH=7.35 cond=520 F-=0.18

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW12-184 SHEET 7 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 10"ID Steel Casing to 8.5 ft, 6"ID-200

WATER LEVELS _____ START 5-10-98 FINISH 5-17-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above, coarser gravel, angular to subrounded.	Driller reports sand heaving into casing.
185.0					SAND, (SW), as above.	185 feet bgs water sample: T=20 degrees C pH=7.39 cond=680 F-=0.15
190.0					SAND, (SW), as above except increasing percentage of fine to coarse gravel, subangular to rounded (1/4" - 4" diameter), evidence of cementing, some wood fragments.	Driller reports sand heaving into casing.
195.0					SAND, (SW), as above.	195 feet bgs water sample: T=19 degrees C pH=7.62 cond=520 F-=0.14
200.0					SAND, (SW), as above. Bottom of hole at 200 feet.	200 feet bgs water sample: T=14 degrees C pH=7.7 cond=580 F-=0.20
205.0						

PROJECT NUMBER	BORING NUMBER	
107483.D8.02	MW12-184	SHEET 1 OF 1

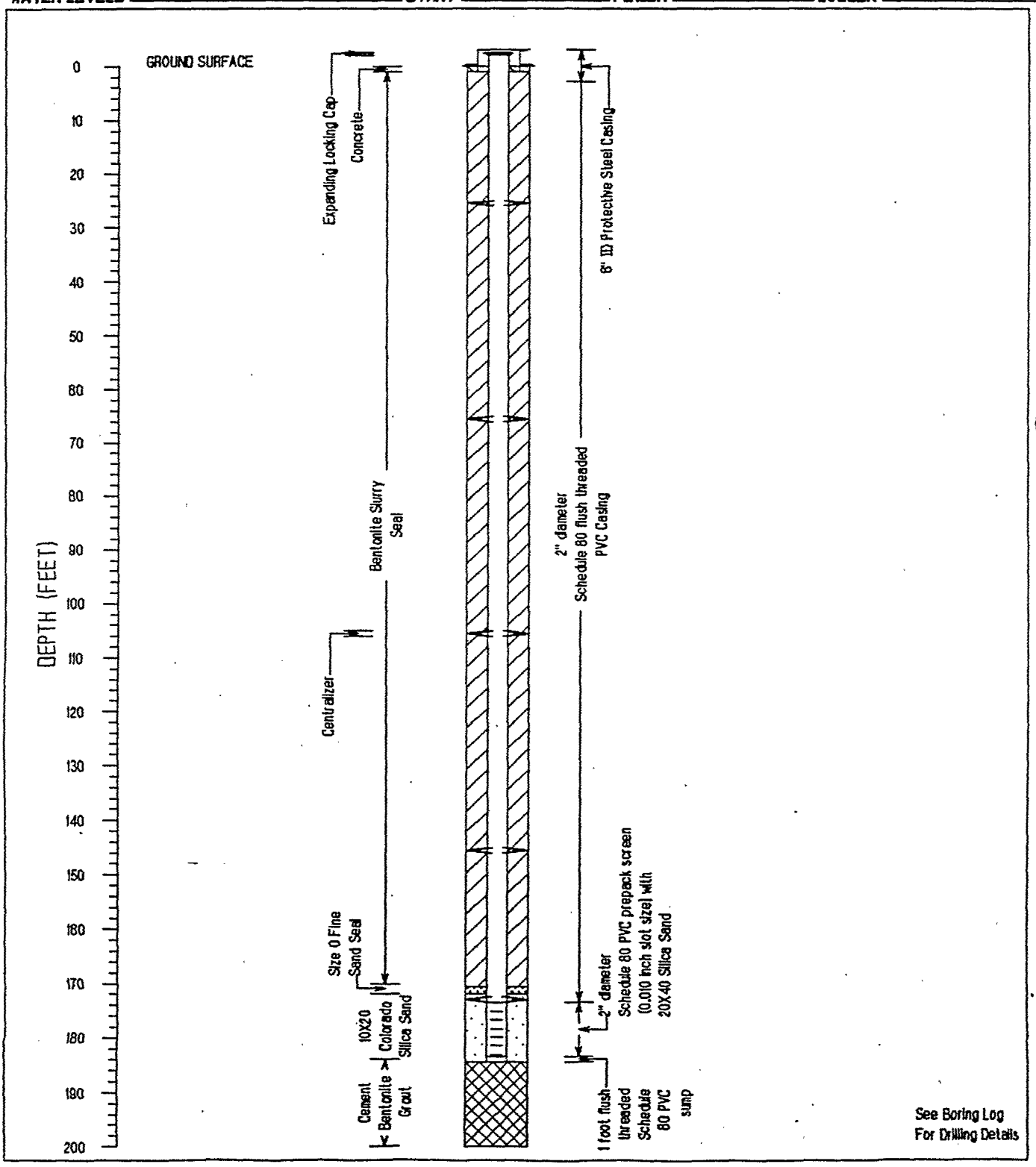
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** West Side of Site Along Sundial Road

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; 10"ID Steel Casing to 8.5 ft, 8"ID-200

WATER LEVELS _____ **START** 5-17-98 **FINISH** 5-21-98 **LOGGER** K. Gehweiler



CH2M HILL

PROJECT NUMBER	WELL NUMBER	
107493.H1.02	MW13	SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Scrap Yard

MEASURING POINT ELEV (NGVD) 30.88 DRILLING CONTRACTOR Geo-Tech Explorations

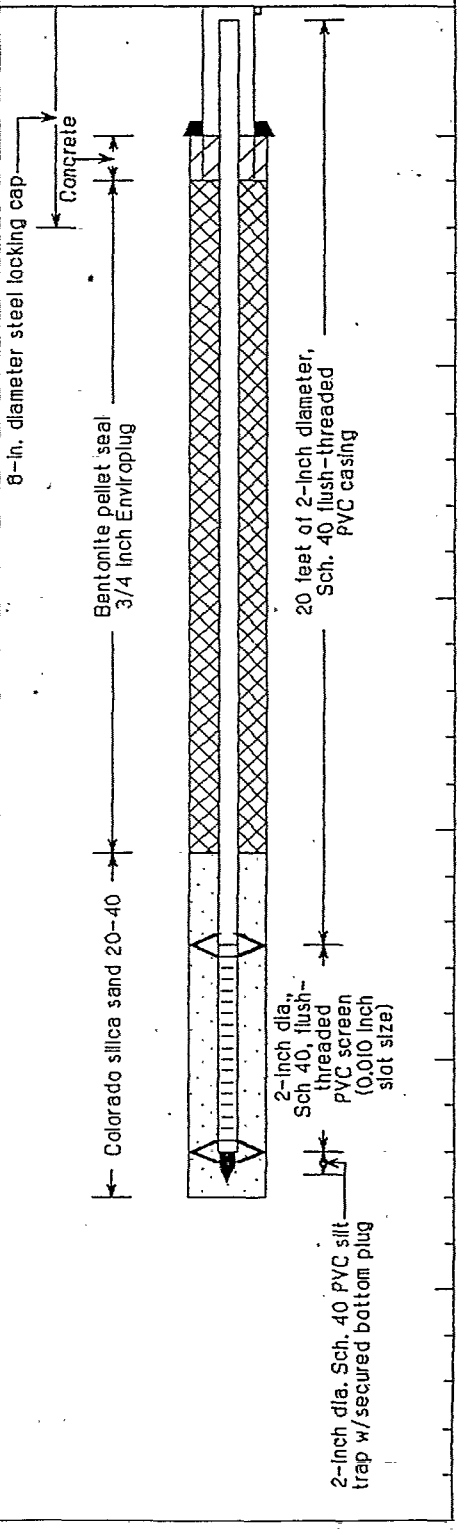
DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 6-1/4" ID Auger

WATER LEVEL ELEV/DATE _____ START 7/12/95 FINISH 7/12/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Sand w/Gravel, (SP), Black, loose, moist, fill material (to 2.5 ft. bgs.) Comment: MW13-0000-0*	SP
	4.0		1.5	8-8-8 (24)	Sand, (SW), Lt. brn, dry, loose, well sorted, mod. well rounded comment: No sample collected	SW
5.0	5.0					
	6.5		1.0	4-2-1 (7)	Sand, (SW), as above, dry Comment: MW13-0050-0*	
	7.5					
	9.0		1.2	3-2-2 (7)	Silt, (ML), tan with orange brn mottling, wet, firm, 5% V. fine sand Comment: MW13-0075-0*	ML
10.0	10.0					
	11.5		1.4	2-2-2 (8)	Silt, (ML), same as above, wet	
	12.5					
	14.0		1.3	1-1-2 (4)	Silt, (ML), as above, increased orange mottling, med. plasticity, higher clay content, wet	
15.0	15.0					
	16.5		1.5	1-3-4 (8)	Silt, (ML), as above, grading down to sand, SP-SM, tan to brown, wet, loose, fine to med.-grained Comment: Sand at 16.0 ft.	
	17.5					
	19.0		1.3	1-1-1 (3)	Silty Sand, (SP-SM), gray brown, wet, loose, grading downward from fine- to med.-grained sand	SP
20.0	20.0					
	21.5		1.4	7-9-14 (30)	Sand, (SP), gray-brown, wet, loose, fine to med.-grained.	
	23.5		1.5	13-19-32 (64)	Sand, (SP), gray-brown, wet, firm, med.- to crs.-grained, mod. well rounded	
25.0						

* = Soil Samples

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.H1.02	MW14 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Scrap Yard

MEASURING POINT ELEV (NGVD) 30.88 DRILLING CONTRACTOR Geo-Tech Explorations

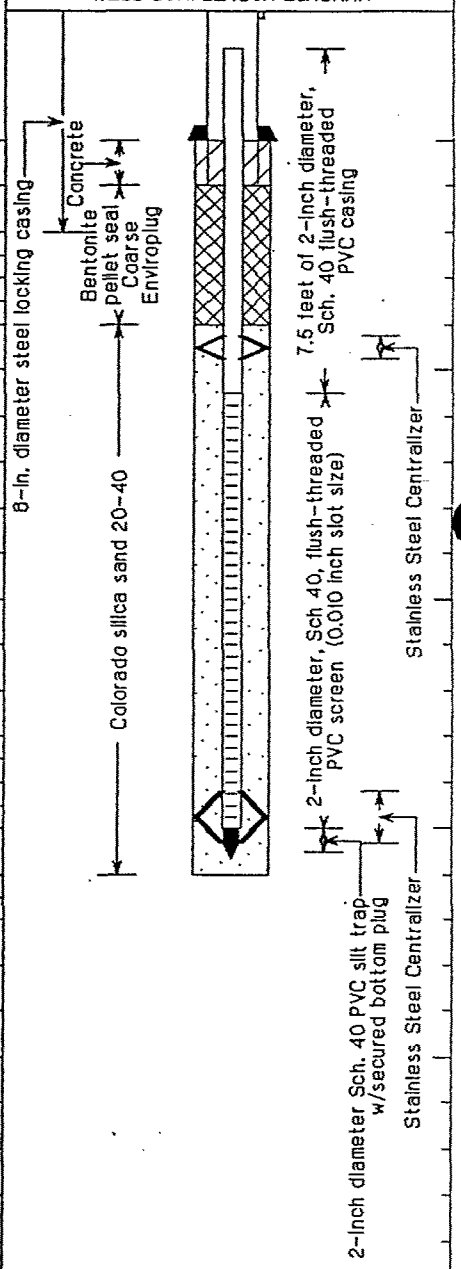
DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Auger

WATER LEVEL ELEV/DATE _____ START 7/11/95 FINISH 7/11/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Silty Loam, Red-brown, damp, loose, grassroots Comment: MW14-0000-0*	
	4.0		1.2	4-8-11 (21)	Sand w/Silt, (SW-SM), Red-brown, damp, loose, 5-10% silt, mod. well-sorted (to 3.5 ft.) - contact with silt, ML, brown, damp, firm, 10-15% sand Comment: MW14-0025-0*	SW
5.0	5.0					ML
	6.5		1.0	6-8-9 (21)	Silt, (ML), Med. Brown, damp, firm, 5-10% sand (to 8 ft.) - sharp contact with sand, (SW-SM), gray to red-brown, wet, loose, poorly-rounded Comment: MW14-0050-0*	SW
	7.5					
	8.0		1.4	9-12-14 (35)	Sand w/Silt, (SP-SM), Med. to dark brown, damp, loose, 40% silt (to 8 ft.) - sharp contact with sand, (SP), gray-brown, wet, loose, 10% silt Comment: 1 piece of 1-in. gravel at 8.0 ft.	
10.0	10.0					SP
	11.5		1.4	5-7-5 (17)	Sand w/Silt, (SP-SM), Gray-brown, wet, loose, L5% gravel to 1/4-in., 5% silt	
	12.5					
	14		1.4	8-3-8 (19)	Sand w/Silt, (SP-SM), Brown, wet, loose (to 13.8 Ft.); Sharp contact with silt, ML, red-brown, wet, loose, 10-15%V. fine sand	
15.0	15.0					ML
	18.5		1.4	8-5-7 (20)	Sand w/Silt, (SP-SM), med. brown, loose, grading to silt, ML	SP
20.0						
25.0						

* = Soil Samples

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.L1.02	MW15 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Fairview Farms

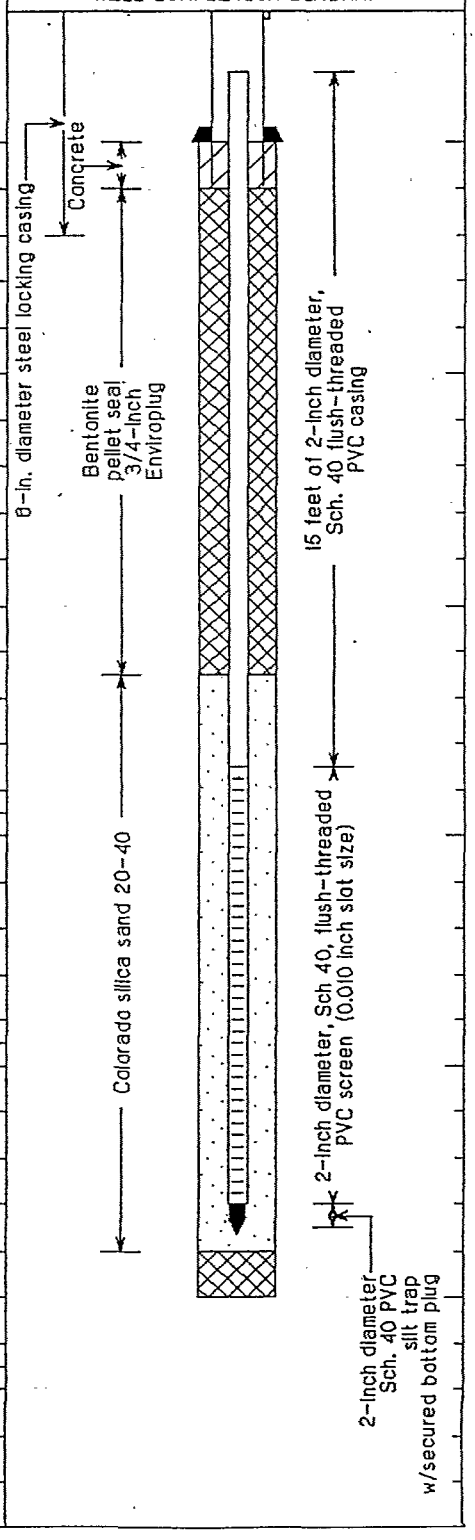
MEASURING POINT ELEV (NGVD) 22.75 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Auger

WATER LEVEL ELEV/DATE _____ START 7/13/95 FINISH 7/13/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Silty Loam, Med. brown, dry, firm, grassroots Comments: MW15-0000-0*	
	4.0		1.2	4-2-3 (9)	Silt w/Sand, (ML), Lt. oange tan, dry, firm, orange mottling, sand ~15%, v. fine grained Comments: MW15-0025-0*	
5.0	5.0					
	6.5		1.3	1-2-3 (6)	Silt, (ML), orange tan, damp, v. firm, orange mottling, 5% v. fine sand Comments: MW15-0050-0*	ML
	7.5					
	9.0		1.5	2-1-2 (5)	Silt, (ML), as above, Some carbon frags, worm burrows contain water, damp	
10.0	10.0					
	11.5		1.5	2-2-3 (7)	Silt, (ML), as above, Wet in worm burrows	
	12.5					
	14.0		1.5	1-3-2 (6)	Silt, (ML)as above, Wet, to 13 ft. sharp contact with sand w/ silt, SP-SM, gray-green, firm, wet, 15% silt, v. fine sand	SP
15.0	15.0					
	16.5		1.5	2-3-4 (9)	Silt, (ML), tan w/orange mottling, damp, v. firm, to 18.2 ft. silt w/sand, ML, gray-green, wet, firm, ~10% v. fine sand	ML
	17.5					
	19.0		1.5	2-2-3 (7)	Sand w/Silt, (SP-SM), gray-green, wet, loose, alternating silt-rich layers, sand fine-grained, silt slightly plastic Comments: Driller Reports Heaving	SP
20.0	20.0					
	21.5		1.5	2-2-3 (7)	Silt w/Sand, (ML), gray-green, damp, v. firm, ~10% - 15% v. fine sand (to 21.1 ft.) - Sharp contact with sand w/silt, (SP-SM), gray-green, wet, loose, 20% silt	ML SP
	22.5					
	24.0		1.5	2-2-4 (8)	Silt, (ML), OK gray, wet, v. firm, variable grain size and moisture content	ML
25.0	25.0					
	26.5			4-7-11 (22)	Silt, (ML), as above * = Soil Sample	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW15-088	SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** West Side of Site Along Sundial Road

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch I.D. Steel Casing

WATER LEVELS _____ **START** 8-3-98 **FINISH** 8-5-98 **LOGGER** Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1 feet: Crushed basalt pad	
5.0						Driller adds 10 gallons of water for bailing. Casing advancing very easily.
10.0	10.0					
	11.5		1.5	1-1-2 (3)	SILT, (ML), light olive gray with orange mottling, damp, very soft, trace fine sand and mica.	
15.0						Casing/Drilling very easy, driller adds 5 gallons of water. Percentage of sand in silt increases with depth.
20.0	20.0					
	21.5		1.2	4-4-8 (10)	SAND with SILT, (SW-SM), light olive gray, wet, loose, approximately 15 percent silt, sand fine to medium grained.	20 feet bgs water sample: T=18 degrees C pH=8.42 cond=160 F-=1.8, Eh=-312
25.0	27.0					Water level in 8 inch casing recovers to approximately 10 feet bgs in 5 minutes. Driller reports good permeability in formation.
	28.5		1.2	13-14-18 (33)	SAND, (SW), grayish olive green (5yr 3/2), wet, medium dense, fine to medium grained, trace of silt and mica, with silt-rich laminae 1-2 inches thick.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW15-088 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 6-inch I.D. Steel Casing

WATER LEVELS _____ START 8-3-88 FINISH 8-5-88 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35.0						Driller open hole 10 feet. Driller reports no heaving sand in casing.
	38.0					
	39.5		1.3	10-7-10 (17)	SAND, (SW), medium dark gray (N4), wet, loose, fine to medium grained, trace red grains and mica, trace of wood fragments.	38 feet bgs water sample: T=18 degrees C pH=6.87 cond=230 F-=0.70, Eh=-307
40.0						
45.0						
50.0	51.0				SAND, (SW), as above except medium dense.	
	52.5		1.1	20-19-23 (42)		Driller reports no sand heaving into casing.
55.0						
	60.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW15-088 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch I.D. Steel Casing

WATER LEVELS _____ START 9-3-96 FINISH 9-5-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0–61.5		1.0	9-4-3 (7)	SAND, (SW), grayish olive green (5 yr 3/2), wet, loose, fine to medium grained, approximately 5% silt, trace wood fragments.	Driller reports 10 feet sand heaved into casing. 60 feet bgs water sample: T=16 degrees C pH=6.59 cond=250 F-=0.41, Eh=-265
65.0						
70.0	70.0–71.5		1.3	38-50-42 (92)	SAND, (SW), medium dark gray (N4), wet, dense, fine to medium grained, trace red grains and mica, some siltier laminae (to 1-inch thick).	70 feet bgs water sample: T=15.5 degrees C pH=7.18 cond=220 F-=0.42, Eh=-283
75.0						Driller adds 15 gallons of water to casing.
80.0	80.0–81.5		0.7	5-8-10 (18)	SAND, (SW), as above, except loose, trace of wood fragments (to 2-inch legnth), no silt.	80 feet bgs water sample: T=14.5 degrees C pH=6.88 cond=210 F-=0.38, Eh=-113
85.0						Driller adds 20 gallons of water to casing.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW15-086 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 6-inch I.D. Steel Casing

WATER LEVELS START 9-3-96 FINISH 9-5-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	82.0					
	83.5		1.5	8-23-28 (51)	SAND, (SW), as above, except no silt or wood fragments.	92 feet bgs water sample: T=13 degrees C pH=6.82 cond=175 F-=0.41, Eh=-88
95.0						
100.0						
105.0						
110.0						
115.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.06.02	MW15-086 SHEET 1 OF 1

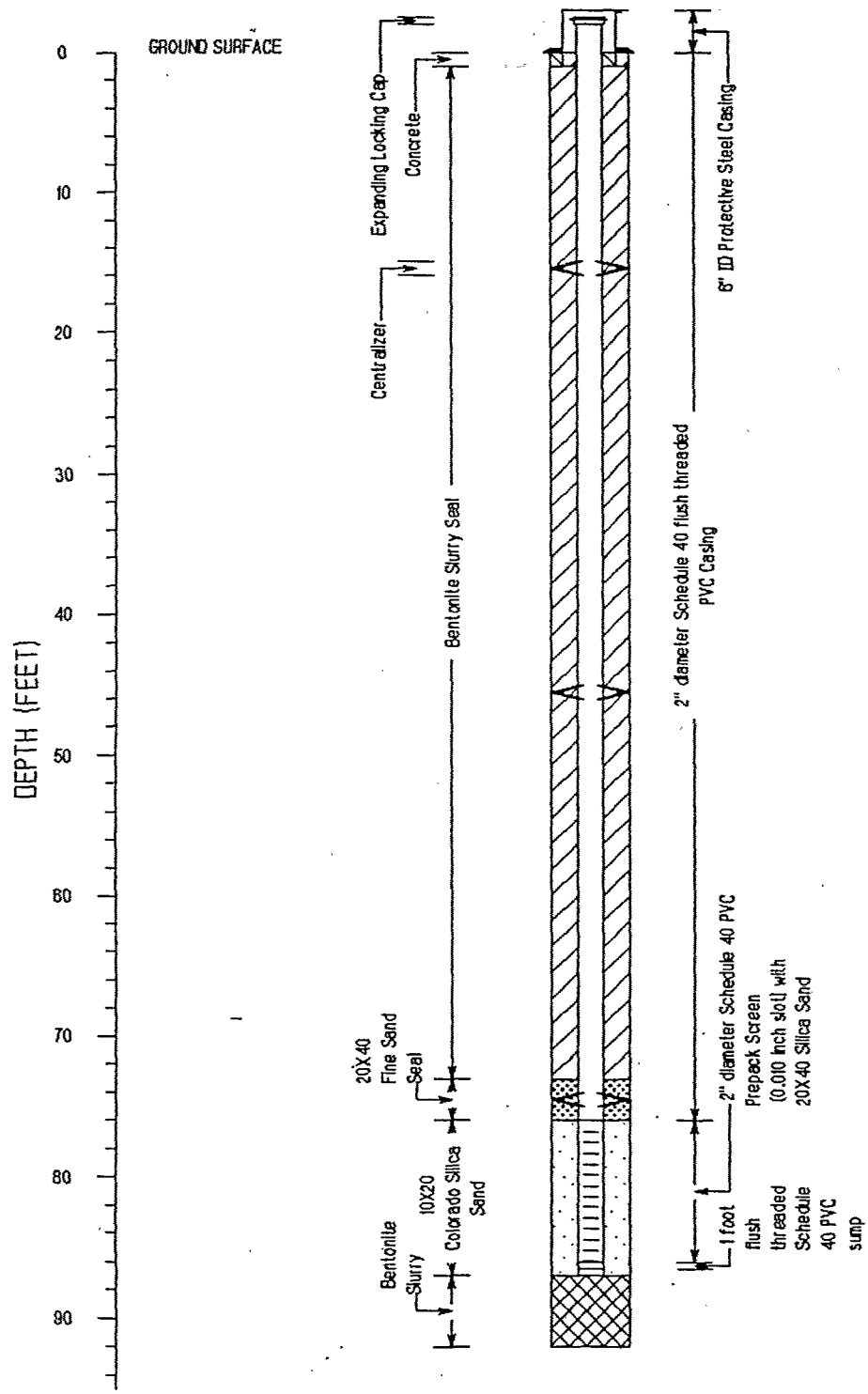
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch I.D. Steel Casing

WATER LEVELS _____ START 9-23-86 FINISH 9-23-86 LOGGER Ivan Gall



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW15-175 SHEET 1 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 5-22-86 FINISH 5-30-86 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-0.5 feet fill, GRAVEL, (GW), gray, dry, loose, coarse, angular to subrounded.	
					0.5-2 SILTY SANDY GRAVEL, (GM), brown, damp, loose.	
					SILT with SAND, (MH), brown, damp, soft.	
5.0						
10.0					SILT with SAND, (MH), brown, damp, soft, slightly elastic.	
15.0					SILT with SAND, (MH), brown, damp, soft.	
20.0	20.0				SILT with SAND, (MH), as above except gray.	20 feet bgs water sample:
	21.5		1.5	4-4-5 (9)		T=13 degrees C pH=6.3 cond=212 F-=0.23.
25.0					SILT with SAND, (MH), as above, higher percentage of sand.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D6.02	MW15-175 SHEET 2 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 5-22-96 FINISH 5-30-96 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), dark gray, wet, loose to medium dense, fine to medium grained, no silt, some red sand grains.	30 feet bgs water sample: T=14 degrees C pH=6.35 cond=212 F-=0.18.
	35.0					
35.0			1.5	4-10-50/4"	SAND, (SW), as above.	35 feet bgs water sample: T=15 degrees C pH=6.9 cond=500 F-=0.31.
	36.5					
40.0					SAND, (SW), as above slightly coarser grained.	
45.0					SAND, (SW), as above.	45 feet bgs water sample: T=16 degrees C pH=6.8 cond=810 F-=0.27
50.0					SAND, (SW), as above.	
55.0					SAND, (SW), as above.	55 feet bgs water sample: T=15 degrees C pH=6.5 cond=520 F-=0.29.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW15-175 SHEET 3 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 5-22-86 FINISH 5-30-86 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	
65.0					SAND, (SW), as above.	65 feet bgs water sample: T=14 degrees C pH=8.5 cond=500 F-=0.34.
70.0					SAND, (SW), as above.	
75.0					SAND, (SW), as above.	
80.0					SAND, (SW), as above except fine to coarse grained sand.	Sheen and some brown foam observed in bailed water from 75-85 interval. Appears similar to sheen and foam noted during drilling of MW12-D.
85.0					SAND, (SW), as above.	85 feet bgs water sample: T=18 degrees C pH=8.5 cond=580 F-=0.33.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW15-175 SHEET 4 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 5-22-88 FINISH 5-30-88 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	
	95.0					
95.0	98.5		1.5	18-50-50 (100)	SAND, (SW), as above except well-graded sand with fine to coarse, rounded to angular gravel.	
						97 feet bgs water sample: T=18 degrees C pH=6.8 cond=810 F-=0.31. Soil Sample at 97 feet was sand heaved into casing.
100.0					SAND, (SW), as above.	
105.0					SAND, (SW), as above except less gravel and a little finer grained.	105 feet bgs water sample: T=14 degrees C pH=6.8 cond=800 F-=0.44
110.0						
	115.0					
115.0	118.5		1.5	25-60-50/3"	SAND, (SW), gray, wet, very dense, fine to coarse grained with trace fine rounded to subangular gravel.	115 feet bgs water sample: T=17.5 degrees C pH=6.5 cond=600 F-=0.41 Soil: PID=1.5 ppm, FID=35 ppm Background=0.2-0.8

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW15-175 SHEET 5 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 5-22-96 FINISH 5-30-96 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	
125.0					SAND, (SW), as above except loose to medium dense.	125 feet bgs water sample: T=17.5 degrees C pH=8.7 cond=580 F-=0.32.
130.0					SAND, (SW), as above.	
135.0	135.0					
	138.5		1.2	3-8-15 (24)	SAND, (SW), as above with trace of wood fragments/plant material.	135 feet bgs water sample: T=18.4 degrees C pH=8.48 cond=580 F-=0.34 PID=0.22 ppm FID=240 ppm max Background=0.02 ppm
140.0					SAND, (SW), as above.	
145.0					SAND, (SW), as above.	145 feet bgs water sample: T=15 degrees C pH=8.58 cond=480 F-=0.35.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW15-175 SHEET 8 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 5-22-88 FINISH 5-30-88 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above except no plant material.	
	155.0					
155.0					SAND, (SW), gray, wet, medium dense, fine to coarse grained sand, some fine 1/4 inch gravel subrounded, no plant material.	155 feet bgs water sample: T=15.6 degrees C pH=6.85 cond=318 F-=0.34. Soil: PID=0.7 ppm FID=280 max Background: PID=0 FID=1
	158.5		1.2	3-7-25 (32)		
160.0					SAND, (SW), as above.	
165.0					SAND, (SW), as above.	165 feet bgs water sample: T=17.2 degrees C pH=6.8 cond=410 F-=0.36. PID/FID detects 0/5 ppm in borehole at 165 feet bgs.
170.0						
	172.0					
	173.5		1.0	18-20-35 (55)	SAND, (SW), as above except medium dense to dense.	173 feet bgs water sample: T=14.8 degrees C pH=7.04 cond=440 F-=0.32 PID/FID 0/80
175.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW15-175 SHEET 7 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION West Side of Site Along Sundial Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 5-22-98 FINISH 5-30-98 LOGGER K. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	181 feet bgs water sample: T=14.4 degrees C pH=6.55 cond=550 F-=0.32
185.0					SAND, (SW), as above.	
190.0	191.0				SAND, (SW), as above.	
	192.5		1.5	3-12-40 (52)		191 feet bgs water sample: T=20.3 degrees C pH=7.28 cond=330 F-=0.34.
195.0					SAND, (SW), as above.	
200.0					SAND, (SW), as above. Bottom of hole at 200 feet bgs.	200 feet bgs water sample: T=13 degrees C pH=6.9 cond=382 F-=0.28.
205.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW15-175	SHEET 1 OF 1

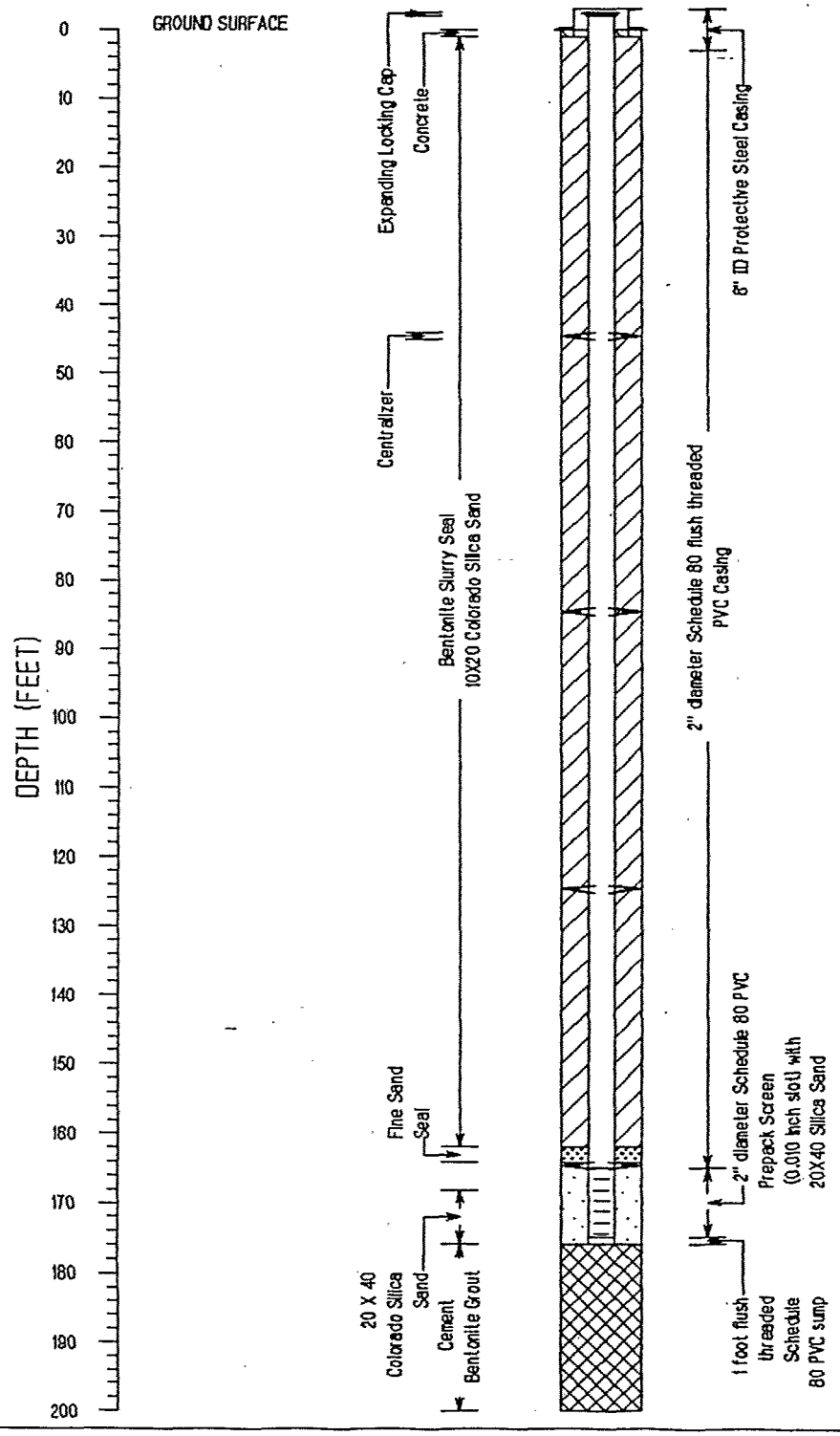
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** West Side of Site Along Sundial Road

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ **START** 5-22-98 **FINISH** 5-30-98 **LOGGER** K. Gehweiler



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.J1.02	MW16 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION South Landfill

MEASURING POINT ELEV (NGVD) 28.91 DRILLING CONTRACTOR Geo-Tech Explorations

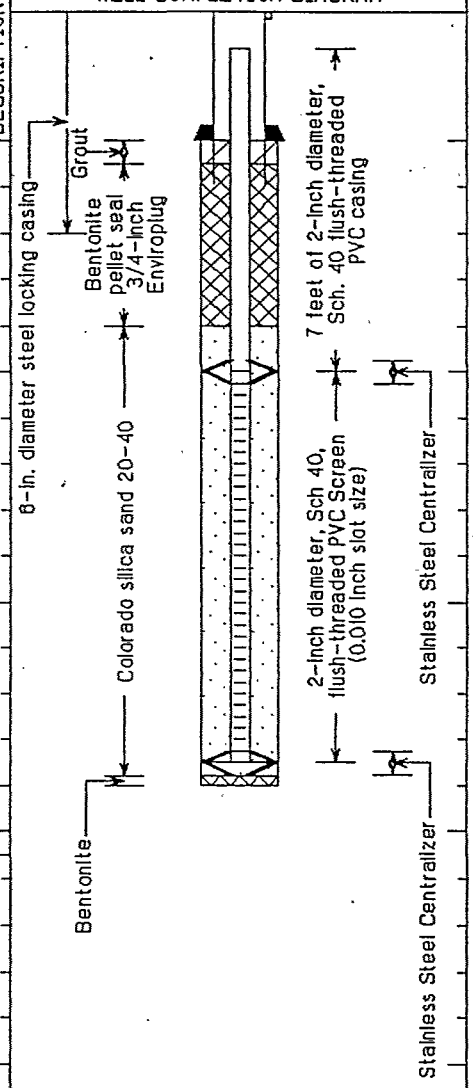
DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Auger

WATER LEVEL ELEV/DATE _____ START 7/13/95 FINISH 7/13/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Sandy Loam, Dark brown, dry, firm, 30-35% silt Comment: MW16-0000-0*	
	4.0		1.0	4-6-8 (18)	Sand, (SP), Gray to red-brown, loose, moist, small silt interbed, sand fine to med. grained Comment: MW16-0025-0*	
5.0	5.0					
	6.5		0.8	6-7-5 (18)	Sand, (SP), Gray, loose, wet, sand med. to coarse grained Comment: MW16-0050-0*	
	7.5					SP
	9.0		0.9	3-3-3 (9)	Sand, (SP), Gray, loose, wet, as above	
10.0	10.0					
	11.5		1.3	2-5-3 (10)	Sand, (SP), as above	
	12.5					
	14.0		1.5	4-5-18 (27)	Sand, (SP), as above, to 13.8 ft. (sharp contact) silt, (ML), tan, firm, damp, 100% v. fine sand	
15.0	15.5		0.8	1-1-1 (3)	Silt, (ML), Tan to gray-green, firm, wet, 10 - 15% very fine sand (to 15.0 ft) Silt, (ML), as above, gray-green, organic rich layers w/sandy silt layers (for 0.3 ft.)	ML
20.0						
25.0						

* = Soil Samples

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.K1.08	MW17-18 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company- Troutdale, OR LOCATION South Wetlands

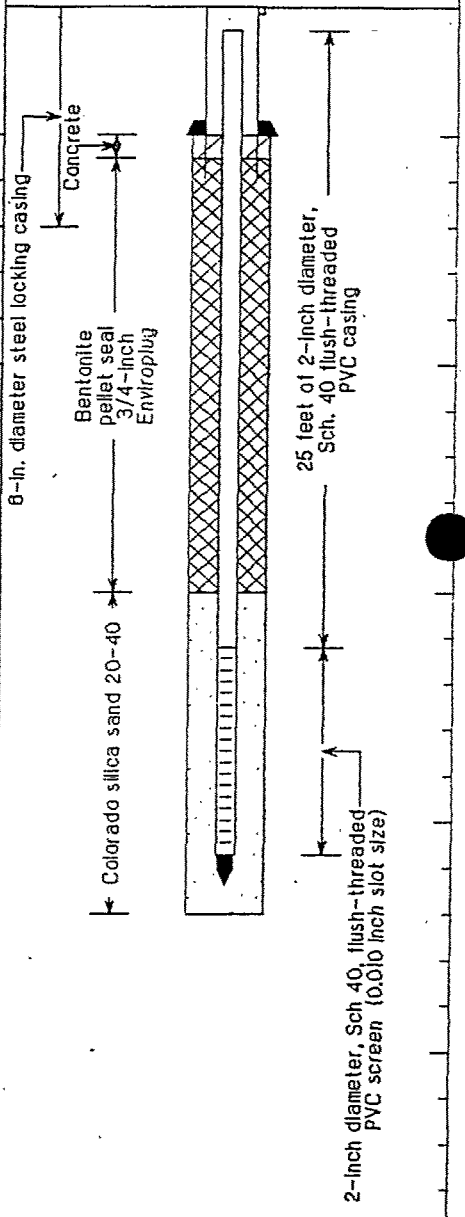
MEASURING POINT ELEV (NGVD) 27.13 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Auger

WATER LEVEL ELEV/DATE _____ START 7/21/95 FINISH 7/21/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
					Silt w/Sand, (ML), tan, dry, loose grassroots Comments: MW17-0000-0*	
	2.5					
	4.0		0.7	3-3-3 (9)	Silt, (ML), Tan-brown, dry, loose, 20% v. fine sand, L2% organic material Comment: MW17-0025-0*	
	5.0					
5.0	6.5		1.5	1-2-2 (5)	Silt, (ML), Med.-brown, as above Comment: MW17-0050-0*	
	7.5					
	9.0		1.5	1-1-2 (4)	Silt, (ML), Gray-brown w/orange mottling, firm, damp, 10 - 15% v. fine sand	
	10.0					
10.0	11.5		1.0	1-1-1 (3)	Silt, (ML), as above, wet	ML
	12.5					
	14.0		1.5	1-1-1 (3)	Silt w/Sand, (ML), Gray, firm, wet, sand fine grained	
	15.0					
15.0	16.5		1.5	1-1-1 (3)	Silt w/Sand, (ML), as above, wet Comment: Gravel to 1-inch at 15.2 ft. BGS	
	17.5					
	19.0		1.5	1-1-1 (2)	Silt w/Sand, (ML), as above, wet	
20.0					* = Soil Sample ** = Note: MW17-18 Drilled to 17 ft. BGS	
25.0					Decommissioned in Summer 1998	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.K1.02	MW17-28 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company- Troutdale, OR LOCATION South Wetlands

MEASURING POINT ELEV (NGVD) 27.30 DRILLING CONTRACTOR Geo-Tech Explorations

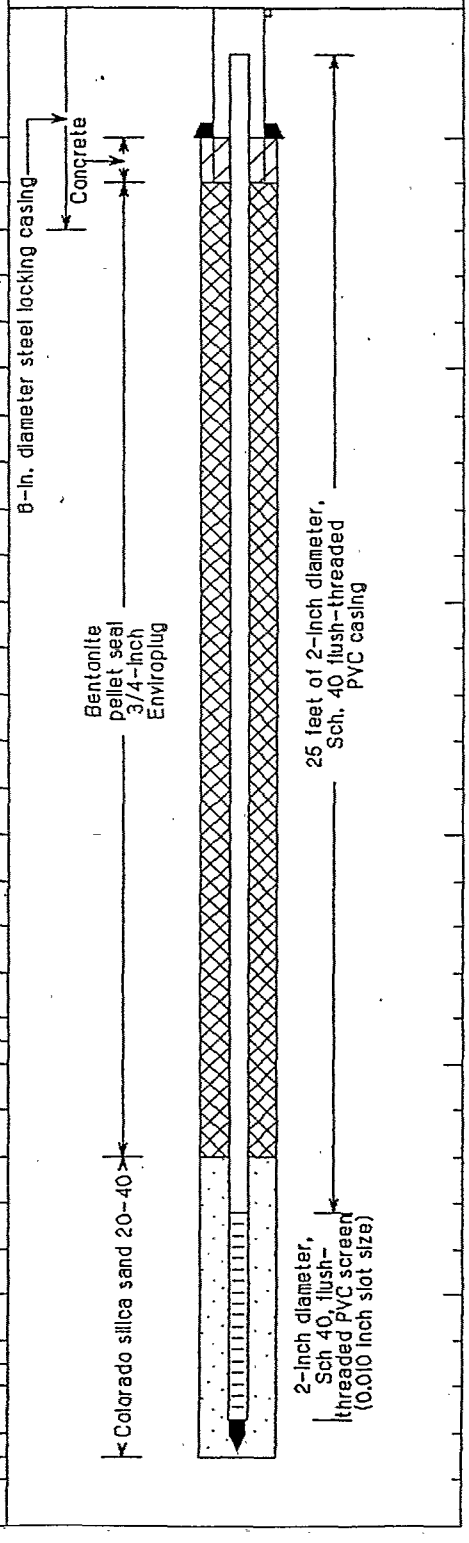
DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Auger

WATER LEVEL ELEV/DATE START 7/21/95 FINISH 7/21/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Silt w/Sand, (ML), tan, dry, loose grassroots Comments: MW17-0000-0*	
	4.0		0.7	3-3-3 (9)	Silt, (ML), Tan-brown, dry, loose, 20% v. fine sand, L2% organic material Comment: MW17-0025-0*	
5.0	5.0					
	6.5		1.5	1-2-2 (5)	Silt, (ML), Med.-brown, as above Comment: MW17-0050-0*	
	7.5					
	9.0		1.5	1-1-2 (4)	Silt, (ML), Gray-brown w/orange mottling, firm, damp, 10 - 15% v. fine sand	
10.0	10.0					
	11.5		1.0	1-1-1 (3)	Silt, (ML), as above, wet	ML
	12.5					
	14.0		1.5	1-1-1 (3)	Silt w/Sand, (ML), Gray, firm, wet, sand fine grained	
15.0	15.0					
	16.5		1.5	1-1-1 (3)	Silt w/Sand, (ML), as above, wet Comment: Gravel to 1-inch at 15.2 ft. BGS	
	17.5					
	19.0		1.5	1-1-1 (2)	Silt w/Sand, (ML), as above, wet	
20.0	20.0					
	21.5		1.5	1-1-1 (3)	Sand w/Silt, (SP-SM), Gray, loose, wet, 10 - 15% silt, sand fine- grained	SP
	22.5					
	24.0		1.5	1-2-3 (6)	Sand, (SW), Gray, loose, wet, med.-grained	SW
25.0	25.0					
	26.5		1.5	9-9-9 (27)	Sand, (SW), as above, wet	
	27.0					
	28.5		1.4	2-4-6 (12)	Silt, (ML), Gray-green, firm, wet, 5% v. fine sand	ML

* = Soil Sample

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.K1.02	MW18-16 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION South Wetlands

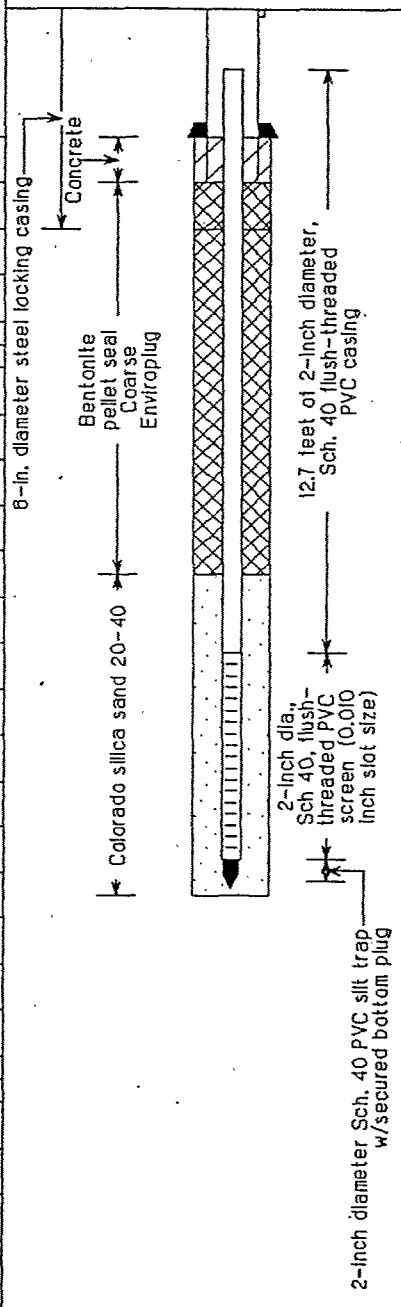
MEASURING POINT ELEV (NGVD) 23.98 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59

WATER LEVEL ELEV/DATE _____ START 7/20/95 FINISH 7/20/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.0				Sandy Loam, Tan, loose, dry, plant roots Comments: MW17-0000-0*	
	3.5		1.2	2-6-8 (16)	Sand, (SP), Gray-brown to gray, dry, loose, orange rich layers, orange mottling Comment: MW17-0020-0*	SP
	4.0					
5.0	5.5		1.2	5-8-4 (15)	Sand, (SP), as above, to 4.7 ft. sharp contact with Silt w/Sand, (ML), Tan-gray, damp, firm, orange mottling Comment: MW17-0040-0*	
	7.0		1.0	2-1-1 (4)	Silt, (ML), as above, 20% sand	ML
	8.5		1.3	1-1-1 (3)	Silt, (ML), Gray-brown w/orange mottling, firm, damp, root remnants	
	9.5					
10.0	11.0		0.9	3-2-2 (7)	Sand, (SP), Gray, loose, wet, fine to med.-grained, siltier at base	
	12.0					
	13.5		1.0	1-1-2 (4)	Sand, (SP), As above, with alternating silt-rich layers	
	14.0					
15.0	15.5		1.0	2-2-1 (5)	Sand, (SP), As above, Alternating silty sand layers	SP
	17.0					
	18.5		1.5	1-2-2 (5)	Sand w/Silt, (SP-SM), Gray-green, loose wet, alt. silt rich layers, sand fine to med.-grained	
20.0					* = Soil Sample ** = Note: MW18=16 Drilled to 16.5 ft. BGS	
25.0						

WELL COMPLETION DIAGRAM



PROJECT NUMBER	WELL NUMBER
107493.K1.02	MW18-31

SHEET 1 OF 2

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION South Wetlands

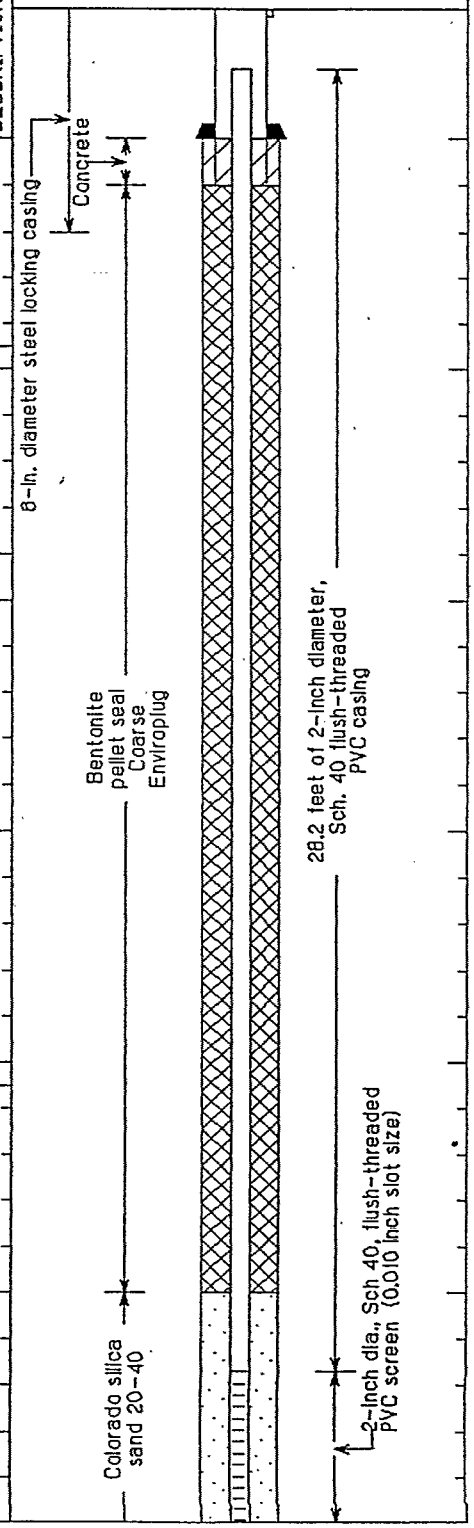
MEASURING POINT ELEV (NGVD) 23.95 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59

WATER LEVEL ELEV/DATE _____ START 7/20/95 FINISH 7/20/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
	2.0				Sandy Loam, Tan, loose, dry, plant roots Comments: MW17-0000-0*	
	3.5		1.2	2-6-8 (16)	Sand, (SP), Gray-brown to gray, dry, loose, orange rich layers, orange mottling Comment: MW17-0020-0*	SP
	4.0					
5.0	5.5		1.2	5-8-4 (15)	Sand, (SP), as above, to 4.7 ft. sharp contact with Silt w/Sand, (ML), Tan-gray, damp, firm, orange mottling Comment: MW17-0040-0*	
	7.0		1.0	2-1-1 (4)	Silt, (ML), as above, 20% sand	ML
	8.5		1.3	1-1-1 (3)	Silt, (ML), Gray-brown w/orange mottling, firm, damp, root remnants	
	9.5					
10.0	11.0		0.9	3-2-2 (7)	Sand, (SP), Gray, loose, wet, fine to med.-grained, siltier at base	
	12.0					
	13.5		1.0	1-1-2 (4)	Sand, (SP), As above, with alternating silt-rich layers	
	14.0					
15.0	15.5		1.0	2-2-1 (5)	Sand, (SP), As above, Alternating silty sand layers	SP
	17.0					
	18.5		1.5	1-2-2 (5)	Sand w/Silt, (SP-SM), Gray-green, loose wet, alt. silt rich layers, sand fine to med.-grained	
	19.0					
20.0	20.5		1.5	1-3-5 (9)	Sand w/Silt, (SP-SM) As above, wet, to 20.4 ft. BGS - sharp contact w/silt, ML, gray-green, wet, firm	
	22.0					
	23.5		1.5	3-2-4 (9)	Silt, (ML), Gray-green, very firm, damp, <5% v. fine sand	
25.0	25.0		1.5	3-3-3 (9)	Silt, (ML), As above, damp	ML
	28.5					
	28.5		1.5	3-3-5 (11)	Silt, (ML), As above, damp Comment: One carbonized wood fragment	
	30.0		1.0	3-3-8 (14)	Silt, (ML), As above, to 28-ft. sand w/silt, (SP-SM), gray-green, wet loose	SP

WELL COMPLETION DIAGRAM



PROJECT NUMBER	WELL NUMBER
107493.K1.02	MW18-31 SHEET 2 OF 2

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION South Wetlands

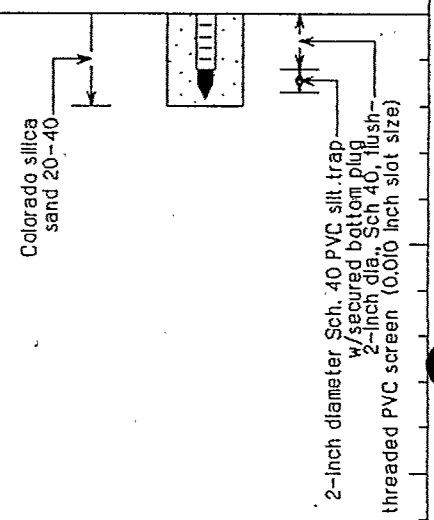
MEASURING POINT ELEV (NGVD) 23.95 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59

WATER LEVEL ELEV/DATE _____ START 7/20/95 FINISH 7/20/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	31.5				Sand (SP-SM) to 31.5 Ft. BGS (as above)	SP
	33.0		1.3	1-2-2 (5)	Silt, (MH), Gray, loose, wet, 20% clay, elastic	MH
	34.5					
35.0	38.0		0.5	2-2-3 (7)	Sand, (SP), Gray, wet, loose, sand med.-grained Comment: Possible sand according to driller	SP
					* = Soil Sample	
40.0						
45.0						
50.0						
55.0						

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.J1.02	MW19 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION South Landfill

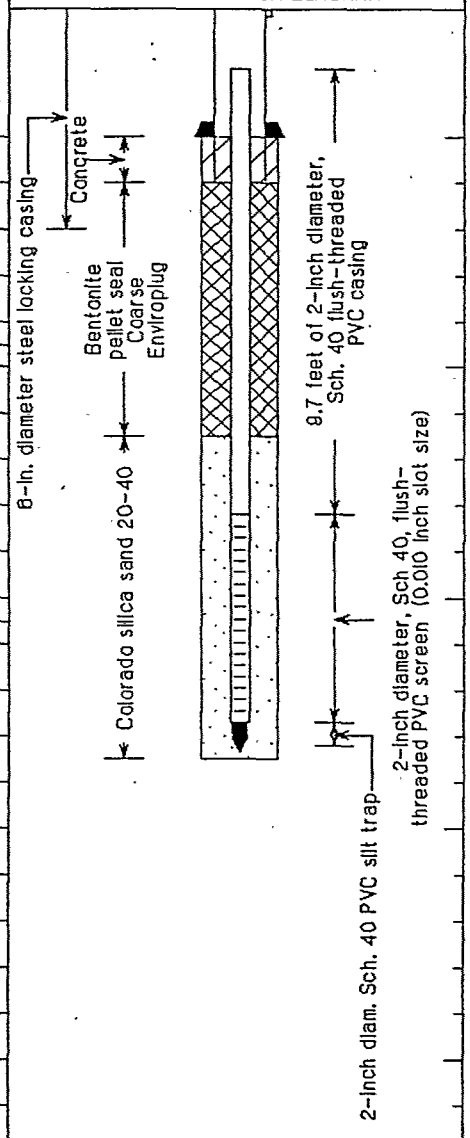
MEASURING POINT ELEV (NGVD) 27.10 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT 8-1/4" ID HSA - Mobile Drill B-59

WATER LEVEL ELEV/DATE _____ START 7/21/95 FINISH 7/21/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	USCS DESCRIPTION
	2.5				Loose Fill, Sandy loam w/debris, brown, dry Comment: MW19-0000-0*	
	4.0		1.0	4-7-7 (18)	Sand, (SP), Gray w/orange mottling, loose, dry, fine- to med.- grained Comment: MW19-0025-0*	SP
5.0	5.0					
	6.5		8.0	7-7-9 (23)	Sand, (SW), Gray, loose, moist, med.-grained	
	7.5					
	9.0		1.0	6-7-4 (17)	Sand, (SW), As above, fining downward to silt w/sand, (ML), tan, firm, wet, at 8.5 ft. Comment: MW19-0075-0*	SW
10.0	10.0					
	11.5		0.8	4-2-1 (7)	Sand, (SW), Gray, loose, wet, med.-grained (to 10.5 ft.) sharp contact w/silt w/sand, (ML), tan, firm, wet, 20% v. fine sand	
	12.5					
	14.0		1.2	2-1-1 (4)	Silt, (ML), Gray-green, firm, wet * = Soil Samples	ML
15.0						
20.0						
25.0						

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.N1.02	MW20 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Company Lake

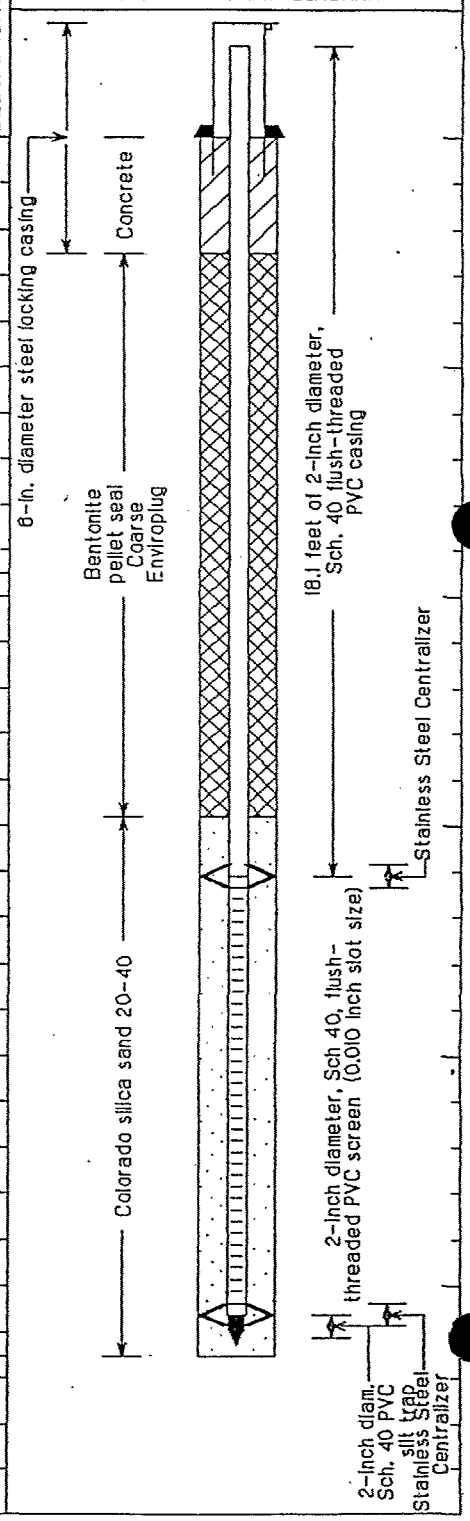
MEASURING POINT ELEV (NGVD) 28.48 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT 8-1/4" ID HSA

WATER LEVEL ELEV/DATE _____ START 9/1/95 FINISH 9/1/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
					0-0.5 ft. gravel for road 0.5 ft. silty loam w/plant roots	
	2.5 – 4.0		0.5	2-3-3 (8)	Silt, (ML), Brownish gray; (5 yr 4/1) to lt. brownish-gray (5 yr 6/1), damp, firm	
5.0	5.0 – 6.5		0.5	3-4-4 (11)	Silt, (ML), as above, dusky yellowish-brown (10 yr 2/2)	ML
	7.5 – 9.0		1.0	2-2-4 (8)	Silt w/Sand, (ML), Brownish-gray, (5 yr 4/1), Moist, firm, 15% very fine sand	
10.0	10.0 – 11.5		0.8	3-4-5 (12)	Sand, (SP), Brownish-gray (5 yr 4/1) damp, loose, fine-medium grained	
	12.5 – 14.0		0.8	4-3-6 (13)	Sand, (SP), As above, medium to coarse grained, damp	
15.0	15.0 – 16.5		0.7	4-4-6 (14)	Sand, (SP), As above, damp	
	17.5 – 19.0		1.0	7-6-5 (18)	Sand, (SP), As above, wet	SP
20.0	20.0 – 21.5		1.2	1-4-7 (12)	Sand, (SP), As above, wet	
	22.5 – 24.0				No Sample	
25.0	25.0 – 26.5			2-2-3 (7)	Sand, (SP), As above, wet	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.N1	MW21-12

SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION North Landfill

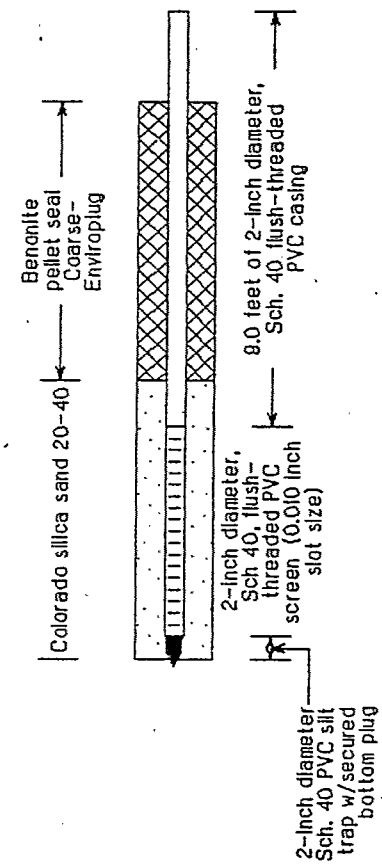
MEASURING POINT ELEV (NGVD) 24.54 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT 8-1/4" ID HSA

WATER LEVEL ELEV/DATE _____ START 9/5/95 FINISH 9/5/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Silty Loam, Brown, loose, damp	
	4.0		0.8	5-6-6 (17)	Silt, (ML), Gray w/orange mottling, damp, firm, plant roots	
5.0	5.0					
	6.5		0.0	5-27-20 (52)	No Recovery, Rig bringing up metal fragments; SPT clogged w/wood	ML
	7.0					
	8.5		0.5	2-1-1 (4)	Silt, (ML), Black to dark gray, wet, firm, wood grags., plastic, metal	
	9.0					
10.0	10.5		1.5	1-1-1 (3)	Silt, (ML), Gray w/ black mottling, wet, firm, carbonized wood frags	
					12 FOOT TOTAL DEPTH DRILLED	
15.0						
20.0						
25.0						

WELL COMPLETION DIAGRAM



Decommissioned in 1998

CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.N1.02	MW21-25 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION North Landfill

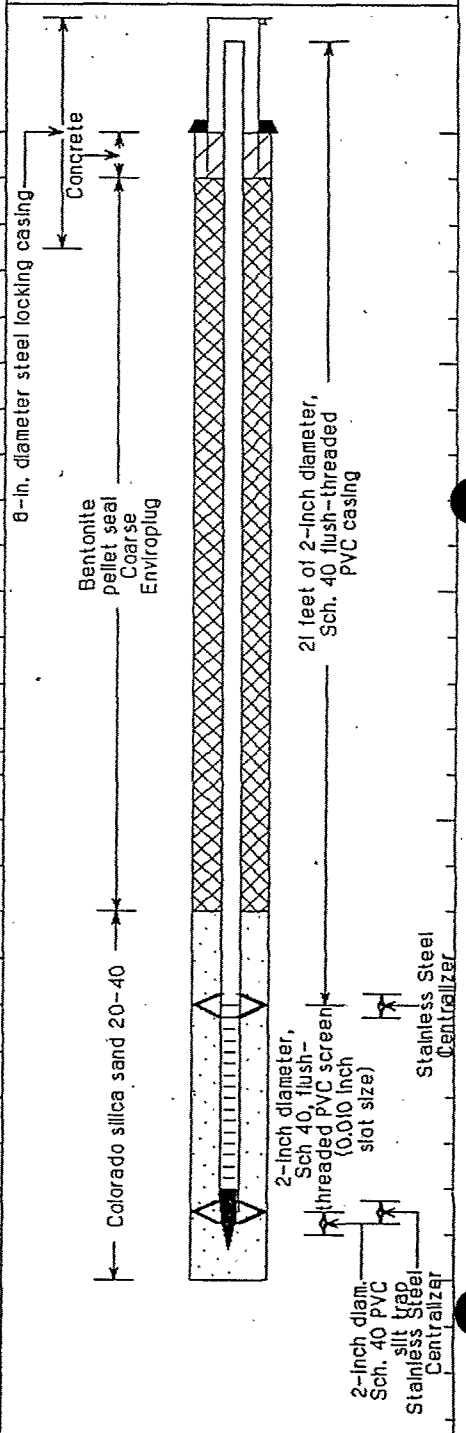
MEASURING POINT ELEV (NGVD) 24.8 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT 8-1/4" ID HSA

WATER LEVEL ELEV/DATE _____ START 9/5/95 FINISH 9/5/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Silty Loam, Brown, loose, damp	
	4.0		0.8	5-6-6 (17)	Silt, (ML), Gray w/orange mottling, damp, firm, plant roots	
	5.0					
5.0	6.5			4-2-3 (9)	No Recovery - Wood frag. in split spoon	
	7.5					ML
	9.0			8-4-2 (14)	No recovery	
	10.0					
10.0	11.5		0.5	1-2-2 (5)	Silt, (ML), Gray w/orange mottling, firm, wet	
	13.0			3-1-2 (6)	No recovery in SPT-3 inch spoon Silt, (ML), Gray, loose, wet, 10-15% wood frags	
	14.5		1.0	6-5-4 (15)	Silt, (ML) As above, to 14 ft. Sand, (SP), Red to gray red, loose, dry, sand fine to med. grained	
15.0	16.0		0.8	3-4-5 (12)	Sand, (SP), Gray-brown to gray, loose, wet, sand med. grained	
	17.5					
	19.0		1.0	3-1-2 (6)	Sand (SP), Gray, loose, wet, med. grained, silt ~5%	
	20.0					
20.0	21.5		1.0	1-2-7 (10)	Sand, (SP), As above, wet	SP
	22.5					
	24.0		1.0	4-4-2 (10)	Sand, (SP), As above, wet	
	25.0					
25.0	26.5			2-2-4 (8)	Sand, (SP), As above, wet	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW21-083 SHEET 1 OF 3

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch ID Steel Casing

WATER LEVELS _____ START 9-30-98 FINISH 10-1-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1.5 feet: Crushed basalt fill.	Driller adds water to bail out hole.
					SILT, (ML), brown, damp, firm. Hit root at 4 feet.	
5.0					SAND, (SW), yellow brown, moist, very loose, medium to fine grained, no silt.	
10.0	10.0					
	11.5		1.5	4-4-8 (10)	SAND, (SW), as above, except wet, loose.	
15.0					SAND, (SW), as above, except fine to coarse grained.	Casing advancing easily; add water to bail hole.
20.0						
25.0	25.0					
	28.5		1.5	4-4-8 (12)	SAND, (SW), as above, except medium to coarse grained.	25 feet bgs water sample: T=18.5 degrees C pH=8.88 cond=348 F-=8.8

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW21-083 SHEET 2 OF 3

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch ID Steel Casing

WATER LEVELS _____ START 9-30-86 FINISH 10-1-86 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35.0					SAND, (SW), as above, except fine to medium grained.	
40.0	40.0					
	41.5		1.5	4-12-12 (24)	SAND, (SW), gray brown, wet, medium dense, fine to medium grained.	
45.0					SAND, (SW), as above, except trace coarse grains, mica flakes, and red grains of sand.	
50.0	50.0					
	51.5		0.8	2-3-4 (7)	SAND, (SW), as above except trace wood fragments, very loose.	50 feet bgs water sample: T=14.0 degrees C pH=8.4 cond=338 F-=0.84
55.0					SAND, (SW), as above except loose, with 5 percent silt.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW21-063 SHEET 3 OF 3

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 6-inch ID Steel Casing

WATER LEVELS _____ START 9-30-86 FINISH 10-1-86 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	
	65.0					
65.0					SAND, (SW), as above except 20 percent wood fragments.	65 feet bgs water sample: T=14.3 degrees C pH=7.42 cond=400 F-=0.34
	66.5		0.6	3-3-3 (6)	Total depth equals 65 feet.	
70.0						
75.0						
80.0						
85.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D6.02	MW21-063	SHEET 1 OF 1

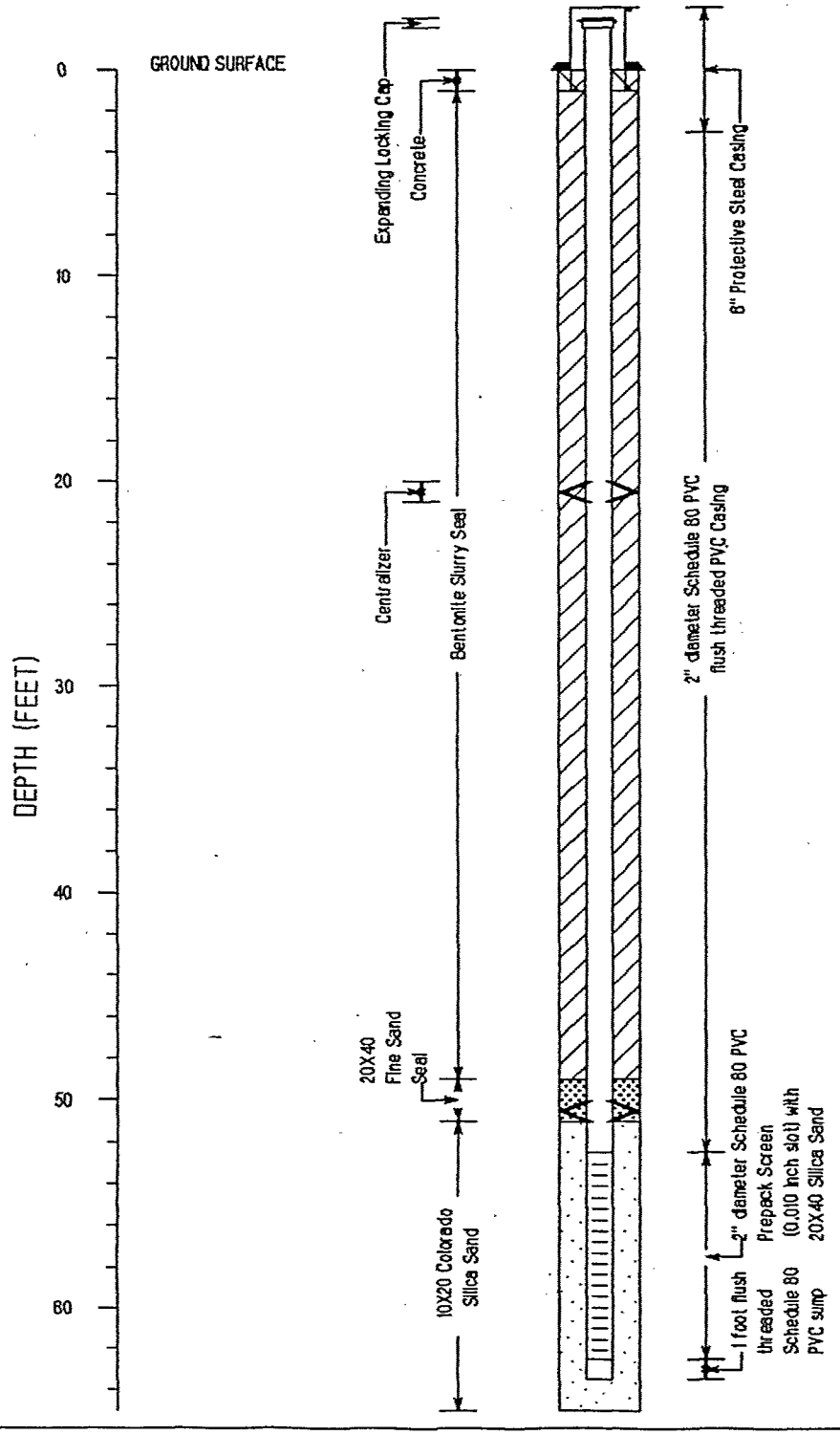
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Northeast Corner of NLF

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool; Drilling 8-inch ID Steel Casing

WATER LEVELS _____ **START** 10-1-98 **FINISH** 10-1-98 **LOGGER** T. Gehweiler



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW21-178 SHEET 1 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-6-96 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1.5 feet: Crushed basalt fill.	Driller adds approximately 10 gallons of water.
	5.0					
5.0	6.5		0.9	1-3-7 (10)	SILT, (ML), dark yellowish brown (10yr 4/2), damp, firm, orange, mottling;	Drilled open hole 5-12 feet bgs.
	7.5				Sharp contact at 8 feet bgs with SAND, (SW), moderate yellow brown (10yr 5/4), damp, loose, fine-medium-grained, poorly rounded.	
	8.5		1.4	6-8-8 (16)	SAND, (SW), dark yellow brown (10yr 4/2), wet, loose, fine-medium- grained, poorly rounded.	
	10.0					
10.0	11.5		1.0	6-7-8 (15)	SAND, (SW), brownish gray (5yr 4/1), wet, loose, fine-coarse- grained, trace (less than 1 percent) wood fragments.	Driller reports increased permeability. 12 feet bgs water sample: T=11.8 degrees C pH=8.02 cond=350 F-=5.30.
	15.0				SAND, (SW), as above.	
15.0	18.5		0.8	3-4-5 (9)	SAND, (SW), as above, except trace of wood fragments.	10-inch casing total depth = 18 feet bgs.
	20.0					Driller adds 10 gallons of water.
20.0	21.5		1.0	1-1-3 (4)	SAND, (SW), as above.	Driller reports heaving sand in casing. Casing advances easily.
	24.5					
25.0	28.0		1.2	5-9-10 (19)	SAND, (SW), as above, except medium-coarse-grained, trace gravel (to 1-inch diameter)	
						29 feet bgs water sample: T=17 degrees C pH=8.31 cond=550 F-=2.81. Driller reports 10 feet of heaving sand in casing.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW21-178 SHEET 2 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-8-88 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above, except fine-medium-grained.	Small silt fragments, sample from strainer.
	35.0					
35.0	36.5		1.4	8-8-10 (18)	SAND, (SW), dark gray (N3), wet, loose, fine-medium grained, poorly rounded.	Driller reports heaving sand in casing - silt fragments in bailer casing advances easily.
40.0					SAND, (SW), as above, except trace of wood fragments.	Driller reports heaving sand in casing (12 feet).
45.0	48.0				SAND, (SW), as above, except trace of wood fragments and gravel.	45 feet bgs water sample: T=11.2 degrees C pH=8.40 cond=420 F-=0.59. Sample from strainer
	49.5		1.4	11-11-12 (23)		Driller adds 15 gallons of water, casing advances easily.
50.0	54.0				SAND, (SW), as above.	
55.0	58.0		1.2	3-4-6-4 (10)	SAND, (SW), dark gray (N3), wet, loose, fine-medium-grained, poorly rounded, with 5 percent silt.	
						Driller reports 5 feet heaving sand in casing.
						58 feet bgs water sample: T=12 degrees C pH=8.45 cond=850 F-=0.28.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW21-176 SHEET 3 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-8-88 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	Sample from strainer.
65.0	65.0					
	67.0		1.3	2-4-4-8 (12)	SAND, (SW), as above.	
					GRAVEL with SAND, (GW), dark gray (N3), wet, loose, moderately well rounded, up to 1-inch diameter. Approximately 20 percent sand (medium to coarse-grained). Silt less than 20 percent at 69 feet bgs.	Drilling open hole, bailing weathered basalt fragments, drilling and casing advancing slowly, driller reports gravel/sand heaving into casing.
70.0						70 feet bgs water sample: T=12.9 degrees C pH=6.66 cond=370 F-=0.29.
						Begin air rotary drilling at 70 feet bgs on 5-13-88. Soil sample collected with strainer.
75.0					GRAVEL with SAND, (GW), as above.	Very permeable (Hole producing greater than 50 percent gpm.
80.0					GRAVEL, (GW), dark gray (N3), wet, dense, moderately well-rounded, primarily basalt.	80 feet bgs water sample: T=14.5 degrees C pH=6.85 cond=350 F-=0.28.
85.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW21-176 SHEET 4 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-8-96 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	Hole producing greater than 50 gpm, no evidence of cement in cuttlings.
					GRAVEL, (GW), dark gray (N3) with olive gray (5yr 3/2) cement, wet, dense, gravel moderately well-rounded, primarily basalt partially cemented.	Lower permeability (approximately 10 gpm).
95.0						
					GRAVEL, (GW), grayish black (N2), wet very dense.	Driller reports very hard drilling, cuttings 90 percent crushed basalt, likely from cobbles, hole producing less than 1 gpm, no evidence of cement.
100.0						100 feet bgs water sample: T=18.2 degrees C pH=7.09 cond=230 F-=0.52
105.0						
					GRAVEL, (GW), dark gray (N3) with olive gray (5yr 3/2) cement, wet, dense, gravel moderately well rounded, partially cemented.	Permeability increases slightly (approximately 2 gpm), cement evident on gravel, drilling rate increases.
110.0						
115.0						Permeability increases (approximately 5 gpm).

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW21-176 SHEET 5 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-6-86 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	120 feet bgs water sample: T=17 degrees C pH=7.06 cond=210 F-=0.38
125.0					GRAVEL, (GW), as above.	
130.0					GRAVEL, (GW), as above.	
135.0					GRAVEL, (GW), as above.	Discharge increase to 10-15 gpm less cement evident, percentage of basalt gravel decreases.
140.0					GRAVEL, (GW), as above.	140 feet bgs water sample: T=15 degrees C pH=6.73 cond=250 F-=0.57
145.0					GRAVEL, (GW), as above.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW21-178 SHEET 8 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-8-88 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	More cement evident in cuttings
					SAND, (SW), dusky yellow (5yr 6/4), wet, loose, fine-to-coarse- grained, mica flakes, 5 percent gravel.	Driller reports sand heaving into casing, and increased permeability.
165.0					SAND with GRAVEL, (SW), olive gray (5yr 3/2), wet, loose, fine to coarse-grained, gravel moderately well-rounded.	
180.0						180 feet bgs water sample: T=12.1 degrees C pH=7.22 cond=210 F-=0.28
					SAND with GRAVEL, (SW), as above.	
185.0					SAND, (SW), light olive gray (5yr 5/2), wet, loose, medium to very coarse grained, large mica flakes, trace of gravel.	Driller reports sand heaving into casing producing greater than 50 gpm.
170.0					SAND, (SW), as above.	
175.0					SAND, (SW), as above.	

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW21-178 SHEET 7 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-6-88 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	180 feet bgs water sample: T=12.2 degrees C pH=7.45 cond=220 F--=0.29
					SAND with GRAVEL, (SW), light olive gray (5yr 5/2) wet, loose, fine to coarse grained sand and gravel, rounded to angular gravel, large micas.	Driller reports sand heaving into casing producing greater than 50 gpm.
185.0					SAND, (SW), dusky yellow (5yr 6/4), wet, loose, fine to coarse grained, mica flakes, trace of gravel, small, rounded.	Driller reports sand heaving into casing producing greater than 50 gpm.
190.0					SAND, (SW), medium light gray (N6), wet, loose, medium to coarse grained sand, large mica flakes, trace of gravel less than 5 percent.	Driller reports sand heaving into casing producing greater than 50 gpm. Some pieces of wood from 195 feet.
195.0					SAND with GRAVEL, (SW), medium light gray (N6) wet, loose, fine to coarse-grained, rounded gravels, large micas.	Driller reports casing becoming harder to rotate.
200.0						200 feet bgs water sample: T=12.8 degrees C pH=7.27 cond=138 F--=0.298
205.0					SILT, (ML) grayish olive green (5yr 3/2), wet, very firm, slightly plastic, trace of sand.	Formation producing no water.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW21-178 SHEET 8 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-8-98 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SILT, (ML) as above to 215 feet bgs.	Producing approximately 20 gpm.
215.0					SAND, (SW), grayish olive green (5yr 3/2), wet, loose, fine to coarse-grained, mica flakes, grading to 218 feet.	Percentage of gravel increases with depth to 217 feet bgs.
						Gravel at 218 feet bgs.
					GRAVEL, (GW), dark gray (N3), wet, loose, moderately well rounded, gravel to 2-inch, 5 percent sand.	Producing greater than 80 gpm.
220.0						220 feet bgs water sample: T=13 degrees C pH=7.8 cond=140 F-=0.25
225.0					GRAVEL, (GW), as above.	Producing greater than 80 gpm.
230.0					GRAVEL, (GW), as above.	
						234 feet bgs water sample:
235.0					GRAVEL, (GW), as above.	T=14 degrees C pH=7.70 cond=130 F-=0.28
						Producing greater than 80 gpm.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW21-176 SHEET 9 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-8-98 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	
					GRAVEL, (GW), as above.	
245.0					SILT, (ML), olive gray (5yr 4/1) wet, firm.	
					SAND, (SW), dark greenish gray (5yr 4/1), wet, loose, fine-to- coarse-grained, trace of gravel, wood fragments, grading at 250.	
250.0					GRAVEL, (GW), with sand, dark gray (N3), wet, loose, gravel, poorly rounded, trace of wood fragments.	Producing greater than 50 gpm.
255.0					SAND, (SW), medium gray (N5), wet, loose, fine-to-coarse-grained, mica flakes, trace wood fragments, 10 percent silt.	Driller reports sand heaving into casing producing approximately 40 gpm.
						260 feet total depth 5/14/98.
260.0					SAND, (SW), as above, except no silt.	260 feet bgs water sample: T=15 degrees C pH=8.25 cond=130 F-=0.27
265.0					SAND, (SW), as above.	Producing approximately 70 gpm, sand is heaving into casing.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW21-178 SHEET 10 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-8-98 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), dark gray (N3), wet, very dense, partially-cemented, moderately well-rounded, primarily basalt.	Cuttings primarily crushed basalt, driller reports very hard drilling, producing approximately 120 gpm.
275.0						
						277 feet bgs water sample: T=18.1 degrees C pH=7.72 cond=130 F-=0.21
280.0					GRAVEL, (GW), as above.	
						Producing approximately 120 gpm, drilled open hole 280-285 ft bgs.
285.0					SAND, (SW), medium gray (N5), wet, loose, fine-to-medium-grained, mica flakes, trace wood fragments, less than 1 percent gravel.	
290.0					SAND, (SW), as above.	Producing approximately 50 gpm, driller reports sand heaving into casing.
295.0					SAND, (SW), as above.	
						Note: Removed 4 cubic yards of sand from 280-300 feet bgs.

PROJECT NUMBER	BORING NUMBER
107483.06.02	MW21-176 SHEET 11 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-8-88 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	300 feet bgs water sample: T=18.1 degrees C pH=8.29 cond=170 F-=0.16 Driller reports sand heaving into casing producing approximately 50 gpm.
305.0					SAND, (SW), as above.	
310.0					SAND, (SW), as above, except with 5 percent gravel.	
315.0					SAND, (SW), as above, except with 5 percent silt.	Note: Removed 4 cubic yards of sand from 300-320 feet bgs.
320.0					SAND, (SW), as above, except 10 percent gravel.	320 feet bgs water sample: T=18 degrees C pH=7.84 cond=198 F-=0.32
					GRAVEL, (GW), dark gray (N3), wet, very dense, moderately well rounded, primarily basalt, 10-15 percent sand, partially cemented, trace wood fragments.	Driller reports very slow drilling rate. Producing greater than 100 gpm.
325.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW21-178 SHEET 12 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-6-98 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	Driller reports very slow drilling rate. Producing greater than 100 gpm.
335.0					GRAVEL, (GW), as above.	
						340 feet total depth on 5/15/98.
340.0					GRAVEL, (GW), as above.	340 feet bgs water sample: T=18.7 degrees C pH=7.81 cond=180 F--=0.28
345.0					Basalt grayish black (N2), wet, very dense, fragmented, sharp edges, small pieces, very small amount sand grains less than 2 percent.	Drilling open hole producing roughly 1-2 gpm. Driller believes sand came in from above.
360.0					Basalt, as above, except no fines present.	
365.0					Basalt, as above, except with small fragments of silt stone (light olive gray (5yr 8/1) angular less than 5 percent, present for 1 foot to .5 foot.	Driller noted that there was a slight quick drop after going through section which showed siltstone fragments.

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW21-176 SHEET 13 OF 13

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-8-96 FINISH _____ LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						360 feet bgs water sample: T=20.2 degrees C pH=8.54 cond=290 F-=0.19
					Basalt, as above.	
					End of Boring	
365.0						
370.0						
375.0						
380.0						
385.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW21-178 SHEET 1 OF 1

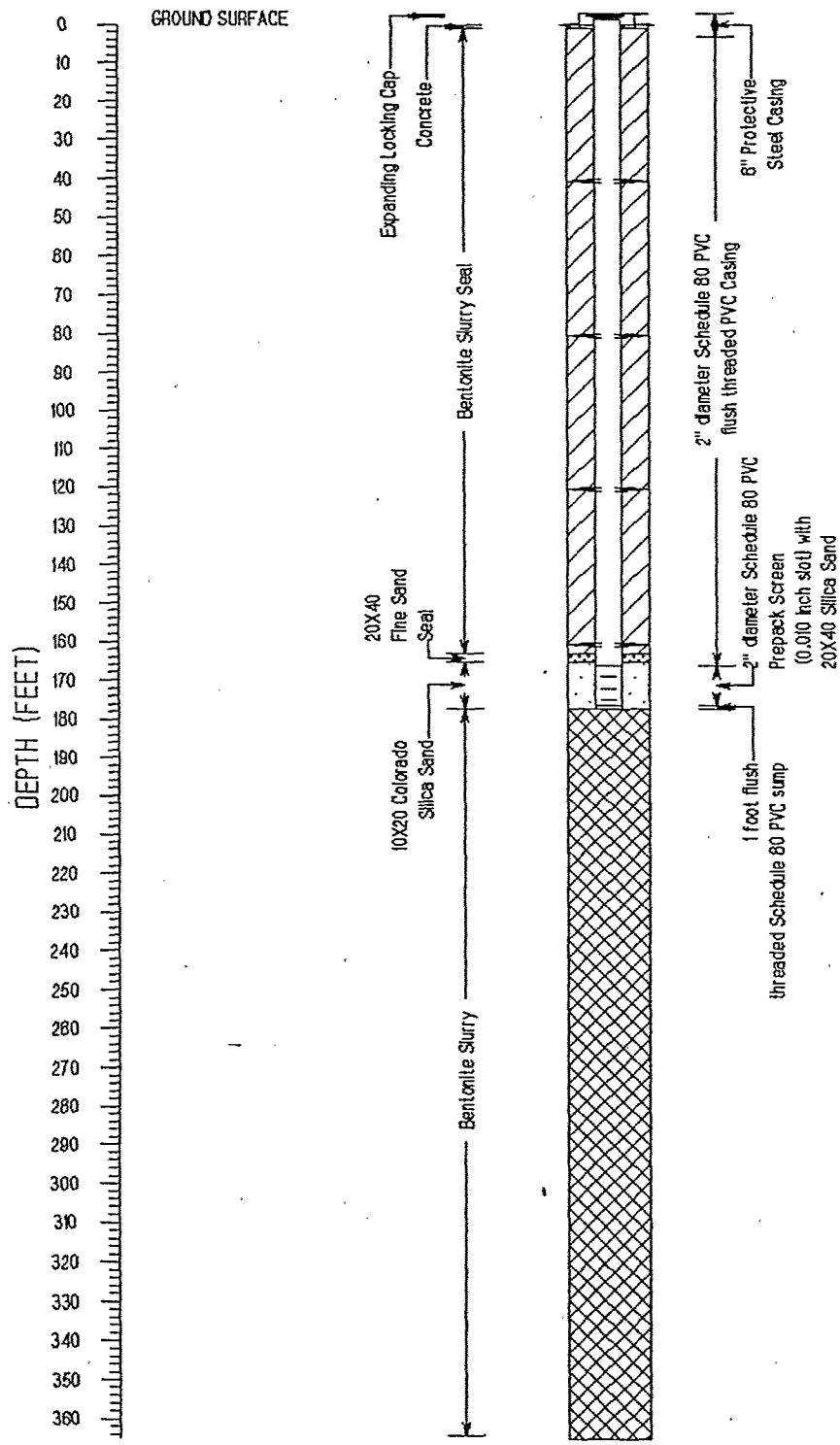
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of NLF

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool Air Rotary;

WATER LEVELS _____ START 5-6-86 FINISH _____ LOGGER I. Gall



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.N1.02	MW22 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company – Troutdale, OR LOCATION North Landfill

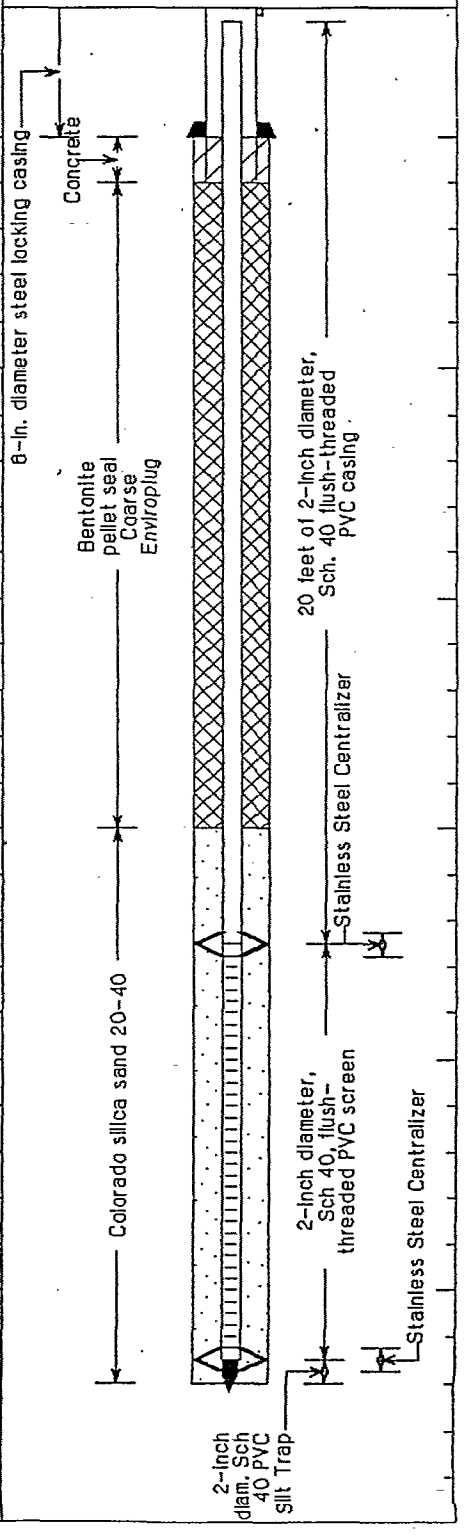
MEASURING POINT ELEV (NGVD) 25.35 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT 8-1/4" ID HSA

WATER LEVEL ELEV/DATE _____ START 9/8/95 FINISH 9/8/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Silty Loam, Mod. yellow-brown (10 yr 5/4), loose, dry	
	4.0		1.0	4-4-4 (12)	Silt, (ML), Dusky brown (5 yr 2/2), damp, firm, ~5% fine- grained sand	ML
	5.0					
5.0	6.5		0.5	2-2-4 (6)	Silt w/Sand, (ML), Mod. yellow-brown (10 yr 5/4), Damp, firm, to 6 ft. – Sand w/Silt, (SP), Mod. yellow-brown (10 yr 5/4), damp loose, sand fine grained	
	7.5					
	9.0		1.0	3-4-6 (13)	Sand, (SP), As above, damp, 5-10% silt	
	10.0					
10.0	11.5		1.0	5-7-7 (19)	Sand, (SP), Brownish gray, (5 yr 4/1), damp, loose, fine grained coarsening downwards to med. grained	
	12.5					
	14.0		1.0	4-4-6 (14)	Sand, (SP), As above, damp	
	15.0					
15.0	16.5		0.9	2-3-3 (8)	Sand, (SP), As above, wet	
	17.5					SP
	19.0			3-5-6 (14)	Sand, (SP), As above, wet	
	20.0					
20.0	21.5		–	2-2-4 (6)	Sand, (SP), As above, wet	
	22.5					
	24.0			1-2-2 (5)	Sand, (SP), As above, wet	
25.0	26.5				Sand, (SP), As above, wet, silt-rich layer at 26.5 ft. BGS	
	28.0			1-5-5 (11)		

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.NI	MW23 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION North Landfill

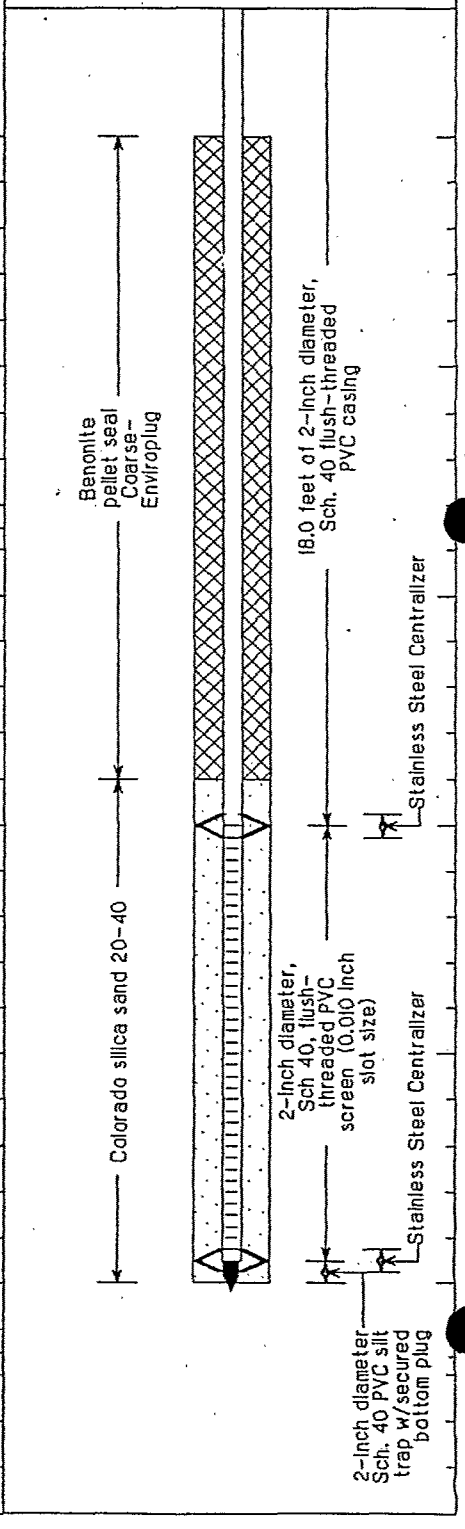
MEASURING POINT ELEV (NGVD) 28.41 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT 8-1/4" ID HSA

WATER LEVEL ELEV/DATE _____ START 9/1/95 FINISH 9/1/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
					Silty Loam, Grass roots	
					Comment: TMW22-0000-0*	
	2.5					
	4.0		0.8	4-6-7 (17)	Silt, (ML), Brownish-gray (5 yr 4/1), damp, firm	
					Comment: TMW22-0025-0*	ML
	5.0					
5.0					Silt, (ML), As above, damp	
	8.5		1.0	2-5-7 (14)	Comment: TMW22-0050-0*	
	7.5					
	9.0		1.0	2-6-5 (13)	Silt, (ML) As above, coarsening downwards to sand (SP), brownish-gray (5 yr 4/1), damp, loose, fine to med.-grained sand at 8.5 ft.	
	10.0					
10.0					Sand, (SP), As above, damp	
	11.5		1.0	1-2-4 (7)		
	12.5					
	14.0		1.1	2-2-5 (9)	Sand, (SP), As above, damp	
	15.0					
15.0					Sand, (SP), As above, wet, alternating fine and med.- to coarse- grained layers	
	16.5		1.2	2-2-4 (8)		
	17.5				Comment: Columbia & Sandy (Crs.) sands	
	19.0		1.2	2-2-3 (7)	Sand, (SP), As above, wet, med.- to coarse-grained	SP
	20.0				Comment: Sandy river sand	
20.0					Sand, (SP), As above, wet	
	21.5		1.0	1-2-2 (5)		
	22.5					
	24.0		1.5	6-8-8 (22)	Sand, (SP), As above, wet	
	25.0					
25.0					Sand, (SP), As above, wet	
	26.5			2-6-9 (17)		
					25 FEET TOTAL DEPTH DRILLED	
					* = Soil Sample	

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.H1.02	MW24 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Scrap Yard

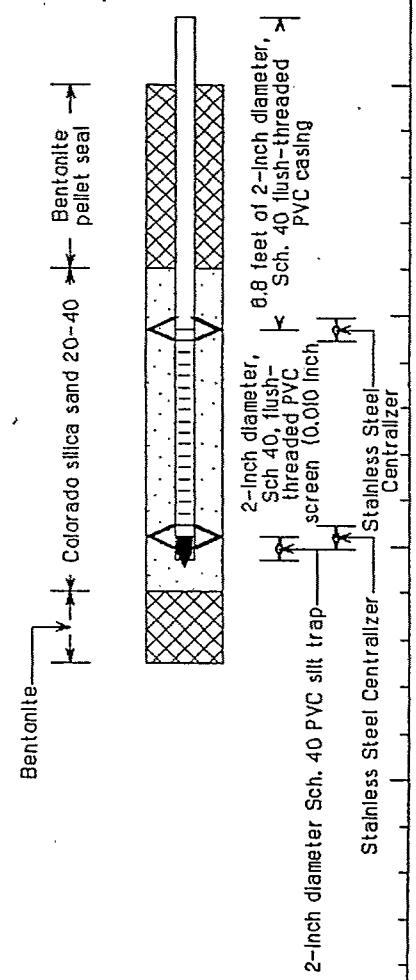
MEASURING POINT ELEV (NGVD) 30.13 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Augers

WATER LEVEL ELEV/DATE _____ START 7/12/95 FINISH 7/12/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Sand w/Debris, Black, loose, dry Comment: TMW01-0000-0*	SW
	4.0		1.4	3-3-2 (8)	Sand, (SW), Lt. brown, damp, loose, fine to med.-grained	
	5.0					
5.0	6.5		1.5	2-2-1 (5)	Sand w/Silt, (SP-SM), Med.-brown, damp to wet (at 6 ft.), loose, sand fine-grained, ~30% silt	SP
	7.5					
	9.0		1.4	2-5-7 (14)	Sand, (SP), Med.-brown, wet, loose, fine- to med.-grained at 8.5	
	10.0					
10.0	11.5		1.2	1-1-1 (3)	Sand, (SP), As above, to 10.5 ft. silt, (ML), tan orange to dark gray, firm, wet, FeO concretions, slightly plastic	ML
	12.5					
	14.0		1.4	1-1-3 (5)	Silt, (ML), Dark gray-green, firm, damp, slightly plastic, 10 - 15% clay	
15.0					* = Soil Samples	
20.0						
25.0						

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.H1.02	MW25-24 SHEET 1 OF 2

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Scrap Yard

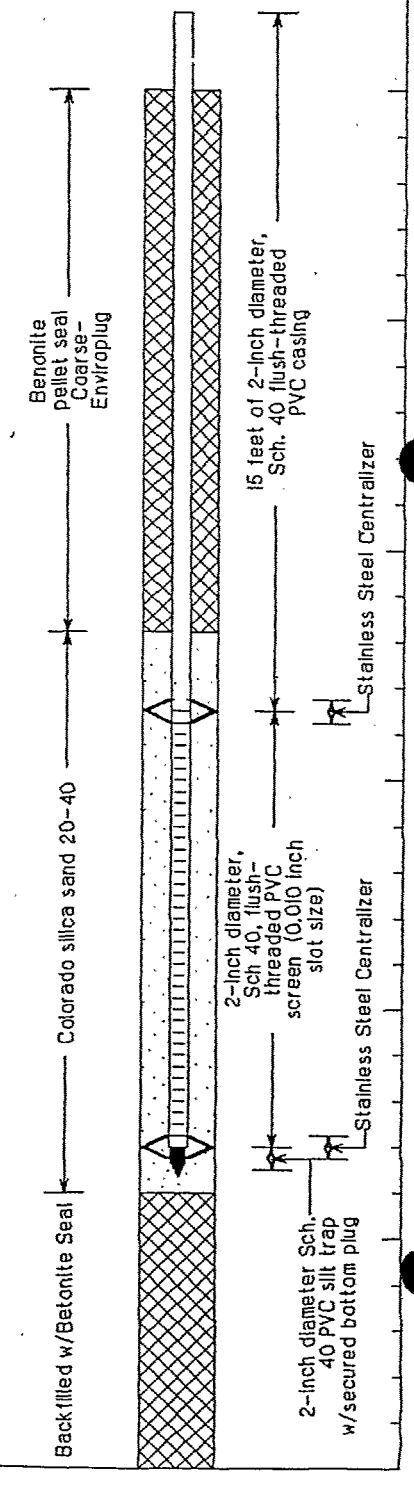
MEASURING POINT ELEV (NGVD) 31.14 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Augers

WATER LEVEL ELEV/DATE _____ START 7/12/95 FINISH 7/12/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Sand, (SP), Brown-gray, loose, dry Comment: Refractory brick to 1 ft. TMW02-0000-0*	
	4.0		1.3	4-4-3 (11)	Sand, (SP), Tan-brown, loose, dry, fine- to med.-grained, 5 - 10% silt Comment: TMW02-0025-0*	SP
5.0	5.0					
	6.5		1.3	2-2-1 (5)	Sand, (SP), As above, damp Comment: TMW02-0050-0*	
	7.5					
	9.0		1.0	3-3-2 (8)	Silt, (ML), Brown w/orange mottling, firm, wet, 10 - 15% v. fine sand	
10.0	10.0					
	11.5		1.5	1-1-1 (3)	Silt, (ML), Gray-brown w/orange mottling, firm, damp, slightly elastic	
	12.5					ML
	14.0		1.5	1-1-1 (3)	Silt, (ML), Lt. gray-brown w/orange mottling, firm, damp, slightly plastic, 5% v. fine sand	
15.0	15.0					
	16.5		1.5	1-1-1 (3)	Silt w/Sand, (ML), Lt. gray-brown w/orange mottling, firm, wet, 15% v. fine sand	
	17.5					
	19.0		1.0	1-1-1 (3)	Silty Sand, (SM), Gray-green, firm, wet, 20% silt, sand fine- grained	
20.0	20.0					SM
	21.5		1.3	2-2-2 (6)	Silty Sand, (sm), As above, damp to wet	
	22.5					
	24.0		1.3	1-1-4 (6)	Silt w/Sand, (ML), Gray-green, firm, damp, 15% fine sand	ML
25.0	25.0					
	26.5		1.2	2-3-4 (9)	Silty Sand, (SM), Gray-green, firm, damp to wet, 20% silt, sand fine-grained	SM
	27.5					
	29.0		1.0	1-1-1 (3)	Silty Sand, (SM), As above, to 28.5 ft. BGS; Sand, (SW), Gray, loose, wet, sand med.-grained	SW
	30.0					

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.H1.02	MW25-24 SHEET 2 OF 2

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Scrap Yard

MEASURING POINT ELEV (NGVD) 31.14 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Augers

WATER LEVEL ELEV/DATE _____ START 7/12/95 FINISH 7/12/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION	WELL COMPLETION DIAGRAM
	30.0 - 31.5			3-5-10 (18)	Sand, (SW), As above Comment: Driller reports heave in auger	SW	
35.0							
40.0							
45.0							
50.0							
55.0							

CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.H1.02	MW25-35

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Scrap Yard

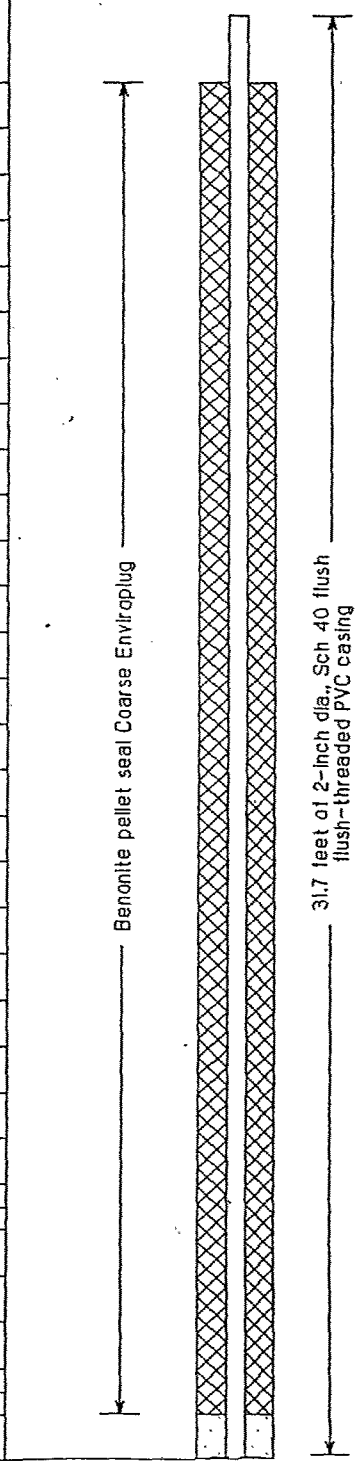
MEASURING POINT ELEV (NGVD) 30.89 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Augers

WATER LEVEL ELEV/DATE _____ START 7/24/95 FINISH 7/24/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
					Sand, (SP), Brown-gray, loose, dry Comment: Refractory brick to 1 ft.	
	2.5					
	4.0		1.3	4-4-3 (11)	Sand, (SP), Tan-brown, loose, dry, fine- to med.-grained, 5 - 10% silt	SP
	5.0					
5.0	6.5		1.3	2-2-1 (5)	Sand, (SP), As above, damp	
	7.5					
	9.0		1.0	3-3-2 (8)	Silt, (ML), Brown w/orange mottling, firm, wet, 10 - 15% v. fine sand	
	10.0					
10.0	11.5		1.5	1-1-1 (3)	Silt, (ML), Gray-brown w/orange mottling, firm, damp, slightly elastic	
	12.5					ML
	14.0		1.5	1-1-1 (3)	Silt, (ML), Lt. gray-brown w/orange mottling, firm, damp, slightly plastic, 5% v. fine sand	
	15.0					
15.0	16.5		1.5	1-1-1 (3)	Silt w/Sand, (ML), Lt. gray-brown w/orange mottling, firm, wet, 15% v. fine sand	
	17.5					
	19.0		1.0	1-1-1 (3)	Silty Sand, (SM), Gray-green, firm, wet, 20% silt, sand fine- grained	
	20.0					SM
20.0	21.5		1.3-	2-2-2 (6)	Silty Sand, As above, damp to wet	
	22.5					
	24.0		1.3	1-1-4 (6)	Silt w/Sand, (ML), Gray-green, firm, damp, 15% fine sand	ML
	25.0					
25.0	26.5		1.2	2-3-4 (9)	Silty Sand, (SM), Gray-green, firm, damp to wet, 20% silt, sand fine-grained	SM
	27.5					
	29.0		1.0	1-1-1 (3)	Silty Sand, (SM), As above, to 28.5 ft. BGS; Sand, (SW), Gray, loose, wet, sand med.-grained	
	30.0					SW

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.H1.02	MW25-35 SHEET 2 OF 2

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Scrap Yard

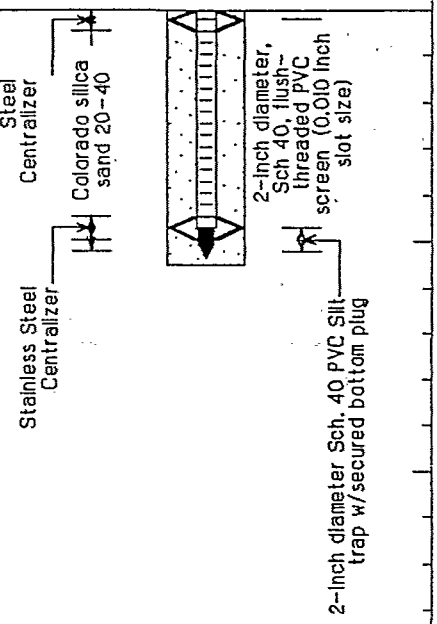
MEASURING POINT ELEV (NGVD) 30.89 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT HSA - Mobile Drill B-59, 8-1/4" ID Augers

WATER LEVEL ELEV/DATE _____ START 7/24/95 FINISH 7/24/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	30.0 – 31.5			3-5-10 (18)	Sand, (SW), As above Comment: Driller reports heave in auger	
	32.5					
	32.5 – 34.0		1.0	7-9-9 (25)	Sand, (SW/SP), Gray, wet, loose, med.-grained	SW
	34.0 – 35.0					
35.0	35.0 – 36.5		1.2	3-9-13 (25)	Sand, (SW/SP), Gray-green, wet, loose, w/silt laminations	
40.0						
45.0						
50.0						
55.0						

WELL COMPLETION DIAGRAM



CH2M HILL

PROJECT NUMBER	WELL NUMBER
107493.H1.02	MW26 SHEET 1 OF 1

MONITORING WELL GEOLOGIC AND CONSTRUCTION LOG

PROJECT Reynolds Aluminum Company - Troutdale, OR LOCATION Scrap Yard

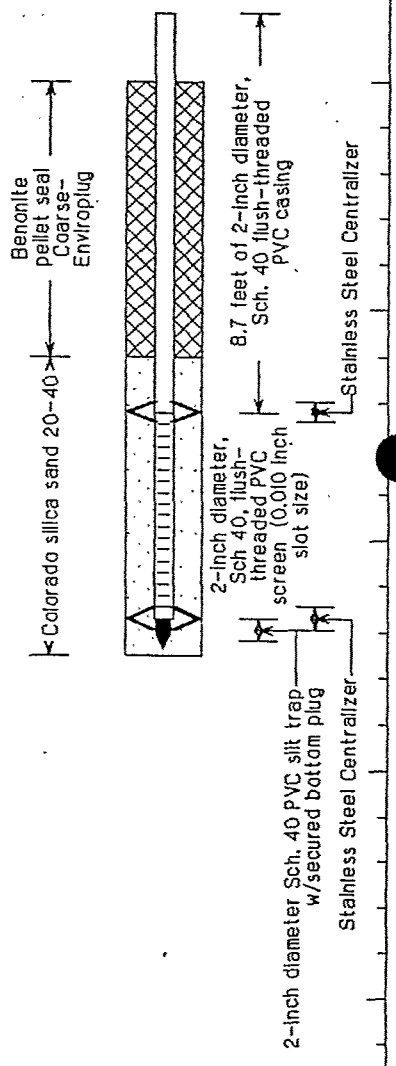
MEASURING POINT ELEV (NGVD) 28.26 DRILLING CONTRACTOR Geo-Tech Explorations

DRILLING METHOD AND EQUIPMENT 8-1/4" ID HSA Mobile Drill B-59

WATER LEVEL ELEV/DATE _____ START 7/24/95 FINISH 7/24/95 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	USCS DESCRIPTION
	2.5				Silty Loam, (ML), Dark brown, damp, loose, debris (brick, metal) Comment: TMW03-0000-0*	ML
	4.0		1.1	2-2-3 (7)	Sand, (SP), Tan-brown w/orange mottling, loose, damp med.-grained Comment: TMW03-0025-0*	SP
5.0	5.0					
	6.5		1.0	3-3-3 (9)	Sand, (SP), As above, wet, fine-grained, 10% silt Comment: TMW03-0050-0*	
	7.5					
	9.0		1.0	2-2-2 (6)	Sand, (SP), Gray, wet, loose, med.-grained	
10.0	10.0					
	11.5		1.0	2-2-1 (5)	Sand, (SP), As above, wet	
	12.5					
	14.0		1.4	2-3-4 (9)	Silt, (ML), Gray-green, firm, wet, 10 - 15% sand, v. fine	ML
15.0					* = Soil Sample ID	
20.0						
25.0						

WELL COMPLETION DIAGRAM



PROJECT NUMBER	BORING NUMBER	
107493.08.02	MW27-045	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall

ELEVATION _____ DRILLING CONTRACTOR GeoTech Exploration Inc.

DRILLING METHOD AND EQUIPMENT Mobile HSA Rig; 8 5/8-inch I.D. Auger

WATER LEVELS _____ START 10-31-98 FINISH 11-01-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-0.25 feet: Crushed basalt road base	
5.0					SILT WITH SAND, (ML), brown, damp, very soft, 15% sand.	
					Grades to SAND WITH SILT, (SP-SM), brown, damp, loose, fine to medium grained.	
10.0	10.0					
	11.5		1.2	8-12-15 (27)	SAND, (SP), brown, damp, medium dense, fine grained to 10.3 ft. becomes fine to medium grained SAND, (SW), at 10.8 ft. No silt	
15.0						
	20.0					
20.0	21.5		0.9	5-5-6 (11)	SAND, (SW), brown, damp, loose, fine to coarse grained. Red sand grains observed (5%). No silt	
25.0					Becomes wet and gray at approx. 24 ft.	Driller reports heaving sands
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-045 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall

ELEVATION _____ DRILLING CONTRACTOR GeoTech Exploration Inc.

DRILLING METHOD AND EQUIPMENT Mobile HSA Rig; 8 5/8-inch I.D. Auger

WATER LEVELS _____ START 10-31-98 FINISH 11-01-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.5	18-15-18 (31)	SAND, (SW), gray, wet, medium dense, fine to medium grained (<10% red grains).	Driller reports heaving sands
35.0						
40.0	40.0 – 41.5		1.5	3-3-11 (14)	SAND, (SW), gray, wet, loose, fine to coarse grained, less than 5% fine subangular gravel, 2 0.5-inch thick silt layers at approx. 41 ft. Red sand grains and mica flakes observed. SAND, (SW), as above to 45'	
45.0						
50.0						
55.0						

PROJECT NUMBER	BORING NUMBER	
107493.06.02	MW27-045	SHEET 1 OF 1

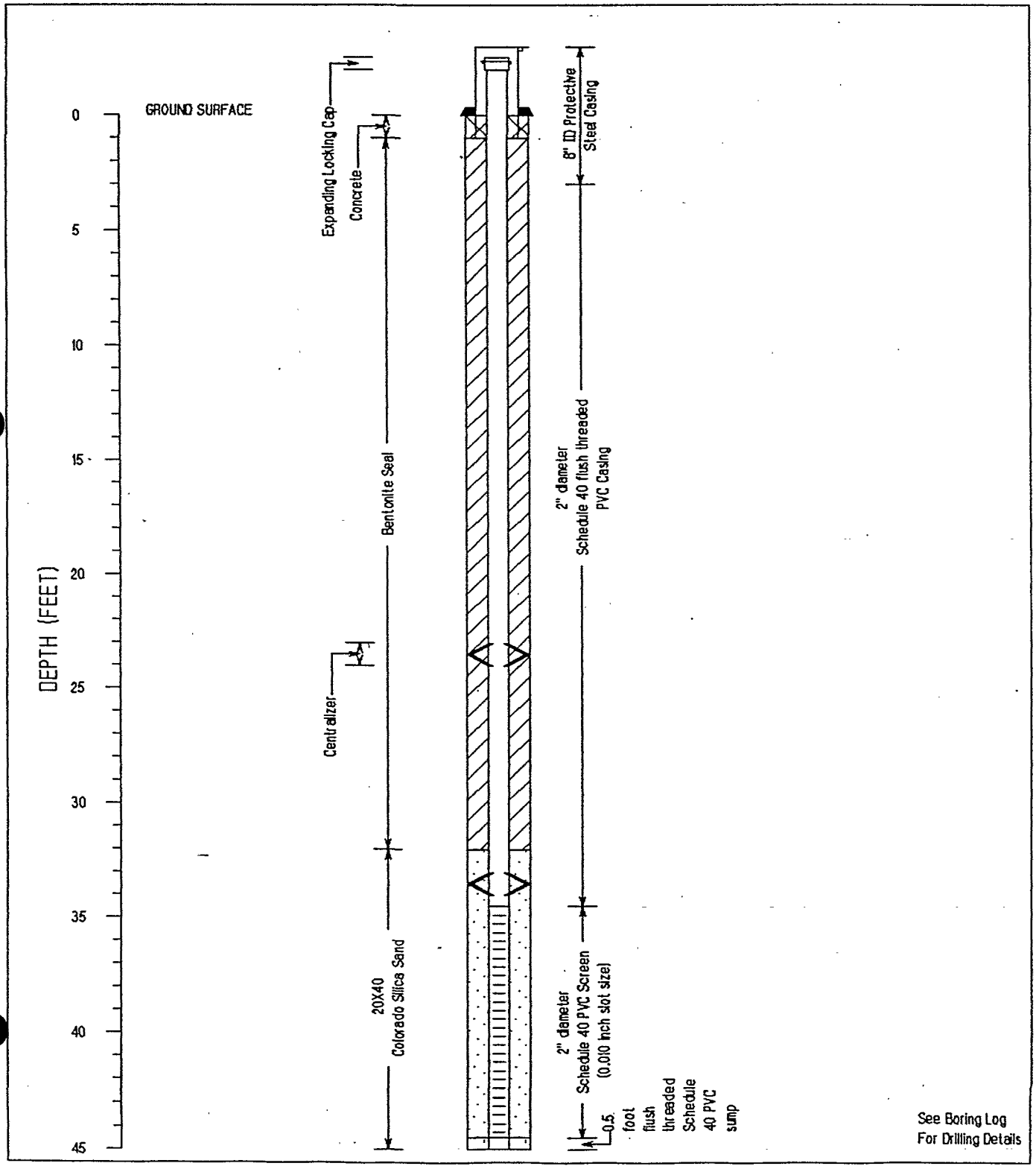
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Approx. 40 ft. East of Co. Lake Outfall

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Exploration Inc.

DRILLING METHOD AND EQUIPMENT Mobile HSA Rig; 6 5/8-inch I.D. Auger

WATER LEVELS _____ **START** 11-1-96 **FINISH** 11-1-96 **LOGGER** T. Gehweiler



CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-081 SHEET 1 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approximately 40 feet East of C.Lake Outfall

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool;GMC 7500;6-inch ID,8.5-inch OD Casing

WATER LEVELS _____ START 4-16-86 FINISH 4-26-86 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0 to .25 feet crushed basalt road base.	
	5.0					
5.0	6.5		1.5	1-1-1 (2)	SILT With SAND, (ML), dark yellowish brown (10 yr 4/2), damp, very soft, grading to SAND with SILT, (SP-SM), dark yellowish brown, sand fine to medium grained.	Driller adds approximately 10 gallons of water to bail.
	10.0					
10.0	11.5		1.5	8-10-12 (22)	SILT with SAND, (ML), as above to 11 feet-sharp contact with	
					SAND, (SP), pale yellowish brown (10 yr 6/12), damp, medium dense, fine-medium grained, no apparent bedding.	
	15.0					
15.0	16.5		1.0	6-7-10 (17)	SAND with SILT, (SW-SM), dark yellow brown (10 yr 4/2), damp, loose, interbedded sand, and silty sand, layers 1-inch thick.	
	20.0					
20.0	21.5		0.9	4-6-10 (16)	SAND, (SW), brownish gray (5 yr 4/1), wet, loose, silt-rich layers 1-2 inches thick silty sand.	20 feet below ground surface (bgs) water sample: F-=4.4 pH=6.30 T=13.4 degrees C cond=350 . DTW 14.4 feet bgs at 17:00. Collect water sample for field screening.
	25.0					
25.0	26.5		1.4	4-7-13 (20)	SAND, (SW), as above, except no silt, homogeneous.	
	30.0					

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-081 SHEET 2 OF 8

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approximately 40 feet East of C.Lake Outfall

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool;GMC 7500;6-inch ID,8.5-inch OD Casing

WATER LEVELS _____ START 4-16-96 FINISH 4-26-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 31.5		0.7	2-4-6 (10)	SAND, (SW), as above.	Driller reports heaving sand. 30 feet bgs water sample: pH=6.45 cond=425 T=11.5 degrees C.
	35.0					
35.0	36.5		0.6	4-4-10 (14)	SAND, (SW), brownish gray (5 yr 4/1), wet, loose, fine-to coarse- grained, 2-inch thick fine sand bed.	Driller reports heaving sand in casing.
	40.0					
40.0	41.5		1.4	4-6-10 (16)	SAND, (SW), as above, two 0.5-inch thick silt layers at approximately 41 feet.	Driller reports 9 feet of heaving sand in bottom of casing. Driller reports small silt layer 40-45 feet.
	45.0					
45.0	46.5		1.3	14-20-25 (45)	SAND, (SW), as above, except medium dense, fine-to-medium grained.	Bailed 4-inch cobble, 2 1-inch pebbles. 45 feet bgs water sample: F-=6.8 pH=6.18 cond=800 T=12.5 degrees C.
	50.0					
50.0	51.5		0.7	6-6-6 (12)	SAND, (SW), as above, except loose.	
	55.0					
55.0	56.5		1.4	16-35-25 (60)	SAND, (SW), as above, except dense.	
	60.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-081 SHEET 3 OF 8

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approximately 40 feet East of C.Lake Outfall

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool;GMC 7500;6-inch ID,8.5-inch OD Casing

WATER LEVELS _____ START 4-16-88 FINISH 4-28-88 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 – 61.5		0.8	4-6-7 (13)	SAND, (SW), as above, except loose, wood fragments, mica flakes evident.	60 feet bgs water sample: F-=17.0 pH=6.57 cond=600 T=13.9 degrees C. 12 feet of heaving sand in bottom of casing after bailing water sample.
65.0	65.0 – 66.5		1.2	6-7-8 (15)	SAND, (SW), as above.	Driller reports heaving sand in casing.
70.0	70.0 – 75.0				NO RECOVERY. Bailing SAND, (SW), as above.	70 feet bgs water sample: F-=18.5 pH=6.9 cond=670 T=12.7 degrees C.
75.0	75.0 – 76.5		1.4	20-25-25 (50)	SAND, (SW), as above except medium dense.	Driller reports heaving sand in casing.
	76.5 – 78.5					Driller reports heaving sand.
80.0	78.5 – 80.5		0.5	5-6-7 (13)	SAND, (SW), as above, except loose.	78 feet bgs water sample: F-=12.8 pH=7.13 cond=620 T=11.5 degrees C.
85.0	80.5 – 85.0					
	85.0 – 86.5		0.3	2-4-6 (10)	SAND, (SW), as above.	Driller reports heaving sand in casing.
	86.5 – 90.0					

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-081 SHEET 4 OF 8

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approximately 40 feet East of C.Lake Outfall

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool;GMC 7500;8-inch ID,8.5-inch OD Casing

WATER LEVELS _____ START 4-16-96 FINISH 4-28-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0–91.5		0.3	2-4-10 (14)	SAND, (SW), brownish gray (5 yr 4/1), wet, loose, medium-to-coarse -grained, small wood fragments and mica flakes evident.	Heaving Sand – Drillers report balling pebbles, coarse sand.
95.0	95.0–98.5		0.3	4-4-6 (10)	SAND, (SW), as above, except fine to medium grained.	95 feet bgs water sample: F-=4.39 pH=7.05 cond=700 T=11.5 degrees C.
100.0	100.0–100.8		0.8	50/6"	SAND, (SW), as above except very dense.	Driller reports harder drilling.
						103 feet: Driller reports hard layer 6-inch thick, ball 2-3 inch gravel.
105.0	105.0–105.8		0.8	30/6"-50/4"	GRAVEL with SAND, (GW), gray black (N2), wet, very dense, gravel to 3-inch diameter, both angular and moderately well rounded.	
110.0	110.0–110.3		0.0	60/4"	No Sample	110 feet bgs water sample: F-1.81 pH=7.4 cond=580 T=12.7 degrees C.
						Balling Gravel-Slow drilling -little water-driller thinks gravel with silt, semi-consolidated. Balling is very hard; unable to drive spoon.
115.0					No Sample	
					GRAVEL, (GW), gray black to green, varying composition and color, wet, loose to medium dense, moderately well-rounded.	117 feet: making more water – some gravel heave possible less silt or cementation.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-081 SHEET 5 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approximately 40 feet East of C.Lake Outfall

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool;GMC 7500;6-inch ID,8.5-inch OD Casing

WATER LEVELS _____ START 4-16-98 FINISH 4-28-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	Balling gravel, with silt in bailed water-casing driving hard (likely cobbles), quick recovery at 123 feet, dark gray silt suspended in bailed water.
					No Sample	
					GRAVEL with SAND, (GW), as above, with dark gray (N3), wet, loose, fine to medium-grained.	Drilling and driving casing faster at 123 feet bgs 123 feet bgs water sample:
125.0						F--=0.28 pH=7.05 cond=410 T=12.5 degrees C.
	128.0					
	129.5		0.0	50/0"	Very Hard Possibly CEMENTED GRAVEL, (GW).	Heaving sand - at 129.5 feet bgs bailed out partially consolidated silt with sand and gravel.
130.0						
					GRAVEL with SAND, (GW), as above, 2-3 inch in diameter (largest pieces).	Slow water level recovery
						133 feet bgs water sample:
						F--=0.44 pH=8.5 cond=400 T=13.5 degrees C.
135.0					GRAVEL, (GW), moderately olive brown (5 yr 4/4) to olive gray (5 yr 3/2), moderately well rounded, some cement/coating evident to 138.5 feet below ground surface.	Driller reports increased permeability.
					GRAVEL with SAND, (GW), as above, dark gray.	
						138.5 feet bgs water sample:
140.0						F--=0.41 pH=7.85 cond=350 T=13.0 degree C
						141 feet casing drives hard, drill open hole 141-142 feet bg.
					CEMENTED GRAVEL, (GW), as above, with sand (20%).	
145.0						
					CEMENTED GRAVEL, (GW), as above.	
	150.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D6.02	MW27-081 SHEET 6 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approximately 40 feet East of C.Lake Outfall

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool;GMC 7500;8-inch ID,8.5-inch OD Casing

WATER LEVELS _____ START 4-16-96 FINISH 4-26-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	150.0 150.3		0.0	100/3"	At 148 feet: CEMENTED SAND, (SW) with gravel (35%), olive gray (5yr 3/2), wet, very, dense, poorly rounded sand, moderately well rounded gravel, gravel less 1.5-inch.	Piece of tan silt with sand, drilling open hole. Driller reports higher permeability. 151 feet bgs water sample: F--=0.3 pH=6.80 cond=170 T=12.5 degrees C.
155.0					CEMENTED GRAVEL, (GW), dark gray (N3) to olive gray (5yr 3/2), wet, dense, gravel 0.25-1 inch, basalt 80% of gravel.	Drilling open hole; no heaving sand; good water production-some cement evident on some gravel - <1% small, tan silt pieces. Drilling harder, casing sticking - likely cobbles in formation.
160.0					CEMENTED GRAVEL, (GW), olive gray (5yr 3/2), wet, very dense, with cement, dusky yellow (5yr 6/4), hard, pebble-sized fragments.	162 feet - cement changes to hard, dusky yellow fragments.
165.0					CEMENTED GRAVEL, (GW), as above.	165-168 feet bgs water sample: F--=0.35 pH=7.10 cond=180 T=12.0 degrees C. Pump @ 25 gpm with 3 feet drawdown after 15 minutes.
170.0					CEMENTED GRAVEL, (GW), as above.	Producing water; slow drilling
175.0					CEMENTED GRAVEL, (GW), as above.	Total depth on 4-26-96 is 175 feet bgs.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW27-081 SHEET 1 OF 1

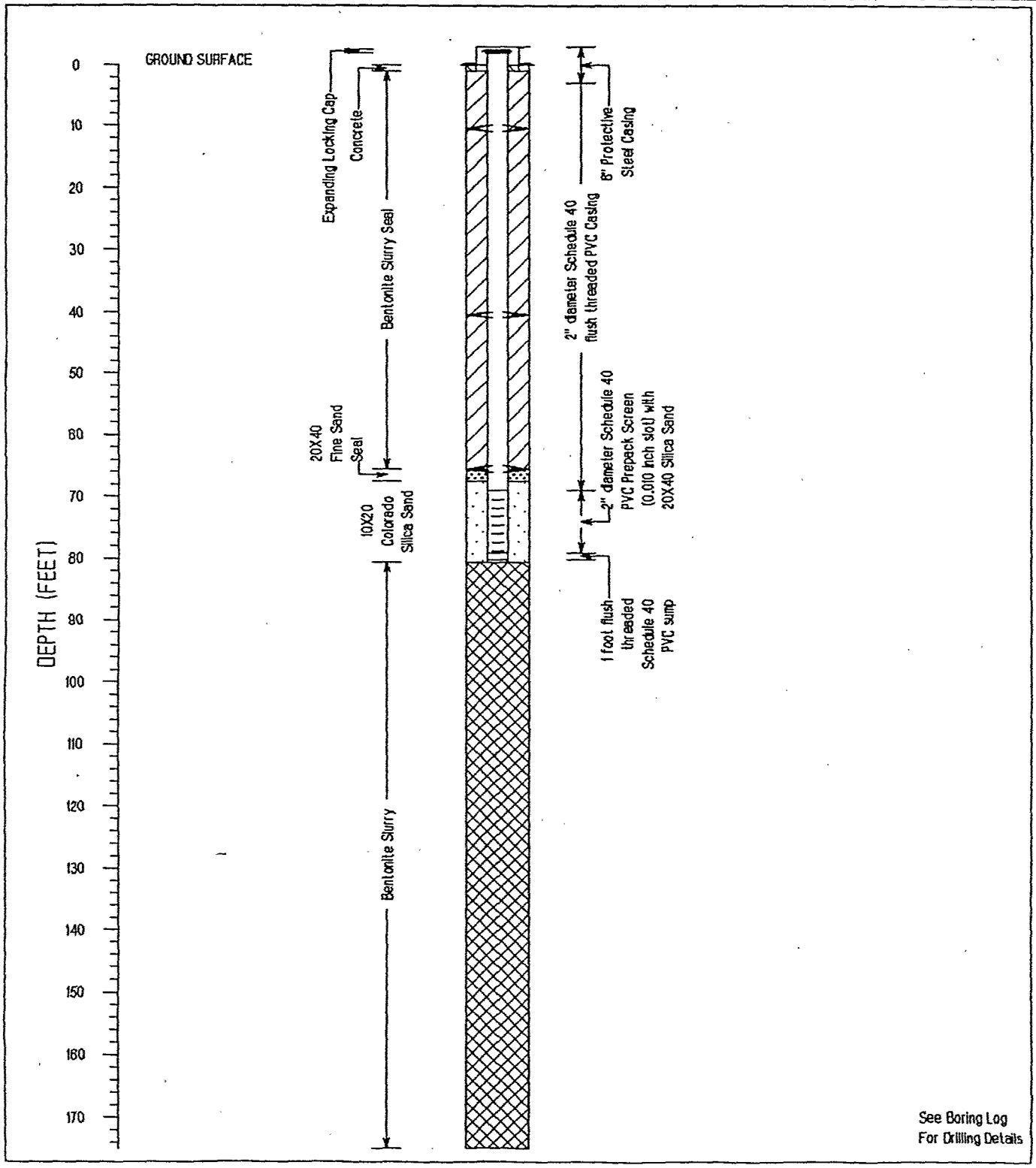
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approximately 40 feet East of C.Lake Outfall

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool;GMC 7500;8-inch ID,8.5-inch OD Casing

WATER LEVELS _____ START 8-12-98 FINISH 8-28-98 LOGGER Ivan Gall



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-176 SHEET 1 OF 9

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 280 feet.

WATER LEVELS _____ START 7-8-96 FINISH 7-17-96 LOGGER Kathy Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0 - 0.25 feet crushed basalt road base (fill).	
5.0					SILT with SAND, (ML), brown, damp, very soft, sand fine to medium grained, 15 - 20 percent sand.	
10.0	10.0					
	11.5		1.2	6-8-8 (16)	SILT with SAND, (ML), as above.	
					At 11 feet becomes: SAND, (SP), brown, damp, loose, fine to medium grained.	
15.0					SAND with SILT, (SW-SM), brown, damp loose, interbedded with 1-inch thick layers of SAND, (SP), and SILTY SAND, (SM).	
	20.0					
20.0	21.5		0.8	2-3-4 (7)	SAND, (SW), brownish gray, wet, very loose, fine to medium grained, less than 5 percent coarse subangular sand. No silt. Red sand grains observed approximately 5 percent or less.	20 feet below ground surface (bgs) water sample: F-=3.18 pH=6.23 T=21.1 degrees C cond=500.
25.0					SAND, (SW), as above.	
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW27-178 SHEET 2 OF 9

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 280 feet.

WATER LEVELS _____ START 7-8-96 FINISH 7-17-96 LOGGER Kathy Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		2.0	6-8-12 (20)	SAND, (SW), as above, except goes from brown to brownish yellow at 30.5 feet, to brownish gray at 31 feet. Brown SILTY SAND, (SM), layer 1-inch thick at 30.9 feet. Sand is fine to medium grained with red grains less than 5 percent, loose.	Driller reports heaving sand in casing.
35.0					SAND, (SW), brownish gray (5 yr 4/1), wet, loose, fine-to-coarse grained sand, less than 10 percent fine (1/4) to coarse (1-inch) subangular gravel varying in color from dark gray to red.	Driller reports small silt layer at 35 feet.
40.0	40.0 – 41.5		0.4	8-8-8 (16)	SAND, (SW), as above, except thin silt layer (.5 - 1 inch) at 40 feet, less red sand, less than 5 percent fine gravel, mica flakes observed (less than 5 percent).	40 feet bgs water sample: F--=8.0 pH=8.98 T=15.0 degrees C cond=450.
45.0					SAND, (SW), as above, except no silt, less than 5 percent gravel, one piece of wood.	Driller reports heaving sand in casing.
50.0	50.0 – 51.5		2.0	20-35-35 (70)	SAND, (SW), as above, except gray, no gravel, fine to medium grained sand, one piece vegetation, dense.	
55.0					SAND, (SW), as above.	
	60.0					

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW27-176 SHEET 3 OF 9

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 260 feet.

WATER LEVELS _____ START 7-8-88 FINISH 7-17-88 LOGGER Kathy Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	80.0 – 81.5		0.5	10/6"	SAND, (SW), dark gray, wet, loose, fine to medium grained, trace red grains, micaeous, trace (less than 5 percent) vegetation and coarse sand.	80 feet bgs water sample: F-=11.5 pH=7.08 T=18 degrees C cond=720.
65.0					SAND, (SW), as above.	
70.0	70.0 – 71.5		1.0	6-20-35 (55)	SAND, (SW), as above, except medium dense, no vegetation, and 2-3 inch thick SILT, (ML), layer from 70.7 - 70.8 feet, followed by SAND, (SW) as above.	
75.0					SAND, (SW), as above except no silt.	
80.0	80.0 – 81.5		0.3	8-6/2"	SAND, (SW), dark gray, wet, loose, fine to coarse-grained. Trace red sand, micaceous.	80 feet bgs water sample: F-=1.51 pH=7.52 T=14.8 degrees C cond=780.
85.0						
	90.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-176 SHEET 4 OF 9

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 280 feet.

WATER LEVELS _____ START 7-8-98 FINISH 7-17-98 LOGGER Kathy Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0 – 91.5		1.5	9-10-20 (30)	SAND, (SW), as above, except with trace pebbles, (to 0.5-inch maximum size).	
95.0	91.5 – 99.0					
100.0	99.0 – 100.5		1.3	3-4-10 (14)	SAND, (SW), as above, with trace of gravel (to 3 inch maximum size) and trace of wood fragments.	100 feet: Driller reports gravel in bailer. 100 feet bgs water sample: F--=11.6 pH=7.25 T=14.2 degrees C cond=600.
105.0	100.5 – 110.0				101 feet: GRAVEL, (GW), gray black (N2), wet, dense, moderately well rounded primarily basalt with trace quartz, volcanics, and metamorphics, trace wood fragments, sand.	Air rotary takes over at 100 feet bgs. Gravel at 101 feet bgs. Casing producing approximately 3 gpm. Casing producing approximately 50 gpm water. Slight sheen noted on water.
110.0	110.0 –			50/0"	GRAVEL, (GW), as above.	110 feet bgs water sample: F--=0.28 pH=7.80 T=14.5 degrees C cond=500. Casing producing approximately 80 gpm.
115.0					GRAVEL, (GW), as above. GRAVEL, (GW), gray black (N2) with red (possibly matrix or cement) wet, dense, gravel moderately well rounded (to 1.5-inch maximum size).	Casing producing 3-5 gpm. 118 feet bgs water sample: F--=0.28 pH=7.84 T=14.0 degrees C cond=430.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW27-178 SHEET 5 OF 9

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 260 feet.

WATER LEVELS _____ START 7-8-96 FINISH 7-17-96 LOGGER Kathy Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	Casing producing approximately 50 gpm. 122 feet bgs water sample: F-=0.30 pH=7.48 T=14.8 degrees C cond=440.
					GRAVEL, (GW), gray black (N2), wet, dense, moderately well rounded (to 1.5-inch maximum size), 85 percent basalt, some quartz.	Gray sand with gravel at 123-125 feet sheen and odor on water.
125.0					GRAVEL, (GW), as above.	
130.0					GRAVEL, (GW), as above.	Casing producing approximately 70 gpm.
					GRAVEL, (GW), moderate olive brown (5 yr 4/4), wet, dense, moderately well rounded, partially cemented, primarily basalt (85-90 percent), some white/yellow quartz, red volcanics.	Casing producing approximately 70 gpm.
135.0						
140.0					GRAVEL, (GW), as above.	PID/FID less than 1 ppm 140 feet: water production approximately 10 gpm, sheen and odor on water.
145.0						Some (10 percent) sand at 146 feet.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW27-176 SHEET 6 OF 9

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 280 feet.

WATER LEVELS _____ START 7-8-98 FINISH 7-17-98 LOGGER Kathy Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	Water production approximately 10 gpm. 150 feet bgs water sample: F-=0.28 pH=7.58 T=16.7 degrees C cond=280. Harder drilling; less water production (5 gpm) at 151 ft.
155.0					GRAVEL, (GW), as above.	154 feet: water production approximately 50 gpm, sheen and odor on water.
160.0					GRAVEL, (GW), as above.	Water production from casing approximately 80 gpm. 161-163 feet: less water production approximately 10 gpm.
165.0					GRAVEL, (GW), as above.	
						Casing producing approximately 50 gpm.
170.0					GRAVEL, (GW), as above.	170 feet bgs water sample: F-=0.28 pH=7.54 T=15.9 degrees C cond=210. Sheen and odor on water.
175.0					GRAVEL with SILT, (GW-GM), dark gray (N3), gravel with pale yellowish brown (10 yr 6/2) silt matrix, wet, dense, (silt firm), gravel as above.	Casing producing approximately 80 gpm in gravel.
					SAND, (SW), light olive (10 yr 5/4), wet, loose, angular, fine-to- medium-grained, trace pebbles, mica flakes.	179 feet bgs water sample: F-=0.31 pH=7.54 T=15.9 degrees C cond=210. No sheen or odor. Casing producing approximately 5 gpm in gravel with silt.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-178 SHEET 7 OF 8

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 260 feet.

WATER LEVELS _____ START 7-8-98 FINISH 7-17-98 LOGGER Kathy Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	Casing producing approximately 50 gpm and significant amounts of sand.
					GRAVEL, (GW), dark gray (N3), wet, dense, partially cemented, 85 percent basalt, moderately well rounded.	Casing producing less than 5 gpm - air possibly pushing water into formation.
185.0					SAND with SILT, (SW-SM), dusky yellow (5 yr 6/4), wet, loose, approximately 15 percent silt, sand fine to coarse-grained, subangular to subrounded, mica flakes.	PID/FID less than 1 ppm on cyclone casing producing less than 3 gpm water.
190.0					SAND, (SW), dusky yellow green (5 yr 5/2), wet, loose, fine to coarse-grained, subangular to subrounded.	Casing producing approximately 50 gpm water. 182 feet bgs water sample: F-=0.34 pH=7.41 T=13.9 degrees C cond=340. No odor, slight sheen.
195.0	197.0				GRAVEL, (GW), grayish black (N2), wet, dense, moderately well- rounded, primarily basalt, partially cemented.	Casing producing less than 1 gpm water.
	198.5		0.0	50/2"	SAND, (SW), medium dark gray (N4), wet, loose, fine-coarse- grained, sub-angular to subrounded, trace of gravel and mica.	Casing producing approximately 80 gpm water.
200.0						
205.0					GRAVEL, (GW), grayish black (N2), wet, dense, moderately well rounded, maximum size 2 inches, primarily basalt, trace of sand.	Casing producing approximately 80 gpm. 208 feet bgs water sample: F-=0.31 pH=7.47 T=14.4 degrees C cond=370. No odor or sheen.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW27-178 SHEET 8 OF 9

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 280 feet.

WATER LEVELS _____ START 7-8-98 FINISH 7-17-98 LOGGER Kathy Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVEL, (GW), as above.	
						212 feet: Silt and sand in gravel; casing producing less than 5 gpm.
215.0					GRAVEL, (GW), as above, 10 percent silt.	
						Casing producing approximately 10 gpm water.
220.0					GRAVEL, (GW), as above.	220 feet bgs water sample:
					Weathered basalt, silt matrix, medium dark gray (N4), gravel grayish black (N2), grayish red purple (5 rp 4/2), and grayish green (5 g 5/2) wet, medium dense, gravel to 0.5-inch maximum size, subangular to subrounded, 20-25 percent gravel.	F-=0.31 pH=7.86 T=14.9 degrees C cond=270. Slight HC odor; slight sheen on water.
						Casing produces no water.
225.0						
						Casing produces no water.
	230.0					
230.0			0.8	45-60/4"	Weathered basalt, mottled gray, red, and blue-green, dense, damp, silt-matrix with gravel (maximum size less than 0.5 inch).	
	231.5					
235.0					Weathered basalt, as above.	Casing produces no water.

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW27-176 SHEET 9 OF 9

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 280 feet.

WATER LEVELS _____ START 7-8-96 FINISH 7-17-96 LOGGER Kathy Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Weathered basalt, grayish red (5 yr 4/2), wet, very dense, weatherd to silt and clay plus gravel.	Casing producing no water. Driller adds 40 gallons of water.
245.0						Contact at 247 feet bgs
					Basalt, grayish black (N2) to grayish red (5 yr 4/2), wet, very dense.	Casing producing less than 1 gpm driller adds 20 gallons of water.
250.0						
255.0					Basalt, as above.	
260.0					Basalt, as above.	280 feet bgs water sample: F-=0.28 pH=8.21 T=14.4 degrees C cond=470. Slight HC odor, water tea colored. Total Depth = 280 feet bgs Casing shoe cut at approximately 248 feet bgs on 7/18/96.
265.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107483.06.02	MW27-176	SHEET 1 OF 1

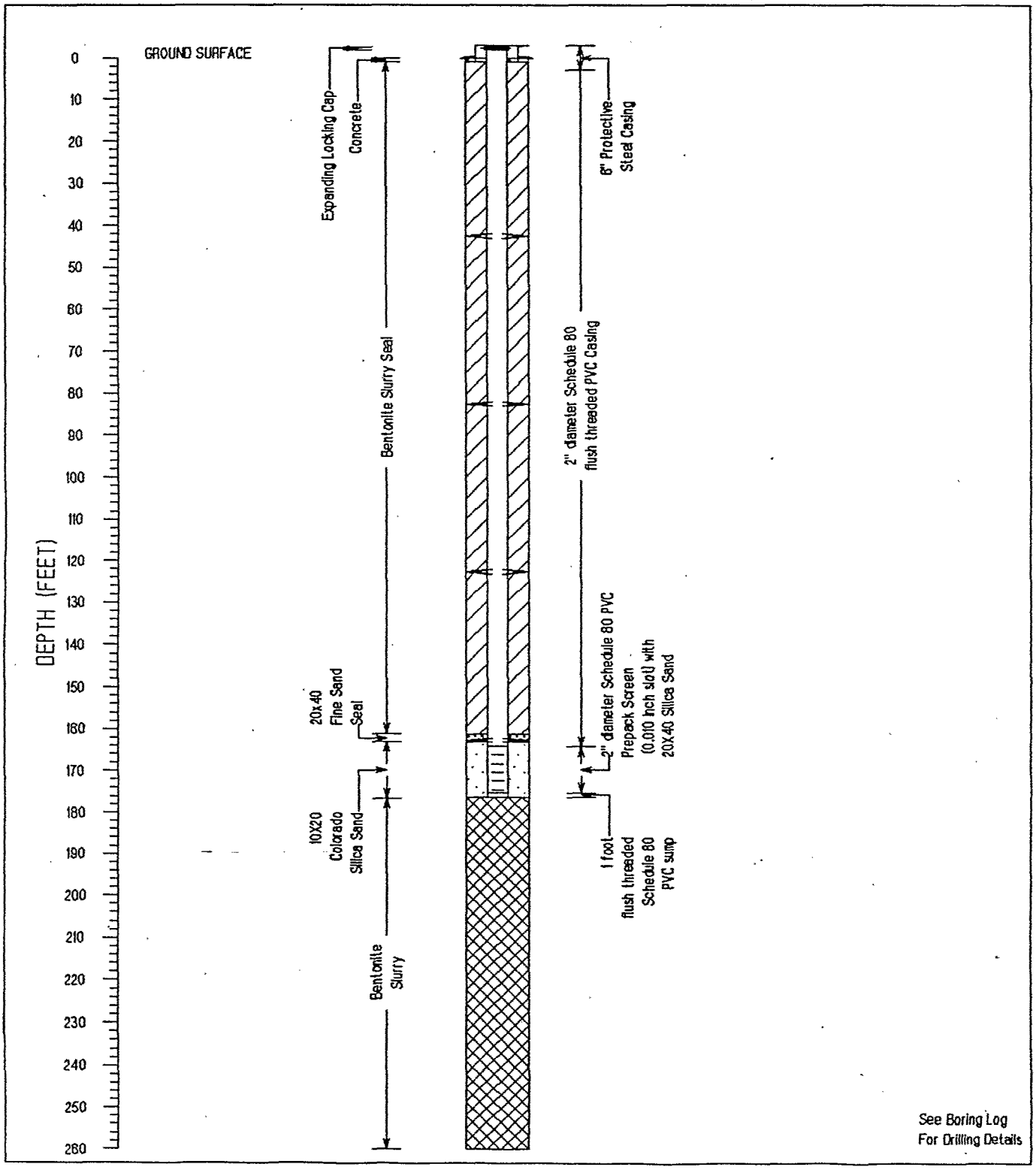
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Approx. 40 ft. East of Co. Lake Outfall Ditches

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool to 100 feet/Air Rotary to 260 feet.

WATER LEVELS _____ **START** 8-8-96 **FINISH** 8-14-96 **LOGGER** Kathy Gehweiler



CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW28-180 SHEET 1 OF 8

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Southside of Bakehouse Near PW13

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 10-2-88 FINISH 10-8-88 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	5.0				GRAVELLY SAND, (SW), tan to black, damp, very loose, fine to coarse grained sand with greater than or equal 15 percent subangular to rounded fine to coarse gravel, less than or equal to 5 percent silt.	Add 40 gallons of water to drill.
5.0	6.5		0.3	8-18-24 (42)	SAND, (SW), brown, moist, medium dense, fine to medium grained, trace of (less than or equal to 5 percent) silt.	Add water to drill.
10.0	11.5		1.5	14-30-50/6	SAND, (SW), gray to brown, moist, dense, fine to coarse grained sand, some fine angular to subrounded gravel (less than 10 percent) from 8-9 feet bgs; fine to medium grained sand from 9-10 feet bgs.	Percent oxygen/LEL =21/0 PID = 0.06 ppm FID = 0.31 ppm Slight sheen noted in IDW tank on bailed water. Driller reports easy drilling from 10-14 feet, becoming harder from 14-18 feet. Able to drill open hole from 10-18 feet. Drilling becomes easy at 18-19 feet.
15.0	16.5		1.5	18-30-34 (64)	SAND, (SW), gray to brown, moist, dense, fine to medium grained, less than 5 percent coarse sand and fine subangular gravel, and silt.	
					Becomes silty at 18 feet.	
20.0	21.5		1.5-	2-3-3 (6)	SANDY SILT, (ML), gray, brown, soft, no gravel, moist, trace mica flakes.	20 feet bgs water sample: 0 Not making water at 20 feet.
25.0	30.0				SANDY SILT, (ML), as above.	Seems to making water slowly at 27 feet. Wait 25 minutes and try to collect water sample. Not enough water. Stop at 27 feet with 10 inch casing telescope down with 8 inch casing.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW28-160 SHEET 2 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Southside of Bakehouse Near PW13

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 10-2-96 FINISH 10-8-96 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	30.0 - 31.5		1.5	4-8-8 (16)	SANDY SILT, (ML), as above except firm, 1 inch to 1/2 inch thick sand lens at 31 feet. Sand is fine to medium grained.	Only 1 foot water in hole after almost 2 hours.
35.0						Driller reports change in how casing drives at 38 feet.
					SAND, (SW), gray, loose, wet, fine to medium grained, no silt, some (5-7 percent) wood fragments, red grains observed.	Oxygen/LEL =21/0 PID = 0.23 ppm FID = 0.21 ppm
40.0	40.0 - 41.5		1.5	3-4-9 (13)		40 feet bgs water sample: T=19.4 degrees C pH=7.38 cond=1150 F-=0.74 Formation starting to heave. Heaves until about 48 feet bgs, then formation gets siltier.
45.0						
					Becomes silty.	
50.0	50.0 - 51.5		1.5-	6-10-10 (20)	SILTY SAND, (SM), gray, loose, wet, fine grained, less than or equal to 15 percent silt, trace of wood fragments and mica flakes.	50 feet bgs water sample: T=20.1 degrees C pH=7.38 cond=400 F-=0.25 No noticeable sheen on water.
55.0					SILTY SAND, (SM), as above.	
						Heaving sands at approximately 58 feet.
	60.0					

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW28-180 SHEET 3 OF 8

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Southside of Bakehouse Near PW13

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 10-2-88 FINISH 10-8-88 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 – 61.5		1.0	2-5-12 (17)	SAND, (SW), gray, loose to medium dense, wet, fine to medium grained, trace of mica flakes.	Heaving sands
65.0						
70.0	70.0 – 71.5		0.8	2-2-6 (8)	SAND, (SW), as above except loose.	70 feet bgs water sample: T=15.2 degrees C pH=6.84 cond=320 F-=0.34
75.0						Heaving sands
80.0	80.0 – 81.5		1.0	2-2-6 (8)	SAND, (SW), as above.	
85.0						
	90.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW28-180 SHEET 4 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Southside of Bakehouse Near PW13

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 10-2-88 FINISH 10-8-88 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	80.0 – 81.5		1.0	4-5-12 (17)	SAND, (SW), as above.	80 feet bgs water sample: T=16.0 degrees C pH=6.97 cond=282 F-=0.33
95.0						
100.0	100.0 – 101.5		0.75	4-5-5 (10)	SAND, (SW), as above except trace coarse sand to fine gravel (less than 1/4 inch diameter.	Driller reports not heaving very much.
105.0						
110.0	110.0 – 111.5		1.5-	8-20-24 (48)	SAND, (SW), as above except medium dense, fine subangular to subrounded gravel (15-20 percent) from 111-111.5 feet.	110 feet bgs water sample: T=17.9 degrees C pH=6.88 cond=320
115.0					Becomes less gravelly.	PID/FID in borehole = 0.45/1.43
	120.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW28-160 SHEET 5 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Southside of Bakehouse Near PW13

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 10-2-98 FINISH 10-8-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	120.0 – 121.5		1.5	8-14-18 (32)	SAND, (SW), as above except no gravel, trace wood fragments.	
125.0					Trace of gravel from 125 feet to 130 feet.	
130.0	130.0 – 131.5		1.0	4-4-10 (14)	SAND, (SW), as above except trace of fine subangular gravel and wood fragments, loose.	130 feet bgs water sample: T=18.8 degrees C pH=6.58 cond=310 Heaving sands at 130 feet.
135.0						
140.0	140.0 – 141.5		1.5	4-6-10 (16)	SAND, (SW), gray, wet, loose, fine to medium grained, trace coarse subrounded sand and mica flakes.	Heaving sands.
145.0						
	150.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW28-160 SHEET 6 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Southside of Bakehouse Near PW13

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 10-2-86 FINISH 10-8-86 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	150.0 – 151.5		1.5	8-24-14 (38)	SAND, (SW), gray, wet, medium dense, fine to coarse grained trace fine gravel (subangular), mica flakes, wood fragments and silt.	150 feet bgs water sample: T=13.2 degrees C pH=7.87 cond=190 F-=0.34
155.0						
160.0	160.0 – 161.5		0.8	6-10-14 (24)	SAND, (SW), as above except no wood fragments or fine gravel. Total depth equals 160 feet bgs.	160 feet bgs water sample: T=13.7 degrees C pH=7.60 cond=212 F-=0.38
165.0						
170.0						
175.0						

PROJECT NUMBER	BORING NUMBER	
107493.08.02	MW28-180	SHEET 1 OF 1

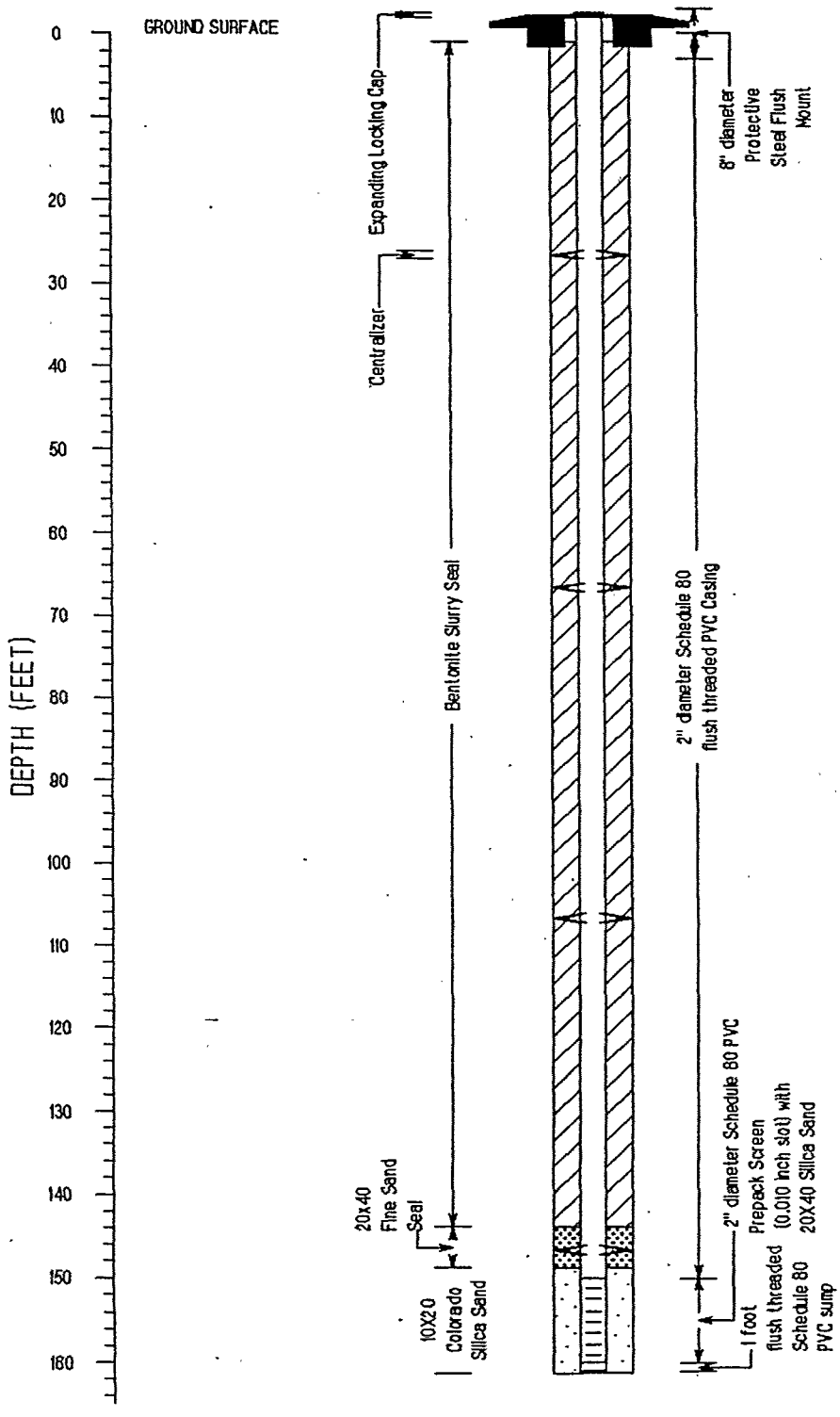
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Southside of Bakehouse Near PW13

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling

DRILLING METHOD AND EQUIPMENT Cable Tool

WATER LEVELS _____ START 10-9-98 FINISH 10-10-98 LOGGER T. Gehweiler



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW29-033 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** North of BPA Substation by Access Road

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Exploration Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Auger Rig, 6 5/8-inch ID Auger

WATER LEVELS _____ **START** 10-31-98 **FINISH** 10-31-98 **LOGGER** T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-0.3 foot: SILTY SANDY GRAVEL, (GM), gray, dry, loose, drill pad fill.	
5.0					SAND, (SW), brown, damp, very loose, fine to medium grained, less than 5 percent silt.	
10.0	10.0				SAND, (SW), as above	
	11.5		0.8	1-1-1 (2)	At 11.2, SILT, (MH), brown, wet, very soft, elastic, less than 1 percent fine angular gravel.	
15.0					Silt becomes dark gray at 15 feet bgs.	
20.0	20.0				SILT, (MH), dark gray, wet, soft, elastic, very uniform, no gravel.	
	21.5		1.5	1-2-4 (6)		
						Drilling rate slowed down at 23 feet.
					SAND, (SW), gray, wet, loose, fine to medium grained.	
25.0						
	30.0					

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW29-033 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR GeoTech Exploration Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Auger Rig, 6 5/8-inch ID Auger

WATER LEVELS _____ START 10-31-98 FINISH 10-31-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	30.0 – 31.5		1.1	6-10-12 (22)	SAND, (SW), brownish gray, wet, loose, fine to medium grained, one 1/2-inch thick silt layer at 30.5 feet, red sand grains (less than 12 percent).	
35.0	37.0				At 33 feet, SILT, (MH), gray, wet, very soft, plastic.	
	38.5		1.5	1-2-1 (3)	SILT, (MH), as above	
					Total Depth = 38.5 Feet	
40.0						
45.0						
50.0						
55.0						

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW29-033 SHEET 1 OF 1

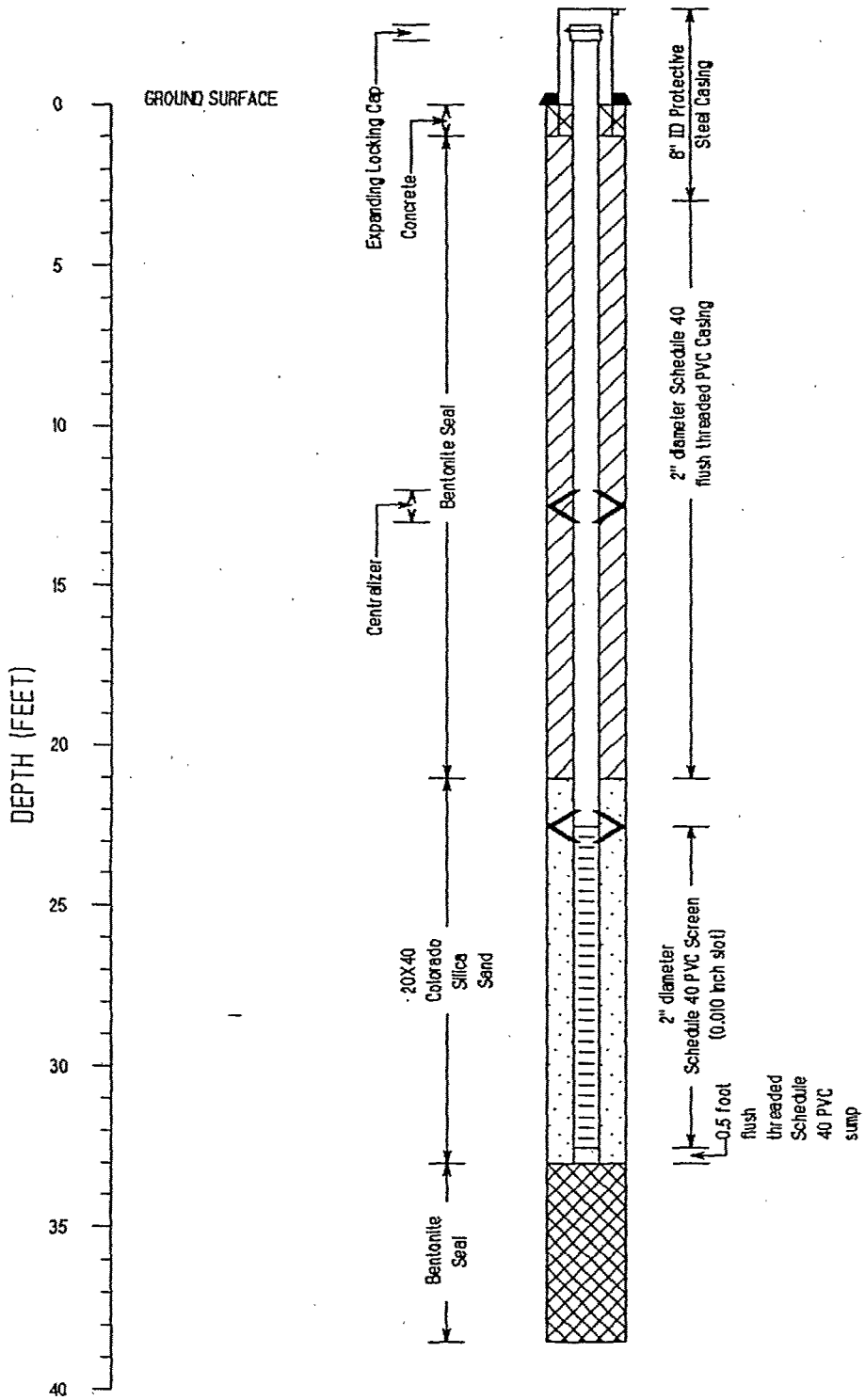
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** North of BPA Substation by Access Road

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Exploration Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Auger Rig, 8 5/8-inch ID Auger

WATER LEVELS _____ **START** 10-31-98 **FINISH** 10-31-98 **LOGGER** T. Gehweiler



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW29-090 SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ START 9-16-96 FINISH 9-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0						Driller adds 5 gallons of water for bailing.
10.0	10.0 – 11.5		0.5	7-7-10 (17)	SAND, (SW), brownish gray (5 yr 4/1), moist, loose, fine-medium- grained, 5 percent silt, sand sub-angular.	
15.0						Driller adds 5 gallons of water for bailing.
20.0	20.0 – 21.5		1.2	3-3-5 (8)	SILT, (MH), dark greenish gray (5 gy 4-1), moist, firm, plastic, approximately 20 percent clay.	
25.0	30.0				SAND, (SW), gray, wet, loose, fine to medium grained	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW29-090 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 9-16-98 FINISH 9-17-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		0.3	3-4-7 (11)	SAND, (SW), brownish gray (5 yr 4/1), wet, loose, fine-to medium- grained, some orange-red oxidized layers.	30 feet bgs water sample: T=15.5 degrees C pH=6.80 cond=140 F-=NA Driller reports increased permeability.
35.0						
40.0	40.0 – 41.5		1.2	7-9-9 (18)	SAND, (SW), as above, with some siltier layers.	
45.0						
50.0	50.0 – 51.5		1.0	7-18-18 (36)	SAND, (SW), medium dark gray (N4), wet, medium dense, fine-medium- grained, trace red grains, organic material.	End of day 50 feet 9/16/98. 50 feet bgs water sample: T=13.7 degrees C pH=7.04 cond=180 F-=NA
55.0						
	60.0					

PROJECT NUMBER	BORING NUMBER
107483.D6.02	MW29-090 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 9-18-96 FINISH 9-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME; USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 – 61.5		1.2	6-25-6 (31)	SAND, (SW), as above.	
65.0						
70.0	70.0 – 71.5		1.4	25-25-30 (55)	SAND, (SW), as above, with trace of mica.	70 feet bgs water sample: T=15.2 degrees C pH=7.14 cond=180 F--=NA Driller reports 10 feet sand heaved into casing.
75.0						
80.0					SAND, (SW), as above, except percentage of mica increasing.	Driller adds 20 gallons of water to control heaving sand; sample from bailer.
85.0						
	89.0		1.0	15-18-12		

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW29-090 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Steel Casing

WATER LEVELS _____ START 9-16-96 FINISH 9-17-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.5				SAND, (SW), as above.	91 feet bgs water sample: T=16.1 degrees C pH=7.40 cond=190 F--=NA 91 feet total depth 9/17/96.
95.0						
100.0						
105.0						
110.0						
115.0						

PROJECT NUMBER	BORING NUMBER	
107493.08.02	MW29-090	SHEET 1 OF 1

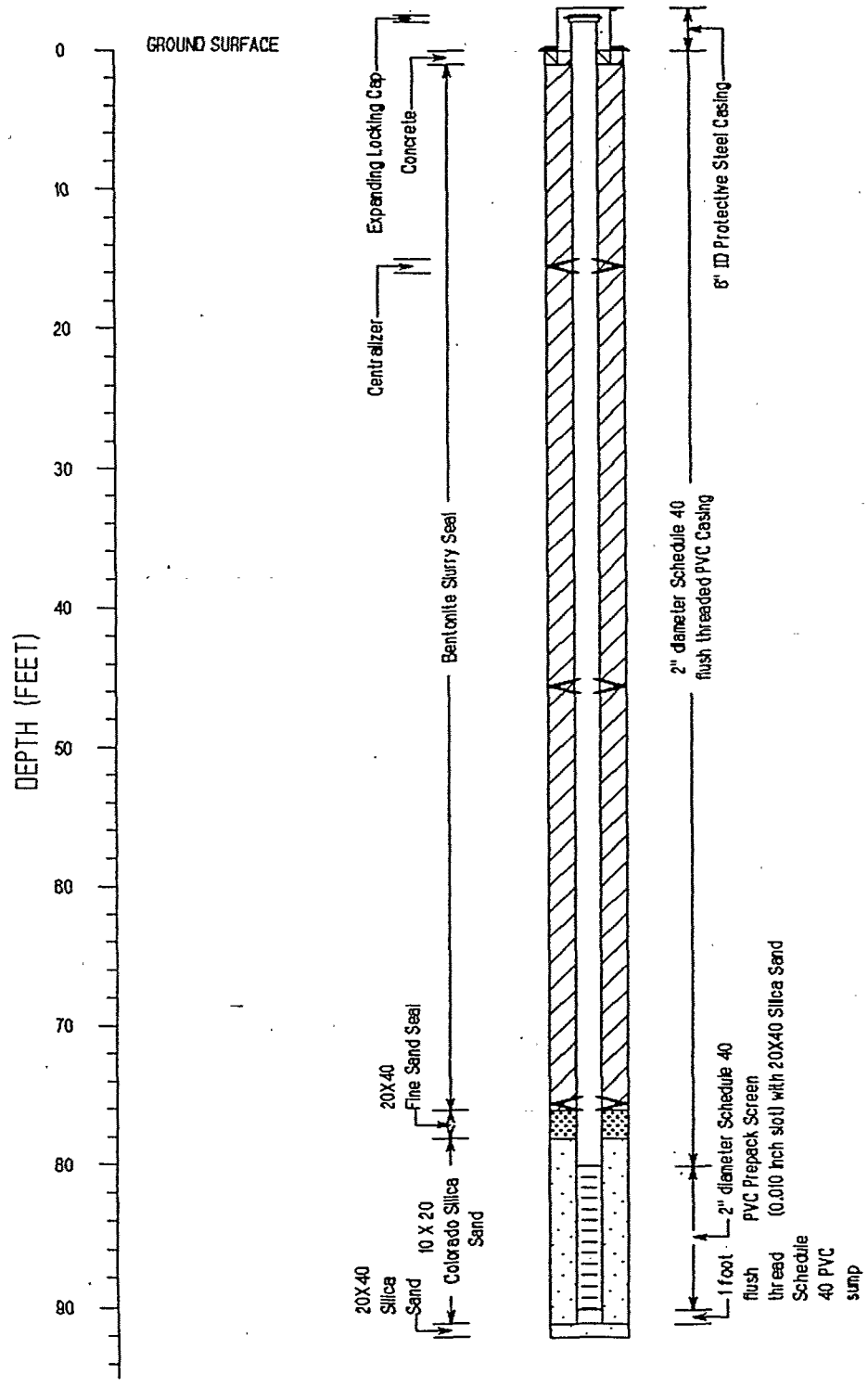
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** North of BPA Substation by Access Road

ELEVATION _____ **DRILLING CONTRACTOR** Tacoma Pump & Drilling Company

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Steel Casing

WATER LEVELS _____ **START** 9-17-96 **FINISH** 9-18-96 **LOGGER** Ivan Gall



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW29-179 SHEET 1 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool (Bucyrus Erie-29)10" to 18', 8" to 200'

WATER LEVELS _____ START 4-24-98 FINISH 5-7-98 LOGGER P. Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	1.0		0.5	45-55 (100)	Fill: Brown loamy silt, wet from rain, Refractory Bricks, gravel, dense.	Spud-in with 10 inch hole.
	2.0		0.5	15-30-50 (80)	Fill, as above, moist.	Add 5 gallons of water.
	3.0		1.0	17-17-7 (24)	As above then 0.2 feet SAND with SILT, (SW-SM), 20 percent silt, brown, moist, loose.	Add 5 gallons of water, bail hole.
	5.0					
5.0	8.0		1.0	19-19-20 (39)	SAND, (SW), light brown, moist, medium dense, very fine to medium angular, less than 5 percent silt.	Drive 10 inch casing to 9 feet.
	10.0					Add 10 gallons of water and bail.
10.0	11.0		1.0	2-3-3 (6)	SILT, (ML), light gray-brown with orange mottling, wet, soft, very fine; 10 percent clay silt, 10 percent very fine sand.	Drive casing to 15 feet; bail hole.
	15.0					
15.0	16.5		1.5	4-5-4 (9)	SILT, (MH), dark gray, wet, firm, plastic (.25 inch roll) 20 percent clay fraction. Organic H2S odor.	.4 PPM, PID, in hole. End of day 4/24/98 at 15 feet. Set outer 10 inch casing.
	20.0					At 18 feet began drilling 8 inches.
20.0	21.5		1.5-	3-4-5 (9)	SILT, (MH), as above, no odor, very uniform.	No water sample collected due to low permeability.
	25.0					
25.0	26.5		1.5	8-10-17 (27)	SAND, (SW), gray, wet, loose, fine to medium, last 0.2' brown with reddish-brown silt interbeds, minor.	High blow count due to heaving sand. Bailed out, collected water sample. 25 feet bgs water sample: T=13 degrees C pH=8.5 cond=320 F-=0.11.
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW28-178 SHEET 2 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool (Bucyrus Erie-29)10" to 18', 8" to 200'

WATER LEVELS _____ START 4-24-98 FINISH 5-7-98 LOGGER P. Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.5	50-37-43 (80)	SAND, (SW), as above, (gray), loose.	High blow count likely a function of heave and sand lock.
35.0	35.0 – 38.0		1.0	10-30-25 (55)	SAND, (SW), as above, last 0.03' slight reddish-brown staining plus a single 0.3' brown SILT, layer (ML).	Same comment as 30 feet.
40.0	40.0 – 41.5		1.5	8-10-15 (25)	SAND, (SW), as above, reddish-brown to gray, uniform.	Bail 80 gallons of water and sample. 40 feet bgs water sample: T=13 degrees C pH=8.8 cond=400 F-=0.10.
45.0	45.0 – 46.5		1.5	7-15-20 (35)	SAND with SILT, (SW-SM), brown-gray, wet, medium dense, laminar, micaceous, sand is very fine to fine, 20 percent silt, 20 percent medium sand. Silt occurs in thin lamina, medium plastic, brown.	Bailing organic material with sand: wood, roots, etc. finer sand and silt in bailer at 44 feet.
50.0	50.0 – 51.5		1.5	3-3-5 (8)	SAND, (SP), gray, wet, loose, very fine to fine, 20 percent silt.	End of day, 4/25/98 Drive casing to 55 feet.
55.0	55.0 – 58.5		1.5	6-5-10 (15)	SAND, (SW), dark gray, wet, loose, very fine to medium, micaceous.	Bail dry, let recover, collect sample. 55 feet bgs water sample: T=12 degrees C pH=8.5 cond=210 F-=0.25. Bailing 15 feet of sand out of casing at 55 feet.
	60.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW29-179 SHEET 3 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool (Bucyrus Erie-29)10" to 18', 8" to 200'

WATER LEVELS _____ START 4-24-98 FINISH 5-7-98 LOGGER P. Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	80.0 – 81.5		1.0	5-12-55 (67)	SAND, (SW), as above.	High blow count likely due to heaving sand.
	85.0 – 86.5		1.0	10-17-30 (47)	SAND, (SW), as above, trace of silt.	Same comment as 80 feet.
70.0	70.0 – 71.5		1.5	15-12-50 (62)	SAND, (SW), as above, no silt.	Bail approximately 100 gallons and sample. 70 feet bgs water sample: T=12 degrees C pH=8.5 cond=550 F-=0.5.
75.0	75.0 – 78.0				SAND, (SW), as above, very fine to very coarse.	Casing harder to drive. Trace gravel in cuttings; basaltic, well rounded to 1 cm.
80.0	80.0 – 81.0				SAND, (SW), as above, no gravel.	Bail hole to 79 feet. Driller reports sand and water heave into casing to 85 feet. Bail once more and sample. 80 feet bgs water sample: T=12 degrees C pH=8.5 cond=490 F-=1.8. Drive casing to 83 feet. End of day 4/28/98.
85.0					SAND, (SW), as above, no gravel, very fine to medium, micaceous.	Drive 8 inch casing to 90 feet. Bail hole to 90 feet. Use hydropunch to collect water sample at 90 feet.

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW28-178 SHEET 4 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool (Bucyrus Erie-29)10" to 18', 8" to 200'

WATER LEVELS _____ START 4-24-96 FINISH 5-7-96 LOGGER P. Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above, very fine to medium, no gravel, micaceous.	90 feet bgs water sample: T=18 degrees C pH=6.3 cond=600 F-=5.9.
95.0					SAND, (SW), as above.	
	100.0					
100.0	101.5		0.9	7-8-8 (18)	SAND, (SW), as above.	Bail, then sample. Collect drive sample and water sample at 100 feet. 100 feet bgs water sample: T=18 degrees C pH=6.4 cond=750 F-=6.0
105.0					SAND, (SW), as above.	
110.0					SAND, (SW), as above.	Bail out hole, set hydropunch, collect water sample at 110 feet. 110 feet bgs water sample: T=14.5 degrees C pH=6.5 cond=720 F-=5.33
115.0					SAND, (SW), as above.	
	120.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW29-179 SHEET 5 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool (Bucyrus Erie-29)10" to 18', 8" to 200'

WATER LEVELS _____ START 4-24-98 FINISH 5-7-98 LOGGER P. Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	120.0 – 121.5		1.0	50-22-30 (52)	SAND, (SW), as above except very fine to fine.	Collect drive sample and water sample at 120 feet. 120 feet bgs water sample: T=20 degrees C pH=7.0 cond=820 F-=3.84 High blow count due to heaving sand.
125.0					SAND, (SW), as above.	
130.0					SAND, (SW), as above.	Collect water sample with hydrograph system after bail hole down. 130 feet bgs water sample: T=18 degrees C pH=7.4 cond=800 F-=1.34.
135.0					SAND, (SW), as above.	
140.0	140.0 – 141.5		0.85	10-50-50/3"	SAND, (SW), as above, very fine to fine. Less than 5 percent fine, subrounded green-gray to black gravel noted in bailed samples from approximately 137-140 feet. No gravel in split spoon driven from 140-141.5 feet.	Collect and drive sample at 140 feet to 141.5 feet after bailing out hole to 140 feet. Clean hole again, install hydropunch. Collect water sample at 140 feet. 140 feet bgs water sample: T=14 degrees C pH=7.5 cond=750 F-=1.87.
145.0					SAND, (SW), as above except trace fine rounded basaltic gravel in bailed samples.	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW29-179 SHEET 6 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool (Bucyrus Erie-29)10" to 18', 8" to 200'

WATER LEVELS _____ START 4-24-98 FINISH 5-7-98 LOGGER P. Brown

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above.	Collect water sample at 150 feet. 150 feet bgs water sample: T=16 degrees C pH=7.8 cond=720 F-=3.29.
155.0					SAND, (SW), as above.	
	160.0					
160.0	161.5		1.1	50-75-50/3"	SAND, (SW), as above except fine to coarse grained sand. Shoe contained parts of large rounded basaltic cobble (.2 feet lengthwise).	Collect soil and water sample at 160 feet. Blow count high because hammered split spoon through cobble. 160 feet bgs water sample: T=17.5 degrees C pH=7.9 cond=800 F-=2.07
165.0						Casing driving harder at 166 feet.
	170.0				GRAVEL, (GW-GM), black, wet, very dense, weakly cemented, sub- rounded to angular, well graded gravel and coarse to fine sand and silt.	
170.0	171.5		0.0	100/2"	No Sample	Lithology from 166 feet to 171 feet based on samples from bailer and drilling rate. Formation not making much water at 171. Try another drive sample at 171 feet. Sample recovered rock more representative of formation, finer material from pounding rock. Bail out 80 gallons of water then collect water sample at 171.5 feet.
	173.0		0.85	150/2"	GRAVEL, (GW-GM), as above.	
175.0					GRAVEL, (GW-GM), as above.	171 feet bgs water sample: T=15.0 degrees C pH=7.82 cond=590 F-=1.61 Drilling very hard 172 feet on.
	180.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW29-179 SHEET 7 OF 7

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool (Bucyrus Erie-29)10" to 18', 8" to 200'

WATER LEVELS _____ START 4-24-98 FINISH 5-7-98 LOGGER P. Brown

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	180.0–181.5		1.2	50/4"	GRAVEL, (GW-GM), as above.	Remove approximately 56 gallons with dart baller, let hole recover and collect water sample at 180 feet. 180 feet bgs water sample: T=11.1 degrees C pH=7.82 cond=390 F--=1.24
185.0	185.0–188.5		1.5	20-50/4"	GRAVEL, (GW-GM), as above.	Started drilling a little easier at 184 feet, but producing a lot of cuttings which makes progress slow.
190.0	190.0–191.5		0.8	25-25-25 (50)	GRAVEL, (GW-GM), as above.	5/8/98 DTW=18.3 feet from ground level at 188 feet. Collect water sample at 190 feet after removing approximately 72 gallons water. 190 feet bgs water sample: T=17.3 degrees C pH=7.88 cond=400 F--=1.46.
195.0	197.0–198.5		1.5	12-25-25 (50)	GRAVEL, (GW-GM), as above.	Drilled open hole from 181-200 feet, then drove casing, balled, and sampled water at 200 feet.
200.0					GRAVEL, (GW-GM), as above.	200 feet bgs water sample: T=18 degrees C pH=7.91 cond=380 F--=1.27.
205.0					Bottom of borehole 200 feet bgs. Bottom of casing shoe at 197 feet bgs.	

PROJECT NUMBER	BORING NUMBER	
107493.D6.02	MW29-179	SHEET 1 OF 1

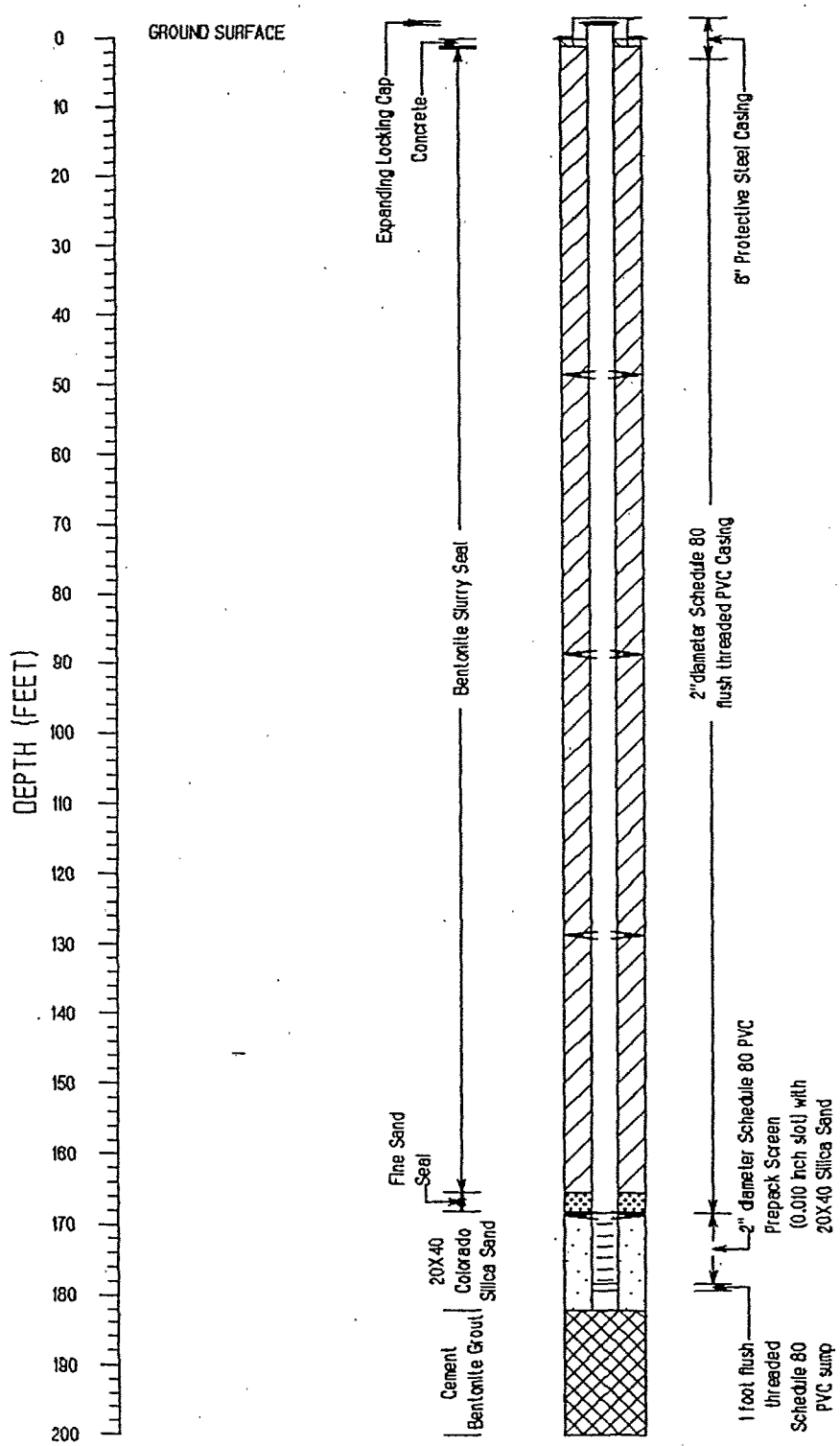
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of BPA Substation by Access Road

ELEVATION _____ DRILLING CONTRACTOR Tacoma Pump & Drilling Co.

DRILLING METHOD AND EQUIPMENT Cable Tool (Bucyrus Erie-29)10" to 18', 8" to 200'

WATER LEVELS _____ START 4-24-96 FINISH 5-7-96 LOGGER P. Brown



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW30-030 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Gresham Sand and Gravel

ELEVATION _____ DRILLING CONTRACTOR GeoTech Exploration Inc.

DRILLING METHOD AND EQUIPMENT Mobile HSA Rig, 6 5/8-inch ID Auger

WATER LEVELS _____ START 12-04-96 FINISH 12-04-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), medium dark gray (N4), damp, loose, fine to coarse grained, dredge sand.	
	5.0				SILT, (ML), dark yellow orange (10YR6/6), firm, damp, orange mottling.	
5.0	6.5		1.0	3-3-5 (8)	SAND, (SW), moderate yellow brown (10YR5/4), damp, loose, fine to medium grained.	Soil sample MW30S-0050-0
	7.5					
	9.0		0.8	2-2-4 (6)	SILT, (ML), dark yellow brown (10YR4/2), damp, firm, trace organics.	
	10.0					
10.0	11.5		1.0	1-2-2 (4)	SILT, (ML), as above, except wet.	
	12.5				SAND, (SW), moderate yellow brown (10YR5/4), moist, loose, fine to medium grained, trace organics, 10-15% silt.	
	14.0		0.7	2-2-3 (5)	SAND, (SW), as above.	
	15.0					
15.0	16.5		0.5	3-4-4 (8)	SAND, (SW), as above.	Soil sample MW30S-0150-0
	17.5					
	19.0		0.8	2-2-3 (5)	SAND, (SW), as above.	
	20.0					
20.0	21.5		1.0	3-3-4 (7)	SAND, (SW), as above, except wet.	
	22.5					
	24.0		0.3	2-2-2 (4)	SAND, (SW), as above.	
	25.0					
25.0	26.5		1.3	4-4-6 (10)	SAND, (SW), as above, except, wood fragment to 1-inch.	Soil sample MW30S-0250-0
	27.5					
	29.0		1.2	3-4-6 (10)	SAND, (SW), as above.	
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW30-030 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Gresham Sand and Gravel

ELEVATION _____ DRILLING CONTRACTOR GeoTech Exploration Inc.

DRILLING METHOD AND EQUIPMENT Mobile HSA Rig, 6 5/8-inch ID Auger

WATER LEVELS _____ START 12-04-96 FINISH 12-04-96 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 31.5		1.5	4-5-5 (10)	SAND, (SW), as above, to 31.5 feet.	
					Total Depth = 30 feet.	
35.0						
40.0						
45.0						
50.0						
55.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW30-030 SHEET 1 OF 1

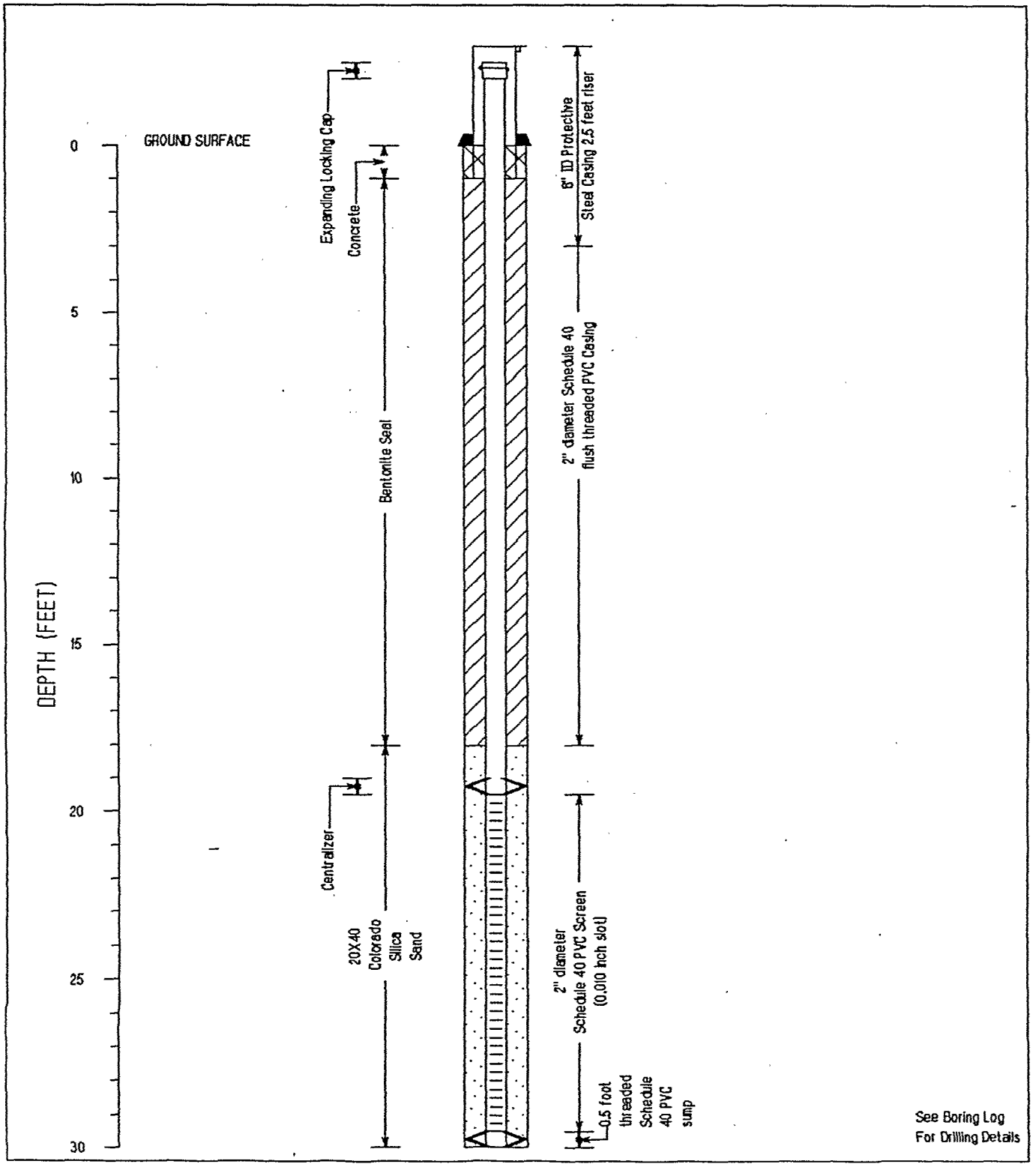
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Gresham Sand and Gravel

ELEVATION _____ DRILLING CONTRACTOR GeoTech Exploration Inc.

DRILLING METHOD AND EQUIPMENT Mobile HSA Rig, 6 5/8-inch ID Auger

WATER LEVELS _____ START 12-04-98 FINISH 12-05-98 LOGGER Ivan Gall



CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW30-100 SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Gresham Sand and Gravel

ELEVATION _____ DRILLING CONTRACTOR Staco

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" ID Threaded Casing

WATER LEVELS _____ START 12-11-96 FINISH 12-12-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					For top 30 feet; refer to log MW30-30	
5.0						
10.0						
15.0						
20.0						
25.0						
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW30-100 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Gresham Sand and Gravel

ELEVATION _____ DRILLING CONTRACTOR Staco

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" ID Threaded Casing

WATER LEVELS _____ START 12-11-96 FINISH 12-12-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.5		SAND, (SW), moderate yellow brown (10YR5/4), wet, loose, fine to medium grained, 5 to 10% fines, mica and red colored grains present.	30 feet bgs water samples: T=10.3 degrees C pH=6.91 cond=250 F-=0.210
35.0						
40.0	40.0 – 41.5		1.5	1-5-7 (12)	SAND, (SW), medium dark gray (N4), wet, loose, medium grains, round to subrounded 5% fines, mica and red grains present.	Soil sample MW301-0400-0
45.0						
50.0	50.0 – 51.5		1.5	3-7-9 (16)	SAND, (SW), medium dark gray (N4), wet, loose, fine with some medium grains, 5% fines, small 1 foot Silt layers at 50.5 feet to 51 feet, rounded to subrounded grains, mica and red grains present.	
55.0						
	60.0					

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW30-100 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Gresham Sand and Gravel

ELEVATION _____ DRILLING CONTRACTOR Staco

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" ID Threaded Casing

WATER LEVELS _____ START 12-11-96 FINISH 12-12-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 – 61.5		1.5	1-3-5 (8)	SAND, (SW), medium dark gray (N4), wet, loose, fine to medium grains, little to no fines, rounded to subrounded, mica and red grains present.	Soil sample MW30I-0600-0 60 feet bgs water sample: T=11.1 degrees C pH=6.63 cond=340 F-=0.472
65.0						
70.0	70.0 – 71.5		1.5	7-9-11 (20)	SAND, (SW), as above.	
75.0						
80.0	80.0 – 81.5		1.5	6-5-8 (13)	SAND, (SW), as above.	Soil sample MW30I-0800-0 80 feet bgs water sample: T=10.4 degrees C pH=7.22 cond=380 F-=1.63
85.0						
	90.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW30-100 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Gresham Sand and Gravel

ELEVATION _____ DRILLING CONTRACTOR Staco

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" ID Threaded Casing

WATER LEVELS _____ START 12-11-96 FINISH 12-12-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0 - 91.5		0		No return in split spoon sampler.	
95.0						
100.0	100.0 - 101.5		1.5	8-10-40 (50)	SAND, (SW), as above.	Soil sample MW30I-1000-0 100 feet bgs water sample: T=10.4 degrees C pH=7.26 cond=370 F-=0.522
					End of log 100 Feet BGS Set 2 inch well screen from 90-100 feet PVC	
105.0						
110.0						
115.0						

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW30-100	SHEET 1 OF 1

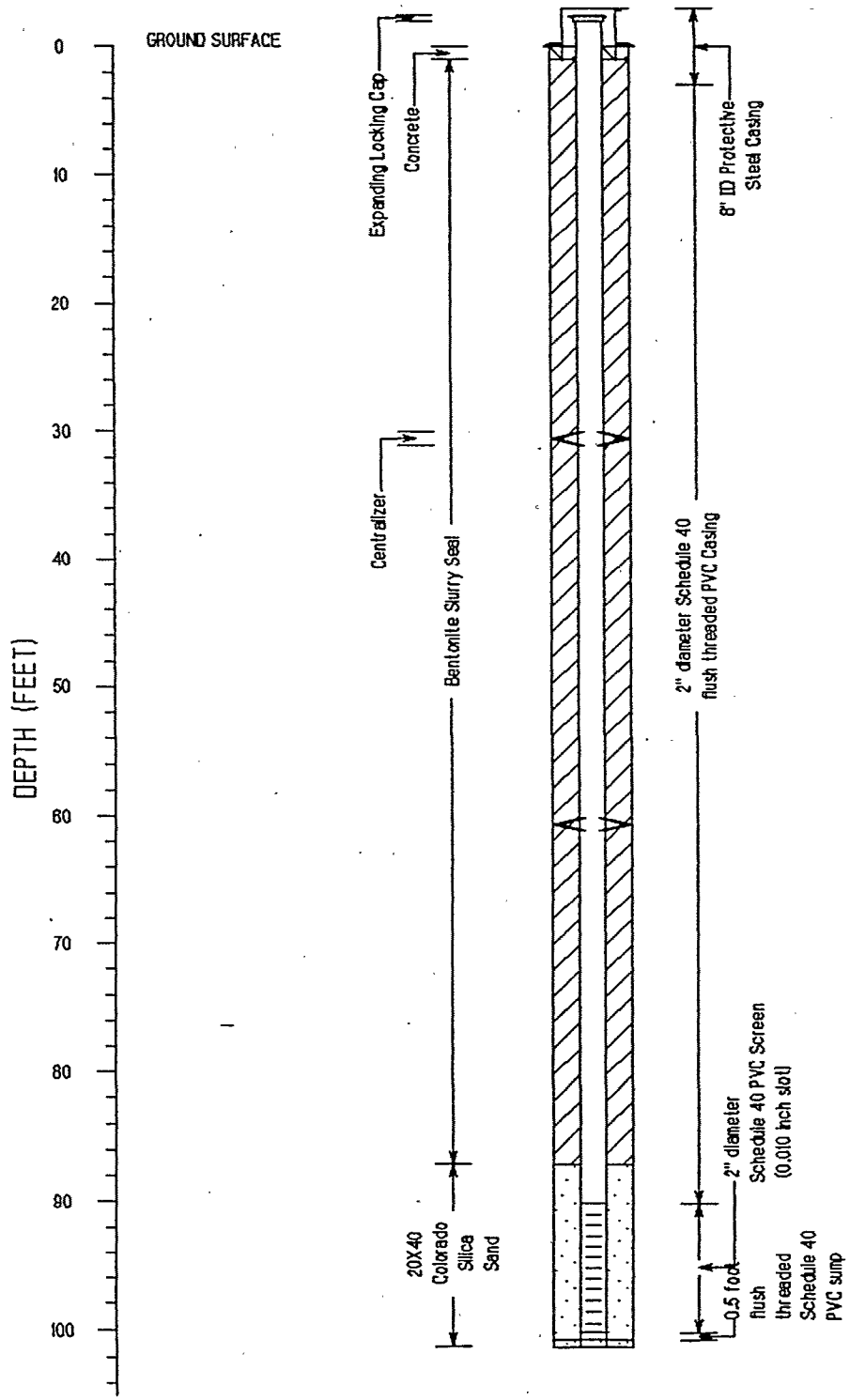
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Gresham Sand and Gravel

ELEVATION _____ **DRILLING CONTRACTOR** Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" ID Threaded Casing

WATER LEVELS _____ **START** 12-13-98 **FINISH** 12-17-98 **LOGGER** J. Bowker



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW3I-034 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of Fairview Farms

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Auger Rig, 8 1/4" I.D. Auger

WATER LEVELS Mobile Drill B-59 #210 START 11-28-98 FINISH 11-28-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1 ft: Gravel fill for drill pad	
	4.5					
5.0	6.0		1.5	1-1-2 (3)	SAND with SILT, (SM), moderate olive brown (5Y4/4), wet, loose, sand very fine to fine, 25% silt, mottled appearance,	
					SILT, (ML), moderate olive brown, soft, wet, mottled appearance, slightly plastic, trace organics.	DTW approximately 7 feet bgs
	9.0					
10.0	10.5		1.5	1-1-1 (2)	SILT, (ML), as above, with orange mottling.	Soil sample MW3IS-0100-0
	11.5					
	13.0		1.5	1-1-2 (3)	SILT, (ML), as above.	
	14.0					
15.0	15.5		1.5	1-2-2 (4)	SILT, (ML), as above.	
	18.5					
	18.0		1.5	2-2-2 (4)	SILT, (ML), as above, except trace very fine sand.	
	19.0					
20.0	20.5		1.5	2-2-2 (4)	SILT, (ML), as above.	Soil sample MW3IS-0200-0
	21.5		–			
	23.0		1.5	4-4-5 (9)	SAND WITH SILT, (SM), greenish black (5GY2/1), wet, loose, very fine to fine, 20-25% silt, trace organics.	
	24.0					
25.0	25.5		1.5	3-4-5 (9)	SAND WITH SILT, (SM), as above, except 10-15% silt.	
	26.5					
	28.0		1.4	6-7-6 (13)	SAND, (SW), dark gray (N3), wet, loose, fine to medium grained, red grains, well graded.	
	29.0					
	29.9		1.4	4-5-5 (10)	SAND, (SW), as above, 2-inch silt layer at 30 feet.	Soil sample MW3IS-0300-0

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW31-034 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of Fairview Farms

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Auger Rig, 8 1/4" I.D. Auger

WATER LEVELS Mobile Drill B-59 #210 START 11-26-98 FINISH 11-26-98 LOGGER Ivan Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	32.0					
	33.5		1.3	5-7-8 (15)	SAND, (SW), as above, silt laminae (1-inch) at 33.2 feet bgs	
	34.0					
35.0	35.5		1.3	5-6-6 (12)	SAND, (SW), as above	
					Total Depth = 34 Feet BGS	
40.0						
45.0						
50.0						
55.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW3I-034 SHEET 1 OF 1

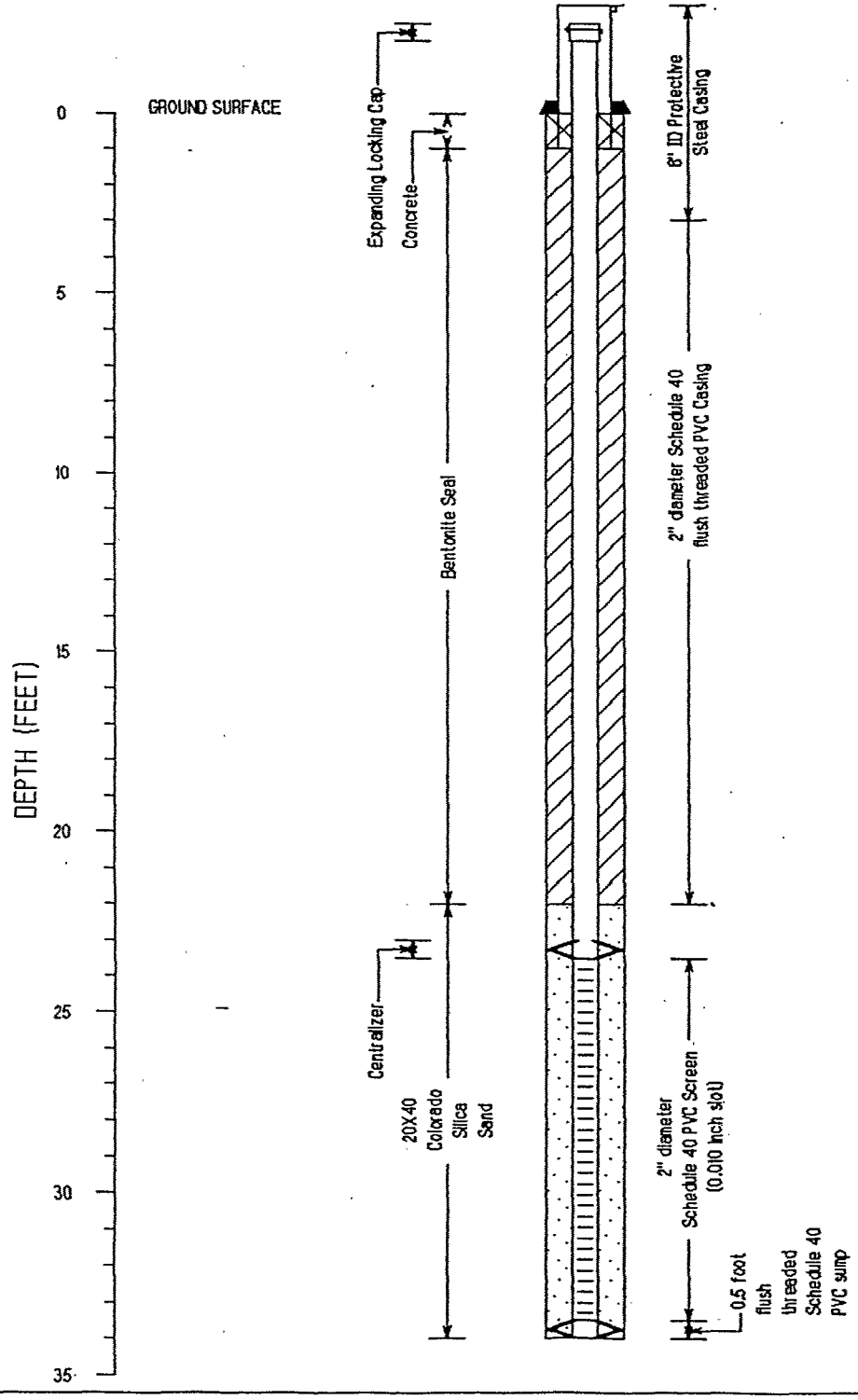
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Northeast Corner of Fairview Farms

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Auger Rig, 8 1/4" I.D. Auger

WATER LEVELS Mobile Drill B-59 #210 **START** 11-26-96 **FINISH** 11-26-96 **LOGGER** Ivan Gall



See Boring Log For Drilling Details

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW31-095 SHEET 1 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of Fairview Farms

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Threaded Casing

WATER LEVELS _____ START 11-28-98 FINISH 12-8-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Refer to by MW31S for upper 20 feet.	
5.0						
10.0						
15.0						
20.0						
	21.0					
	22.5		1.5	1-1-2 (3)	Top 1.0 foot: SILT with SAND, (ML), olive gray (5Y4/1), moist, soft, fine grained sand. Bottom 0.5 foot: SILT, (ML), olive gray (5Y4/1), moist, soft.	
25.0						24 feet bgs water sample: T=NA degrees C pH=7.33 cond=180 F-=0.382
	28.0				SAND, (SW), medium dark gray (N4), wet, medium dense, fine to coarse grained, 5-10% fines.	
	28.8		1.5	7-12-15 (27)		

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW31-095 SHEET 2 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of Fairview Farms

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" Threaded Casing

WATER LEVELS _____ START 11-26-96 FINISH 12-6-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35.0						
40.0	40.0					
	41.5		1.5	7-7-7 (14)	SAND, (SW), same as above.	Soil sample MW31I-0400-0 40 feet bgs water sample: T=7.0 degrees C pH=7.33 cond=195 F-=0.285
45.0						
50.0	50.0					
	51.5		1.5	7-8-11 (19)	SAND, (SW), same as above.	
55.0						
	60.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW31-095 SHEET 3 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of Fairview Farms

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" Threaded Casing

WATER LEVELS _____ START 11-26-96 FINISH 12-6-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 – 61.5		1.5	7-10-11 (21)	SAND, (SW), same as above, with little to no fines and slightly coarser sand grains.	Soil sample MW31I-0800-0 60 feet bgs water sample: T=8.4 degrees C pH=6.82 cond=250 F-=1.84
65.0						
70.0	70.0 – 71.5		0.2	10-11-9 (20)	SAND, (SW), same as above with 5-10% fines.	
75.0						
80.0	80.0 – 81.5		1.5		SAND, (SW), same as above.	Soil sample MW31I-0800-0 80 feet bgs water sample: T=NA degrees C pH=7.50 cond=190 F-=11.1
85.0						
	90.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW31-095 SHEET 4 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of Fairview Farms

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Threaded Casing

WATER LEVELS _____ START 11-28-96 FINISH 12-6-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0 – 91.5		1.5		SAND, (SW), same as above.	90 feet bgs water sample: T=8.4 degrees C pH=6.83 cond=270 F-=13.5
95.0						
100.0	100.0 – 101.5		1.5		SAND, (SW), same as above.	Soil sample MW31I-1000-0 100 feet bgs water sample: T=8.5 degrees C pH=7.08 cond=285 F-=14.1
105.0						
110.0	110.0 – 111.5		1.5		SAND, (SW), same as above.	110 feet bgs water sample: T=8.4 degrees C pH=7.20 cond=280 F-=13.2
115.0						
	120.0					

PROJECT NUMBER	BORING NUMBER
107493.08.02	MW31-095 SHEET 5 OF 5

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northeast Corner of Fairview Farms

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Threaded Casing

WATER LEVELS _____ START 11-26-96 FINISH 12-6-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	120.0 121.5		1.5		SAND, (SW), same as above.	Driller reports bailing gravels Soil sample MW-31I-1200-0 120 feet bgs water sample: T=9.6 degrees C pH=7.07 cond=210 F--=3.20
125.0						
130.0						
135.0						
140.0						
145.0						

PROJECT NUMBER	BORING NUMBER	
107493.06.02	MW31-095	SHEET 1 OF 1

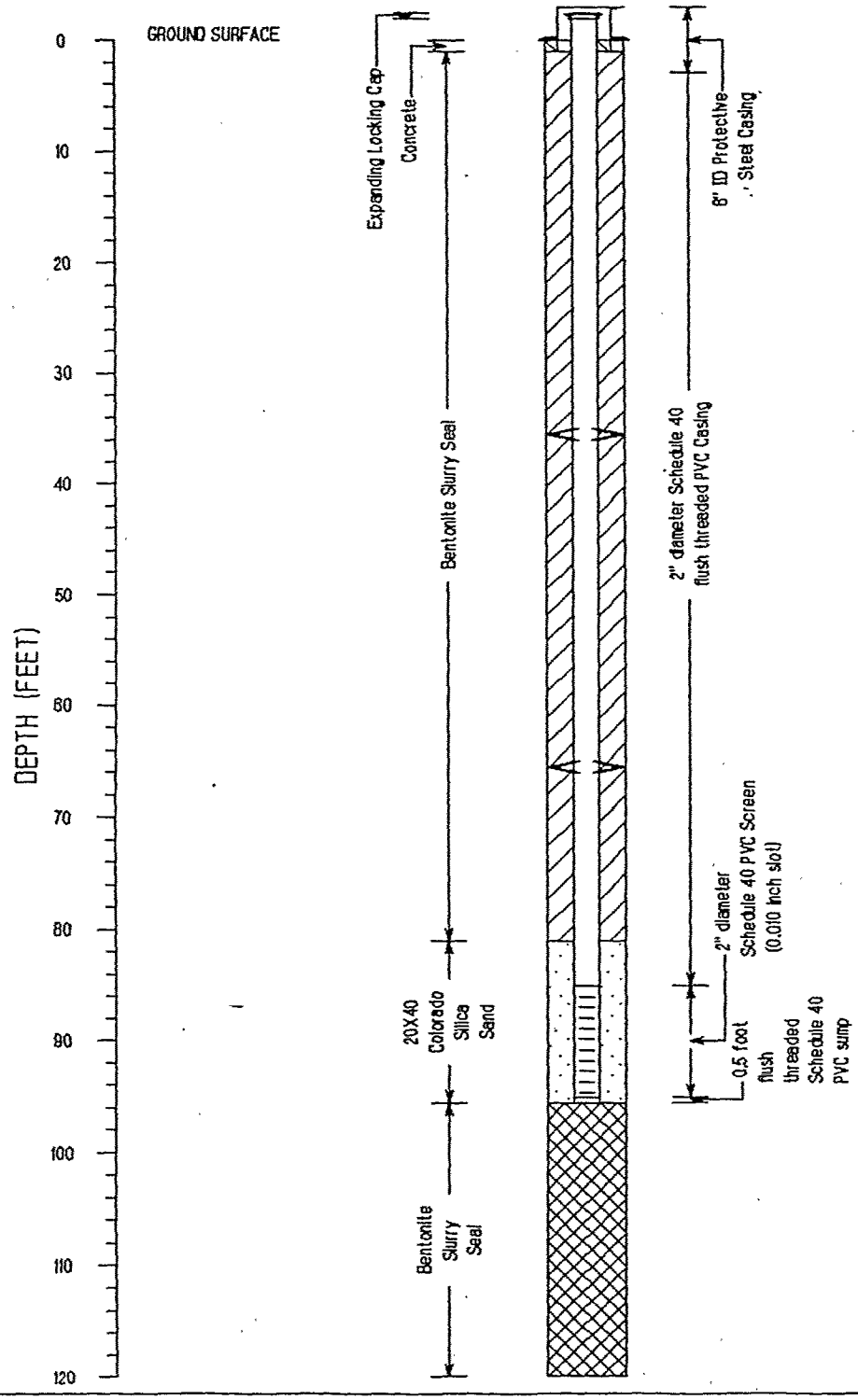
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Northeast Corner of Fairview Farms

ELEVATION _____ **DRILLING CONTRACTOR** Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" Threaded Casing

WATER LEVELS _____ **START** 12-8-96 **FINISH** 12-9-96 **LOGGER** J. Bowker



See Boring Log
For Drilling Details

PROJECT NUMBER	BORING NUMBER
107483.08.02	MW32-040 SHEET 1 OF 1

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** East End of Building 48

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Auger; 8.25" ID Auger

WATER LEVELS Approximately 15 feet bgs **START** 12-08-98 **FINISH** 12-08-98 **LOGGER** I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0					See MW32-I and MW32-D for Lithology	
10.0						Sand heaving into auger from 35-40 feet bgs
15.0						
20.0						Total Depth = 41 Feet BGS
25.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW32-040 SHEET 1 OF 1

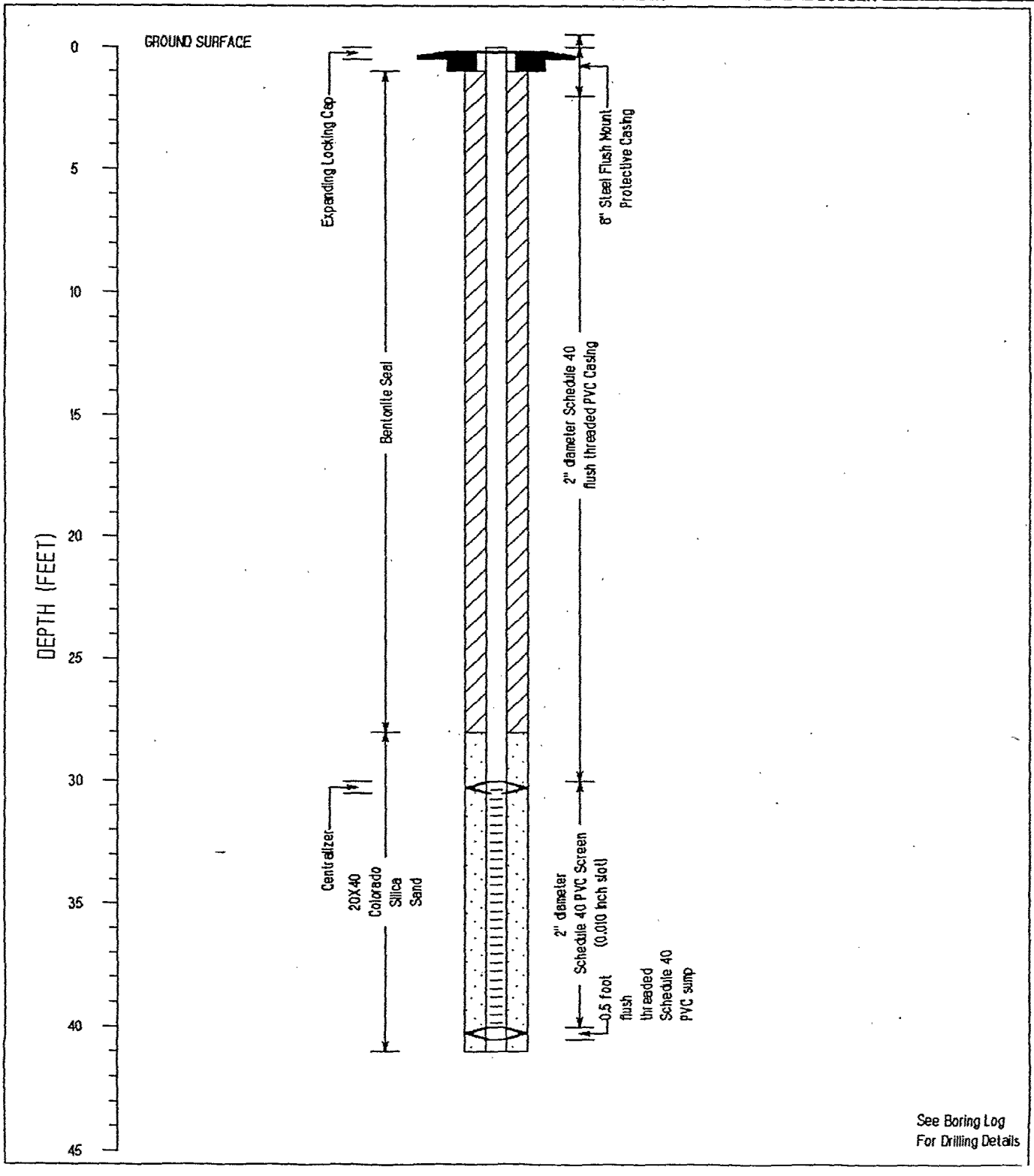
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** East End of Building 48

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Auger; 8.25" ID Auger

WATER LEVELS Approximately 15 feet bgs **START** 12-08-98 **FINISH** 12-08-98 **LOGGER** I. Gall



See Boring Log For Drilling Details

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW32-085 SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" O Threaded Steel Casing

WATER LEVELS _____ START 12-03-88 FINISH 12-05-88 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-.25 foot: Asphalt concrete pavement	Driller adds 15 gallons of water
					.25-2 feet: Fill - SILTY SANDY GRAVEL, (GM), brown, moist, medium dense, fine angular gravel, medium to fine grained sand.	
5.0					SILTY SAND, (SW-SM), brown, moist, medium dense, medium to fine grained sand, approximately 10% silt, no gravel.	
10.0					SANDY SILT, (ML), brown, wet, soft with orange mottles grading to	
					SAND, (SW), brown, wet, loose, fine grained, no silt or gravel. Becomes medium to fine grained with trace of coarse sand to 12 feet.	
					SANDY SILT, (ML), brown, wet, soft with orange mottles, not elastic.	Driller adds water
15.0						
20.0					SANDY SILT, (MH), gray, wet, very soft, slightly plastic:	
25.0						
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D6.02	MW32-085 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" O Threaded Steel Casing

WATER LEVELS _____ START 12-03-98 FINISH 12-05-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.0	1-1-2 (3)	SAND, (SW), brown, wet, very loose, medium to fine grained, less than 5 percent silt, trace mica flakes.	Collect soil for TOC analysis at 30 ft. bgs with split spoon sampler. 30 feet bgs water sample: T=8.7 degrees C pH=8.97 cond=185 F-=0.219
35.0						
40.0					SAND, (SW), as above.	
45.0						
50.0	50.0 – 51.5		1.5	2-8-8 (14)	SAND, (SW), gray, wet, loose, medium to fine grained, trace wood fragments and mica flakes.	Collect soil for TOC analysis at 50 ft. 50 feet bgs water sample: T=8.3 degrees C pH=7.03 cond=170 F-=0.013
55.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D6.02	MW32-085 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" O Threaded Steel Casing

WATER LEVELS _____ START 12-03-98 FINISH 12-05-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), as above except no wood fragments.	
65.0						
70.0	70.0					
	71.5		1.5	3-7-8 (15)	SAND (SW), gray, wet, loose, medium to fine grained, trace mica flakes and red sand grains.	Collect soil for TOC analysis at 70 ft. 70 feet bgs water sample: T=10.7 degrees C pH=8.04 cond=210 F-=0.289
75.0						
80.0					SAND, (SW), as above.	
85.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW32-085 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" O Threaded Steel Casing

WATER LEVELS _____ START 12-03-98 FINISH 12-05-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95.0	95.0				SAND, (SW), gray, wet, loose, medium to fine grained, trace mica flakes	Collect soil sample for TOC analysis at 95 feet.
	96.5		1.5	2-5-7 (12)		
100.0						
105.0						
110.0						
115.0						

PROJECT NUMBER	BORING NUMBER	
107483.08.02	MW32-085	SHEET 1 OF 1

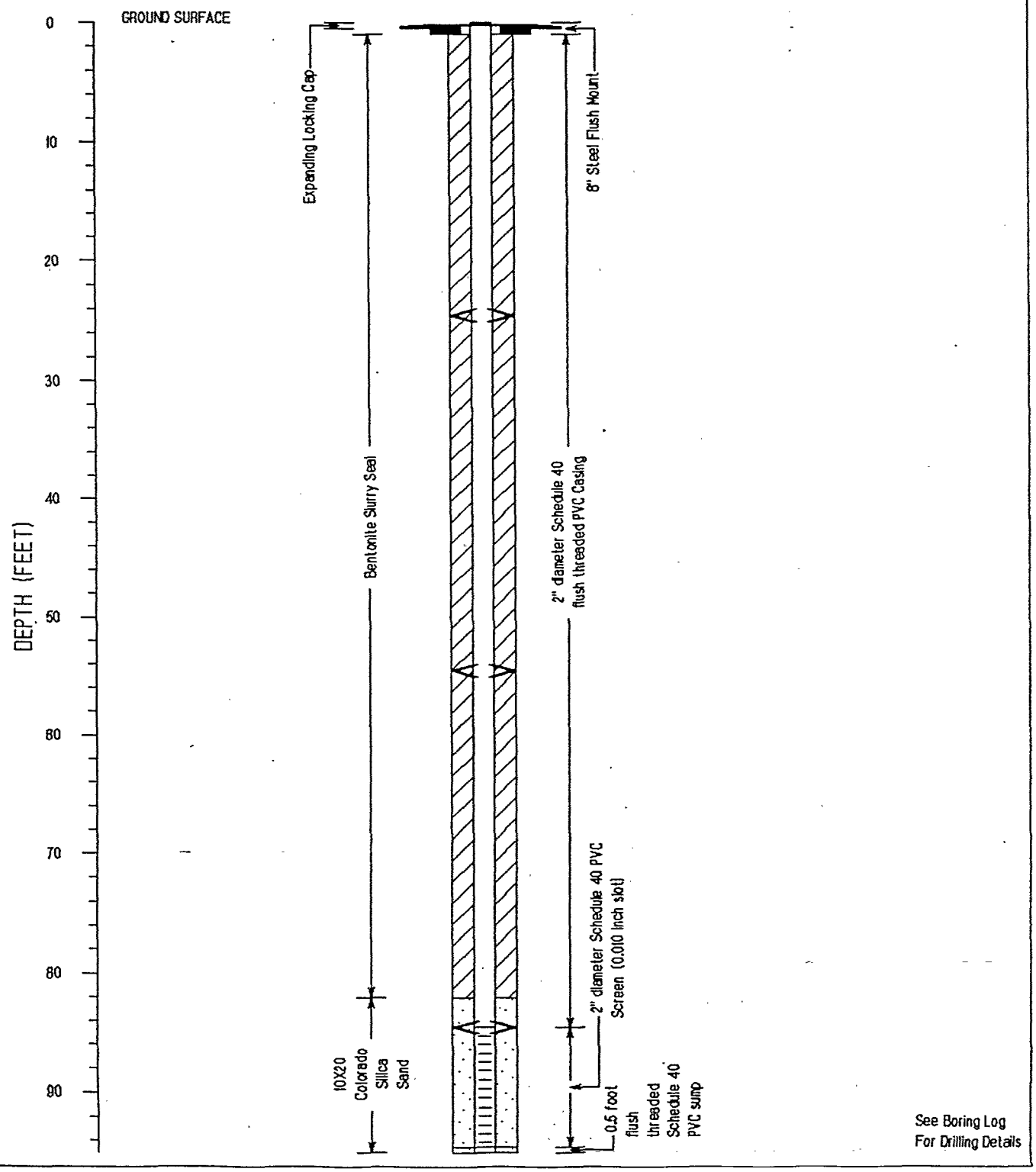
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** East end of Building 48

ELEVATION _____ **DRILLING CONTRACTOR** Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" O Threaded Steel Casing

WATER LEVELS _____ **START** 12-05-88 **FINISH** 12-06-88 **LOGGER** T. Gehweiler



CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW32-165 SHEET 1 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Threaded Steel Casing

WATER LEVELS _____ START 11-20-96 FINISH 11-26-96 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-0.25 foot: Asphalt concrete pavement. 0.25-2 feet: Fill SILTY SANDY GRAVEL, (GM), brown, moist, fine angular gravel, medium to fine grained sand.	Driller adds 15 gallons of water
5.0					SILTY SAND, (SW-SM), brown, moist, medium dense, medium to fine grained sand, approximately 10% silt, no gravel.	
10.0	10.0					
	11.5		1.5	6 Total	10-10.5 feet, SANDY SILT, (ML), brown, wet, soft, with orange mottling, not elastic.	Bail hole clean, collect soil sample for TOC analysis at 10 ft bgs. at 1355; MW32D-0100-0; Used cathead and hammer to collect blow counts.
					10.5-11.0 feet, SAND, (SW), brown, wet, loose, fine grained, no silt or gravel. Grades into fine to medium grained brown sand from 11-11.5 feet, predominantly medium grained (75%), 20% fine, less than 5 percent coarse angular sand. 11.5 feet, SANDY SILT, (ML), brown, wet, soft with orange mottling, not elastic.	
15.0						Driller adds water approximately 10 gallons
20.0	20.0					
	21.5		1.25	1-1-1 (2)	SANDY SILT, (ML), gray, wet, very soft, slightly plastic	Bail out hole at 20 feet, driller reports formation not producing water at 20 feet, Collect soil sample for TOC, no water sample.
25.0						
	30.0					

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW32-165 SHEET 2 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Threaded Steel Casing

WATER LEVELS _____ START 11-20-96 FINISH 11-26-96 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.1	2-19/6"	SAND, (SW), gray brown to brown, wet, medium dense, medium to fine grained, less than 5 percent silt, trace red sand grains and mica flakes.	Driller says sampler acts like its full. 6 inch left to go according to marks. Retrieve. Collect soil for TOC at 30 ft at 1630.
35.0						
40.0	40.0 – 41.5		1.3	1-1-2 (3)	SAND, (SW), as above except very loose.	Collect soil and H20 sample at 40 feet at 915 40 feet bgs water sample: T=13.2 degrees C pH=6.48 cond=190 F-=0.104 Driller reports 5 ft of heave inside casing
45.0					Wood fragments observed in bailer.	
50.0	50.0 – 51.5		1.5	1-5-5 (10)	SAND, (SW), as above except gray, loose, trace wood fragments less than 5 percent.	Collect soil sample for TOC at 50 feet at 1040.
55.0						
	60.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW32-165 SHEET 3 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Threaded Steel Casing

WATER LEVELS _____ START 11-20-96 FINISH 11-26-96 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	60.0 – 61.5		1.5	3-6-8 (14)	SAND, (SW), as above except no wood fragments.	60 feet bgs water sample: T=10 degrees C pH=6.83 cond=200 F-=0.184
65.0						
70.0	70.0 – 71.5		1.5	3-10-10 (20)	SAND, (SW), as above.	
75.0						
80.0	80.0 – 81.5		0.6	1-2-3 (5)	SAND, (SW), as above.	80 feet bgs water sample: T=11.9 degrees C pH=7.7 cond=215 F-=0.309
85.0						
	90.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW32-165 SHEET 4 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Threaded Steel Casing

WATER LEVELS _____ START 11-20-96 FINISH 11-26-96 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	90.0 91.5		0.8	3-4-6 (10)	SAND, (SW), as above.	1 1/2 feet of heave after sitting over weekend
95.0					96 feet, SAND, (SW), as above with 5-10% rounded to subangular fine gravel (up to 3/4-inch).	
100.0	100.0 101.5		0.4	3-5-6 (11)	SAND, (SW), gray, wet, loose, medium to fine grained, micaeous, no silt, wood fragments, or gravel.	100 feet bgs water sample: T=13.3 degrees C pH=7.52 cond=210 F-=0.375
105.0						
110.0	110.0 111.5		0.9	3-4-9 (13)	SAND, (SW), as above except 5% fine subangular gravel (up to 1/2-inch).	
115.0						
	120.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW32-165 SHEET 5 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Threaded Steel Casing

WATER LEVELS _____ START 11-20-96 FINISH 11-26-96 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	120.0 – 121.5		0.8	3-4-19 (23)	SAND, (SW), as above except loose to medium dense, 5% fine subangular gravel and trace wood fragments.	120 feet bgs water sample: T=13 degrees C pH=7.08 cond=210 F-=0.328
125.0						
130.0	130.0 – 131.5		0.75	1-1-2 (3)	SAND, (SW), as above except very loose, no gravel, no wood fragments.	
135.0						
140.0	140.0 – 141.5		0.8	2-2-4 (6)	SAND, (SW), as above.	140 feet bgs water sample: T=12.6 degrees C pH=6.95 cond=208 F-=0.449
145.0					Trace (less than or equal to 5 percent) fine subangular gravel observed in cuttings.	Casing driving a little slower/harder.
	150.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW32-165 SHEET 6 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION East end of Building 48

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 6" ID Threaded Steel Casing

WATER LEVELS _____ START 11-20-96 FINISH 11-26-96 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	150.0 – 151.5		0	2-3-5 (8)	No Sample Recovered	
					Percent gravel increasing (up to 15%) based on cuttings bailed from borehole.	
155.0						
160.0	160.0 – 161.5		0	1-4-36 (40)	No Sample Recovery	160 feet bgs water sample: T=12.1 degrees C pH=7.4 cond=205 F-=0.387
					SAND, (SW), gray, wet, loose, up to 15% fine subrounded to subangular fine gravel.	
165.0	165.0				Total Depth = 165 Feet BGS	
170.0						
175.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW32-165 SHEET 1 OF 1

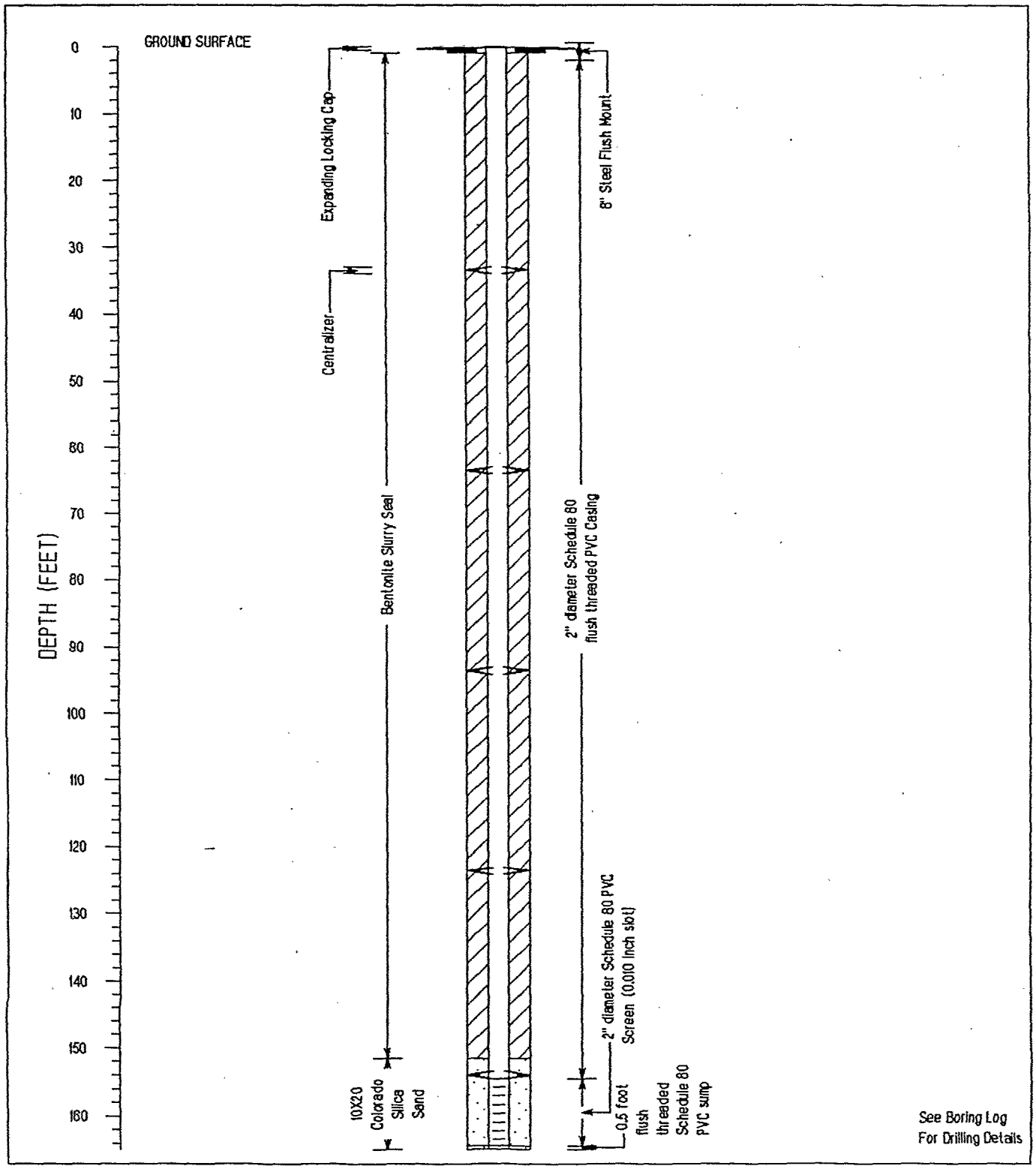
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** East end of Building 48

ELEVATION _____ **DRILLING CONTRACTOR** Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool; 8" ID Threaded Steel Casing

WATER LEVELS _____ **START** 11-27-96 **FINISH** 12-02-96 **LOGGER** T. Gehweiler



CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW33-033 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Scrap Yard Area, North of MW13

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Augers Rig, 6-inch ID Augers

WATER LEVELS _____ START 12-04-96 FINISH 12-04-96 LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0	5.0–6.5		0.3	2-3-3 (6)	SAND, (SW), brownish gray (5YR4/1), wet, loose, fine to medium grained, trace silt and roots.	
10.0	10.0–11.5		1.5	1-1-1 (2)	SILT, (ML), olive gray (5Y4/1), wet, soft, trace organics and very fine sand, orange mottling.	
15.0	15.0–16.5		1.0	2-2-3 (5)	SILT, (ML), dark yellowish orange (10YR6/6), wet, soft, orange mottling prevalent, contact at 16 feet with SILT, (ML), olive gray (5Y4/1), wet, soft, some orange mottling.	
20.0	20.0–21.5		1.5	3-3-4 (7)	SILT, (ML), as above, slightly plastic, Last 0.1 feet is SAND, (SW), medium dark gray (N4), wet, loose, fine to medium, grained, trace red grains.	
25.0	25.0–26.5		1.0	2-3-4 (7)	SAND, (SW), as above.	
	27.5–29.0		1.2	3-3-4 (7)	SAND, (SW), as above.	
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW33-033 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Scrap Yard Area, North of MW13

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Augers Rig, 6-inch ID Augers

WATER LEVELS _____ START 12-04-96 FINISH 12-04-96 LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		0.8	3-4-4 (8)	SAND, (SW), as above.	
	33.0 – 33.5		0.5	4-3-4 (7)	SAND, (SW), as above.	Total Depth = 33.5 Feet BGS
35.0						
40.0						
45.0						
50.0						
55.0						

PROJECT NUMBER	BORING NUMBER	
107483.08.02	MW33-033	SHEET 1 OF 1

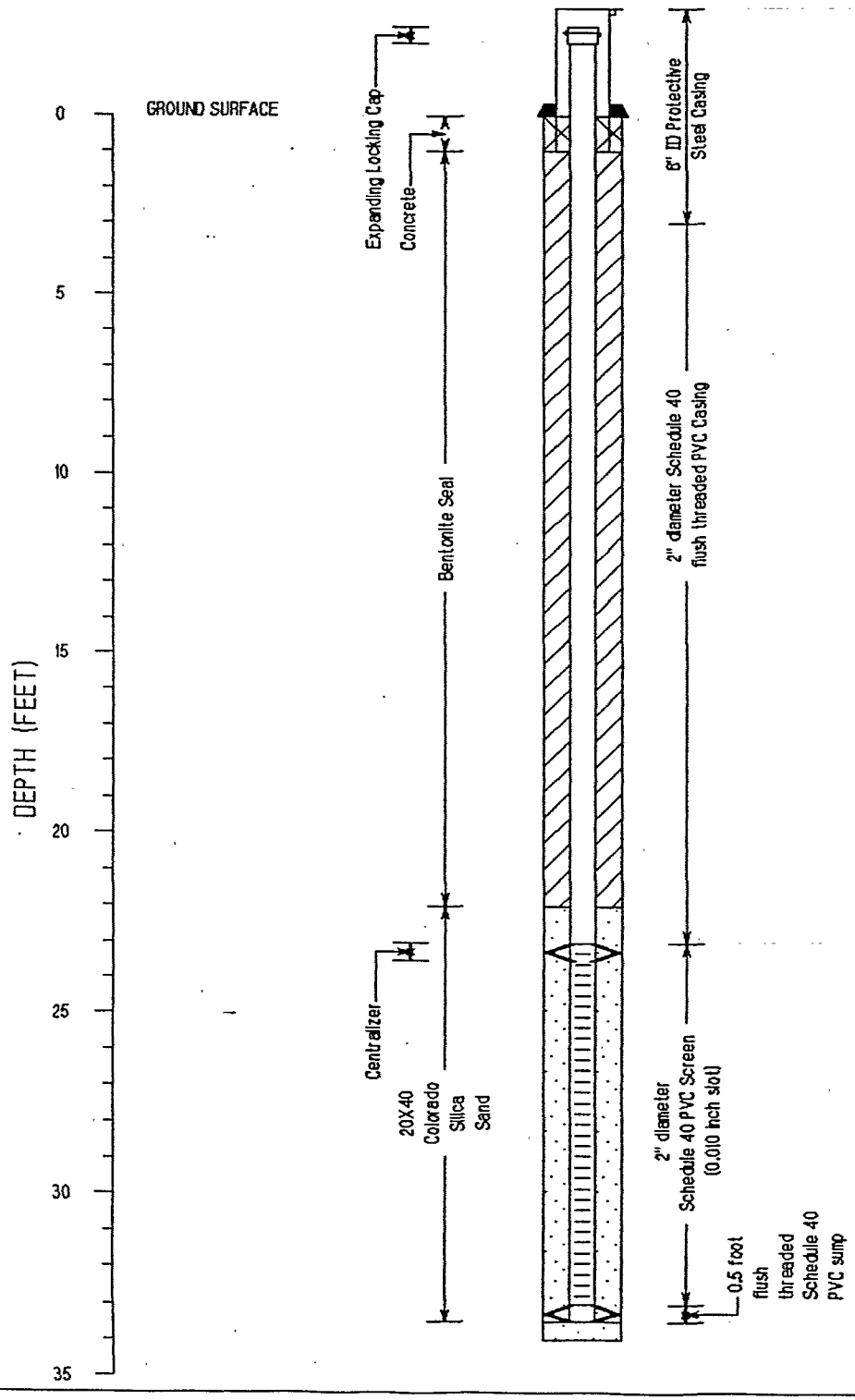
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Scrap Yard Area, North of MW13

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile Hollow Stem Augers Rig, 8-Inch ID Augers

WATER LEVELS _____ START 12-04-98 FINISH 12-04-98 LOGGER I. Gall



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW33-095 SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Scrap Yard Area; North of MW13

ELEVATION _____ **DRILLING CONTRACTOR** Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" Casing

WATER LEVELS _____ **START** 11-18-96 **FINISH** 11-25-96 **LOGGER** J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0						
10.0	10.0				SILT, (MH), olive gray (5Y4/1), moist to wet, stiff, medium plasticity.	
	11.5		1.5			
15.0						
20.0						Mixture of sand and silt in cuttings
					SAND, (SW), medium dark gray (N4), wet, loose, fine- to medium- grained, Trace red grains.	
25.0						
	30.0					

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW33-095 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Scrap Yard Area; North of MW13

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" Casing

WATER LEVELS _____ START 11-18-96 FINISH 11-25-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 31.5		1.5		SAND, (SW), medium dark gray (N4), wet, loose to medium dense, fine to coarse grained sand, 5% fines.	Soil sample MW33I-0300-0 analyzed for PAH, TOC, Total F & Cyanide, 23 metals.
35.0						
40.0						
45.0						
50.0					From cuttings. SAND, (SW), same as above.	
55.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW33-085 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Scrap Yard Area; North of MW13

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" Casing

WATER LEVELS _____ START 11-18-96 FINISH 11-25-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65.0						
70.0					From cuttings. SAND, (SW), same as above.	
75.0						
80.0						
85.0	85.0				SAND, (SW), same as above.	Soil sample MW33I-0850-0 analyzed for PAH, VOC, Total F & Cyanide, 23 metals.
	88.5					88 ft bgs water sample: T=NA degrees C F-=20.2 Water sample: MW33I-32598-0

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW33-095 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Scrap Yard Area; North of MW13

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Casing

WATER LEVELS _____ START 11-18-98 FINISH 11-25-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95.0	95.0				SAND, (SW), same as above.	Soil sample: MW33I-0950-0 analyzed for PAH, VOC, Total F & Cyanide, 23 metals.
	98.0					End of Boring 98 Feet
100.0						
105.0						
110.0						
115.0						

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW33-095 SHEET 1 OF 1

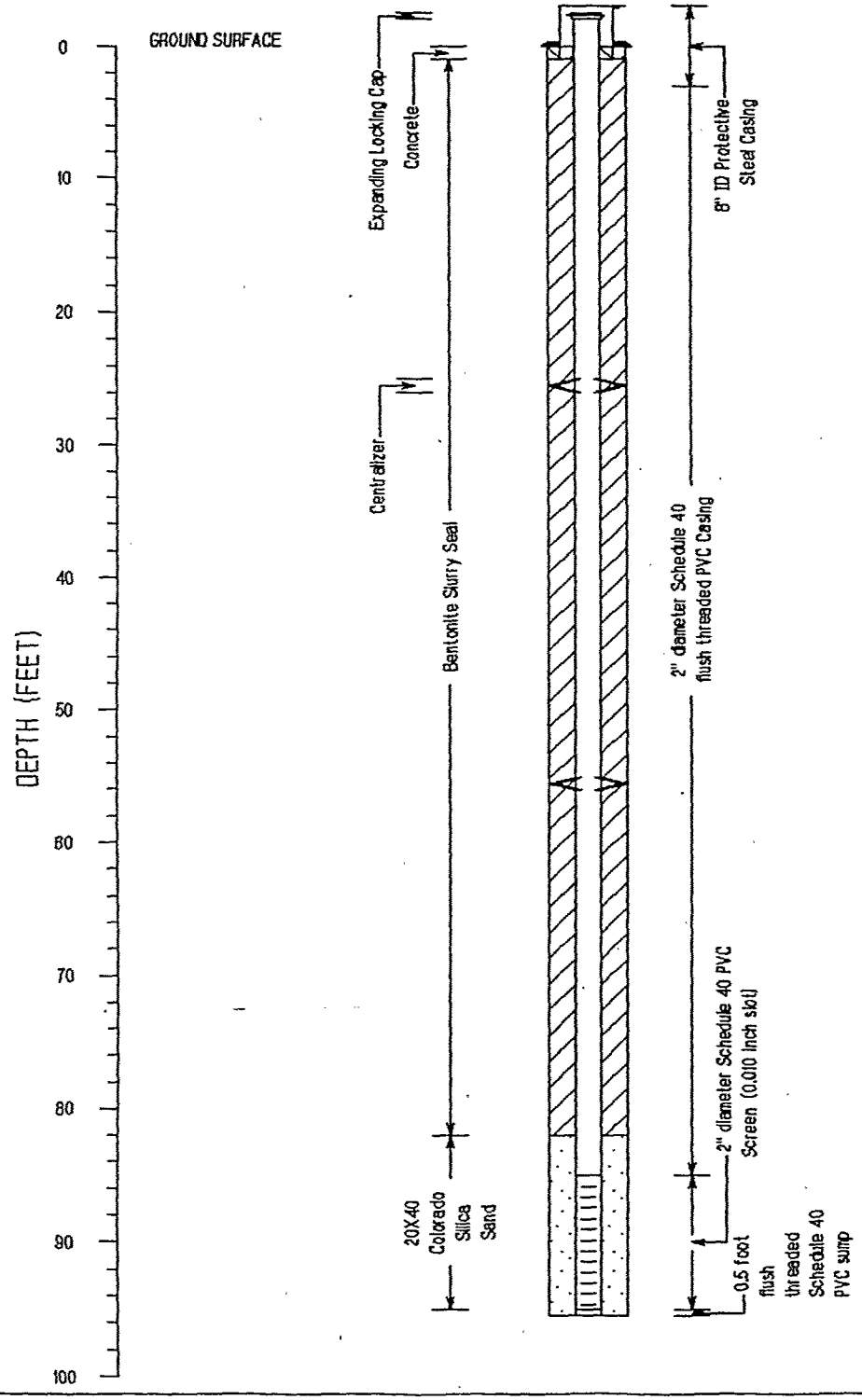
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Scrap Yard Area; North of MW13

ELEVATION _____ **DRILLING CONTRACTOR** Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Casing

WATER LEVELS _____ **START** 11-25-96 **FINISH** 11-27-96 **LOGGER** J. Bowker



See Boring Log For Drilling Details

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW33-165 SHEET 1 OF 8

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Reynolds (Troutdale)

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Casing

WATER LEVELS _____ START 10-21-98 FINISH 12-20-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5.0					SAND, (SW), brownish gray (5YR4/1), dry to damp, loose, trace fines less than 5%.	Soil from cuttings
10.0					SILT, (ML)	Driller hitting saturated zone about 10 feet bgs
	14.0					
15.0	15.5		1.5		Top .5 foot SILT, (ML), olive gray (5Y4/1), wet, medium stiff, trace fine grained sand. Middle .8 foot SAND WITH SILT, (SM), moderate yellowish brown (10YR5/4), wet, loose, fine grained sand. Bottom .2 foot SILT, (ML), olive gray (5Y4/1), wet, medium stiff, trace fine grained sand.	
	20.0					20 feet bgs water sample:
20.0	21.5				SILT, (ML), olive gray (5Y4/1), moist to wet, stiff, trace fine grained sand, slight plasticity.	T=8 degrees C pH=6.82 cond=110 F-=0.32
						Driller adding 5 gallons water
25.0						
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW33-185 SHEET 2 OF 8

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Reynolds (Troutdale)

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Casing

WATER LEVELS _____ START 10-21-98 FINISH 12-20-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.5		SAND AND SILT, (SM), medium dark gray (N4), wet, loose, fine to medium grained sand.	30 feet bgs water sample: T=7.8 degrees C pH=6.96 cond=155 F-=0.34 Driller adding 5 gallons water
35.0						
	38.0 – 39.5				SAND, (SW), medium dark gray (N4), wet, loose to medium dense, fine to coarse grained, 5-10% silt with .1 foot thick silt layer near bottom of sample, rounded to subrounded grains.	38 feet bgs water sample: T=7.8 degrees C pH=7.31 cond=135 F-=0.23 Driller adding 10 gallons water
40.0						
45.0						
	48.0 – 49.5				SAND, (SW), medium dark gray (N4), wet, loose to medium dense, fine to coarse grained, rounded to subrounded grains, little to no fines, red grains present.	Drilling slowing down
50.0						
55.0						Driller added 15 gallons water
	58.0 – 59.5				SAND, (SW), as above with no fines.	58 feet bgs water sample: T=8.3 degrees C pH=6.97 cond=150 F-=0.26 Driller has about 20 ft of heave in casing

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW33-185 SHEET 3 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Reynolds (Troutdale)

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 6" Casing

WATER LEVELS _____ START 10-21-96 FINISH 12-20-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65.0						Driller added approximately 25 gallons of water
	68.0					
	69.5		1.5		SAND, (SW), as above except higher percentage of coarse grained sand to fine grained.	
70.0						Driller added 30 gallons of water
75.0						
	78.0					78 feet bgs water sample:
	79.5		1.1		SAND, (SW), same as above.	T=NA degrees C pH=6.77 cond=420 F-=9.6
80.0						Driller got about 30 feet of heave after collecting water sample
85.0						
	88.0					88 feet bgs water sample:
	89.5		1.0		SAND, (SW), same as above.	T=NA degrees C pH=6.7 cond=625 F-=70.4

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW33-185 SHEET 4 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Reynolds (Troutdale)

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Casing

WATER LEVELS _____ START 10-21-98 FINISH 12-20-98 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Driller has 40 feet of heave after bailing hole for sample
95.0						
	98.0					98 feet bgs water sample: T=NA degrees C pH=6.5 cond=370 F-=30.8
			0.5		SAND, (SW), same as above.	
	98.5					Driller reports 30 feet of heave after collecting water sample
100.0						
105.0						
						Drilling slowing down driller added water
	108.0					108 feet bgs water sample:
			0		No Return SAND, (SW), same as above from cuttings.	T=NA degrees C pH=7.15 cond=500 F-=58.7
	108.5					
110.0						Driller reports 45 ft of heave after water sampling
			-			
115.0						
					No Return	
	118.0					118 feet bgs water sample:
			0		SAND, (SW), same as above from cuttings.	T=14.1 degrees C pH=7.00 cond=260 F-=15.7
	118.5					

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW33-185 SHEET 5 OF 8

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Reynolds (Troutdale)

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Casing

WATER LEVELS _____ START 10-21-88 FINISH 12-20-88 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
125.0						
	128.0					128 feet bgs water sample:
			0.5		SAND, (SW), same as above.	T=11.7 degrees C pH=6.93 cond=225 F-=28.2
	129.5					
130.0						Driller reports 45 ft of heave after bailing for water sample
135.0						Driller adding water
	138.0					138 feet bgs water sample:
			1.0		SAND, (SW), same as above.	T=12.0 degrees C pH=7.13 cond=245 F-=18.8
	139.5					
140.0						Driller reports 40 ft of heave after bailing for water sample
145.0						Driller reports drilling through small percentage of gravel
	148.0					148 feet bgs water sample:
			.75		SAND, (SW), same as above with 5% white nodules.	T=11.5 degrees C pH=7.28 cond=220 F-=10.8
	149.5					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW33-165 SHEET 6 OF 6

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Reynolds (Troutdale)

ELEVATION _____ DRILLING CONTRACTOR Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Casing

WATER LEVELS _____ START 10-21-96 FINISH 12-20-96 LOGGER J. Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
165.0						
	158.0					Drilling slow at 158.5 ft bgs; increased water production, soil from bailer cuttings.
	159.5		0		SAND AND GRAVEL, (GW), medium dark gray (N4), wet, dense, moderately well-rounded, 1 to 2 inch diameter gravels with medium to coarse grained sand. Gravel primarly basalt.	158 feet bgs water sample: T=13.0 degrees C pH=7.75 cond=225 F-=12.2
180.0						Driller believes sand in casing from up above gravel zone, pulled in when bailing 2 feet heave reported after bailing for water sample
185.0					SAND AND GRAVEL, (GW), same as above, higher percentage of gravel 2 to 3 inch in diameter.	184 feet bgs water sample: T=12.2 degrees C pH=7.99 cond=170 F-=7.37
170.0						
175.0						

PROJECT NUMBER	BORING NUMBER	
107483.D8.02	MW33-185	SHEET 1 OF 1

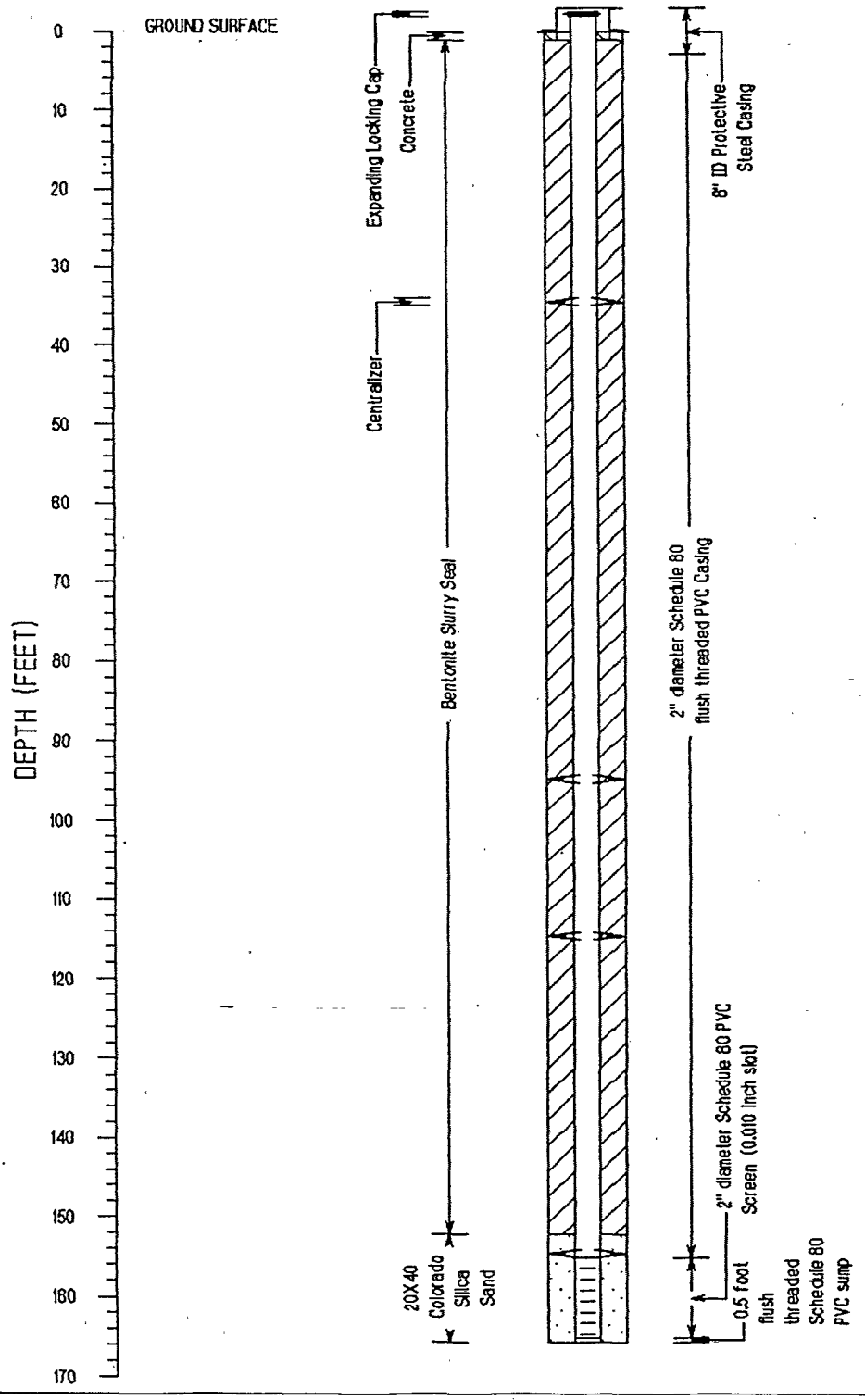
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Scrapyard Area, North of MW13

ELEVATION _____ **DRILLING CONTRACTOR** Staco Well Services

DRILLING METHOD AND EQUIPMENT Cable Tool with 8" Casing

WATER LEVELS _____ **START** 12-20-98 **FINISH** 12-30-98 **LOGGER** J. Bowker



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW34-038 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of EPL

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger 10" O.D. - 6.25" I.D.; Mobile

WATER LEVELS Approximately 4 feet bgs START 11-27-96 FINISH 12-03-96 LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1 Foot: Gravel Fill for drill pad	
5.0	5.0					
	6.5		0.5	2-2-4 (6)	SAND, (SW), moderate yellowish brown (10YR5/4), damp, loose, very fine to medium grained, 5-10% silt, trace organics.	
10.0	10.0					
	11.5		1.5	1-1-1 (2)	SILT, (ML), moderate yellowish brown (10YR5/4), wet, very soft, trace fine sand and organics.	Soil sample MW34S-0100-0
	12.5					
	14.0		1.3	1-1-1 (2)	SILT, (ML), as above, trace pebbles (to 0.5-inch).	Silt has a very disturbed appearance - driller reports 3-4 feet silt heaved into auger
15.0						
						No sample - Unable to remove heaved silt from auger
20.0	20.0					
	21.5		1.5	2-1-2 (3)	SILT, (ML), medium dark gray (N4), wet, very soft, orange mottling.	Soil sample MW34S-0200-0
25.0	25.0					
	26.5		1.5	2-2-3 (5)	SILT, (ML), as above except soft.	
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW34-038 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of EPL

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger 10" O.D. - 6.25" I.D.; Mobile

WATER LEVELS Approximately 4 feet bgs START 11-27-96 FINISH 12-03-96 LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		1.4	2-3-4 (7)	SILT, (ML), as above, grading to	First boring backfilled to total depth with bentonite chips on 11-27-96.
					(at 31.3 ft bgs) SAND with SILT, (SM), medium dark gray (N4), wet, loose, very fine to fine, 20-25% silt.	
35.0	35.5 – 37.0		0.6	5-6-6 (12)	SAND, (SW), medium dark gray (N4), wet, loose, fine to medium grained, trace red grains.	
						Total Depth = 37.5 Feet bgs 12-03-96
40.0						
45.0						
50.0						
55.0						

PROJECT NUMBER	BORING NUMBER	
107493.D6.02	MW34-038	SHEET 1 OF 1

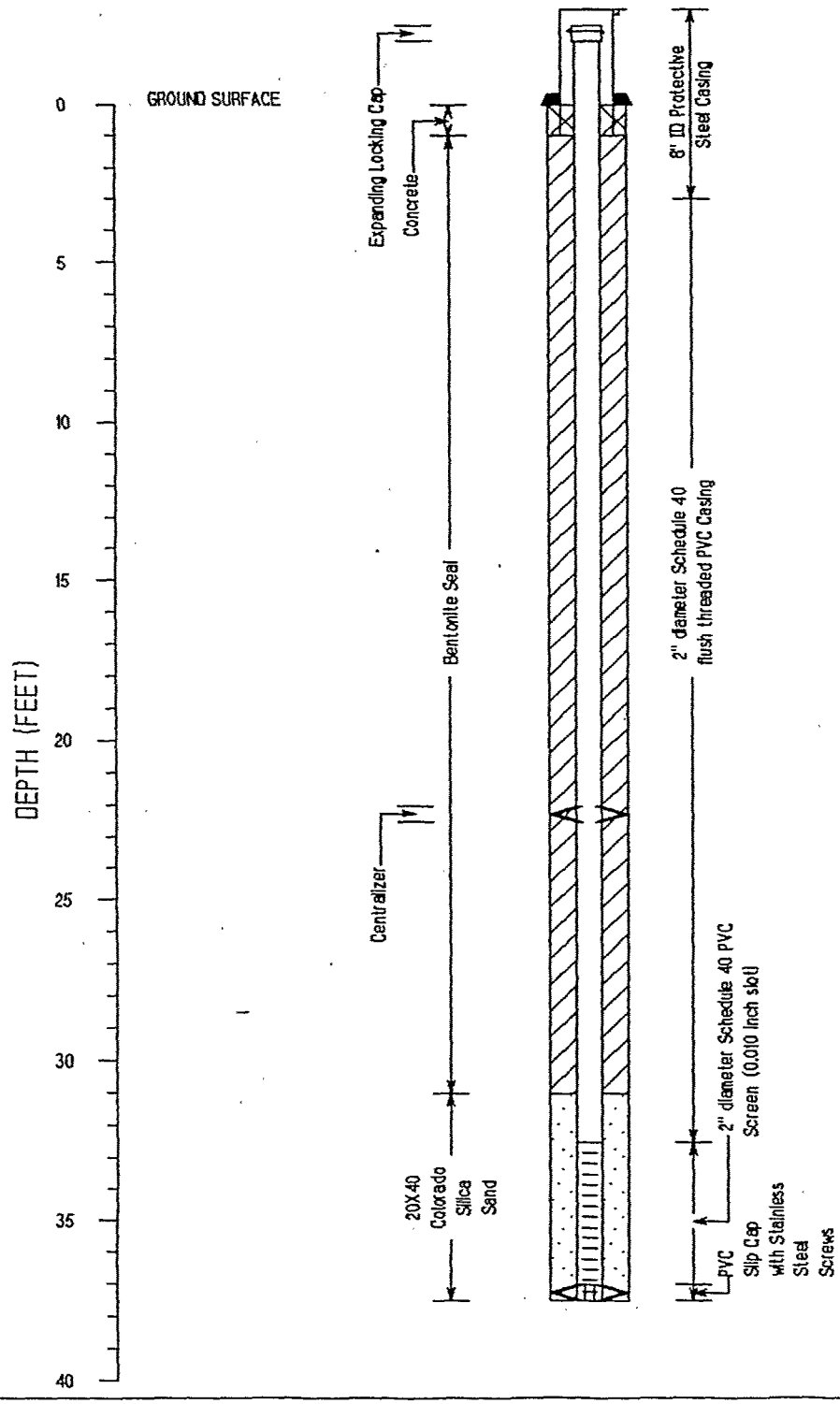
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** North of EPL

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger 10" O.D. - 6.25" I.D.; Mobile

WATER LEVELS Approximately 4 feet bgs **START** 12-03-96 **FINISH** 12-03-96 **LOGGER** I. Gall



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW35-038 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northwest of EPL; West of MW34

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVELS Approximately 3 feet bgs START 12-02-96 FINISH 12-02-96 LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-1.5 feet: Crushed rock fill	
						Water
5.0	5.0					
	6.5		0	2-2-2 (4)	No Sample Recovery	
10.0	10.0					
	11.5		1.5	1-2-2 (4)	SILT with SAND, (ML), dark yellowish brown (10YR4/2), soft, wet, 15-20% very fine sand, trace organics.	Soil sample MW35S-0100-0
15.0	15.0					
	16.5		1.3	1-1-1 (2)	SILT with SAND, (ML), as above except very soft.	Driller reports formation very soft
20.0	20.0					
	21.5		0.5	1-1-1 (2)	SILT with SAND, (ML), as above.	Soil sample MW35S-0200-0
25.0	25.0					
	26.5		0.3	1-1-1 (2)	SILT with SAND, (ML), as above, to 26.2 ft bgs - Sharp contact with SILT, (ML), medium dark gray (N4), wet, soft, trace very fine sand.	
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.06.02	MW35-038 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION Northwest of EPL; West of MW34

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVELS Approximately 3 feet bgs START 12-02-96 FINISH 12-02-96 LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 – 31.5		0.5	6-8-8 (16)	SAND, (SW), medium dark gray (N4), wet, loose, very fine to fine, 10% silt.	Soil sample MW35S-0300-0
35.0	35.0 – 36.5		0.8	3-8-9 (17)	SAND, (SW), medium dark gray (N4), wet, loose, fine to medium grained, red grains.	Total Depth with 6-inch augers= 35 Feet
						Total Depth with 10-inch augers = 37.5 Feet on 12-03-96
40.0						
45.0						
50.0						
55.0						

PROJECT NUMBER	BORING NUMBER	
107483.D8.02	MW35-038	SHEET 1 OF 1

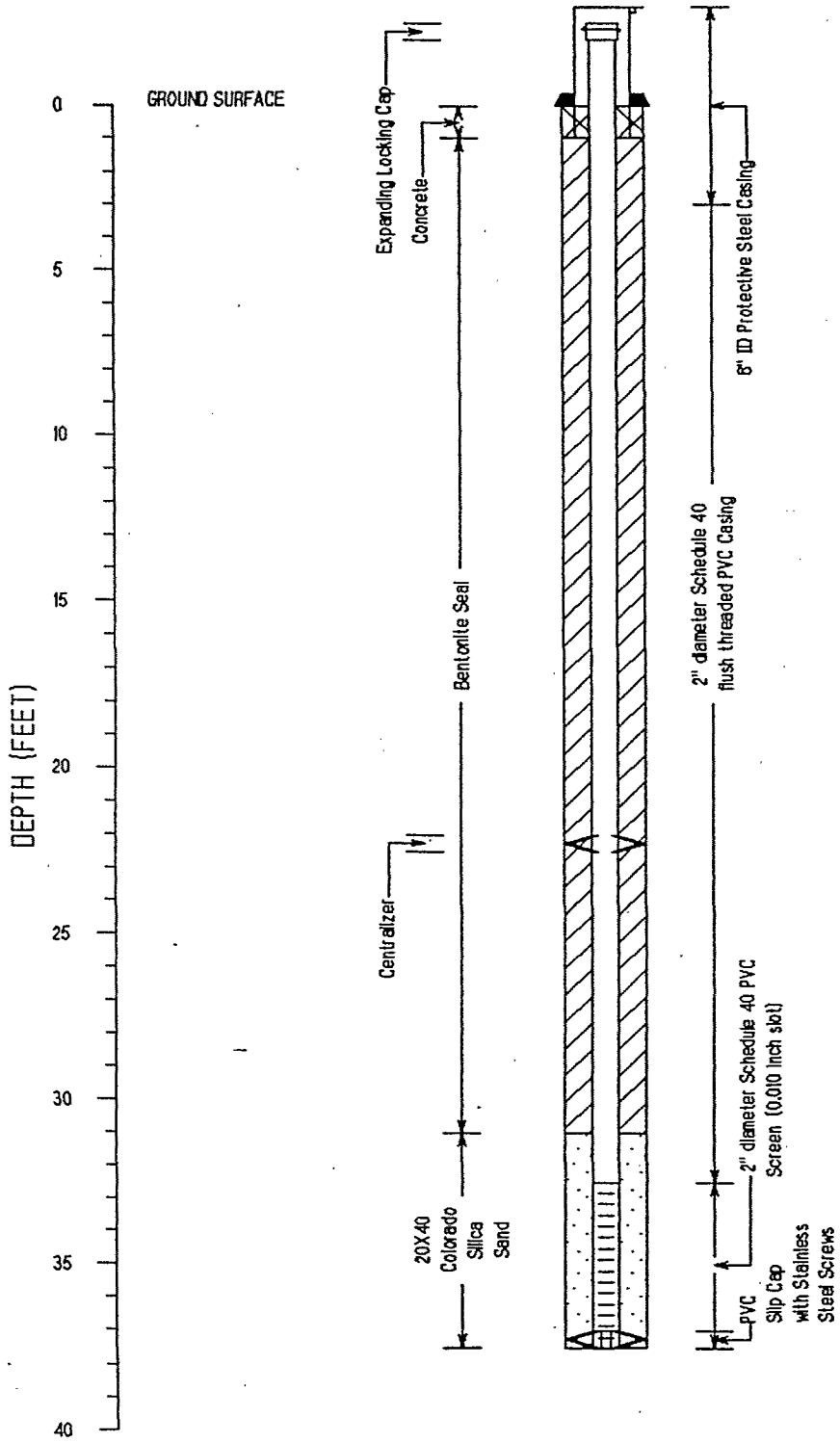
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** Northwest of EPL; West of MW34-038

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVELS Approximately 3 feet bgs **START** 12-03-98 **FINISH** 12-03-98 **LOGGER** I. Gall



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW38-008 SHEET 1 OF 1

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** North of Railroad Dike in South Wetlands

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Little Beaver HSA rig; 4 1/4 I.D. Auger

WATER LEVELS _____ **START** 10-22-98 **FINISH** 10-22-98 **LOGGER** T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	1.5		1.0	1/12"-1 (1)	0-1 FT bgs: Grass covered surface SILTY SAND, (SM), dark brown to medium gray, damp, very loose, medium to fine grained, 20% roots and organics.	Soil sample collected for TOCs and PCBs using split spoon from 0 - 1.5 feet time: 1015
	2.0					
	3.5		1.5	1-10-23 (33)	1-1.5 FT bgs: SILT, (MH), brown, damp, very soft, plastic	2 - 3.5 feet time: 1022
	4.5				2-3.5 FT bgs: SILT, (MH), brown, as above except becomes firm from 2.5-3 ft bgs. Sharp contact with brown SANDY SILT, (ML), at 3.0 ft. Sandy silt is wet, very stiff, not plastic.	
5.0	6.0		0.5	4-2-1 (3)		4.5 - 6 feet time: 1030
	6.5				4.5-6 FT bgs: SANDY SILT, (ML), brown, as above except soft	6.5 - 8 feet time: 1050
	8.0		1.5	1-1/12" (1)	6.5-8 FT bgs: SILT, (MH), gray, wet, very soft, plastic	Collected surface soil sample with s.s.spoon at 0 - 0.5 foot time: 925 DTW at about 2 feet bgs
10.0						
15.0					Decommissioned in Summer 1998	
20.0						
25.0						

PROJECT NUMBER	BORING NUMBER	
107493.06.02	MW36-006	SHEET 1 OF 1

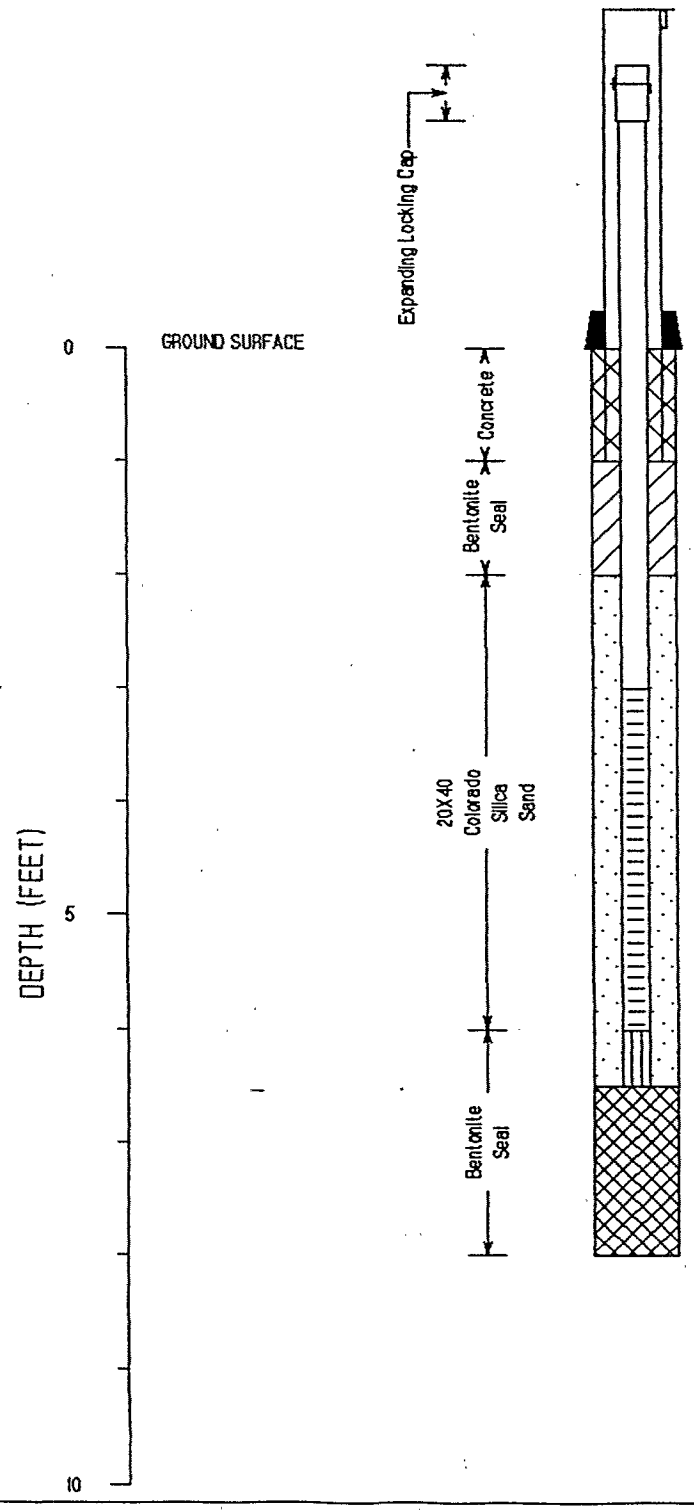
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION North of Railroad Dike in South Wetlands

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Little Beaver HSA rig; 4 1/4 I.D. Auger

WATER LEVELS _____ START 10-22-96 FINISH 10-22-96 LOGGER T. Gehweiler



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW37-012 SHEET 1 OF 1

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION South Wetlands; RR Dike on Old Existing Road

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Little Beaver HSA rig; 4 1/4-Inch I.D. Auger

WATER LEVELS _____ START 10-23-98 FINISH 10-23-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-2 Feet: Grass and moss covered surface. SAND, (SM), dark brown, damp, dense, 50% old brick fill, roots, vegetation, organics. Old roadbed.	Collect Soil samples for TOC analysis at: 2.5 - 4 foot time: 900
	2.5					
	4.0		0.8	1-2/12"	Water observed at 2.5 feet bgs 2.5-4.5 Feet: SILT, (MH), brown, wet, very soft to soft, some orange-brown mottling, plastic	4 - 5.5 foot time: 913
5.0	5.5		1.0	1-2-3 (5)	4.5-5.3 Feet: SILT WITH SAND, (ML), dark gray, wet, soft, medium grained sand, 10% decomposed yellow brick.	
	6.0					
	7.5		1.5	3-3-3 (8)	5.3-9 Feet: SANDY SILT, (ML), brown, wet, soft, mottled, not plastic. Becomes gray at 8 ft bgs.	6 - 7.5 foot time: 930
	8.5					
	10.0		1.5	1-2-1 (3)	9-12 Feet: SANDY SILT, (ML), gray, wet, soft, not plastic.	8.5 - 10 foot time: 1000
10.0						
	12.5				12-12.5 Feet: SANDY SILT, (MH), gray, wet, very soft, plastic.	
	14.0		1.5	1-1-1 (2)	12.5-13 Feet: SILT, (MH), gray, wet, very soft, plastic.	12.5 - 14 foot time: 1020
	14.5					
15.0	16.0		1.5	2-2-2 (4)	13-15 Feet: SILTY SAND, (SM), gray, wet, very loose, wet, fine grained, less than 1% vegetation.	14.5 - 16 foot time: 1045 Driller reports slight odor at 7.5 feet. Hand dug hole from 0 - 2.5 feet.
					15-16 Feet: SILT, (MH), gray, wet, soft, plastic.	
					Total Depth = 16 Feet bgs with sampler; 15 Feet bgs with auger	
20.0						
25.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107483.D8.02	MW37-012	SHEET 1 OF 1

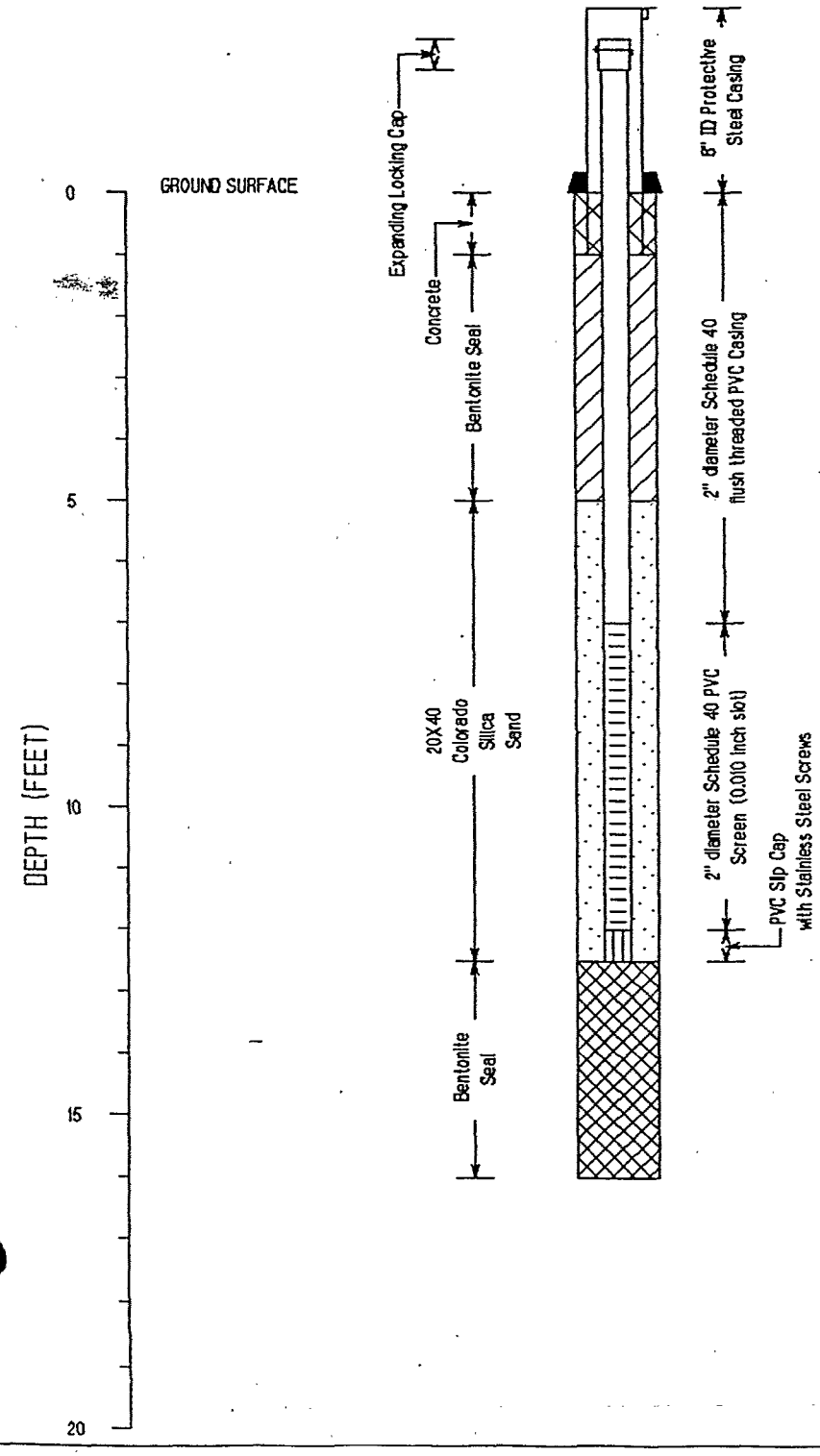
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** South Wetlands; RR Dike on Old Existing Road

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Little Beaver HSA rig; 4 1/4-Inch I.D. Auger

WATER LEVELS _____ **START** 10-23-98 **FINISH** 10-23-98 **LOGGER** T. Gehweiler



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW37-030 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION So. Wetlands; South of RR Dike on Old Exist. Rd.

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Little Beaver with 4.25-inch I.D. HSA

WATER LEVELS Approximately 1 Feet BGS START 12-08-98 FINISH 12-09-98 LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					See MW37-012 Boring Log	
5.0						
10.0						
15.0						
20.0	20.0					
	21.5		0.1	3-3-4 (7)	SAND WITH SILT, (SM), dark gray (N3), wet, loose, fine to very fine grained, 20-25% silt.	Poor sample recovery, blow counts from short stroke and lite hammer
	23.0					
	24.5		0.1	3-4-4 (8)	SAND WITH SILT, (SM), as above - pebble in spoon.	Driller reports possible sand contact approximately 22.5 feet bgs from change in drilling conditions
25.0						
	27.0					
	28.5		0.8	2-4-4 (8)	SAND WITH SILT, (SM), as above, 10-15% silt, sand fine to medium grained.	Soil sample MW37I-0270-0
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107483.D8.02	MW37-030 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** So. Wetlands; South of RR Dike on Old Exist. Rd.

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Little Beaver with 4.25-inch I.D. HSA

WATER LEVELS Approximately 1 Feet BGS **START** 12-08-98 **FINISH** 12-09-98 **LOGGER** I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 31.5		1.0	3-4-5 (9)	SAND, (SW), dark gray (N3), wet, loose, fine to medium grained, trace silt and red grains.	Total Depth = 30.5 Feet
35.0						
40.0						
45.0						
50.0						
55.0						

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW37-030 SHEET 1 OF 1

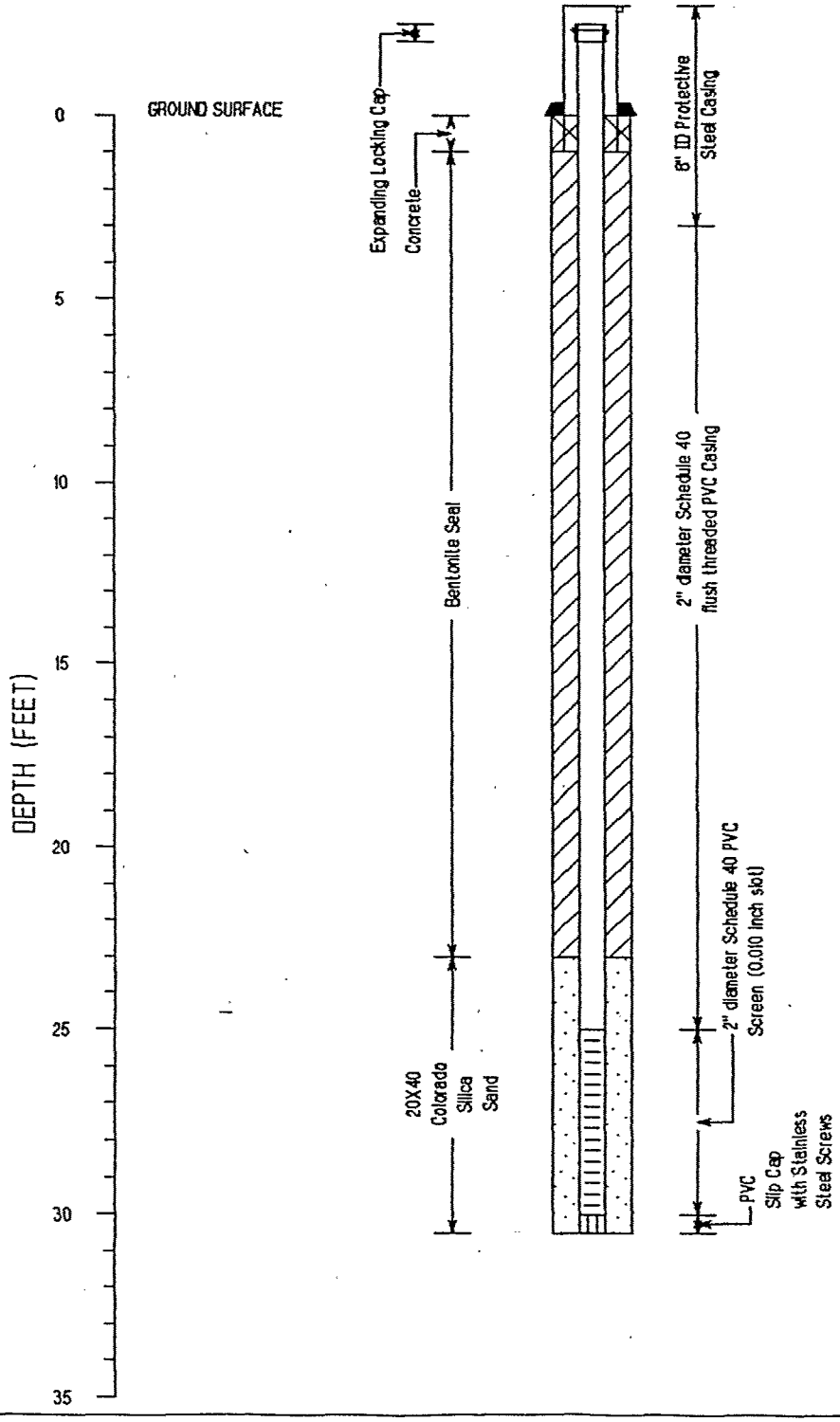
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale **LOCATION** So. Wetlands; South of RR Dike on Old Exist. Rd.

ELEVATION _____ **DRILLING CONTRACTOR** GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Little Beaver with 4.25-inch I.D. HSA

WATER LEVELS Approximately 1 Feet BGS **START** 12-09-86 **FINISH** 12-09-86 **LOGGER** I. Gall



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW38-007 SHEET 1 OF 1

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION RMC Property, East of Walsh Trucking

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile HSA rig; 8 5/8" Auger

WATER LEVELS _____ START 11-01-98 FINISH 11-01-98 LOGGER T. Gehweiler

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	1.0				0-1 Feet: Crushed basalt road base	TOC soil samples collected at: 1 - 2.5 feet time: 1400
	2.5		0.8	4-5-5 (10)	1-2 Feet: SAND, (SP), brown, damp, loose, fine grained, with less than 5% silt, trace roots.	
	4.0		1.5	4-8-9 (17)	2-5 Feet: SAND, (SW), brown, damp, loose, fine to medium grained with orange mottling and red sand grains (less than 10%).	2.5 - 4 feet time: 1405
5.0	5.5		1.5	6-6-7 (13)	5-5.5 Feet: SILT, (ML), brown, damp, medium stiff.	4 - 5.5 feet time: 1410 5.5 - 7 feet time: 1415
	7.0		1.4	3-2-2 (4)	5.5-6.5 Feet: SAND, (SW), gray, brown, wet, loose, fine to medium grained, orange mottling, trace red sand grains 6.5-7 Feet: SILT, (MH), brown, wet, soft, plastic, becomes gray at 7 feet.	
10.0					Total Depth = 7 Feet BGS	
15.0						
20.0						
25.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW38-007	SHEET 1 OF 1

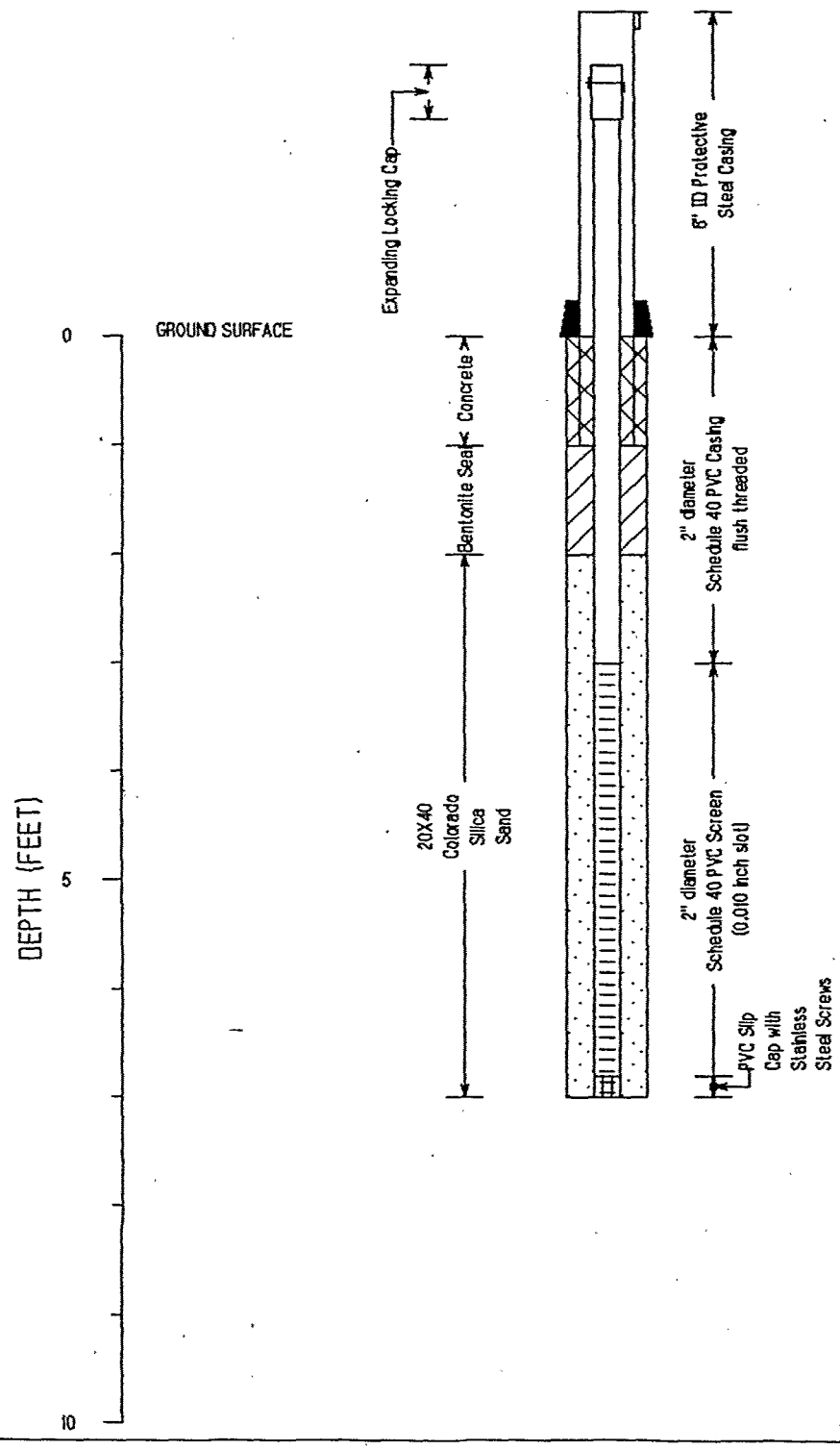
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION RMC Property, East of Walsh Trucking

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT Mobile HSA rig; 8 5/8" Auger

WATER LEVELS _____ START 11-01-98 FINISH 11-01-98 LOGGER T. Gehweiler



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW38-035 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION RMC Property, East of Walsh Trucking

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT HSA (10" O.D., 6.25" I.D.) Mobile Drill B-59

WATER LEVELS _____ START 12-02-96 FINISH 12-02-96 LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					See MW38-7 for first 10 feet of log	
5.0						
10.0	10.0					
	11.5		1.5	2-2-2 (4)	SILT, (ML), medium dark gray (N4), wet, soft, trace orangics and very fine sand.	
15.0	15.0					
	16.5		1.4	1-2-1 (3)	SILT with SAND, (ML), medium dark gray (N4), wet, soft, 15-20% very fine sand, trace organics.	Soil sample MW38I-0150-0 Driller reports formation appears to be moderately permeable
	17.5					
	19.0		1.0	2-2-2 (4)	SILT with SAND, (ML), as above.	
20.0	20.0					
	21.5		1.4	2-2-2 (4)	SILT with SAND, (ML), as above, percent very fine sand increasing to 25-30%.	
	22.5					
	24.0		1.5	2-3-3 (6)	SILT with SAND, (ML), as above.	
25.0	25.0					
	26.5		1.5	2-3-3 (6)	SILT, (ML), medium dark gray (N4), wet, soft, trace organics.	Soil sample MW38I-0250-0
	27.5					
	29.0		1.5	3-4-5 (9)	SILT (ML), as above, to 28 feet - grades to SAND with SILT, (SM), medium dark gray (N4), wet, very loose, very fine to fine grained, 15-25% silt.	
	30.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW38-035 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION RMC Property, East of Walsh Trucking

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT HSA (10" O.D., 6.25" I.D.) Mobile Drill B-59

WATER LEVELS _____ START 12-02-96 FINISH 12-02-96 LOGGER I. Gall

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 31.5		0.6	3-5-5 (10)	SAND, (SW), medium dark gray (N4), loose, wet, fine to medium grained, 10% silt, red grains present.	
	32.5				SAND, (SW), as above except very loose.	
	34.0		0.5	2-3-3 (6)		
	35.0					
35.0	36.0		1.0	3-4-4 (8)	SAND, (SW), as above, trace wood fragments.	Soil sample MW38I-0350-0 Total Depth = 36 Feet BGS
40.0						
45.0						
50.0						
55.0						

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW38-035	SHEET 1 OF 1

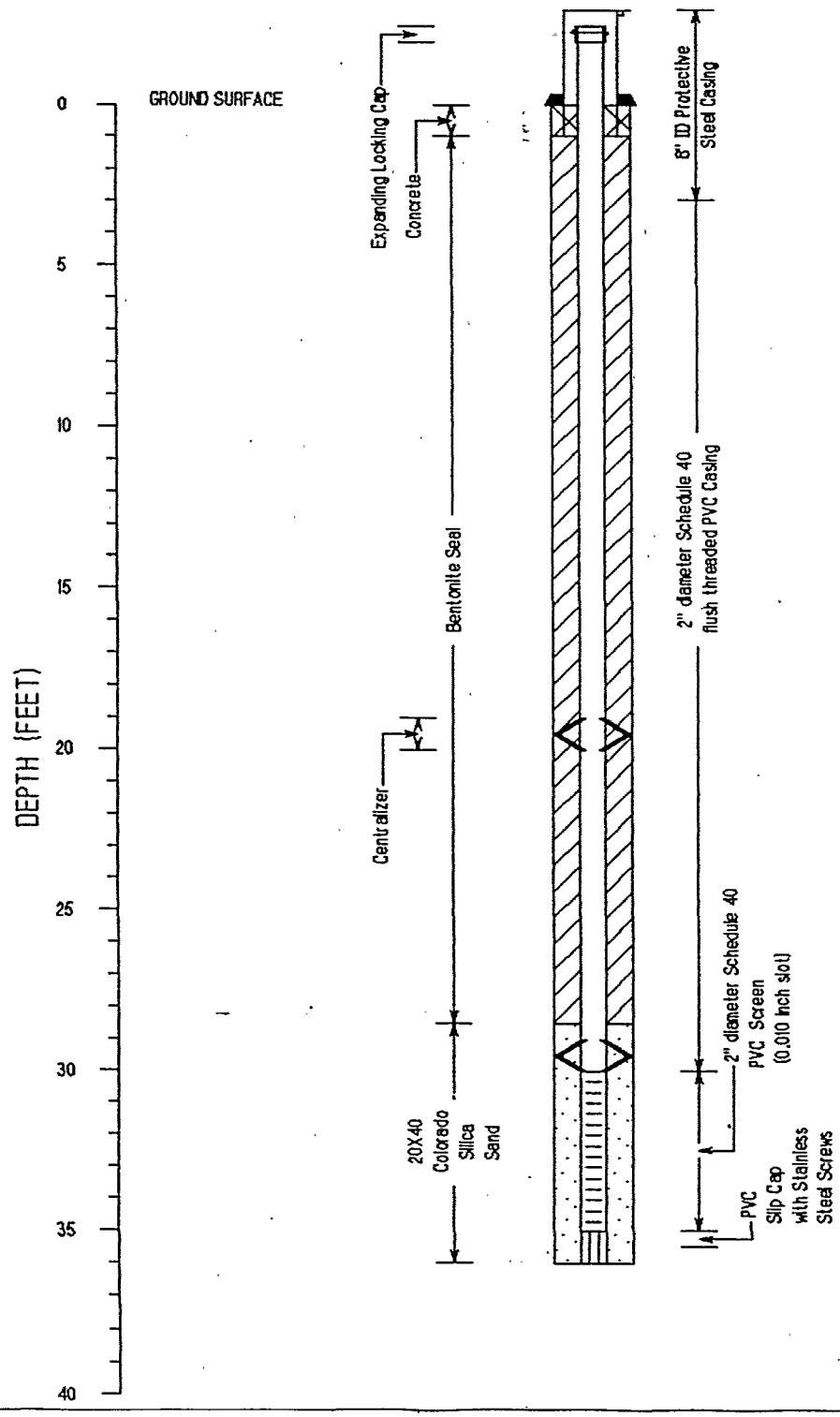
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION RMC Property, East of Walsh Trucking

ELEVATION _____ DRILLING CONTRACTOR GeoTech Explorations, Inc.

DRILLING METHOD AND EQUIPMENT HSA (10" O.D., 6.25" I.D.) Mobile Drill B-59

WATER LEVELS _____ START 12-02-96 FINISH 12-02-96 LOGGER I. Gall



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW39-095	SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION FAIRVIEW FARMS 800' W OF WW31

ELEVATION _____ DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG W/ 6" CASING

WATER LEVELS _____ START 6-23-97 FINISH 6-27-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					0-2' cobble/gravel fill for drilling pad	5" of soil cored with casing during plumbing of casing
					Loamy topsoil	
					SILT, (ML), brownish gray (5yr., 2/1), soft, wet, mottled appearance, trace of organics/roots	FID = 3ppm PID = BKGRD
	5.0					
5.0						
	8.0				SAND WITH SILT, (SM), pale brown (5 yr., 5/2),soft, wet, some mottling, 30% silt	Soil and water samples collected below 5' with sieve and bowl at cyclone hopper, logged from cuttings
	9.0				SILT, (ML), dark yellowish brown (10yr., 4/2), wet, soft, plastic	
	10.0					
10.0						
15.0						
20.0						
	21.0				SILT WITH SAND (ML), dark yellowish brown (10yr., 4/2), wet, soft, 20-25% fine grained sand, subangular grains	
	22.0					
25.0						

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW39-095 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION FAIRVIEW FARMS 800' W OF WW31

ELEVATION _____ DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG W/ 6" CASING

WATER LEVELS _____ START 6-23-97 FINISH 6-27-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35.0						Water sample at 35' BGS F = 0.105ppm
40.0	40.0					
	41.0					
					SAND, (SW), dark gray (N3), wet, loose, fine to medium grained, red grains, organics (wood), 5-10% fine, subangular grains	
45.0						
50.0						Water sample at 50' BGS F = 0.115ppm
55.0					SAND, (SW), as above, with mica flakes	
	58.0					
	57.0					

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW39-095 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION FAIRVIEW FARMS 800' W OF WW31

ELEVATION _____ DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG W/ 6" CASING

WATER LEVELS _____ START 8-23-97 FINISH 8-27-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65.0	65.0 – 68.0				SAND, (SW), same as above	
70.0						Water sample at 70' BGS F = 0.072ppm
75.0	75.0 – 78.0				SAND, (SW), same as above	
80.0						
85.0					SAND, (SW), same as above	Water sample at 85' BGS F = 0.101ppm

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW39-095 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION FAIRVIEW FARMS 800' W OF WW31

ELEVATION _____ DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG W/ 6" CASING

WATER LEVELS _____ START 6-23-97 FINISH 6-27-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW), same as above	
95.0					End of boring at 95'	
100.0						
105.0						
110.0						
115.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW39-095	SHEET 1 OF

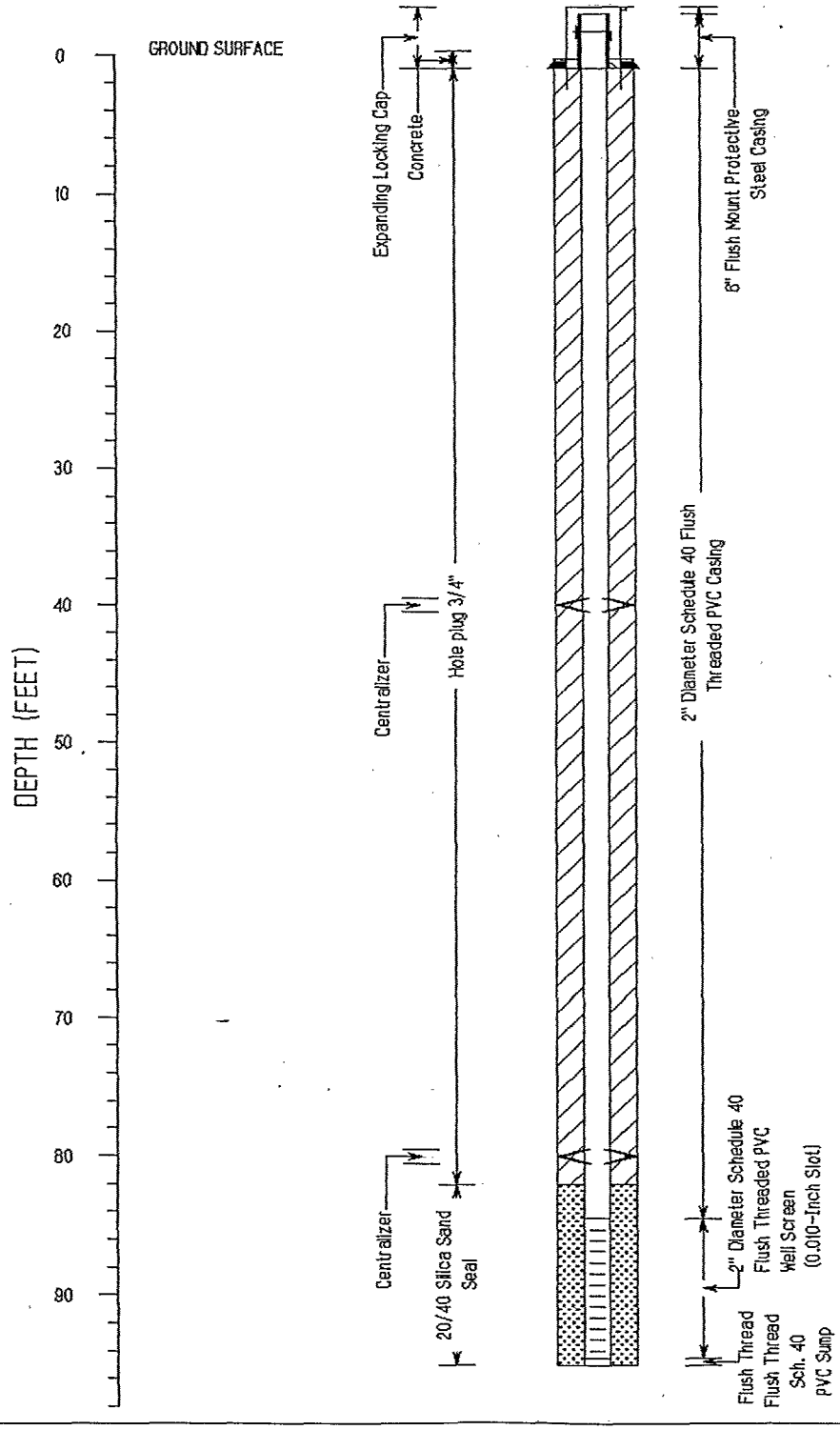
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION FAIRVIEW FARMS 800' W OF WW31

ELEVATION _____ DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG W/ 8" CASING

WATER LEVELS _____ START 8-23-97 FINISH 8-27-97 LOGGER ERIC BROBERG



See Boring Log For Drilling Details

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW40-030/MW40-018 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION N.W. Corner of Bakehouse

ELEVATION _____ DRILLING CONTRACTOR GeoTech

DRILLING METHOD AND EQUIPMENT 11" OD; 6.5" ID HSA, B-58 Mobile Drill

WATER LEVELS _____ START 8-11-97 FINISH 8-11-97 LOGGER Eric Broberg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Surface: Sand/Gravel Fill	
5.0	5.0–6.5	1.4		4-5-5 (14)	SAND, (SW), pale brown (5 yr, 5/2), damp, loose, very fine and fine grained	Lab sample: 850 MW40-0050-18297-0 soil PID=Bkgr, FID-Bkgr, LEL=NB, Dust = 0
10.0	10.0–11.5	1.5		2-3-4 (9)	SILT, (ML), medium yellow-brown (10 yr., 5/9), wet, firm, orange mottling, worm/root holes	
15.0	15.0–16.5	1.5		4-3-3 (10)	SILT (ML), as above	Lab sample: 1140 MW40-0160-18297-0
	17.5–19.0	1.5		2-2-2 (8)	SILT, (ML) medium dark gray (NG) wet, soft, less mottling and root/worm holes	
20.0	20.0–21.5	1.4	–	8-10-12 (30)	SAND, (SW), olive gray (5 yr., 4/1) wet, loose, fine-medium grained, large mica flares, 5% silt, subangular grains	
	22.5–24.0	1.5		8-10-11 (29)	SAND, (SW), as above	
25.0	27.5–30.0	1.4		8-9-10 (27)	SAND, (SW) medium dark gray (NG), wet, loose, fine-medium grained, red grains, some orange-yellow staining, subangular grains	Lab sample: 940 MW40-0280-18297-0

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW40-030/MW40-018 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION N.W. Corner of Bakehouse

ELEVATION _____ DRILLING CONTRACTOR GeoTech

DRILLING METHOD AND EQUIPMENT 11" OD; 8.5" ID HSA, B-59 Mobile Drill

WATER LEVELS _____ START 8-11-97 FINISH 8-11-97 LOGGER Eric Broberg

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30.0 31.5	1.4		29-18-18 (32)	SAND, (NG), red grains, no orange-yellow staining	
						32 FT. TOTAL DEPTH
35.0						
40.0						
45.0						
50.0						
55.0						

PROJECT NUMBER	BORING NUMBER	
107493.D6.02	MW40-018	SHEET 1 OF

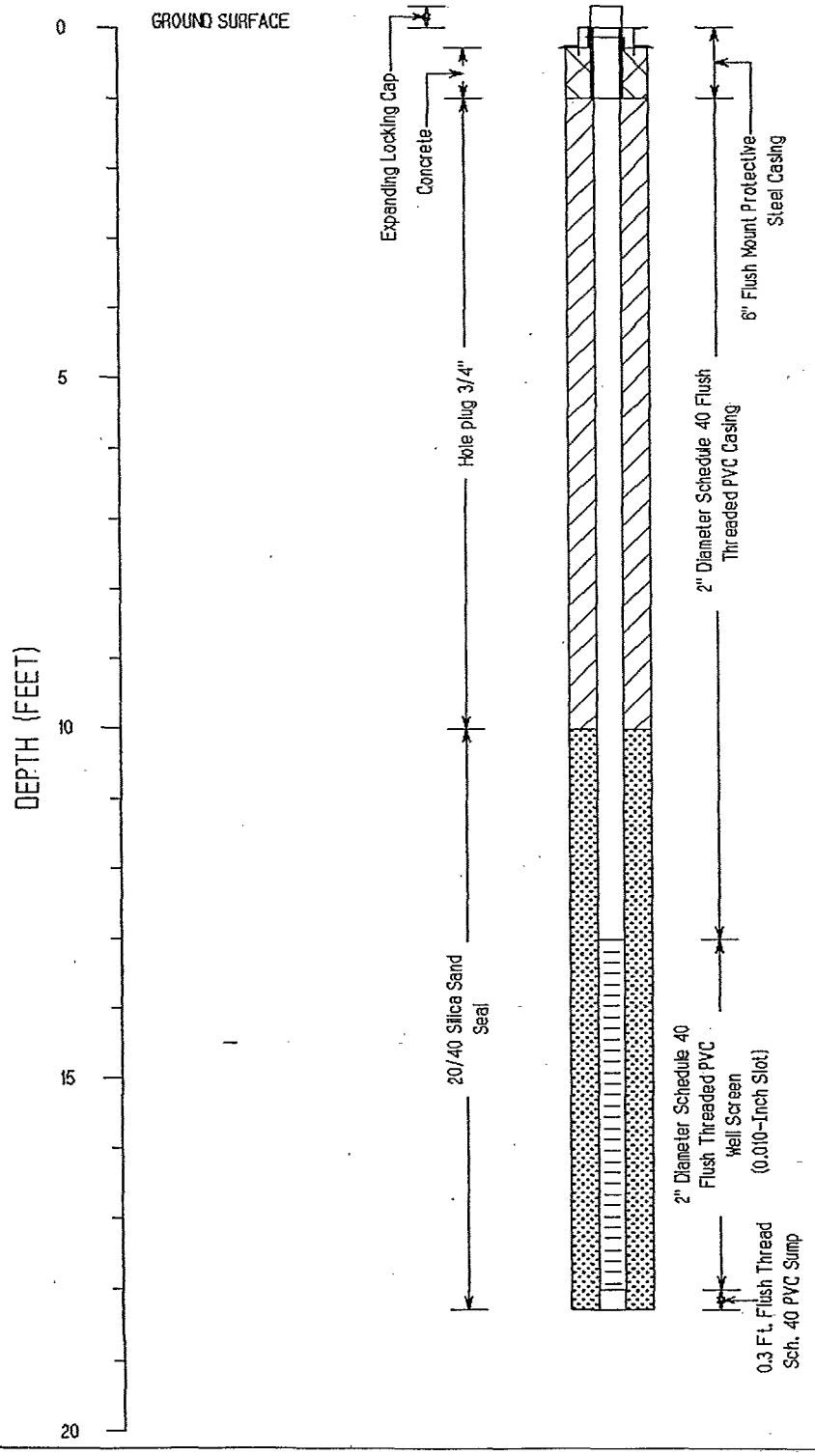
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION N.W. Corner of Bakehouse

ELEVATION _____ DRILLING CONTRACTOR GeoTech

DRILLING METHOD AND EQUIPMENT 11" OD; 6.5" ID HSA, B-59 Mobile Drill

WATER LEVELS _____ START 6-11-97 FINISH 6-11-97 LOGGER Eric Broberg



See Boring Log For Drilling Details

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW40-030 SHEET 1 OF

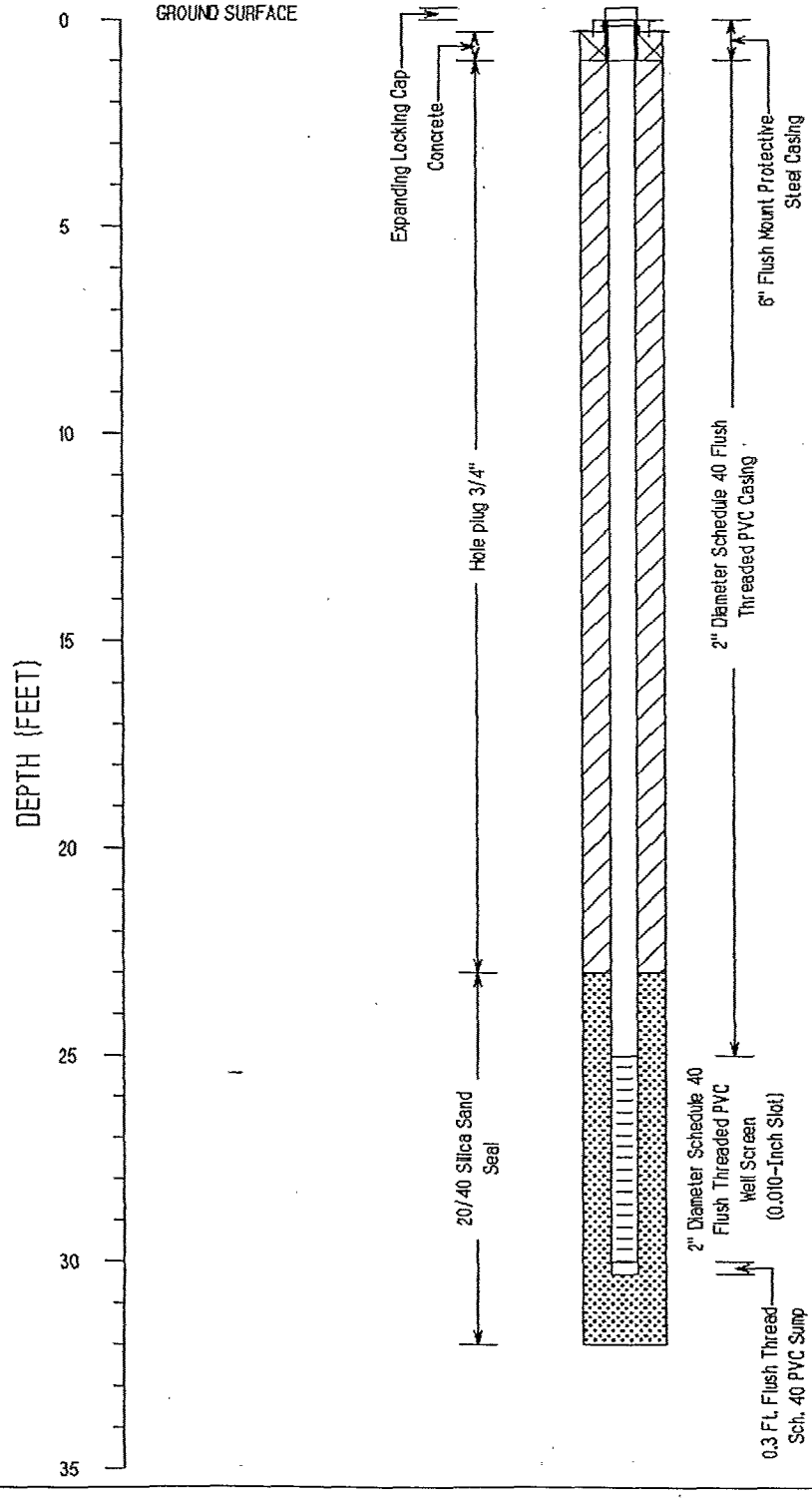
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION N.W. Corner of Bakehouse

ELEVATION _____ DRILLING CONTRACTOR GeoTech

DRILLING METHOD AND EQUIPMENT 11" OD; 6.5" ID HSA, B-59 Mobile Drill

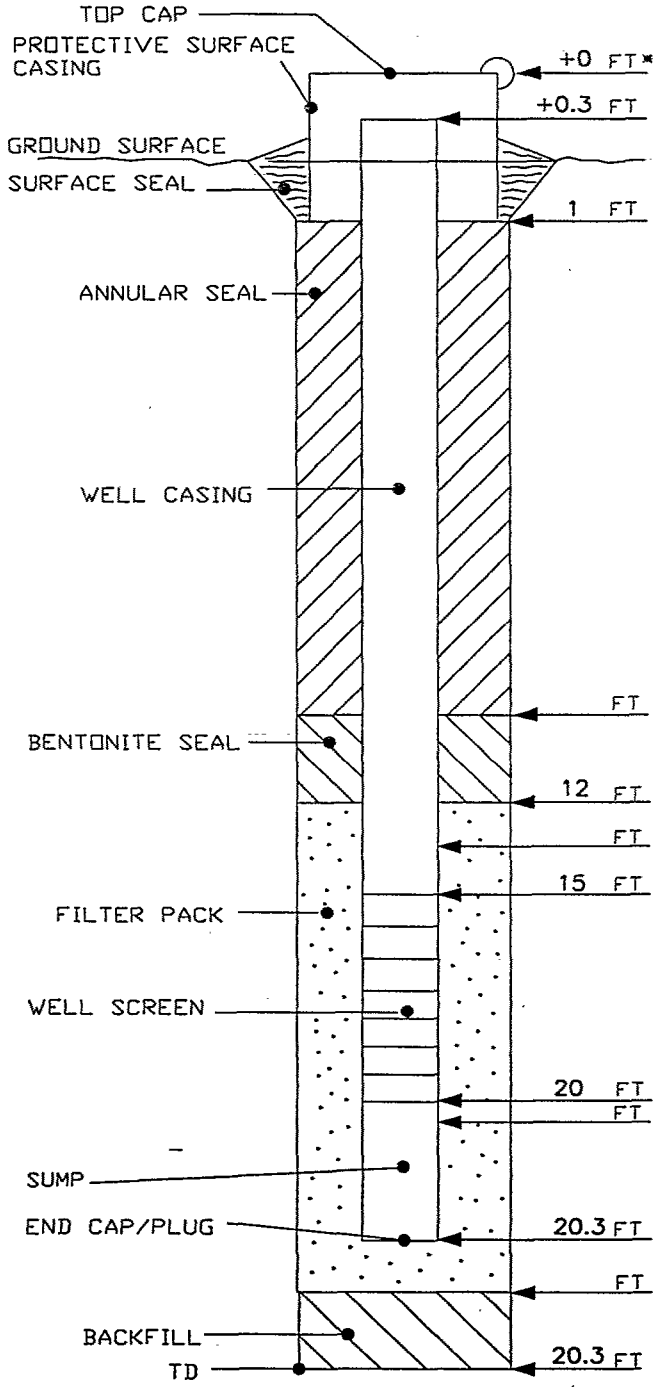
WATER LEVELS _____ START 8-11-97 FINISH 8-11-97 LOGGER Eric Broberg



See Boring Log For Drilling Details

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC-TROUTDALE PROJECT NO. 107493.06.02
WELL NO. MW41-020 FIELD OBSERVERS BROBERG
ELEV, NGVD (top of well casing) 28.63 SURFACE ELEV, NGVD 29.1
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 6/13/97
DRILLING CONTRACTOR GEOTECH FINISH DATE 6/13/97
DRILLING METHOD 11" OD; 6.5" ID HSA/LOCATION: BAKEHOUSE



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

MW-41.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) 11 INCHES TO 20.3 FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
PROTECTIVE CASING TYPE FLUSH MOUNT-SHERWOOD
PROTECTIVE CASING DIAMETER 6"
WELL CASING TYPE SCH 40 PVC DIAMETER 2"
COUPLING TYPE FLUSH THREAD
SCREEN TYPE SCH 40 PVC DIAMETER 2"
SLOT SIZE 0.010" SCREEN LENGTH 5'
TOP CAP TYPE EXPANDABLE LOCKING
END CAP/PLUG TYPE SCH 40 PVC FLUSH THREAD
CENTRALIZER TYPE _____
CENTRALIZER LOCATION(S) _____
FILTER PACK TYPE SILICA SAND (9 BAGS)
GRADATION 20/40

SEAL(S)

SURFACE CONCRETE (2.5 BAGS)
ANNULAR 3/4" HOLEPLUG (10 BAGS)
BENTONITE _____
BACKFILL _____

WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS MW41-020 START CARD #100165
TAG #L05781
* REFER TO MW41-033 FOR SUBSURFACE GEOLOGY INFORMATION

CH2MHILL

PROJECT NUMBER : 107493.D6.02

WELL NUMBER : MW41-033

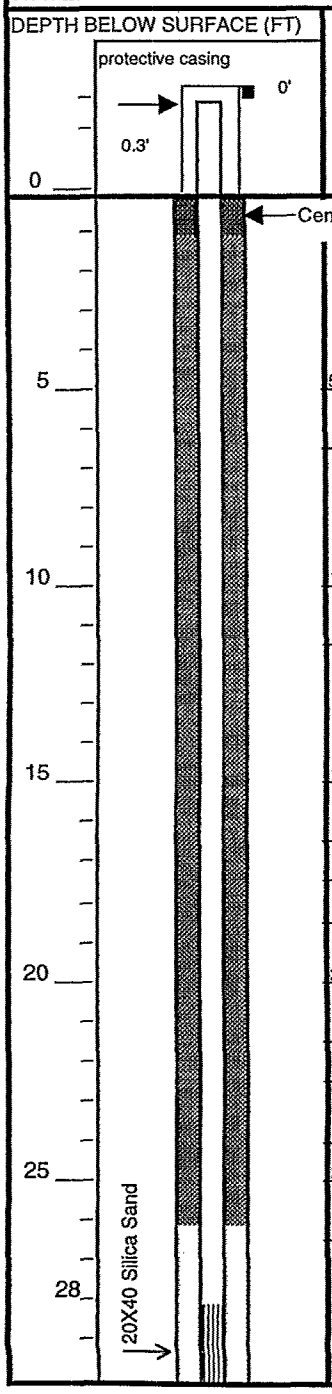
WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **NW SIDE OF ENGINEERING**

ELEVATION : **MPE = 28.71' / GSE = 29.1'** DRILLING CONTRACTOR : **GEOTECH EXPLORATION, TUALATIN, OREGON**

DRILLING METHOD AND EQUIPMENT USED : **11" OD; 6.5" HSA, ID B59 MOBILE DRILL**

WATER LEVELS : START : 6/12/97 END : 6/13/97 LOGGER: **EMB**



DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
0					CONCRETE	
					GRAVELLY SAND (SW), pale brown (5YR 5/2) damp, loose, fine to medium grained sand with >15% fine to coarse gravel, less 5% silt	LAB Sample: 1510 MW41-0050-16397-0
5	5.0		1.4	6-8-14 (22)	SAND (SW), pale brown (5YR 5/2) damp, fine to medium grained, loss 5% silt	PID = 33 ppm FID = acgrd LEL = ND Dust = 0
					SAND WITH SILT (SW-SM.), pale brown (5YR 5/2) to pale medium brown (10YR 5/4), wet yellow, very fine grained, loose, 20-25% silt	
10	10.0		1.4	4-3-3 (6)		
15	15.0		1.5	3-4-5 (9)	SILT (ML), medium gray, wet, soft, plastic, some worm/root holes	LAB Sample: 0830 MW41-0160-16497-0
			1.5	2-2-2 / (4)	SILT (ML), same as above	
20	20.0		1.5	4-6-7 (13)	SILT (ML), same as above	
			1.5	10-11-14 (25)		
25	25.0			10-10-10 (20)	SAND (SM.), dark yellowish brown (10YR 4/2), wet loose, fine to medium grained, some mica 5% silt	
28					SAND (SM.), same as above	

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW41-033 SHEET 2 OF 2

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **NW SIDE OF ENGINEERING**

ELEVATION : **MPE = 28.71' / GSE = 29.1'** DRILLING CONTRACTOR : **GEOTECH EXPLORATION, TUALATIN, OREGON**

DRILLING METHOD AND EQUIPMENT USED : **11" OD; 6.5" HSA, ID B59 MOBILE DRILL**

WATER LEVELS : START : 6/12/97 END : 6/13/97 LOGGER: **EMB**

DEPTH BELOW SURFACE (FT)		Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	20X40 Silica Sand; 2" diameter Schedule 40 10" slot PVC	31.5		1.4	8-10-10 (20)	SAND (SM.), same as above	LAB Sample: 1615 MW41-0310-16397-0
33				1.4	10-10-12 (22)	SAND (SM.), same as above	
35						**End of Boring @ 35.0' bgs**	
						Well Developed on 06/19/97	Start Card # = 100164
						Borehole diameter = 11" to 35.0' bgs	Tag # L05780
40							
45							
50							
55							

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW42-027/MW42-013 SHEET 1 OF 1

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION NE CORNER OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11 WCH O.D. HSA, 8.5"ID, 8-59MOBIL DRILL

WATER LEVELS _____ START 8-11-97 FINISH 8-11-97 LOGGER IVAN GALL

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Surface: sand/gravel fill	
	5					Lab sample: 1400 MW42-0050-18297-0 Soil PID = BKGR FID = BKGROD
5.0	7.5		1.4	4-5-4 (13)	SAND, (SW, dark brown (5yr., 5/2), damp, loose, very fine to fine (likely till)	
	10					
10.0	11.5		1.5	4-3-3 (10)	SILT, (ML), moderately yellow brown (10yr, 5/4), wet, firm, orange mottling, worm/root holes	
	15.0					
15.0	16.5		1.4	8-10-13 (29)	SILT, (ML), as above, to 15.5 feet BGS,	
	17.5				SAND, (SW), gray (5yr., 4/1, wet, loose, fine to medium-grained, large mica flakes, 5% silt, subangular grains	
	19.0		1.4	10-12-1 (23)	SAND, (SW), as above	Lab sample: 1630 W42-0100-18297-0
	20.0					
20.0	21.5		1.4	10-12-13 (35)	SAND, (SW),medium dark gray (N4), wet, loose, fine to medium grained, red grains, subangular grains	
25.0	27.5				SAND, (SW), as above,	Lab sample: 1415 MW42-0230-18297-0
	29.0		1.4	7-8-8 (21)	SAND, (SW), as above, olive gray (5yr., 4/1)	Total depth 27.5 feet

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW42-013	SHEET 1 OF

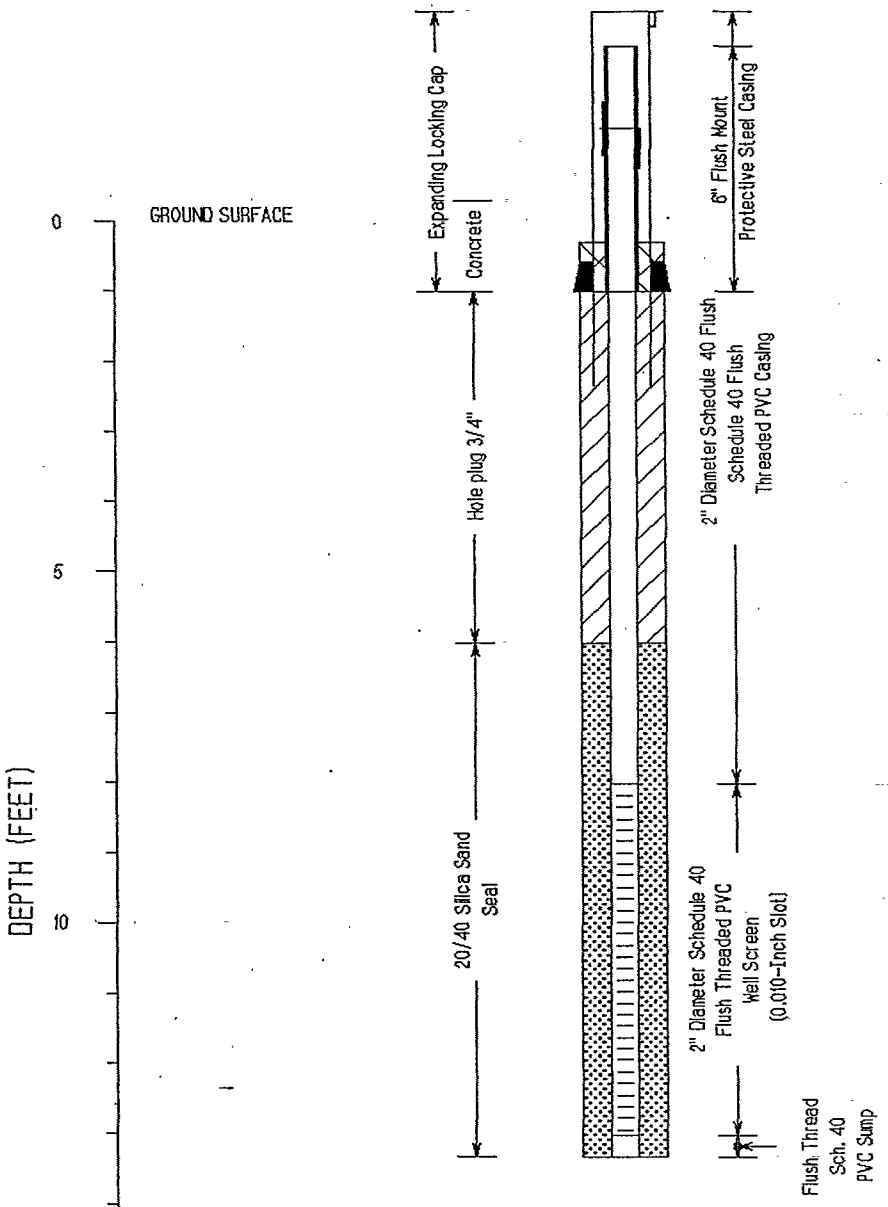
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION NE CORNER OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11 WCH O.D. HSA, 6.5"ID, 8-59 MOBIL DRILL

WATER LEVELS _____ START 8-11-97 FINISH 8-11-97 LOGGER IVAN GALL



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW42-027/MW42-013 SHEET 1 OF

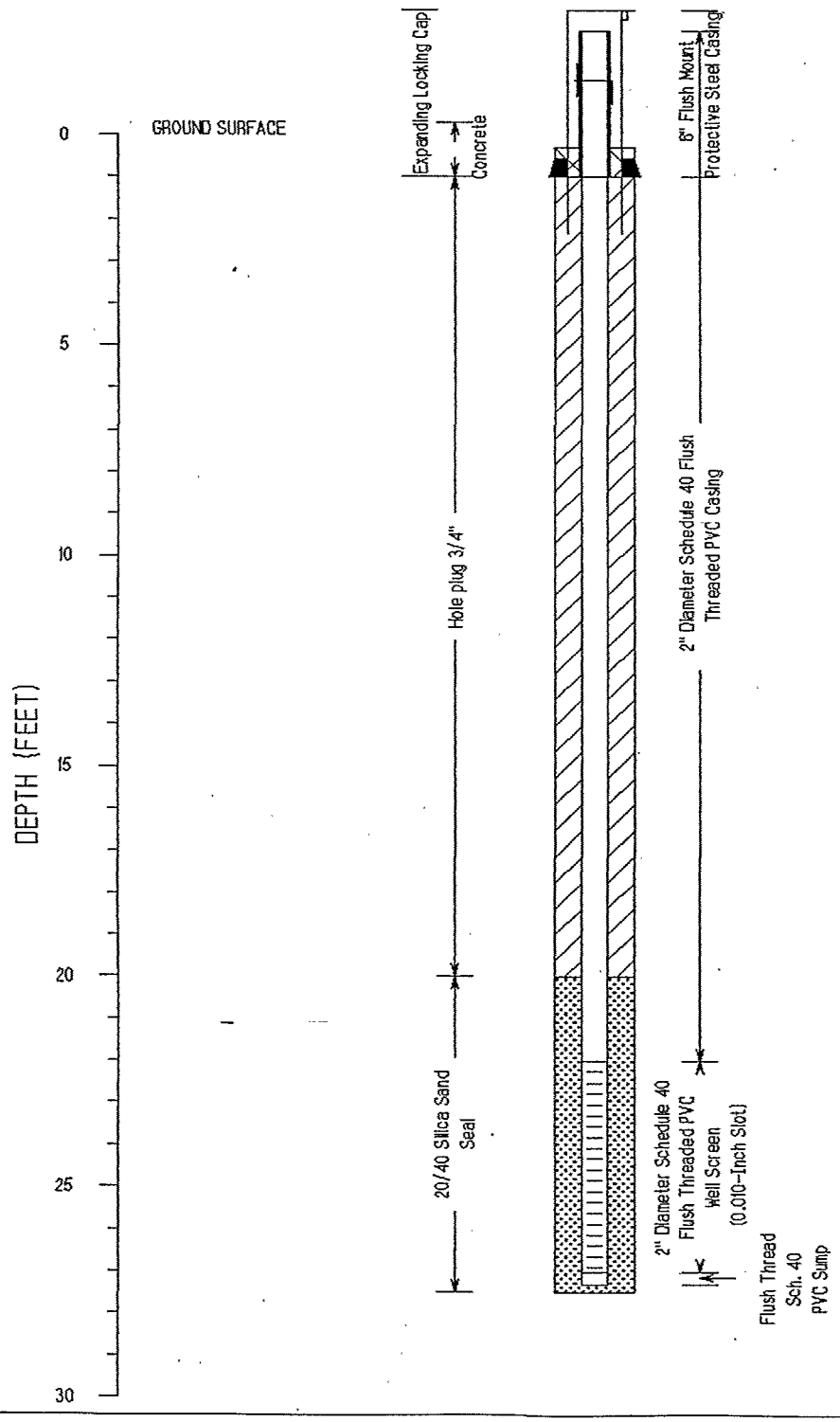
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION NE CORNER OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11 WCH O.D. HSA, 8.5"ID, 8-59 MOBIL DRILL

WATER LEVELS _____ START 6-11-97 FINISH 6-11-97 LOGGER IVAN GALL



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW43-027/MW43-015 SHEET 1 OF 1

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION NE SIDE OF ENGINEERING BUILDING

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. 6.5"ID, 8-59 MOBIL DRILL

WATER LEVELS _____ START 6-13-97 FINISH 6-13-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					4" asphalt	
					GRAVELLY SAND, (SW), gray brown (5yr., 3/2), damp, loose, fine, medium grained 15% fine /// gravek, less than 5% silt	
	550					Lab sample: 1330 MW43-0050-18497-0
5.0	8.5		1.3	12-15-8 (23)	SAND, (ML), pale brown (5yr., 8/2), damp, loose, fine to medium grained <5% silt, subangular grains	FID = 0.25ppm PID = 24ppm LEL = ND 21% 02, 0% Pentane Dubt = 0
	10.0					
10.0	11.5		1.5	2-3-2 (5)	SILT, (ML), dark yellowish brown (10yr., 4/2), wet, firm, plastic mottling, with worm/root holes	Lab sample: 1410 W43-0110-18497-0
	13.5					
	15.0		1.5	4-3-2 (5)	SILT, (ML), as above	
15.0	18.5		1.5	2-3-5 (83)	SILT WITH SAND, (ML-SW), moderate yellowish brown (10YR., 5/9), firm, orange mottling, 20%-25% very fine sand	
	17.5					
	19.0		1.5	3-5-18 (23)	SAND, (SW), dark yellowish brown (10yr., 4/2), wet, loose, mica flakes, 5% silts, subangular grains	
20.0	21.5		1.5 –	6-7-13 (20)	SAND, (SW), brownish gray (5yr., 4/1), wet, loose, mica flakes	
	25.0					
25.0	28.5		1.5	7-10-16 (26)	SAND, (SW), same as above	Lab sample: 1120 MW43-0260-18497-0
					SAND, (SW), same as above	
						Total depth 29.0' BGS

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D6.02	MW43-015	SHEET 1 OF

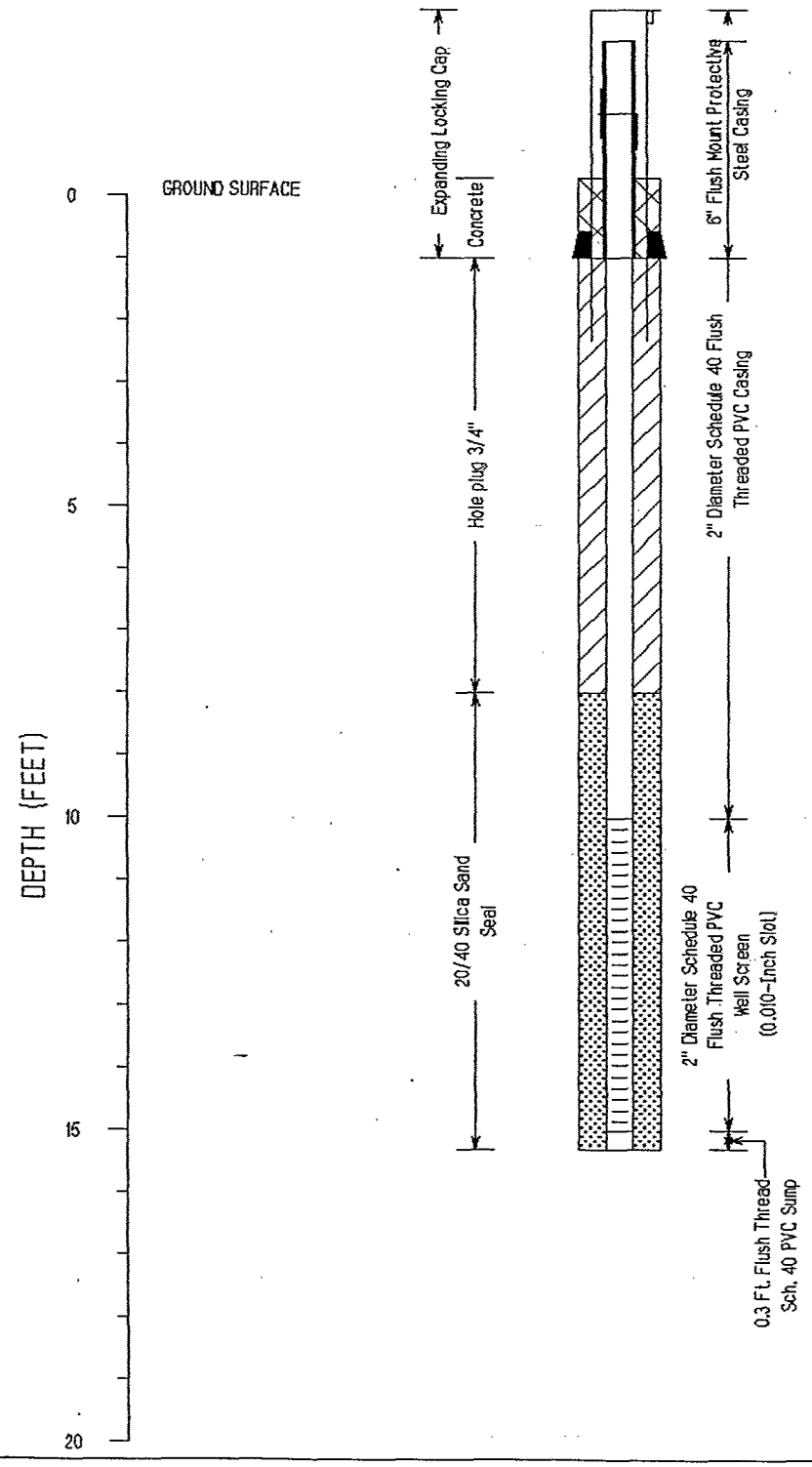
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION NE SIDE OF ENGINEERING BUILDING

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. 6.5"ID, 8-59 MOBIL DRILL

WATER LEVELS _____ START 6-13-97 FINISH 6-13-97 LOGGER ERIC BROBERG



See Boring Log For Drilling Details

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW43-027/MW43-015 SHEET 1 OF

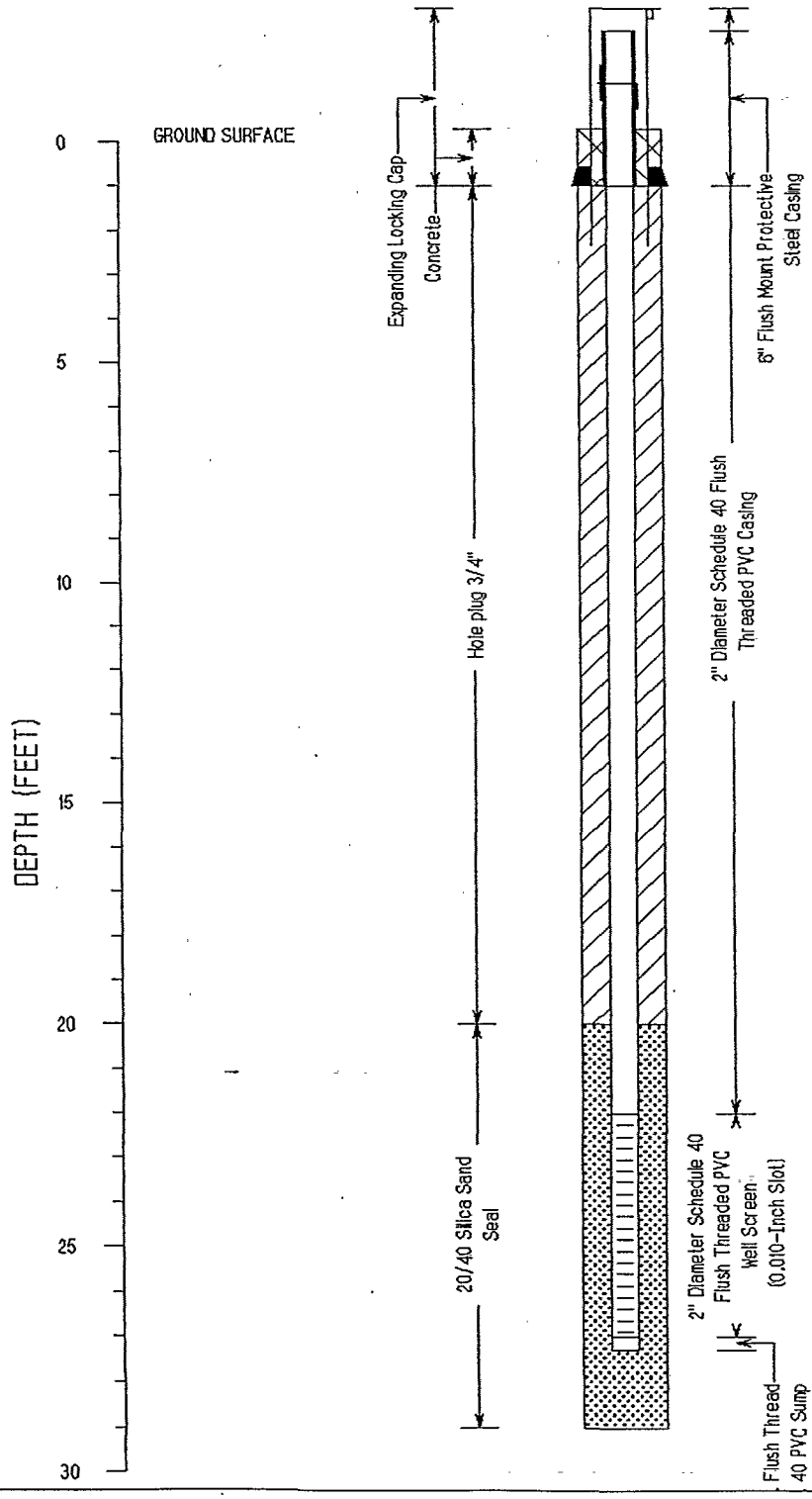
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION NE SIDE OF ENGINEERING BUILDING

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. 6.5"ID, 8-59 MOBIL DRILL

WATER LEVELS _____ START 6-13-97 FINISH 6-13-97 LOGGER ERIC BROBERG



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW44-027/MW44-011 SHEET 1 OF 1

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION EAST SIDE OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. HSA 8.5"ID, B59 MOBILE DRILL

WATER LEVELS _____ START 6-12-97 FINISH 6-12-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Surface - sand/gravel fill	Sampling with 3" "California Modified" split spoon
	550					
5.0	6.5		1.5	5-4-4 (13)	SAND, (SW), pale brown (5yr., 4/2), damp, loose, fine to very fine-grained SAND WITH SILT, (SW-SM), at 6', damp, loose, fine grained	
	7.5					Soil PID = 21ppm Soil FID = Background LEL = ND
	9.0		1.5	2-3-4 (9)	SILT, (ML), pale yellow-brown (10yr., 6/2), wet, firm, orange mottling, worm at root holes	
10.0						
	15.0					
15.0	16.5		1.4	4-8-10 (22)	SAND, (SW), moderate yellow brown with orange (10yr., 5/4), wet, firm, fine to medium grained, mica flakes, 5% silt, subangular grains	
	17.5					
	19.0		1.5	8-17-20 (45)	SAND, (SW), dark yellow brown (10YR., 6/2), wet, firm fine to medium grained, mica flakes, subangular grains	
	20.0					
20.0	21.5		1.4	6-14-20 (40)	SAND, (SW), light olive gray, (5yr., 5/2), fine to medium grained, mica flakes	
	22.5					
	24.0		1.5	4-6-8 (18)		
	25.0				SAND, (SW), olive gray (5yr., 3/2), wet, fine to medium grained, mica flakes, subangular grains	
25.0	26.5		1.5	8-10-12 (30)	SAND, (SW), same as above	
	27.0					
	28.5		1.5	8-9-12 (29)	SAND, (SW), same as above	Total depth 27.5' BGS

PROJECT NUMBER	BORING NUMBER
107493.06.02	MW44-011 SHEET 1 OF

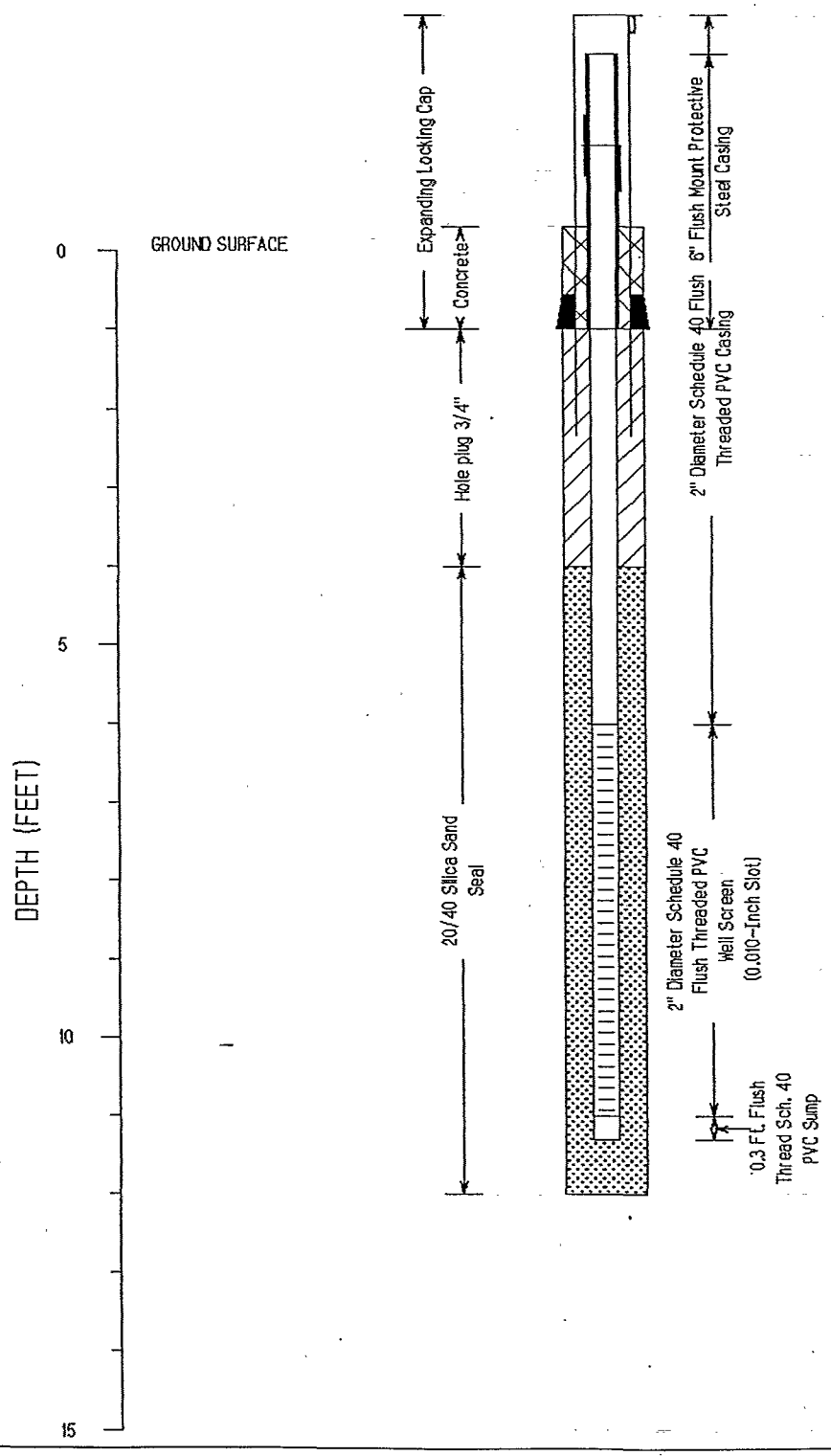
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION EAST SIDE OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. HSA 6.5"ID, B59 MOBILE DRILL

WATER LEVELS _____ START 6-12-97 FINISH 6-12-97 LOGGER ERIC BROBERG



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW44-027/MW44-011 SHEET 1 OF

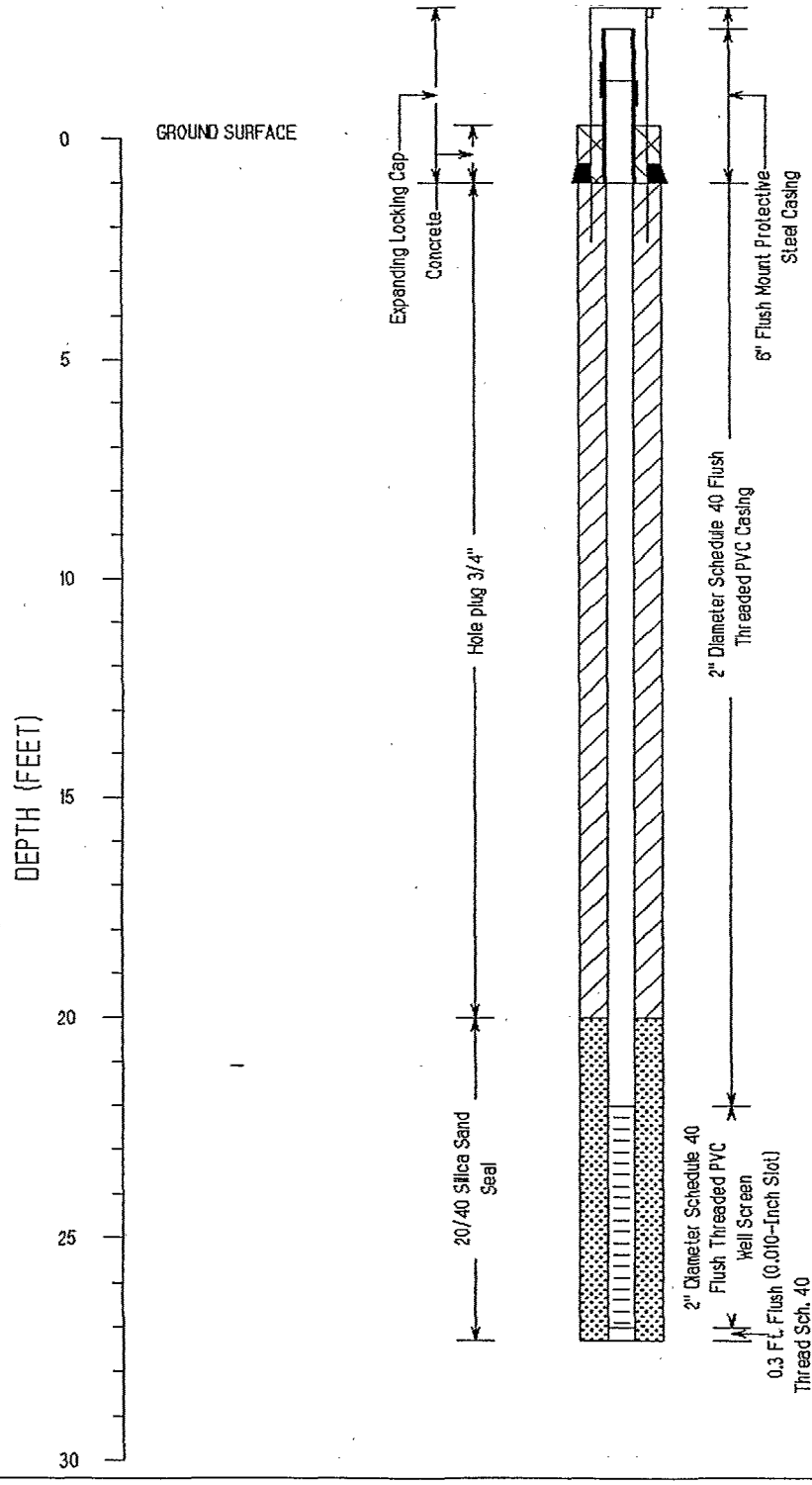
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION EAST SIDE OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. HSA 6.5"ID, B59 MOBILE DRILL

WATER LEVELS _____ START 6-12-97 FINISH 6-12-97 LOGGER ERIC BROBERG



See Boring Log
For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW45-042/MW45-017 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION SOUTH SIDE OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. HSA 8.5"ID, B59 MOBILE DRILL

WATER LEVELS _____ START 8-16-97 FINISH 8-17-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					GRAVELLY SAND, (SW), gray brown (5yr., 3/2), damp, loose, fine to medium grained, 15% fine to coarse gravel, less than 5% silt	No lab samples taken
	5.0					
5.0	8.5		1.5	5-9-7 (21)	SAND, (SW), pale brown (5yr., 5/2), damp, loose, fine to medium grained	PID = 40ppm2ppm FID = Background LE: = ND Dust = 0.0 to 0.53
	10.0					
10.0	11.5		1.5	2-2-2 (8)	SILT, (ML), dark yellowish brown (10yr., 4/2), wet, soft, orange mottling, with root/worm holes	
	15.0					
15.0	16.5		1.5	2-2-2 (8)	SILT, (ML), medium dark gray (N5), wet, soft, less mottling and holes	
	17.5					
	19.0		1.5	2-2-2 (8)	SAND WITH SILT, (SW-ML), dark gray (N3), wet, loose, very fine grained, 30-35% silt	
	20.0					
20.0	21.5		1.5	3-4-4 (11)	SILT, (ML), medium dark gray, (N5), wet, soft, faint mottling	
	25.0					
25.0	26.5		1.5	3-4-5 (12)	SAND WITH SILT, (SW-ML), light olive gray, (5yr., 6/1), wet, soft, fine grained, 30%-35% silt, mica flakes, subangular grains	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW45-042/MW45-017 SHEET 2 OF 2

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION SOUTH SIDE OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. HSA 6.5"ID, B59 MOBILE DRILL

WATER LEVELS _____ START 6-16-97 FINISH 6-17-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	31.0					
	32.5		1.5	6-8-12 (26)	SAND, (SW), dark gray (N3), wet, loose, fine to medium grained, red grains present 5% silt, subangular grains	
	35.0					
35.0	38.5		1.4	7-10-18 (33)	SAND, (SW), same as above	
	40.0					
40.0	41.5		1.3	3-4-5 (12)	SAND, (SW), same as above	
						Total depth 43.0' BGS
45.0						
50.0						
55.0						

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW45-042/MW45-017 SHEET 1 OF

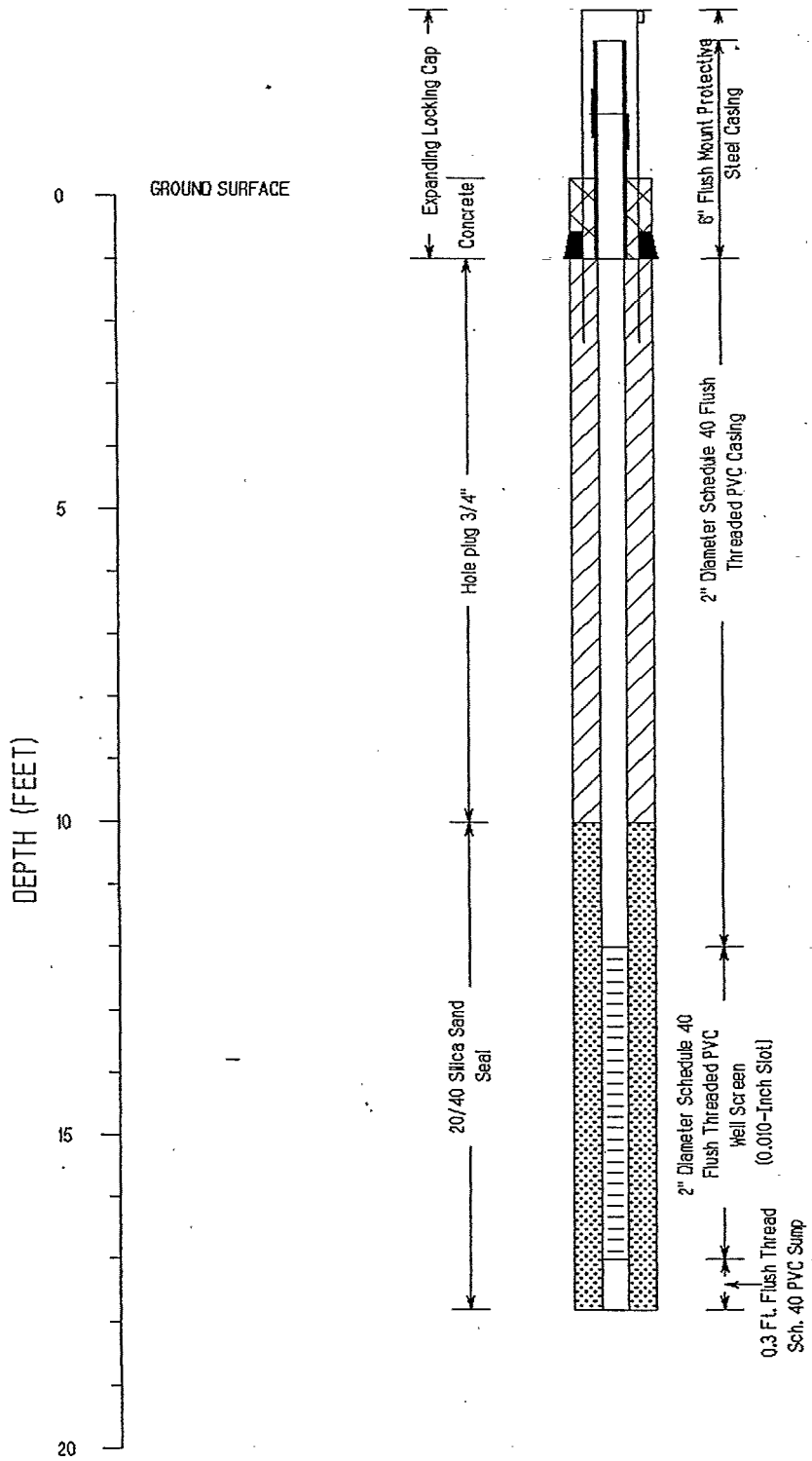
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION SOUTH SIDE OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. HSA 6.5"ID, B59 MOBILE DRILL

WATER LEVELS _____ START 6-16-97 FINISH 6-17-97 LOGGER ERIC BROBERG



See Boring Log For Drilling Details

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW45-042/MW45-017 SHEET 1 OF

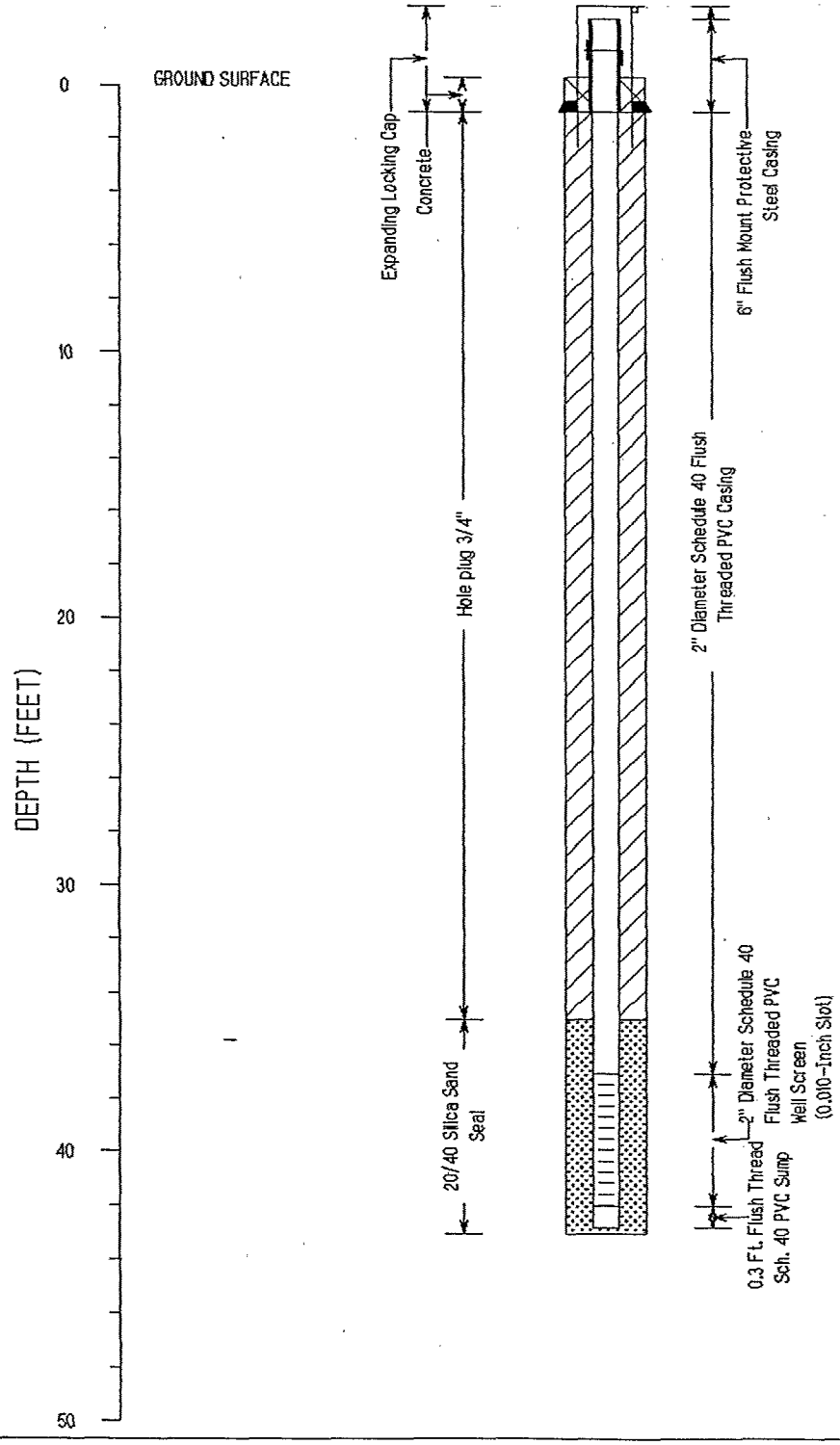
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION SOUTH SIDE OF BAKEHOUSE

ELEVATION _____ DRILLING CONTRACTOR GEOTECH

DRILLING METHOD AND EQUIPMENT 11" O.D. HSA 6.5"ID, B59 MOBILE DRILL

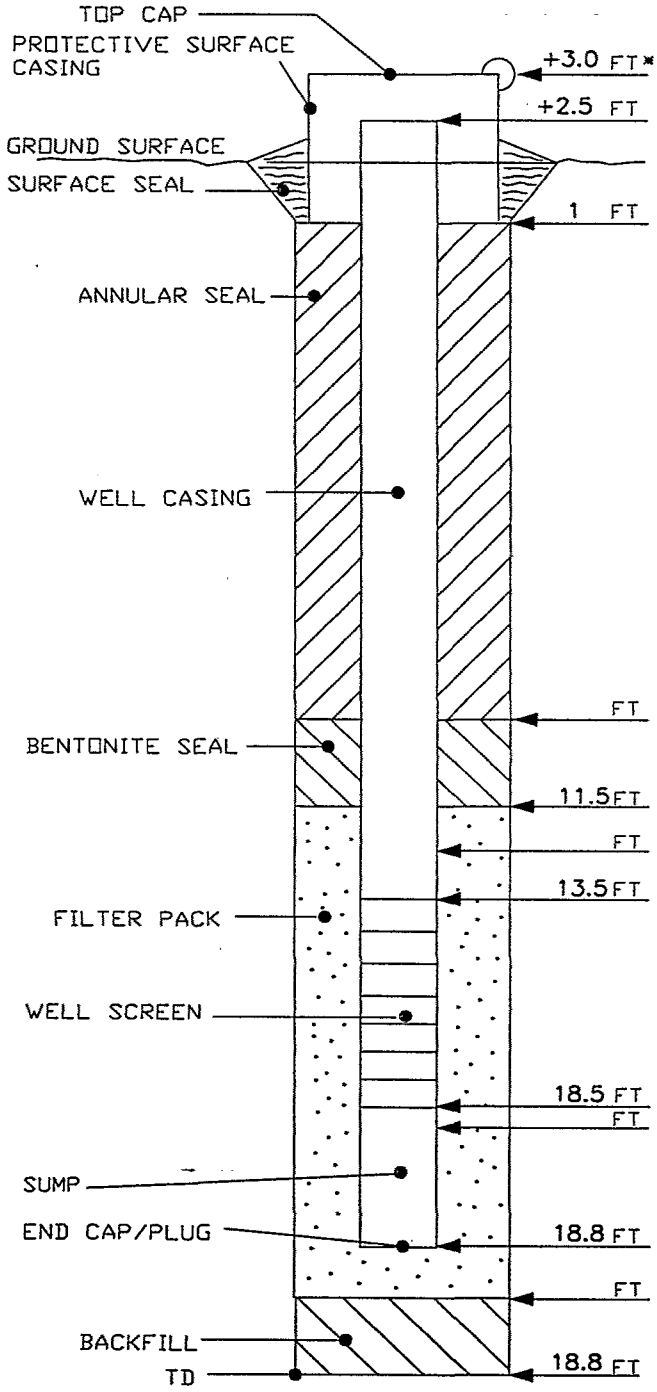
WATER LEVELS _____ START 6-16-97 FINISH 6-17-97 LOGGER ERIC BROBERG



See Boring Log For Drilling Details

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC-TROUTDALE PROJECT NO. 107493.06.02
WELL NO. MW46-018 FIELD OBSERVERS BROBERG
ELEV, NGVD (top of well casing) 31.48 SURFACE ELEV, NGVD 29.6
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 6/16/97
DRILLING CONTRACTOR GEOTECH FINISH DATE 6/16/97
DRILLING METHOD 11" OD; 6.5" ID HSA/LOCATION: BAKEHOUSE



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

MW-46.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) 11 INCHES TO 19 FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
PROTECTIVE CASING TYPE STEEL
PROTECTIVE CASING DIAMETER 6"
WELL CASING TYPE SCH 40 PVC DIAMETER 2"
COUPLING TYPE FLUSH THREAD
SCREEN TYPE SCH 40 PVC DIAMETER 2"
SLOT SIZE 0.010" SCREEN LENGTH 5'
TOP CAP TYPE EXPANDABLE LOCKING
END CAP/PLUG TYPE SCH 40 PVC FLUSH THREAD
CENTRALIZER TYPE NONE
CENTRALIZER LOCATION(S) —
FILTER PACK TYPE SILICA SAND (10 BAGS)
GRADATION 20/40

SEAL(S)

SURFACE CONCRETE (3 BAGS)
ANNULAR 3/4" HOLEPLUG (10 BAGS)
BENTONITE _____
BACKFILL _____

WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS MW46-018 START CARD #100169
TAG #L05785
* REFER TO MW46-043 FOR SUBSURFACE
GEOLOGY INFORMATION

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW46-043 SHEET 1 OF 2

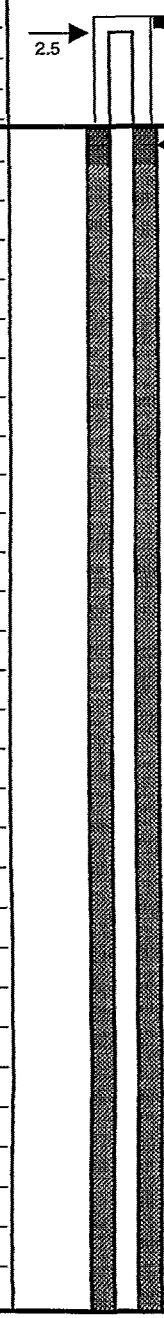
WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **N SIDE OF BAKEHOUSE**

ELEVATION : **MPE = 30.99' / GSE = 29.4'** DRILLING CONTRACTOR : **GEOTECH EXPLORATION, TUALATIN, OREGON**

DRILLING METHOD AND EQUIPMENT USED : **11" OD; 6.5" ID HSA, B59 MOBILE DRILL**

WATER LEVELS : START : 6/16/97 END : 6/16/97 LOGGER: **EMB**



DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0						
1					GRAVELLY SAND (SW), gray brown (5YR 3/2), damp, loose, fine to medium grained, 15% fine to medium gravel, less than 5% silt	
5	5.0		1.5	5-2-3 (5)	SAND (SW), brownish gray (5YR 4/1), damp, loose, fine to medium grained	LAB samples not taken FID = bkgrd PID = 20 ppm LEL = ND Dust = 0
					SAND WITH SILT (SW-SM), pale brown (5YR 5/2), damp, loose, fine grained, 20-25% silt	
10	10.0		1.4	7-4-6 (10)	SAND (SW), medium dark gray (N4), wet, loose, fine to medium grained	
15	15.0		1.5	3-4-5 (9)	SILT (ML), pale yellowish brown (10YR 6/2), wet, soft, orange mottling with worm/root holes	
20	20.0		1.5	2-3-4 (7)	SILT (ML), medium dark gray (N4), wet, soft, faint orange mottling	
					SAND (SW), olive gray (5Y 4/1), wet, loose, fine sand, mica flakes, 5-20% fines	
	–		1.4	3-2-2 (4)	SILT (ML), medium dark gray (N4), wet, soft	
25	25.0		1.5	3-2-4 (6)	SAND WITH SILT (SW-SM), olive gray (5Y 4/1), wet, loose, fine sand, mica flakes, 20-25% silt	

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW46-043 SHEET 2 OF 2

WELL CONSTRUCTION/BORING LOG

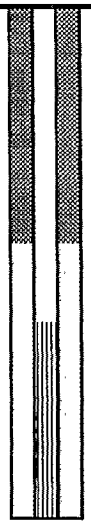
PROJECT : **RMC - TROUTDALE** LOCATION : **N SIDE OF BAKEHOUSE**

ELEVATION : **MPE = 30.99' / GSE = 29.4'** DRILLING CONTRACTOR : **GEOTECH EXPLORATION, TUALATIN, OREGON**

DRILLING METHOD AND EQUIPMENT USED : **11" OD; 6.5" ID HSA, B59 MOBILE DRILL**

WATER LEVELS : START : 6/16/97 END : 6/16/97 LOGGER: **EMB**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	31.5		1.5	3-4-6 (10)	SAND WITH SILT (SW-SM), same as above	
	33.5					
35			1.5	6-8-10 (18)	SAND (SW), dark gray (N3), wet, loose, fine to medium grained, red grains present	
	37.5					
	39.0		1.5	8-14-20 (34)	SAND (SW), same as above, medium dense	
40	41.0					
43	43.0		1.5	5-7-12 (19)	SAND (SW)	
45					**End of Boring @ 43.3' bgs**	Borehole diameter = 11" to 43' bgs Start Card # = 100168 Tag # L05784
50						
55						



CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.06.02	MW47-094	SHEET 1 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION SOUTH LANDFILL

ELEVATION MPE-29.71 DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG OR 24

WATER LEVELS START 6-27-97 FINISH 7-1-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Loose fill, sandy loam with brick debris, greenish-black (N2), loose, dry	Soil and water samples collected below 5' with sieve and bowl at cyclone hopper. Logged from cuttings
	5.0					
5.0	8.0				SAND, (SP), grayish brown (5yr., 7/2), with orange mottling, loose, moist fine grained	
	9.0					
	10.0				SAND, (SP), as above, wet, fine grained, 10% - 15% silt	
10.0						
	14.0					
	15.0					
15.0					SILT, (ML), gray (N3), wet 10% sand, very fine grained, subangular	
20.0						
25.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D6.02	MW47-094 SHEET 2 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION SOUTH LANDFILL

ELEVATION MPE-29.71 DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG OR 24

WATER LEVELS START 6-27-97 FINISH 7-1-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35.0					SILT, (ML), dark gray (N3), firm, wet	
40.0	40.0					
	41.0				SAND, (SW-SM), medium dark gray (N4), wet, loose, fine to medium grained, some red grains, 10% silt, subangular	Water sample at 50' BGS F = 10.2ppm
45.0						
50.0	50.0				SAND, (SW), as above,	
	51.0					
55.0						60' BGS water sample F=11.6

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW47-094 SHEET 3 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION SOUTH LANDFILL

ELEVATION MPE-29.71 DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG OR 24

WATER LEVELS START 8-27-97 FINISH 7-1-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW-SM), medium dark gray (N5), wet, loose, very fine - fine grained, some red grains, organics (wood), 10% silts	
65.0						
70.0						
75.0						
80.0					SAND, (SW-SM), mediumm dark gray (N4), loose, wet, fine to medium grained, some red grains, and mica, organics (wood), 10% silts	80' BGS water sample F = 3.37ppm
85.0					SAND, (SW-SM), same as above	

CH2M HILL

PROJECT NUMBER	BORING NUMBER
107493.D8.02	MW47-094 SHEET 4 OF 4

SOIL BORING LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION SOUTH LANDFILL

ELEVATION MPE-29.71 DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG OR 24

WATER LEVELS START 6-27-97 FINISH 7-1-97 LOGGER ERIC BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY FEET	STANDARD PENETRATION TEST RESULTS 6" -6" -6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND, (SW-SM), same as above	90' BGS water sample F= 0.83ppm
85.0					End of borehole	
100.0						
105.0						
110.0						
115.0						

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D8.02	MW47-094	SHEET 1 OF 1

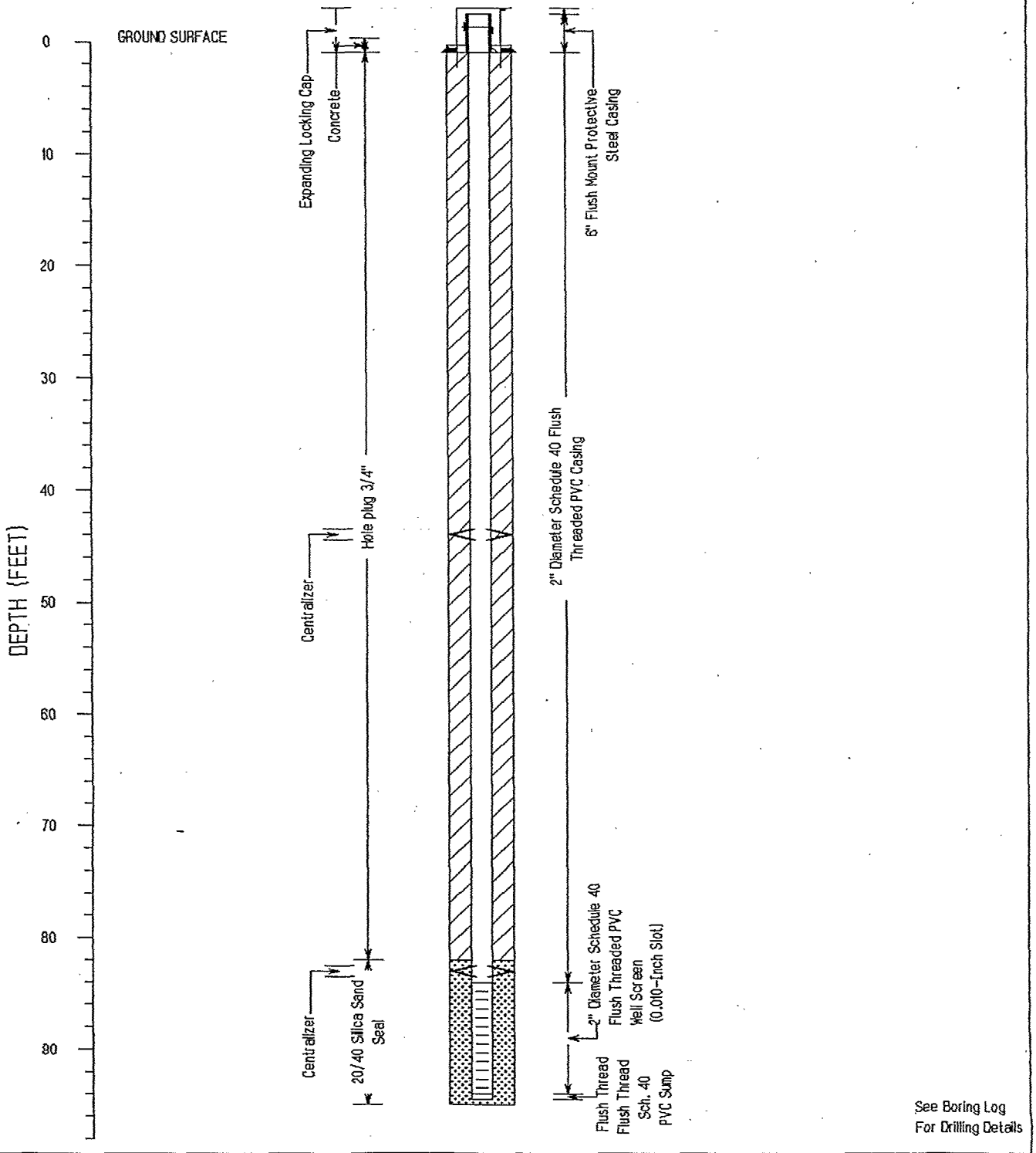
WELL COMPLETION LOG

PROJECT Reynolds Metals -- RMC-Troutdale LOCATION SOUTH LANDFILL

ELEVATION MPE-29.71 DRILLING CONTRACTOR STACO WELL SERVICES

DRILLING METHOD AND EQUIPMENT FOREMOST DRILL - BARBER RIG OR 24

WATER LEVELS START 8-27-97 FINISH 7-1-97 LOGGER ERIC BROBERG



See Boring Log For Drilling Details

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW48-055 SHEET 1 OF 2

WELL CONSTRUCTION/BORING LOG

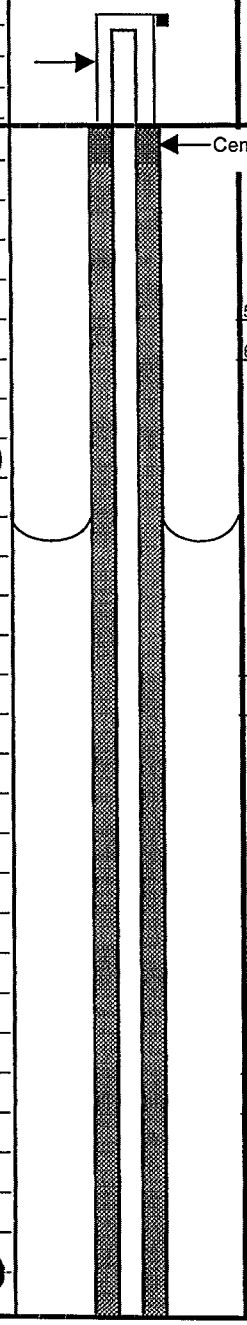
ROJECT : **RMC - TROUTDALE** LOCATION : **NO. SIDE OF CASTHOUSE**

ELEVATION : **MPE = 28.19' / GSE = 28.4'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY**

ATER LEVELS : 17.77 START : 8/28/97 END : 9/2/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0						Spud-In with 6" hole
5	5.0 6.0				SAND (SW), grayish brown (5YR 3/2), dry to damp, loose, fine to medium grained, thin lamina of silty, subangular grains	Soil from cyclone, collected with SS bowl, logged from cuttings
10						
	14.0					
15	15.0				SILT (ML), dark yellowish brown (10YR 4/2), wet, soft, 10% fine grained sand	Drive casing to 15.0'
0						Water @ 20.0'
	24.0					
5	25.0				SAND WITH SILT (SW-SM), brownish gray (5YR 4/1), wet, very loose, fine grained sand, subangular grains	Soil from cyclone, drive casing to 25.0'



CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW48-055 SHEET 2 OF 2

WELL CONSTRUCTION/BORING LOG

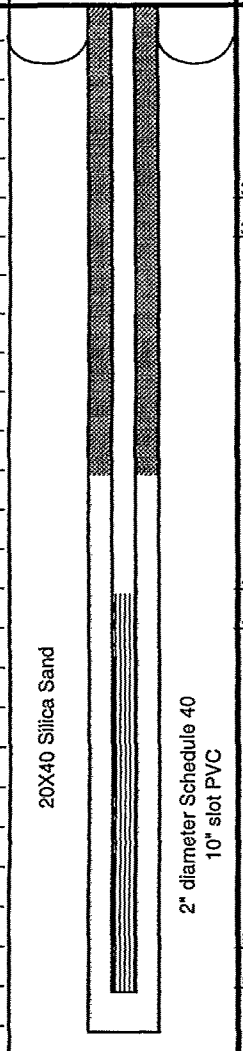
PROJECT : **RMC - TROUTDALE** LOCATION : **NO. SIDE OF CASTHOUSE**

ELEVATION : **MPE = 28.19' / GSE = 28.4'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY**

WATER LEVELS : 17.77 START : 8/28/97 END : 9/2/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35	35.0				SANDY SILT (ML), dark gray (N3), wet, loose, fine grained sand, trace mica, red grains	
	36.0					
40						
45	45.0				SAND (SW), medium dark gray (N4), wet, loose, fine to medium grained, <5% silt, trace mica and red grains, subangular grains	
	46.0					
50						
	54.0					
55	55.0				SAND (SW), as above	
					End of Boring @ 55.9' bgs	
					Borehole diameter = 6" to 56" bgs	**Well developed on 9/02/97.**



CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW48-165
	SHEET 1 OF 7

WELL CONSTRUCTION/BORING LOG

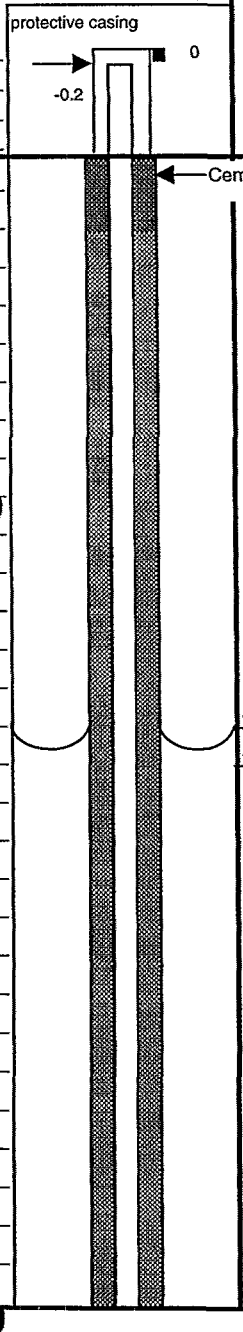
ROJECT : **RMC - TROUTDALE** LOCATION : **NO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 28.12' / GSE = 28.3'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY, 6" CASING**

ATER LEVELS : 17.19 START : 8/19/97 END : 8/27/97 LOGGER: **R. KAZMIEKZAK/GALL**

PTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0						Spud-In with 6" hole
						Lossing samples from cyclone on rig. Logged from cuttings
5						
0						
5	15.0				SILT (ML), dark yellowish brown (10YR 4/2), moist to wet, soft, 10% fine grained sand	Drive casing to 15.0'
	16.0					
20						Water @ 20.0'
25						



CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW48-165 SHEET 2 OF 7

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **NO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 28.12' / GSE = 28.3'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY, 6" CASING**

WATER LEVELS : 17.19 START : 8/19/97 END : 8/27/97 LOGGER: **R. KAZMIEKZAK/GALL**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	31.0				SANDY SILT (ML), dark gray (N3), wet, very loose, 15% fine grained sand	Sample from strainer
35						
	36.0				SANDY SILT (ML), with silt (gray and red brown) interbeds 15% fine grained	Sample from strainer
	37.0					
40	40.0					
	41.0				SAND (SW), medium dark gray (N4), wet, loose, fine to medium grained, 5% silt, trace mica and wood fragments, trace red grains, subangular grains	Sample from strainer
45						
50	50.0				SAND (SW), same as above, slightly courser	Sample from strainer
	51.0					
55						

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW48-165 SHEET 3 OF 7

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **NO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 28.12' / GSE = 28.3'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY, 6" CASING**

WATER LEVELS : 17.19 START : 8/19/97 END : 8/27/97 LOGGER: **R. KAZMIEKZAK/GALL**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65	65.0				SAND (SW), as above	
	66.0					
70						
75	75.0				SAND (SW), as above, wood fragments	Sample from strainer
	76.0					
80						
85						
	89.0				SAND (SW), as above, trace gravel, 3/4", wood fragments	Sample from strainer Fluoride = 3.0 ppm
	90.0					

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW48-165 SHEET 4 OF 7

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **NO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 28.12' / GSE = 28.3'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY, 6" CASING**

WATER LEVELS : 17.19 START : 8/19/97 END : 8/27/97 LOGGER: **R. KAZMIEKZAK/GALL**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95						
100						
105	105.0 106.0				SAND (SW), as above, fines grained sand	Sample from strainer
110						
115	115.0 116.0				SAND (SW), as above, trace gravel 1/4" wood fragments	Sample from strainer, added ~170 gal of H2O to prevent heave. Fluoride = 4.2 ppm

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW48-165 SHEET 5 OF 7

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **NO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 28.12' / GSE = 28.3'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY, 6" CASING**

WATER LEVELS : 17.19 START : 8/19/97 END : 8/27/97 LOGGER: **R. KAZMIEKZAK/GALL**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	121.0				SAND (SW), as above, 5% pumice fragments, trace wood fragments, fine to medium grained subangular grains	Sample from strainer
125						
130	130.0				SAND (SW), as above, pumice fragments up to .25", very fine to fine sand	Sample from strainer. Fluoride = 7.3 ppm
	131.0					
135						
140						
145	145.0				SAND (SW), as above, except trace pumice subangular gravel up to 1/4", fine sand, no wood fragments	
	146.0					

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW48-165 SHEET 6 OF 7

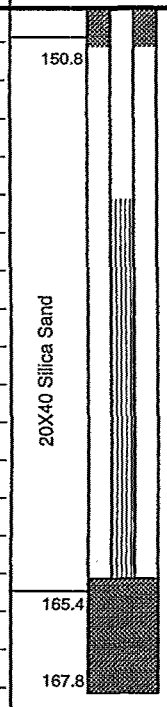
WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **NO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 28.12' / GSE = 28.3'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY, 6" CASING**

WATER LEVELS : 17.19 START : 8/19/97 END : 8/27/97 LOGGER: **R. KAZMIEKZAK/GALL**



DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
155	154.0 155.0				SAND (SW), as above, less than 5% gravel up to 1/2", fine to medium grained	Sample from strainer. Fluoride = 8.9 ppm
165	165.0 166.0				SAND (SW), as above, no gravel very fine to fine, mica	Sample from strainer
175	175.0 176.0				SAND (SW), as above, trace gravel up to 1.0", very fine to fine sand	Fluoride = 5.2 ppm

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW48-165 SHEET 7 OF 7

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **NO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 28.12' / GSE = 28.3'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY, 6" CASING**

WATER LEVELS : 17.19 START : 8/19/97 END : 8/27/97 LOGGER: **R. KAZMIEKZAK/GALL**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
185	185.0				SAND (SW), as above, trace gravel 1/4" trace organic wood fragments	
	186.0					
190						
195					SAND (SW), as above	Fluoride = 1.7 ppm
200					**End of Boring @ 199.0' bgs**	**Backfilled borehole to 165', set well.** **Well development on 9/2/97.**
205						

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-095 SHEET 1 OF 4

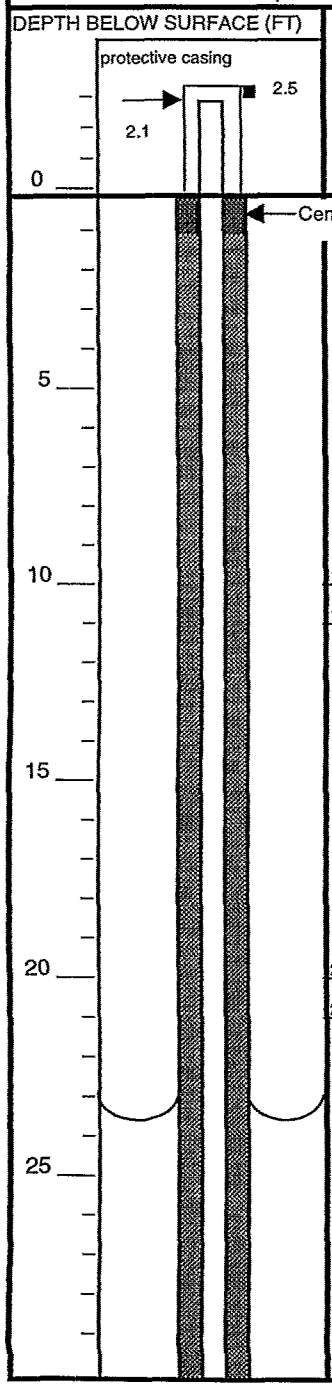
WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.52' / GSE = 28.7'** DRILLING CONTRACTOR : **STACO, WELL SERVICES**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY - 6" CASING (BOREHOLE)**

WATER LEVELS : 19.77 (10/30/97) START : 10/24/97 END : 10/29/97 LOGGER: **R. KAZMIEKZAK**



DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND WITH SILT (SW-SM), brownish gray (5YR, 4/1), dry, very loose, fine grained, 15% silt	Logged from cuttings
10	10.0				SILT (ML), dark yellowish brown (10YR 4/2), damp, soft, trace of fine sand	Driller added water to speed drilling
	11.0					
20	20.0				SILT WITH SAND (ML), olive gray (5Y 4/1), wet, soft, 15% very fine to fine sand	
	21.0					

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-095 SHEET 2 OF 4

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.52' / GSE = 28.7'** DRILLING CONTRACTOR : **STACO, WELL SERVICES**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY - 6" CASING (BOREHOLE)**

WATER LEVELS : 19.77 (10/30/97) START : 10/24/97 END : 10/29/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	31.0				SAND WITH SILT (SW-SM), olive gray (5Y 4/1), wet, loose, fine grained, 10% silt	Fluoride = 0.711
35	35.0					
	36.0				SAND (SW), medium dark gray (N4), wet, loose, fine to medium grained, 5% pak silt, subangular grains	Samples from cyclone Fluoride = 0.603 ppm
40						
45	45.0				SAND (SW), dark gray (N3), wet, loose, fine grained to very fine, trace silt, mica and red grains present, subangular grains	Samples from cyclone Fluoride = <0.40 ppm
	46.0					
50						
55	55.0				SAND (SW), same as above	Samples from cyclone Fluoride = <0.40 ppm Driller added water to prevent heave
	56.0					

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-095 SHEET 3 OF 4

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.52' / GSE = 28.7'** DRILLING CONTRACTOR : **STACO, WELL SERVICES**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY - 6" CASING (BOREHOLE)**

WATER LEVELS : 19.77 (10/30/97) START : 10/24/97 END : 10/29/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65	65.0 – 66.0				SAND (SW), as above	Fluoride = 0.750 ppm
70						
75	75.0 – 76.0				SAND (SW), as above, trace wood fragments	Fluoride = <0.40 ppm
80						
85	85.0 – 86.0				SAND (SW), as above, except fine to medium grained sand	Fluoride = <0.40 ppm

83.7

20X40 Silica Sand

2" diameter Schedule 80 10" slot PVC

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-095 SHEET 4 OF 4

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.52' / GSE = 28.7'** DRILLING CONTRACTOR : **STACO, WELL SERVICES**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY - 6" CASING (BOREHOLE)**

WATER LEVELS : 19.77 (10/30/97) START : 10/24/97 END : 10/29/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
93.7'	94.0				Sand (SW), as above	Fluoride = <0.40 ppm
95	95.0					
					End of Boring @ 95.0' bgs	
						Well development on 10/29/97
100						
105						
110						
115						

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-145 SHEET 1 OF 6

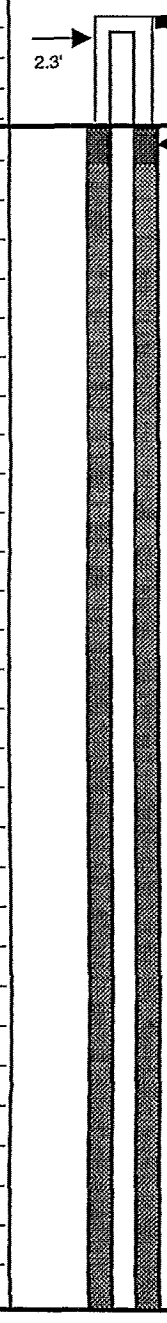
WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.85' / GSE = 28.9'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY 6" CASING TO 146.0'**

WATER LEVELS : 20.13 (10/30/97) START : 10/9/97 END : 10/28/97 LOGGER: **R. KAZMIEKZAK**



DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0					SAND (SW), brownish gray (5YR 4/1), dry, very loose, fine grained	Logged from cuttings
5	5.0–6.0				SILT (ML), dark yellowish brown (10YR 4/2), soft, trace of fine sand	Driller added 20 gallons of water
10	10.0–11.0				SILT (ML), as above	
15	15.0–16.0				SILT (ML), as above	
20	20.0–21.0				SILT (ML), dark yellowish brown (10YR 4/2), wet, soft, trace of fine sand	Collected samples from cyclone. Fluoride = 15.20 ppm
25	25.0–26.0				SILT WITH SAND (ML), olive gray (5Y 4/1), wet, soft, 25% very fine to fine grained sand	

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-145 SHEET 2 OF 6

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.85' / GSE = 28.9'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY 6" CASING TO 146.0'**

WATER LEVELS : 20.13 (10/30/97) START : 10/9/97 END : 10/28/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					SAND WITH SILT (SW-SM), olive gray (5Y 4/1), wet, loose, very fine grained to fine grained 10% silt	
35	35.0					
	36.0				SAND (SW), medium dark gray (N4), wet, loose, fine to medium grained, trace silty subangular grains	Collected samples from cyclone Fluoride = 14.00 ppm
40	40.0					
	41.0				SAND (SW), as above	
45	45.0				SAND (SW), brownish gray (5YR 4/1), wet, loose, fine grained, trace silt	
	46.0					
50						
55	55.0				SAND (SW), medium dark gray (N4), wet, loose, fine to medium grained, trace wood fragments	Collected samples from cyclone Fluoride = 1.89 ppm
	56.0					

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-145 SHEET 3 OF 6

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.85' / GSE = 28.9'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY 6" CASING TO 146.0'**

WATER LEVELS : 20.13 (10/30/97) START : 10/9/97 END : 10/28/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65	65.0–66.0				SAND (SW), dark gray (N3), wet, loose, fine to medium grained, trace red grains and mica flakes subangular grains to subrounded	
70						
75	75.0–76.0				SAND (SW), dark gray (N3), wet, loose, fine to coarse grained, subangular to subrounded, trace mica, red grains	Collected sample from cyclone. Fluoride = 0.933 ppm
80						
85	85.0–86.0				SAND (SW), as above	

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-145 SHEET 4 OF 6

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.85' / GSE = 28.9'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY 6" CASING TO 146.0'**

WATER LEVELS : 20.13 (10/30/97) START : 10/9/97 END : 10/28/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95	95.0 96.0				SAND (SW), as above	Driller reporting heave in casing. Collected samples from cyclone. Fluoride = <0.40 ppm
100						
105	105.0 106.0				SAND (SW), as above	
110						
115	115.0 116.0				SAND (SW), as above, large mica flakes	Filled casing with water to prevent heave. Collected samples from cyclone. Fluoride = <0.40 ppm

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-145
	SHEET 5 OF 6

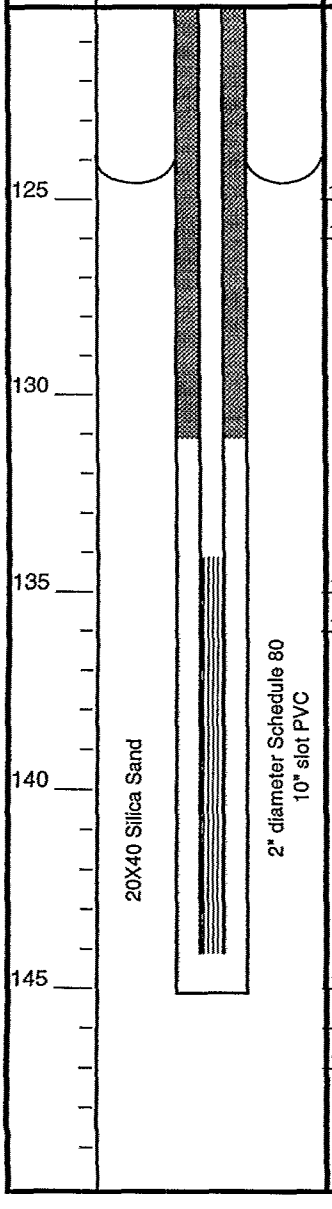
WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.85' / GSE = 28.9'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY 6" CASING TO 146.0'**

WATER LEVELS : 20.13 (10/30/97) START : 10/9/97 END : 10/28/97 LOGGER: **R. KAZMIEKZAK**



DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
125	125.0				SAND (SW), same as 115.0' bgs	Sample from cyclone
	126.0					
130						
135	130.0				SAND (SW), same as above	
	131.0					
140						
145	145.0				SAND WITH GRAVEL (SW), sand same as above, gravel, rounded, primarily basalt, 0.25 - 1.0" in size	Fluoride = <0.40 ppm
	146.0					
	147.0				GRAVEL (GW), dark gray (N3), wet, dense, moderately well rounded primarily basalt, approximately 10-15% sand	Fluoride = <0.40 ppm

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW49-145 SHEET 6 OF 6

WELL CONSTRUCTION/BORING LOG

PROJECT: **RMC - TROUTDALE** LOCATION : **SCRAPYARD**

ELEVATION: **MPE = 30.85' / GSE = 28.9'** DRILLING CONTRACTOR : **STACO, TROY REYNOLDS**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY 6" CASING TO 146.0'**

WATER LEVELS : 20.13 (10/30/97) START : 10/9/97 END : 10/28/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
155	155.0 156.0				GRAVEL (GW), as above, still primarily basalt with some quartzite, sand approximately 5%, moderately well rounded	Slight cement evident Fluoride = <0.40 ppm Casing producing ~ 100 gpm.
160						
165	165.0 166.0				GRAVEL (GW), dark gray (N3), wet, dense, rounded, primarily basalt with some quartz, quartzite, and granite fragments 10-15% sand, fine to coarse grained	No cementation evident Fluoride = 0.584 ppm, Sample from cyclone.
170	171.0 172.0 173.0				SAND WITH GRAVEL (SW), medium dark gray (N4), *medium dense, fine to medium grained, large mica* flakes 5-10% gravel	Casing advancing easier, not as easy as *first sand encountered,* Driller added water to prevent heave
175					**End of Boring @ 173.0'**	**Backfilled to 145.0'** **Well development on 10/27/97**

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW50-094 SHEET 1 OF 4

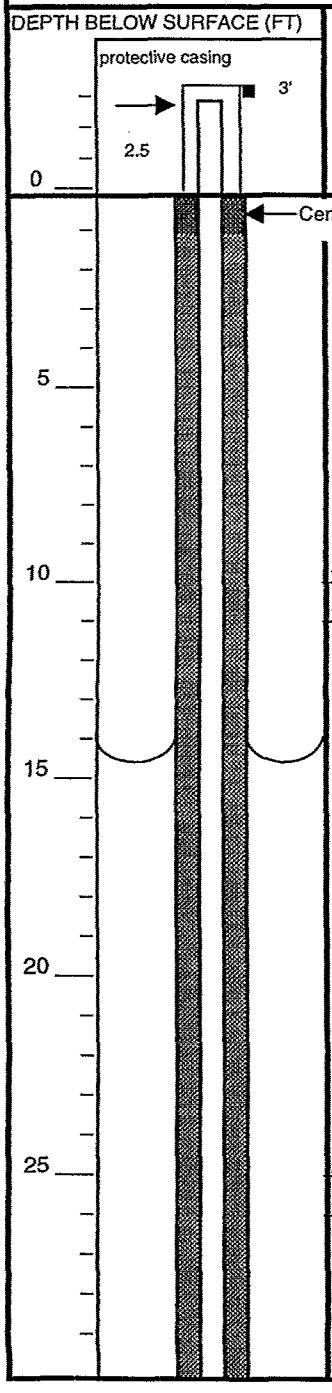
WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 27.06' / GSE = 24.9'** DRILLING CONTRACTOR : **STACO, WELL SERVICES**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY - 6" TO 95.0'**

WATER LEVELS : START : 10/29/97 END : 10/31/97 LOGGER: **R. KAZMIEKZAK**



DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					FILL SILTY SAND WITH GRAVEL (SM), brown, wet, sub to angular gravel up to 1.5", fine to medium sand	Driller added water
10	10.0					
	11.0				SILT (ML), gray, wet, trace fine sand, medium plasticity	
15					SILT (ML), as above	
20						
25	25.0				SILT (ML), as above except 10% trace very fine sand	
	26.0					

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW50-094 SHEET 2 OF 4

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 27.06' / GSE = 24.9'** DRILLING CONTRACTOR : **STACO, WELL SERVICES**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY - 6" TO 95.0'**

WATER LEVELS : START : 10/29/97 END : 10/31/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35	35.0 36.0				SANDY SILT (ML), gray, wet, loose, very fine to fine grained sand (25%) trace wood fragments, subangular grains	Driller added water, collected soil and water sample from cyclone Fluoride = 0.659 ppm
40						
45	45.0 46.0				SAND (SW), dark gray, wet, loose, very fine to fine grained sand, 5% silt, mica grains	Collected samples from cyclone no water sample
50						
55	55.0 56.0				SAND (SW), same as above, fine grained trace mica, trace silt	Driller added water to prevent heave. Soil and water samples collected from cyclone - Fluoride = 0.431 ppm

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW50-094 SHEET 3 OF 4

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 27.06' / GSE = 24.9'** DRILLING CONTRACTOR : **STACO, WELL SERVICES**

DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY - 6" TO 95.0'**

WATER LEVELS : START : 10/29/97 END : 10/31/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65	65.0–66.0				SAND (SW), as above, trace red grains	Samples collected from cyclone, no water sample
70						
75	75.0–76.0				SAND (SW), as above	Driller reporting sand heave, no water added. Fluoride = <0.40 ppm
80						
85	85.0–86.0				SAND (SW), as above,	

84.0

20X40 Silica Sand

2" diameter Schedule 80 10" slot PVC

CH2MHILL

PROJECT NUMBER : 107493.D6.02	WELL NUMBER : MW50-094 SHEET 4 OF 4

WELL CONSTRUCTION/BORING LOG

PROJECT : **RMC - TROUTDALE** LOCATION : **SO. SIDE OF CASTHOUSE**

ELEVATION: **MPE = 27.06' / GSE = 24.9'** DRILLING CONTRACTOR : **STACO, WELL SERVICES**

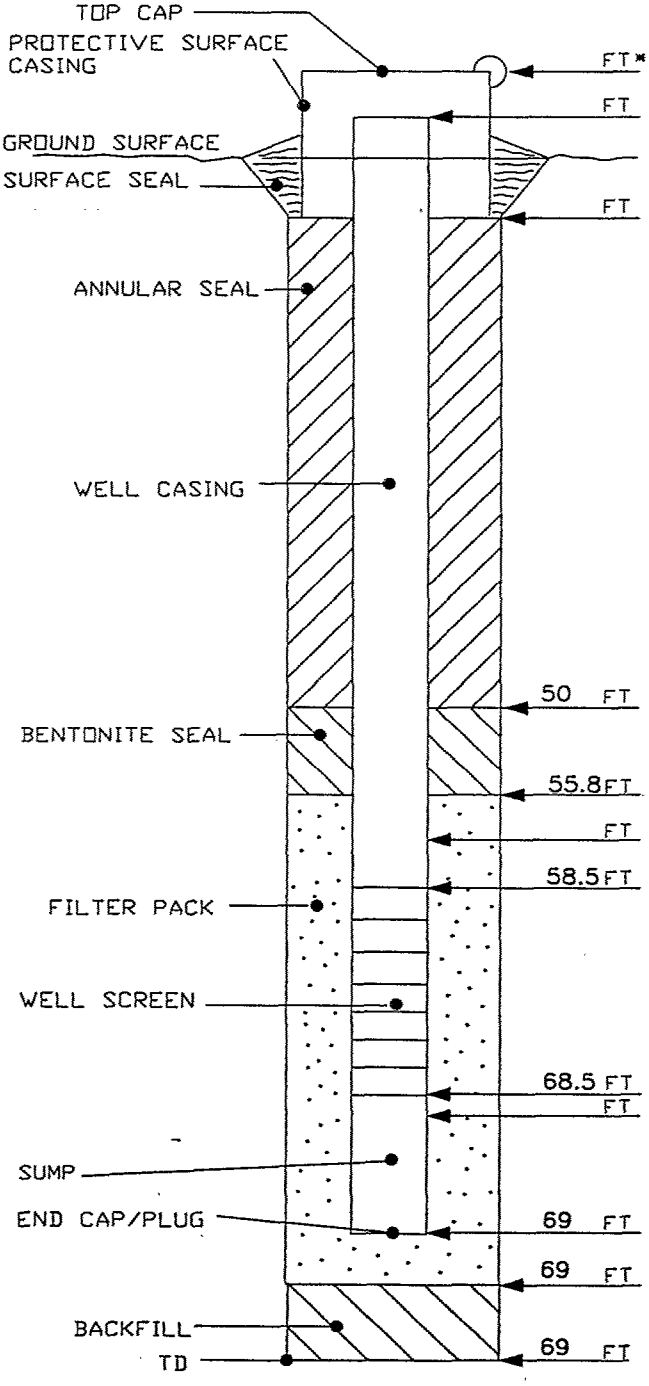
DRILLING METHOD AND EQUIPMENT USED : **AIR ROTARY - 6" TO 95.0'**

WATER LEVELS : START : 10/29/97 END : 10/31/97 LOGGER: **R. KAZMIEKZAK**

DEPTH BELOW SURFACE (FT)	Interval	Type and Number	Recovery (ft)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	94.0				Sand (SW), as above	
95	95.0				**End of Boring @ 95.0' bgs**	No fluoride sample **Well development on 10/31/97**
100						
105						
110						
115						

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC-TROUTDALE PROJECT NO. 107493.06.02
WELL NO. MW51-069 FIELD OBSERVERS SMKREKOS
ELEV, NGVD (top of well casing) 26.17 SURFACE ELEV, NGVD 23.4
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 11/3/97
DRILLING CONTRACTOR GEOTECH FINISH DATE 11/3/97
DRILLING METHOD 6" HSA/LOCATION: NORTHWEST, ADJACENT TO RIVER



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

MW-51.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) 6 INCHES TO 69 FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
PROTECTIVE CASING TYPE SURFACE
PROTECTIVE CASING DIAMETER 6"
WELL CASING TYPE SCH 40 PVC DIAMETER 2"
COUPLING TYPE NONE
SCREEN TYPE _____ DIAMETER 2"
SLOT SIZE 0.010" SCREEN LENGTH 10'
TOP CAP TYPE _____
END CAP/PLUG TYPE 0.5' THREADED
CENTRALIZER TYPE NONE
CENTRALIZER LOCATION(S) NA
FILTER PACK TYPE _____
GRADATION 20/40

SEAL(S)

SURFACE _____
ANNULAR BENTONITE SLURRY (115 GAL)
BENTONITE _____
BACKFILL NONE

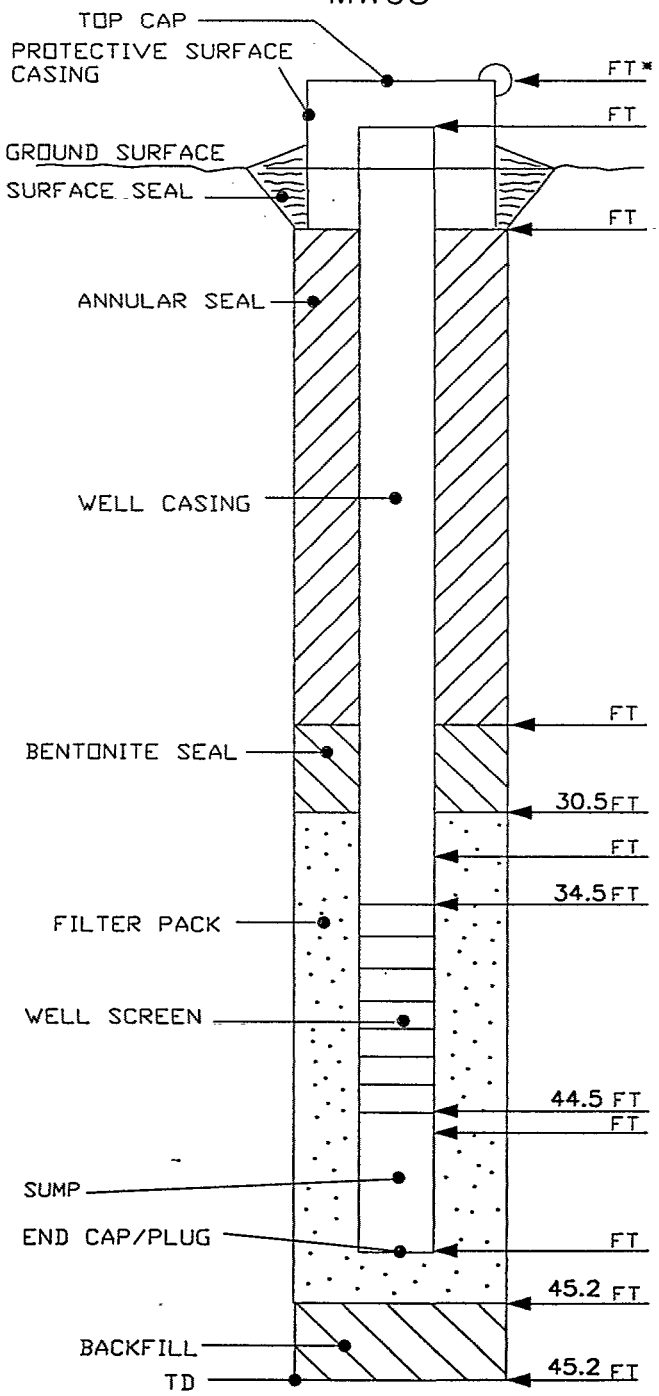
WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS _____

* NO SUBSURFACE GEOLOGIC INFORMATION AVAILABLE

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC-TROUTDALE PROJECT NO. 107493.06.02
WELL NO. MW52-045 FIELD OBSERVERS SMKREKOS
ELEV, NGVD (top of well casing) 26.43 SURFACE ELEV, NGVD 23.8
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 10/30/97
DRILLING CONTRACTOR GEOTECH FINISH DATE 10/30/97
DRILLING METHOD 6" HSA/LOCATION: RIVER BOUNDARY, ADJACENT TO MW08



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

MW-52.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) 6 INCHES TO 45.2 FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
PROTECTIVE CASING TYPE SURFACE
PROTECTIVE CASING DIAMETER 6"
WELL CASING TYPE SCH 40 PVC DIAMETER 2"
COUPLING TYPE NONE
SCREEN TYPE _____ DIAMETER 2"
SLOT SIZE 0.010" SCREEN LENGTH 10'
TOP CAP TYPE _____
END CAP/PLUG TYPE 0.5' THREADED
CENTRALIZER TYPE NONE
CENTRALIZER LOCATION(S) NA
FILTER PACK TYPE _____
GRADATION 20/40

SEAL(S)

SURFACE _____
ANNULAR _____
BENTONITE _____
BACKFILL _____

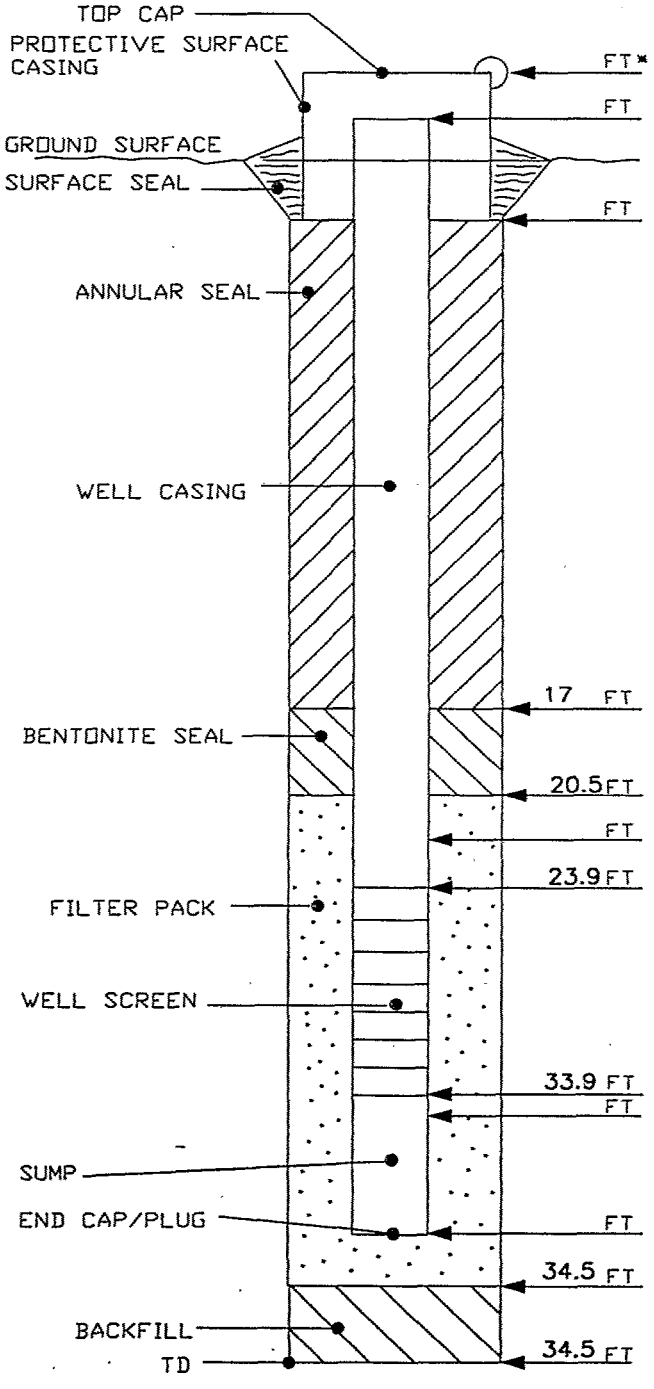
WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS _____

* NO SUBSURFACE GEOLOGIC INFORMATION AVAILABLE

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC-TROUTDALE PROJECT NO. 107493.06.02
WELL NO. MW53-034 FIELD OBSERVERS SMKREKOS
ELEV, NGVD (top of well casing) 23.80 SURFACE ELEV, NGVD 20.6
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 10/31/97
DRILLING CONTRACTOR GEOTECH FINISH DATE 10/31/97
DRILLING METHOD 6" HSA/LOCATION: RIVER BOUNDARY, EAST LAKE



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

MW-53.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) 6 INCHES TO 34.5 FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
PROTECTIVE CASING TYPE ABOVE GROUND
PROTECTIVE CASING DIAMETER 6"
WELL CASING TYPE SCH 40 PVC DIAMETER 2"
COUPLING TYPE NONE
SCREEN TYPE PVC DIAMETER 2"
SLOT SIZE 0.010" SCREEN LENGTH 10'
TOP CAP TYPE _____
END CAP/PLUG TYPE 0.5' THREADED
CENTRALIZER TYPE NONE
CENTRALIZER LOCATION(S) NA
FILTER PACK TYPE SILICA SAND
GRADATION 20/40

SEAL(S)

SURFACE _____
ANNULAR BENTONITE SLURRY
BENTONITE _____
BACKFILL _____

WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS _____

* NO SUBSURFACE GEOLOGIC INFORMATION AVAILABLE

CH2M HILL

PROJECT NUMBER	BORING NUMBER PZ17-039/PZ17-019 SHEET 1 OF 2

SOIL BORING LOG

PROJECT Rmc Troutdale LOCATION 60' west of MW46

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech (Keith Vidor)

DRILLING METHOD AND EQUIPMENT Geoprobe Unit

WATER LEVELS _____ START 10/29/97 FINISH 10/29/97 LOGGER Ochs / Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: NUMBER AND TYPE	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	X				Surface - Gravel + sand, Fill material	
2	X				Sand (SW) Pale Brown, Damp loose, medium to fine grained. subrounded grains. 5% fines.	
4	X				Silt (ML) Pale yellow Brown, ~~med~~ moist, med. stiff. orange mottling present	
6	X				Silt (ML) Pale Yellow Brown, wet, med stiff Low plasticity, friable, orange mottling. 10% fine grained sand.	
8	X				Sand (SW) ~~Pale Brown to Dark~~ Brownish Gray (5YR 4/1) ~~[illegible]~~ Moist loose, fine to med. grained. subangular grains. Red grains.	
10	X					
13	X				~~[illegible]~~ Silt (ML) Dark gray (N4) wet, med stiff. orange mottling, med Plasticity	
	X				~~Silt (ML) Dark Gray (N4) Alternating to yellowish brown, wet, stiff, orange~~	
18	X				16 ft - 18 ft. Silt (ML) yellowish brown wet, med stiff. friable, Low plasticity trace organic material.	
	X				18-20 ft. Silt (ML) med Gray (N4) wet, med stiff. 5 to 10% fine grained sand. orange mottling.	
23	X				20-22 ft. Silt (ML) med Gray (N4) wet med stiff. med plasticity No sand	
	X				22-26 ft. Silt (ML-SM) Dark yellowish brown (10YR 4/2). med stiff. 5-10% Sand fine grained.	
	X				26-28 ft. Silt w/ sand (ML) Dark Yellow Brown wet light med Gray (N5) 25% sand, fine grained	
28	X				28-30 ft. ~~[illegible]~~ Sand w/ Silt (SM) Brownish Gray - Med gray. 20% fines. wet. Silt - med to low plasticity. sand fine to medium grained. light orange mottling.	

(8.30)

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER PZ17-039/PZ17-019 SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC Trootdale LOCATION 60' west of MW46

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech (Keith Vidos)

DRILLING METHOD AND EQUIPMENT Geoprobe Unit.

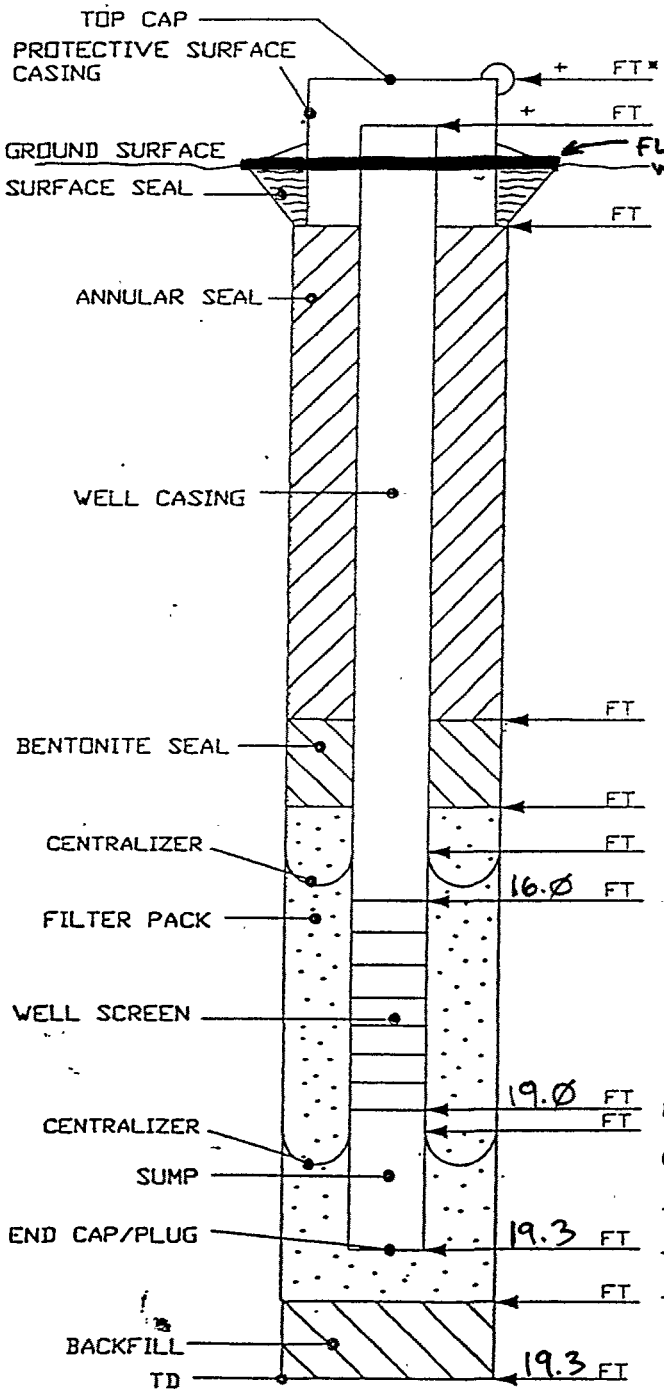
WATER LEVELS _____ START 10/29/97 FINISH 10/29/97 LOGGER Ochs/Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: NUMBER AND TYPE	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	X				Sand w/Silt (SM) Brownish Gray (5YR 4/1) wet. 30% Fines. med. stiff sand-med to fine grained loose, subrounded grains, Red grains present.	
32						
	X				SAND (SW) Dark Gray (N4) wet loose, fine to medium grained. Subrounded → subangular grains. Red grains. Present.	
34						
	X				SAND (SW) same as above	
36						
	X				SAND (SW) same as above	
38						
	X				SAND (SW) same as above	
40						
					END of BORING 40 Ft BGS.	

REV 11/89 FORM D1586

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC Trautdale PROJECT NO. 107493.06.02
WELL NO. PZ-17 Shallow FIELD OBSERVERS GVO
ELEV, NGVD (top of well casing) _____ SURFACE ELEV, NGVD _____
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 10/29/97
DRILLING CONTRACTOR Geo-Tech FINISH DATE 10/29/97
DRILLING METHOD Geoprobe unit



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

WELLINST.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) _____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
PROTECTIVE CASING TYPE N/A/ PVC Piezo
PROTECTIVE CASING DIAMETER _____
WELL CASING TYPE _____ DIAMETER _____
COUPLING TYPE Flush Thread
SCREEN TYPE Prepacked ~~GW2010~~ DIAMETER _____
SLOT SIZE _____ SCREEN LENGTH 3'-0"
TOP CAP TYPE Flush mount w/Box
END CAP/PLUG TYPE _____
CENTRALIZER TYPE _____
CENTRALIZER LOCATION(S) _____
FILTER PACK TYPE Silica Sand GRADATION _____
FILTER PACK VOLUME Prepacked Screen

SEAL(S)

SURFACE _____ VOLUME _____
ANNULAR _____ VOLUME _____
BENTONITE _____ VOLUME _____
BACKFILL _____ VOLUME _____

WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS _____

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC Trautdale PROJECT NO. 107493.06.07

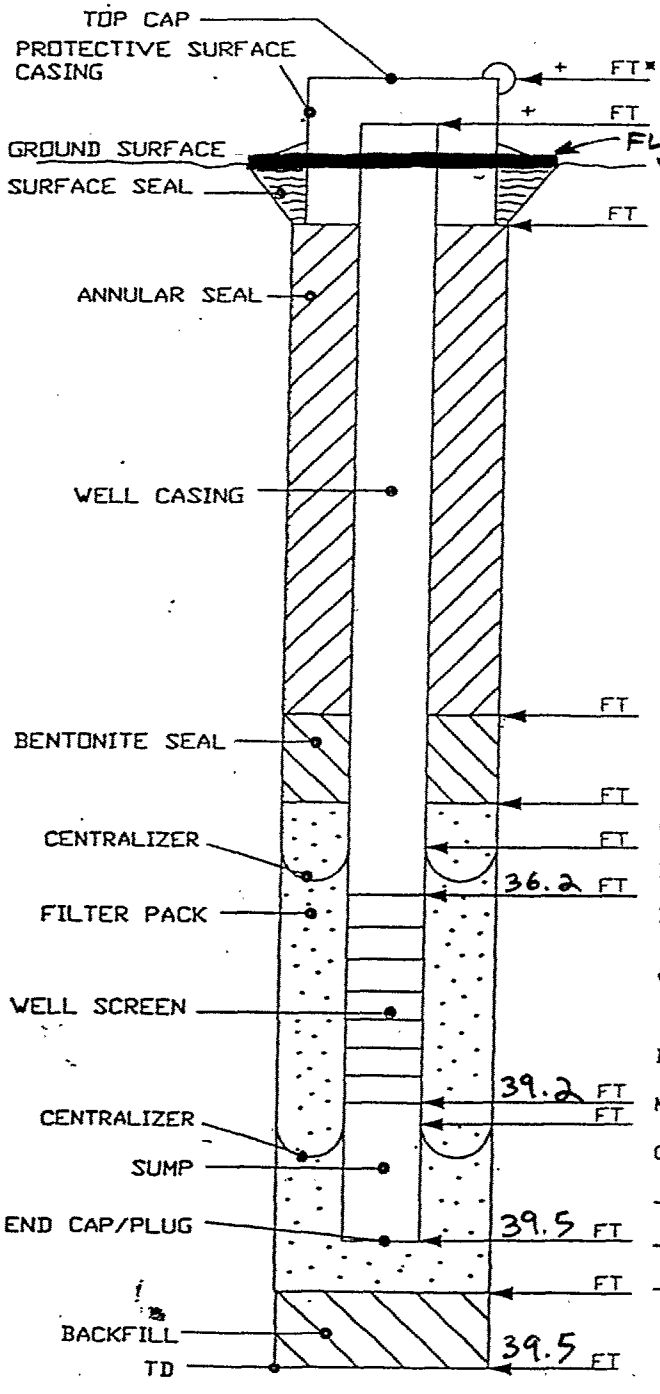
WELL NO. PZ-17 Deep FIELD OBSERVERS GVO

ELEV, NGVD (top of well casing) _____ SURFACE ELEV, NGVD _____

WATER LEVEL ELEV/DATE, NGVD _____ START DATE 10/29/97

DRILLING CONTRACTOR Geo-Tech FINISH DATE 10/29/97

DRILLING METHOD Geoprobe Unit



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

WELLINST.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) _____ INCHES TO _____ FT BGS

_____ INCHES TO _____ FT BGS

_____ INCHES TO _____ FT BGS

PROTECTIVE CASING TYPE NA / PVC Piezo

PROTECTIVE CASING DIAMETER _____

WELL CASING TYPE _____ DIAMETER _____

COUPLING TYPE Flush Thread

SCREEN TYPE GW2010 Prepacked DIAMETER 1.5" OD

SLOT SIZE _____ SCREEN LENGTH 3'-0"

TOP CAP TYPE Flush mount w/ BOX

END CAP/PLUG TYPE _____

CENTRALIZER TYPE _____

CENTRALIZER LOCATION(S) _____

FILTER PACK TYPE Silica Sand GRADATION _____

FILTER PACK VOLUME Prepacked Screen

SEAL(S)

SURFACE _____ VOLUME _____

ANNULAR _____ VOLUME _____

BENTONITE _____ VOLUME _____

BACKFILL _____ VOLUME _____

WELL DEVELOPMENT

DATE _____

METHOD _____

COMMENTS _____

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
107493.06.02	PZ18-040/PZ18-023	1	2

SOIL BORING LOG

PROJECT RMZ Troutdale LOCATION 80' South of MW45

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech (Keith Vidor)

DRILLING METHOD AND EQUIPMENT Geoprobe unit

WATER LEVELS _____ START 10/30/97 FINISH 10/30/97 LOGGER Ochs/Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: NUMBER AND TYPE	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Sand (SW) Gray Brown, Damp loose, medium to fine grained	
4						
5					Sand w/ Silt (SM) Dark Brown 10YR 4/3 ~~Silt w/ Sand~~ transitioning to Dark Grayish Brown 10YR 4/2 med-fine grained, subangular grains moist-wet orange mottling, Low plasticity silt + loose sand.	
8					Sand (SW) Bottom 2 ft. moist-wet loose Dark Gray (N4) Red grains subangular Little to No fines	
10					~~Silt w/ Sand (ML)~~ TOP 3.5 ft as above (SM) Bottom .5 ft. Silt w/ Sand (ML) yellowish orange, moist-wet, med plasticity 20% fine grained sand.	
12					Sand (SW) Dark Gray (N4) moist-wet loose, little to no fines, Red grains present. Subangular grains.	
15						
16					Sand (SW) as above	
18					Silt (ML) Dark Gray (N4) wet med stiff, < 5% fine grained sand med→low plasticity.	
20						
24					wet, med stiff Silt w/ Sand (ML) Brown 10YR 5/2 Slight orange mottling present. + 25% fine grained sand.	
25						
26						

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D6.02	PZ 18-090/PZ18-023	SHEET 2 OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION 80' South of MW45

ELEVATION _____ DRILLING CONTRACTOR Geo Tech (Keith Vidos)

DRILLING METHOD AND EQUIPMENT Geoprobe Unit

WATER LEVELS _____ START 10/30/97 FINISH 10/30/97 LOGGER Ochs / Bowker

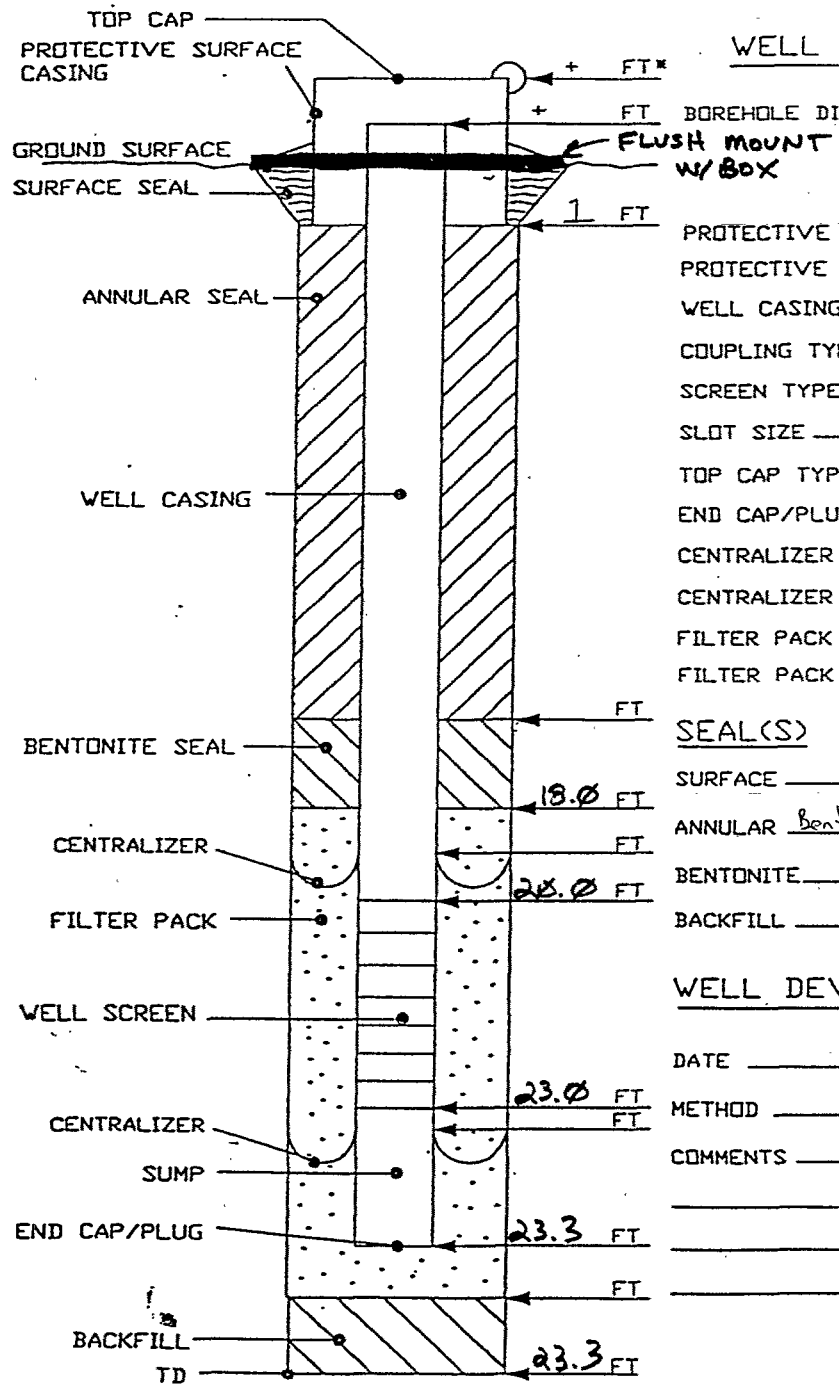
DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: NUMBER AND TYPE	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	X				Silt (ML) w/ Sand. Top 1.8 ft. ~~Grayish~~ Brown 10YR 5/2 Bottom .2 Ft. Dark Gray (N4). 10% fine grained sand.	
32	X				Sand (SW) Dark Gray (N4) wet loose, fine to med. grained red quartz. prest. sub angular to sub rounded grains. little to No fines	
	X					
	X					
	X				Sand (SW) same as above	
40	X					
					END OF BORING 42 Ft BGS.	

(8.30)

REV 11/89 FORM D1586

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC Trautdale PROJECT NO. 107493.06.02
WELL NO. PZ18-023 Shallow FIELD OBSERVERS GVO
ELEV, NGVD (top of well casing) _____ SURFACE ELEV, NGVD _____
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 10/31/97
DRILLING CONTRACTOR Geo-Tech FINISH DATE 10/31/97
DRILLING METHOD Geoprobe Unit



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

WELLINST.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) _____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS

PROTECTIVE CASING TYPE NA / PVC piezo
PROTECTIVE CASING DIAMETER 6"
WELL CASING TYPE PVC Sch 80 DIAMETER .5"
COUPLING TYPE Flush Thread
SCREEN TYPE Prepacked GW2010 DIAMETER .5"
SLOT SIZE _____ SCREEN LENGTH 3'-0"
TOP CAP TYPE Flush Mount W/BOX
END CAP/PLUG TYPE _____
CENTRALIZER TYPE _____
CENTRALIZER LOCATION(S) _____
FILTER PACK TYPE Silica Sand GRADATION _____
FILTER PACK VOLUME Prepacked Screen

SEAL(S)

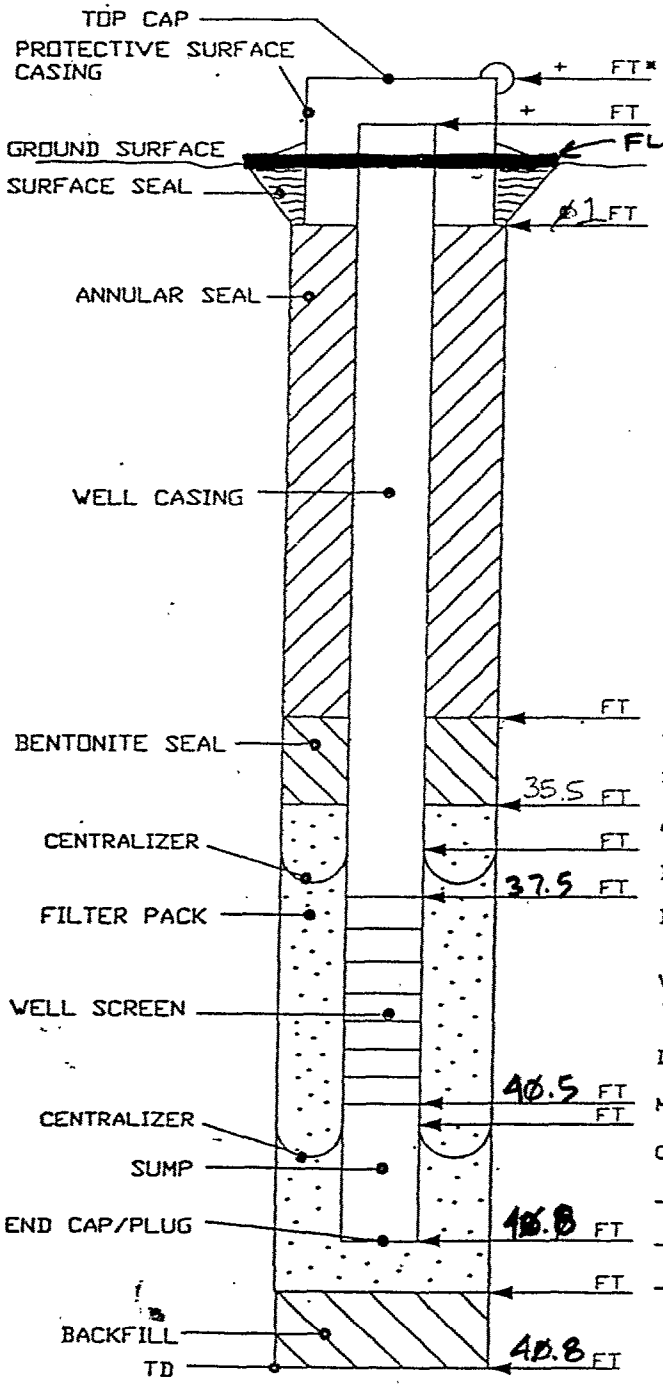
SURFACE _____ VOLUME _____
ANNULAR Bentonite chips VOLUME ~~[illegible]~~ 1 bag
BENTONITE _____ VOLUME _____
BACKFILL _____ VOLUME _____

WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS _____

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC Trautdale PROJECT NO. 107493.06.02
WELL NO. PZ18-010 ~~Deep~~ FIELD OBSERVERS GVO
ELEV, NGVD (top of well casing) _____ SURFACE ELEV, NGVD _____
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 10/30/97
DRILLING CONTRACTOR Geo-Tech FINISH DATE 10/30/97
DRILLING METHOD Geoprobe unit



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

WELLINST.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) _____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
PROTECTIVE CASING TYPE NA / PVC Piezo
PROTECTIVE CASING DIAMETER 6"
WELL CASING TYPE PVC Sch 80 DIAMETER .5"
COUPLING TYPE Flush Thread
SCREEN TYPE Prepacked GW2010 DIAMETER .5"
SLOT SIZE .010 SCREEN LENGTH 3'
TOP CAP TYPE Flush Mount w/ Box
END CAP/PLUG TYPE _____
CENTRALIZER TYPE _____
CENTRALIZER LOCATION(S) _____
FILTER PACK TYPE Silica Sand GRADATION 20x40
FILTER PACK VOLUME Prepacked Screen

SEAL(S)

SURFACE Cement VOLUME _____
ANNULAR Bentonite Chips VOLUME 2 bgs
BENTONITE _____ VOLUME _____
BACKFILL _____ VOLUME _____

WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS _____

CH2MHILL

PROJECT NUMBER	BORING NUMBER		
107493.D6.02	PZ 19-040/PZ 19-019	SHEET 1	OF 2

SOIL BORING LOG

PROJECT RMC Troutdale LOCATION Eastside bakehouse ~150' E of MW44

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech (Pete Larson)

DRILLING METHOD AND EQUIPMENT Geoprobe Unit

WATER LEVELS _____ START 10/31/97 FINISH 10/31/97 LOGGER Ochs/Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: NUMBER AND TYPE	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					Surface - gravel - 1 ft.	
					1-5 ft. SAND (SW) Dark yellowish Brown Damp, loose, fine to medium grained	
5					SAND (SW) Pale Yellow Brown, Damp loose Med → Fine grained. Subangular grains.	
					Silt (ML) Pale Yellow moist → friable, Low plasticity, 5% fine grained sand, orange mottling	
10						
					11-15 ft SILT (ML) Dark Gray (N4) moist → wet. med plasticity. med stiff. Small lenses of med-fine grained sand.	
15					15-19 ft SILT (ML) yellowish Brown wet, ≤ 5% sand, orange mottling, trace med stiff. organic material	
20					SAND (SW) Light Olive Gray wet, loose, med fine grained subangular grains. Trace fines.	
30					SAND (SW) same as above	

REV 11/89 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
107493.D6.02	PZ19-090/PZ19-014	SHEET 2 OF 2

SOIL BORING LOG

PROJECT BMC Troutdale LOCATION Eastside bakehouse ~150' E of MW49

ELEVATION _____ DRILLING CONTRACTOR Geo-Tech (Pete Larson)

DRILLING METHOD AND EQUIPMENT Geoprobe Unit

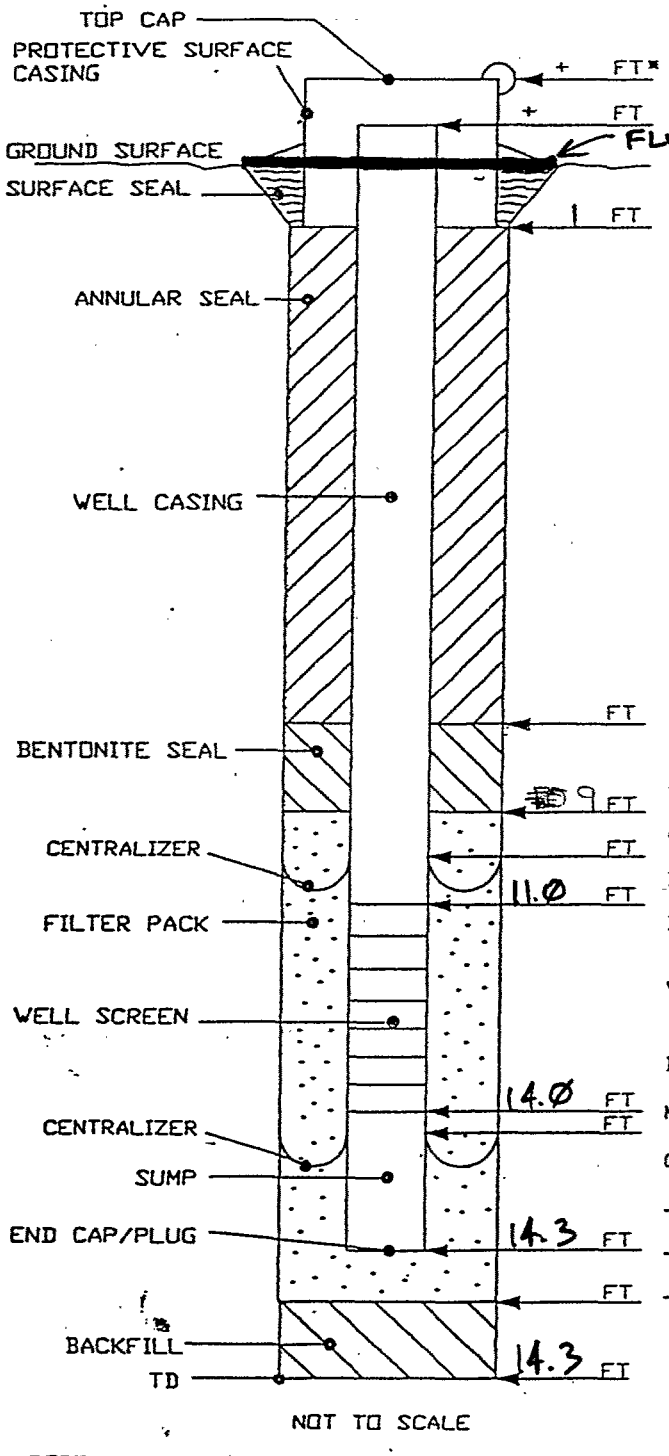
WATER LEVELS _____ START 10/31/97 FINISH 10/31/97 LOGGER Ochs/Bowker

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: NUMBER AND TYPE	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
31	X				SAND(SW) As above	
					SAND(SW) Dark Gray(N4) wet, loose, Fine to medium grained. ~~subangular~~ subangular grains. red grains present.	
35						
					SAND (SW) same as above	
40					END of boring 40 ft. BGS.	

REV 11/89 FORM D1586

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC Troutdale PROJECT NO. 107493.06.02
WELL NO. PZ 19 ~~Shallow~~ FIELD OBSERVERS GVO
ELEV, NGVD (top of well casing) _____ SURFACE ELEV, NGVD _____
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 10/31/97
DRILLING CONTRACTOR Geo-Tech (Pete Larson) FINISH DATE 10/31/97
DRILLING METHOD Geoprobe unit



* DEPTHS ABOVE/BELOW GROUND SURFACE

WELLINST.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) _____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
PROTECTIVE CASING TYPE Flush mount
PROTECTIVE CASING DIAMETER 6"
WELL CASING TYPE PVC Sch 80 DIAMETER .5"
COUPLING TYPE _____
SCREEN TYPE Prepack PVC DIAMETER .5"
SLOT SIZE .010 SCREEN LENGTH 3'
TOP CAP TYPE SLIP CAP
END CAP/PLUG TYPE _____
CENTRALIZER TYPE _____
CENTRALIZER LOCATION(S) _____
FILTER PACK TYPE Sand GRADATION 20x40
FILTER PACK VOLUME _____

SEAL(S)

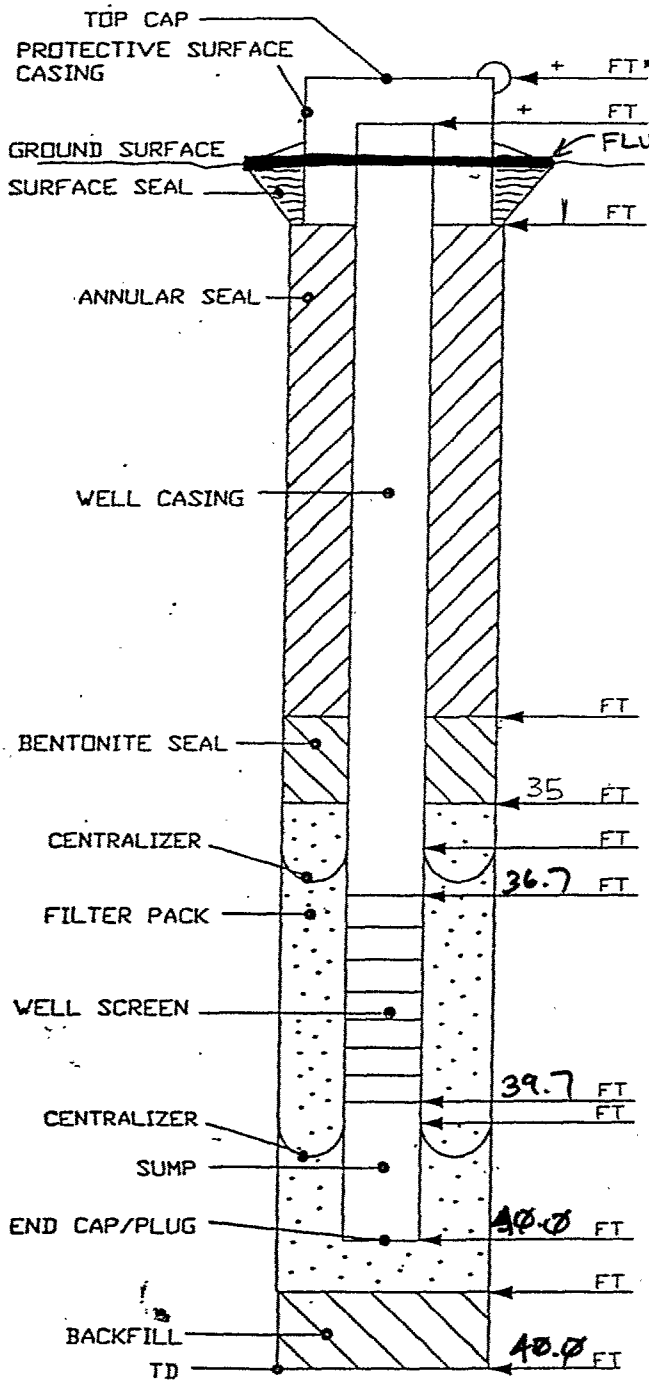
SURFACE Concrete VOLUME _____
ANNULAR Bentonite VOLUME _____
BENTONITE _____ VOLUME _____
BACKFILL _____ VOLUME _____

WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS _____

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC Trautdale PROJECT NO. 107493.06.02
WELL NO. PZ19 ~~Deep~~ Shallow FIELD OBSERVERS GVO
ELEV, NGVD (top of well casing) _____ SURFACE ELEV, NGVD _____
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 10/31/97
DRILLING CONTRACTOR _____ FINISH DATE 10/31/97
DRILLING METHOD _____



NOT TO SCALE

* DEPTHS ABOVE/BELOW GROUND SURFACE

WELLINST.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) _____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
_____ INCHES TO _____ FT BGS
PROTECTIVE CASING TYPE Flushmount
PROTECTIVE CASING DIAMETER 6"
WELL CASING TYPE Sch 80 PVC DIAMETER .5"
COUPLING TYPE _____
SCREEN TYPE Prepack PVC DIAMETER .5"
SLOT SIZE .010 SCREEN LENGTH 3'
TOP CAP TYPE Slip cap
END CAP/PLUG TYPE _____
CENTRALIZER TYPE _____
CENTRALIZER LOCATION(S) _____
FILTER PACK TYPE SAND GRADATION 20x40
FILTER PACK VOLUME _____

SEAL(S)

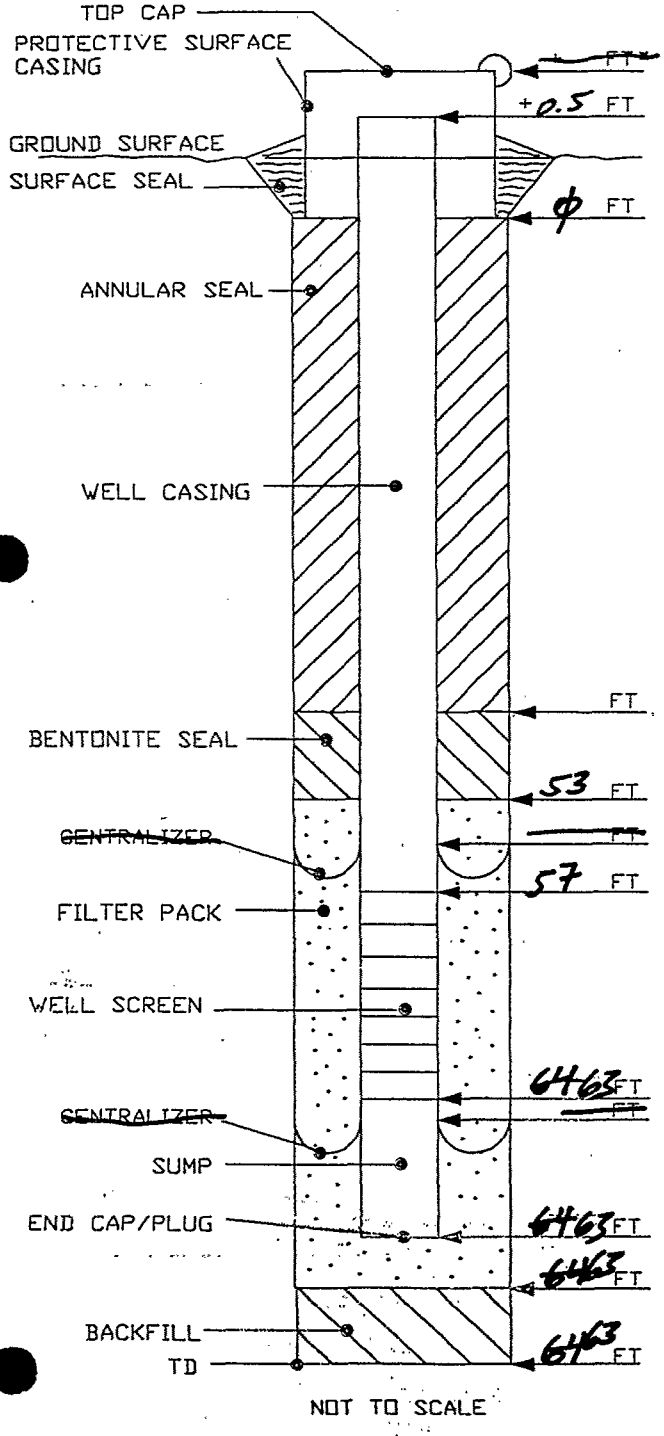
SURFACE Concrete VOLUME _____
ANNULAR Bentonite VOLUME _____
BENTONITE _____ VOLUME _____
BACKFILL _____ VOLUME _____

WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS _____

MONITORING WELL RECORD DRAWING & CONSTRUCTION LOG

PROJECT NAME RMC-TROUTDALE PROJECT NO. 107493.D6.Ø2
WELL NO. FFTØ1 FIELD OBSERVERS GALL/BROBERG
ELEV, NGVD (top of well casing) _____ SURFACE ELEV, NGVD _____
WATER LEVEL ELEV/DATE, NGVD _____ START DATE 7/28/97
DRILLING CONTRACTOR GEO-TECH EXPLORATIONS FINISH DATE 7/30/97
DRILLING METHOD GEOPROBE 2" O.D. 1" ID



* DEPTHS ABOVE/BELOW GROUND SURFACE

WELLINST.DWG

WELL CONSTRUCTION MATERIALS

BOREHOLE DIA(S) 2 INCHES TO ~~64.63~~ 7.0 FT BGS
— INCHES TO — FT BGS
— INCHES TO — FT BGS
PROTECTIVE CASING TYPE NONE
PROTECTIVE CASING DIAMETER —
WELL CASING TYPE PVC DIAMETER 0.5 INCH
COUPLING TYPE FLUSH THREAD
SCREEN TYPE PVC DIAMETER 0.5 INCH
SLOT SIZE 0.010 SCREEN LENGTH 6 FEET
TOP CAP TYPE PLASTIC SLIP
END CAP/PLUG TYPE PVC TO SLIP ONTO STAINLESS GEO POINT
CENTRALIZER TYPE NONE
CENTRALIZER LOCATION(S) —
FILTER PACK TYPE — GRADATION —
FILTER PACK VOLUME —

SEAL(S)

SURFACE QUIK GROUT VOLUME ↑
ANNULAR QUIK GROUT VOLUME 10 GALS.
BENTONITE — VOLUME —
BACKFILL — VOLUME —

WELL DEVELOPMENT

DATE _____
METHOD _____
COMMENTS _____

Decommissioned in Summer 1998

N ↑ FF04 • FFTØ1 •
275 FT

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET 1 OF 1
107493.D6.02	FFT01	

SOIL BORING LOG

PROJECT RMC-TROUTDALE LOCATION ≈275 EAST OF FF04

ELEVATION _____ DRILLING CONTRACTOR GEO-TECH EXPLORATIONS

DRILLING METHOD AND EQUIPMENT GEOPROBE - 2" O.D. 1" I.D.

WATER LEVELS _____ START 7/28/97 FINISH _____ LOGGER G.ALL/BROBERG

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: NUMBER AND TYPE	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
					NO SAMPLES COLLECTED FOR SOIL, WATER ANALYSES OR STRATIGRAPHY - PURPOSE OF TEMPORARY PIEZOMETER IS WATER LEVELS DURING AQUIFER TESTING AT FF04	

REV 11/89 FORM D1586

APPENDIX D

Oregon Water Resources Department Well Logs for Offsite Water Supply Wells

Table

Well Construction Summary for Offsite Wells Located Within 1-Mile Radius of RMC Facility

Reynolds Metals Company - Troutdale, Oregon

Well Inventory No.	Well Location (by 1/4-1/4 Section)	Original Well Owner	Date Completed	Original Well Use (a)	Total Well Depth (b)	Well Yield (gpm) (c)	Static Water Level from Original Well Report (ft bgs)	Screened or Perforated Interval (ft bgs)	Water-Bearing Material and Comments
	T1N R3E								
	Section 14								
1	14cc	Sundial Marine Tug & Barge	Dec. 1979	D	233	60	25	228 - 233	Sand and gravel at 222' bgs.
2	14ccad	Gresham Sand & Gravel *(formerly Harris Quade)*	Nov. 1967	D	127	60	30	120 - 130	Sand, fine with gravel - med. and coarse; sand fine, gray, and black.
	Section 22								
3	22adcc	Fairview Farms Inc. Well # 6	1950	D, I, Mn	200	1,200	17	119 - 200	Fine gray clay; well formerly used for irrigation of 170 acres. *Owned by RMC.*
4	22 ?	A. H. Harding	Apr. 1963	D	98 - Backfilled from 103 bgs.	18	30	93 - 98	Gray sand. Well loc. = 150' No. and 50' E. of the SW corner of tax lot no. 14.
	Section 23								
5	23abcd	Bonneville Power Admin. *(BPA)* Well # 1	1946	In.	183	142	10.3	NA	Sand and gravel from 175 - 183'. Chem. analysis avail. Currently **not in use.**
6	23acaa	BPA Well # 2	Jan. 1947	In	287	500	36	171 - 183 199 - 206 265 - 283	Sand and gravel from all 3 perforated zones. Not used for potable at substation. Hand washing etc.; drinking water is bottled.
7	23bcc	Fairview Farms Inc. Well # 4	1943	D, I, Mn	281	700	11	237 - 250	Sand and gravel. Owned by RMC. Formerly used for irrigation.
8	23dc	Port of Portland *Troutdale Airport loc.*	June 1961	M	750	800	20	435 - 738	Sand and gravel aquifer. Well currently not in use.
9	23 ?	Michael A. Lacey	Dec. 1976	D	121	18	18	None, Cased to 113 bgs	Gray loose sand. Gray sand and gravel.
10	23 ?	Barry Stevens	**VOID.** Well location incorrect on well log. County assessors office shows well in Township T1 S, not T1N.						
	Section 24								
11	24 ?	James Graham	Mar. 1964	D	170	15 - 20	25	None, Cased to 170 bgs	Sand and gravel.
	Section 25								
12	25cbc	City of Troutdale Well # 4 (Shop Well)	Aug. 1980	M	571	590	118	493 - 563	Sand, silt and gravel Aquifer = SGA.
13	25 ?	Darrel J. Muyskins	Feb. 1967	D	115	20	15	None, Cased to 115 bgs	High iron water at 100' bgs - cased off. Coarse sand and gravel.
14	25 ?	Roy Holmberg	Apr. 1974	T	110	20	38	105 - 110	Sandstone. Test well for restaurant.

Table D-1
Well Construction Summary for Offsite Wells Located Within 1-Mile Radius of RMC Facility
Reynolds Metals Company - Troutdale, Oregon

Well Inventory No.	Well Location (by 1/4-1/4 Section)	Original Well Owner	Date Completed	Original Well Use (a)	Total Well Depth (b)	Well Yield (gpm) (c)	Static Water Level from Original Well Report (ft bgs)	Screened or Perforated Interval (ft bgs)	Water-Bearing Material and Comments
Section 26									
15	26ccd	Board of County Commissioners	Mar. 1940	D, I	228	500	67	None, Cased to 228 bgs	Clay and gravel.
16	26ad	M.A. Cerruti	Jun. 1967	D	110 - Backfilled from 115 bgs	35	25	None, Cased to 110 bgs	Fine gravel.
17	26db	Wayne Lawrey	Apr. 1967	D	54	35	20	None, Cased to 54 bgs	Water bearing from 50 - 54' bgs. - loose gravel.
18	26 ?	W. McGinnis	Nov. 1956	D	41	45	NA	NA	Boulders and gravel.
19	26ca	James Dreiling	Mar. 1976	D	52	12	24	None, Cased to 52 bgs	Gravel, large.
20	26cc	Multnomah County Farm	NA	D, I	228 - Backfilled from 257 bgs	500	65	NA	Cemented gravel - Troutdale Fm. from 195 - 228' bgs.
21	26 ?	Standard Oil Co.	Jun. 1971	D	52	36	3	31 - 47	Sandy gravel, coarse brown.
22	26 ?	A.E. Sanderson	Jan. 1971	D	109 - Backfilled from 111 bgs	40	70	99 - 110	Cemented gravel, some loose water-producing gravel, gray clay binder.
23	26 ?	L.S. Klinger	Oct. 1970	D	250	40	40	210 - 250	Blue fine sand, cemented gravel.
24	26 ?	L.W. Arndt	Mar. 1967	D	60	15	3	51 - 60	High silica water at 47' bgs in gravel and sand zone - cased off. Water in cemented gravel.
25	26 ?	Mrs. Weir Owens	Nov. 1956	D	52	15	NA	NA	Boulders, sand, and gravel.
26	26 ?	Reynolds Troutdale Federal C.U.	5/1/60	D	36	40	3	None - Cased to 36 bgs	Gravel.
27	26db	Glen Elswork Oakes	Jul. 1955	I	94	20	77	None - Cased to 94 bgs	Gravel at 90 - 94' bgs. However, location uncertain.
28	26db	James G. Simoni	1945	I	50	45	10	None - Cased to 50	GW permit No. GR2773.
29	26 ?	West Coast Alloys	Jun. 1974	In	23	100	8	NA	Medium gravel.
30	26 ?	West Coast Alloys	Apr. 1961	In	80	30	20	50 - 80	Sand stoned gravel.

Table
Well Construction Summary for Offsite Wells Located Within 1-Mile Radius of RMC Facility
Reynolds Metals Company - Troutdale, Oregon

Well Inventory No.	Well Location (by 1/4-1/4 Section)	Original Well Owner	Date Completed	Original Well Use (a)	Total Well Depth (b)	Well Yield (gpm) (c)	Static Water Level from Original Well Report (ft bgs)	Screened or Perforated Interval (ft bgs)	Water-Bearing Material and Comments
	Section 27								
31	27cbbb	City of Fairview Well # 3	Aug. 1956	M	1,060	400	60	275 - 340	SGA aquifer - cemented gravel. Reperforated in 1958.
32	27cabb	City of Fairview New well # 6	Jul. 1992	M	314 - Backfilled from 322 bgs	500	102	201 - 216 236 - 256 265 - 301	Well at 199 St. - TSA Aquifer. Gravel - gray brn. tan w/sand mica layers of loosely cemented sand and gravel. Large cobbles and cemented gravel.
33	27adb	Fairview Farms Inc. Well # 5	1940	D, I, Mn	275	400	35	53 - 61 65 - 75 195 - 220 240 - 263	Irrigation of 110 acres.
34	27ad	Fairview Farms Inc. Well # 2	1939	D, I, Mn	408	200	30	66 - 83	Irrigation of 2 acres.
35	27addc	Fairview Farms Inc. Well # 1	1954	D, I, Mn	182	100	NA	139 - 150	Gravel at 137 - 150' bgs. Irrigation of 10 acres.
36	27dc	Gordon Cousey	May 1971	D	72	20	10	None (cased to 67)	Sand and gravel, occasional boulders - TGA aquifer.
37	27bd	Townsend	1939	I, Dairy	60	150	25	Unknown	Sandy loam, sand rock, gravel
38	27dacc	Wood Village Well # 3	1980	M	300	700-800	78	200-230 245-255	Sand and gravel. Sand and gravel.

Notes:

1. *Well log information compiled from original Water Well Report forms collected from Oregon Water Resources Department, Salem, Oregon, and from a literature review from McCarthy and Anderson, 1990.*
2. Refer to Figure 3-21 for approximate well locations and to Appendix D in Volume 3 for well logs.

(a) Original Well Use:
D = Domestic M = Municipal P = Production Wells
I = Irrigation Mn = Manufacturing T = Test

(b) ft bgs = feet below ground surface.

(c) Well yield reported in gallons per minute.

Yield value from pumping (air test, boiler test, etc.) test rate performed after well completion.

Abbreviations:

bgs = below ground surface.
gpm = gallons per minute.
NA = Information not available.
SGA = Sand and Gravel Aquifer.
TSA = Troutdale Sandstone Aquifer.
TGA = Troutdale Gravel Aquifer.
* Static Water level for February 2, 1995.

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the WATER RESOURCES DEPARTMENT, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED MAR 21 1980 WATER RESOURCES DEPT SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

MULT 001251

State Well No. 1N/3E-14ce
State Permit No.

(1)

(1) OWNER:
Name Sundial Marine Tug & Barge
Address Rt. 2 Box 19A
Trotdale, Oregon 97060

(2) TYPE OF WORK (check):
New Well XX Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary XX Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic XX Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED: Threaded ☐ Welded XX
6" Diam. from 0 ft. to 227 ft. Gage .250
5" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? ☐ Yes XX No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? XX Yes ☐ No
Manufacturer's Name UOP Johnson
Type stainless Model No.
Diam. 6 Slot size 15 Set from 228 ft. to 233 ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes XX No If yes, by whom?
60 gal./min. with 0 ft. drawdown after hrs.
" " "
" " "
Bailer test 60 gal./min. with 0 ft. drawdown after 1 hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used cement
Well sealed from land surface to 20 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 9 sacks
How was cement grout placed? pumped
Was drive shoe used? XX Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes XX No
Type of water? depth of strata
Method of sealing strata off
Was gravel packed? ☐ Yes XX No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Multnomah Driller's well number
SW ¼ SW ¼ Section 14 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 30 ft.
Static level 25 ft. below land surface. Date 12-19-79
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 6
Depth drilled 233 ft. Depth of completed well 233 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
mucky sand	0	16	
mucky sand & clay	16	30	
sand, water	30	85	
sand, wood, water	85	100	
sand	100	135	
sand, water	135	180	
sand & water some silt	180	222	25
sand & gravel water	222	233	

RECEIVED DEC 24 1979 WATER RESOURCES DEPT SALEM, OREGON

Work started 12-14 19 79 Completed 12-19 1979
Date well drilling machine moved off of well 12-19- 19 79

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Jim G Hansen (Drilling Machine Operator) Date 12-20, 1979
Drilling Machine Operator's License No. 841

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Hansen Drilling Co., Inc. (Person, firm or corporation) (Type or print)
Address 6711 NE 58th Ave. Vancouver, WA.
[Signed] Marvin Sample (Water Well Contractor)
Contractor's License No. 604 Date 12-20, 1979

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED NOV 14 1967 STATE ENGINEER SALEM OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED JAN 18 1968 STATE ENGINEER SALEM OREGON

State Well No. 1N/3-14ccad
State Permit No. MULT 001252

(2)

(1) OWNER:
Name Harris E Quade
Address Box 52 Troutdale Ore.

(2) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED: Threaded ☐ Welded ☑
~~6" Diam. from 0 ft. to 127 ft. Gage 250~~
6" Diam. from 0 ft. to 120 ft. Gage 250
" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? ☐ Yes ☑ No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☑ Yes ☐ No
Manufacturer's Name Johnson
Type Shelled Model No.
Diam. 6" Slot size 15 Set from 125 ft. to 130 ft.
Diam. 6" Slot size 10 Set from 120 ft. to 125 ft.

(8) WATER LEVEL: Completed well.
Static level 30 ft. below land surface Date Nov 10
Artesian pressure lbs. per square inch Date

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 60 gal./min. with 4 ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date
Temperature of water 52 Was a chemical analysis made? ☐ Yes ☐ No

(10) CONSTRUCTION:
Well seal—Material used Bentonite
Depth of seal 19' ft.
Diameter of well bore to bottom of seal 10 in.
Were any loose strata cemented off? ☐ Yes ☐ No Depth
Was a drive shoe used? ☑ Yes ☐ No
Did any strata contain unusable water? ☐ Yes ☑ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☑ No Size of gravel:
Gravel placed from ft. to ft.

(11) LOCATION OF WELL:
County Multnomah Driller's well number 1967-47
¼ ¼ Section 14 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG: Diameter of well below casing 6
Depth drilled 127 ft. Depth of completed well 127 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rate.

MATERIAL	From	To	SWL
SAND FINE BLACK	0	57	
SAND FINE GRAY WATER	57	120	57
SAND FINE WITH GRAVEL	120	122	
MEDIUM COARSE WATER BEARING			
SAND FINE GRAY BLACK	122	130	
WATER BEARING			

Work started Oct 26 1967 Completed Nov 10 1967
Date well drilling machine moved off of well Nov 10 1967

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Kenneth Skinner Date Nov 10, 1967
(Drilling Machine Operator)
Drilling Machine Operator's License No. 277

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Skyles Drilling & Supply
(Person, firm or corporation) (Type or print)
Address Gladstone, Oregon
[Signed] George H. Skyles
(Water Well Contractor)
Contractor's License No. 58 Date Nov 10, 1967

(USE ADDITIONAL SHEETS IF NECESSARY)

2

22adcc

STATE ENGINEER
Salem, Oregon

MULT 0013C6

Well Record

GR- 1589

STATE WELL NO. 1N/3-22H
COUNTY Multnomah
APPLICATION NO. GR- 1443

OWNER: Fairview Farms Inc.

MAILING ADDRESS: Rt. 2, Box 40

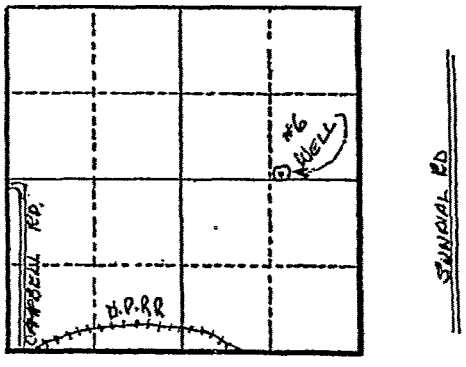
LOCATION OF WELL: Owner's No. #6

CITY AND STATE: Troutdale, Oregon

(3)

SE ¼ NE ¼ Sec. 22 T. 1 N., R. 3 E., W.M.

Bearing and distance from section or subdivision corner For location see sketch on map ----



Altitude at well 26'

TYPE OF WELL: Drilled Date Constructed 1950

Depth drilled 200' Depth cased 200'

Section 22

CASING RECORD:
18" from 0 to 140 ft.
12" from 119 to 200 ft.

FINISH:
Perforated from 119 to 200 ft.

AQUIFERS:

WATER LEVEL:
17'

PUMPING EQUIPMENT: Type Pearless turbine H.P. 75
Capacity 1200 G.P.M.

WELL TESTS:
Drawdown 12 ft. after hours 1200 G.P.M.
Drawdown 14 ft. after hours 1500 G.P.M.

USE OF WATER Dom., Irrigation & Manuf. Temp. °F., 19
SOURCE OF INFORMATION GR Record
DRILLER or DIGGER
ADDITIONAL DATA:
Log ✓ Water Level Measurements Chemical Analysis Aquifer Test

REMARKS: Irrigation of 170 acres.

Log:		
	Top soil & yellow clay	0 to 16 ft.
	Yellow sand	16 to 27 ft.
	Blue quicksand	27 to 49 ft.
	Fine gray sand	49 to 82 ft.
	Brown silt	82 to 94 ft.
	Fine gray sand - gray clay binder	94 to 136 ft.
	Coarse sand - small gravel - gray clay binder	136 to 158 ft.
	Coarse sand - small gravel - water bearing	158 to 183 ft.
	Fine gray sand - gray clay binder	183 to 196 ft.
	Gray silt	196 to 200 ft.

State Printing 89316

3

RECEIVED
JUL 1 1963
STATE ENGINEER
SALEM, OREGON

MULT
001305

(4)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM 10, OREGON within 30 days from the date of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

State Well No. 1N/3-22

State Permit No.

(1) OWNER:
Name Mr. A.H. Harding
Address Rt.2 Box 259C
Troutdale, Oregon

(2) LOCATION OF WELL:
County Multnomah. Driller's well number
¼ ¼ Section 28 T.1N R.3E W.M.
Bearing and distance from section or subdivision corner
150 ft. north and 50 ft. east of the SW corner of tax lot no/ 14

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 96.15" ft. Gage .280
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☒ Yes ☐ No
Manufacturer's Name Cook
Type Red brass Model No. 75 LP
Diam. 6 Slot size 14 Set from 93 ft. to 98 ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal Bentonite and drill cuttings.
Depth of seal 22 24 ft. Was a packer used?
Diameter of well bore to bottom of seal 10 in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? Depth of strata.
Method of sealing strata off

(10) WATER LEVELS:
Static level 30 ft. below land surface Date 4-9-63
Artesian pressure lbs. per square inch Date

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 18 gal./min. with 32 ft. drawdown after 8 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG: Diameter of well below casing
Depth drilled 103 ft. Depth of completed well 98 ft.
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
rocky clay	0	1
sand	1	17
brown clay	17	40
gray sandy clay, some wood	40	45
gray sand & water	45	57
about three in. of silt		
gray sand & water	57	99
silt	99	99½
sand & water	99½	103

Work started 4-8-63 19 . Completed 4-9-63 19
Date well drilling machine moved off of well 4-9-63 19

(13) PUMP:
Manufacturer's Name
Type: H.P.

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME George Zent & Sons (Person, firm or corporation) (Type or print)
Address 4305 N.E. 44th. St Vancouver Wsah.
Drilling Machine Operator's License No. 213
[Signed] George L. Zent (Water Well Contractor)
Contractor's License No. 288 Date 4-9-63, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

4

STATE ENGINEER
Salem, Oregon

MULT 001317

Well Record

STATE WELL NO. 1N/3-23R1 ab
COUNTY MULTNOMAH
APPLICATION NO.

OWNER: Bonneville Power Admin.

MAILING ADDRESS: 5a

CITY AND STATE:

LOCATION OF WELL: Owner's No.

NW ¼ NE ¼ Sec. 23 T. 1 ~~S~~ N., R. 3 ~~W~~ E., W.M.

Bearing and distance from section or subdivision corner

Altitude at well 25'

TYPE OF WELL: Drilled Date Constructed 1946

Depth drilled 183' Depth cased 183'

Section 23

CASING RECORD:

10 inch

FINISH:

AQUIFERS:

Gravel, sand, Troutdale Formation, from 175 to 183

WATER LEVEL:

10.3 feet below land surface on March 15, 1946

PUMPING EQUIPMENT: Type Turbine H.P.
Capacity G.P.M.

WELL TESTS:
Drawdown 142 ft. after 20 hours 142 G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Industrial Temp. 63 °F. — June 7, 1954
SOURCE OF INFORMATION USGS
DRILLER or DIGGER
ADDITIONAL DATA:
Log X Water Level Measurements Chemical Analysis X Aquifer Test

REMARKS:

Pumped 142 gpm, drawdown 142 feet after 20 hours.

5a

State Printing 89318

STATE ENGINEER
Salem, Oregon

State Well No. 1N/3-23B1 ab
County MULTNOMAH
Application No.

Well Log

5b

Owner: Bonneville Power Admin. Owner's No. 1

Driller: R. J. Strasser Drilling Co. Date Drilled 1946

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
Younger alluvium:			
Sand	0	10	10
Clay	10	25	15
Sand	25	168	143
Clay	168	174	6
Troutdale Formation:			
Gravel, cemented	174	175	1
Gravel and sand	175	183	8

5b

STATE ENGINEER
Salem, Oregon

State Well No. 1N/3-23B1 ab

County Multnomah

Application No.

Chemical Analysis

5c

OWNER Bonneville Power Administration OWNER'S NO. 1

ANALYST USGS Address

Date of Collection 6/7/54

Point of Collection

	P.P.M.	E.P.M.
Silica (SiO_2)	57.	
Iron (Fe) Total	.08	
Manganese (Mn)	.00	
Calcium (Ca)	56.	
Magnesium (Mg)	4.4	
Sodium (Na)	79.	
Potassium (K)	7.2	
Bicarbonate (HCO_3)	132.	
Carbonate (CO_3)	0.	
Sulfate (SO_4)	7.8	
Chloride (Cl)	156.	
Fluoride (F)	.3	
Nitrate (NO_3)	.4	
Boron (B)		
Dissolved Solids	454.	
Hardness as $CaCO_3$	158.	
Specific Conductance (Micromhos at 25°C)	726.	
pH	7.8	
Percent Sodium		
Sodium Absorption Ratio (S.A.R.)		
CLASS		

State Printing 89313

5c

STATE ENGINEER
Salem, Oregon

MULT
001316

Well Record

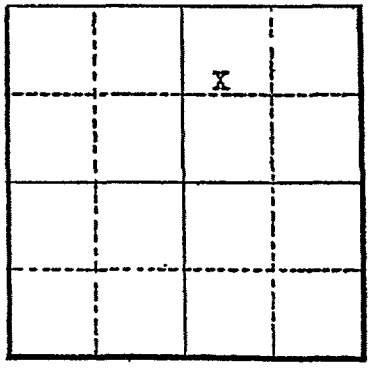
STATE WELL NO. 1N/3-23B ab
COUNTY Multnomah
APPLICATION NO. GR-4163

OWNER: Bonneville Power Administration
MAILING ADDRESS: P.O. Box 3537 (6a)
CITY AND STATE: Portland 8, Oregon

LOCATION OF WELL: Owner's No. 2

NW ¼ NE ¼ Sec. 23 T. 1 N. R. 3 E., W.M.

Bearing and distance from section or subdivision corner N. 27°34'10" W. 4642.0 ft. from SE Cor. Sec. 23



Altitude at well

TYPE OF WELL: Drilled. Date Constructed 1/47

Depth drilled 287 ft. Depth cased 287 ft.

Section 23

CASING RECORD:

10 inch std. pipe from 0 to 200 feet
8 inch std. pipe from 150 to 287 feet

FINISH:

Perforations from 171 to 182 ft.; 199 to 206 ft.; 265 to 283 ft.

AQUIFERS:

WATER LEVEL:
36 feet below surface

PUMPING EQUIPMENT: Type Worthington 9 stage turbine H.P. 40
Capacity 500 G.P.M.

WELL TESTS:
Drawdown 61 ft. after hours 750 G.P.M.
Drawdown 35 ft. after hours 500 G.P.M.

USE OF WATER Industrial Temp. °F., 19
SOURCE OF INFORMATION Well Registration Statement Cert. # GR-3796
DRILLER or DIGGER Force account
ADDITIONAL DATA:
Log X Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

6a

State Printing 89316

STATE ENGINEER
Salem, Oregon

State Well No. 1N/3-23B ab
County Multnomah
Application No. GR-4163

Well Log

66

Owner: Bonneville Power Administration Owner's No. 2

Driller: — Date Drilled January, 1947

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
Loam & clay	0	29	29
Sand	29	139	110
Gravel	139	142	3
Sand & gravel	142	169	27
Clay	169	170	1
Sand & gravel	170	181	11
Silt	181	183	2
Alternating layers of sand & clay	183	197	14
Sand & gravel	197	206	9
Clay, sand & gravel	206	265	59
Gravel	265	287	22

66

STATE ENGINEER
Salem, Oregon

MULT
001318

Well Record

GR- 1587

STATE WELL NO. 1N/3-23E bc
COUNTY Multnomah
APPLICATION NO. GR- 1444

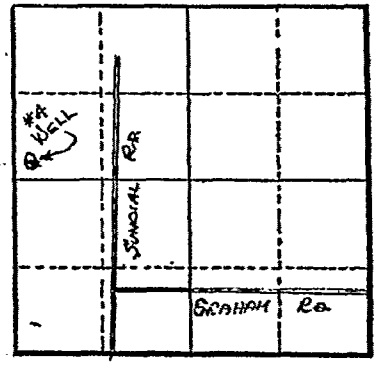
7

OWNER: Fairview Farms Inc. MAILING ADDRESS: Rt. 2, Box 40

LOCATION OF WELL: Owner's No. #4 CITY AND STATE: Troutdale, Oregon

SW ¼ NW ¼ Sec. 23 T. 1 N., R. 3 E., W.M.

Bearing and distance from section or subdivision corner For location see sketch on map



Altitude at well 26'

TYPE OF WELL: Drilled Date Constructed 1943

Depth drilled 281' Depth cased 281'

Section 23

CASING RECORD:
24" from 0 to 55 ft.
12" from 55 to 230 ft.
8" from 209 to 281 ft.

FINISH:
8" casing perforated from 237 to 250 ft.

AQUIFERS:

WATER LEVEL:
11'

PUMPING EQUIPMENT: Type Pomona turbine H.P. 40
Capacity 700 G.P.M.

WELL TESTS:
Drawdown 28 ft. after hours 700 G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Dom., Irrigation & Manuf. Temp. °F. , 19
SOURCE OF INFORMATION GR Record
DRILLER or DIGGER
ADDITIONAL DATA:
Log Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

Log:	Yellow clay	0 to 16 ft.
	Blue sand & silt	16 to 35 ft.
	Quick sand	35 to 56 ft.
	Dark coarse sand	56 to 108 ft.
	Gray sand	108 to 168 ft.
	Some gravel in sand (water)	168 to 182 ft.
	Gray sand	182 to 231 ft.
	Water bearing sand & gravel	231 to 250 ft.
	Cemented gravel	250 to 281 ft.

Irrigation of 178 acres.

State Printing 83316

7

RECEIVED JUL 14 1961 STATE ENGINEER SALEM, OREGON

MULT 001321

(8a) dc 23 Q(1)

File Original and First Copy with the STATE ENGINEER, SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON

State Well No. 1N/3 -4E

State Permit No.

(1) OWNER:

Name: The Port of Portland

Address: 5848 N. Lagoon Ave. Portland, Ore.

(2) LOCATION OF WELL:

County: Multnomah Owner's number, if any—

¼ ¼ Section T. R. W.M.

Bearing and distance from section or subdivision corner

45 1N 3E

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☒

Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:

Rotary ☒ Driven ☐

Cable ☐ Jetted ☐

Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒

12" Diam. from 0 ft. to 510 ft. Gage Std.

10" Diam. from 435 ft. to 685 ft. Gage "

8" Diam. from 668 ft. to 738 ft. Gage "

(7) PERFORATIONS: Perforated? ☒ Yes ☐ No

Type of perforator used: Torch

SIZE of perforations: 1/8 in. by 12 in.

4 per ft. perforations from 435 ft. to 738 ft.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

perforations from ft. to ft.

(8) SCREENS: Well screen installed ☐ Yes ☒ No

Manufacturer's Name

Type Model No.

Diam. Slot size Set from ft. to ft.

Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

Was a surface seal provided? ☒ Yes ☐ No To what depth? 510 ft.

Material used in seal— Cement

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? Depth of strata

Method of sealing strata off

(10) WATER LEVELS:

Static level 20 ft. below land surface Date 6/29/61

Artesian pressure lbs. per square inch Date

Log Accepted by:

[Signed] (Owner) Date , 19

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? A. M. Jannsen Drilling Co.

Yield: 800 gal./min. with 58 ft. drawdown after 24 hrs.

" " " "

" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m. Date

Temperature of water 65 Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG: Diameter of well 12 inches.

Depth drilled 750 ft. Depth of completed well 750 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Silt & black top soil	0	2
Pink & gray fine sand	2	22
Fine to medium sand layers	22	33
Blue gray silty mud	33	43
Fine to medium sand with sawdust and silt layers	43	55
Fine to medium sand, some gravel	55	78
Fine to medium sand with silt	78	87
Medium brown sand	87	95
Gravel, cobble, & sand	95	103
Green fairly coarse sand	103	107
Cemented gravel	107	148
Brown cemented gravel	148	154
Gray sand & pea gravel	154	160
Coarse brown sand	160	201
Gray sand	201	239
Silty blue gray sand	239	252
Lightly cemented sand & gravel	252	261
Sandy blue clay	261	274
Rock	274	279
Fine sandy clay with broken rock	279	303
Sandy clay	303	313
Fine blue sand with clay streaks & mica, some thin rock (Continued)	313	332

Work started Jan. 19 61 Completed June 19 61

(13) PUMP:

Manufacturer's Name

Type: H.P.

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME A. M. JANNSEN DRILLING CO. (Person, firm, or corporation) (Type or print)

Address 21075 S. W. Tualatin Valley Hwy. Aloha, Ore.

Driller's well number

[Signed] Edward M. Jannsen (Well Driller)

License No. 79 Date 7/13, 1961

(USE ADDITIONAL SHEETS IF NECESSARY)

8a

RECEIVED JUL 14 1961

Page 2

(86) 23 do (1)

The Original and First Copy with the STATE ENGINEER, SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON

State Well No. 1N/3-45

State Permit No. .....

(1) OWNER:

Name The Port of Portland

Address 5848 N. Lagoon Ave.
Portland, Ore.

(2) LOCATION OF WELL:

County ..... Owner's number, if any—

¼ ¼ Section T. R. W.M.

Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):

New Well ☐ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐

....." Diam. from ..... ft. to ..... ft. Gage .....
....." Diam. from ..... ft. to ..... ft. Gage .....
....." Diam. from ..... ft. to ..... ft. Gage .....

(7) PERFORATIONS: Perforated? ☐ Yes ☐ No

Type of perforator used

SIZE of perforations in. by in.

..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.

(8) SCREENS: Well screen installed ☐ Yes ☐ No

Manufacturer's Name .....

Type ..... Model No. .....

Diam. ..... Slot size ..... Set from ..... ft. to ..... ft.
Diam. ..... Slot size ..... Set from ..... ft. to ..... ft.

(9) CONSTRUCTION:

Was well gravel packed? ☐ Yes ☐ No Size of gravel: .....

Gravel placed from ..... ft. to ..... ft.

Was a surface seal provided? ☐ Yes ☐ No To what depth? ..... ft.

Material used in seal—

Did any strata contain unusable water? ☐ Yes ☐ No

Type of water? Depth of strata

Method of sealing strata off

(10) WATER LEVELS:

Static level ft. below land surface Date

Artesian pressure lbs. per square inch Date

Log Accepted by:

[Signed] ..... (Owner) Date ....., 19.....

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☐ No If yes, by whom? -

Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG: Diameter of well ..... inches.

Depth drilled ft. Depth of completed well ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

Log. Cont. MATERIAL	FROM	TO
Rock	332	333
Blue sand with clay streaks & mica, small rock shells	333	376
Rock	376	377
Blue silty sand with clay	377	448
Blue sandy clay	448	452
Blue sandy clay with silt & rock streaks	452	488
Broken rock	488	490
Sandy blue clay	490	495
Black rock with broken areas	495	500
Silty fine blue sand	500	506
Broken rock	506	508
Fine blue sand	508	510
Broken rock	510	514
Sandy clay	514	521
Broken rock, cobbles & clay seams	521	566
Broken rock & cobble with clay	566	596
Broken rock & cobble	596	604
Rock	604	619
Blue clay	619	624
Rock	624	626
Blue sand with clay streaks	626	637
Blue sand with rock & clay	637	650
(Continued)		

Work started 19 . Completed 19

(13) PUMP:

Manufacturer's Name .....

Type: ..... H.P. .....

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME ..... (Person, firm, or corporation) (Type or print)

Address .....

Driller's well number .....

[Signed] ..... (Well Driller)

License No. ..... Date ....., 19.....

(USE ADDITIONAL SHEETS IF NECESSARY)

86

RECEIVED JUL 14 1961 STATE ENGINEER SALEM, OREGON

(8c) dc 23 0/11

File Original and First Copy with the STATE ENGINEER, SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON

State Well No. 1N/3-45

State Permit No.

(1) OWNER:

Name: The Port of Portland

Address: 5848 N. Lagoon Ave.
Portland, Ore.

(2) LOCATION OF WELL:

County: Owner's number, if any—

¼ ¼ Section T. R. W.M.

Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):

New Well ☐ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☐

" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☐ No

Type of perforator used

SIZE of perforations in. by in.

perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☐ Yes ☐ No

Manufacturer's Name

Type Model No.

Diameter Slot size Set from ft. to ft.
Diameter Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Was well gravel packed? ☐ Yes ☐ No Size of gravel:

Gravel placed from ft. to ft.

Was a surface seal provided? ☐ Yes ☐ No To what depth? ft.

Material used in seal—

Did any strata contain unusable water? ☐ Yes ☐ No

Type of water? Depth of strata

Method of sealing strata off

(10) WATER LEVELS:

Static level ft. below land surface Date

Artesian pressure lbs. per square inch Date

Log Accepted by:

[Signed] (Owner) Date, 19

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☐ No If yes, by whom?

Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG: Diameter of well inches.

Depth drilled ft. Depth of completed well ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

Log Cont. MATERIAL	FROM	TO
Broken rock & cobbles	650	666
Broken rock & cobbles	666	700
Broken rock & cobbles with clay	700	723
Rock & cobbles with sand & clay	723	728
Sand, gravel & broken rock	728	735
Broken rock & gravel	735	743
Sandy blue clay	743	750

Work started 19 . Completed 19

(13) PUMP:

Manufacturer's Name

Type: H.P.

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME (Person, firm, or corporation) (Type or print)

Address

Driller's well number

[Signed] (Well Driller)

License No. Date, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

8c

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

MULT
001309

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED
DEC 29 1976
WATER RESOURCES DEPT
SALEM, OREGON

State Well No. 1N-3E-23
State Permit No.
(9)

(1) OWNER:
Name Michael A. Lacey
Address 2850 N. E. 17th, Gresham, Or. 97030

(2) TYPE OF WORK (check):
New Well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary [ ] Driven [ ]
Cable [X] Jetted [ ]
Dug [ ] Bored [ ]

(4) PROPOSED USE (check):
Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

CASING INSTALLED:
Threaded [ ] Welded [X]
6" Diam. from Plus 1 ft. to 113 ft. Gage 0.250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

PERFORATIONS:
Perforated? [ ] Yes [X] No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? [ ] Yes [X] No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? [ ] Yes [X] No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 18 gal./min. with 15 ft. drawdown after 2 hrs.
Artesian flow g.p.m.
Temperature of water 53° Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Bentonite
Well sealed from land surface to 21 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal sacks
Number of sacks of bentonite used in well seal 7 sacks
Brand name of bentonite National
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? [X] Yes [ ] No Plugs Size: location ft.
Did any strata contain unusable water? [ ] Yes [X] No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? [ ] Yes [X] No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Multnomah Driller's well number 53-76
¼ ¼ Section 23 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner
Tax Lot 101 - Jackson Addition

(11) WATER LEVEL: Completed well.
Depth at which water was first found 121 ft.
Static level 18 ft. below land surface. Date 12/16/76
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 6"
Depth drilled 121 ft. Depth of completed well 121 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Silt and sand	0	25	
Grey loose sand	25	120	
Grey sand and gravel	120	121	18

Work started Nov. 12 1976 Completed Dec. 15 1976
Date well drilling machine moved off of well Dec. 17 1976

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Jack M. Davis (Drilling Machine Operator) Date Dec. 27, 1976
Drilling Machine Operator's License No. 67

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Steinman Bros. Drilling Co. (Person, firm or corporation) (Type or print)
Address 11912 S. E. Kellogg Ave., Milwaukie, Or. 972
[Signed] Robert E. McConnell (Water Well Contractor)
Contractor's License No. 1 Date Dec. 27, 1976

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

9

MULT

(11)

RECEIVED AUG 25 1965 STATE ENGINEER SALEM, OREGON

RECEIVED SEP 15 1965 STATE ENGINEER SALEM, OREGON

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

State Well No. 1N/3-24

State Permit No.

(1) OWNER:
Name James Graham
Address Troutdale Oreg.

(2) LOCATION OF WELL:
County Mult. Driller's well number
¼ ¼ Section 24 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

(5) TYPE OF WELL:
Rotary [ ] Driven [ ]
Cable [X] Jetted [ ]
Dug [ ] Bored [ ]

(6) CASING INSTALLED: Threaded [ ] Welded [X]
6" Diam. from 0 ft. to 170 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? [ ] Yes [X] No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed? [ ] Yes [X] No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION: Cement backfill with drillings.
Well seal—Material used in seal
Depth of seal below 18 ft. Was a packer used?
Diameter of well bore to bottom of seal 8 in.
Were any loose strata cemented off? [ ] Yes [ ] No Depth
Was a drive shoe used? [X] Yes [ ] No
Was well gravel packed? [ ] Yes [X] No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusuable water? [ ] Yes [ ] No
Type of water? depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 25 ft. below land surface Date March 19-64
Artesian pressure lbs. per square inch Date

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? [X] Yes [ ] No If yes, by whom? driller
Yield: 15 gal./min. with 20 ft. drawdown after 48 hrs.
" " " "
" " " "
Bailer test 20 gal./min. with 25 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water 52 Was a chemical analysis made? [ ] Yes [X] No

(12) WELL LOG: Diameter of well below casing to bottom,
Depth drilled 170 ft. Depth of completed well 170 ft.
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
~~O~~ Top soil	0	1
River sand	1	12
silt and sand	12	70
Sand and rock	70	95
Sand silt	95	98
fine sand wood particles	98	165
Sand gravel	165	170

Work started March 19 64 Completed March 18 1964
Date well drilling machine moved off of well March 19 1964

(13) PUMP:
Manufacturer's Name F. E. Myers
Type: Submersible H.P. ½

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME A. D. Olsen (Person, firm or corporation) (Type or print)
Address 1831 S.E. Powell Gresham
Drilling Machine Operator's License No. 215
[Signed] A. D. Olsen (Water Well Contractor)
Contractor's License No. 285 Date March 30, 1964

(USE ADDITIONAL SHEETS IF NECESSARY)

11

WATER WELL REPORT
STATE OF OREGON

MULT
AUG 28 1980
WATER RESOURCES DEPT
SALEM, OREGON

State Well No. 1N/3E-25 25CBC
State Permit No.

GS = 135'

(1) OWNER:
Name CITY OF TROUTDALE
Address 104 KIBLING ST.
City TROUTDALE State ORE 97060

(2) TYPE OF WORK (check): WELL No 4.
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary Air ☐ Driven ☐
Rotary Mud ☐ Dug ☐
Cable ☒ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐
Thermal: Withdrawal ☐ Reinjection ☐

(5) CASING INSTALLED: Steel ☒ Threaded ☐ Plastic ☐ Welded ☒
16" Diam. from 0 ft. to 38 ft. Gauge .315
12" Diam. from +2 ft. to 494 ft. Gauge .330
LINER INSTALLED:
6" Diam. from 468 ft. to 563 ft. Gauge .250
6" Diam. from 493 ft. to 571 ft. Gauge .250

(6) PERFORATIONS: Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☒ Yes ☐ No
Manufacturer's Name UOP JOHNSON
Type STAINLESS STEEL Model No.
Diam. 6 Slot Size 30 Set from 493 ft. to 563 ft.
Diam. Slot Size Set from ft. to ft.
WITH 5 FT OF 6IN PIPE BETWEEN EACH 10 FT. SECTION OF SCREEN

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? STRASSER
Yield: 590 gal./min. with 52 ft. drawdown after 24 hrs.
" " " "
test gal./min. with drill stem at ft. hrs.
bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water 61° Depth artesian flow encountered ft.

(9) CONSTRUCTION: Special standards: Yes ☐ No ☒
Well seal—Material used CEMENT GROUT
Well sealed from land surface to 18 FT. 38-45 64-75 ft.
Diameter of well bore to bottom of seal 20 AND 16 in.
Diameter of well bore below seal 12 in.
Number of sacks of cement used in well seal 95 sacks
How was cement grout placed? PUMPED THROUGH ONE INCH GROUT PIPE FROM BOTTOM UP IN EACH ZONE
Was pump installed? NO Type HP Depth ft.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of Water? depth of strata
Method of sealing strata off
Was well gravel packed? ☒ Yes ☐ No Size of gravel: NO 8 MONTEREY SAND
Gravel placed from 469 ft. to 571 ft.

(10) LOCATION OF WELL:
County MULT. Driller's well number 5570
NW ¼ SW ¼ Section 25 T. 1N R. 3E W
Tax Lot # Lot Blk Subdivision
Address at well location: CITY SHOP TROUTDALE, ORE.

(11) WATER LEVEL: Completed well.
Depth at which water was first found 287
Static level 118 ft. below land surface. Date 7/30/
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing —
Depth drilled 573 ft. Depth of completed well 571
Formation: Describe color, texture, grain size and structure of materials; and sl thickness and nature of each stratum and aquifer penetrated, with at least one er for each change of formation. Report each change in position of Static Water L and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
SEE ATTACHED SHEET			

Work started APR 1 19 80 Completed AUG 7 19 80
Date well drilling machine moved off of well AUG 8 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials us and information reported above are true to my best knowledge and belie
[Signed] Irvin Johnson (Drilling Machine Operator) Date 8/27, 19 8
Drilling Machine Operator's License No. 911

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true the best of my knowledge and belief.
Name R.J. STRASSER DRILLING CO (Person, firm or corporation) (Type or print)
Address 8710 SE SUNSET LANE PORTLAND O
[Signed] Robert J. Strasser (Water Well Contractor)
Contractor's License No. 10 Date AUG 27, 19 8

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with WATER RESOURCES DEPARTMENT, SALEM, OREGON 97310 within 30 days from the date

R. J. Strasser Drilling Co.

8110 S. E. Sunset Lane
Portland, Oregon 97206

August 20, 1980

126

RECEIVED
AUG 28 1980
WATER RESOURCES DEPT
SALEM, OREGON

Log of well No. 4 City of Troutdale

GS - 135

brown sand	UGA	0 - 9	CASING
cemented gravel		9 - 18	
sand and gravel	TGA	18 - 23	
cemented gravel		23 - 94	
brown clay		94 - 100	
blue clay	CU2	100 - 148	
blue and brown clay		148 - 155	
blue clay		155 - 218	
cemented gravel		218 - 287	
sand		287 - 296	
blue clay		296 - 302	
grey clay		302 - 313	
blue and brown clay	SGA	313 - 328	
grey clay and seams		328 - 348	
green clay		348 - 356	
conglomerate		356 - 365	
cemented gravel		365 - 392	
sand and gravel		392 - 405	
silty clay		405 - 417	
sand and clay stone		417 - 419	
sand, silt, some gravel		419 - 485	
green sandstone		485 - 486	
sand, silt, and gravel		486 - 570	screens
brown sand and claystone		570 - 573	

Interpretation PDX Basin 1992

No TGA or CU1

SGA screened at 486-570

MULT

001338

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

RECEIVED JAN 28 1967 STATE ENGINEER

(13)

State Well No. 1N/3-25

State Permit No. ~~(18)~~ ~~(14)~~

(1) OWNER:
Name Darrel J. Muyskins
Address 1621 NE 136th
Portland, Oreg.

(2) LOCATION OF WELL:
County Multnomah Driller's well number
¼ ¼ Section 25 T. 1N, R. 3E W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☑
6" Diam. from 0 ft. to 115 ft. Gage 1250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☑ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed? ☐ Yes ☑ No
Manufacturer's Name
Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal Cemented below 18'
Depth of seal below 18 ft. Was a packer used? —
Diameter of well bore to bottom of seal 8 in.
Were any loose strata cemented off? ☐ Yes ☑ No Depth
Was a drive shoe used? ☑ Yes ☐ No
Was well gravel packed? ☐ Yes ☑ No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusable water? ☑ Yes ☑ No iron bearing
Type of water? iron depth of strata 100'
Method of sealing strata off Cased off

(10) WATER LEVELS:
Static level 15 ft. below land surface Date Feb-67
Artesian pressure lbs. per square inch Date

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs
" " " "
" " " "
Bailer test 20 gal./min. with 30 ft. drawdown after 1 hrs
Artesian flow g.p.m. Date
Temperature of water 53 Was a chemical analysis made? ☑ Yes ☐ No

(12) WELL LOG: Diameter of well below casing 115
Depth drilled 115 ft. Depth of completed well 115 ft
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation*

MATERIAL	FROM	TO
Top soil	0	1
river sand	1	40
blue clay & cement gravel	40	50
brown sandy clay	50	66
green clay	66	77
blue clay	77	82
yellow clay	82	93
brown sand	93	101
course sand & gravel	101	115
water bearing		

Work started Jan 1967 Completed Feb 1967
Date well drilling machine moved off of well Feb 1967

(13) PUMP:
Manufacturer's Name SE 10A-21
Type: Submersible H.P. 1

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME A. O. Olsen (Person, firm or corporation) (Type or print)
Address 18211 SE Powell Gresham
Drilling Machine Operator's License No. 215
[Signed] A. O. Olsen (Water Well Contractor)
Contractor's License No. 282 Date March 10, 1967

(USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON within 30 days from the date of well completion.

MULT 001336

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED JUL 1 9 1974 STATE ENGINEER SALEM, OREGON

(14)

State Well No. 1N/3E-25
State Permit No.

(1) OWNER:
Name Roy Holmberg.
Address 2337 NE 17th Portland, Oreg.

(2) TYPE OF WORK (check):
New Well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary [ ] Driven [ ]
Cable [X] Jetted [ ]
Dug [ ] Bored [ ]

(4) PROPOSED USE (check):
Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [X] Other Restaurant

(5) CASING INSTALLED: Threaded [ ] Welded [X]
6" Diam. from 0 ft. to 102 ft. Gage 250#
5" Diam. from 95 ft. to 110 ft. Gage 125#
" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? [X] Yes [ ] No.
Type of perforator used Saw cut
Size of perforations in. by in.
100 perforations from 105 ft. to 110 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? [ ] Yes [X] No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? [ ] Yes [ ] No. If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "
Bailer test 20 gal./min. with 10 ft. drawdown after 1 hrs.
Artesian flow g.p.m.
Temperature of water 53 Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Cement
Well sealed from land surface to ~~100~~ 90 ft.
Diameter of well bore to bottom of seal 8 in.
Diameter of well bore below seal driven pipe
Number of sacks of cement used in well seal 25 sacks
Number of sacks of bentonite used in well seal 1 sacks
Brand name of bentonite National
Number of pounds of bentonite per 100 gallons of water mixed with cement lbs./100 gals.
Was a drive shoe used? [X] Yes [ ] No Plugs Size: location ft.
Did any strata contain unusable water? [ ] Yes [X] No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? [ ] Yes [X] No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Mult. Driller's well number
¼ ¼ Section 25 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found Surface ft.
Static level 38 ft. below land surface. Date April 8-74
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing
Depth drilled ft. Depth of completed well ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
gravel & boulder	0	25	
blue clay	25	102	
sandstone	102	110	

Surface pipe set to 40' removed after sealing.

From 0-22 - Cemented with 20 sacks neat cement.

Work started April 1 1974 Completed April 8 1974
Date well drilling machine moved off of well April 8 1974

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] C. O. Olsen (Drilling Machine Operator) Date June, 1974
Drilling Machine Operator's License No. 214

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Olsen Well Drilling Inc. (Person, firm or corporation) (Type or print)
Address 1821 SE Powell Gresham
[Signed] C. O. Olsen (Water Well Contractor)
Contractor's License No. 275 Date June, 1974

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45654-119

14

MULT

STATE ENGINEER
Salem, Oregon

Well Record

001349

(15)

STATE WELL NO. 1N/3-26N
COUNTY: Multnomah
APPLICATION NO. GR-4279
and App. No. G # 1275

OWNER: Board of County Commissioners

MAILING ADDRESS: Multnomah County Courthouse

CITY AND STATE: Oregon

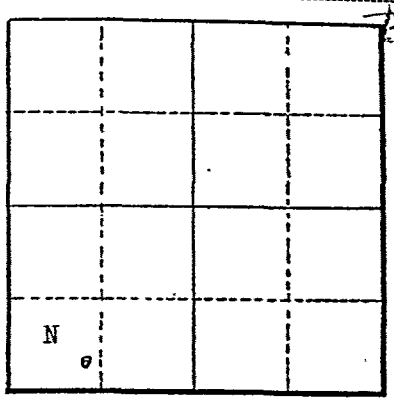
(15) 26ccd

LOCATION OF WELL: Owner's No. 1

SW ¼ SW ¼ Sec. 26 T. 1 ~~S.~~ N., R. 3 ~~E.~~ W., W.M.

Bearing and distance from section or subdivision corner 500 feet North and 1440 feet West from S¼ Corner, Section 26

Altitude at well 157 feet



TYPE OF WELL: Drilled Date Constructed March 1940

Depth drilled 228 feet Depth cased 228 feet

Section 26

CASING RECORD:

12-inch steel casing set from 0 to 188 feet
10-inch steel casing set from 188 to 228 feet

FINISH:

AQUIFERS:

clay and gravel

WATER LEVEL:
67 feet

PUMPING EQUIPMENT: Type Western Land Roller Turbine H.P.
Capacity 500 G.P.M.

WELL TESTS:
Drawdown 114 ft. after hours 500 G.P
Drawdown 121 ft. after hours 540 G.P

USE OF WATER Institutional and Irrigation Temp. °F., 19..
SOURCE OF INFORMATION GR-4131
DRILLER or DIGGER
ADDITIONAL DATA:
Log x Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

top soil and clay	11	11	cemented gravel	27	195
cemented grave with boulders	69	80	cemented gravel with seams (water)	33	228
cemented gravel, no boulders	50	130			
cemented gravel (trace of water	38	168	clay	29	257

State Printing 89316

MULT 26ad (16)

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED JUN 1967 STATE ENGINEER OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

001347

State Well No. 1N/3E-26

State Permit No. (17)

(1) OWNER:
Name M.A. CERRUTI
Address RT. 2
TROUTDALE, OREGON

(2) LOCATION OF WELL:
County MULTNOMAH Driller's well number 30
SE ¼ NE ¼ Section 26 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 110 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal BENTONITE
Depth of seal 31 ft. Was a packer used? NO
Diameter of well bore to bottom of seal 10 in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 25 ft. below land surface Date 6-7-67

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 35 gal./min. with 15 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water 56° Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG: Diameter of well below casing —
Depth drilled 115 ft. Depth of completed well 110 ft.
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
TOP SOIL	0	2
SANDY BROWN CLAY	2	20
CEMENTED GRAVEL	20	43
BROWN CLAY	43	67
SANDY BROWN CLAY, SOME GRAVEL	67	72
BLUE CLAY	72	78
BROWN CLAY	78	90
BLUE CLAY	90	108
FINE GRAVEL	108	111
BLUE CLAY	111	115

Work started 6-1 1967 Completed 6-7 1967
Date well drilling machine moved off of well 6-7 1967

(13) PUMP:
Manufacturer's Name —
Type: — H.P. —

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME KELLER WELL DRILLING CO. (Person, firm or corporation) (Type or print)
Address 16306 S.E. FRANKLIN, PORTLAND
Drilling Machine Operator's License No. 329
[Signed] [illegible] (Water Well Contractor)

MULT

061348

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

RECEIVED 1967

State Well No. 1N/3-26 K

State Permit No. 35

26db (17)

(1) OWNER:
Name WAYNE LAWREY
Address RT. 2 BOX 55
TROUTDALE, OREGON

(2) LOCATION OF WELL:
County MULTNOMAH Driller's well number 24
NW ¼ SE ¼ Section 26 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 54 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS:
Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
mm. Slot size Set from ft. to ft.
mm. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal CEMENT
Depth of seal 37 ft. Was a packer used? NO
Diameter of well bore to bottom of seal 10 in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☒ Yes ☐ No
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 20 ft. below land surface Date 4-1-67

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level (19)
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 35 gal./min. with 15 ft. drawdown after ½ hrs.
Artesian flow g.p.m. Date
Temperature of water 56° Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG:
Diameter of well below casing —
Depth drilled 54 ft. Depth of completed well 54 ft.
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
TOP SOIL	0	2
SANDY BROWN CLAY	2	20
CEMENTED GRAVEL	20	37
LOOSE GRAVEL (WATER BEARING FROM 50' TO 54')	37	54

Work started 3-29 1967 Completed 4-1 1967
Date well drilling machine moved off of well 4-1 1967

(13) PUMP:
Manufacturer's Name —
Type: — H.P. —

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME KELLER WELL DRILLING CO. (Person, firm or corporation) (Type or print)
Address 16306 S.E. FRANKLIN PORTLAND
Drilling Machine Operator's License No. 329
[Signed] C. C. Keller (Water Well Contractor)

ORIGINAL
File Original, and Duplicate with the STATE ENGINEER, SALEM, OREGON

WATER WELL DRILLERS REPORT
STATE OF OREGON

Do Not Fill In — State Well No. 1N/3-26 — State Permit No. MULT 001345

(1) OWNER:
Name: William M. Yoppis
Address: P.O. Box 36 Troutdale Ore

(2) LOCATION OF WELL:
County: Mult. Owner's number, if any
R. F. D. or Street No.: Sandy Road
Bearing and distance from section or subdivision corner: Sec 26 1-N-3 E. Township N

(3) TYPE OF WORK (check):
New well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☐
Cable ☑
Dug Well ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☐

FROM	ft. to	ft.	Diam.	Gage or Wall
"	"	"	"	"
"	"	"	"	"
"	"	"	"	"
"	"	"	"	"
"	"	"	"	"

Type and size of shoe or well ring
Describe joint

If gravel packed

Diameter of Bore	from ft.	to ft.
	"	"
	"	"
	"	"
	"	"
	"	"

Size of gravel:

(7) PERFORATIONS:
Type of perforator used
Size of perforations in., length, by in.

FROM	ft. to	ft.	perf per foot	No. of rows
"	"	"	" " "	" " "
"	"	"	" " "	" " "
"	"	"	" " "	" " "
	"	"	" " "	" " "

SCREENS:
Give Manufacturer's Name, Model No. and Size

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☒ Yes ☐ No To what depth ft.
Were any strata sealed against pollution? ☒ Yes ☐ No
If yes, note depth of strata

FROM	ft. to	ft.
"	"	"

METHOD OF SEALING: Cemented

(9) WATER LEVELS:
Depth at which water was first found ft.
Standing level before perforating ft.
Standing level after perforating ft.

Log Accepted by:
[Signed] William M. Yoppis (Owner) Dated 11-20-, 1956

(10) WELL TESTS: 18
Was a pump test made? ☐ Yes ☐ No If yes, by whom?

Yield:	gal./min. with	ft. draw down after	hrs.
"	"	"	"
"	"	"	"

Artesian flow ..... g.p.m.
Shut-in pressure ..... lbs. per square inch.
Bailer test 45 g.p.m. with ..... ft. drawdown
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No
Was electric log made of well? ☐ Yes ☐ No

(11) WELL LOG:
Diameter of well 6 inches.
Total depth 41 ft. Depth of completed well ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

0 ft. to	10 ft.	dirt
10 "	41 "	boulders and gravel water

Ground elevation at well site ..... feet above mean sea level.
Work started Nov-12 19 56 Completed Nov-21 19 56

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME C. E. Hamblet (Person, firm, or corporation) (Typed or printed)
Address 6116 SE 56
Driller's well number
[Signed] C. E. Hamblet (Well Driller)
License No. 713 Dated Nov-21, 1956

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

RECEIVED
JUL 28 1976
WATER RESOURCES DEPT.
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

(19)

MULT State Well No. _____
State Permit No. 1N/3E 26ca
(32) (31)
901343

(1) OWNER:
Name James Dreiling
Address Rt 2 Box 40
Troutdale, Oregon 97060

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

CASING INSTALLED: Threaded ☐ Welded ☒
5/8" Diam. from 0 ft. to 52 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

PERFORATIONS: Perforated? ☐ Yes ☒ No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? driller
Yield: 12 gal./min. with total drawdown after 1 hrs.
" " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water 50 Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Cement, bentonite- pressure
Well sealed from land surface to 20 ft.
Diameter of well bore to bottom of seal 10" 6x in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 6 sacks
Number of sacks of bentonite used in well seal 100lbs. sacks
Brand name of bentonite National
Number of pounds of bentonite per 100 gallons of water 1:5 ratio lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Multnomah Driller's well number 770
NE ¼ SW ¼ Section 26 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 49 ft.
Static level 24 ft. below land surface. Date 3/25/76
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing
Depth drilled 52 ft. Depth of completed well 52 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Clay brown sandy	0	10	
Consolidated conglomerate	10	50	
Gravel large	50	52	

Work started 3/24/76 19 Completed 3/25/76 19
Date well drilling machine moved off of well 3/26/76 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Ross Jannsen (Drilling Machine Operator) Date 4/13/76, 19
Drilling Machine Operator's License No. 399

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Ross A. Jannsen Well Drilling (Person, firm or corporation) (Type or print)
Address Rt 1 Box 485 Estacada, Ore. 9702
[Signed] Ross Jannsen (Water Well Contractor)
Contractor's License No. 433 Date 4/13/76, 19

SP*45656-119

(20)

STATE ENGINEER
Salem, Oregon

MULT

Well Record

001350

STATE WELL NO. 1N/3-26N1
COUNTY MULTNOMAH
APPLICATION NO.

OWNER: Multnomah County Farm

MAILING ADDRESS:

LOCATION OF WELL: Owner's No.

CITY AND STATE:

____¼ ____¼ Sec. ____ T. ____ N. S., R. ____ E. W., W.M.

Bearing and distance from section or subdivision corner

Altitude at well 135

TYPE OF WELL: Drilled Date Constructed

Depth drilled 228 Depth cased

Section

CASING RECORD:

10 inch

FINISH:

AQUIFERS:

Cemented gravel, Troutdale Formation, from 195 to 228

WATER LEVEL:

65 feet below land surface, 1943

PUMPING EQUIPMENT: Type Turbine H.P.
Capacity G.P.M.

WELL TESTS:

Drawdown ft. after hours G.P.M.

Drawdown ft. after hours G.P.M.

USE OF WATER Public Supply, Irr. Temp. °F., 19
SOURCE OF INFORMATION USGS
DRILLER or DIGGER
ADDITIONAL DATA:
Log Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

Drilled to 257 feet, backfilled to 228 feet.
Pumped 500 gpm, drawdown 100 feet.

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED
JUL 9 - 1971
STATE ENGINEER
SALEM, OREGON

NC

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

MULT

State Well No. 1N/3-26 (21)

State Permit No. 061351 (24) (28)

(1) OWNER:
Name: Standard Oil Company, Inc.
Address: P. O. Box 950, Portland, Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED: Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 30 ft. Gage .250
5" Diam. from 27 ft. to 52 ft. Gage .125
" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? ☒ Yes ☐ No.
Type of perforator used: Torch
Size of perforations: 1 in. by 1-1/4 in.
48 perforations from 31 ft. to 47 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "
Bailer test 36 gal./min. with 17 ft. drawdown after 2 hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used: Bentonite
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 0 sacks
Number of sacks of bentonite used in well seal 2 sacks
Brand name of bentonite: Well Gel
Number of pounds of bentonite per 100 gallons of water 25 lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County: Multnomah Driller's well number
¼ ¼ Section 26 T. 1 N R. 3 E. W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 26 ft.
Static level 3 ft. below land surface. Date 6/29/71
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 6"
Depth drilled 52 ft. Depth of completed well 52 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Fill dirt	0	3	
Reddish brown sand	3	9	
Blue clay	9	16	
Brown clay	16	26	
Sandy Gravel	26	40	20 gpm
Brown sand (coarse)	40	49	16 gpm
Cemented gray sand	49	52	

Work started 6/22/71 19 Completed 6/29/71 19
Date well drilling machine moved off of well 6/29/71 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] [illegible] (Drilling Machine Operator) Date 7/6/71, 19
Drilling Machine Operator's License No. 722

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name A. M. Jannsen Drilling Co. (Person, firm or corporation) (Type or print)
Address 21075 S. W. Tualatin Valley Hwy, Aloha, (
[Signed] [illegible] (Water Well Contractor)
Contractor's License No. 79 Date 7/6/71, 19

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

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FEB - 9 1971
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

MULT
001352

State Well No. 1N/3-26
State Permit No. 28
29

(1) OWNER:
Name Mr. and Mrs. Alex E. Sanderson
Address 19333 N.E. Sandy Portland, Oreg. 97230

(2) TYPE OF WORK (check):
New Well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary [ ] Driven [ ]
Cable [X] Jetted [ ]
Dug [ ] Bored [ ]

(4) PROPOSED USE (check):
Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

CASING INSTALLED:
Threaded [ ] Welded [X]
" Diam. from 0 ft. to 99 ft. Gage .250
5 " Diam. from 97 ft. to 111 ft. Gage 10
" Diam. from ft. to ft. Gage

(6) PERFORATIONS:
Perforated? [X] Yes [ ] No.
Type of perforator used Torch
Size of perforations 1/4 in. by 8 in.
33 perforations from 99 ft. to 110 ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? [ ] Yes [X] No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.
Static level 70 ft. below land surface Date 1-26-71
Artesian pressure lbs. per square inch Date

(9) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? [ ] Yes [X] No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 40 gal./min. with 5 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? [ ] Yes [X] No

(10) CONSTRUCTION:
Well seal—Material used Cement
Depth of seal 28 ft.
Diameter of well bore to bottom of seal 10 in.
Were any loose strata cemented off? [ ] Yes [X] No Depth
Was a drive shoe used? [X] Yes [ ] No
Did any strata contain unusable water? [ ] Yes [X] No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? [ ] Yes [X] No Size of gravel:
Gravel placed from ft. to ft.

(11) LOCATION OF WELL:
County Multnomah Driller's well number
¼ ¼ Section 26 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG:
Diameter of well below casing none
Depth drilled 111 ft. Depth of completed well 109 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
Top soil	0	1	
Clay	1	2	
Fine brown sand	2	6	
Gravel, cobbles & Boulders	6	25	
Silt & blue clay	25	42	
Gravel - Surface water	42	44	20
Tan clay	44	53	
Yellow sand rock	53	70	
Cemented gravel & sand	70	84	
Sand - 10 gpm	84	84'6"	72
Cemented gravel	84'6"	88	
Cemented gravel	88	99	
Cemented gravel, some loose water producing	99	109	70
Gravel gray clay binder	109	111	

Work started 1-7-71 19 Completed 1-26 19 71
Date well drilling machine moved off of well 1-27 19 71

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] C. C. Fram (Drilling Machine Operator) Date 2-7, 19 71
Drilling Machine Operator's License No. 18

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Calvin C. Fram, Well Drilling (Person, firm or corporation) (Type or print)
Address 17120 S.E. Foster Rd., Portland Oregon 97236
[Signed] Calvin C. Fram (Water Well Contractor)
Contractor's License No. 222 Date 2-7, 19 71

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED
NOV 10 1970
STATE ENGINEER
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

MULT State Well No. 1N/3-26
State Permit No. 061353

(23)

(1) OWNER:
Name L. B. Klinger
Address Rt 2 Box 46
Troutdale, Oreg.

(2) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

CASING INSTALLED: Threaded ☐ Welded ☑
6" Diam. from 0 ft. to 215 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

PERFORATIONS: Perforated? ☒ Yes ☐ No.
Type of perforator used Torch cut
Size of perforations 1/4 in. by 8 in.
152 perforations from 215 ft. to 250 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "
Bailer test 40 gal./min. with 30 ft. drawdown after 2 hrs.
Artesian flow g.p.m.
Temperature of water 53 Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Cement-sand
Well sealed from land surface to 215' ft.
Diameter of well bore to bottom of seal pipe driven
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 1 sacks
Number of sacks of bentonite used in well seal none sacks
Brand name of ~~bentonite~~ native blue clay slurry
Number of pounds of bentonite per 100 gallons
Clay lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☐ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Multnomah Driller's well number
1/4 1/4 Section 26 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 70' ft.
Static level 40 ft. below land surface. Date Sept 15-
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing to bottom
Depth drilled 250 ft. Depth of completed well 250 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Sandy loam	0	15	
boulders gravel	15	70	
yellow sand	70	85	40'
cement gravel	85	130	
water bearing 15 g.p.m.			40
blue clay	130	210	
blue fine sand with water	210	215	105'
cement gravel	215	250	
water bearing streaks			110'
surface pipe 10" to 8" to		20' 46'	
removed.			

Work started Sept 1 1970 Completed Oct 22 1970
Date well drilling machine moved off of well Oct 22 1970

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] A. O. Olsen (Drilling Machine Operator) Date Oct 25, 1970
Drilling Machine Operator's License No. 214

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name A. O. Olsen (Person, firm or corporation) (Type or print)
Address 1821 SE Powell Portland
[Signed] A. O. Olsen (Water Well Contractor)
Contractor's License No. 282 Date Oct 25 1970

RECEIVED (24) MULT
MAR 17 1967
STATE ENGINEER
SALEM, OREGON
001354

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

WATER WELL REPORT

STATE OF OREGON
(Please type or print)

State Well No. 1N/3-26

State Permit No. [illegible]

(1) OWNER:

Name Mr. Lester W. Arndt

Address 920 N. E. 239th Pl.

Troutdale, Oregon

(2) LOCATION OF WELL:

County Multnomah Driller's well number

¼ ¼ Section 26 T. 1N R. 3E W.M.

Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

Abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):

Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒

6 " Diam. from 0 ft. to 50 ft. Gage .250
5 " Diam. from 49 ft. to 60 ft. Gage 10
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☒ Yes ☐ No

Type of perforator used Torch

Size of perforations ¼ in. by 5 in.

27 perforations from 51 ft. to 60 ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed? ☐ Yes ☒ No

Manufacturer's Name

Model No.

Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Well seal—Material used in seal Bentonite & cement

Depth of seal 30 ft. Was a packer used? no

Diameter of well bore to bottom of seal 9 in.

Were any loose strata cemented off? ☐ Yes ☒ No Depth

Was a drive shoe used? ☒ Yes ☐ No

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? high silica depth of strata 47

Method of sealing strata off Drive casing

(10) WATER LEVELS:

Static level 3 ft. below land surface Date 3-11-67

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom?

Yield: gal./min. with ft. drawdown after h

" " "

" " "

Bailer test 15 gal./min. with 42 ft. drawdown after 1 h

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? ☐ Yes ☒

(12) WELL LOG: Diameter of well below casing none

Depth drilled 60 ft. Depth of completed well 60

Formation: *Describe by color, character, size of material and structure, a show thickness of aquifers and the kind and nature of the material in ea stratum penetrated, with at least one entry for each change of formati*

MATERIAL	FROM	TO
Top soil	0	1
Soil & sand	1	2
Clean coarse sand	2	5
Sand	5	25
Gray silt	25	29
Cobbles & Boulders	29	38
Gravel	38	41
Silt, sand & silica	41	[illegible]
Gravel & sand, high silica content	44	47
Gravel & silica	47	49
Cemented gravel	49	52
Water producing cemented gravel	52	60

Work started 3-6 1967 Completed 3-11 1967

Date well drilling machine moved off of well 3-11 19

(13) PUMP:

Manufacturer's Name

Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.

NAME Calvin C. Bram, Well Drilling
(Person, firm or corporation) (Type or print)

Address 17120 S.E. Foster Rd., Portland.

Drilling Machine Operator's License No. 18

[Signed] Calvin C. Bram
(Water Well Contractor)

Contractor's License No. 222 Date 3-15 19

ORIGINAL
File Original, and Duplicate with the STATE ENGINEER, SALEM, OREGON

WATER WELL DRILLERS REPORT
STATE OF OREGON

Do Not Fill In — State Well No. IN/3-26 (25)
State Permit No. MULT 001355

(1) OWNER:
Name Mrs. Weir Owens
Address Rt 2 Box 41
TROUTDALE, ORE

(2) LOCATION OF WELL:
County MULT Owner's number, if any—
R. F. D. or Street No. Rt 2 Box 48 TROUTDALE
Bearing and distance from section or subdivision corner
S W 1/4 OF D. F. BUXTON DLC
SEC. 26 T1N R3E OF WM

(3) TYPE OF WORK (check):
New well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☐
Cable ☑
Dug Well ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☐

FROM	ft. to	ft.	Diam.	Gage or Wall
"	"	"	"	"
"	"	"	"	"
"	"	"	"	"
"	"	"	"	"
"	"	"	"	"

Type and size of shoe or well ring
Describe joint

If gravel packed

Diameter of Bore	from ft.	to ft.
Cemented	"	"
	"	"
	"	"
	"	"

Size of gravel:

(7) PERFORATIONS:
Type of perforator used
Size of perforations in., length, by in.

FROM	ft. to	ft.	perf per foot	No. of rows
"	"	"	" " "	" " "
	"	"	" " "	" " "
	"	"	" " "	" " "
"	"	"	" " "	" " "

(8) SCREENS:
Give Manufacturer's Name, Model No. and Size

(9) CONSTRUCTION:
Was a surface sanitary seal provided? ☐ Yes ☐ No To what depth ft.
Were any strata sealed against pollution? ☐ Yes ☐ No
If yes, note depth of strata

FROM	ft. to	ft.
	"	"

METHOD OF SEALING

(10) WELL TESTS:
Was a pump test made? ☐ Yes ☑ No If yes, by whom?

Yield:	gal./min. with	ft. draw down after	hrs.
"	"	"	"
"	"	"	"

Artesian flow g.p.m.
Shut-in pressure lbs. per square inch.
Bailer test 25 g.p.m. with ft. drawdown
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No
Was electric log made of well? ☐ Yes ☐ No

(11) WELL LOG:
Diameter of well 6 inches.
Total depth 52 ft. Depth of completed well 52 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

ft. to	ft.	
0 "	6 "	fill [illegible]
"	"	
6 "	52 "	hard dense basalt
"	"	one joint (open)

Ground elevation at well site feet above mean sea level.
Work started 11-1 19 56 Completed 11-9 1956

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME C. E. Hamblet (Person, firm, or corporation) (Typed or printed)
Address 6116 SE 56
Driller's well number
[Signed] C. E. Hamblet (Well Driller)
License No. 13 Dated 11-9, 1956

(12) WATER LEVELS:
Depth at which water was first found 30 ft.
Standing level before perforating ft.
Standing level after perforating ft.

Log Accepted by:
[Signed] Wm Owens Owner Dated 11/9, 1956

ORIGINAL
File Original and Duplicate with the STATE ENGINEER, SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON

MULT State Well No. 1N/3-26 (26)

State Permit No. 001356 (29) (28)

(1) OWNER:
Name Reynolds Troutdale Federal C.U.
Address Route 2, Box 19C
Troutdale, Oregon

(2) LOCATION OF WELL:
County Multnomah Owner's number, if any—
¼ ¼ Section 26 T. 1 N R. 3 E W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 36 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☐ Yes ☒ No
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☐ Yes ☒ No
Manufacturer's Name
Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.
Was a surface seal provided? ☒ Yes ☐ No To what depth? 17 ft.
Material used in seal— Cement
Did any strata contain unusable water? ☒ Yes ☐ No
Type of water? surface Depth of strata 5 ft.
Method of sealing strata off cementing

(10) WATER LEVELS:
Static level 3 ft. below land surface Date 5-10-60
Artesian pressure lbs. per square inch Date

Log Accepted by:
Signed) X [signature] (Owner) Date 6-16-60, 19
Manager - Reynolds Troutdale F.C.U.

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 10 gal./min. with 10 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG: Diameter of well 6 inches.
Depth drilled 36 ft. Depth of completed well 36 ft.
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Dirt and clay	0	3'
Sand with water	3'	6'
Dry sand and clay	6'	17'
Gravel & boulders	17'	25'
Gravel & clay	25'	33'
Water bearing gravel	33'	36'

RECEIVED JUN 2 1960 STATE ENGINEER SALEM, OREGON

Work started May 6 1960. Completed May 10 1960

(13) PUMP:
Manufacturer's Name
Type: H.P.

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Calvin C. Bram, Well Drilling
(Person, firm, or corporation) (Type or print)
Address 17120 S. E. Foster Rd.
Portland 36, Oregon
Driller's well number
[Signed] Calvin C. Bram (Well Driller)
License No. 222 Date 6-16, 1960.

(USE ADDITIONAL SHEETS IF NECESSARY)

STATE ENGINEER
Salem, Oregon

Well Record

(27a)

STATE WELL NO. 1N/3-26K
COUNTY Multnomah
APPLICATION NO. GR-4131

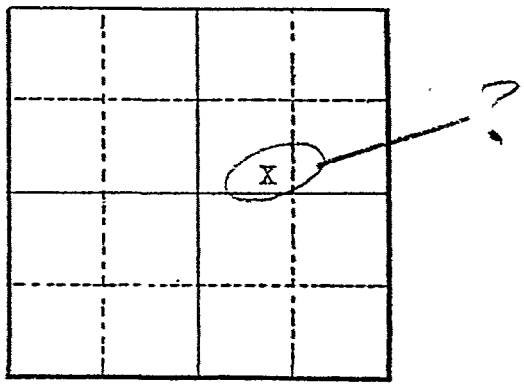
OWNER: Glen Elsworth Oakes
MAILING ADDRESS: Route 2, Box 57
CITY AND STATE: Troutdale, Oregon

LOCATION OF WELL: Owner's No.

NW ¼ SE ¼ Sec. 26 T. 1 ~~S.~~ N., R. 3 ~~W.~~ E., W.M.

Bearing and distance from section or subdivision corner N. 45° 30' W. SE Cor. Sec. 26

Altitude at well



TYPE OF WELL: Drilled Date Constructed 7/7/55
Depth drilled 94 ft. Depth cased 94 ft.

Section 26

CASING RECORD:

6 inch casing set to 94 ft.

FINISH:

Well casing is a series of standard length threaded and coupled pipe all the way with a regulation drive shoe screwed on the end. No perforations.

AQUIFERS:

WATER LEVEL:

77½ feet below surface

PUMPING EQUIPMENT: Type Myers submersible 1" H.P. 1
Capacity 20 G.P.M.

WELL TESTS:
Drawdown None ft. after hours 20 G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Irrigation Temp. °F., 19
SOURCE OF INFORMATION Well Registration Statement Cert. # GR-3708
DRILLER or DIGGER
ADDITIONAL DATA:
Log X Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

State Printing 89316

(276) 2606

STATE ENGINEER
Salem, Oregon

State Well No. 1N/3-26K
County Multnomah
Application No. GR-4131

Water right permit No. GR-782

Well Log

(29)

Owner: Glen Elsworth Oakes Owner's No.

Driller: Date Drilled July 7, 1955

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
Topsoil & clay	0	10	10
Sand & gravel	10	20	10
Cemented gravel	20	75	55
Sand	75	77	2
Cemented gravel	77	81	4
Sand & gravel	81	90	9
Water gravel	90	92	2
Gravel	92	94	2

STATE ENGINEER
Salem, Oregon

MULT

Well Record

STATE WELL NO. 1N/3-26K
COUNTY MULTNOMAH
~~APPLICATION NO.~~ GR-2955

001365

OWNER: JAMES G. SIMONI

MAILING ADDRESS: P.O. Box 42

28

CITY AND STATE: Troutdale, Oregon

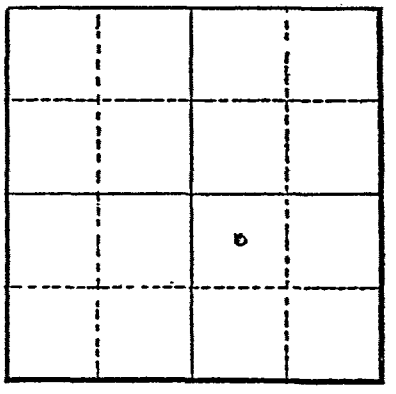
~~30~~

LOCATION OF WELL: Owner's No.

NW ¼ SE ¼ Sec. 26 T. 1 ~~S.~~ N., R. 3 ~~W.~~ E., W.M.

Bearing and distance from section or subdivision corner N. 37° 30' W.

Altitude at well



26db

TYPE OF WELL: drilled Date Constructed 1945

Depth drilled 50 Depth cased 50

Section

CASING RECORD:

8-inch

GW permit # GR2773

FINISH:

AQUIFERS:

WATER LEVEL:

10-feet

PUMPING EQUIPMENT: Type Pacific Pump Co., Model 1½ L. H.P. 3
Capacity 45 G.P.M.

WELL TESTS:
Drawdown ft. after hours G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Irrigation Temp. °F. 19
SOURCE OF INFORMATION GR-2773
DRILLER or DIGGER
ADDITIONAL DATA:
Log Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

State Printing 89316

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

MULT 001344

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

RECEIVED JUN 26 1974 STATE ENGINEER SALEM, OREGON

State Well No. 1N/3E-26 (29)
State Permit No.
Multnomah

(1) OWNER:
Name West Coast Alloys
Address 2345 NE 244 Avenue
Portland, Oregon

(2) TYPE OF WORK (check):
New Well XX Deepening ☐ Reconditioning ☐ Abandon ☐.
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary XX Driven ☐
Cable ☐ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal XX
Irrigation ☐ Test Well ☐ Other ☐

CASING INSTALLED: Threaded ☐ Welded XX
8" Diam. from 0 ft. to 19 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

PERFORATIONS: Perforated? ☐ Yes XX No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes XX No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Air
Was a pump test made? XX Yes ☐ No If yes, by whom? driller
Yield: 100 gal./min. with 15 ft. drawdown after 2 hrs.
12 " 7 " 1 "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Cement & bentonite
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 15 in.
Diameter of well bore below seal 8 in.
Number of sacks of cement used in well seal 2 sacks
Number of sacks of bentonite used in well seal 2 sacks
Brand name of bentonite Bariod Mud Gel
Number of pounds of bentonite per 100 gallons of water 100 lbs./100 gals.
Was a drive shoe used? XX Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes XX No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes XX No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Driller's well number 40-74
¼ ¼ Section 26 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 18 ft.
Static level 8 ft. below land surface. Date 6-24-74
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 8
Depth drilled 23 ft. Depth of completed well 23 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Grey clay	0	11	
Very large boulders	11	16	
Large gravel	16	19	
Medium gravel	19	23	8

Work started 6-21 1974 Completed 6-24 1974
Date well drilling machine moved off of well 6-24 1974

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Eugene M. Skyles (Drilling Machine Operator) Date 6-24 1974
Drilling Machine Operator's License No. 271

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Skyles Drilling and Supply (Person, firm or corporation) (Type or print)
Address 1169 Molalla Avenue, Oregon City
[Signed] Francis A. Skyles (Water Well Contractor)
Contractor's License No. 553 Date 6-24, 1974

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

29

File Original and First Copy with the STATE ENGINEER, SALEM, OREGON

MULT 01346

WATER WELL REPORT
STATE OF OREGON

State Well No. 1N/3E-26

State Permit No. (30)

(1) OWNER:
Name West Coast Alloys Co.
Address P.O. Box 1941
Troutdale, Oregon

(2) LOCATION OF WELL:
County Multnomah Owner's number, if any—
¼ ¼ Section 26 T. 1N R. 3E W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☑ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☑
6" Diam. from 0 ft. to 80 ft. Gage 280
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(7) PERFORATIONS: Perforated? ☑ Yes ☐ No
Type of perforator used torch cut
SIZE of perforations ¼ in. by 10 in.
perforations from 50 ft. to 80 ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS: Well screen installed ☐ Yes ☑ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Was well gravel packed? ☑ Yes ☐ No Size of gravel: ½" minus
Gravel placed from 45 ft. to 80 ft.
Was a surface seal provided? ☑ Yes ☐ No To what depth? 45 ft.
Material used in seal— cement & bentonite seal
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? Depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 20 ft. below land surface Date April 1961
Artesian pressure lbs. per square inch Date

Log Accepted by:
Signed West Coast Alloys Co. (Owner) Date Oct 17, 1961
G. W. Mayfield, Plant Manager

(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☑ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "
Bailer test 30 gal./min. with 30 ft. drawdown after 2 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG: Diameter of well 6 inches.
Depth drilled 80 ft. Depth of completed well 80 ft.
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
clay	0	4
cement (grave) boulders	4	28
cemented grave)	28	50
sand stone & grave)	50	80
water bearing.		

Work started April 1961 Completed April 1961

(13) PUMP:
Manufacturer's Name Franklin
Type: Submersible H.P. 3/4

Well Driller's Statement:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME A. O. Olsen (Person, firm, or corporation) (Type or print)
Address 18211 S.E. Powell Gresham
Driller's well number
[Signed] A. O. Olsen (Well Driller)
License No. 282 Date Oct, 1961

(USE ADDITIONAL SHEETS IF NECESSARY)

30

27cbb

ORIGINAL
File Original, and Duplicate with the STATE ENGINEER, SALEM, OREGON

RECEIVED OCT 10 1956 STATE ENGINEER SALEM, OREGON

WATER WELL DRILLERS REPORT
STATE OF OREGON

Do Not Fill In — State Well No. 1N/2E-27M1 — State Permit No. MULT

(1) OWNER: GS = 120' Well #3

Name CITY OF FAIRVIEW

Address Main and First Street
Block 5, Lot 7, City of Fairview

(2) LOCATION OF WELL:

County Multnomah — Owner's number, if any—

R. F. D. or Street No.

Bearing and distance from section or subdivision corner
From a center point Main & First Sts., north 200 ft., thence 30 ft. east to well

(3) TYPE OF WORK (check):

New well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]

If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic [ ] Industrial [ ] Municipal [X]
Irrigation [ ] Test Well [ ] Other [ ]

(5) EQUIPMENT:

Rotary [ ]
Cable [X]
Dug Well [ ]

(6) CASING INSTALLED:

Threaded [ ] Welded [X]

FROM	ft. to	ft.	Diam.	Gage or Wall
0 "	" 82	"	12 "	Std."
82 "	"800	"	10 "	Std."
"	"	"	"	"
"	"	"	"	"
"	"	"	"	"

Type and size of shoe or well ring

Describe joint weld

If gravel packed

Diameter of Bore	from ft.	to ft.
	"	"
	"	"
	"	"
	"	"
	"	"

Size of gravel:

(7) PERFORATIONS:

Type of perforator used Mills Knife

SIZE of perforations 2" in., length, by 1/4 in.

FROM 320 ft. to 340 ft. perf per foot No. of rows

" " " " " " " " "

4 ross "of 30 each " " " " " "

" " " " " " " " "

" " " " " " " " "

SCREENS:

Give Manufacturer's Name, Model No. and Size

(8) CONSTRUCTION:

Was a surface sanitary seal provided? [X] Yes [ ] No To what depth 82 ft.

Were any strata sealed against pollution? [X] Yes [ ] No
If yes, note depth of strata

FROM 0 ft. to 82 ft.

" " "

METHOD OF SEALING Back fill cuttings

(9) WATER LEVELS:

Depth at which water was first found 10 ft.

Standing level before perforating 90 ft.

Standing level after perforating 90 ft.

Log Accepted by:

[Signed] ..... Dated ....., 19.....
Owner

(10) WELL TESTS: (3/a) 00136 (3)

Was a pump test made? [X] Yes [ ] No If yes, by whom? Bettner

Yield:	gal./min. with	ft. draw down after	hrs.
"	"	"	"
"	"	"	"

Artesian flow ..... g.p.m.

Shut-in pressure ..... lbs. per square inch.

Bailer test none g.p.m. with none ft. drawdown

Temperature of water Was a chemical analysis made? [ ] Yes [X] No

Was electric log made of well? [ ] Yes [X] No

(11) WELL LOG:

Diameter of well, 12 inches.

Total depth 1060 ft. Depth of completed well 1060 ft

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation*

ft. to ft.

" " SEE EXHIBIT "A" ATTACHED

" " Turbine - 4" inch - 10HP

" " Static Level 60'

Ground elevation at well site ..... feet above mean sea level

Work started March 12 19 56 Completed Aug. 12 19 56

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME BARRON & STRAYER (Person, firm, or corporation) James Strayer (Typed or printed)

Address Route 1, Box 254, Beaverton, Oregon

Driller's well number Hal Gossett

[Signed] 35 Hal Gossett (Well Driller)

License No. 191 Dated Sept. 6, 1957

STATE ENGINEER
Salem, Oregon

State Well No. 1N/3-27M1
County MULTNOMAH
Application No.

Well Log

316

Owner: City of Fairview Owner's No.

Driller: Barron & Strayer GS = 120 Date Drilled 1956

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
Troutdale Formation:			
Clay	0	5	5
Boulders and gravel USA	5	20	15
Gravel	20	59	39
Gravel, cemented TGA	59	83	24
Clay, blue CU1	83	105	22
Silt	105	125	20
Gravel, sandy, water-bearing	125	140	15
Gravel, cemented; bottom of 12-in. casing at 182 feet.	140	203	63
Silt TSA	203	265	62
Gravel, clean	265	320	55
Gravel, muddy Screened	320	345	25
Gravel, cemented, static water level 110 ft.	345	360	15
Sandy River Mudstone (?):			
Clay, yellow, sandy	360	380	20
Sand, fine, "heaving" CU2	380	420	40
"Rock" (gravel?), coarse	420	445	25
Silt, sandy	445	495	50
Sand, heaving	495	535	40
Shale, blue S+G	535	540	5
Sand, black	540	560	20
Sand, some gravel	560	575	15
Sand, fine, white; static water level dropped			

(Continued)

Continued--

STATE ENGINEER
Salem, Oregon

State Well No. 1N/3-27M1
County
Application No.

31c

Well Log

Owner: City of Fairview Owner's No.

Driller: Date Drilled

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
to 120 ft. at 585-ft. depth	575	625	50
Gravel, water-bearing	625	626	1
Sand, fine, white	626	670	44
Sand, fine, and gravel	670	690	20
Sandstone, hard, "sharp"	690	705	15
Shale, blue	705	715	10
Sand, fine	715	735	20
Gravel, small, sandy, caving	735	745	10
Clay, gray, sandy	745	755	10
Clay, yellow; bottom of 10-in. casing at 800-ft. depth	755	800	45
Columbia River Basalt:			
Rock, gray, hard; open 10-in. hole below 800-ft. depth	Rx 800	810	10
Rock, broken	810	826	16
Clay	826	827	1
Rock, black, hard	827	850	23
Rock, hard, some blue clay	850	875	25
Rock, black	875	900	25
Clay, blue	900	915	15
Rock, gray	915	920	5
Older rocks:			
Clay, blue; static water level 90 ft.	920	935	15
"Shell," hard	935	937	2

Continued--

STATE ENGINEER
Salem, Oregon

State Well No. 1N/3-27M1
County
Application No.

31 d

Well Log

Owner: City of Fairview Owner's No.

Driller: Date Drilled

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
Clay	937	950	13
"Sand rock," (tuffaceous (?) sandstone), hard, gray	950	965	15
Clay, blue	965	967	2
Sandstone, gray, hard, water-bearing	967	975	8
Rock, hard, black	975	998	23
Clay, red and pink	998	1,002	4
Rock, broken, hard, drilled muddy	1,002	1,030	28
Rock, broken, and blue clay	1,030	1,045	15
Sand, gray, and clay	1,045	1,060	15

STATE ENGINEER
Salem, Oregon

Well Record

STATE WELL NO. 1N/3-27M1
COUNTY MULTNOMAH
APPLICATION NO.

OWNER: City of Fairview

MAILING ADDRESS: 27CBBB2 Alt. 117' Fairview #3

CITY AND STATE: 31e

LOCATION OF WELL: Owner's No.

.....¼ .....¼ Sec. ..... T. ..... N. S., R. ..... E. W., W.M.

Bearing and distance from section or subdivision corner

Altitude at well 130

TYPE OF WELL: Drilled Date Constructed 1956

Depth drilled 1,060 Depth cased 830

Section

CASING RECORD:

12 inch

FINISH:

AQUIFERS: Gravel, Troutdale Formation, from 265 to 345
Sandstone from 967 to 975

WATER LEVEL:
92.7 feet below land surface on July 30, 1958

PUMPING EQUIPMENT: Type ..... H.P. .....
Capacity ..... G.P.M.

WELL TESTS:
Drawdown ..... ft. after ..... hours ..... G.P.M.
Drawdown ..... ft. after ..... hours ..... G.P.M.

USE OF WATER Public Supply Temp. ..... °F. ....., 19.....
SOURCE OF INFORMATION USGS
DRILLER or DIGGER
ADDITIONAL DATA:
Log X Water Level Measurements ..... Chemical Analysis ..... Aquifer Test .....

REMARKS:

Pumped 400 gpm.
Perforated 320-340 feet. — SGA

State Printing 89316

TABLE 2.—*Dri[redacted] logs of representative wells in the East Portland area, Oregon*—Continued

Materials	Thickness (feet)	Depth (feet)
1N/3-23G4		
[Reynolds Metals Co. Drilled by R. J. Strasser Drilling Co., 1949]		
Old well, no record	190	190
Troutdale Formation:		
Silt, sandy, blue	16	206
Sand, hard-packed	21	227
Silt, sandy	11	238
Sand, coarse, and gravel	6	244
Clay, blue	8	252
Sand, hard-packed; some gravel	85	337
Silt, sand and gravel layers	35	372
Clay, sandy	5	377
Sand, hard-packed, and gravel	8	385
Clay and silt, sandy	16	401
Sand, hard-packed	15	416
Clay	5	421
Troutdale Formation—Con.		
Sand, hard-packed	11	432
Clay, sandy, containing some gravel	29	461
Gravel, cemented	11	472
Sand and gravel, water-bearing	10	482
Gravel, cemented	31	513
Sand, clay, and small gravel	7	520
Sand and gravel, water-bearing	12	532
Silt, blue	4	536
Sand and gravel, water-bearing	23	559
Silt and clay; some gravel	28	587
Shale, hard	38	625
1N/3-23K1		
[Reynolds Metals Co. Drilled by R. J. Strasser Drilling Co., 1949 and 1954]		
Artificial fill and younger alluvium:		
Fill and soil	24	24
Younger alluvium:		
Silt and clay	18	42
Sand, brown	12	54
Sand, fine, gray	89	143
Sand, coarse, gray; some clay	13	156
Troutdale Formation:		
Sand, coarse, some gravel, water-bearing	31	187
Sand and clay, gray	43	230
Sand; in part water-bearing	4	234
Sand and clay, blue	31	265
Shale, blue	16	281
Clay and sand	24	305
Sand, fine, containing scattered gravel	47	352
Troutdale Formation—Con.		
Sand and clay, gray	9	361
Shale and sand, black	23	384
Clay, brown	12	396
Sandstone	13	409
Sand and clay, containing some gravel	11	420
Sand, hard-packed, containing some clay	26	446
Clay and gravel	28	474
Clay, sandy	13	487
Sandstone	20	507
Sand and gravel, loose, water-bearing	70	577
Gravel, cemented	20	597
Sand and silt	9	606
Clay, blue, hard	9	615

[redacted]LE 2.—*Drillers' logs of representative wells in the East Portland area, Oregon*—Continued

31f.

Materials	Thickness (feet)	Depth (feet)
1N/3-27M1		
[City of Fairview. Drilled by Barron & Strayer, 1956]		
Troutdale Formation:		
Clay	5	5
Boulders and gravel	15	20
Gravel	39	59
Gravel, cemented	24	83
Clay, blue	22	105
Silt	20	125
Gravel, sandy, water-bearing	15	140
Gravel, cemented; bottom of 12-in. casing at 182 ft	63	203
Silt	62	265
Gravel, clean	55	320
Gravel, muddy	25	345
Gravel, cemented; swl 110 ft	15	360
Sandy River(?) Mudstone:		
Clay, yellow, sandy	20	380
Sand, fine, "heaving"	40	420
"Rock" (gravel?), coarse	25	445
Silt, sandy	50	495
Sand, heaving	40	535
Shale, blue	5	540
Sand, black	20	560
Sand; some gravel	15	575
Sand, fine, white; swl dropped to 120 ft at 585-ft depth	50	625
Gravel, water-bearing	1	626
Sand, fine, white	44	670
Sand, fine, and gravel	20	690
Sandstone, hard, "sharp"	15	705
Shale, blue	10	715
Sandy River(?) Mudstone—Con.		
Sand, fine	20	735
Gravel, small, sandy, caving	10	745
Clay, gray, sandy	10	755
Clay, yellow; bottom of 10-in. casing at 800-ft depth	45	800
Columbia River Basalt:		
Rock, gray, hard; open 10-in. hole below 800-ft depth	10	810
Rock, broken	16	826
Clay	1	827
Rock, black, hard	23	850
Rock, hard; some blue clay	25	875
Rock, black	25	900
Clay, blue	15	915
Rock, gray	5	920
Older rocks:		
Clay, blue; swl 90 ft	15	935
"Shell," hard	2	937
Clay	13	950
"Sand rock," (tuffaceous(?) sandstone), hard, gray	15	965
Clay, blue	2	967
Sandstone, gray, hard, water-bearing	8	975
Rock, hard, black	23	998
Clay, red and pink	4	1,002
Rock, broken, hard; drilled muddy	28	1,030
Rock, broken, and blue clay	15	1,045
Sand, gray, and clay	15	1,060
1N/3-34N1		
[Carl Zimmerman. Drilled by Steinman Bros. Drilling Co., 1944]		
Fluviolacustrine deposits:		
Gravel and boulders	11	11
Gravel	26	37
Gravel and boulders	8	45
Gravel; water bearing at 55 ft	25	70
Clay, sandy	15	85
Troutdale Formation:		
Gravel, cemented, water bearing	35	120
Gravel, fine, and coarse sand	10	130
Clay, sandy, yellow	2	132
1/1-1Q1		
[Sunnybrook Farm. Drilled by A.M. Jannsen Drilling Co., 1945]		
Fluviolacustrine deposits:		
Sand	80	80
Sand and gravel	5	85
Boring(?) Lava:		
Black lava rock(?)	13	98
Sand	2	100
Boring(?) Lava—Continued		
Rock(?)	10	110
Troutdale Formation:		
Sand and gravel	33	143
Sand, brown; some clay	9	152
Sand and gravel	4	156

RECORDER'S OFFICE

IN/3-27M(1)
MULT.

CITY OF FAIRVIEW
OREGON

NURSERIES, FRUIT AND DAIRYING INDUSTRIES

31g

July 18, 1958

City of Fairview Well #3

State Engineer
Salem, Oregon

Attention: Jack Sceva, Geoligist

Dear Mr. Sceva:

In reply to your letter bearing file #G-529 in regards to re-perforating our well by Hakkon Bottner.

Mr. Bottner reperforated this well with 765 perforations. Perforating was done between the 275 foot and 340 foot levels.

Test Pumping was done over a two day period with the following results:

Static water level before reperforation----------93 feet
Static water level after reperforation----------87 feet

340 G.P.M.	- - -	-11	foot	draw	down
380 G.P.M.	- - -	-13	"	"	"
430 "	- - -	-15	"	"	"
480 "	- - -	-17½	"	"	"
580 "	- - -	-22½	"	"	"
780 "	- - -	-38	"	"	"
850 "	- - -	-45	"	"	"

850 G.P.M. was the capacity of the test pump used by Mr. Bottner

Enclosed find Form B and Form C, covering completion and application of this well.

Sincerely

Thomas L Shaw

Thomas L. Shaw
Water Superintendent

31b

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

MULT 3104

RECEIVED
JUL 28 1992
WATER RESOURCES DEPT.
SALEM OREGON

1N/3E/27c

(START CARD) # 37319

(1) OWNER: Well Number 6-NEW
Name CITY OF FAIRVIEW
Address 300 HARRISON ST.
City FAIRVIEW State OR Zip 97024

(2) TYPE OF WORK:
[XX] New Well [ ] Deepen [ ] Recondition [ ] Abandon

(3) DRILL METHOD:
[ ] Rotary Air [ ] Rotary Mud [XX] Cable
[ ] Other

(4) PROPOSED USE:
[ ] Domestic [XX] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [ ] Yes [XX] No Depth of Completed Well 314 ft.
Explosives used [ ] Yes [XX] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
24	0	28	CEMENT	0	157	209
16	28	100				
14	100	157				
10	157	322				

How was seal placed: Method [ ] A [ ] B [XX] C [ ] D [ ] E
[ ] Other
Backfill placed from ft. to ft. Material
Gravel placed from 188 ft. to 314 ft. Size of gravel 6-9 & 10-20 GCS

CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	10	+2	200	.250	XX		XX	
	10	301	322	.365	XX		XX	
Liner:								

Final location of shoe(s) 322

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method V-WIRE
[XX] Screens Type JOHNSON Material STAINLESS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
201	216	.060		6"	P/S		
236	256	.060		6"	P/S		
265	301	.030		5"	P/S		
6" BLANK PIPE W/K PACKER FROM 189-201							
6" BLANK PIPE FROM 216-236							
5" BLANK PIPE FROM 256-265							
5" TAIL PIPE FROM 301-314							

(8) WELL TESTS: Minimum testing time is 1 hour
[XX] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
500	56		5 hr.
500	60		12 HR
360	45		24 HR

Temperature of Water 56 Depth Artesian Flow Found
Was a water analysis done? [XX] Yes By whom COFFEE LABS
Did any strata contain water not suitable for intended use? [ ] Too little
[ ] Salty [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County MULTNOMAH Latitude Longitude
Township 1N N or S. Range 3E E or W. WM.
Section 27 SW ¼ ¼
Tax Lot Lot 7 Block Subdivision SHAES
Street Address of Well (or nearest address) 199 CRESTWOOD ST.

(10) STATIC WATER LEVEL:
102 ft. below land surface. Date 7-3-92
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 28

From	To	Estimated Flow Rate	SWL
200	300	350-500	102

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
CRUSHED ROCK & DIRT	0	1	
SILTY SOIL	1	7	
SILTY SOIL W/LARGE BOULDERS	7	10	
CEMENTED COBBLES & GRAVEL BRN	10	21	
GRAVEL GREY LOOSLY CEMENTED	21	42	
GRAVEL & COBBLES TIGHTLY CEMTD	42	81	
GRAVEL & CLAY GREY	81	86	
CLAY GREY	86	101	
SANDSTONE BLACK	101	126	
SANDSTONE BLACK W/GRAVEL	125	128	
SANDSTONE BLACK	128	140	
SANDSTONE BLK W/STRKS OF GRN GREY CLAY	140	144	
SANDSTONE BLACK	144	157	
SANDSTONE GRAVEL CONGLOMERATE BRN CEMENTED	157	164	
SAND BRN	164	165	
SAND & GRAVEE BRN CEMENTED	165	194	
GRAVEL CARAMEL BRN W/SAND GREY GRN W/MICA CEMENTED	194	201	
GRAVEL GREY, BRN, TAN W/SAND & MICA LAYERS OF LOOSE & LOOSLY CEMENTED.	201	207	←

Date started Completed

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed Daniel R. Stadeli WWC Number 148
Date 7-20-92

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

Signed Steven M. Stadeli WWC Number 688
Date 7-20-92

Mult 3104

RECEIVED
JUL 28 1992
WATER RESOURCES DEPT.
SALEM, OREGON

1N/3E/27C
32b

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

(START CARD) # 37319

(1) OWNER: Well Number 6-NEW
Name CITY OF FAIRVIEW
Address 300 HARRISON ST.
City FAIRVIEW State OR Zip 97024

(2) TYPE OF WORK:
☐ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☐ No Depth of Completed Well ____ ft.
Explosives used ☐ Yes ☐ No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from ____ ft. to ____ ft. Material
Gravel placed from ____ ft. to ____ ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

Temperature of Water Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County MULTNOMAH Latitude Longitude
Township 1N N or S. Range 3E E or W. WM.
Section 27 SW ¼ ¼
Tax Lot Lot 7 Block Subdivision SHAES
Street Address of Well (or nearest address) 199 CRESTWOOD ST.

(10) STATIC WATER LEVEL:
ft. below land surface. Date
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found

From	To	Estimated Flow Rate	SWL

(12) WELL LOG:
Ground elevation

Material	From	To	SWL
SAND & GRAVEL BRN GREY CEMENTED	207	218	
VERY FINE SILTY SAND W/MICA & SOME GRAVEL TAN	218	226	
FINE TO MED FINE TAN-BRN SAND W/MICA & SOME SILT	226	234	
LARGE COBBLES & GRAVEL CEMENTED W/COURSE ANGULAR SAND & SOME MICA	234	257	
CEMENTED SAND VERY COURSE W/SOME GRAVEL FINE	257	258	
SAND BRN,GREY,WHITE VERY FINE W/SOME SILT	258	263	SA
GRAVEL SMALL TO MED COURSE GRY BRN W/SAND LOOSLY CEMENTED	263	265	
SAND BRN GRY MED TO FINE W/MICA SOME SILT	265	282	
SAND BRN/GRY MED TO COURSE W/ MICA	282	284	
SAND COURSE, ANGULAR W/SMALL GRAVEL CEMENTED	284	287	
GRAVEL & SAND MED COURSE CMTD	287	312	
CLAY GREY SANDY	312	322	CU

Date started Completed

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed Daniel R. Stadeli WWC Number 148
Date 7-20-92

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

Signed Steven N. Stadeli WWC Number 68
Date 7-20-92

STATE ENGINEER
Salem, Oregon

MULT

Well Record

001360

GR- 1588

STATE WELL NO. 1N/3-27H
COUNTY Multnomah
APPLICATION NO. GR- 1442

OWNER: Fairview Farms Inc.

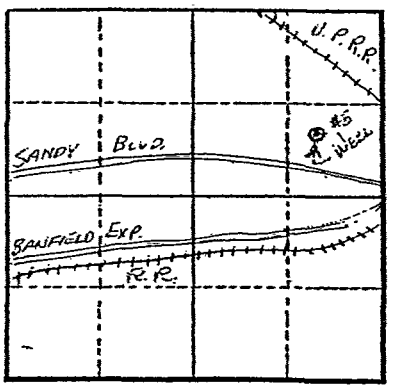
MAILING ADDRESS: Rt. 2, Box 40

CITY AND STATE: Troutdale, Oregon

LOCATION OF WELL: Owner's No. #5

SE ¼ NE ¼ Sec. 27 T. 1 N., R. 3 E., W.M.

Bearing and distance from section or subdivision corner For location see sketch on map



Altitude at well 60'

TYPE OF WELL: Drilled Date Constructed 1940

Depth drilled 275' Depth cased 275'

Section 27

CASING RECORD:

12" from 0 to 84 ft.
10" from 51 to 103 ft.
8" from 103 to 275 ft.

FINISH:

Perforated: 12" from 53 to 63 ft.
12" from 65 to 75 ft.
10" from 65 to 75 ft.
8" from 195 to 220 ft.
8" from 240 to 263 ft.

AQUIFERS:

WATER LEVEL:

35'

PUMPING EQUIPMENT: Type Pomona turbine H.P. 30
Capacity 400 G.P.M.

WELL TESTS:

Drawdown 60 ft. after hours 400 G.P.

Drawdown ft. after hours G.P.

USE OF WATER Dom., Irrigation & Manuf. Temp. °F., 19

SOURCE OF INFORMATION GR Record

DRILLER or DIGGER

ADDITIONAL DATA:

Log X Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

Irrigation of 110 acres.

State Printing 89316

STATE ENGINEER
Salem, Oregon

State Well No. 1N/3-27H
County Multnomah
Application No. GR-1442

Well Log

336

Owner: Fairview Farms Inc. Owner's No. #5

Driller: Date Drilled 1940

CHARACTER OF MATERIAL	(Feet below land surface) From	To	Thickness (feet)
Gravel, sandstone & boulders	0	38	38
Sand	38	51	13
Gravel with some water ←	51	75	24
Cement gravel	75	155	80
Gravel with binder	155	174	19
Fine sand & silt	174	179	5
Tight gravel	179	187	8
Sand & gravel	187	198	11
Cement gravel	198	205	7
Pea gravel trace of water	205	212	7
Cement gravel	212	246	34
Yellow sand & gravel - water ←	246	262	16
White sand & silt	262	267	5
Cement gravel	267	275	8

STATE ENGINEER
Salem, Oregon

MULT
001362

Well Record

GR- 1585

STATE WELL NO. 1N/3-27H
COUNTY Multnomah
APPLICATION NO. GR- 143

OWNER: Fairview Farms Inc.

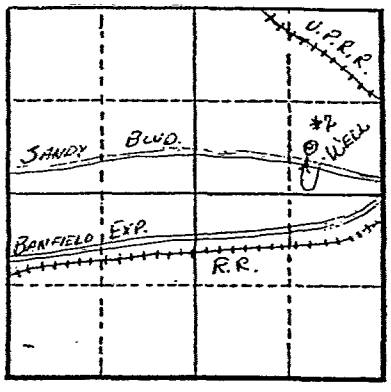
MAILING ADDRESS: Rt. 2, Box 40

CITY AND STATE: Troutdale, Oregon

LOCATION OF WELL: Owner's No. #2

SE ¼ NE ¼ Sec. 27 T. 1 N., R. 3 E., W.M.

Bearing and distance from section or subdivision corner For location see sketch on map



Altitude at well 60'

TYPE OF WELL: Drilled Date Constructed 1939

Depth drilled 408' Depth cased 150'

Section 27

CASING RECORD:
12"

FINISH:
Perforated: from 66 to 75 ft.
from 76 to 83 ft.

AQUIFERS:

WATER LEVEL:
30'

PUMPING EQUIPMENT: Type Pomona turbine H.P. 20
Capacity 200 G.P.M.

WELL TESTS:
Drawdown 35 ft. after hours 800 G.P
Drawdown ft. after hours G.P

USE OF WATER Dom., Irrigation & Manuf. Temp. °F. , 19.
SOURCE OF INFORMATION GR Record
DRILLER or DIGGER
ADDITIONAL DATA:
Log Water Level Measurements Chemical Analysis Aquifer Test

REMARKS: First 166 ft. unknown

Log:	Cemented gravel	167 to 274 ft.
	Yellow clay	274 to 278 ft.
	Dark binder in gravel	278 to 324 ft.
	Green sand stone	324 to 346 ft.
	Gray sand stone	346 to 392 ft.
	Cemented gravel	392 to 408 ft.

Irrigation of 2 acres.

State Printing 89316

STATE ENGINEER
Salem, Oregon

Well Record

GR- 1584

STATE WELL NO. 1N/3-27H
COUNTY Multnomah
APPLICATION NO. GR- 1438

OWNER: Fairview Farms Inc.

MAILING ADDRESS: Rt. 2, Box 40

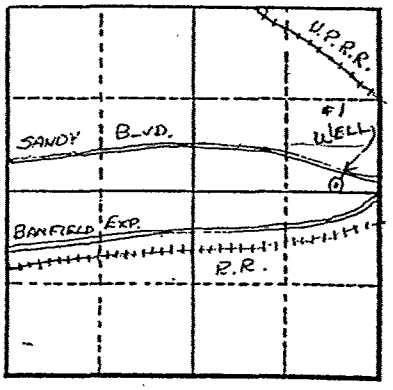
35

LOCATION OF WELL: Owner's No. #1

CITY AND STATE: Troutdale, Oregon

SE ¼ NE ¼ Sec. 27 T. 1 ~~S.~~ N. R. 3 ~~W.~~ E. W.M.

Bearing and distance from section or subdivision corner For location see sketch on map ----



Altitude at well 65'

TYPE OF WELL: Drilled Date Constructed 1954

Depth drilled 182' Depth cased 162'

Section 27

CASING RECORD:
8"

FINISH:
Perforated: from 139' to 143'
from 143' to 150'

AQUIFERS:

WATER LEVEL:

PUMPING EQUIPMENT: Type Peerless turbine H.P. 10
Capacity 100 G.P.M.

WELL TESTS:
Drawdown 85 ft. after hours 110 G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Dom., Irrigation & Manuf. Temp. °F. , 19
SOURCE OF INFORMATION GR Record
DRILLER or DIGGER
ADDITIONAL DATA:
Log Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

Log:		
	Top soil	0 to 6 ft.
	Yellow clay	6 to 14 ft.
	Yellow clay & boulders	14 to 29 ft.
	Blue clay, sand & silt	29 to 137 ft.
	Gravel	137 to 150 ft.
	Gravel with binder	150 to 160 ft.
	Brown clay	160 to 164 ft.
	Cemented gravel	164 to 182 ft.

State Printing 89316

Irrigation of 10 acres

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED MAY 12 1971 STATE ENGINEER SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

GS=142 27DC

MULT State Well No. 1N/3-27

901358 State Permit No. ~~33~~ ~~36~~ 36

(1) OWNER:
Name Gordon Coulsey
Address 23160 N. E. Halsey, Portland, Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED: Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 67 ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? ☐ Yes ☒ No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "
Bailer test 20 gal./min. with 45 ft. drawdown after 2 hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Bentonite
Well sealed from land surface to 19 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 0 sacks
Number of sacks of bentonite used in well seal 2 sacks
Brand name of bentonite Well Gel
Number of pounds of bentonite per 100 gallons of water 25 lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Multnomah Driller's well number
¼ ¼ Section 27 T. 1 N R. 3 E. W.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 40
Static level 10 ft. below land surface. Date 5/3/7
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 6"
Depth drilled 72 ft. Depth of completed well 72

Formation: Describe color, texture, grain size and structure of materia and show thickness and nature of each stratum and aquifer penetrate with at least one entry for each change of formation. *Report each change position of Static Water Level and indicate principal water-bearing stra*

MATERIAL	From	To	SWL
Top soil	0	2	
Silty brown sand	2	4	
Boulders	4	8	
Cemented gravel, occ.boulder	8	40	
Sand & gravel, occ.boulder	40	72	

67
72 [illegible]

Work started 4/16/71 19 Completed 5/3/71 19
Date well drilling machine moved off of well 5/4/71 19

Drilling Machine Operator's Certification:
This well was constructed under my direct supervisic Materials used and information reported above are true to r best knowledge and belief.
[Signed] [signature] (Drilling Machine Operator) Date 5/10/71 19
Drilling Machine Operator's License No. 523

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.
Name A. M. Jannsen Drilling Co. (Person, firm or corporation) (Type or print)
Address 21075 S. W. Tualatin Valley Highway Aloha, Oregon
[Signed] [signature] (Water Well Contractor)
Contractor's License No. 79 Date 5/10/71, 19

STATE ENGINEER
Salem, Oregon

MULT
001359

Well Record

STATE WELL NO. 1N/3-27F
COUNTY Multnomah
~~APPLICATION NO.~~ GR-3339

OWNER: William Alan Townsend and Florence M. Townsend

MAILING ADDRESS: Route 2, Box 111 (37)

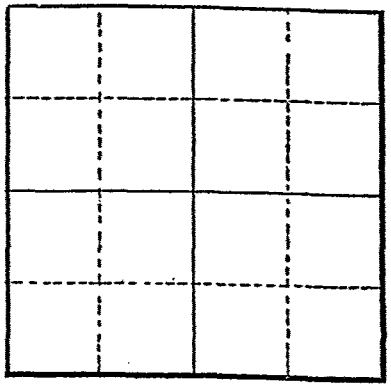
CITY AND STATE: Troutdale, Oregon

LOCATION OF WELL: Owner's No.

SE ¼ NW ¼ Sec. 27 T. 1 ~~S.~~ N. R. 3 ~~W.~~ E., W.M.

Bearing and distance from section or subdivision corner 900' N. and 500' W.

Altitude at well



TYPE OF WELL: drilled Date Constructed 1939

Depth drilled 76' Depth cased 60'

Section

CASING RECORD:

6"

FINISH:

perforations

AQUIFERS:

sandy loam, sand rock, gravel

WATER LEVEL:

25'

PUMPING EQUIPMENT: Type Jacuzzi H.P. 10
Capacity 150 G.P.M.

WELL TESTS:
Drawdown 15 ft. after hours pumping 150 G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Dairy & Irrigation Temp. °F., 19
SOURCE OF INFORMATION GR-3093
DRILLER or DIGGER
ADDITIONAL DATA:
Log x Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

Sandy Loam	12
Layer Sand Rock	4 to 6
Gravel Material	to bottom 72'

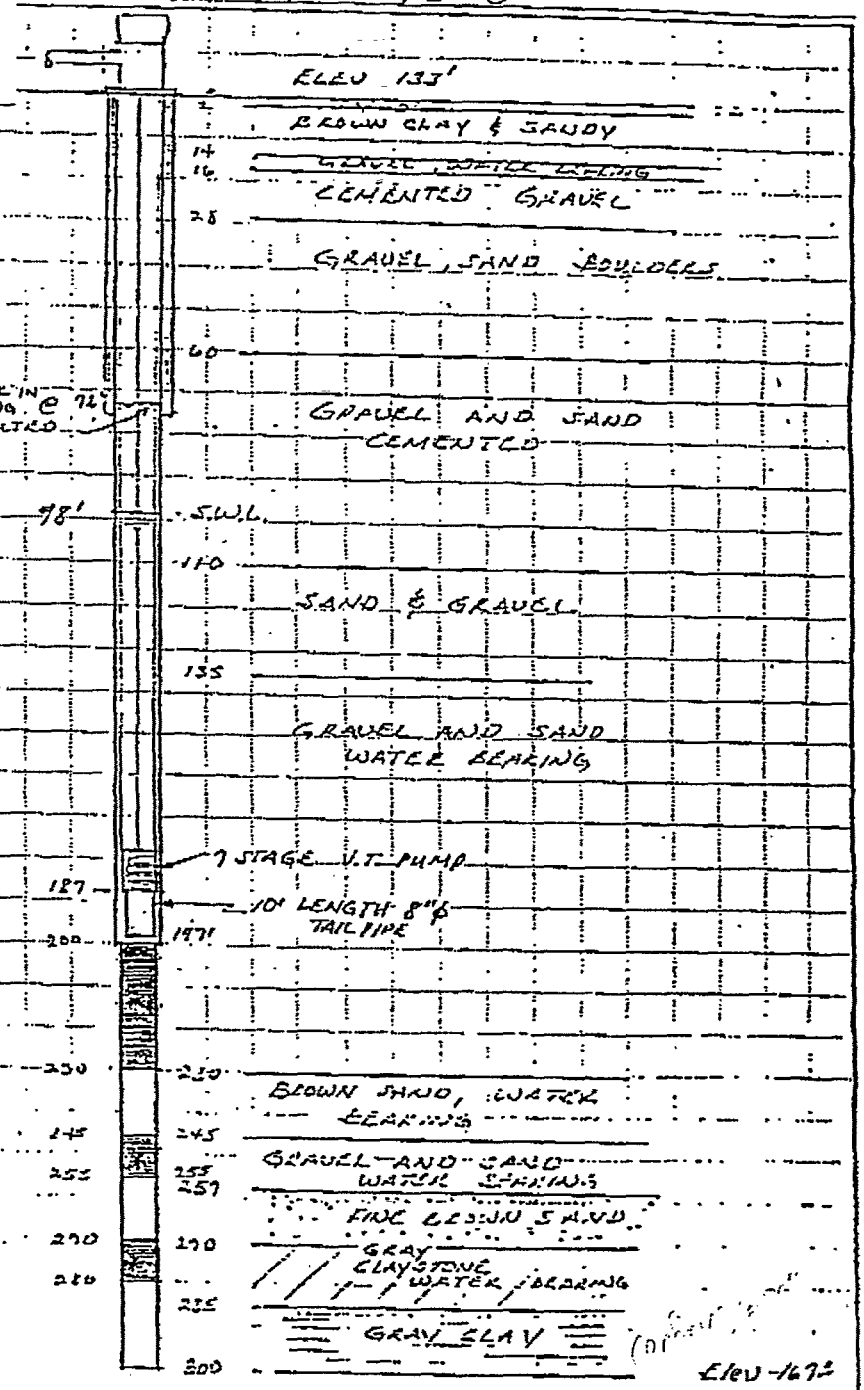
State Printing 89316

27 days (38)

CENTURY WEST ENGINEERING CORPORATION
PLANNERS ENGINEERS SCIENTISTS
Suite 1222
One S.W. Columbia Street
Portland, Oregon 97258
Phone (503) 224-9430
James E. Baker, P.E.
Project Manager

JOB Wood Village - Well No. 3 (235th & Halsey)
SHEET NO. ____ OF ____
CALCULATED BY JEB DATE 01/21/85
CHECKED BY ____ DATE ____
SCALE 1" = 40'-0"

Present well output @ 700-800 gpm



This represents what I believe was built from data received
Jim Baker 2/15/85

TD = 300'

Installed in 1980

JOHNSON 4" IOP WELL SCREEN.

APPENDIX E

Summary of Analytical Data

This appendix contains two tables. Table E-1 lists all site monitoring wells sorted by the area of the plant in which they are located. Table E-2 is a data summary of the constituents detected in groundwater in each area and groundwater zone. This summary presents simple statistics for each constituent, including the maximum, minimum, frequency of detection, arithmetic mean, and geometric mean.

Table E-1
Monitoring Wells Associated with Site Areas
Reynolds Metals Company - Troutdale Oregon

Site Area	Monitoring Wells Used to Evaluate Water Quality in Site
Bakehouse	MW28, MW40, MW41, MW42, MW43, MW44, MW45, MW46
Columbia and Sandy Rivers	MW08, MW10, MW51, MW52, and MW53
Company Lake	MW06, MW07, MW20, MW22, MW27, MW29, MW30, MW31
Cryolite Ponds	MW01, MW19, MW47, MW50
East Potliner	MW11, MW34, MW35
Fairview Farms	MW31, MW39, FF04
North Landfill	MW09, MW20, MW21, MW22, MW23
Scrap Yard	MW02, MW13, MW14, MW24, MW25, MW49
South Ditch	MW01, MW04, MW11, MW16, MW25, MW35, MW47
South Landfill	MW03, MW16, MW19, MW26
South Wetlands	MW04, MW17, MW18, MW36, MW37, MW38
VOC Area	MW28, MW32, MW33, MW48
Western Extent	MW06, MW12, MW15, MW30, MW31, MW39, FF04

Abbreviations:
FF = Fairview Farms
MW = monitoring well
PW = production well
VOC = volatile organic compound

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
Bakehouse	Silt	CONV	Fluoride by Field	mg/L	19	20	0.95	0.4	0.4	0.68	20.2	9.18	5.54
Bakehouse	Silt	M-TOTAL	Aluminum	mg/L	1	1	1.00			0.067	0.067	0.0670	0.0670
Bakehouse	Silt	M-TOTAL	Barium	mg/L	1	1	1.00			0.03809	0.03809	0.0381	0.0381
Bakehouse	Silt	M-TOTAL	Iron	mg/L	1	1	1.00			2.83	2.83	2.83	2.83
Bakehouse	UGS	CONV	Fluoride by Field	mg/L	28	28	1.00			0.57999	22	4.91	2.40
Bakehouse	UGS	M-TOTAL	Aluminum	mg/L	2	2	1.00			0.05359	0.12399	0.0888	0.0815
Bakehouse	UGS	M-TOTAL	Arsenic	mg/L	1	2	0.50	0.004	0.004	0.0086	0.0086	0.0053	0.0041
Bakehouse	UGS	M-TOTAL	Barium	mg/L	1	2	0.50	0.01999	0.01999	0.03779	0.03779	0.0239	0.0194
Bakehouse	UGS	M-TOTAL	Copper	mg/L	1	2	0.50	0.002	0.002	0.002	0.002	0.0015	0.0014
Bakehouse	UGS	M-TOTAL	Iron	mg/L	1	2	0.50	0.1	0.1	1.22	1.22	0.6350	0.2470
Bakehouse	UGS	M-TOTAL	Lead	mg/L	1	2	0.50	0.001	0.001	0.0041	0.0041	0.0023	0.0014
Bakehouse	UGS	M-TOTAL	Selenium	mg/L	1	2	0.50	0.00499	0.00499	0.00499	0.00499	0.0037	0.0035
Bakehouse	UGS	M-TOTAL	Silver	mg/L	1	2	0.50	0.003	0.003	0.003	0.003	0.0023	0.0021
Bakehouse	UGS	VOC	1,1,1-Trichloroethane	mg/L	2	3	0.67	0.001	0.001	0.0002	0.002	0.0009	0.0006
Bakehouse	UGS	VOC	Tetrachloroethene	mg/L	3	3	1.00			0.00069	0.002	0.0013	0.0012
Bakehouse	UGS	VOC	Toluene	mg/L	1	3	0.33	0.001	0.001	0.00018	0.00018	0.0004	0.0004
Bakehouse	Deep	CONV	Chloride	mg/L	1	1	1.00			5.5	5.5	5.50	5.50
Bakehouse	Deep	CONV	Hardness, Total	mg/L	1	1	1.00			89	89	89.0	89.0
Bakehouse	Deep	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			168	168	168	168
Bakehouse	Deep	M-TOTAL	Barium	mg/L	3	4	0.75	0.01999	0.01999	0.0225	0.032	0.0231	0.0212
Bakehouse	Deep	M-TOTAL	Calcium	mg/L	1	1	1.00			20.2	20.2	20.2	20.2
Bakehouse	Deep	M-TOTAL	Iron	mg/L	4	4	1.00			1.82	3.98	2.84	2.70
Bakehouse	Deep	M-TOTAL	Magnesium	mg/L	1	1	1.00			8.32	8.32	8.32	8.32
Bakehouse	Deep	M-TOTAL	Manganese	mg/L	1	1	1.00			1.19	1.19	1.19	1.19
Bakehouse	Deep	M-TOTAL	Potassium	mg/L	1	1	1.00			3.48	3.48	3.48	3.48
Bakehouse	Deep	M-TOTAL	Sodium	mg/L	1	1	1.00			7.12	7.12	7.12	7.12
Bakehouse	Deep	VOC	Toluene	mg/L	1	2	0.50	0.001	0.001	0.001	0.001	0.0008	0.0007
Columbia and Sandy Rivers	Silt	M-TOTAL	Aluminum	mg/L	3	3	1.00			0.165	0.24799	0.1977	0.1946
Columbia and Sandy Rivers	Silt	M-TOTAL	Barium	mg/L	1	1	1.00			0.0599	0.0599	0.0599	0.0599
Columbia and Sandy Rivers	Silt	M-TOTAL	Chromium	mg/L	1	3	0.33	0.00999	0.00999	0.0141	0.0141	0.0080	0.0071
Columbia and Sandy Rivers	Silt	M-TOTAL	Iron	mg/L	1	1	1.00			0.397	0.397	0.3970	0.3970
Columbia and Sandy Rivers	UGS	CONV	Chloride	mg/L	1	1	1.00			13.8	13.8	13.8	13.8
Columbia and Sandy Rivers	UGS	CONV	Fluoride by 300.0	mg/L	3	3	1.00			2.47	3.75	3.24	3.19
Columbia and Sandy Rivers	UGS	CONV	Fluoride by Field	mg/L	10	10	1.00			2.49	10.8	5.37	4.42
Columbia and Sandy Rivers	UGS	CONV	Hardness, Total	mg/L	1	1	1.00			55	55	55.0	55.0
Columbia and Sandy Rivers	UGS	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			143	143	143	143
Columbia and Sandy Rivers	UGS	CONV	Sulfate	mg/L	1	1	1.00			4.9	4.9	4.90	4.90
Columbia and Sandy Rivers	UGS	M-DISS	Aluminum, Dissolved	mg/L	2	2	1.00			0.01629	0.07389	0.0451	0.0347
Columbia and Sandy Rivers	UGS	M-DISS	Iron, Dissolved	mg/L	4	4	1.00			7	12.7	9.71	9.34
Columbia and Sandy Rivers	UGS	M-DISS	Manganese, Dissolved	mg/L	4	4	1.00			0.407	0.666	0.5400	0.5258
Columbia and Sandy Rivers	UGS	M-TOTAL	Aluminum	mg/L	6	10	0.60	0.05	0.05	0.07469	0.53899	0.1810	0.0929
Columbia and Sandy Rivers	UGS	M-TOTAL	Barium	mg/L	2	4	0.50	0.01999	0.01999	0.0263	0.02759	0.0185	0.0164

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
Columbia and Sandy Rivers	UGS	M-TOTAL	Beryllium	mg/L	3	10	0.30	0.0003	0.001	0.00036	0.0006	0.0003	0.0003
Columbia and Sandy Rivers	UGS	M-TOTAL	Calcium	mg/L	1	1	1.00			13.6	13.6	13.6	13.6
Columbia and Sandy Rivers	UGS	M-TOTAL	Copper	mg/L	4	8	0.50	0.001	0.002	0.00139	0.0037	0.0019	0.0015
Columbia and Sandy Rivers	UGS	M-TOTAL	Iron	mg/L	4	8	0.50	0.1	0.1	6.93	13.1	4.94	0.6857
Columbia and Sandy Rivers	UGS	M-TOTAL	Lead	mg/L	1	10	0.10	0.0008	0.001	0.0175	0.0175	0.0022	0.0007
Columbia and Sandy Rivers	UGS	M-TOTAL	Magnesium	mg/L	1	1	1.00			5.78	5.78	5.78	5.78
Columbia and Sandy Rivers	UGS	M-TOTAL	Manganese	mg/L	4	5	0.80	0.01999	0.01999	0.39599	0.669	0.4336	0.2373
Columbia and Sandy Rivers	UGS	M-TOTAL	Potassium	mg/L	1	1	1.00			1.74	1.74	1.74	1.74
Columbia and Sandy Rivers	UGS	M-TOTAL	Sodium	mg/L	1	1	1.00			17.2	17.2	17.2	17.2
Columbia and Sandy Rivers	Intermediate	CONV	Chloride	mg/L	1	1	1.00			13.8	13.8	13.8	13.8
Columbia and Sandy Rivers	Intermediate	CONV	Fluoride by 300.0	mg/L	2	2	1.00			0.25999	0.27	0.2650	0.2649
Columbia and Sandy Rivers	Intermediate	CONV	Hardness, Total	mg/L	1	1	1.00			80	80	80.0	80.0
Columbia and Sandy Rivers	Intermediate	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			162	162	162	162
Columbia and Sandy Rivers	Intermediate	CONV	Sulfate	mg/L	1	1	1.00			7.73	7.73	7.73	7.73
Columbia and Sandy Rivers	Intermediate	M-DISS	Iron, Dissolved	mg/L	2	2	1.00			24.1	26.6	25.4	25.3
Columbia and Sandy Rivers	Intermediate	M-DISS	Manganese, Dissolved	mg/L	2	2	1.00			0.888	0.92699	0.9075	0.9073
Columbia and Sandy Rivers	Intermediate	M-TOTAL	Arsenic	mg/L	1	10	0.10	0.004	0.004	0.00089	0.00089	0.0019	0.0018
Columbia and Sandy Rivers	Intermediate	M-TOTAL	Barium	mg/L	1	5	0.20	0.01999	0.01999	0.05389	0.05389	0.0188	0.0140
Columbia and Sandy Rivers	Intermediate	M-TOTAL	Calcium	mg/L	1	1	1.00			19.5	19.5	19.5	19.5
Columbia and Sandy Rivers	Intermediate	M-TOTAL	Iron	mg/L	7	7	1.00			0.58499	27.1	11.5	3.25
Columbia and Sandy Rivers	Intermediate	M-TOTAL	Magnesium	mg/L	1	1	1.00			7.25	7.25	7.25	7.25
Columbia and Sandy Rivers	Intermediate	M-TOTAL	Manganese	mg/L	3	3	1.00			0.236	0.92299	0.6833	0.5790
Columbia and Sandy Rivers	Intermediate	M-TOTAL	Potassium	mg/L	1	1	1.00			3.02	3.02	3.02	3.02
Columbia and Sandy Rivers	Intermediate	M-TOTAL	Sodium	mg/L	1	1	1.00			15.9	15.9	15.9	15.9
Columbia and Sandy Rivers	Intermediate	VOC	Toluene	mg/L	1	2	0.50	0.001	0.001	0.004	0.004	0.0023	0.0014
Columbia and Sandy Rivers	Deep	CONV	Chloride	mg/L	1	1	1.00			38	38	38.0	38.0
Columbia and Sandy Rivers	Deep	CONV	Hardness, Total	mg/L	1	1	1.00			108	108	108	108
Columbia and Sandy Rivers	Deep	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			188	188	188	188
Columbia and Sandy Rivers	Deep	CONV	Sulfate	mg/L	1	1	1.00			0.75	0.75	0.7500	0.7500
Columbia and Sandy Rivers	Deep	M-TOTAL	Aluminum	mg/L	1	7	0.14	0.05	0.05	0.0649	0.0649	0.0307	0.0287
Columbia and Sandy Rivers	Deep	M-TOTAL	Beryllium	mg/L	1	7	0.14	0.0003	0.0003	0.0006	0.0006	0.0002	0.0002
Columbia and Sandy Rivers	Deep	M-TOTAL	Calcium	mg/L	1	1	1.00			29.1	29.1	29.1	29.1
Columbia and Sandy Rivers	Deep	M-TOTAL	Iron	mg/L	5	5	1.00			0.15399	0.287	0.2246	0.2175
Columbia and Sandy Rivers	Deep	M-TOTAL	Magnesium	mg/L	1	1	1.00			8.85	8.85	8.85	8.85
Columbia and Sandy Rivers	Deep	M-TOTAL	Manganese	mg/L	1	1	1.00			0.164	0.164	0.1640	0.1640
Columbia and Sandy Rivers	Deep	M-TOTAL	Potassium	mg/L	1	1	1.00			2.86	2.86	2.86	2.86
Columbia and Sandy Rivers	Deep	M-TOTAL	Sodium	mg/L	1	1	1.00			17.6	17.6	17.6	17.6
Columbia and Sandy Rivers	Deep	VOC	Toluene	mg/L	2	2	1.00			0.001	0.004	0.0025	0.0020
Company Lake	Silt	CONV	Chloride	mg/L	4	4	1.00			1.82	4.19	2.81	2.66
Company Lake	Silt	CONV	Cyanide, Total	mg/L	1	8	0.13	0.00999	0.01999	0.05099	0.05099	0.0139	0.0103
Company Lake	Silt	CONV	Hardness, Total	mg/L	4	4	1.00			47	95	69.8	66.2
Company Lake	Silt	CONV	Nitrate-N	mg/L	4	4	1.00			0.69999	4.5	2.49	1.90

Table E-2
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Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
Company Lake	Silt	CONV	Solids, Total Dissolved	mg/L	4	4	1.00			119	208	161	156
Company Lake	Silt	CONV	Sulfate	mg/L	4	4	1.00			2.87	10.3	6.21	5.28
Company Lake	Silt	M-TOTAL	Aluminum	mg/L	1	8	0.13	0.05	0.05	0.103	0.103	0.0348	0.0298
Company Lake	Silt	M-TOTAL	Barium	mg/L	3	7	0.43	0.01999	0.01999	0.02339	0.0252	0.0160	0.0146
Company Lake	Silt	M-TOTAL	Calcium	mg/L	4	4	1.00			9.23	19.4	14.0	13.3
Company Lake	Silt	M-TOTAL	Iron	mg/L	1	8	0.13	0.1	0.1	0.156	0.156	0.0633	0.0576
Company Lake	Silt	M-TOTAL	Lead	mg/L	1	7	0.14	0.001	0.001	0.001	0.001	0.0006	0.0006
Company Lake	Silt	M-TOTAL	Magnesium	mg/L	4	4	1.00			5.36	11	8.06	7.66
Company Lake	Silt	M-TOTAL	Potassium	mg/L	4	4	1.00			1.52	2.08	1.73	1.72
Company Lake	Silt	M-TOTAL	Sodium	mg/L	4	4	1.00			5.91	15	10.5	9.51
Company Lake	UGS	CONV	Chloride	mg/L	4	4	1.00			2	32.2	10.2	4.90
Company Lake	UGS	CONV	Fluoride by 300.0	mg/L	4	4	1.00			0.68	3.76	2.13	1.58
Company Lake	UGS	CONV	Fluoride by Field	mg/L	16	20	0.80	0.4	0.4	0.40999	20.5	7.42	2.50
Company Lake	UGS	CONV	Hardness, Total	mg/L	4	4	1.00			49	80	62.8	61.8
Company Lake	UGS	CONV	Nitrate-N	mg/L	2	4	0.50	0.05	0.1	0.1	0.52999	0.1762	0.0902
Company Lake	UGS	CONV	Solids, Total Dissolved	mg/L	4	4	1.00			53	194	148	132
Company Lake	UGS	CONV	Sulfate	mg/L	4	4	1.00			2	10.6	6.88	5.77
Company Lake	UGS	M-DISS	Manganese, Dissolved	mg/L	1	2	0.50	0.01999	0.01999	1.18	1.18	0.5950	0.1086
Company Lake	UGS	M-TOTAL	Aluminum	mg/L	7	14	0.50	0.05	0.05	0.09459	1.62	0.2256	0.0838
Company Lake	UGS	M-TOTAL	Arsenic	mg/L	4	13	0.31	0.004	0.004	0.004	0.00509	0.0028	0.0026
Company Lake	UGS	M-TOTAL	Barium	mg/L	9	11	0.82	0.01999	0.01999	0.0207	0.0507	0.0270	0.0245
Company Lake	UGS	M-TOTAL	Beryllium	mg/L	4	14	0.29	0.0003	0.0003	0.00038	0.0013	0.0003	0.0002
Company Lake	UGS	M-TOTAL	Calcium	mg/L	4	4	1.00			10.6	23.4	15.4	14.6
Company Lake	UGS	M-TOTAL	Copper	mg/L	4	11	0.36	0.002	0.0024	0.0024	0.0048	0.0018	0.0015
Company Lake	UGS	M-TOTAL	Iron	mg/L	6	12	0.50	0.1	0.1	3.89	8.45	3.69	0.5958
Company Lake	UGS	M-TOTAL	Magnesium	mg/L	4	4	1.00			4.54	5.99	5.30	5.27
Company Lake	UGS	M-TOTAL	Manganese	mg/L	2	4	0.50	0.01999	0.01999	1.19	1.52	0.6825	0.1159
Company Lake	UGS	M-TOTAL	Potassium	mg/L	4	4	1.00			1.52	3.14	2.43	2.34
Company Lake	UGS	M-TOTAL	Sodium	mg/L	4	4	1.00			16.1	28.8	23.4	22.8
Company Lake	Intermediate	CONV	Chloride	mg/L	1	1	1.00			3.87	3.87	3.87	3.87
Company Lake	Intermediate	CONV	Cyanide, Total	mg/L	1	8	0.13	0.00999	0.01999	0.027	0.027	0.0115	0.0104
Company Lake	Intermediate	CONV	Fluoride by 300.0	mg/L	2	2	1.00			13	13.4	13.2	13.2
Company Lake	Intermediate	CONV	Fluoride by Field	mg/L	14	18	0.78	0.4	0.4	6.58	25.4	13.5	6.13
Company Lake	Intermediate	CONV	Hardness, Total	mg/L	1	1	1.00			80	80	80.0	80.0
Company Lake	Intermediate	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			236	236	236	236
Company Lake	Intermediate	M-TOTAL	Aluminum	mg/L	1	10	0.10	0.05	0.05	0.05979	0.05979	0.0285	0.0273
Company Lake	Intermediate	M-TOTAL	Barium	mg/L	8	8	1.00			0.03209	0.13899	0.0563	0.0476
Company Lake	Intermediate	M-TOTAL	Beryllium	mg/L	2	10	0.20	0.0003	0.0003	0.00052	0.0006	0.0002	0.0002
Company Lake	Intermediate	M-TOTAL	Calcium	mg/L	1	1	1.00			16.8	16.8	16.8	16.8
Company Lake	Intermediate	M-TOTAL	Iron	mg/L	8	8	1.00			7.21	22	9.42	8.70
Company Lake	Intermediate	M-TOTAL	Magnesium	mg/L	1	1	1.00			10.1	10.1	10.1	10.1
Company Lake	Intermediate	M-TOTAL	Manganese	mg/L	1	1	1.00			0.75099	0.75099	0.7510	0.7510
Company Lake	Intermediate	M-TOTAL	Potassium	mg/L	1	1	1.00			3.46	3.46	3.46	3.46

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
Company Lake	Intermediate	M-TOTAL	Sodium	mg/L	1	1	1.00			48.6	48.6	48.6	48.6
Company Lake	Intermediate	VOC	1,1-Dichloroethane	mg/L	2	4	0.50	0.001	0.001	0.004	0.004	0.0023	0.0014
Company Lake	Intermediate	VOC	Methylene Chloride	mg/L	1	4	0.25	0.0002	0.002	0.0001	0.0001	0.0006	0.0003
Company Lake	Deep	CONV	Chloride	mg/L	2	2	1.00			19.7	185	102	60.4
Company Lake	Deep	CONV	Fluoride by Field	mg/L	6	8	0.75	0.4	0.4	0.60699	4.24	1.92	1.16
Company Lake	Deep	CONV	Hardness, Total	mg/L	2	2	1.00			91	296	194	164
Company Lake	Deep	CONV	Nitrate-N	mg/L	1	2	0.50	0.05	0.05	0.09	0.09	0.0575	0.0474
Company Lake	Deep	CONV	Solids, Total Dissolved	mg/L	2	2	1.00			150	505	328	275
Company Lake	Deep	CONV	Sulfate	mg/L	2	2	1.00			1.89	53.5	27.7	10.1
Company Lake	Deep	M-TOTAL	Aluminum	mg/L	3	11	0.27	0.05	0.05	0.0562	0.111	0.0386	0.0332
Company Lake	Deep	M-TOTAL	Barium	mg/L	9	9	1.00			0.0232	0.0544	0.0420	0.0405
Company Lake	Deep	M-TOTAL	Calcium	mg/L	2	2	1.00			23.3	109	66.2	50.4
Company Lake	Deep	M-TOTAL	Copper	mg/L	2	9	0.22	0.002	0.002	0.00209	0.0029	0.0013	0.0012
Company Lake	Deep	M-TOTAL	Iron	mg/L	5	9	0.56	0.1	0.1	0.12399	0.25999	0.1364	0.1077
Company Lake	Deep	M-TOTAL	Magnesium	mg/L	2	2	1.00			8.14	8.43	8.29	8.28
Company Lake	Deep	M-TOTAL	Manganese	mg/L	2	2	1.00			0.171	0.388	0.2795	0.2576
Company Lake	Deep	M-TOTAL	Potassium	mg/L	2	2	1.00			2.93	6.65	4.79	4.41
Company Lake	Deep	M-TOTAL	Sodium	mg/L	2	2	1.00			14	27.7	20.9	19.7
Company Lake	Deep	VOC	Toluene	mg/L	2	4	0.50	0.001	0.001	0.002	0.00499	0.0020	0.0013
Cryolite Ponds	Silt	CONV	Chloride	mg/L	2	2	1.00			5.64	750	378	65.0
Cryolite Ponds	Silt	CONV	Cyanide, Amenable	mg/L	2	2	1.00			0.09	0.43999	0.2650	0.1990
Cryolite Ponds	Silt	CONV	Cyanide, Total	mg/L	5	6	0.83	0.01999	0.01999	0.028	0.43999	0.1822	0.0865
Cryolite Ponds	Silt	CONV	Fluoride by 300.0	mg/L	3	3	1.00			30.7	50.3	38.0	37.1
Cryolite Ponds	Silt	CONV	Fluoride by 340.1/340.2	mg/L	1	1	1.00			30	30	30.0	30.0
Cryolite Ponds	Silt	CONV	Fluoride by Field	mg/L	4	4	1.00			22	79.6	58.7	52.8
Cryolite Ponds	Silt	CONV	Hardness, Total	mg/L	2	2	1.00			22	889	456	140
Cryolite Ponds	Silt	CONV	Nitrate-N	mg/L	2	2	1.00			0.31999	0.67	0.4950	0.4630
Cryolite Ponds	Silt	CONV	Solids, Total Dissolved	mg/L	2	2	1.00			521	1460	991	872
Cryolite Ponds	Silt	CONV	Sulfate	mg/L	2	2	1.00			9.88	44.1	27.0	20.9
Cryolite Ponds	Silt	M-TOTAL	Aluminum	mg/L	6	6	1.00			4.42	8.18	6.02	5.87
Cryolite Ponds	Silt	M-TOTAL	Barium	mg/L	1	5	0.20	0.01999	0.01999	0.0372	0.0372	0.0154	0.0130
Cryolite Ponds	Silt	M-TOTAL	Beryllium	mg/L	7	7	1.00			0.00139	0.0053	0.0032	0.0030
Cryolite Ponds	Silt	M-TOTAL	Calcium	mg/L	2	2	1.00			3.78	337	170	35.7
Cryolite Ponds	Silt	M-TOTAL	Copper	mg/L	3	6	0.50	0.002	0.00499	0.0039	0.0197	0.0070	0.0037
Cryolite Ponds	Silt	M-TOTAL	Iron	mg/L	4	5	0.80	0.1	0.1	0.15399	2.89	1.20	0.5084
Cryolite Ponds	Silt	M-TOTAL	Lead	mg/L	1	7	0.14	0.001	0.00499	0.0013	0.0013	0.0009	0.0007
Cryolite Ponds	Silt	M-TOTAL	Magnesium	mg/L	2	2	1.00			1.63	5.49	3.56	2.99
Cryolite Ponds	Silt	M-TOTAL	Manganese	mg/L	2	2	1.00			0.17	0.397	0.2835	0.2598
Cryolite Ponds	Silt	M-TOTAL	Potassium	mg/L	2	2	1.00			4.32	7.14	5.73	5.55
Cryolite Ponds	Silt	M-TOTAL	Sodium	mg/L	2	2	1.00			55.2	177	116	98.8
Cryolite Ponds	Intermediate	CONV	Ammonia-N	mg/L	1	1	1.00			2.1	2.1	2.10	2.10
Cryolite Ponds	Intermediate	CONV	Chloride	mg/L	2	2	1.00			1.79	43.6	22.7	8.83

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
Cryolite Ponds	Intermediate	CONV	Fluoride by Field	mg/L	1	6	0.17	0.4	0.4	1	1	0.3333	0.2615
Cryolite Ponds	Intermediate	CONV	Hardness, Total	mg/L	2	2	1.00			50	196	123	99.0
Cryolite Ponds	Intermediate	CONV	Solids, Total Dissolved	mg/L	2	2	1.00			117	379	248	211
Cryolite Ponds	Intermediate	CONV	Sulfate	mg/L	1	2	0.50	0.5	0.5	131	131	65.6	5.72
Cryolite Ponds	Intermediate	M-TOTAL	Arsenic	mg/L	1	5	0.20	0.004	0.004	0.0052	0.0052	0.0026	0.0024
Cryolite Ponds	Intermediate	M-TOTAL	Barium	mg/L	3	3	1.00			0.0271	0.0864	0.0479	0.0414
Cryolite Ponds	Intermediate	M-TOTAL	Calcium	mg/L	2	2	1.00			12.2	42.4	27.3	22.7
Cryolite Ponds	Intermediate	M-TOTAL	Iron	mg/L	3	3	1.00			1.73	27.4	10.8	5.38
Cryolite Ponds	Intermediate	M-TOTAL	Magnesium	mg/L	2	2	1.00			3.89	20.4	12.1	8.91
Cryolite Ponds	Intermediate	M-TOTAL	Manganese	mg/L	2	2	1.00			0.721	3.27	2.00	1.54
Cryolite Ponds	Intermediate	M-TOTAL	Potassium	mg/L	2	2	1.00			2.13	4.19	3.16	2.99
Cryolite Ponds	Intermediate	M-TOTAL	Silver	mg/L	1	3	0.33	0.003	0.003	0.003	0.003	0.0020	0.0019
Cryolite Ponds	Intermediate	M-TOTAL	Sodium	mg/L	2	2	1.00			7.21	22.5	14.9	12.7
Cryolite Ponds	Intermediate	VOC	1,2-Dichloroethane	mg/L	1	2	0.50	0.001	0.001	0.002	0.002	0.0013	0.0010
East Potliner	Silt	CONV	Cyanide, Total	mg/L	1	1	1.00			0.674	0.674	0.6740	0.6740
East Potliner	Silt	CONV	Fluoride by 300.0	mg/L	3	3	1.00			385	432	404	404
East Potliner	Silt	CONV	Fluoride by Field	mg/L	4	4	1.00			303	440	352	348
East Potliner	Silt	M-DISS	Aluminum, Dissolved	mg/L	2	2	1.00			1.2	8.4	4.80	3.17
East Potliner	Silt	M-DISS	Arsenic, Dissolved	mg/L	2	2	1.00			0.078	0.08699	0.0825	0.0824
East Potliner	Silt	M-DISS	Beryllium, Dissolved	mg/L	1	2	0.50	0.0003	0.0003	0.0013	0.0013	0.0007	0.0004
East Potliner	Silt	M-DISS	Chromium, Dissolved	mg/L	1	2	0.50	0.00999	0.00999	0.01119	0.01119	0.0081	0.0075
East Potliner	Silt	M-DISS	Lead, Dissolved	mg/L	2	2	1.00			0.001	0.00469	0.0028	0.0022
East Potliner	Silt	M-DISS	Nickel, Dissolved	mg/L	1	2	0.50	0.03999	0.03999	0.04619	0.04619	0.0331	0.0304
East Potliner	Silt	M-TOTAL	Aluminum	mg/L	3	3	1.00			7.34	42.2	20.1	14.9
East Potliner	Silt	M-TOTAL	Arsenic	mg/L	3	3	1.00			0.07999	0.10999	0.0940	0.0932
East Potliner	Silt	M-TOTAL	Barium	mg/L	1	1	1.00			0.73799	0.73799	0.7380	0.7380
East Potliner	Silt	M-TOTAL	Beryllium	mg/L	3	3	1.00			0.00082	0.00179	0.0014	0.0014
East Potliner	Silt	M-TOTAL	Chromium	mg/L	2	3	0.67	0.00999	0.00999	0.01209	0.0423	0.0198	0.0137
East Potliner	Silt	M-TOTAL	Copper	mg/L	1	1	1.00			0.21999	0.21999	0.2200	0.2200
East Potliner	Silt	M-TOTAL	Iron	mg/L	1	1	1.00			40.6	40.6	40.6	40.6
East Potliner	Silt	M-TOTAL	Lead	mg/L	3	3	1.00			0.0058	0.0171	0.0097	0.0085
East Potliner	Silt	M-TOTAL	Nickel	mg/L	3	3	1.00			0.0425	0.096	0.0630	0.0591
East Potliner	Silt	M-TOTAL	Silver	mg/L	1	1	1.00			0.0034	0.0034	0.0034	0.0034
East Potliner	Silt	M-TOTAL	Vanadium	mg/L	1	1	1.00			0.409	0.409	0.4090	0.4090
East Potliner	Silt	M-TOTAL	Zinc	mg/L	1	1	1.00			0.13799	0.13799	0.1380	0.1380
East Potliner	UGS	CONV	Cyanide, Amenable	mg/L	2	2	1.00			0.08699	0.14399	0.1155	0.1119
East Potliner	UGS	CONV	Cyanide, Total	mg/L	2	2	1.00			0.26899	0.944	0.6065	0.5039
East Potliner	UGS	CONV	Fluoride by Field	mg/L	5	8	0.63	0.4	0.4	1.74	37.5	17.1	3.39
East Potliner	UGS	M-TOTAL	Aluminum	mg/L	1	2	0.50	0.05	0.05	0.12899	0.12899	0.0770	0.0568
East Potliner	UGS	M-TOTAL	Arsenic	mg/L	1	2	0.50	0.004	0.004	0.0049	0.0049	0.0035	0.0031
East Potliner	UGS	M-TOTAL	Barium	mg/L	2	2	1.00			0.02179	0.07789	0.0498	0.0412
East Potliner	UGS	M-TOTAL	Beryllium	mg/L	1	2	0.50	0.0003	0.0003	0.00043	0.00043	0.0003	0.0003

Table E-2
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Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
East Potliner	UGS	M-TOTAL	Copper	mg/L	1	2	0.50	0.002	0.002	0.002	0.002	0.0015	0.0014
East Potliner	UGS	M-TOTAL	Iron	mg/L	2	2	1.00			2.15	3.23	2.69	2.64
East Potliner	UGS	M-TOTAL	Selenium	mg/L	1	2	0.50	0.00499	0.00499	0.00499	0.00499	0.0037	0.0035
East Potliner	UGS	M-TOTAL	Vanadium	mg/L	1	2	0.50	0.01999	0.01999	0.02789	0.02789	0.0189	0.0167
Fairview Farms	UGS	CONV	Fluoride by Field	mg/L	1	4	0.25	0.4	0.4	4.97	4.97	1.39	0.4465
Fairview Farms	UGS	M-TOTAL	Barium	mg/L	1	1	1.00			0.03099	0.03099	0.0310	0.0310
Fairview Farms	UGS	M-TOTAL	Iron	mg/L	1	1	1.00			3.89	3.89	3.89	3.89
Fairview Farms	Intermediate	CONV	Cyanide, Total	mg/L	1	1	1.00			0.027	0.027	0.0270	0.0270
Fairview Farms	Intermediate	CONV	Fluoride by Field	mg/L	4	8	0.50	0.4	0.4	6.58	25.4	8.89	1.77
Fairview Farms	Intermediate	M-TOTAL	Aluminum	mg/L	1	4	0.25	0.05	0.05	0.05979	0.05979	0.0337	0.0311
Fairview Farms	Intermediate	M-TOTAL	Arsenic	mg/L	3	4	0.75	0.004	0.004	0.00439	0.0052	0.0040	0.0038
Fairview Farms	Intermediate	M-TOTAL	Barium	mg/L	2	2	1.00			0.03859	0.0423	0.0404	0.0404
Fairview Farms	Intermediate	M-TOTAL	Beryllium	mg/L	1	4	0.25	0.0003	0.0003	0.0006	0.0006	0.0003	0.0002
Fairview Farms	Intermediate	M-TOTAL	Iron	mg/L	2	2	1.00			7.63	9.1	8.37	8.33
Fairview Farms	Deep	CONV	Alkalinity, Bicarbonate	mg/L	1	1	1.00			142	142	142	142
Fairview Farms	Deep	CONV	Alkalinity, Total	mg/L	1	1	1.00			116	116	116	116
Fairview Farms	Deep	CONV	Chloride	mg/L	1	1	1.00			4.51	4.51	4.51	4.51
Fairview Farms	Deep	CONV	Hardness, Total	mg/L	1	1	1.00			97	97	97.0	97.0
Fairview Farms	Deep	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			168	168	168	168
Fairview Farms	Deep	M-TOTAL	Aluminum	mg/L	1	4	0.25	0.0111	0.05	0.0855	0.0855	0.0353	0.0233
Fairview Farms	Deep	M-TOTAL	Barium	mg/L	2	4	0.50	0.02	0.02	0.0202	0.0228	0.0157	0.0146
Fairview Farms	Deep	M-TOTAL	Beryllium	mg/L	1	4	0.25	0.0003	0.00063	0.00064	0.00064	0.0003	0.0003
Fairview Farms	Deep	M-TOTAL	Calcium	mg/L	1	1	1.00			26.8	26.8	26.8	26.8
Fairview Farms	Deep	M-TOTAL	Iron	mg/L	4	4	1.00			0.95	1.58	1.33	1.31
Fairview Farms	Deep	M-TOTAL	Magnesium	mg/L	1	1	1.00			7.96	7.96	7.96	7.96
Fairview Farms	Deep	M-TOTAL	Manganese	mg/L	1	1	1.00			0.33	0.33	0.3300	0.3300
Fairview Farms	Deep	M-TOTAL	Potassium	mg/L	1	1	1.00			3.23	3.23	3.23	3.23
Fairview Farms	Deep	M-TOTAL	Silver	mg/L	1	4	0.25	0.003	0.003	0.0026	0.0026	0.0018	0.0017
Fairview Farms	Deep	M-TOTAL	Sodium	mg/L	1	1	1.00			9.52	9.52	9.52	9.52
Fairview Farms	Deep	M-TOTAL	Zinc	mg/L	1	4	0.25	0.05	0.05	0.0018	0.0018	0.0192	0.0130
North Landfill	Silt	BNA	Acenaphthene	mg/L	1	4	0.25	0.00009	0.0001	0.00011	0.00011	0.0001	0.0001
North Landfill	Silt	BNA	Fluorene	mg/L	1	4	0.25	0.00009	0.0001	0.00013	0.00013	0.0001	0.0001
North Landfill	Silt	BNA	Naphthalene	mg/L	4	4	1.00			0.0003	0.00086	0.0006	0.0005
North Landfill	Silt	BNA-DISS	Naphthalene, Dissolved	mg/L	1	1	1.00			0.0001	0.0001	0.0001	0.0001
North Landfill	Silt	CONV	Chloride	mg/L	1	1	1.00			2.73	2.73	2.73	2.73
North Landfill	Silt	CONV	Fluoride by 300.0	mg/L	4	4	1.00			37	60.5	48.3	47.1
North Landfill	Silt	CONV	Fluoride by Field	mg/L	1	1	1.00			36.6	36.6	36.6	36.6
North Landfill	Silt	CONV	Hardness, Total	mg/L	1	1	1.00			73	73	73.0	73.0
North Landfill	Silt	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			591	591	591	591
North Landfill	Silt	CONV	Sulfate	mg/L	1	1	1.00			24.1	24.1	24.1	24.1
North Landfill	Silt	M-TOTAL	Aluminum	mg/L	4	4	1.00			9.58	13.7	11.5	11.3

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North Landfill	Silt	M-TOTAL	Antimony	mg/L	1	2	0.50	0.00499	0.00499	0.00109	0.00109	0.0018	0.0016
North Landfill	Silt	M-TOTAL	Barium	mg/L	4	4	1.00			0.04079	0.0753	0.0628	0.0611
North Landfill	Silt	M-TOTAL	Beryllium	mg/L	4	4	1.00			0.01269	0.02439	0.0172	0.0166
North Landfill	Silt	M-TOTAL	Calcium	mg/L	1	1	1.00			18.2	18.2	18.2	18.2
North Landfill	Silt	M-TOTAL	Chromium	mg/L	1	4	0.25	0.002	0.00999	0.01889	0.01889	0.0075	0.0047
North Landfill	Silt	M-TOTAL	Copper	mg/L	3	4	0.75	0.0196	0.0196	0.04409	0.11699	0.0548	0.0395
North Landfill	Silt	M-TOTAL	Iron	mg/L	4	4	1.00			44.6	121	91.2	85.2
North Landfill	Silt	M-TOTAL	Lead	mg/L	4	4	1.00			0.0013	0.0068	0.0036	0.0030
North Landfill	Silt	M-TOTAL	Magnesium	mg/L	1	1	1.00			8.44	8.44	8.44	8.44
North Landfill	Silt	M-TOTAL	Manganese	mg/L	1	1	1.00			1.29	1.29	1.29	1.29
North Landfill	Silt	M-TOTAL	Potassium	mg/L	1	1	1.00			5.76	5.76	5.76	5.76
North Landfill	Silt	M-TOTAL	Sodium	mg/L	1	1	1.00			200	200	200	200
North Landfill	Silt	VOC	Naphthalene	mg/L	2	4	0.50	0.001	0.001	0.002	0.002	0.0013	0.0010
North Landfill	Silt	VOC	Toluene	mg/L	1	4	0.25	0.001	0.001	0.003	0.003	0.0011	0.0008
North Landfill	UGS	CONV	Chloride	mg/L	4	4	1.00			4.35	32.2	12.1	8.35
North Landfill	UGS	CONV	Cyanide, Total	mg/L	1	14	0.07	0.00999	0.01999	0.03099	0.03099	0.0104	0.0093
North Landfill	UGS	CONV	Fluoride by 300.0	mg/L	7	7	1.00			3.36	18.2	10.3	8.82
North Landfill	UGS	CONV	Fluoride by Field	mg/L	13	13	1.00			5	31.5	14.3	12.7
North Landfill	UGS	CONV	Hardness, Total	mg/L	4	4	1.00			44	80	58.5	56.9
North Landfill	UGS	CONV	Nitrate-N	mg/L	4	4	1.00			0.1	0.52999	0.2925	0.2360
North Landfill	UGS	CONV	Solids, Total Dissolved	mg/L	4	4	1.00			53	267	169	145
North Landfill	UGS	CONV	Sulfate	mg/L	4	4	1.00			2	15.1	7.47	5.91
North Landfill	UGS	M-TOTAL	Aluminum	mg/L	14	14	1.00			0.201	2.49	1.27	0.8995
North Landfill	UGS	M-TOTAL	Barium	mg/L	6	13	0.46	0.01999	0.01999	0.0207	0.0361	0.0176	0.0156
North Landfill	UGS	M-TOTAL	Beryllium	mg/L	12	14	0.86	0.0003	0.0003	0.00038	0.00279	0.0012	0.0009
North Landfill	UGS	M-TOTAL	Calcium	mg/L	4	4	1.00			9.09	23.4	14.3	13.2
North Landfill	UGS	M-TOTAL	Copper	mg/L	12	13	0.92	0.002	0.002	0.0024	0.008	0.0042	0.0037
North Landfill	UGS	M-TOTAL	Iron	mg/L	3	14	0.21	0.1	0.1	0.10899	0.23499	0.0761	0.0645
North Landfill	UGS	M-TOTAL	Lead	mg/L	1	13	0.08	0.001	0.001	0.0029	0.0029	0.0007	0.0006
North Landfill	UGS	M-TOTAL	Magnesium	mg/L	4	4	1.00			5.35	5.99	5.68	5.67
North Landfill	UGS	M-TOTAL	Potassium	mg/L	3	4	0.75	1	1	1.52	2.25	1.47	1.28
North Landfill	UGS	M-TOTAL	Sodium	mg/L	4	4	1.00			16.1	64.1	37.4	32.1
North Landfill	Deep	CONV	Chloride	mg/L	1	1	1.00			54.3	54.3	54.3	54.3
North Landfill	Intermediate	CONV	Chloride	mg/L	1	1	1.00			87.8	87.8	87.8	87.8
North Landfill	Intermediate	CONV	Fluoride by Field	mg/L	1	2	0.50	0.4	0.4	0.416	0.416	0.3080	0.2884
North Landfill	Intermediate	CONV	Hardness, Total	mg/L	1	1	1.00			103	103	103	103
North Landfill	Intermediate	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			445	445	445	445
North Landfill	Intermediate	CONV	Sulfate	mg/L	1	1	1.00			86.7	86.7	86.7	86.7
North Landfill	Intermediate	M-TOTAL	Barium	mg/L	4	4	1.00			0.06619	0.0909	0.0765	0.0760
North Landfill	Intermediate	M-TOTAL	Calcium	mg/L	1	1	1.00			20.7	20.7	20.7	20.7
North Landfill	Intermediate	M-TOTAL	Copper	mg/L	1	4	0.25	0.002	0.002	0.00329	0.00329	0.0016	0.0013
North Landfill	Intermediate	M-TOTAL	Iron	mg/L	4	4	1.00			11.5	15.7	13.7	13.6
North Landfill	Intermediate	M-TOTAL	Magnesium	mg/L	1	1	1.00			12.6	12.6	12.6	12.6

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
North Landfill	Intermediate	M-TOTAL	Manganese	mg/L	1	1	1.00			0.52899	0.52899	0.5290	0.5290
North Landfill	Intermediate	M-TOTAL	Nickel	mg/L	1	4	0.25	0.03999	0.03999	0.05	0.05	0.0275	0.0251
North Landfill	Intermediate	M-TOTAL	Potassium	mg/L	1	1	1.00			2.84	2.84	2.84	2.84
North Landfill	Intermediate	M-TOTAL	Sodium	mg/L	1	1	1.00			106	106	106	106
North Landfill	Deep	CONV	Hardness, Total	mg/L	1	1	1.00			135	135	135	135
North Landfill	Deep	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			214	214	214	214
North Landfill	Deep	CONV	Sulfate	mg/L	1	1	1.00			9.27	9.27	9.27	9.27
North Landfill	Deep	M-TOTAL	Barium	mg/L	4	4	1.00			0.0383	0.05079	0.0455	0.0452
North Landfill	Deep	M-TOTAL	Calcium	mg/L	1	1	1.00			32.8	32.8	32.8	32.8
North Landfill	Deep	M-TOTAL	Iron	mg/L	3	4	0.75	0.1	0.1	0.21699	0.237	0.1820	0.1549
North Landfill	Deep	M-TOTAL	Magnesium	mg/L	1	1	1.00			12.8	12.8	12.8	12.8
North Landfill	Deep	M-TOTAL	Manganese	mg/L	1	1	1.00			0.855	0.855	0.8550	0.8550
North Landfill	Deep	M-TOTAL	Potassium	mg/L	1	1	1.00			3.65	3.65	3.65	3.65
North Landfill	Deep	M-TOTAL	Sodium	mg/L	1	1	1.00			17.2	17.2	17.2	17.2
Scrap Yard	Silt	CONV	Chloride	mg/L	4	4	1.00			0.62	4.77	1.83	1.29
Scrap Yard	Silt	CONV	Cyanide, Amenable	mg/L	2	5	0.40	0.01999	0.5	0.01999	0.03999	0.0680	0.0331
Scrap Yard	Silt	CONV	Cyanide, Total	mg/L	10	21	0.48	0.00999	0.01999	0.012	0.13199	0.0246	0.0167
Scrap Yard	Silt	CONV	Fluoride by 300.0	mg/L	17	17	1.00			5.9	119	34.4	21.3
Scrap Yard	Silt	CONV	Fluoride by 340.1/340.2	mg/L	4	4	1.00			14	27	20.3	19.7
Scrap Yard	Silt	CONV	Fluoride by Field	mg/L	8	8	1.00			6.5	130	63.7	37.2
Scrap Yard	Silt	CONV	Hardness, Total	mg/L	4	4	1.00			16	25	20.8	20.4
Scrap Yard	Silt	CONV	Nitrate-N	mg/L	4	4	1.00			0.46999	1.97	1.27	1.12
Scrap Yard	Silt	CONV	Solids, Total Dissolved	mg/L	4	4	1.00			66	143	107	103
Scrap Yard	Silt	CONV	Sulfate	mg/L	4	4	1.00			2.07	5.56	3.96	3.72
Scrap Yard	Silt	M-DISS	Aluminum, Dissolved	mg/L	2	2	1.00			0.804	1.83	1.32	1.21
Scrap Yard	Silt	M-DISS	Arsenic, Dissolved	mg/L	1	2	0.50	0.004	0.004	0.00669	0.00669	0.0043	0.0037
Scrap Yard	Silt	M-DISS	Beryllium, Dissolved	mg/L	3	3	1.00			0.00249	0.006	0.0043	0.0041
Scrap Yard	Silt	M-TOTAL	Aluminum	mg/L	19	19	1.00			1.11	6.21	4.03	3.62
Scrap Yard	Silt	M-TOTAL	Arsenic	mg/L	3	22	0.14	0.004	0.004	0.00749	0.00939	0.0029	0.0024
Scrap Yard	Silt	M-TOTAL	Barium	mg/L	1	17	0.06	0.01999	0.01999	0.0554	0.0554	0.0127	0.0111
Scrap Yard	Silt	M-TOTAL	Beryllium	mg/L	19	22	0.86	0.0003	0.01999	0.0003	0.0064	0.0026	0.0016
Scrap Yard	Silt	M-TOTAL	Calcium	mg/L	4	4	1.00			2.48	6.47	4.13	3.86
Scrap Yard	Silt	M-TOTAL	Copper	mg/L	15	20	0.75	0.002	0.01999	0.0023	0.04409	0.0053	0.0033
Scrap Yard	Silt	M-TOTAL	Iron	mg/L	8	17	0.47	0.1	0.1	0.12899	4.58	0.4266	0.1319
Scrap Yard	Silt	M-TOTAL	Lead	mg/L	2	22	0.09	0.001	0.00499	0.0012	0.0015	0.0008	0.0007
Scrap Yard	Silt	M-TOTAL	Magnesium	mg/L	4	4	1.00			1.04	1.87	1.38	1.34
Scrap Yard	Silt	M-TOTAL	Potassium	mg/L	4	4	1.00			1.2	1.75	1.51	1.50
Scrap Yard	Silt	M-TOTAL	Sodium	mg/L	4	4	1.00			7.21	34.6	19.8	17.2
Scrap Yard	Silt	M-TOTAL	Vanadium	mg/L	1	13	0.08	0.01999	0.01999	0.05009	0.05009	0.0131	0.0113
Scrap Yard	UGS	CONV	Chloride	mg/L	2	2	1.00			1.89	2.32	2.11	2.09
Scrap Yard	UGS	CONV	Cyanide, Amenable	mg/L	2	2	1.00			0.01999	0.07	0.0450	0.0374
Scrap Yard	UGS	CONV	Cyanide, Total	mg/L	4	8	0.50	0.00999	0.01999	0.05	0.11999	0.0486	0.0266

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
Scrap Yard	UGS	CONV	Fluoride by 300.0	mg/L	3	6	0.50	0.25	0.25	3.1	6.69	2.64	0.7832
Scrap Yard	UGS	CONV	Fluoride by Field	mg/L	1	2	0.50	0.4	0.4	6	6	3.10	1.10
Scrap Yard	UGS	CONV	Hardness, Total	mg/L	2	2	1.00			60	64	62.0	62.0
Scrap Yard	UGS	CONV	Solids, Total Dissolved	mg/L	2	2	1.00			140	152	146	146
Scrap Yard	UGS	CONV	Sulfate	mg/L	2	2	1.00			3.51	11.8	7.66	6.44
Scrap Yard	UGS	M-TOTAL	Aluminum	mg/L	3	8	0.38	0.05	0.05	0.0529	0.082	0.0397	0.0354
Scrap Yard	UGS	M-TOTAL	Arsenic	mg/L	5	8	0.63	0.004	0.004	0.0043	0.00469	0.0036	0.0033
Scrap Yard	UGS	M-TOTAL	Barium	mg/L	7	8	0.88	0.01999	0.01999	0.0212	0.03649	0.0269	0.0251
Scrap Yard	UGS	M-TOTAL	Beryllium	mg/L	1	8	0.13	0.0003	0.0003	0.00047	0.00047	0.0002	0.0002
Scrap Yard	UGS	M-TOTAL	Calcium	mg/L	2	2	1.00			10.2	11.8	11.0	11.0
Scrap Yard	UGS	M-TOTAL	Copper	mg/L	1	8	0.13	0.002	0.002	0.002	0.002	0.0011	0.0011
Scrap Yard	UGS	M-TOTAL	Iron	mg/L	8	8	1.00			0.10199	7.62	3.13	1.33
Scrap Yard	UGS	M-TOTAL	Magnesium	mg/L	2	2	1.00			6.11	7.06	6.59	6.57
Scrap Yard	UGS	M-TOTAL	Manganese	mg/L	2	2	1.00			1.04	1.45	1.25	1.23
Scrap Yard	UGS	M-TOTAL	Potassium	mg/L	2	2	1.00			2.03	2.51	2.27	2.26
Scrap Yard	UGS	M-TOTAL	Sodium	mg/L	2	2	1.00			9.27	22.4	15.8	14.4
Scrap Yard	Intermediate	CONV	Ammonia-N	mg/L	1	1	1.00			1	1	1.00	1.00
Scrap Yard	Intermediate	CONV	Chloride	mg/L	1	1	1.00			15	15	15.0	15.0
Scrap Yard	Intermediate	CONV	Hardness, Total	mg/L	1	1	1.00			54	54	54.0	54.0
Scrap Yard	Intermediate	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			136	136	136	136
Scrap Yard	Intermediate	CONV	Sulfate	mg/L	1	1	1.00			14.5	14.5	14.5	14.5
Scrap Yard	Intermediate	M-TOTAL	Aluminum	mg/L	1	3	0.33	0.05	0.05	0.108	0.108	0.0527	0.0407
Scrap Yard	Intermediate	M-TOTAL	Arsenic	mg/L	1	3	0.33	0.004	0.004	0.00419	0.00419	0.0027	0.0026
Scrap Yard	Intermediate	M-TOTAL	Barium	mg/L	1	1	1.00			0.03079	0.03079	0.0308	0.0308
Scrap Yard	Intermediate	M-TOTAL	Calcium	mg/L	1	1	1.00			12.1	12.1	12.1	12.1
Scrap Yard	Intermediate	M-TOTAL	Iron	mg/L	1	1	1.00			1.74	1.74	1.74	1.74
Scrap Yard	Intermediate	M-TOTAL	Magnesium	mg/L	1	1	1.00			4.63	4.63	4.63	4.63
Scrap Yard	Intermediate	M-TOTAL	Manganese	mg/L	1	1	1.00			0.39599	0.39599	0.3960	0.3960
Scrap Yard	Intermediate	M-TOTAL	Potassium	mg/L	1	1	1.00			2.56	2.56	2.56	2.56
Scrap Yard	Intermediate	M-TOTAL	Sodium	mg/L	1	1	1.00			14.3	14.3	14.3	14.3
Scrap Yard	Deep	CONV	Ammonia-N	mg/L	1	1	1.00			3.6	3.6	3.60	3.60
Scrap Yard	Deep	CONV	Chloride	mg/L	1	1	1.00			445	445	445	445
Scrap Yard	Deep	CONV	Fluoride by 300.0	mg/L	1	1	1.00			0.47999	0.47999	0.4800	0.4800
Scrap Yard	Deep	CONV	Fluoride by Field	mg/L	4	4	1.00			0.46999	1.24	0.7000	0.6439
Scrap Yard	Deep	CONV	Hardness, Total	mg/L	1	1	1.00			719	719	719	719
Scrap Yard	Deep	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			1470	1470	1470	1470
Scrap Yard	Deep	CONV	Sulfate	mg/L	1	1	1.00			493	493	493	493
Scrap Yard	Deep	M-TOTAL	Aluminum	mg/L	3	3	1.00			0.15399	3.75	1.42	0.5868
Scrap Yard	Deep	M-TOTAL	Barium	mg/L	1	1	1.00			0.15999	0.15999	0.1600	0.1600
Scrap Yard	Deep	M-TOTAL	Calcium	mg/L	1	1	1.00			182	182	182	182
Scrap Yard	Deep	M-TOTAL	Chromium	mg/L	1	3	0.33	0.00999	0.00999	0.0113	0.0113	0.0071	0.0066
Scrap Yard	Deep	M-TOTAL	Iron	mg/L	1	1	1.00			0.21799	0.21799	0.2180	0.2180
Scrap Yard	Deep	M-TOTAL	Lead	mg/L	2	3	0.67	0.001	0.001	0.00139	0.0023	0.0014	0.0012

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
Scrap Yard	Deep	M-TOTAL	Magnesium	mg/L	1	1	1.00			42.5	42.5	42.5	42.5
Scrap Yard	Deep	M-TOTAL	Manganese	mg/L	1	1	1.00			2	2	2.00	2.00
Scrap Yard	Deep	M-TOTAL	Potassium	mg/L	1	1	1.00			19.6	19.6	19.6	19.6
Scrap Yard	Deep	M-TOTAL	Sodium	mg/L	1	1	1.00			221	221	221	221
South Ditch	Silt	CONV	Chloride	mg/L	4	4	1.00			0.94999	750	192	12.9
South Ditch	Silt	CONV	Cyanide, Amenable	mg/L	2	4	0.50	0.01999	0.1	0.09	0.43999	0.1475	0.0667
South Ditch	Silt	CONV	Cyanide, Total	mg/L	9	16	0.56	0.00999	0.01999	0.01999	0.674	0.1182	0.0326
South Ditch	Silt	CONV	Fluoride by 300.0	mg/L	15	15	1.00			9.9	432	116	51.7
South Ditch	Silt	CONV	Fluoride by 340.1/340.2	mg/L	2	2	1.00			30	73	51.5	46.8
South Ditch	Silt	CONV	Fluoride by Field	mg/L	8	8	1.00			10.1	440	190	90.6
South Ditch	Silt	CONV	Hardness, Total	mg/L	4	4	1.00			18	889	271	90.2
South Ditch	Silt	CONV	Nitrate-N	mg/L	4	4	1.00			0.05999	2.32	1.17	0.5442
South Ditch	Silt	CONV	Solids, Total Dissolved	mg/L	4	4	1.00			119	1460	805	467
South Ditch	Silt	CONV	Sulfate	mg/L	4	4	1.00			3.5	9.88	6.59	5.91
South Ditch	Silt	M-DISS	Aluminum, Dissolved	mg/L	3	3	1.00			1.2	26	11.9	6.40
South Ditch	Silt	M-DISS	Arsenic, Dissolved	mg/L	4	4	1.00			0.01239	0.08699	0.0476	0.0323
South Ditch	Silt	M-DISS	Barium, Dissolved	mg/L	1	1	1.00			0.19099	0.19099	0.1910	0.1910
South Ditch	Silt	M-DISS	Beryllium, Dissolved	mg/L	3	4	0.75	0.0003	0.0003	0.0013	0.0091	0.0040	0.0018
South Ditch	Silt	M-DISS	Chromium, Dissolved	mg/L	3	4	0.75	0.00999	0.00999	0.01119	0.096	0.0510	0.0265
South Ditch	Silt	M-DISS	Copper, Dissolved	mg/L	2	2	1.00			0.0394	0.04559	0.0425	0.0424
South Ditch	Silt	M-DISS	Iron, Dissolved	mg/L	1	1	1.00			17.9	17.9	17.9	17.9
South Ditch	Silt	M-DISS	Lead, Dissolved	mg/L	4	4	1.00			0.001	0.01899	0.0100	0.0061
South Ditch	Silt	M-DISS	Nickel, Dissolved	mg/L	1	4	0.25	0.03999	0.03999	0.04619	0.04619	0.0265	0.0247
South Ditch	Silt	M-TOTAL	Aluminum	mg/L	16	16	1.00			3.62	42.2	9.80	6.95
South Ditch	Silt	M-TOTAL	Antimony	mg/L	1	10	0.10	0.00499	0.00499	0.0052	0.0052	0.0028	0.0027
South Ditch	Silt	M-TOTAL	Arsenic	mg/L	7	18	0.39	0.004	0.004	0.00999	0.10999	0.0202	0.0059
South Ditch	Silt	M-TOTAL	Barium	mg/L	5	14	0.36	0.01999	0.01999	0.0372	0.73799	0.1005	0.0275
South Ditch	Silt	M-TOTAL	Beryllium	mg/L	18	18	1.00			0.00082	0.00969	0.0029	0.0023
South Ditch	Silt	M-TOTAL	Calcium	mg/L	4	4	1.00			3.15	337	97.7	24.0
South Ditch	Silt	M-TOTAL	Chromium	mg/L	7	18	0.39	0.00999	0.01999	0.0101	0.12399	0.0231	0.0111
South Ditch	Silt	M-TOTAL	Copper	mg/L	11	16	0.69	0.002	0.00499	0.00249	0.21999	0.0259	0.0067
South Ditch	Silt	M-TOTAL	Iron	mg/L	11	14	0.79	0.1	0.1	0.11599	40.6	8.26	0.6225
South Ditch	Silt	M-TOTAL	Lead	mg/L	9	18	0.50	0.001	0.00499	0.001	0.043	0.0065	0.0019
South Ditch	Silt	M-TOTAL	Magnesium	mg/L	4	4	1.00			1.17	9.99	4.60	3.26
South Ditch	Silt	M-TOTAL	Manganese	mg/L	2	4	0.50	0.01999	0.01999	0.397	1.78	0.5492	0.0917
South Ditch	Silt	M-TOTAL	Nickel	mg/L	4	18	0.22	0.03999	0.03999	0.0425	0.135	0.0336	0.0266
South Ditch	Silt	M-TOTAL	Potassium	mg/L	4	4	1.00			1.2	6.11	4.00	3.43
South Ditch	Silt	M-TOTAL	Silver	mg/L	2	10	0.20	0.003	0.01999	0.0034	0.00949	0.0042	0.0029
South Ditch	Silt	M-TOTAL	Sodium	mg/L	4	4	1.00			20.1	397	129	65.8
South Ditch	Silt	M-TOTAL	Vanadium	mg/L	3	10	0.30	0.01999	0.01999	0.133	0.409	0.0937	0.0266
South Ditch	Silt	M-TOTAL	Zinc	mg/L	3	10	0.30	0.05	0.05	0.05379	0.13799	0.0470	0.0369
South Ditch	Silt	VOC	Tetrachloroethene	mg/L	2	6	0.33	0.001	0.001	0.001	0.003	0.0010	0.0008

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Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
South Ditch	UGS	CONV	Chloride	mg/L	1	1	1.00			2.32	2.32	2.32	2.32
South Ditch	UGS	CONV	Cyanide, Amenable	mg/L	1	1	1.00			0.08699	0.08699	0.0870	0.0870
South Ditch	UGS	CONV	Cyanide, Total	mg/L	1	5	0.20	0.00999	0.01999	0.26899	0.26899	0.0608	0.0168
South Ditch	UGS	CONV	Fluoride by Field	mg/L	1	5	0.20	0.4	0.4	1.74	1.74	0.5080	0.3083
South Ditch	UGS	CONV	Hardness, Total	mg/L	1	1	1.00			60	60	60.0	60.0
South Ditch	UGS	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			140	140	140	140
South Ditch	UGS	CONV	Sulfate	mg/L	1	1	1.00			3.51	3.51	3.51	3.51
South Ditch	UGS	M-TOTAL	Arsenic	mg/L	5	5	1.00			0.0043	0.0049	0.0045	0.0045
South Ditch	UGS	M-TOTAL	Barium	mg/L	4	5	0.80	0.01999	0.01999	0.0212	0.0256	0.0202	0.0193
South Ditch	UGS	M-TOTAL	Calcium	mg/L	1	1	1.00			11.8	11.8	11.8	11.8
South Ditch	UGS	M-TOTAL	Iron	mg/L	5	5	1.00			3.23	7.62	5.25	5.05
South Ditch	UGS	M-TOTAL	Magnesium	mg/L	1	1	1.00			6.11	6.11	6.11	6.11
South Ditch	UGS	M-TOTAL	Manganese	mg/L	1	1	1.00			1.45	1.45	1.45	1.45
South Ditch	UGS	M-TOTAL	Potassium	mg/L	1	1	1.00			2.03	2.03	2.03	2.03
South Ditch	UGS	M-TOTAL	Selenium	mg/L	1	3	0.33	0.00499	0.00499	0.00499	0.00499	0.0033	0.0031
South Ditch	UGS	M-TOTAL	Sodium	mg/L	1	1	1.00			9.27	9.27	9.27	9.27
South Ditch	Intermediate	CONV	Chloride	mg/L	1	1	1.00			1.79	1.79	1.79	1.79
South Ditch	Intermediate	CONV	Hardness, Total	mg/L	1	1	1.00			50	50	50.0	50.0
South Ditch	Intermediate	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			117	117	117	117
South Ditch	Intermediate	M-TOTAL	Arsenic	mg/L	1	2	0.50	0.004	0.004	0.0052	0.0052	0.0036	0.0032
South Ditch	Intermediate	M-TOTAL	Barium	mg/L	2	2	1.00			0.0271	0.0302	0.0287	0.0286
South Ditch	Intermediate	M-TOTAL	Calcium	mg/L	1	1	1.00			12.2	12.2	12.2	12.2
South Ditch	Intermediate	M-TOTAL	Iron	mg/L	2	2	1.00			1.73	3.28	2.51	2.38
South Ditch	Intermediate	M-TOTAL	Magnesium	mg/L	1	1	1.00			3.89	3.89	3.89	3.89
South Ditch	Intermediate	M-TOTAL	Manganese	mg/L	1	1	1.00			0.721	0.721	0.7210	0.7210
South Ditch	Intermediate	M-TOTAL	Potassium	mg/L	1	1	1.00			2.13	2.13	2.13	2.13
South Ditch	Intermediate	M-TOTAL	Silver	mg/L	1	2	0.50	0.003	0.003	0.003	0.003	0.0023	0.0021
South Ditch	Intermediate	M-TOTAL	Sodium	mg/L	1	1	1.00			7.21	7.21	7.21	7.21
South Landfill	Deep	CONV	Chloride	mg/L	1	1	1.00			2.68	2.68	2.68	2.68
South Landfill	Deep	CONV	Hardness, Total	mg/L	1	1	1.00			46	46	46.0	46.0
South Landfill	Deep	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			110	110	110	110
South Landfill	Deep	M-TOTAL	Beryllium	mg/L	1	4	0.25	0.0003	0.0003	0.00041	0.00041	0.0002	0.0002
South Landfill	Deep	M-TOTAL	Calcium	mg/L	1	1	1.00			10	10	10	10.0
South Landfill	Deep	M-TOTAL	Iron	mg/L	4	4	1.00			0.665	0.76999	0.7165	0.7151
South Landfill	Deep	M-TOTAL	Magnesium	mg/L	1	1	1.00			5.13	5.13	5.13	5.13
South Landfill	Deep	M-TOTAL	Manganese	mg/L	1	1	1.00			0.316	0.316	0.3160	0.3160
South Landfill	Deep	M-TOTAL	Potassium	mg/L	1	1	1.00			1.99	1.99	1.99	1.99
South Landfill	Deep	M-TOTAL	Sodium	mg/L	1	1	1.00			4.17	4.17	4.17	4.17
South Landfill	Deep	VOC	Toluene	mg/L	1	2	0.50	0.001	0.001	0.008	0.008	0.0043	0.0020
South Landfill	Intermediate	CONV	Fluoride by Field	mg/L	4	4	1.00			0.46	0.56999	0.5000	0.4983
South Landfill	Intermediate	M-TOTAL	Aluminum	mg/L	1	3	0.33	0.05	0.05	0.149	0.149	0.0663	0.0453
South Landfill	Intermediate	M-TOTAL	Arsenic	mg/L	3	3	1.00			0.0065	0.00689	0.0068	0.0068

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
South Landfill	Intermediate	M-TOTAL	Iron	mg/L	1	1	1.00			6.04	6.04	6.04	6.04
South Landfill	Silt	CONV	Chloride	mg/L	2	2	1.00			3.14	5.64	4.39	4.21
South Landfill	Silt	CONV	Cyanide, Total	mg/L	4	7	0.57	0.01999	0.01999	0.026	0.54799	0.0946	0.0275
South Landfill	Silt	CONV	Fluoride by 300.0	mg/L	7	7	1.00			9.9	104	57.8	41.2
South Landfill	Silt	CONV	Fluoride by Field	mg/L	8	12	0.67	0.4	0.4	10.1	94	48.2	9.17
South Landfill	Silt	CONV	Hardness, Total	mg/L	2	2	1.00			22	28	25.0	24.8
South Landfill	Silt	CONV	Nitrate-N	mg/L	2	2	1.00			0.67	2.32	1.50	1.25
South Landfill	Silt	CONV	Solids, Total Dissolved	mg/L	2	2	1.00			189	521	355	314
South Landfill	Silt	CONV	Sulfate	mg/L	2	2	1.00			9.14	44.1	26.6	20.1
South Landfill	Silt	M-TOTAL	Aluminum	mg/L	7	10	0.70	0.05	0.05	3.62	8.18	4.10	1.10
South Landfill	Silt	M-TOTAL	Barium	mg/L	1	7	0.14	0.01999	0.01999	0.0232	0.0232	0.0119	0.0113
South Landfill	Silt	M-TOTAL	Beryllium	mg/L	7	10	0.70	0.0003	0.0003	0.00093	0.0053	0.0019	0.0010
South Landfill	Silt	M-TOTAL	Calcium	mg/L	2	2	1.00			3.78	7.18	5.48	5.21
South Landfill	Silt	M-TOTAL	Chromium	mg/L	1	10	0.10	0.00999	0.00999	0.0101	0.0101	0.0055	0.0054
South Landfill	Silt	M-TOTAL	Copper	mg/L	6	7	0.86	0.002	0.002	0.0125	0.063	0.0217	0.0134
South Landfill	Silt	M-TOTAL	Iron	mg/L	7	7	1.00			0.11599	5.89	2.26	0.9784
South Landfill	Silt	M-TOTAL	Lead	mg/L	2	10	0.20	0.001	0.001	0.001	0.0016	0.0007	0.0006
South Landfill	Silt	M-TOTAL	Magnesium	mg/L	2	2	1.00			1.63	1.75	1.69	1.69
South Landfill	Silt	M-TOTAL	Manganese	mg/L	1	2	0.50	0.01999	0.01999	0.17	0.17	0.0900	0.0412
South Landfill	Silt	M-TOTAL	Nickel	mg/L	1	10	0.10	0.03999	0.03999	0.11299	0.11299	0.0293	0.0238
South Landfill	Silt	M-TOTAL	Potassium	mg/L	2	2	1.00			6.11	7.14	6.63	6.60
South Landfill	Silt	M-TOTAL	Sodium	mg/L	2	2	1.00			42.6	177	110	86.8
South Landfill	Silt	M-TOTAL	Vanadium	mg/L	1	6	0.17	0.01999	0.01999	0.0705	0.0705	0.0201	0.0138
South Landfill	Silt	VOC	Tetrachloroethene	mg/L	2	4	0.50	0.001	0.001	0.001	0.003	0.0013	0.0009
South Landfill	Intermediate	CONV	Fluoride by Field	mg/L	4	4	1.00			0.46	0.56999	0.5000	0.4983
South Landfill	Intermediate	M-TOTAL	Aluminum	mg/L	1	3	0.33	0.05	0.05	0.149	0.149	0.0663	0.0453
South Landfill	Intermediate	M-TOTAL	Arsenic	mg/L	3	3	1.00			0.0065	0.00689	0.0068	0.0068
South Landfill	Intermediate	M-TOTAL	Iron	mg/L	1	1	1.00			6.04	6.04	6.04	6.04
South Landfill	Deep	CONV	Chloride	mg/L	1	1	1.00			2.68	2.68	2.68	2.68
South Landfill	Deep	CONV	Hardness, Total	mg/L	1	1	1.00			46	46	46.0	46.0
South Landfill	Deep	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			110	110	110	110
South Landfill	Deep	M-TOTAL	Beryllium	mg/L	1	4	0.25	0.0003	0.0003	0.00041	0.00041	0.0002	0.0002
South Landfill	Deep	M-TOTAL	Calcium	mg/L	1	1	1.00			10	10	10	10.0
South Landfill	Deep	M-TOTAL	Iron	mg/L	4	4	1.00			0.665	0.76999	0.7165	0.7151
South Landfill	Deep	M-TOTAL	Magnesium	mg/L	1	1	1.00			5.13	5.13	5.13	5.13
South Landfill	Deep	M-TOTAL	Manganese	mg/L	1	1	1.00			0.316	0.316	0.3160	0.3160
South Landfill	Deep	M-TOTAL	Potassium	mg/L	1	1	1.00			1.99	1.99	1.99	1.99
South Landfill	Deep	M-TOTAL	Sodium	mg/L	1	1	1.00			4.17	4.17	4.17	4.17
South Landfill	Deep	VOC	Toluene	mg/L	1	2	0.50	0.001	0.001	0.008	0.008	0.0043	0.0020
South Wetlands	Silt	BNA	Chrysene	mg/L	1	9	0.11	0.00009	0.0001	0.00011	0.00011	0.0001	0.0001
South Wetlands	Silt	CONV	Chloride	mg/L	4	4	1.00			1.82	12.2	5.13	3.89
South Wetlands	Silt	CONV	Cyanide, Total	mg/L	3	20	0.15	0.00999	0.01999	0.01999	0.03599	0.0116	0.0103

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
South Wetlands	Silt	CONV	Fluoride by 300.0	mg/L	11	14	0.79	0.25	0.25	3.13	200	34.5	5.37
South Wetlands	Silt	CONV	Fluoride by 340.1/340.2	mg/L	1	1	1.00			73	73	73.0	73.0
South Wetlands	Silt	CONV	Fluoride by Field	mg/L	5	14	0.36	0.4	0.4	5.1	62.9	10.0	0.9315
South Wetlands	Silt	CONV	Hardness, Total	mg/L	4	4	1.00			53	148	79.0	71.4
South Wetlands	Silt	CONV	Nitrate-N	mg/L	1	4	0.25	0.05	0.05	0.05999	0.05999	0.0337	0.0311
South Wetlands	Silt	CONV	Solids, Total Dissolved	mg/L	4	4	1.00			135	1450	573	383
South Wetlands	Silt	CONV	Sulfate	mg/L	4	4	1.00			3.5	47	26.5	17.6
South Wetlands	Silt	M-DISS	Aluminum, Dissolved	mg/L	1	1	1.00			26	26	26.0	26.0
South Wetlands	Silt	M-DISS	Arsenic, Dissolved	mg/L	2	2	1.00			0.01239	0.013	0.0127	0.0127
South Wetlands	Silt	M-DISS	Barium, Dissolved	mg/L	1	1	1.00			0.19099	0.19099	0.1910	0.1910
South Wetlands	Silt	M-DISS	Beryllium, Dissolved	mg/L	2	2	1.00			0.00549	0.0091	0.0073	0.0071
South Wetlands	Silt	M-DISS	Chromium, Dissolved	mg/L	2	2	1.00			0.092	0.096	0.0940	0.0940
South Wetlands	Silt	M-DISS	Copper, Dissolved	mg/L	2	2	1.00			0.0394	0.04559	0.0425	0.0424
South Wetlands	Silt	M-DISS	Iron, Dissolved	mg/L	1	1	1.00			17.9	17.9	17.9	17.9
South Wetlands	Silt	M-DISS	Lead, Dissolved	mg/L	2	2	1.00			0.01539	0.01899	0.0172	0.0171
South Wetlands	Silt	M-TOTAL	Aluminum	mg/L	17	23	0.74	0.05	0.05	0.07619	63.2	5.12	0.3043
South Wetlands	Silt	M-TOTAL	Antimony	mg/L	1	15	0.07	0.00499	0.05	0.0052	0.0052	0.0042	0.0031
South Wetlands	Silt	M-TOTAL	Arsenic	mg/L	5	24	0.21	0.004	0.004	0.00999	0.01999	0.0048	0.0030
South Wetlands	Silt	M-TOTAL	Barium	mg/L	17	19	0.89	0.01999	0.01999	0.02979	0.29699	0.0845	0.0608
South Wetlands	Silt	M-TOTAL	Beryllium	mg/L	12	24	0.50	0.0003	0.00067	0.00095	0.01019	0.0019	0.0006
South Wetlands	Silt	M-TOTAL	Calcium	mg/L	4	4	1.00			10.3	43.6	19.6	16.0
South Wetlands	Silt	M-TOTAL	Chromium	mg/L	8	24	0.33	0.00999	0.00999	0.01019	0.12399	0.0203	0.0093
South Wetlands	Silt	M-TOTAL	Copper	mg/L	12	20	0.60	0.002	0.002	0.00209	0.855	0.0507	0.0040
South Wetlands	Silt	M-TOTAL	Iron	mg/L	17	19	0.89	0.1	0.1	0.15099	38.1	19.1	5.43
South Wetlands	Silt	M-TOTAL	Lead	mg/L	8	24	0.33	0.001	0.001	0.00109	0.043	0.0049	0.0012
South Wetlands	Silt	M-TOTAL	Magnesium	mg/L	4	4	1.00			6.52	9.99	7.58	7.46
South Wetlands	Silt	M-TOTAL	Manganese	mg/L	4	4	1.00			0.08309	1.78	0.7100	0.4308
South Wetlands	Silt	M-TOTAL	Mercury	mg/L	1	15	0.07	0.0002	0.0002	0.00075	0.00075	0.0001	0.0001
South Wetlands	Silt	M-TOTAL	Nickel	mg/L	2	24	0.08	0.03999	0.03999	0.135	0.279	0.0356	0.0242
South Wetlands	Silt	M-TOTAL	Potassium	mg/L	4	4	1.00			1.5	4.36	2.25	2.00
South Wetlands	Silt	M-TOTAL	Selenium	mg/L	1	15	0.07	0.00499	0.00999	0.00609	0.00609	0.0029	0.0028
South Wetlands	Silt	M-TOTAL	Silver	mg/L	2	15	0.13	0.003	0.01999	0.0065	0.00949	0.0029	0.0021
South Wetlands	Silt	M-TOTAL	Sodium	mg/L	4	4	1.00			13.2	397	134	65.3
South Wetlands	Silt	M-TOTAL	Vanadium	mg/L	7	16	0.44	0.01999	0.01999	0.0409	0.609	0.0830	0.0271
South Wetlands	Silt	M-TOTAL	Zinc	mg/L	3	15	0.20	0.05	0.05	0.05379	0.119	0.0384	0.0321
South Wetlands	UGS	CONV	Chloride	mg/L	2	2	1.00			18.1	48.6	33.4	29.7
South Wetlands	UGS	CONV	Cyanide, Amenable	mg/L	1	1	1.00			0.01999	0.01999	0.0200	0.0200
South Wetlands	UGS	CONV	Cyanide, Total	mg/L	1	9	0.11	0.00999	0.01999	0.07999	0.07999	0.0167	0.0108
South Wetlands	UGS	CONV	Fluoride by 300.0	mg/L	3	5	0.60	0.25	0.25	0.28999	0.44999	0.2780	0.2412
South Wetlands	UGS	CONV	Hardness, Total	mg/L	2	2	1.00			180	256	218	215
South Wetlands	UGS	CONV	Solids, Total Dissolved	mg/L	2	2	1.00			284	422	353	346
South Wetlands	UGS	CONV	Sulfate	mg/L	2	2	1.00			20.3	89.3	54.8	42.6
South Wetlands	UGS	M-TOTAL	Aluminum	mg/L	1	11	0.09	0.05	0.05	0.08439	0.08439	0.0304	0.0279

Table E-2
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Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
South Wetlands	UGS	M-TOTAL	Arsenic	mg/L	8	11	0.73	0.004	0.004	0.00419	0.0063	0.0045	0.0041
South Wetlands	UGS	M-TOTAL	Barium	mg/L	9	9	1.00			0.03729	0.122	0.0850	0.0795
South Wetlands	UGS	M-TOTAL	Cadmium	mg/L	1	7	0.14	0.002	0.002	0.00279	0.00279	0.0013	0.0012
South Wetlands	UGS	M-TOTAL	Calcium	mg/L	2	2	1.00			37.1	66.6	51.9	49.7
South Wetlands	UGS	M-TOTAL	Chromium	mg/L	1	11	0.09	0.00999	0.00999	0.01319	0.01319	0.0057	0.0055
South Wetlands	UGS	M-TOTAL	Copper	mg/L	3	9	0.33	0.002	0.00249	0.0026	0.00359	0.0017	0.0015
South Wetlands	UGS	M-TOTAL	Iron	mg/L	9	9	1.00			10	67.6	35.4	25.2
South Wetlands	UGS	M-TOTAL	Lead	mg/L	2	11	0.18	0.001	0.001	0.00109	0.0038	0.0009	0.0006
South Wetlands	UGS	M-TOTAL	Magnesium	mg/L	2	2	1.00			18.9	27.1	23.0	22.6
South Wetlands	UGS	M-TOTAL	Manganese	mg/L	2	2	1.00			4.63	7.17	5.90	5.76
South Wetlands	UGS	M-TOTAL	Nickel	mg/L	1	11	0.09	0.03999	0.03999	0.0514	0.0514	0.0229	0.0218
South Wetlands	UGS	M-TOTAL	Potassium	mg/L	2	2	1.00			2.57	3.59	3.08	3.04
South Wetlands	UGS	M-TOTAL	Silver	mg/L	1	7	0.14	0.003	0.003	0.003	0.003	0.0017	0.0017
South Wetlands	UGS	M-TOTAL	Sodium	mg/L	2	2	1.00			13.4	19.4	16.4	16.1
South Wetlands	UGS	M-TOTAL	Zinc	mg/L	1	7	0.14	0.05	0.05	0.0635	0.0635	0.0305	0.0286
VOC Area	UGS	CONV	Chloride	mg/L	1	1	1.00			1.24	1.24	1.24	1.24
VOC Area	UGS	CONV	Fluoride by 300.0	mg/L	1	3	0.33	0.25	0.25	0.62	0.62	0.2900	0.2132
VOC Area	UGS	CONV	Fluoride by Field	mg/L	3	6	0.50	0.4	0.4	0.48699	0.83999	0.4245	0.3558
VOC Area	UGS	CONV	Hardness, Total	mg/L	1	1	1.00			70	70	70.0	70.0
VOC Area	UGS	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			154	154	154	154
VOC Area	UGS	CONV	Sulfate	mg/L	1	1	1.00			5.33	5.33	5.33	5.33
VOC Area	UGS	M-TOTAL	Arsenic	mg/L	4	5	0.80	0.004	0.004	0.0059	0.00769	0.0057	0.0052
VOC Area	UGS	M-TOTAL	Barium	mg/L	5	5	1.00			0.0202	0.0402	0.0328	0.0320
VOC Area	UGS	M-TOTAL	Beryllium	mg/L	1	5	0.20	0.0003	0.0003	0.00062	0.00062	0.0002	0.0002
VOC Area	UGS	M-TOTAL	Calcium	mg/L	1	1	1.00			15.4	15.4	15.4	15.4
VOC Area	UGS	M-TOTAL	Iron	mg/L	4	5	0.80	0.1	0.1	3.38	5.23	3.64	1.82
VOC Area	UGS	M-TOTAL	Magnesium	mg/L	1	1	1.00			7.35	7.35	7.35	7.35
VOC Area	UGS	M-TOTAL	Manganese	mg/L	1	1	1.00			1.71	1.71	1.71	1.71
VOC Area	UGS	M-TOTAL	Potassium	mg/L	1	1	1.00			1.84	1.84	1.84	1.84
VOC Area	UGS	M-TOTAL	Sodium	mg/L	1	1	1.00			12.5	12.5	12.5	12.5
VOC Area	UGS	VOC	1,1,1-Trichloroethane	mg/L	2	5	0.40	0.001	0.001	0.024	0.04199	0.0135	0.0026
VOC Area	UGS	VOC	1,1-Dichloroethane	mg/L	2	5	0.40	0.001	0.001	0.0008	0.001	0.0007	0.0006
VOC Area	UGS	VOC	1,1-Dichloroethene	mg/L	2	5	0.40	0.001	0.001	0.001	0.003	0.0011	0.0008
VOC Area	UGS	VOC	1,2-Dichlorobenzene	mg/L	1	5	0.20	0.001	0.001	0.0002	0.0002	0.0004	0.0004
VOC Area	UGS	VOC	Chloromethane	mg/L	1	5	0.20	0.001	0.001	0.0001	0.0001	0.0004	0.0004
VOC Area	UGS	VOC	Methylene Chloride	mg/L	1	5	0.20	0.0002	0.002	0.0001	0.0001	0.0006	0.0004
VOC Area	UGS	VOC	Tetrachloroethene	mg/L	2	5	0.40	0.001	0.001	0.34	0.37	0.1423	0.0069
VOC Area	UGS	VOC	Trichloroethene	mg/L	2	5	0.40	0.001	0.001	0.0005	0.0006	0.0005	0.0005
VOC Area	Intermediate	CONV	Chloride	mg/L	1	1	1.00			61.5	61.5	61.5	61.5
VOC Area	Intermediate	CONV	Cyanide, Amenable	mg/L	1	1	1.00			0.149	0.149	0.1490	0.1490
VOC Area	Intermediate	CONV	Cyanide, Total	mg/L	1	3	0.33	0.01999	0.01999	0.402	0.402	0.1407	0.0342
VOC Area	Intermediate	CONV	Fluoride by 300.0	mg/L	2	3	0.67	0.25	0.25	112	113	75.0	11.7

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Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
VOC Area	Intermediate	CONV	Fluoride by Field	mg/L	8	12	0.67	0.4	0.4	0.47999	141	31.8	2.14
VOC Area	Intermediate	CONV	Hardness, Total	mg/L	1	1	1.00			127	127	127	127
VOC Area	Intermediate	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			276	276	276	276
VOC Area	Intermediate	CONV	Sulfate	mg/L	1	1	1.00			18.5	18.5	18.5	18.5
VOC Area	Intermediate	M-TOTAL	Aluminum	mg/L	1	7	0.14	0.05	0.05	1.01	1.01	0.1657	0.0424
VOC Area	Intermediate	M-TOTAL	Arsenic	mg/L	1	7	0.14	0.004	0.004	0.00949	0.00949	0.0031	0.0025
VOC Area	Intermediate	M-TOTAL	Barium	mg/L	3	3	1.00			0.03079	0.0524	0.0433	0.0423
VOC Area	Intermediate	M-TOTAL	Beryllium	mg/L	1	7	0.14	0.0003	0.0003	0.003	0.003	0.0006	0.0002
VOC Area	Intermediate	M-TOTAL	Boron	mg/L	1	1	1.00			0.18	0.18	0.1800	0.1800
VOC Area	Intermediate	M-TOTAL	Calcium	mg/L	1	1	1.00			22.5	22.5	22.5	22.5
VOC Area	Intermediate	M-TOTAL	Copper	mg/L	1	3	0.33	0.002	0.002	0.03319	0.03319	0.0117	0.0032
VOC Area	Intermediate	M-TOTAL	Iron	mg/L	3	3	1.00			6.52	10.9	8.72	8.54
VOC Area	Intermediate	M-TOTAL	Lead	mg/L	1	7	0.14	0.001	0.001	0.00359	0.00359	0.0009	0.0007
VOC Area	Intermediate	M-TOTAL	Magnesium	mg/L	1	1	1.00			14.7	14.7	14.7	14.7
VOC Area	Intermediate	M-TOTAL	Manganese	mg/L	1	1	1.00			0.77399	0.77399	0.7740	0.7740
VOC Area	Intermediate	M-TOTAL	Potassium	mg/L	1	1	1.00			4.92	4.92	4.92	4.92
VOC Area	Intermediate	M-TOTAL	Sodium	mg/L	1	1	1.00			18.5	18.5	18.5	18.5
VOC Area	Intermediate	M-TOTAL	Vanadium	mg/L	1	3	0.33	0.01999	0.01999	0.0227	0.0227	0.0142	0.0131
VOC Area	Intermediate	VOC	1,1,1-Trichloroethane	mg/L	1	5	0.20	0.001	0.001	0.0002	0.0002	0.0004	0.0004
VOC Area	Intermediate	VOC	1,1-Dichloroethane	mg/L	5	5	1.00			0.0002	0.001	0.0006	0.0005
VOC Area	Intermediate	VOC	1,1-Dichloroethene	mg/L	5	5	1.00			0.0003	0.002	0.0010	0.0009
VOC Area	Intermediate	VOC	Methylene Chloride	mg/L	2	5	0.40	0.0002	0.002	0.0001	0.0003	0.0005	0.0003
VOC Area	Intermediate	VOC	Tetrachloroethene	mg/L	3	5	0.60	0.001	0.001	0.0002	0.0004	0.0004	0.0004
VOC Area	Deep	CONV	Ammonia-N	mg/L	1	1	1.00			14.2	14.2	14.2	14.2
VOC Area	Deep	CONV	Chloride	mg/L	3	3	1.00			2.2	98.3	35.3	10.6
VOC Area	Deep	CONV	Cyanide, Amenable	mg/L	1	1	1.00			0.337	0.337	0.3370	0.3370
VOC Area	Deep	CONV	Cyanide, Total	mg/L	5	10	0.50	0.00999	0.01999	0.041	1.17	0.1525	0.0309
VOC Area	Deep	CONV	Fluoride by 300.0	mg/L	3	5	0.60	0.25	0.25	1.27	6.63	1.89	0.7046
VOC Area	Deep	CONV	Fluoride by Field	mg/L	10	12	0.83	0.4	0.4	1.3	40.7	11.7	4.62
VOC Area	Deep	CONV	Hardness, Total	mg/L	3	3	1.00			89	140	120	117
VOC Area	Deep	CONV	Solids, Total Dissolved	mg/L	3	3	1.00			168	533	306	269
VOC Area	Deep	CONV	Sulfate	mg/L	1	3	0.33	0.5	0.5	128	128	42.8	2.00
VOC Area	Deep	M-TOTAL	Aluminum	mg/L	2	12	0.17	0.05	0.05	0.0599	0.0649	0.0312	0.0291
VOC Area	Deep	M-TOTAL	Arsenic	mg/L	2	12	0.17	0.004	0.004	0.00469	0.00499	0.0025	0.0023
VOC Area	Deep	M-TOTAL	Barium	mg/L	9	10	0.90	0.01999	0.01999	0.0225	0.10199	0.0336	0.0287
VOC Area	Deep	M-TOTAL	Beryllium	mg/L	2	12	0.17	0.0003	0.0003	0.00062	0.00086	0.0002	0.0002
VOC Area	Deep	M-TOTAL	Calcium	mg/L	3	3	1.00			20.2	47.6	36.3	34.0
VOC Area	Deep	M-TOTAL	Copper	mg/L	1	10	0.10	0.002	0.002	0.0054	0.0054	0.0014	0.0012
VOC Area	Deep	M-TOTAL	Iron	mg/L	10	10	1.00			0.157	4.28	1.78	1.09
VOC Area	Deep	M-TOTAL	Lead	mg/L	1	12	0.08	0.001	0.001	0.00279	0.00279	0.0007	0.0006
VOC Area	Deep	M-TOTAL	Magnesium	mg/L	3	3	1.00			4.55	8.32	5.92	5.70
VOC Area	Deep	M-TOTAL	Manganese	mg/L	3	3	1.00			0.17599	1.19	0.6197	0.4691
VOC Area	Deep	M-TOTAL	Potassium	mg/L	3	3	1.00			3.48	38.3	15.6	8.71

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
VOC Area	Deep	M-TOTAL	Silver	mg/L	1	10	0.10	0.003	0.003	0.003	0.003	0.0017	0.0016
VOC Area	Deep	M-TOTAL	Sodium	mg/L	3	3	1.00			7.12	92.8	37.8	20.8
VOC Area	Deep	VOC	Toluene	mg/L	1	8	0.13	0.001	0.001	0.001	0.001	0.0006	0.0005
Western Extent	Silt	CONV	Chloride	mg/L	3	3	1.00			3.08	4.94	4.07	3.99
Western Extent	Silt	CONV	Cyanide, Total	mg/L	1	9	0.11	0.00999	0.01999	0.05099	0.05099	0.0134	0.0103
Western Extent	Silt	CONV	Fluoride by 300.0	mg/L	2	4	0.50	0.25	0.25	0.68	1.04	0.4925	0.3242
Western Extent	Silt	CONV	Fluoride by Field	mg/L	4	8	0.50	0.4	0.4	0.46999	2.56	0.8275	0.4728
Western Extent	Silt	CONV	Hardness, Total	mg/L	3	3	1.00			47	58	51.3	51.1
Western Extent	Silt	CONV	Nitrate-N	mg/L	3	3	1.00			0.15	1.16	0.6700	0.4957
Western Extent	Silt	CONV	Solids, Total Dissolved	mg/L	3	3	1.00			119	141	128	128
Western Extent	Silt	CONV	Sulfate	mg/L	3	3	1.00			2.87	4.39	3.44	3.38
Western Extent	Silt	M-TOTAL	Aluminum	mg/L	4	11	0.36	0.05	0.05	0.07619	0.864	0.1286	0.0526
Western Extent	Silt	M-TOTAL	Barium	mg/L	4	9	0.44	0.01999	0.01999	0.02209	0.03179	0.0169	0.0151
Western Extent	Silt	M-TOTAL	Beryllium	mg/L	1	11	0.09	0.0003	0.0003	0.00062	0.00062	0.0002	0.0002
Western Extent	Silt	M-TOTAL	Calcium	mg/L	3	3	1.00			9.23	13.5	10.9	10.8
Western Extent	Silt	M-TOTAL	Iron	mg/L	4	9	0.44	0.1	0.1	0.133	16.7	2.01	0.1656
Western Extent	Silt	M-TOTAL	Lead	mg/L	1	11	0.09	0.001	0.001	0.001	0.001	0.0005	0.0005
Western Extent	Silt	M-TOTAL	Magnesium	mg/L	3	3	1.00			5.36	6.51	5.88	5.86
Western Extent	Silt	M-TOTAL	Manganese	mg/L	1	3	0.33	0.01999	0.01999	0.03659	0.03659	0.0189	0.0154
Western Extent	Silt	M-TOTAL	Potassium	mg/L	3	3	1.00			1.52	2.08	1.77	1.76
Western Extent	Silt	M-TOTAL	Silver	mg/L	1	9	0.11	0.003	0.0085	0.003	0.003	0.0020	0.0018
Western Extent	Silt	M-TOTAL	Sodium	mg/L	3	3	1.00			5.91	14.7	8.92	8.11
Western Extent	UGS	CONV	Fluoride by Field	mg/L	4	8	0.50	0.4	0.4	0.40999	4.97	0.9775	0.4651
Western Extent	UGS	M-TOTAL	Barium	mg/L	2	2	1.00			0.02309	0.03099	0.0270	0.0267
Western Extent	UGS	M-TOTAL	Iron	mg/L	1	2	0.50	0.1	0.1	3.89	3.89	1.97	0.4410
Western Extent	Intermediate	CONV	Chloride	mg/L	1	1	1.00			3.87	3.87	3.87	3.87
Western Extent	Intermediate	CONV	Cyanide, Total	mg/L	1	8	0.13	0.00999	0.01999	0.027	0.027	0.0115	0.0104
Western Extent	Intermediate	CONV	Fluoride by 300.0	mg/L	2	2	1.00			13	13.4	13.2	13.2
Western Extent	Intermediate	CONV	Fluoride by Field	mg/L	6	22	0.27	0.4	0.4	6.58	25.4	4.79	0.6583
Western Extent	Intermediate	CONV	Hardness, Total	mg/L	1	1	1.00			80	80	80.0	80.0
Western Extent	Intermediate	CONV	Solids, Total Dissolved	mg/L	1	1	1.00			236	236	236	236
Western Extent	Intermediate	M-TOTAL	Aluminum	mg/L	2	17	0.12	0.05	0.05	0.05979	0.10499	0.0318	0.0286
Western Extent	Intermediate	M-TOTAL	Arsenic	mg/L	7	17	0.41	0.004	0.004	0.004	0.00559	0.0031	0.0028
Western Extent	Intermediate	M-TOTAL	Barium	mg/L	8	9	0.89	0.01999	0.01999	0.0327	0.13899	0.0449	0.0365
Western Extent	Intermediate	M-TOTAL	Beryllium	mg/L	2	17	0.12	0.0003	0.0003	0.00052	0.0006	0.0002	0.0002
Western Extent	Intermediate	M-TOTAL	Calcium	mg/L	1	1	1.00			16.8	16.8	16.8	16.8
Western Extent	Intermediate	M-TOTAL	Iron	mg/L	9	9	1.00			7.21	30.2	12.0	10.3
Western Extent	Intermediate	M-TOTAL	Lead	mg/L	1	17	0.06	0.001	0.001	0.00219	0.00219	0.0006	0.0005
Western Extent	Intermediate	M-TOTAL	Magnesium	mg/L	1	1	1.00			10.1	10.1	10.1	10.1
Western Extent	Intermediate	M-TOTAL	Manganese	mg/L	1	1	1.00			0.75099	0.75099	0.7510	0.7510
Western Extent	Intermediate	M-TOTAL	Potassium	mg/L	1	1	1.00			3.46	3.46	3.46	3.46
Western Extent	Intermediate	M-TOTAL	Silver	mg/L	1	9	0.11	0.003	0.003	0.003	0.003	0.0017	0.0016

Table E-2
Summary Statistics for Monitoring Wells by Site Areas and Groundwater Zone
Reynolds Metals Company - Troutdale, Oregon

Area	Groundwater Zone	Report Class	Analyte	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Nondetect Value	Maximum Nondetect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean	Geometric Mean
Western Extent	Intermediate	M-TOTAL	Sodium	mg/L	1	1	1.00			48.6	48.6	48.6	48.6
Western Extent	Intermediate	M-TOTAL	Zinc	mg/L	1	9	0.11	0.05	0.05	0.06459	0.06459	0.0294	0.0278
Western Extent	Deep	CONV	Alkalinity, Bicarbonate	mg/L	1	1	1.00			142	142	142	142
Western Extent	Deep	CONV	Alkalinity, Total	mg/L	1	1	1.00			116	116	116	116
Western Extent	Deep	CONV	Chloride	mg/L	4	4	1.00			2.6	185	48.8	9.04
Western Extent	Deep	CONV	Fluoride by Field	mg/L	1	6	0.17	0.4	0.4	1.4	1.4	0.4000	0.2766
Western Extent	Deep	CONV	Hardness, Total	mg/L	4	4	1.00			77	296	142	121
Western Extent	Deep	CONV	Nitrate-N	mg/L	1	4	0.25	0.05	0.05	0.09	0.09	0.0413	0.0344
Western Extent	Deep	CONV	Solids, Total Dissolved	mg/L	4	4	1.00			152	505	248	215
Western Extent	Deep	CONV	Sulfate	mg/L	3	4	0.75	0.5	0.5	0.68	53.5	13.8	1.7
Western Extent	Deep	M-TOTAL	Aluminum	mg/L	5	16	0.31	0.0111	0.05	0.05389	0.238	0.0505	0.0344
Western Extent	Deep	M-TOTAL	Barium	mg/L	6	16	0.38	0.01999	0.02	0.0202	0.0544	0.0221	0.0167
Western Extent	Deep	M-TOTAL	Beryllium	mg/L	3	16	0.19	0.0003	0.00063	0.00063	0.00064	0.0003	0.0002
Western Extent	Deep	M-TOTAL	Calcium	mg/L	4	4	1.00			22.3	109	45.5	35.4
Western Extent	Deep	M-TOTAL	Copper	mg/L	1	16	0.06	0.0011	0.002	0.00219	0.00219	0.0010	0.0010
Western Extent	Deep	M-TOTAL	Iron	mg/L	12	16	0.75	0.1	0.1	0.13899	2.48	0.8169	0.4049
Western Extent	Deep	M-TOTAL	Magnesium	mg/L	4	4	1.00			6.06	9.83	8.00	7.88
Western Extent	Deep	M-TOTAL	Manganese	mg/L	4	4	1.00			0.0804	0.44699	0.2571	0.2122
Western Extent	Deep	M-TOTAL	Potassium	mg/L	4	4	1.00			3.23	6.65	4.23	4.03
Western Extent	Deep	M-TOTAL	Silver	mg/L	3	16	0.19	0.003	0.0079	0.0026	0.00939	0.0023	0.0019
Western Extent	Deep	M-TOTAL	Sodium	mg/L	4	4	1.00			8.4	27.7	14.7	13.0
Western Extent	Deep	M-TOTAL	Zinc	mg/L	1	16	0.06	0.05	0.05	0.0018	0.0018	0.0236	0.0212
Western Extent	Deep	VOC	Toluene	mg/L	6	7	0.86	0.001	0.001	0.002	0.013	0.0052	0.0035

Notes:

1. Analytes shown have been detected at least once in the most recent four rounds of sampling for each well.
2. Arithmetic mean and geometric mean were calculated using 1/2 the detection limit for nondetected values.
3. UGS = upper gray sand.
4. BNA = semivolatile organic analytes.
5. BNA-Diss = dissolved semivolatile organic analytes.
6. CONV = conventional analytes.
7. M-Total = total metals.
8. M-Diss = dissolved metals.
9. VOC = volatile organic analytes.

APPENDIX F

Water Level Response at the RMC Site to Pumping at the City of Portland's Columbia South Shore Wellfield

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APPENDIX F

Water Level Response at the RMC Site to Pumping at the City of Portland's Columbia South Shore Wellfield

F.1 Introduction

On November 28, 1995, the City of Portland (COP) started pumping four production wells that are constructed in the Blue Lake Aquifer (BLA) and are part of the Columbia South Shore Wellfield (CSSW). Pumping continued through December 24, 1995, and was performed to replace water supply capacity lost when two water supply lines at the Bull Run Watershed were damaged in a mudslide. The CSSW begins approximately 1 ½ miles west of the Reynolds Metal Company (RMC) facility in Troutdale, Oregon (see Figure F-1).

Data collection began in RMC wells after the start of pumping following notification by COP. Water level data, pumping rates, pump on and off times, and temporary shutdown times during pumping for the COP water supply wells were supplied by Woodward-Clyde Consultants.

The purpose of this data evaluation is to assess the potential for production pumping at the CSSW to influence water levels, and therefore possibly flow directions, at the RMC site. These data combined with aquifer tests conducted at the RMC facility will support predictive analysis of current, and likely future, degrees of hydraulic interaction between the two areas.

Data gathered during this test were evaluated to:

- Assess the magnitude of water level response to COP pumping in shallow groundwater monitoring wells and deeper production wells at the RMC site.
- Assess the degree of hydraulic connection between the CSSW wells and the aquifers at the RMC facility.
- Provide data to support future predictive analysis of groundwater flow and transport under existing, and likely future, pumping conditions.

Groundwater elevations were monitored in the following wells around the RMC facility during pumping:

- Production Well 16 (PW16), an unused deep production well
- Fairview Farms No. 4 and No. 6 (FF04 and FF06), both offsite, deep wells formerly used for irrigation
- Monitoring wells MW18-31 and MW06, both shallow groundwater monitoring wells, screened in the upper gray sand (UGS) and silt unit, respectively

- Columbia River (CR)

Table F-1 contains general construction details for PW16, FF04, FF06, MW18-31, MW06, and the CSSW production wells (COP No. 12, 13, 18, and 19).

Table F-1
General Well Construction Details

Well	Date Completed	Total Well Depth (ft bgs)	Reported Well Yield (gpm)	Screened or Perforated Interval (ft bgs)	Screened Hydrogeologic Unit
FF04	1943	281	700	237 to 250	Deep
FF06	1950	200	1,200	119 to 200	Deep
PW16	1967	279	545	151 to 192 256 to 269	Deep
MW06	1994	25	NA	14 to 24	Silt
MW18-31	1995	32	NA	26 to 31	UGS
COP 12	1982	123	5,000	60 to 118	BLA
COP 13	1983	171	10,000	85 to 165	BLA
COP 18	1983	195	8,500	80 to 190	BLA
COP 19	1984	123	10,000	55 to 113	BLA

Notes:

Information contained in Table F-1 derived from drillers' logs on file at OWRD and in RMC files.
ft bgs = feet below ground surface.
gpm = gallons per minute.
NA = not available.
UGS = upper gray sand.
BLA = Blue Lake Aquifer.
OWRD = Oregon Water Resources Department.

Pumping began on November 28, 1995, with a reported cumulative discharge rate of approximately 20,000 gallons per minute (gpm). Discharge rates and pump shutdown periods for each pumping well are listed in Table F-2.

Two precipitation events occurred during the period COP was pumping. The precipitation graphs for November and December, 1995, are presented in Attachment A. Water levels in the Columbia River rose several feet in late November and early December, apparently in response to these precipitation events. It is unknown whether the aquifer responds primarily to infiltration of precipitation, Columbia River stage increases coincident with precipitation events, or a combination of the two factors.

Table F-2
Columbia South Shore Wellfield Pumping Rates and Shutdown Periods

Pumping Well	Pumping Rate (gpm)
COP 12	
Nov 28-Dec 9	4,700
Dec 9-Dec 9	4,200
Dec 9-Dec 10	NA
Dec 10-Dec 24	4,500
COP 13	
Nov 28-Dec 7	6,300-7,900
Dec 7-Dec 9	6,800
Dec 9-Dec 10	NA
Dec 10-Dec 19	8,000
Dec 19- Dec 24	6,700
COP 18	
Dec 12- Dec 14	7,700
COP 19	
Nov 28- Dec 7	7,700
Dec 7- Dec 9	6,300
Dec 9- Dec 10	No Pumping
Dec 10-Dec 12	7,600
Dec 12- Dec 14	No Pumping
Dec 14-Dec 19	7,600
Dec 19-Dec 24	6,400
	Approximate Cumulative Average = 20,000 gpm

Notes:

Information supplied by Woodward-Clyde Consultants in Portland, Oregon.
gpm = gallons per minute.
COP = City of Portland.
NA = not available.

F.2 Data Collection and Handling

F.2.1 Data Collection

CH2M HILL collected water level data from: two deep wells formerly used for irrigation (Fairview Farms No. 4 and No. 6) located west of the RMC plant site; one deep production well on the RMC plant site (PW16); two shallow monitoring wells (screened in the UGS and silt unit) along the western edge of the RMC plant site (MW06 and MW18-31); and the Columbia River (see Figure F-1). In addition to the monitoring locations described above, Woodward-Clyde Consultants provided electronic water level data for four COP pumping wells (wells COP 12, COP 13, COP 18, and COP 19) located west of the RMC plant site (see Figure F-1).

Baseline or background water level measurements were not collected by CH2M HILL prior to the COP pumping due to the emergency nature of the wellfield start-up. CH2M HILL began data collection on November 28, 1995 for wells FF04 and FF06; on November 29, 1995,

for wells PW-16 and MW-06; and on December 3, 1995, for MW-18-31. Manual water level measurements were collected with a water level indicator; electronic water level measurements were collected using GeoKon® dataloggers and pressure transducers. Manual water level measurements were used to calibrate and verify the dataloggers and pressure transducer measurements.

F.2.2 Data Handling

The frequency of data collection for the dataloggers was modified based on the proximity of the monitoring well to the pumping wells. Manual water levels were collected periodically during the COP pumping test to check the datalogger calibration. If the datalogger readings were not within 0.10 feet of the manual water level, the datalogger was recalibrated to match the manual water level. Raw electronic water level data and manual water level calibration checks are included in Attachment B. Several deviations in the datalogger data from the manual measurements were noted and corrected. Corrections to the electronic data are noted on the well hydrographs.

F.3 Water Level Monitoring Results

F.3.1 Data Reduction

Water levels in the three deep wells monitored fluctuated in apparent response to Columbia River stage changes. Seasonal fluctuations that result in long-term (greater than one month) increases or decreases in river stage elevation were not observed during the COP pumping period. The observed Columbia River stage fluctuations appear to result from:

- Tidal response, resulting in approximately two water level peaks and two water level lows per day
- Precipitation events and/or variations in regulated river flow rates, resulting in increasing or decreasing river stage trends approximately 3 to 7 days in length

Electronic water level data measurements collected during the COP pumping period were input into a spreadsheet. The raw data with the date, time, and well identification were reduced to hourly readings to minimize the data volume for presentation. This reduction in data volume did not influence water level trends or minimize observed variability.

The response to daily tidal and longer-term river stage fluctuations created a variable, or "noisy," aquifer response that required smoothing or filtering before response to the CSSW pumping could be assessed. As described below, the method selected for smoothing was to apply a 24-hour moving average to the Columbia River and well data sets to remove the response to tidal fluctuations.

Because there is a delay between river stage change and aquifer water level response, the Columbia River data was shifted forward along the time axis to align peaks and troughs in the river and well water level data. This time shift was based on water level data collected following the end of the COP pumping (baseline data prior to the beginning of the test was not collected due to short notice). The forward time shift of the river data was done to simplify the evaluation of the river efficiency coefficient and comparison of trends between the river stage and well water levels. A river efficiency coefficient, the ratio of aquifer water

level response to river stage response (Walton, 1970), was then calculated for each well where water level data was collected. The water level data were normalized to a time period corresponding to the first water level data collected in the individual wells.

A predicted groundwater elevation data set (with the river influence removed) was then produced. The data with the river influence removed were then observed to see if fluctuations from other stresses were evident. The data reduction steps are detailed further below.

F.3.1.1 24-Hour Moving Average

A 24-hour moving average was applied to the Columbia River and raw well data to remove daily tidal fluctuations. The smoothing provides a better basis for the estimation of average river stage elevation during the aquifer test, and helps identify other trends in river stage that may have affected the water levels in observation wells. The 24-hour moving average for a given time (t) was calculated by computing the arithmetic average of water levels for times (t), (t-1), (t-2), ..., (t-11), and times (t+1), (t+2), ..., (t+12). This is the same method used by Erskine (1991) and Serfes (1991) to filter out tidal fluctuations.

F.3.1.2 Time Lag Shift

Two approaches were used to estimate the forward time shift for the smoothed Columbia River data: statistical and visual. The statistical approach consisted of choosing a subset of the two 24-hour moving average data sets with the following criteria:

- The subset was selected either before or after the COP pumping to remove potential pumping effects.
- The subsets were visually similar.

Erskine (1991) used both methods to determine time shifts; however, the visual method appears to be the best for the RMC site due to the more complex nature of the river stage fluctuations. The forward time shift of the river data was done to simplify the evaluation of the river efficiency coefficient and comparison of trends between the river stage and well water levels.

F.3.1.3 River Efficiencies

A river efficiency, the ratio of groundwater elevation change to corresponding river stage change (Walton, 1970), was calculated using the smoothed, shifted river data and the smoothed elevation data for the individual wells. Erskine (1991) estimated a tidal efficiency using the ratio of the standard deviation of the tidal data and the monitoring water level data. This method is preferred to using the ratio if individual peaks because it reduces the effect of individual reading errors, but is only strictly applicable for identically formed signals symmetrical about their mean with continuous reading. The fluctuations observed in the Columbia River and deep well water level data are not symmetrical about their mean because of the long-term trends in water levels, in addition to tidal fluctuations during the observed period.

River efficiencies were calculated by comparing corresponding peak and trough heights of the river and the corresponding response in individual wells. This information gives an estimate of the amount a given river fluctuation will influence the water level in the well.

Efficiencies were calculated on the data following the COP pumping. It was assumed there were no other influences to the well data other than river stage fluctuations during the period of river efficiency calculation.

This calculation was done for each well monitored during the COP pumping period. Table F-3 lists the river efficiencies and the time period used for calculation. Attachment C contains the river efficiency calculations for the monitored wells.

The largest river efficiency coefficients were estimated for the two Fairview Farms wells, and the smallest coefficients were estimated for the two shallow monitoring wells. A pressure wave in an aquifer, initially generated by a river stage fluctuation, is mostly the result of changes in storage due to dewatering and resaturation of pores in unconfined aquifers, and to changes in fluid pressure in confined aquifers (Serfes, 1991). The tidal period and amplitude, and the aquifer transmissivity, storage coefficient, and distance between the river and the measuring point, will affect the water level change in the well resulting from river stage fluctuations (Ferris, 1951, in Serfes, 1991).

Table F-3
River Efficiencies for Wells Monitored During the COP Pumping

Well	Estimated Efficiency Coefficient	Time Period for Efficiency Coefficient Estimation
FF06	71%	12/31/96 to 1/2/96
FF04	65%	12/31/95 to 1/2/96
PW-16	33%	12/30/95 to 1/2/96
MW-06	30%	12/31/96 to 1/2/96
MW-18-31	32%	12/30/95 to 1/2/96

F.3.1.4 Water Level with River Influence Removed

A predicted water level at an individual well, with the Columbia River influence removed, was calculated by taking the observed groundwater elevation at a distinct time and subtracting the product of the river efficiency multiplied by the change in river stage for the same period using the equation:

$hf(t) = h(t) - E[CR_N(t)]$, where

$hf(t)$ = filtered water level for an individual well with the river stage fluctuations removed at time t

$h(t)$ = 24-hour moving average water level in an individual well at time t

E = estimated river efficiency coefficient for an individual well

CR_N = normalized 24-hour moving average Columbia River stage at time t

F.3.2 Water Level Response to Pumping

Water level data collected during and after the COP pumping period were analyzed to assess if wells completed in the shallow and deep aquifers near RMC responded to pumping at the CSSW. No background water level data were collected because of the sudden emergency startup of the CSSW. Due to other stresses (river stage fluctuations, precipitation, and possibly pumping at RMC) potentially acting upon the groundwater system, background water level data would normally be used to estimate drawdown at individual wells. Because these data are not available, the following analysis relies on the recovery portion of the water level data set (following shutdown of the CSSW) to assess hydraulic response in RMC wells to CSSW pumping.

F.3.2.1 Deep Zone Response

Fairview Farms No. 6. Hydrographs for Fairview Farms No. 6 (FF06) (closest to the CSSW) and the Columbia River from November 27, 1995, to January 2, 1996, are presented in Figure F-2. The influence of the Columbia River daily tidal cycles is evident in FF06 water levels. Two daily tidal cycles seen in the river hydrograph appear muted and combined into a single daily cycle at FF06 (December 20 and 21, 1995). Longer-term Columbia River stage fluctuations (FF06 water level response to November 28 and December 12 rise in river levels) are also apparent in FF06 water levels.

As described in Section F.3.1.1, a 24-hour moving average was used to smooth the Columbia River and FF06 data to make the river data more comparable to the groundwater elevation data set. The river data were also shifted forward 3 hours to align the peaks and troughs of both data sets (Figure F-3). The 3-hour shift was conducted by visually comparing the two data sets after the 24-hour moving average was applied. A river efficiency of 71 percent was calculated based on data for the time period from December 31, 1995, through January 2, 1996. No response was noted in the deep groundwater resulting from the end of the CSSW pumping. The river efficiency calculation is included in Attachment C.

Water levels in FF06 appear to change consistently with changes in the Columbia River during the COP pumping. Figure F-4 shows the Columbia River (smoothed and shifted), and FF06 smoothed and without the river influence. The influence of the Columbia River was removed from FF06 to evaluate if any noticeable recovery occurred following pumping. There are no noticeable changes in water elevation until December 27 (three days after the COP wells were turned off) when the water elevation drops approximately 0.5 foot. In fact, a slight water level rise, which began approximately 24 hours prior to the pump shut-off, did not change slope in the 24 hours after the pumps stopped. A rise in groundwater elevation or increase in the rate of rise following the CSSW pumping shutdown would be expected to occur if the COP pumping had an influence on FF06 water levels. Based on these observations, no measurable response to pumping occurred in the groundwater zone monitored by FF06, the closest well to the CSSW.

Fairview Farms No. 4. Data from FF04 was handled and reduced in the same manner as FF06. An efficiency of 65 percent was calculated using data from December 31, 1995, through January 2, 1996 (Attachment C). Water levels in FF04 appear to change consistently with changes in the Columbia River during the COP pumping. The influence of the Columbia River was removed from FF04 to evaluate if any noticeable recovery occurred following

pumping. Figure F-4 shows the Columbia River (smoothed and shifted), and the FF04 data with the influence of the Columbia River removed. As observed at FF06, a slight water level increase began approximately 12 hours prior to the CSSW shutdown, and did not change slope for the next 48 hours following the CSSW shutdown. The first inflection on the hydrograph following the CSSW shutdown was a 0.5-foot water level decline beginning approximately 48 hours after the CSSW shutdown. Therefore, no measurable water level responses were observed at FF04 following the end of CSSW pumping.

Well PW16. Data from PW16 was handled and reduced in the same manner as FF06. An efficiency of 33 percent was calculated using data from December 31, 1995, through January 2, 1996 (Attachment C). Water levels in PW16 appear to change consistently with changes in the Columbia River during the COP pumping. The influence of the Columbia River was removed from PW-16 to evaluate if any noticeable recovery occurred following pumping. Figure F-4 shows the Columbia River (smoothed and shifted), and the PW16 data with the influence of the Columbia River removed. Water level response at PW16 is similar to that observed at FF04 and FF06. Therefore, no measurable water level responses were observed at PW16 following the end of CSSW pumping.

F.3.2.2 Shallow Groundwater Response

CH2M HILL collected electronic water level data from two shallow groundwater monitoring wells (MW06 and MW18-31) closest to the CSSW during the pumping event (see Figure F-1). Shallow monitoring well water level data were reduced and evaluated in the same way as the deeper wells. Groundwater elevation data were collected from the two shallow groundwater monitoring wells to assess whatever measurable drawdown could be observed during the COP pumping.

Well MW06. Groundwater level data from MW06 and the Columbia River data are shown in Figure F-5. The Columbia River data were shifted (using the visual method) to align river peaks and troughs with the shallow aquifer's (after a 24-hour moving average was applied). A shift of 3 hours appears to be the best match for the data set during the recovery period, although this shift does not provide a good match during earlier portions of the data. A river efficiency of 30 percent was calculated based on the recovery stage data from December 31, 1995, through January 2, 1996. River efficiency calculations are presented in Attachment C.

Figure F-6 shows MW06 with the Columbia River influence removed. The data do not indicate a water level recovery response from discontinued CSSW pumping; water levels continued to decline after the CSSW pumps were turned off.

Well MW18-31. Groundwater elevation data from MW18-31 and the Columbia River data are shown in Figure F-7. The Columbia River data has been shifted (using the visual method) to align river peaks and troughs with the shallow aquifer's (after the 24-hour moving average was applied). A shift of 8 hours appears to be the best match for the data set during the recovery period. A river efficiency of 32 percent was calculated based on the last period of the recovery stage (Attachment C).

Figure F-6 shows MW18-31 with the Columbia River influence removed. The data do not indicate a water level recovery response from discontinued CSSW pumping; water levels continued to decline after the CSSW pumps were turned off.

F.4 Conclusions

Based on these analysis methods, pumping at the CSSW did not appear to produce a measurable response in either the shallow or deeper groundwater between the four operating BLA wells and the RMC plant site. This observation suggests that pumping from the BLA wells in the CSSW is unlikely to influence groundwater flow directions beneath the RMC plant site.

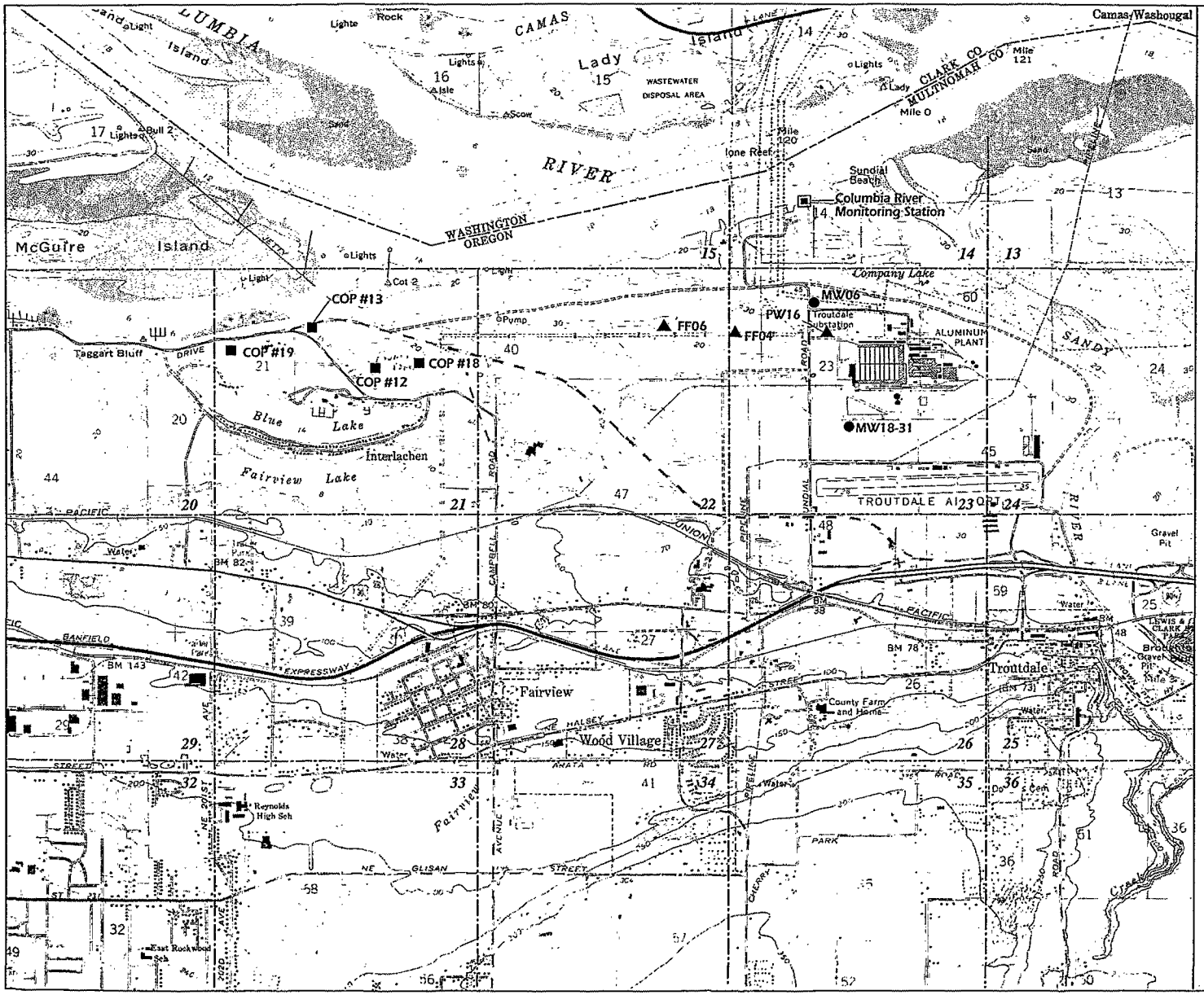
F.5 References

Erskine, A.D., 1991. *The Effect of Tidal Fluctuation on a Coastal Aquifer in the U.K.* Groundwater. V.29, No. 4, pp. 556-562.

Ferris, J.G., 1951. *Cyclic Fluctuations of Water Level as a Basis for Determining Aquifer Transmissibility*. Intl. Assoc. Sci. Hydrology Publ. 33, pp. 148-155.

Serfes, M.F., 1991. *Determining the Mean Hydraulic Gradient of Groundwater Affected by Tidal Fluctuations*. Groundwater. V.29, No. 4, pp. 549-555.

Walton, W.C., 1970. *Groundwater Resource Evaluation*. McGraw-Hill Book Company, New York, New York.



LEGEND

- COP #19 — Pumped City of Portland production well location
- Columbia River Monitoring Station
- Deep well monitored for response to pumping
- Shallow well monitored for response to pumping

Base map: U.S. Geological Survey 7.5 minute Camas, Washington Quadrangle. Photo revised 1970 and 1975. Contour interval: 10 feet.

NORTH

0 — 2,000 Feet
Approximate Scale

Figure F-1
City of Portland and Other Wells Monitored for Response to City of Portland Production Well Pumping
(11/28/95 through 12/24/95)
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Groundwater Remedial Investigation Report

CH2M HILL

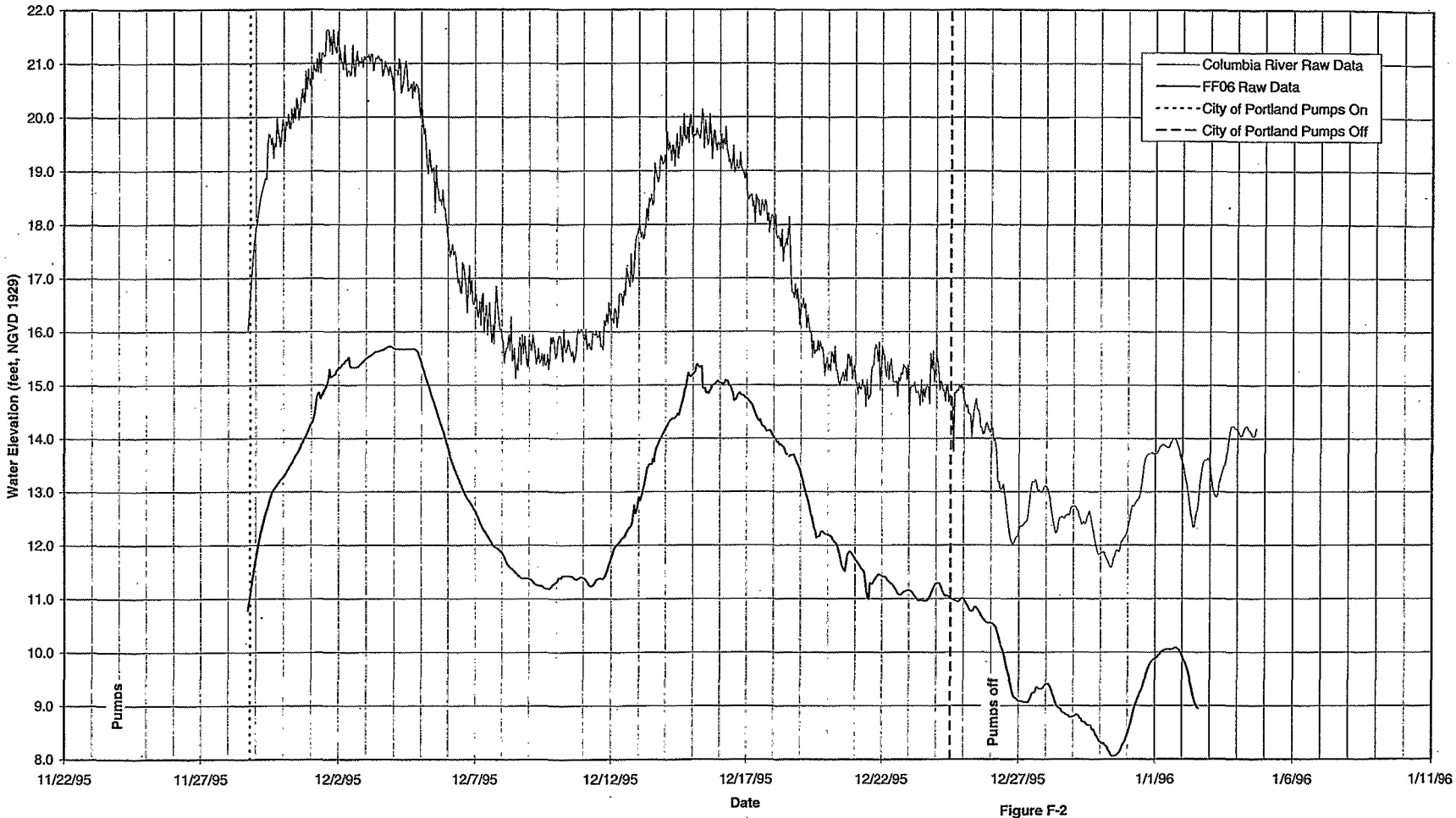


Figure F-2
FF06 and Columbia River Raw Data Hydrographs
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

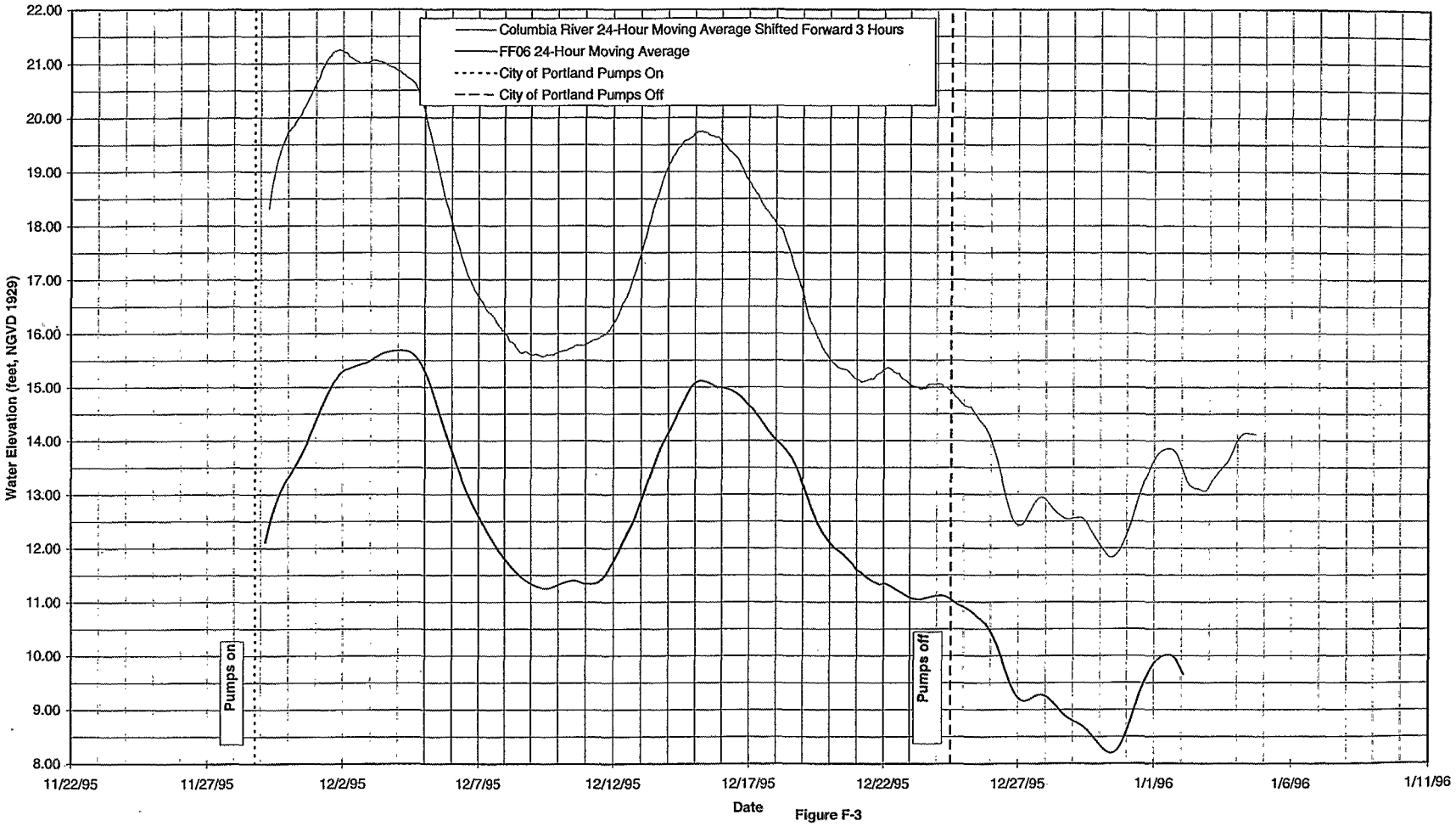


Figure F-3
FF06 and Columbia River Hydrographs (24-Hour Moving Averages)
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

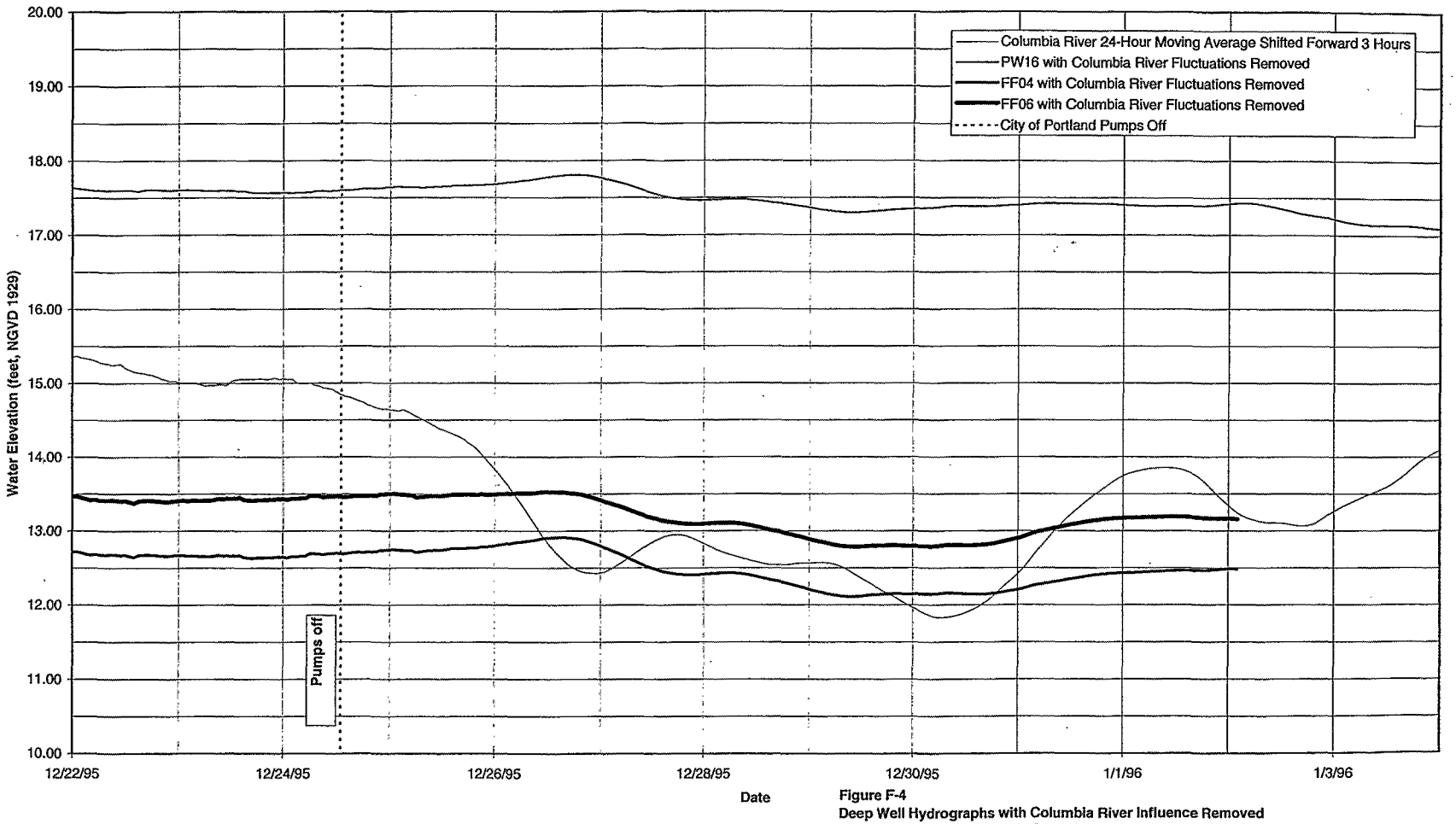


Figure F-4
Deep Well Hydrographs with Columbia River Influence Removed
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

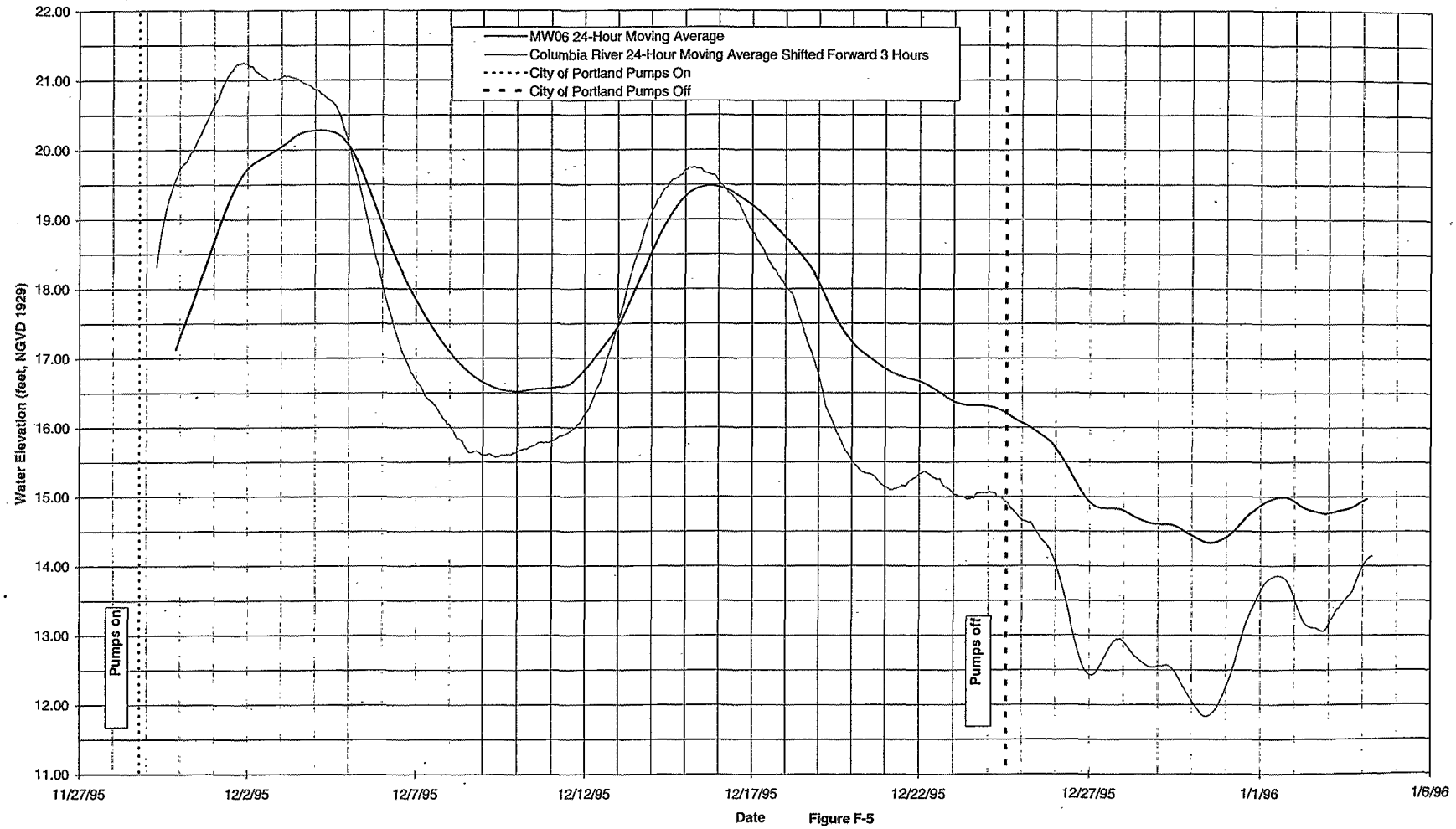


Figure F-5
MW06 and Columbia River Hydrographs (with 24-Hour Moving Average)
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

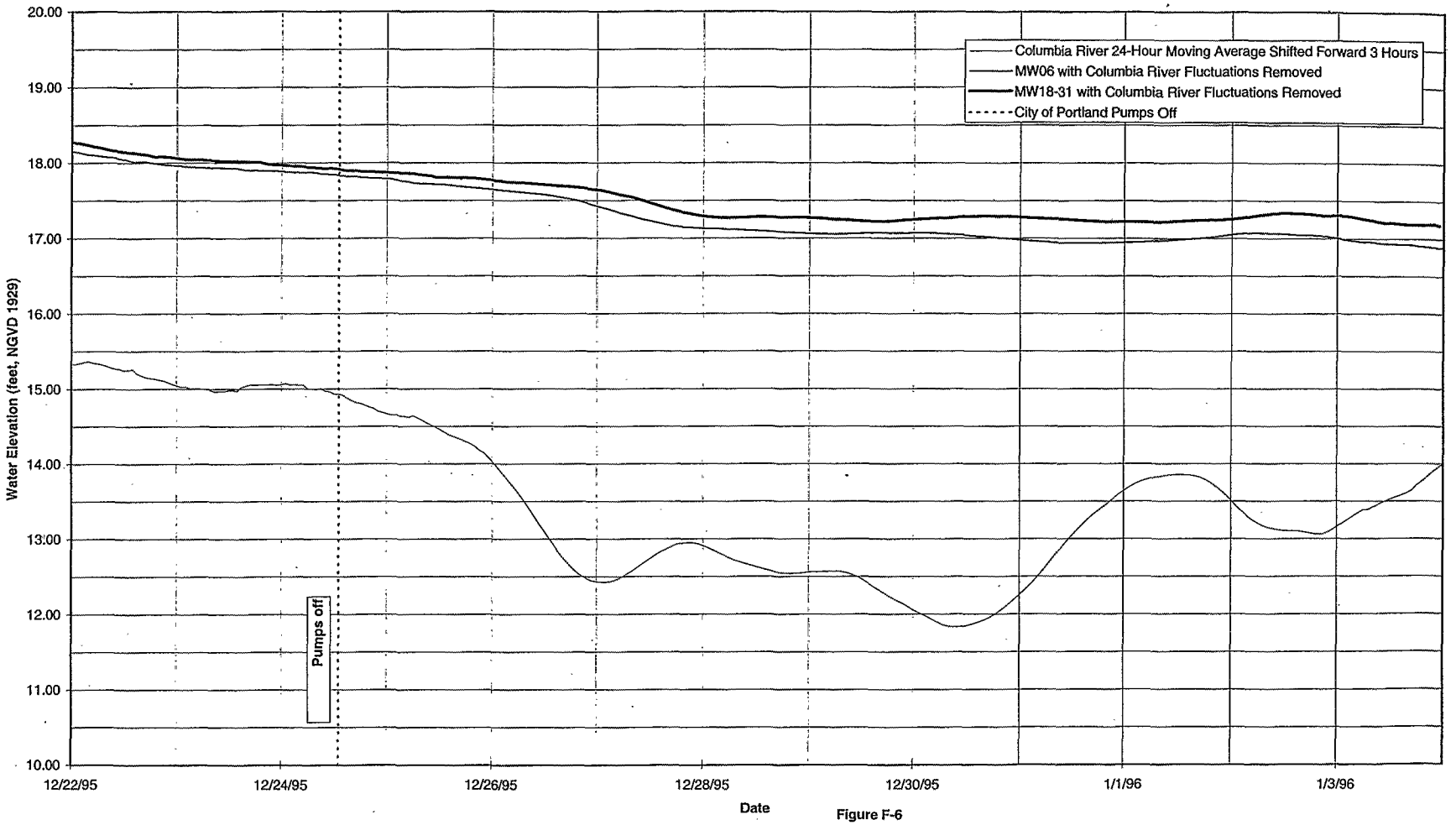


Figure F-6
Shallow Well Hydrographs with Columbia River Influence Removed
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

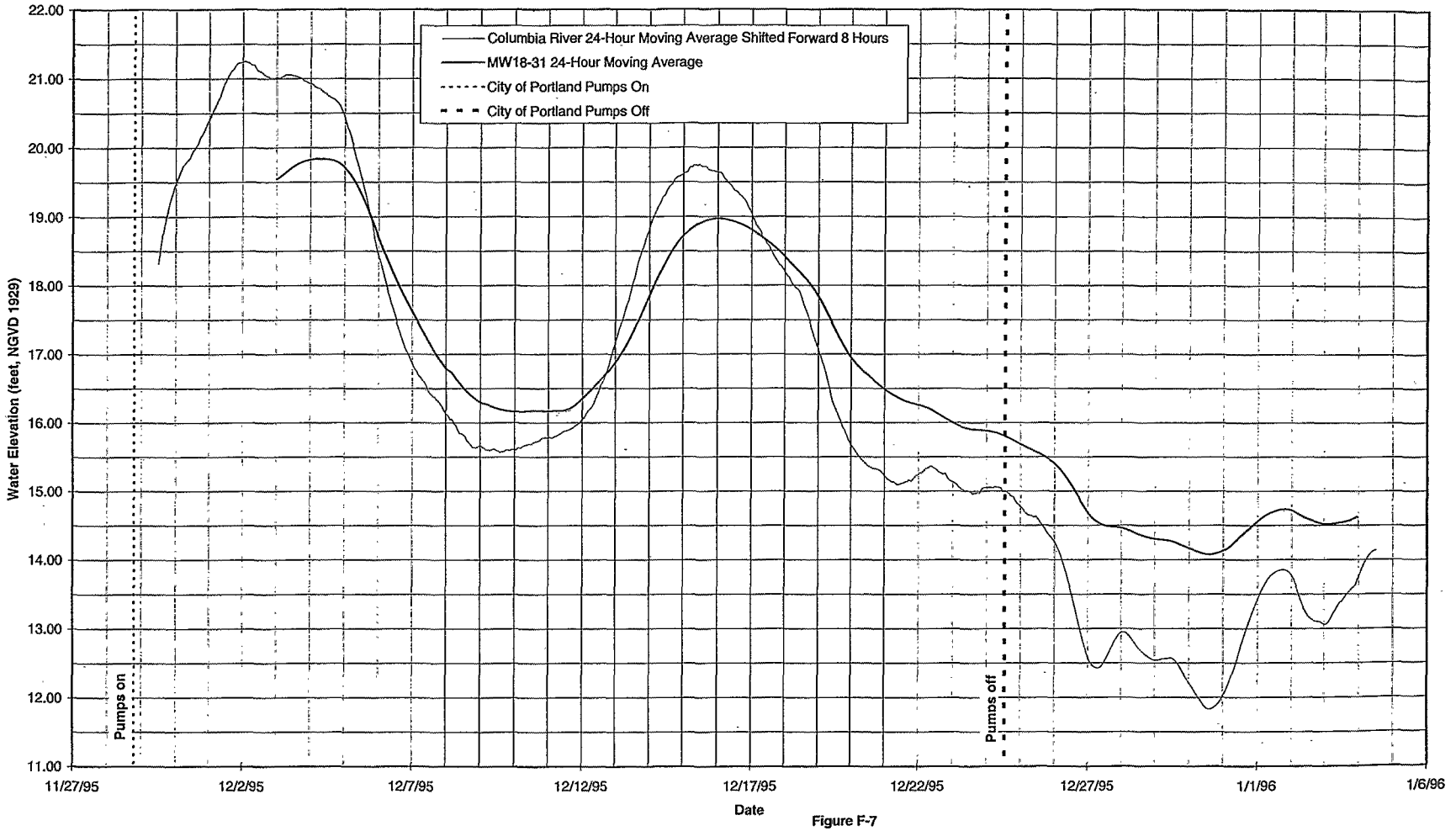


Figure F-7
MW18-31 and Columbia River Hydrographs (24-Hour Moving Average)
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

ATTACHMENT A

Precipitation Hydrographs (November 1995 and December 1995)

PDX18256.DOC

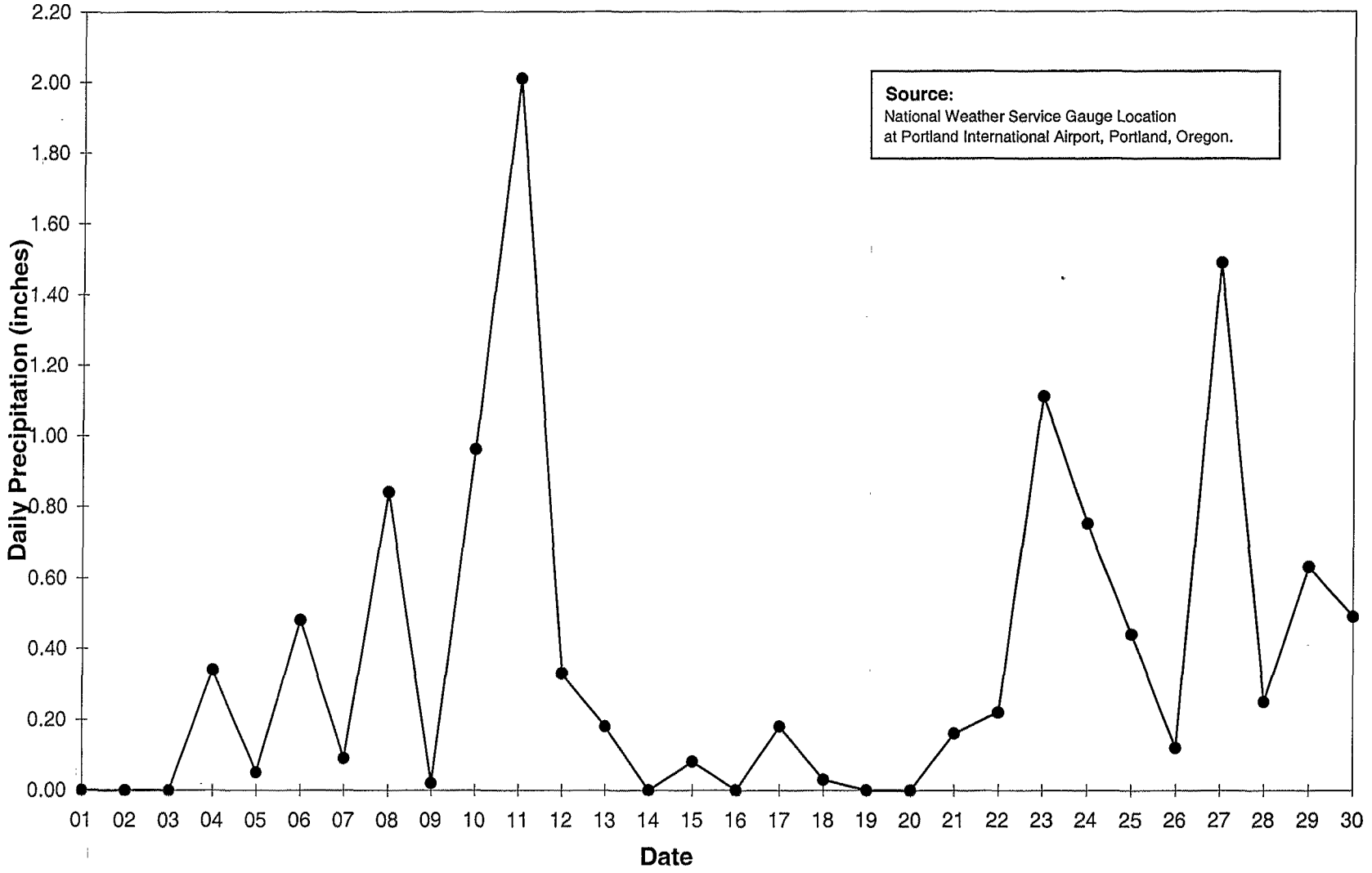


Figure F.A-1
Daily Precipitation During November 1995
Reynolds Metals Company
Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

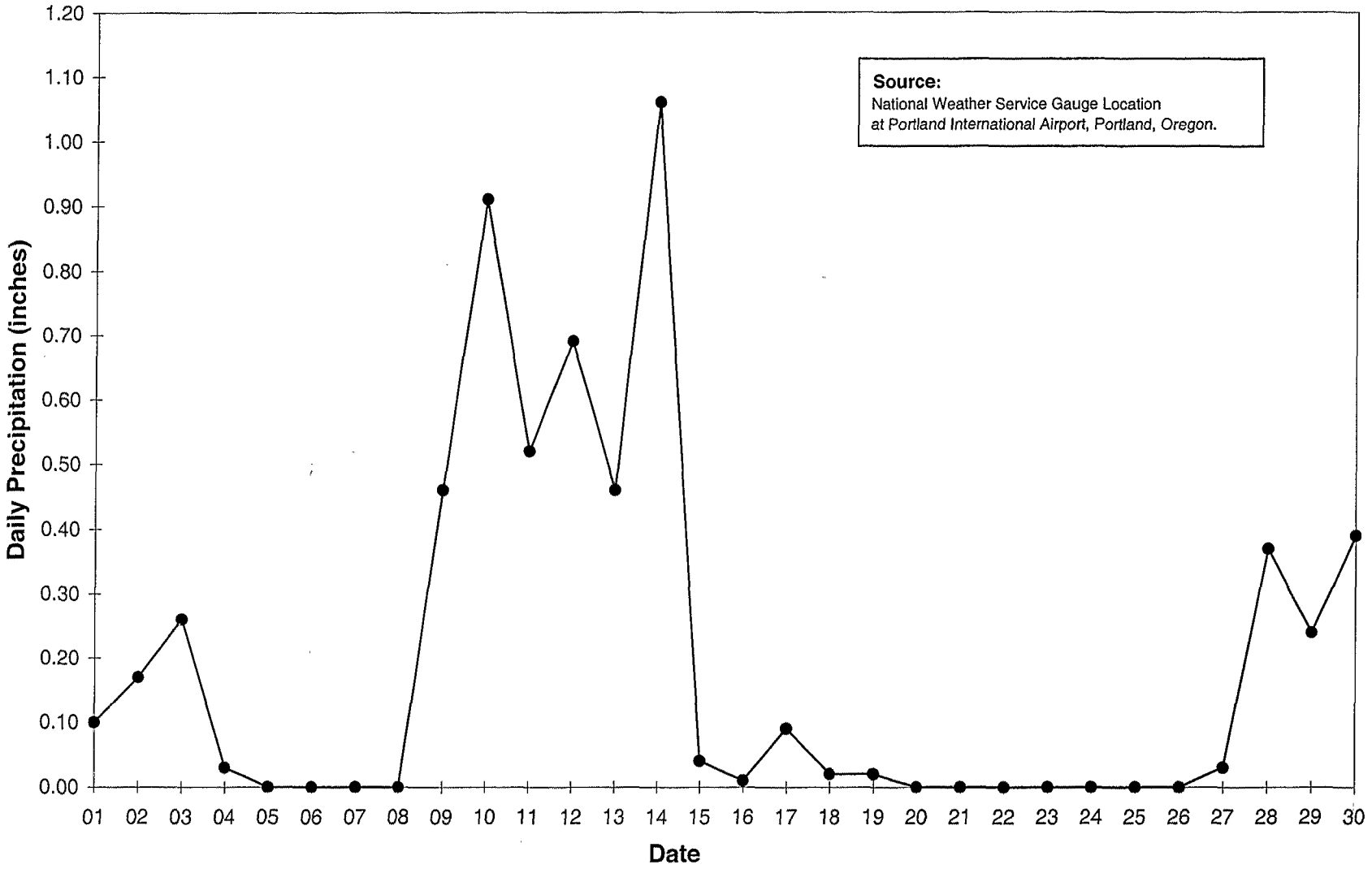


Figure F.A-2
Daily Precipitation During December 1995
Reynolds Metals Company
Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

Printed 5/18/99

ATTACHMENT B

Raw Monitoring Well and Columbia River Hydrographs

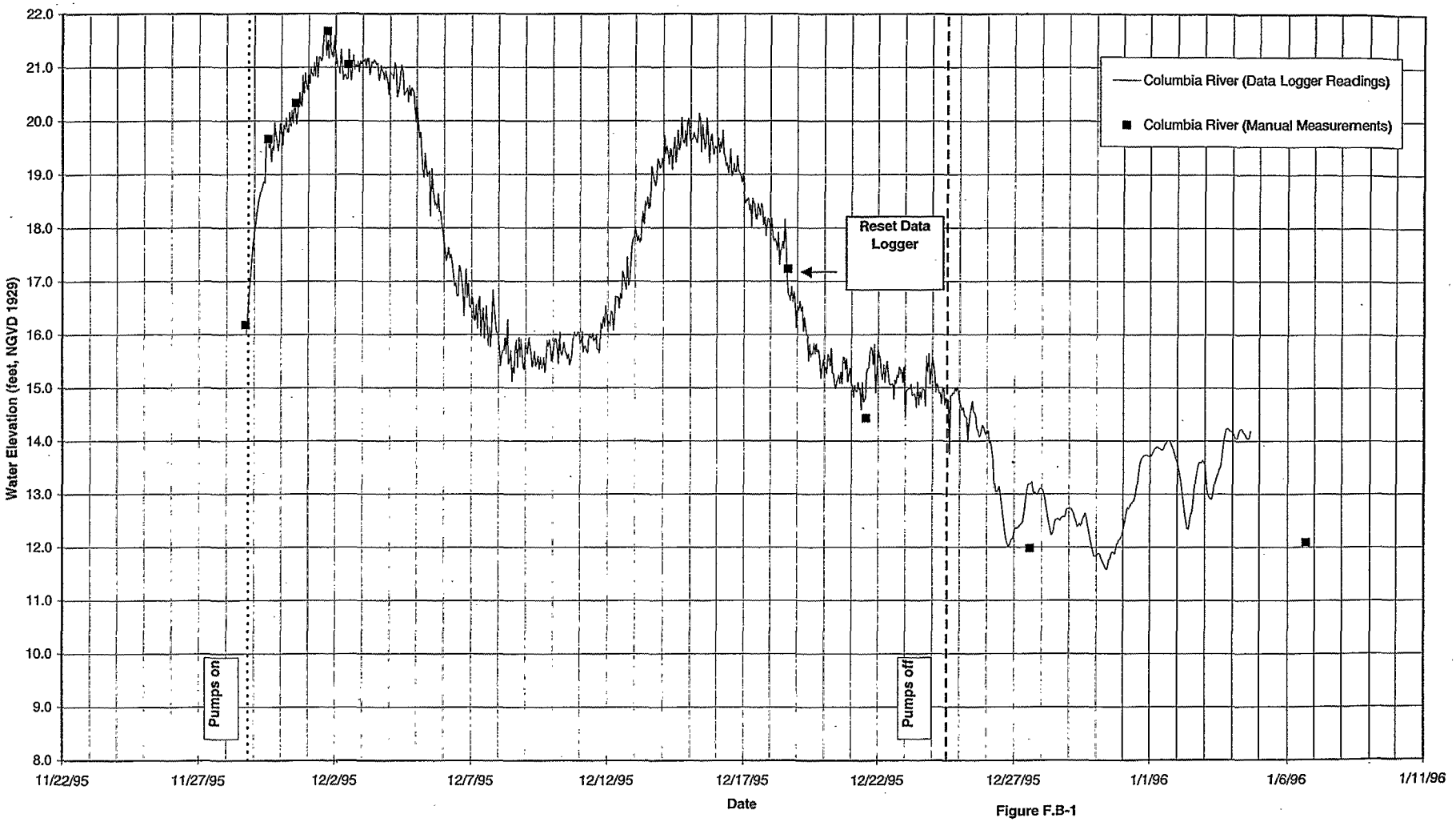


Figure F.B-1
Columbia River Raw Data Hydrograph
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

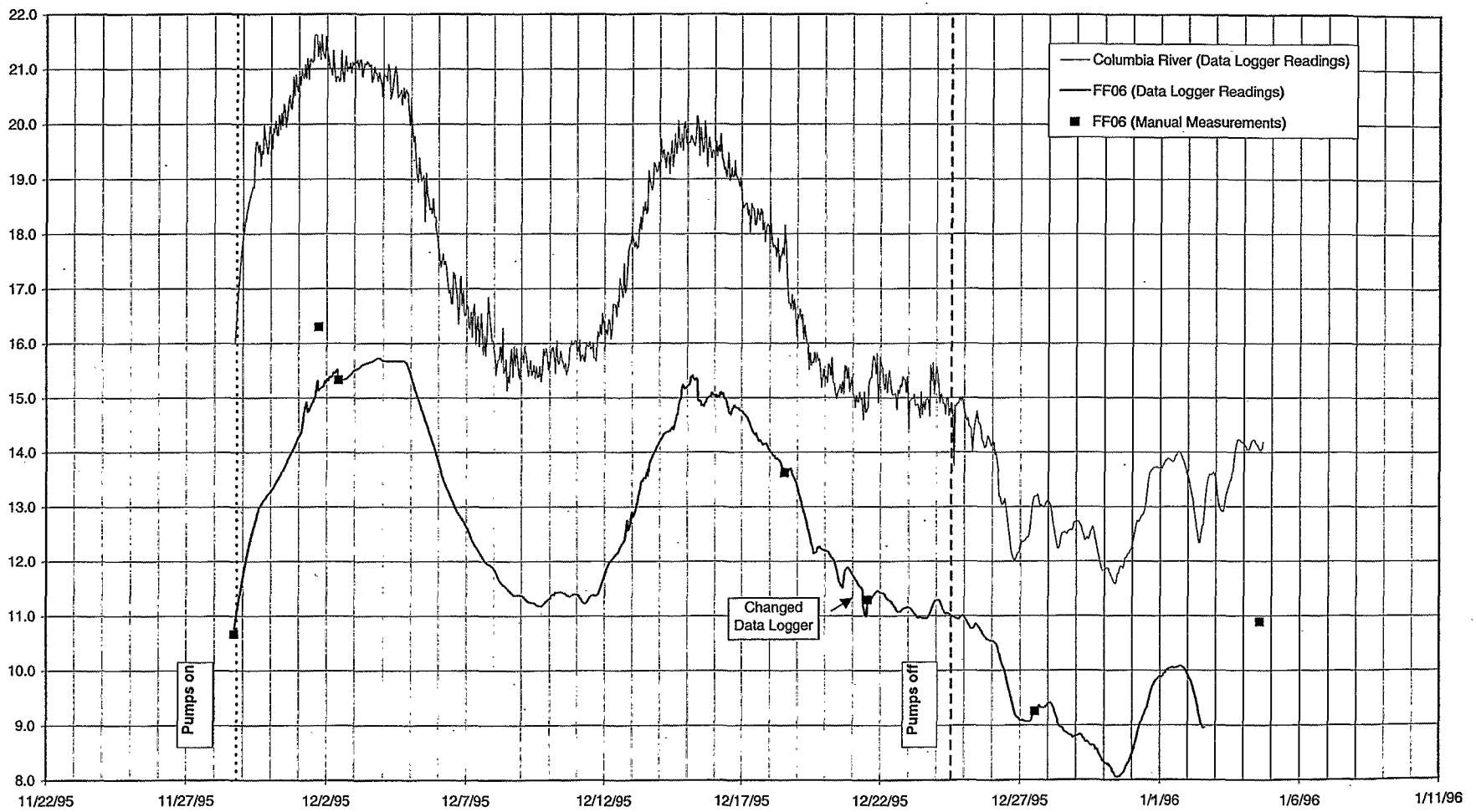


Figure F.B-2
FF06 and Columbia River Raw Data Hydrographs
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

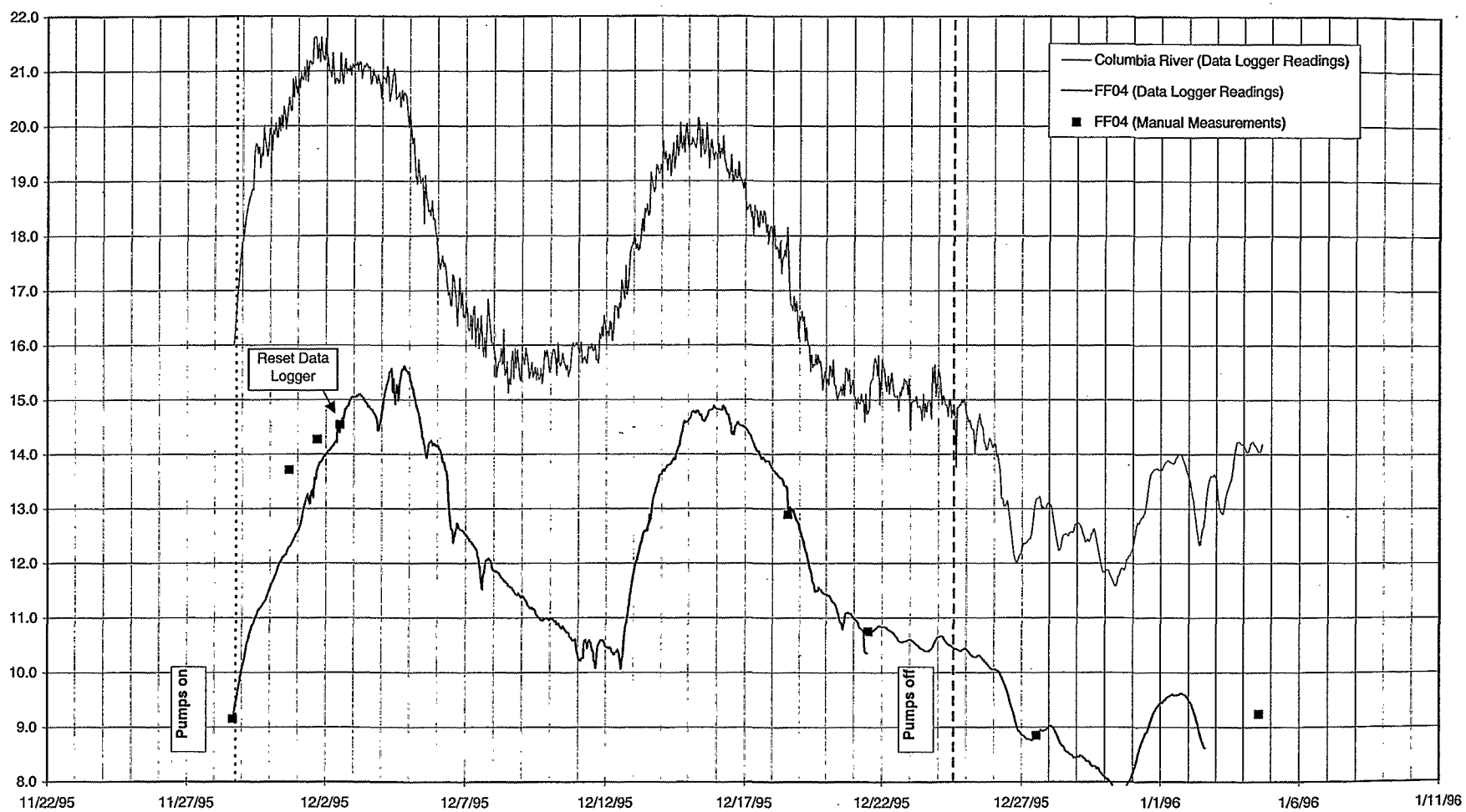


Figure F.B-3
FF04 and Columbia River Raw Data Hydrographs
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

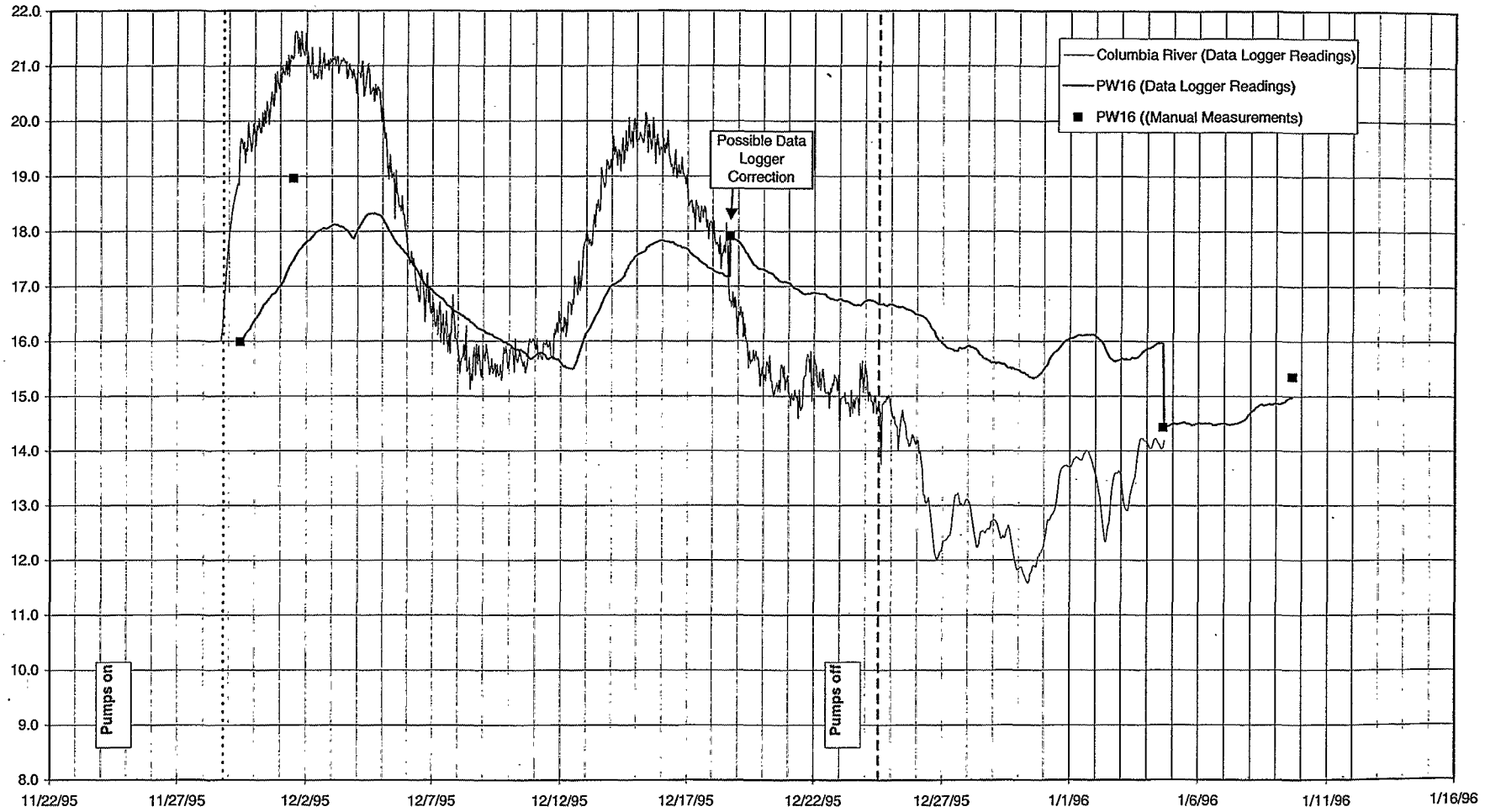


Figure F.B-4
PW16 and Columbia River Raw Data Hydrographs
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

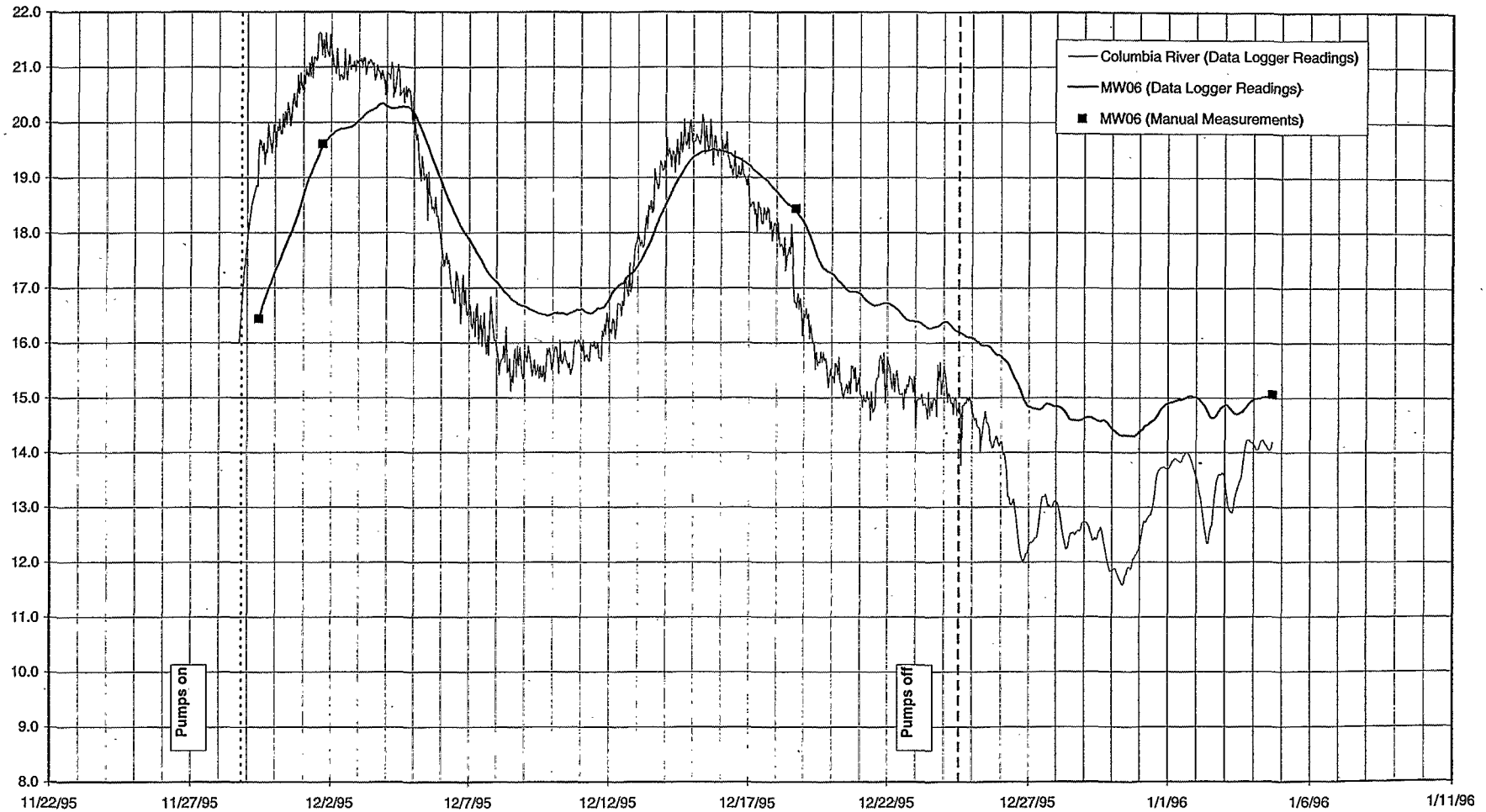


Figure F.B-5
MW06 and Columbia River Raw Data Hydrographs
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

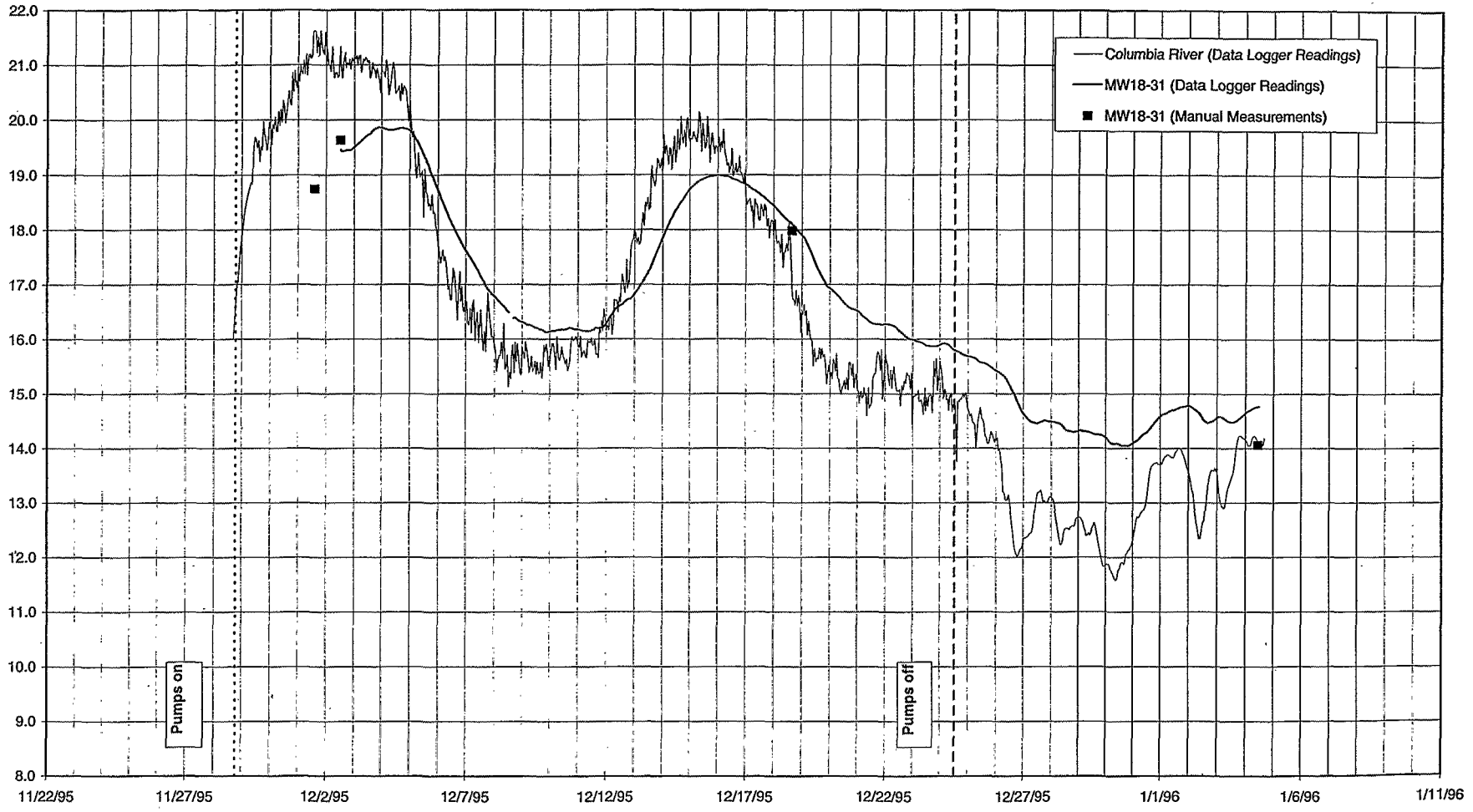


Figure F.B-6
MW18-31 and Columbia River Raw Data Hydrographs
Reynolds Metals Company, Troutdale, Oregon
Groundwater Remedial Investigation Report

PDX1826F.XLS

ATTACHMENT C

River Efficiency Calculations

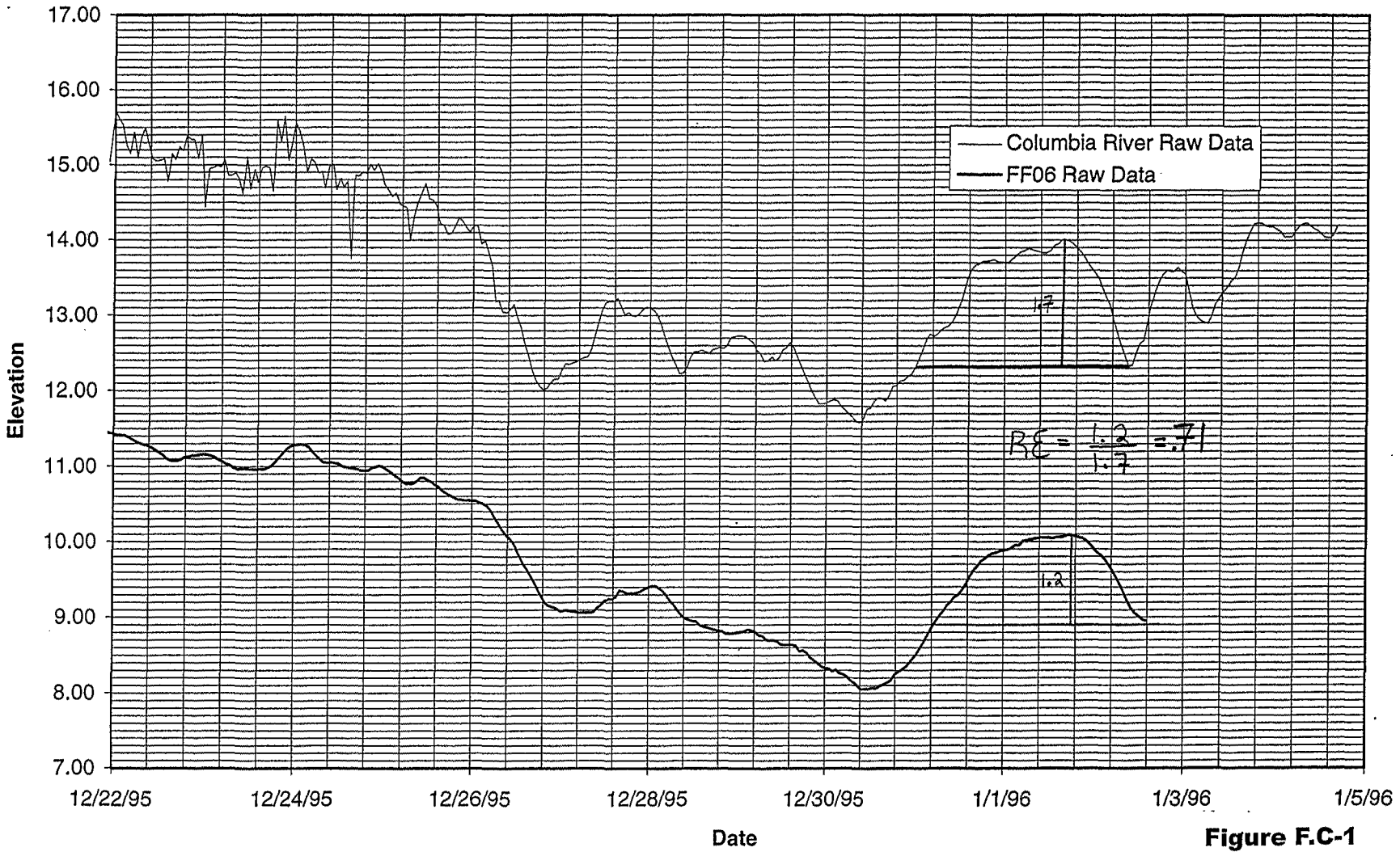
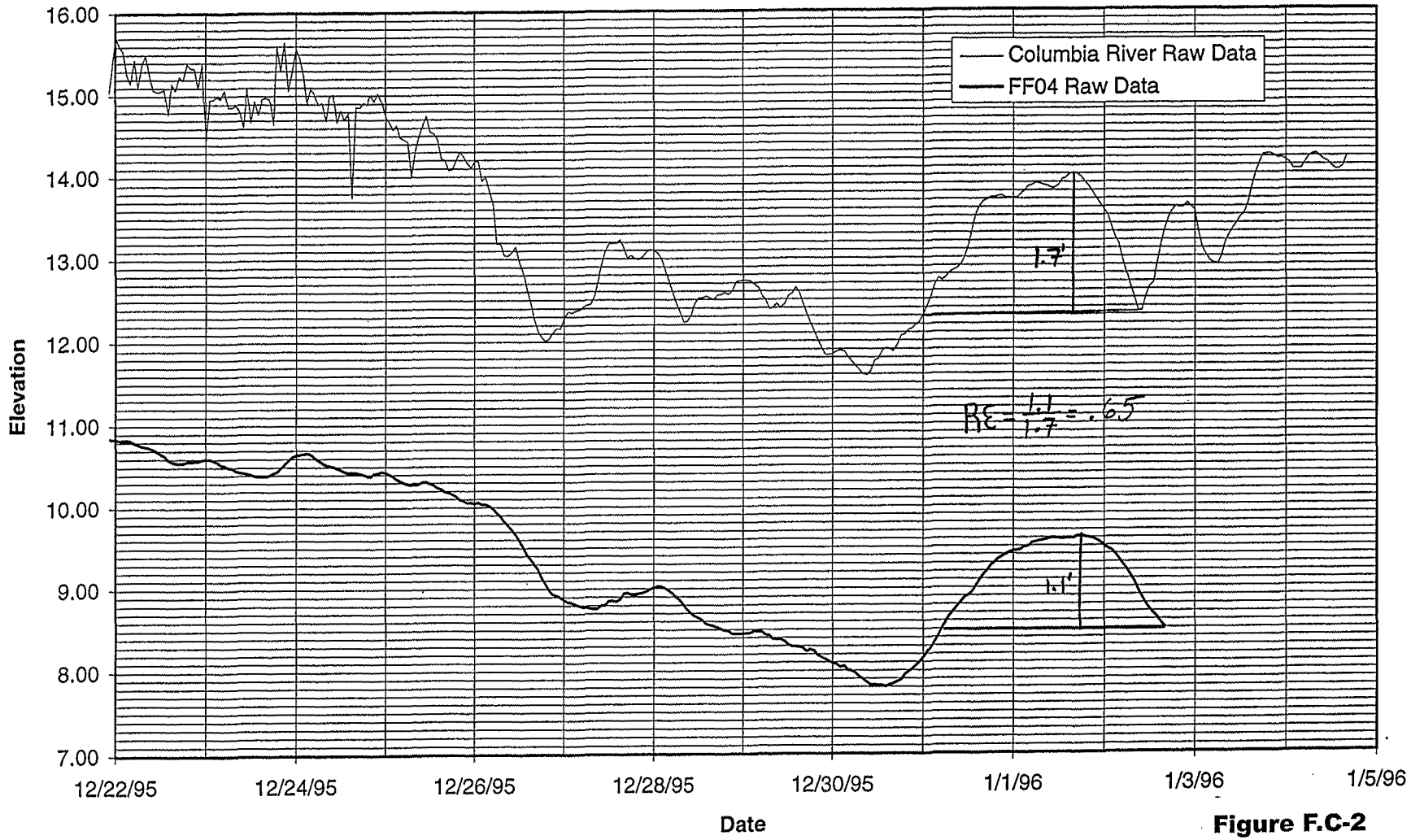

17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
Elevation
12/22/95
12/24/95
12/26/95
12/28/95
12/30/95
1/1/96
1/3/96
1/5/96
Date
Columbia River Raw Data
FF06 Raw Data
1.7
1.2
RE = 1.2/1.7 = .71

Figure F.C-1


Columbia River Raw Data
FF04 Raw Data
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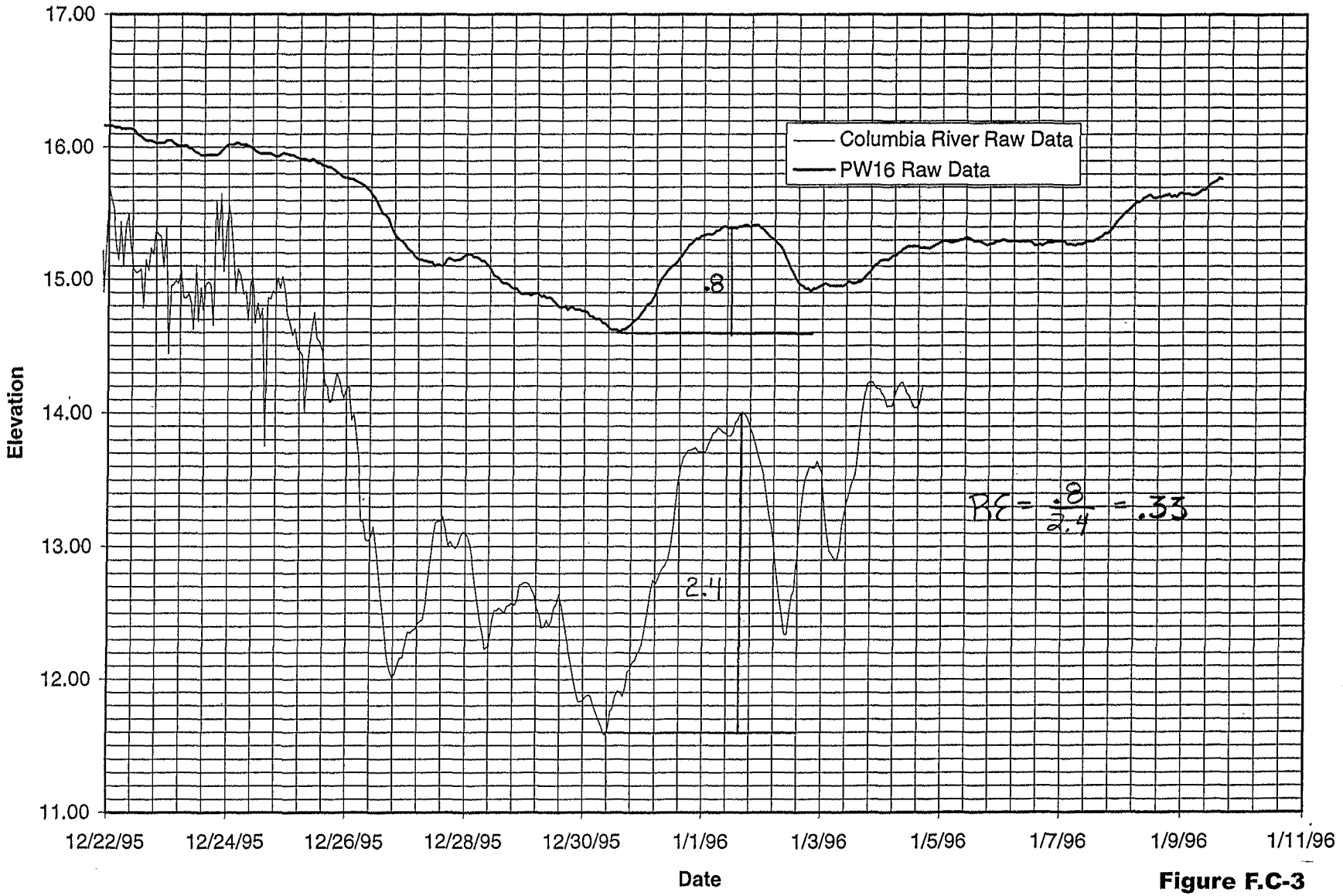
9.00
8.00
7.00
Elevation
12/22/95
12/24/95
12/26/95
12/28/95
12/30/95
1/1/96
1/3/96
1/5/96
Date
1.7'
1.1'
RE = 1.1/1.7 = .65

Figure F.C-2


17.00
16.00
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12.00
11.00
Elevation
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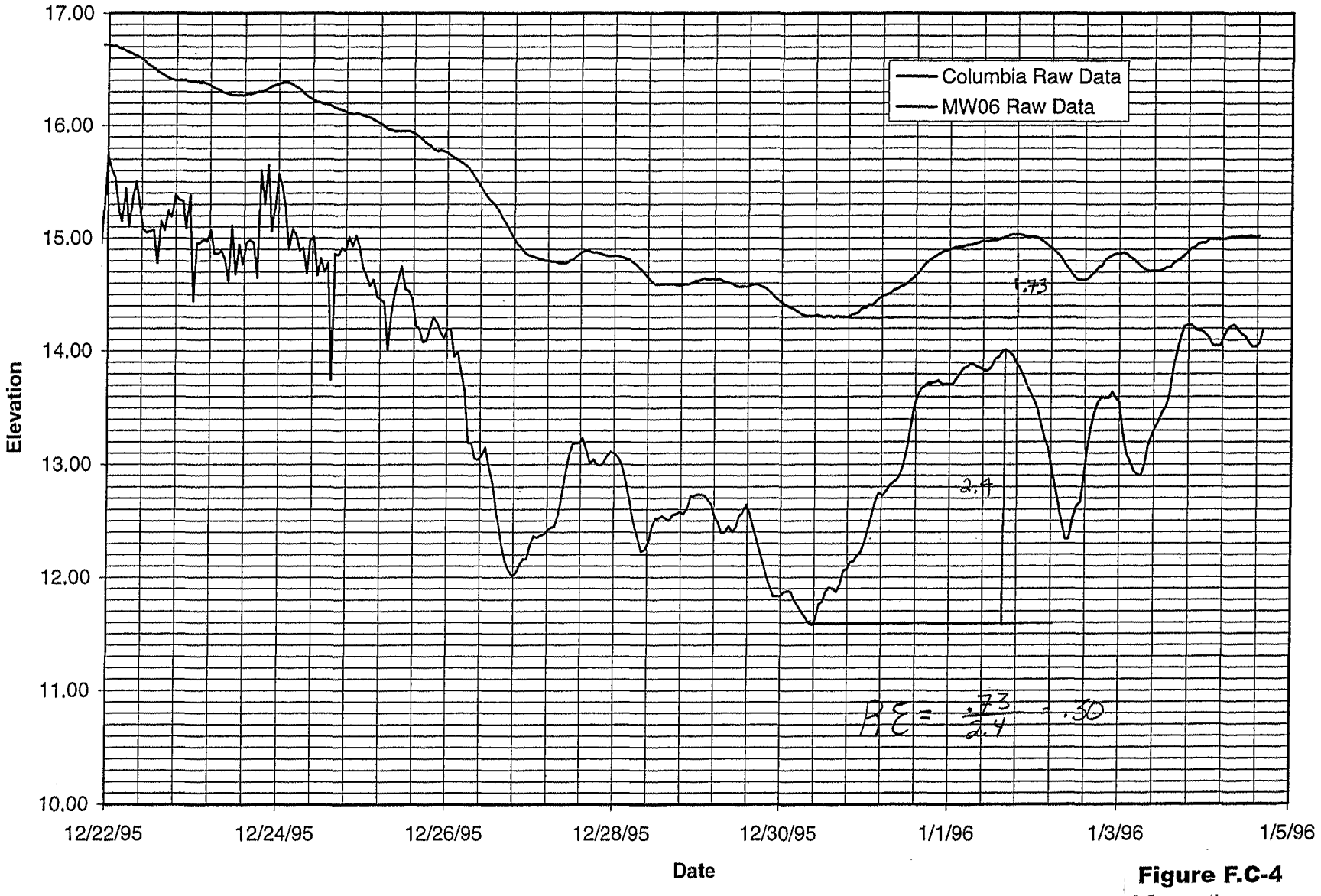
12/24/95
12/26/95
12/28/95
12/30/95
1/1/96
1/3/96
1/5/96
1/7/96
1/9/96
1/11/96
Date
Columbia River Raw Data
PW16 Raw Data
.8
2.4
RE = .8/2.4 = .33

Figure F.C-3


17.00
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14.00
13.00
12.00
11.00
10.00
Elevation
12/22/95
12/24/95
12/26/95
12/28/95
12/30/95
1/1/96
1/3/96
1/5/96
Date
Columbia Raw Data
MW06 Raw Data
.73
2.4
RE = .73/2.4 = .30

Figure F.C-4

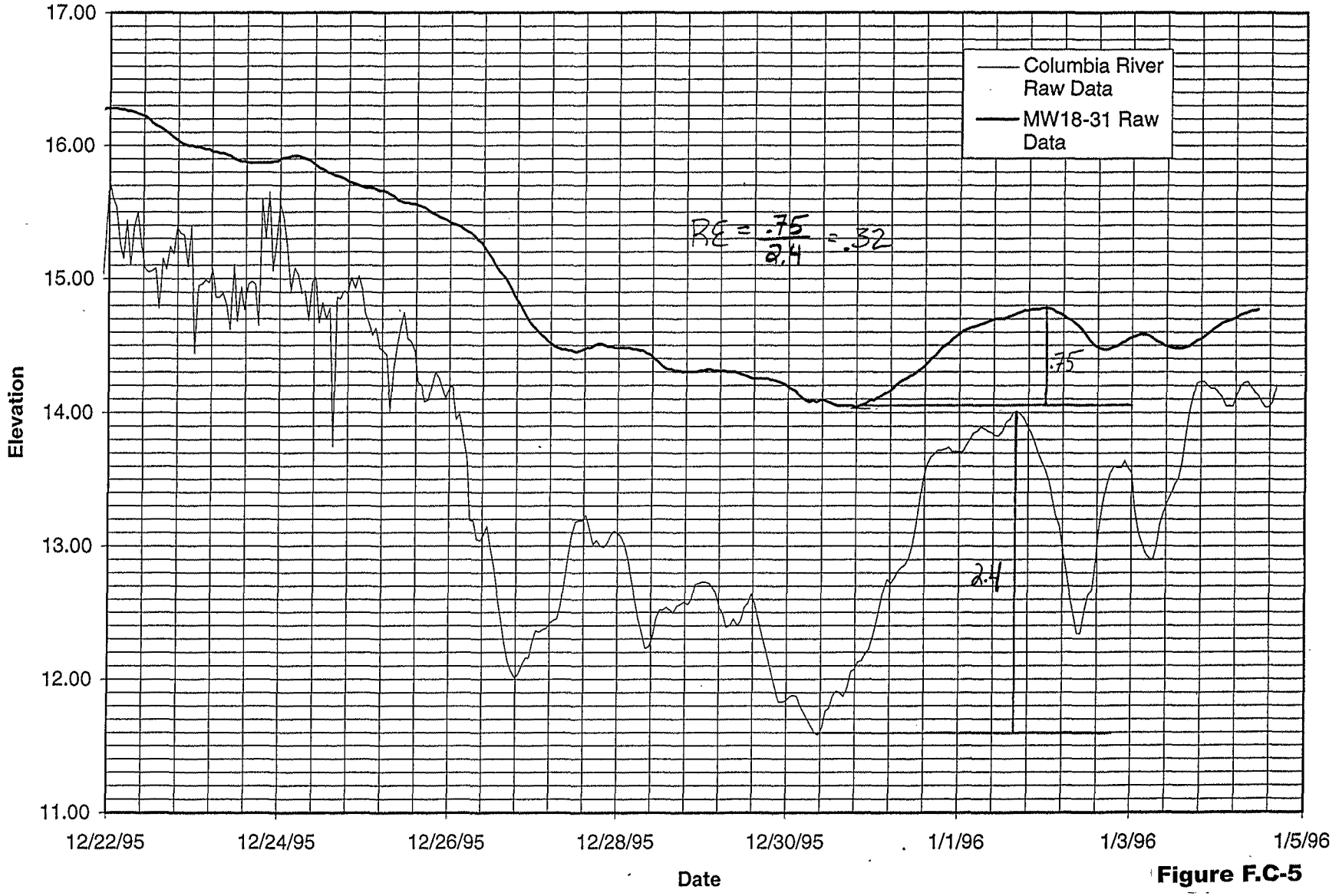
17.00
16.00
15.00
14.00
13.00
12.00
11.00
Elevation
12/22/95
12/24/95
12/26/95
12/28/95
12/30/95
1/1/96
1/3/96
1/5/96
Date
Columbia River Raw Data
MW18-31 Raw Data
RE = .75/2.4 = .32
.75
2.4

Figure F.C-5

APPENDIX G

Fluoride Transport Assessment at the RMC Site

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APPENDIX G

Fluoride Transport Assessment at the RMC Site

This appendix discusses the processes that control the adsorption and desorption of fluoride between site soils and groundwater. The adsorption and desorption mechanisms anticipated to occur in each water-bearing zone [the silt unit, the upper gray sand (UGS), the intermediate sand, and the deep sand] beneath the RMC facility are addressed. The understanding of adsorption and desorption mechanisms is derived by sampling site soils and by reviewing published literature describing the transport of fluoride in the subsurface.

This appendix presents the following information:

- G.1: Objectives of the transport assessment
- G.2: Summary of conclusions from the assessment
- G.3: Methodology used to perform the assessment
- G.4: Mechanics of fluoride adsorption and desorption
- G.5: Summary of findings in published literature
- G.6: Comparison of site soil data with literature soil data
- G.7: Calculation of Equilibrium Groundwater Concentrations
- G.8: References

G.1 Objectives

The objectives of the fluoride transport analysis were as follows:

1. Use published literature to identify the processes controlling fluoride adsorption and desorption. Specifically:
   - Identify whether the partitioning relationships for the adsorption and desorption phenomena are linear or nonlinear.
   - For nonlinear mechanisms, identify the type of isotherm (Langmuir, Freundlich, other) and the concentration ranges over which the isotherm applies.
2. Identify isotherm coefficients that are representative of the expected adsorption/desorption mechanics for site soils. Perform the correlation by matching concentrations of key adsorption/desorption indicator parameters reported in the literature with concentrations measured for site soils.
3. Predict the groundwater concentration that would arise from desorption of currently adsorbed fluoride under equilibrium conditions if low-concentration groundwater were in contact with the soil. The purpose of this calculation is to understand how any future reductions in groundwater concentrations upgradient of a given soil sampling location would potentially influence groundwater quality trends at that location. Desorption is the primary process of interest at the RMC facility because fluoride has been present in groundwater for a sufficiently long time that a dynamic equilibrium exists between adsorption and desorption. (In other words, the rates of adsorption and desorption are

equal.) This conclusion is also consistent with time-series plots and cross sections of fluoride concentrations, which together indicate that fluoride concentrations in groundwater have been relatively unchanged since site investigations began in 1994 and that no further expansion of the fluoride plume in groundwater is occurring.

G.2 Summary of Conclusions

This section summarizes conclusions reached in the analysis of fluoride transport at the RMC Troutdale site. Conclusions are as follows:

1. The published literature [particularly articles by Peek and Volk (1985), Simard and LaFrance (1996), and Arnesen and Krogstad (1998)] states the following regarding adsorption and desorption mechanics.

   - For a wide range of dissolved-phase groundwater concentrations, fluoride adsorption and desorption are generally best described by the nonlinear Freundlich isotherm. The nonlinear Langmuir isotherm is also a good descriptor of adsorption, but only at dissolved-phase concentrations of about 15 mg/L or less.
   - Desorption of adsorbed non-mineral fluoride is not a fully reversible process in many soils. Consequently, separate isotherm constants generally apply to the adsorption and desorption processes.
   - The oxalate-extractable aluminum content of soils is directly correlated with (and the most significant factor affecting) the fluoride adsorption capacity of a given soil and the degree of reversibility of the sorption process. Other properties that can affect adsorption-desorption mechanics are the soil pH, the oxalate-extractable iron content, the dithionite-extractable aluminum and iron contents, and the organic carbon content. The grain size distribution may only indirectly affect adsorption and desorption.

2. Based on correlation of literature and site soils (using the oxalate-extractable aluminum content and to a lesser extent the other secondary factors listed above), soils in some locations can desorb sufficient fluoride to cause groundwater concentrations to be above the maximum contaminant level (MCL) of 4 mg/L. Specific conclusions are:

   - The soils that form the aquifer matrix within the intermediate sand zone do not contain sufficient fluoride to sustain groundwater concentrations above the MCL because soil concentrations are similar to background levels.
   - Soils in the UGS could sustain fluoride concentrations above the MCL at scrap yard and east potliner. At south landfill, the soil concentrations in the UGS are similar to background levels and are not expected to sustain fluoride concentrations above the MCL.
   - Portions of the silt unit and the overlying surficial sands could sustain fluoride concentrations above the MCL. However, the degree to which these soils could sustain concentrations above the MCL is somewhat uncertain because some of the aqueous-phase concentrations that were calculated from the soil concentration data were substantially higher than measured groundwater concentrations in these units.

This indicates that only a portion of the sorbed fluoride may be leachable, a conclusion that is consistent with the desorption behavior described in the literature. Calculations of the degree of reversibility of the site soils suggest that adsorption could be as little as 20 percent reversible in the surficial sand, may be less than 50 percent in the silt unit, and may be greater than 50 percent in the UGS.

G.3 Methodology

The transport evaluation consisted of the following five steps:

Step 1. A library search of literature publications describing the presence of fluoride in soil and groundwater. The literature search consisted of the following tasks:

- Database search of journal articles (conducted at the Portland State University library)
- Review of these articles and other journal articles collected by project team members
- Review of references cited in relevant journal articles

Step 2. Collection of soil samples and groundwater samples from temporary borings drilled using Geoprobe® and hollow stem auger drilling methods. The temporary borings were completed in the silt unit and the upper gray sand beneath four of the soil and debris areas in the south plant. The samples were analyzed for chemical constituents deemed to be significant for correlating the site soils with adsorption and desorption mechanisms (isotherms and isotherm parameters) described in the literature. Table G-1 presents a summary of the soil and groundwater samples that were collected. The table shows two categories of samples.

- **Co-located samples.** These are samples of soil and groundwater obtained at the same depths in adjacent borings. The purpose of these samples was to evaluate sorption dynamics between the sorbed-phase and dissolved-phase fluoride concentrations. Borings in which soil samples were collected were situated in close proximity to (within a feet of) borings where groundwater samples were collected.
- **Soil samples analyzed for literature correlation purposes.** These are soil samples analyzed for specific constituents (besides fluoride) that are good indicators of fluoride adsorption/desorption mechanics, according to published literature.

Step 3. Correlation of site soil sampling results with literature soil samples to identify isotherm constants that would be applicable to describing desorption from site soil samples.

Step 4. Calculation of the mass of fluoride that is estimated to be available for desorption from site soil samples. This is calculated by subtracting background (mineral) fluoride concentrations and dissolved-phase concentrations from the measured fluoride concentrations in site soil samples.

Step 5. For each site soil sample, calculation of the equilibrium aqueous-phase concentration that would be associated with contact of low-concentration groundwater with the soils,

which would desorb fluoride mass that is present above background (mineral) concentrations.

G.4 Mechanics of Fluoride Adsorption and Desorption

The isotherms that describe adsorption and desorption mechanics (and the corresponding rate and capacity coefficients) are typically determined empirically by measuring the amount of fluoride sorbed by a soil (C_{ads}) that is in contact with fluoride dissolved in water (C). The sorption coefficient is derived from the resulting sorption isotherm, which describes the relationship of the sorbed-phase concentration (C_{ads}), which is the mass of solute sorbed per unit dry weight of soil versus the solute concentration (C). Four isotherm models for equilibrium conditions (as described in Fetter, 1993) are summarized below. Equilibrium conditions assume that the solute is in equilibrium with the sorbed phase (that is, the sorptive process is rapid compared with the groundwater flow velocity).

1. Linear Sorption Isotherm

   $C_{ads} = K_d C$ — Plot of C vs. C_{ads} is straight line
   Slope = K_d

2. Freundlich Sorption Isotherm

   $C_{ads} = KC^{1/N}$ — Plot of log C vs. log C_{ads} is straight line
   N = slope of isotherm
   log K = intercept

3. Langmuir Sorption Isotherm

   $C/C_{ads} = (1/b)C + 1/Kb$ — Plot of C vs. C/C_{ads} is straight-line
   b = Sorption Capacity = reciprocal slope of isotherm
   K = Equilibrium constant or binding energy = (slope/intercept)

4. Langmuir Two-Surface Sorption Isotherm

   $C/C_{ads} = (1/b)C + 1/Kb$ — Plot of C vs. C/C_{ads} is curve with two straight line segments.
   b = Sorption Capacity = reciprocal slope of isotherm
   K = Equilibrium constant or binding energy = (slope/intercept).
   Each line segment has separate coefficients: (K1, K2, b1, and b2)

As the leading edge of a groundwater plume containing elevated levels of fluoride moves through an aquifer, a portion of the fluoride mass is adsorbed to the soils that form the aquifer matrix. This adsorption process is possible because adsorption sites are available. If the groundwater concentration source is sustained (or increases) over time, primary adsorption sites (and secondary sites, if present) become progressively bound with fluoride. Although these sites can exchange fluoride with the aqueous phase, the net exchange rate of fluoride between water and soil diminishes over time. When the net adsorption rate

approaches zero, a condition of dynamic equilibrium exists in which adsorption rates and desorption rates are equal. Under dynamic equilibrium, the groundwater plume continues moving with no net adsorption of fluoride by the aquifer soil. This condition reflects steady-state adsorption/desorption conditions. Once groundwater containing less dissolved fluoride begins to move past soils containing adsorbed fluoride, the existence of steady-state conditions ends because a portion of the fluoride will desorb back into groundwater. If all the adsorbed fluoride is desorbed, then the adsorption process is considered to be fully reversible. If only a portion of the fluoride desorbs, then the process is considered to be only partially reversible.

G.5 Summary of Findings in Published Literature

Section G.8 provides citations for 25 published articles that were obtained and reviewed as part of the fluoride transport assessment. The majority of the articles describe studies of the changes in sorbed-phase concentrations that occur as varying concentrations of dissolved-phase fluoride are placed in contact with soil samples. These lab studies typically use a combination of column tests, shaker tests, and centrifugation methods to obtain sorbed-phase concentrations arising from contact with the time-varying dissolved-phase concentrations.

The publications together indicate that the relationship between adsorbed fluoride and the solute fluoride concentration is nonlinear in nature. However, most of the publications that were obtained studied fluoride adsorption processes, with little or no evaluation of desorption processes. Three articles were identified that evaluated both adsorption and desorption in detail, including substantial quantitative evaluations:

- Peek and Volk (1985) evaluated adsorption and desorption from 10 soils, of which 8 were collected in Oregon.
- Simard and LaFrance (1996) evaluated adsorption and desorption from 24 soils in Quebec in an area of heavy aluminum smeltering activity.
- Arnesen and Krogstad (1998) evaluated soils collected at an aluminum smelter in Ardal, Norway. Their study compared the adsorption and desorption mechanics from these soils with the mechanics for soils located at distances of 0.5 kilometers (km) and 1 km from the smelter.

The principal findings from the literature publications are as follows:

1. Fluoride adsorption to soils initially containing only background levels of fluoride (i.e., mineral fluoride) follows a Langmuir isotherm for dissolved-phase concentrations below approximately 15 mg/L. Above this concentration, the process follows either a two-phase Langmuir isotherm or a Freundlich isotherm (Peek and Volk, 1985). In general, the Freundlich isotherm is a better descriptor of adsorption phenomenon over the full range of dissolved-phase concentrations than either the single-phase or two-phase Langmuir isotherms (Peek and Volk, 1985; Simard and LaFrance, 1996). Table F-2 presents the results of these and other studies. The first page of the table lists the available data describing desorption, while the remaining pages provide the available

data describing adsorption. For each soil, the table provides the following specific data for each soil that is described in the literature publications:

- Soil series name and classification
- Soil horizon
- Particle size distribution
- Chemical parameters: pH, extractable aluminum and iron
- Range of equilibrium solute concentrations (C)
- Isotherm model and associated coefficients

2. Peek and Volk (1985) found that their desorption data could be fit to a Freundlich isotherm. They also found that the two Freundlich constants for each soil had different values for desorption than for adsorption. Simard and LaFrance (1996) were unable to fit their desorption data to either the Langmuir or the Freundlich isotherm. These authors derived a relationship describing the amount of fluoride mass that is desorbed as a function of the aqueous-phase fluoride concentration. However, they did not provide an isotherm describing the relationship between sorbed and aqueous-phase concentrations. Arnesen and Krogstad (1998) also did not identify whether the desorption process fit the Langmuir or Freundlich isotherms.

3. The oxalate-extractable aluminum content of soils is a good indicator of the ability of soils to adsorb fluoride according to several of the literature publications. The oxalate-extractable aluminum content measures the concentration of aluminum oxyhydroxides (AlOX) in the soil. The AlOX content of soils was also reported to be a good indicator of the reversibility of the adsorption process (that is, the degree to which adsorbed mass can be desorbed from soils in the presence of water having a low dissolved fluoride concentration). Specific findings were:

   - Peek and Volk (1985) and Arnesen and Krogstad (1998) found that the AlOX content accounted for about 85 to 90 percent of the variation in fluoride adsorption capacities between soils. Peek and Volk also found good correlation between various Langmuir and Freundlich coefficients and the oxalate-extractable iron (FeOX) content, the dithionite-extractable aluminum and iron contents, and the soil pH. However, these and other factors contributed to no more than 7 percent of the variation in the fluoride adsorption capacity of the soils.

   - Simard and LaFrance (1998) found that adsorption was more significant in Spodosol soils (coarse loams and sands of deltaic and morainic origin) than in Aqueptic soils (poorly drained fine loams, silts, and clays of alluvial, lacustrine, and marine origin). This difference was attributed primarily to the high AlOX and FeOX contents of the Spodosol soils compared with the Aqueptic soils, with additional limited correlation to soil pH.

   - Peek and Volk (1985) found that fluoride adsorption was fully reversible in only 3 of 10 soils, all 3 of which were clays or silty clays. For the 7 other soils (loams and sandy loams, and two other soils having low to moderate fractions of clay), only a portion of the adsorbed fluoride was desorbed.

   - Simard and LaFrance (1996) found that reversibility of fluoride adsorption was weak in the Spodosol (coarse-grained) soils because of their higher AlOX and FeOX

contents. They found that the proportion of adsorbed fluoride that could be desorbed (a ratio that they called qd/qc in their paper) was about 15 percent or less for 8 of the 11 Spodosol soils that they studied. In contrast nine of the 13 Aqueptic (fine-grained) soils that they studies showed qd/qc ratios of 50 percent or higher. Simard and LaFrance found close statistical correlations between the qd/qc ratio and AlOX, FeOX, and soil pH, but weak correlation between the qd/qc ratio and the grain-size distribution. Because of the influence of AlOX and FeOX, they found that the Langmuir constant (K) for adsorption was a good predictor of the qd/qc ratio.

- Arnesen and Krogstad found that the shallowest A-horizon soils tended to desorb a greater proportion of adsorbed fluoride (between 36 percent and 58 percent) than did deeper B-horizon soils (between 18 percent and 36 percent). The authors attributed this to the difference in the AlOX content.

In summary, the conclusions from the literature evaluation are:

- The relationship between adsorbed fluoride and solute concentration is nonlinear:

$$C_{ads} \neq K_d \, C_{sol}$$

- The Freundlich or two-phase Langmuir isotherms best describe fluoride adsorption over a large range of dissolved-phase concentrations.
- The oxalate-extractable aluminum content of soils is directly correlated with (and the most significant factor affecting) the fluoride adsorption capacity of a given soil and the degree of reversibility of the sorption process (that is, the proportion of adsorbed fluoride that can desorb from a soil).

G.6 Comparison of Site Soil Data with Literature Soil Data

Existing analytical data for soils at the RMC facility were compiled in an effort to compare site soil parameters with those reported in the literature sorption studies. The site soil samples that were used for the correlation were collected during 1998 for the purposes of facilitating the correlation work. Samples were collected from the upper gray sand and the overlying silt unit at depths ranging from 5 to 45 feet below ground surface (bgs). Samples were obtained from the three soil and debris areas in the south plant (east potliner, scrap yard, and south landfill). A total of ten soil samples were collected and analyzed for:

- Oxalate-extractable aluminum and iron
- Dithionite-extractable aluminum and iron
- pH
- Total aluminum and iron
- Physical soil parameters (grain size distribution, total organic carbon content, specific gravity, and total porosity)

The samples were correlated with the sample data published by Peek and Volk (1985). No other studies were used for the correlation. The rationale for selecting this study (and no others) was:

- The Peek and Volk study quantified Freundlich isotherm coefficients for fluoride desorption, which is the primary process of interest at the RMC facility. [As discussed previously, adsorption is of less interest than desorption because the net adsorption of fluoride onto soils takes place over short periods of time (hours or days) compared with the time frames that fluoride is thought to have been present in groundwater at the facility (years).]
- Unlike other studies, the soils sampled by Peek and Volk were predominantly from Oregon. In addition, the soil described in the Peek and Volk study included a mixture of loams, loamy sands, silts, and clays with pH values similar to those encountered in the surficial sand, the silt unit, and the UGS.
- The study by Simard and LaFrance (1996) was considered. However, no desorption isotherm was provided that allowed estimation of pore water concentrations from measured soil concentrations.
- The study by Arnesen and Krogstad (1998) was also considered, but was not used because neither the desorption isotherm nor its coefficients were presented.

The correlation of site soils with the soil data by Peek and Volk (1985) is summarized in Table G-3. The table highlights (in large bold font) the literature data that were best correlated to the site soil samples data. Weight was given primarily to the oxalate-extractable aluminum concentration data. However, where correlations with AlOX data were difficult, the analyses were supplemented with the oxalate-extractable iron concentrations and the dithionite-extractable aluminum and iron concentrations. Lesser consideration was given to the soil pH and grain size, and no emphasis was given to the total organic carbon content. For the surficial overlying sand and underlying silt, separate correlations were performed for each of the three soil and debris areas. For the UGS, correlations were made for all soil samples together, rather than performing separate correlations for each soil and debris area.

Table G-4 summarizes the results of the correlation. The table shows arithmetic and geometric mean values of the Freundlich parameters.[1] The table shows that the highest arithmetic and geometric mean values of the Freundlich affinity parameter (K) are at south landfill and scrap yard. In contrast, the arithmetic and geometric mean values of the K parameter are substantially lower at east potliner and in the UGS. Also, the arithmetic mean is generally higher than the geometric mean. For the Freundlich n parameter, the arithmetic and geometric mean values are similar.

G.7 Calculation of Equilibrium Groundwater Concentrations

The desorption isotherms from Table G-4 were applied to the site soils for the purposes of calculating equilibrium groundwater concentrations that would arise from desorption off of site soils. Tables G-5 and G-6 present the calculation procedure. The calculation was applied to soil samples collected from the surficial overlying sand, the silt unit, and the UGS during the summer 1998 sampling event. The calculation was also applied to soil samples collected

[1] The geometric mean is equal to the product of n data points taken to the 1/n power. For data sets with more high values than low values, the geometric mean is lower in value than the arithmetic mean.

in the intermediate zone during drilling of the borehole for well MW33-095, which is situated in the middle of the primary fluoride plume at the site. The plume extends from scrap yard to the production wells just downgradient of MW33-095. The calculation steps and results are presented below.

G.7.1 Calculation Procedure

The calculation was performed using the following steps. (The calculations for steps 1, 2, and 3 are presented in Table G-5, and the calculations for Steps 4 and 5 are presented in Table G-6.)

Step 1. The total fluoride concentration data in site soils measure both the sorbed-phase and dissolved-phase (pore water) concentrations. The total sorbed-phase concentration (Cads-total), which is needed for calculating the equilibrium groundwater concentration, was calculated by subtracting the associated dissolved-phase (pore water) concentration (Cpw) from the total soil fluoride concentration. The dissolved-phase (pore water) concentration (Cpw) was calculated from the total soil fluoride concentration using the laboratory-measured moisture content and the laboratory-measured or field-measured groundwater concentration data. The equation for calculating the dissolved-phase (pore water) concentration is:

$$Cpw = \theta * Cgw / \rho w$$

where:

Cpw = pore water concentration (mg fluoride/ kg wet soil)
θ = moisture content (% weight by water = kg H_2O / kg wet soil)
Cgw = the measured groundwater concentration (mg fluoride / L H_2O)
ρw = density of water (1 kg H_2O / L H_2O)

Step 2. The pore water concentration (Cpw) was converted from units of mg fluoride/ kg wet soil to mg fluoride/ kg dry soil using the following conversion relationship:

$$Cpw \text{ as mg/kg dry soil} = (Cpw \text{ as mg/kg wet soil}) / ([1-\theta] / 1)$$

where the term ([1-θ] / 1) represents the unit dry weight of the soil solids.

Step 3. The fluoride concentration that is currently adsorbed due to the presence of the groundwater plume (Cads) was calculated from the measured fluoride concentration in soil by subtracting a background "mineral fluoride" concentration (Cbkgrnd). The mineral fluoride concentration (Cbkgrnd) represents fluoride that is present in the soil mineral structure and is assumed unavailable for sorption or desorption. The soil fluoride concentrations measured in the laboratory include this mineral content because they were measured using aggressive distillation methods (EPA methods 340.1 and 340.2). The calculations of Cads used the background concentration of 208 mg/kg (expressed on a dry-weight basis) for upland surface soils [see *Technical Memorandum DS No. 12: Background Data Summary for RMC-Troutdale* (CH2M HILL, December 3, 1996)].

Step 4. The equilibrium groundwater concentration (C) was calculated from the value of Cads using the Freundlich isotherm equation. The calculation used the geometric mean values of the Freundlich isotherm parameters (K and n), rather than the arithmetic mean

values. The geometric mean values were used because they predict higher equilibrium groundwater concentrations than the arithmetic mean, thereby producing a conservative analysis of the potential for soils to be a source of fluoride to groundwater. The calculation was performed using the Freundlich isotherm equation rearranged to solve for the equilibrium groundwater concentration (C) as follows:

$$C = (C_{ads} / K)^{N}$$

Step 5. Because the Freundlich isotherm constants (K and N) are based on the paper by Peek and Volk (1985), the resulting groundwater concentration is in units of millimoles per liter (mmol/L). This concentration was converted to milligrams per liter (mg/L) by multiplying by the molecular weight of fluoride (19 grams/mole)

G.7.2 Calculation Results

Table G-7 compares the calculated equilibrium groundwater concentrations with measured groundwater concentrations and with the MCL of 4 mg/L. Samples with equilibrium concentrations below the MCL are highlighted. The calculations indicate the following:

- Equilibrium groundwater concentrations in the intermediate sand zone at MW33-095 are expected to be below detectable levels because the total soil concentrations are at or below the average background level of 208 mg/kg. Consequently, the soils at this location are not expected to sustain fluoride concentrations exceeding the MCL in groundwater.
- In the UGS, the equilibrium groundwater concentrations are at or below detectable levels at south landfill, which indicates that the UGS soils at this location are not expected to sustain fluoride concentrations exceeding the MCL in groundwater. In contrast, the UGS soils could cause groundwater concentrations of fluoride at scrap yard and east potliner to exceed the MCL. The highest equilibrium groundwater concentrations are estimated to be 45 mg/L at scrap yard and 228 mg/L at east potliner.
- In the silt unit and the overlying surficial sand unit, the calculated equilibrium groundwater concentrations range from below detectable levels to concentrations substantially above the MCL and (in some cases) above measured groundwater concentrations. This indicates that some soils in each area could sustain fluoride concentrations in groundwater exceeding the MCL.
- For some soils in the silt unit and the surficial overlying sand, it is unclear to what degree these soils could cause groundwater concentrations of fluoride to exceed the MCL. The uncertainty exists for soils that have calculated aqueous-phase concentrations substantially higher than measured groundwater concentrations.[2] This indicates that only a portion of the sorbed fluoride may be leachable, a conclusion consistent with the desorption behavior described in the literature. For these soil samples, further calculations were performed to estimate the soil concentration required to create the observed groundwater concentrations. The calculated soil concentrations were then compared with the measured soil concentrations to estimate the degree of reversibility of the

[2] See in particular, the surficial sand sample at GP60 (south landfill), the silt unit sample at GP50 (scrap yard), the 15-foot sample at GP65 (east potliner), and the 5-foot, 15-foot and 30-foot samples at GP66 (east potliner).

adsorption process. As shown in Table G-8, the calculations were performed for one surficial sand sample, five silt unit samples, and one sample from the UGS. The calculations indicate the following:

- The degree of reversibility in the surficial sand at south landfill was calculated to be 20 percent. This is similar to the observation by Simard and LaFrance (1996) that the adsorption process was typically 15 percent or less reversible in coarse-grained Spodosol soils.
- The degree of reversibility in the five silt unit samples ranged from 10 percent to 58 percent, with a median value of 0.40 and an arithmetic mean of 0.36. These data suggest that there may be somewhat less reversibility than was found by Simard and LaFrance (1996), who found that the adsorption process was typically at least 50 percent reversible in fine-grained Aqueptic soils.
- The degree of reversibility in the UGS was calculated to be 64 percent in the sample from east potliner. This is higher than the degree of reversibility (15 percent or less) observed by Simard and LaFrance (1996) for coarse-grained Spodosol soils.

G.8 References

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Table G-1
Summary of Soil Sample Data Collected For Transport Assessment
Reynolds Metals Company - Troutdale, Oregon

South Plant Soil and Debris Areas	Number of Borings	Number of Co-Located Soil and Groundwater Samples	Number of Soil Samples Analyzed for Literature Correlation Purposes [a]
Scrap Yard	4	Surficial Overlying Sand: 1	Surficial Overlying Sand: 1
		Silt: 2	Silt: 2
		UGS: 10	UGS: 2
South Landfill	4	Surficial Overlying Sand: 2	Surficial Overlying Sand: 1
		Silt: 20	Silt: 1
		UGS: 3	UGS: 1
East Potliner	3	Surficial Overlying Sand: NA [b]	Surficial Overlying Sand: NA [b]
		Silt: 13	Silt: 1
		UGS: 3	UGS: 1

[a] These soil samples were analyzed for oxalate-extractable aluminum and iron, dithionite-extractable aluminum and iron, pH, organic matter content, grain size distribution, particle density, and porosity.
[b] NA = not applicable. Surficial overlying sand is not present at this location.

Table G-2
Summary of Fluoride Sorption Studies Reported in Published Literature
Reynolds Metals Company - Troutdale, Oregon

Soil Series	Horizon	Soil Type/Class	Soil Particle Size/Texture			Organic Carbon Content	pH	Extractable Al[a]	Extractable Al[b]	Extractable Al[c]	Extractable Al[d]	Extractable Fe[a]	Extractable Fe[b]	Solution Equilibrium Concentration	Isotherm Model[d]	K[e,f]	b, N[g,h]	Reference and Soil Origins	Comments
			% Sand	% Silt	% Clay	%		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)					
Fluoride Desorption																			
Courval	Ap	Typic Humaquept			14.9	3.24	6.3	1,130					5,200		Freundlich (desorb)	1.100	0.314	Simard & LaFrance, 1996 Soils from Province of Quebec, Canada	Listed constants describe desorption as follows: $q(c) = k1 + k2 \ln C$ where units are: $k1 = (mol/m^3)$ $k2 = (dimensionless)$ Note: Authors did not identify their measurement units for K. Plot for Courval Aeg soil suggests units are (mol/m3)^(-N), but this doesn't appear to work for the Saint-Andre Bf2 soil plot.
Courval	Aeg	(fine silty, mixed, frigid)			6.2	0.46	6.1	730					4,900		Freundlich (desorb)	0.614	0.219		
Courval	II Bg	alluvial parent material			24.4	0.45	6.9	1,070					13,700		Freundlich (desorb)	1.160	0.528		
Courval	II Cg				25.4	0.26	7.2	650					4,600		Freundlich (desorb)	1.290	0.594		
Courval	II Ckg				28.6	0.25	7.5	910					4,300		Freundlich (desorb)	1.150	0.659		
Saint-Andre	Ap	Typic Haplorthod			25.3	3.00	5.6	2,620					11,200		Freundlich (desorb)	0.366	0.121		
Saint-Andre	Bf1	(coarse loamy, mixed,			19.5	1.93	6.2	4,600					10,500		Freundlich (desorb)	0.210	0.036		
Saint-Andre	Bf2	frigid)			9.6	1.05	5.0	5,740					9,800		Freundlich (desorb)	0.255	0.069		
Saint-Andre	Bfj	morainic parent material			11.7	0.54	4.7	4,480					8,200		Freundlich (desorb)	0.270	0.092		
Saint-Andre	C				6.4	0.18	4.6	2,560					8,600		Freundlich (desorb)	1.720	0.601		
Taillon	Ap	Aeric Haplaquept			15.5	3.62	6.1	3,510					4,900		Freundlich (desorb)	0.484	0.173		
Taillon	Bfj	(fine loamy, mixed, frigid)			14.4	1.82	6.4	6,600					10,100		Freundlich (desorb)	0.659	0.256		
Taillon	Bg	lacustrine parent material			22.0	0.38	6.5	1,420					4,400		Freundlich (desorb)	1.401	0.628		
Taillon	BCg				22.4	0.18	6.6	1,350					3,600		Freundlich (desorb)	1.473	0.417		
Taillon	Cg				30.2	0.08	6.7	1,420					4,000		Freundlich (desorb)	1.576	0.463		
Parent	Ap	Typic Cryorthod			7.1	2.00	5.0	4,380					10,800		Freundlich (desorb)	0.500	0.126		
Parent	Ae	(sandy, mixed, frigid)			9.1	2.22	4.9	8,840					11,700		Freundlich (desorb)	0.313	0.107		
Parent	Bf	deltaic parent material			4.6	0.88	4.9	1,820					14,800		Freundlich (desorb)	0.310	0.101		
Parent	Bg				0.9	0.23	5.2	1,800					11,500		Freundlich (desorb)	0.862	0.321		
Parent	BCg				0.9	0.24	5.3	1,030					8,600		Freundlich (desorb)	1.097	0.408		
Parent	Cg				22.0	0.26	5.4	1,660					5,500		Freundlich (desorb)	1.210	0.411		
Kamouraska	Ap	Typic Humaquept			54.4	2.45	7.1	1,900					6,900		Freundlich (desorb)	4.490	1.740		
Kamouraska	Bg	(clayey, mixed, frigid)			45.8	0.40	7.3	1,960					9,000		Freundlich (desorb)	1.300	0.610		
Kamouraska	Ckg	marine parent material			42.5	0.46	7.3	2,540					10,500		Freundlich (desorb)	1.500	0.775		
Coker	A	Chromic Pelloxerert	clay		52	2.04	6.7	675	998			7,260	949		Freundlich (desorb)	12.82	3.39	Peek & Volk, 1985 8 soils from Oregon, 1 each from California and Hawaii	These constants describe desorption only. The Freundlich isotherm is applicable for all dissolved-phase concentrations. K is in units of mmol/kg.
Elmore	A	Pachic Ultic Argixeroll	loam		16	2.40	7.6	351	540			5,752	558		Freundlich (desorb)	15.61	2.37		
Hembre	A	Typic Haplumbrept	loam		23	8.52	4.6	4,911	11,224			47,135	5,808		Freundlich (desorb)	82.28	1.58		
Jory	A	Xeric Haplohumult	clay		49	3.96	5.4	2,914	9,875			85,669	4,468		Freundlich (desorb)	119.93	1.45		
Molokai	A	Typic Torrox	clay loam		34	1.68	6.8	836	5,963			97,844	782		Freundlich (desorb)	16.44	4.00		
Nyssa	A	Xerollic Durorthid	silt loam		10	0.96	8.1	351	378			4,635	391		Freundlich (desorb)	2.35	1.50		
Ontko	A	Andic Cryaquept	loam		17	2.04	6.5	243	459			6,702	1,005		Freundlich (desorb)	15.61	2.37		
Panoche	A	Typic Torriothent	silty clay		28	0.48	8.1	216	540			8,489	447		Freundlich (desorb)	1.46	1.89		
Sagehill	A	Xerollic Camborthid	loamy sand		6	0.48	7.5	216	216			3,965	447		Freundlich (desorb)	0.87	2.53		
Woodburn	A	Aquultic Argixeroll	silty clay		35	1.92	5.6	2,374	2,644			20,384	6,869		Freundlich (desorb)	35.85	1.79		
Moa	Ah	Cambic Podzol					4.5	6200	6400		513	9,800	12,700	0-50	Not Discussed	X	X	Arnesen & Krogstad, 1998 Soils from Western Norway	Isotherm constants not reported for either adsorption or desorption.
Moa	Bh	Cambic Podzol	47.1	50.1	2.8		5.0	18,700	6200		104	15,300	27,400	0-50	Not Discussed	X	X		
Moa	BC	Cambic Podzol	51.6	46.4	2.0		5.2	16,600	6500		72	6,700	13,300	0-50	Not Discussed	X	X		
Hjelle	Ah	Cambic Arenosol					5.1	5200	4500		135	5,700	11,500	0-50	Not Discussed	X	X		
Hjelle	Bw	Cambic Arenosol	67.7	30.4	1.9		5.1	8000	8000		206	6,900	10,000	0-50	Not Discussed	X	X		
Hjelle	BC	Cambic Arenosol	66.9	31.5	1.6		5.2	6900	6800		112	5800	7900	0-50	Not Discussed	X	X		
Vetti	Ah	Cambic Arenosol					4.2	3900	3900		425	4000	8000	0-50	Not Discussed	X	X		
Vetti	Bw	Cambic Arenosol	61.9	35.7	2.4		4.7	8400	7800		247	4300	8600	0-50	Not Discussed	X	X		
Fluoride Adsorption																			
Courval	Ap	Typic Humaquept			14.9	3.24	6.3	1,130					5,200		Freundlich (adsorb)	1.373	0.703	Simard & LaFrance, 1996 Soils from Province of Quebec, Canada	Listed constants describe adsorption as follows: $q(C) = K \times C^N$ where measurement units are: $C = (mol/m^3 soil)$ $q(C) = (mol/m^3 soil)$ Note: Authors did not identify their measurement units for K. Plot for Courval Aeg soil suggests units are (mol/m3)^(-N), but this doesn't appear to work for the Saint-Andre Bf2 soil plot.
Courval	Aeg	(fine silty, mixed, frigid)			6.2	0.46	6.1	730					4,900		Freundlich (adsorb)	0.535	0.722		
Courval	II Bg	alluvial parent material			24.4	0.45	6.9	1,070					13,700		Freundlich (adsorb)	1.043	0.500		
Courval	II Cg				25.4	0.26	7.2	650					4,600		Freundlich (adsorb)	0.828	0.787		
Courval	II Ckg				28.6	0.25	7.5	910					4,300		Freundlich (adsorb)	0.687	0.451		
Saint-Andre	Ap	Typic Haplorthod			25.3	3.00	5.6	2,620					11,200		Freundlich (adsorb)	3.832	0.770		
Saint-Andre	Bf1	(coarse loamy, mixed,			19.5	1.93	6.2	4,600					10,500		Freundlich (adsorb)	3.887	0.845		
Saint-Andre	Bf2	frigid)			9.6	1.05	5.0	5,740					9,800		Freundlich (adsorb)	4.431	0.934		
Saint-Andre	Bfj	morainic parent material			11.7	0.54	4.7	4,480					8,200		Freundlich (adsorb)	3.496	0.641		
Saint-Andre	C				6.4	0.18	4.6	2,560					8,600		Freundlich (adsorb)	2.358	0.659		
Taillon	Ap	Aeric Haplaquept			15.5	3.62	6.1	3,510					4,900		Freundlich (adsorb)	3.880	0.706		
Taillon	Bfj	(fine loamy, mixed, frigid)			14.4	1.82	6.4	6,600					10,100		Freundlich (adsorb)	4.191	0.839		
Taillon	Bg	lacustrine parent material			22.0	0.38	6.5	1,420					4,400		Freundlich (adsorb)	1.196	0.654		
Taillon	BCg				22.4	0.18	6.6	1,350					3,600		Freundlich (adsorb)	1.099	0.571		

Table G-2
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Reynolds Metals Company - Troutdale, Oregon

Soil Series	Horizon	Soil Type/Class	Soil Particle Size/Texture			Organic Carbon Content	pH	Extractable Al[a]	Extractable Al[b]	Extractable Al[c]	Extractable Al[d]	Extractable Fe[a]	Extractable Fe[b]	Solution Equilibrium Concentration	Isotherm Model[e]	K[e,f]	b, N[e,h]	Reference and Soil Origins	Comments
			% Sand	% Silt	% Clay	%		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)					
Tallion	Cg				30.2	0.08	6.7	1,420					4,000		Freundlich (adsorb)	1.685	0.676		
Parent	Ap	Typic Cryorthod			7.1	2.00	5.0	4,380					10,800		Freundlich (adsorb)	4.065	0.714		
Parent	Ae	(sandy, mixed, frigid)			9.1	2.22	4.9	8,840					11,700		Freundlich (adsorb)	4.073	0.800		
Parent	Bf	deltaic parent material			4.6	0.88	4.9	1,820					14,800		Freundlich (adsorb)	3.956	0.348		
Parent	Bg				0.9	0.23	5.2	1,800					11,500		Freundlich (adsorb)	1.494	0.469		
Parent	BCg				0.9	0.24	5.3	1,030					8,600		Freundlich (adsorb)	1.289	0.548		
Parent	Cg				22.0	0.26	5.4	1,660					5,500		Freundlich (adsorb)	1.271	0.487		
Kamouraska	Ap	Typic Humaquept			54.4	2.45	7.1	1,900					6,800		Freundlich (adsorb)	1.875	0.549		
Kamouraska	Bg	(clayey, mixed, frigid)			45.8	0.40	7.3	1,980					9,000		Freundlich (adsorb)	1.713	0.597		
Kamouraska	Ckg	marine parent material			42.5	0.46	7.3	2,540					10,500		Freundlich (adsorb)	1.647	0.696		
Coker	A	Chromic Pelloxerert	clay		52	2.04	6.7	675	998			7,260	949	0-50	Langmuir	0.178	350	Peek & Volk, 1985 Eight soils from Oregon, one each from California and Hawaii	These constants describe adsorption only. The Langmuir isotherm is applicable only for dissolved-phase concentrations of 15 mg/L or less.
Elmore	A	Pachic Ultic Argixeroll	loam		16	2.40	7.6	351	540			5,752	558	0-50	Langmuir	0.412	238		
Hembre	A	Typic Haplumbrept	loam		23	8.52	4.6	4,911	11,224			47,135	5,808	0-50	Langmuir	0.104	1567		
Jory	A	Xeric Haplohumult	clay		49	3.96	5.4	2,914	9,875			85,669	4,468	0-50	Langmuir	0.175	1900		
Molokai	A	Typic Torrox	clay loam		34	1.68	6.8	836	5,963			97,844	782	0-50	Langmuir	0.247	404		
Nyssa	A	Xerollic Durorthid	silt loam		10	0.96	8.1	351	378			4,635	391	0-50	Langmuir	0.158	42		
Ontko	A	Andic Cryaquept	loam		17	2.04	6.5	243	459			6,702	1,005	0-50	Langmuir	0.075	268		
Panoche	A	Typic Torriothent	silty clay		28	0.48	8.1	216	540			8,489	447	0-50	Langmuir	0.056	47		
Sagehill	A	Xerollic Camborthid	loamy sand		6	0.48	7.5	216	216			3,965	447	0-50	Langmuir	0.044	54		
Woodburn	A	Aquultic Argixeroll	silty clay		35	1.92	5.6	2,374	2,644			20,384	6,869	0-50	Langmuir	0.111	1118		
Coker	A	Chromic Pelloxerert	clay		52	2.04	6.7	675	998			7,260	949	0-50	Freundlich (adsorb)	3.43	2.86		These constants describe adsorption only. The Freundlich isotherm is applicable only for dissolved-phase concentrations greater than 15 mg/L. K is in units of mmol/kg.
Elmore	A	Pachic Ultic Argixeroll	loam		16	2.40	7.6	351	540			5,752	558	0-50	Freundlich (adsorb)	2.75	2.73		
Hembre	A	Typic Haplumbrept	loam		23	8.52	4.6	4,911	11,224			47,135	5,808	0-50	Freundlich (adsorb)	60.59	1.53		
Jory	A	Xeric Haplohumult	clay		49	3.96	5.4	2,914	9,875			85,669	4,468	0-50	Freundlich (adsorb)	105.93	1.52		
Molokai	A	Typic Torrox	clay loam		34	1.68	6.8	836	5,963			97,844	782	0-50	Freundlich (adsorb)	19.23	2.40		
Nyssa	A	Xerollic Durorthid	silt loam		10	0.96	8.1	351	378			4,635	391	0-50	Freundlich (adsorb)	1.7	2.29		
Ontko	A	Andic Cryaquept	loam		17	2.04	6.5	243	459			6,702	1,005	0-50	Freundlich (adsorb)	9.27	1.49		
Panoche	A	Typic Torriothent	silty clay		28	0.48	8.1	216	540			8,489	447	0-50	Freundlich (adsorb)	1.14	1.62		
Sagehill	A	Xerollic Camborthid	loamy sand		6	0.48	7.5	216	216			3,965	447	0-50	Freundlich (adsorb)	1.29	1.46		
Woodburn	A	Aquultic Argixeroll	silty clay		35	1.92	5.6	2,374	2,644			20,384	6,869	0-50	Freundlich (adsorb)	41.74	1.68		
Hanford		Typic Xerorthent	sandy loam		6-18		7.2							2-16	Langmuir	0.16	87	Bower & Hatcher, 1967 Soil origin not specified	Only describes adsorption (not desorption). Units for K listed as L/mg. Units for b listed as mg/kg.
Sebree		Xerollic Nadurargid	silt loam		27-35		7.7							2-16	Langmuir	0.13	154		
Yolo		Typic Xerorthent	loam		20-35		7.3							2-16	Langmuir	0.07	172		
Aiken		Xeric Haplohumult	clay loam		35-50		5.6							2-16	Langmuir	0.25	1317		
Gila		Typic Torrifluvent	loam		<18		7.9							2-16	Langmuir	0.07	111		
Chino		Aquic Haploxeroll	clay		18-35		8.0							2-16	Langmuir	0.08	215		
Liebefeld	no CaCo3	Dystrochrept	65.4	18.5	16.1	2.9	4.2			4100		6300	2400	0-5000	Langmuir	0.001	6650	Fluhler, Polomski, and Blaser, 1982 Soils from Switzerland	Only describes adsorption (not desorption). Slope 1: C<180mg/L Slope 2: C>760 mg/L
Liebefeld	w/CaC03	Dystrochrept	65.4	18.5	16.1		7.3			x		x	x	0-5000	Langmuir (2)	0.136/0.005	293/3983		
Sierre	A	Rendoll	40.0	50.0	10.0	7.9	6.9			1100		6400	3300	0-5000	None	X	X		
Sierre	B	Rendoll	46.5	45.0	8.5	3.8	7.5			1000		6600	3100	0-5000	None	X	X		
Schitterwald	A	Eutrochreptic Rendoll	20.8	47.0	32.2	28.5	7.2			4300		14500	1900	0-5000	Langmuir (2)	0.007/0.001	5772/32404		Slope 1: C<255 mg/L Slope 2: C>340 mg/L
Schitterwald	B	Eutrochreptic Rendoll	54.5	26.0	19.5	15.7	7.5			4000		14100	2100	0-5000	Langmuir (2)	0.024/0.002	2377/18970		Slope 1: C<210mg/L Slope 2: C>270 mg/L
Unknown		ESP = 5	65.8	20.5	14.5		?							0-11	Langmuir	0.23	31	Chabra, Singh, & Abrol, 1980 Soils from Indo-gangetic plains, India Omueti & Jones, 1977 Soils from Illinois	Only describes adsorption (not desorption). Units for K unclear in article (assume L/mM). Listed K values are in L/mg; listed b in mg/kg. Only describes adsorption (not desorption). 2-surface Langmuir slope is less from 20-50 mg/L. Author provides constants for C<20 mg/L. Note: b is called Q in article and is in mg/kg. Article does not define units for K. Units for listed K are unknown.
		ESP = 30	65.8	20.5	14.5		?							0-11	Langmuir	0.13	35		
		ESP = 70	65.8	20.5	14.5		?							0-11	Langmuir	0.39	9		
Joy	A	Aquic Hapludoll	Silt loam		17.8	3.26	5.1	1200						0-20	Langmuir	0.219	365		
Joy	B22		Silt loam		21.6	0.52	5.6	1300						0-20	Langmuir	0.25	285		
Joy	B31		Silt loam		20.0	0.18	5.9	1000						0-20	Langmuir	0.379	188		
Ipava	A	Aquic Argiudoll	Silty clay loam		29.0	3.13	5.7	1200						0-20	Langmuir	0.215	444		
Ipava	B1		Silty clay loam		39.8	1.39	5.5	1900						0-20	Langmuir	0.397	469		
Ipava	B22		Silty clay loam		37.3	0.36	6.2	1300						0-20	Langmuir	0.251	316		
Cisne	A	Mollic Albaqualf	Silt loam		13.9	1.20	4.4	1300						0-20	Langmuir	0.038	493		
Cisne	B21		Silty clay loam		43.8	0.53	4.8	2300						0-20	Langmuir	0.129	508		
Cisne	B31		Silty clay loam		34.4	0.28	5.7	1400						0-20	Langmuir	0.317	408		
Muscatine	A	Aquic Argiudoll	Silty clay loam		23.7	3.53	5.2	1200						0-20	Langmuir	0.213	358		
Elliott	A	Aquic Argiudoll	Silty clay loam		25.5	4.31	6.4	1200						0-20	Langmuir	0.045	625		
Herrick	A	Aquic Argiudoll	Silt loam		20.8	2.45	6.0	750						0-20	Langmuir	0.166	173		
Sable	A	Typic Haplaquoll	Silty clay loam		27.0	1.99	6.5	1000						0-20	Langmuir	0.201	361		

Table G-2
Summary of Fluoride Sorption Studies Reported in Published Literature
Reynolds Metals Company - Troutdale, Oregon

Soil Series	Horizon	Soil Type/Class	Soil Particle Size/Texture			Organic Carbon Content	pH	Extractable Al[a]	Extractable Al[b]	Extractable Al[c]	Extractable Al[d]	Extractable Fe[a]	Extractable Fe[b]	Solution Equilibrium Concentration	Isotherm Model[d]	K[e,f]	b, N[g,h]	Reference and Soil Origins	Comments
			% Sand	% Silt	% Clay	%		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)					
Alford (acid)	A	Typic Hapludalf	Silt loam		19.0	0.86	5.6	850						0-20	Langmuir	0.307	132		
Alford (limed)	A	Typic Hapludalf	Silt loam		19.0	0.79	7.7	790						0-20	Langmuir	0.066	100		
Fayette	A	Typic Hapludalf	Silt loam		14.9	1.62	5.9	900						0-20	Langmuir	0.205	192		
Seaton	A	Typic Hapludalf	Silt loam		10.4	0.94	5.9	825						0-20	Langmuir	0.247	149		
Bount	A	Aeric Ochraqualf	Silt loam		18.3	3.03	5.6	960						0-20	Langmuir	0.148	267		
Hosmer	A	Typic Fragiudalf	Silt loam		14.8	0.71	6.6	1000						0-20	Langmuir	0.142	200		
Tamalco	A	Typic Natrudalf	Silt loam		14.9	1.18	4.6	1300						0-20	Langmuir	0.039	521		
Unknown-A		Na-saturated calcareous	38% silt		16.9		8.95							0-13	Langmuir	0.24	59	Gupta et al., 1982	Only describes adsorption (not desorption).
Unknown-A		Na-saturated calcareous					10.4							0-13	Langmuir	0.21	72	Soils from India	Units for K unclear in article (assume L/mM).
Unknown-B		Na-saturated non-calcareous					8.95							0-13	Langmuir	0.75	25		Listed K values are in L/mg; listed b in mg/kg
Unknown-B		Na-saturated non-calcareous					10.4							0-13	Langmuir	0.17	61		Lab-prepared soil.

Definitions:
ESP = exchangeable sodium percentage
[a] *Oxalate-extractable*
[b] Dithionite-extractable
[c] NaOH-extractable
[d] Extractable in 1M KCl
[d] Langmuir (2) = Langmuir 2 surface (2 slope) Isotherm
[e] K = Equilibrium constant (or affinity constant) for Langmuir isotherm [L^3/M]. Units are L/mg except where noted.
[f] K = Equilibrium affinity constant for Freundlich isotherm [$L^3/M]^N$ except where noted.
[g] *k1 = for desorption isotherm by Simard and LaFrance [L^3/M]*
[h] b = Adsorption capacity for Langmuir isotherm (M/M). Units are mg/kg except where noted.
[i] N = Degree of linearity for Freundlich isotherm (unitless)
[j] k2 = for desorption isotherm by Simard and LaFrance (units not defined in article)

Notes:
1) Where not specified by the author, particle size distribution was estimated for U.S. soils by using the soil series descriptions obtained from the U.S. Department of Agriculture—Natural Resource Conservation Service (USDA—NRCS) Web site at www.statlab.iastate.edu/soils/osd/ .
2) The listed isotherm models and sorption coefficients were derived from graphical data for articles in which the values were not specified. The error introduced by the data interpolation is uncertain but expected to be small.
3) Chemical and sorption parameters were converted to common units for each parameter to allow for comparison between articles.
4) A blank entry means that this information was not provided in the journal article.
5) Entries of "x" in the columns for the isotherm coefficient indicate that the values are not presented in the journal article or cannot be calculated from the information contained in the article.

Table G-3
Fluoride Partitioning From Soil to Groundwater
Freundlich Desorption Isotherm (Peek and Volk, 1985)
South Plant Soil and Debris Areas (Scrap Yard, South Landfill, and East Potliner)
Reynolds Metals Company - Troutdale, Oregon

Site Soil Parameters

Sample ID	Analytical Laboratory Results: Oxalate Extractable Aluminum (mg/kg)	Dithionite Extractable Aluminum (mg/kg)	Oxalate Extractable Iron (mg/kg)	Dithionite Extractable Iron (mg/kg)	Soil pH	Organic Matter Content (%)	Soil Particle Size: Sand (%)	Silt (%)	Clay (%)	Soil Physical Properties: Particle Density (ρ_s) (kg/L)	Soil Bulk Density (ρ_b) (kg/L)	Porosity (θ)
Surficial Sand in Scrap Yard												
SY-SB10-005-0698	4,228	1,888	5,570	3,101	7.3	0.5	87.2	9.3	3.5	2.74	1.90	0.306
Surficial Sand in South Landfill												
SL-SB61-005-0698	1,427	1,842	2,519	3,456	8.5	1.0	86.1	9.4	4.5	2.68	1.89	0.371
Silt in Scrap Yard												
SY-SB11-005-0698	1,672	2,192	2,123	9,885	7.9	2.1	14.4	60.8	24.9	2.73	1.23	0.549
SY-SB10-017-0698	3,067	1,570	6,276	3,713	8.4	2.2	8.9	65.0	26.1	2.71	1.33	0.508
Silt in South Landfill												
SL-SB61-017-0698	993	1,053	12,555	6,508	6.6	2.6	5.0	65.8	29.2	2.77	1.74	0.371
Silt in East Potliner												
EP-SB01-014-0698	1,876	1,394	5,527	6,657	9.8	1.4	43.3	44.2	12.5	2.72	1.49	0.454
Gray Sand below Silt--Upper Gray Sand (UGS)												
SY-SB10-035-0698	1,063	1,261	8,310	4,964	8.6	0.7	91.1	6.6	2.1	2.69	1.54	0.429
SY-SB11-040-0698	947	810	7,048	3,630	7.7	0.5	96.3	0.8	0.9	2.71	1.47	0.458
EP-SB01-040-0698	919	987	7,122	4,010	8.5	0.6	91.4	7.7	0.9	2.69	1.62	0.398
SL-SB61-045-0698	895	1,110	7,319	3,799	6.8	0.7	88.9	9.4	1.7	2.69	1.72	0.362

Soil Parameters from Literature Review

Sample ID	Similar soil series from literature	Oxalate Extractable Aluminum (mg/kg)	Dithionite Extractable Aluminum (mg/kg)	Oxalate Extractable Iron (mg/kg)	Dithionite Extractable Iron (mg/kg)	Soil pH	Organic Carbon Content (%)	Soil type/% Clay: Silt (%)	Clay (%)	Soil type	Freundlich Coefficients: Freundlich Constant (K) (mmol/kg)	Freundlich Constant (K) (mg/kg)	Freundlich Exponent (N)
Surficial Sand in Scrap Yard													
SY-SB10-005-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	Clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	1.46	27.7	1.89
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	0.87	16.5	2.53
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5
Surficial Sand in South Landfill													
SL-SB61-005-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	1.46	27.7	1.89
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	0.87	16.5	2.53
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5
Silt in Scrap Yard													
SY-SB11-005-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	Clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	1.46	27.7	1.89
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	0.87	16.5	2.53
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5
SY-SB10-017-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	Clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	1.46	27.7	1.89
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	0.87	16.5	2.53
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5
Silt in South Landfill													
SL-SB61-017-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	Clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	1.46	27.7	1.89
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	0.87	16.5	2.53
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5
Silt in East Potliner													
EP-SB01-014-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	Clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	1.46	27.7	2.53
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	0.87	16.5	1.89
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5
Gray Sand below Silt--Upper Gray Sand (UGS)													
SY-SB10-035-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	Clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	1.46	27.7	2.53
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	0.87	16.5	1.89
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5
SY-SB11-040-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	Clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	1.46	27.7	2.53
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	0.87	16.5	1.89
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5
EP-SB01-040-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	Clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	1.46	27.7	2.53
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	0.87	16.5	1.89
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5
SL-SB61-045-0698	Woodburn	2,374	2,644	20,384	6,869	5.6	1.92		35.0	silty clay	35.85	681.2	1.79
	Hembre	4,911	11,224	47,135	5,808	4.6	8.52		23.0	loam	82.28	1563.3	1.58
	Jory	2,914	9,875	85,669	4,468	5.4	3.96		49.0	Clay	119.93	2278.7	1.45
	Ontko	243	459	6,702	1,005	6.5	2.04		17.0	loam	15.61	296.6	2.37
	Coker	675	998	7,260	949	6.7	2.04		52.0	clay	12.82	243.6	3.39
	Molokai	836	5,963	97,844	782	6.8	1.68		34.0	clay loam	16.44	312.4	4
	Elmore	351	540	5,752	558	7.6	2.4		16.0	loam	15.61	296.6	2.37
	Sagehill	216	216	3,965	447	7.5	0.48		6.0	loamy sand	1.46	27.7	2.53
	Panoche	216	540	8,489	447	8.1	0.48		28.0	silty clay	0.87	16.5	1.89
	Nyssa	351	378	4,635	391	8.1	0.96		10.0	silt loam	2.35	44.7	1.5

Notes:
Sample ID Nomenclature: Location-Boring-Depth-Sample date
Locations: EP = east potliner; SL = south landfill; SY = scrap yard
Site soil particle size based on Wentworth scale, percent sand includes sand and gravel
Freundlich constant (K) and Freundlich exponent (n) specified in literature or derived from literature data

Table G-4
Summary of Literature Soil and Site Soil Correlation
South Plant Soil and Debris Areas
Reynolds Metals Company - Troutdale, Oregon

Unit	Location	Matching Soil Name	Matching Soil Type	Freundlich K (mg/kg)	Freundlich N	Average Freundlich K (mg/kg)	Average Freundlich N	Geometric Mean Freundlich K (mg/kg)	Geometric Mean Freundlich N
Surficial Sand	Scrap Yard	Hembre	Loam	1563.3	1.58				
		Coker	Clay	243.6	3.39				
		Elmore	Loam	296.6	2.37	700	2.4	480	2.3
	South Landfill	Woodburn	Silty clay	681.2	1.79				
		Jory	Clay	2278.7	1.45				
		Ontko	Loam	296.6	2.37				
		Coker	Clay	243.6	3.39				
		Molokai	Clay loam	312.4	4	760	2.6	510	2.4
Silt	Scrap Yard	Woodburn	Silty clay	681.2	1.79				
		Jory	Clay	2278.7	1.45				
		Ontko	Loam	296.6	2.37				
		Elmore	Loam	296.6	2.37	890	2.0	610	2.0
	South Landfill	Woodburn	Silty clay	681.2	1.79				
		Jory	Clay	2278.7	1.45				
		Coker	Clay	243.6	3.39				
		Molokai	Clay loam	312.4	4	880	2.7	590	2.4
	East Potliner	Woodburn	Silty clay	681.2	1.79				
		Elmore	Loam	296.6	2.37				
		Nyssa	Silt loam	44.7	1.5	340	1.9	210	1.9
Upper Gray Sand (UGS)	Entire South Plant	Ontko	Loam	296.6	2.37				
		Coker	Clay	243.6	3.39				
		Molokai	Clay loam	312.4	4	280	3.3	280	3.2

Note: The Jory clay was not included in the list of correlated samples for the UGS because of its high clay content, very high Freundlich K value, and the lack of correlation with oxalate-extractable aluminum. Although the Jory correlates well with measured dithionite-extractable iron concentrations, the data listed above suggest that the dithionite-extractable iron concentration is not a good indicator of desorption for this particular soil.

Table G-5
Calculation of Current Sorbed-Phase Fluoride Concentration
South Plant Soil and Debris Areas (Scrap Yard, South Landfill, East Potliner)
Reynolds Metals Company - Troutdale, Oregon

Soil and Debris Area	Station ID	Depth (ft bgs)	Total Soil Fluoride by EPA Method 340.1/340.2 (mg F / kg of dry weight soil)	Soil Moisture Content (% w/wt)	Lab-Measured Groundwater Fluoride (EPA 300.0) (mg/L)	Field-Measured Groundwater Fluoride (Probe) (mg/L)	Calculated Pore Water Fluoride (mg F / kg of wet weight soil)	Calculated Pore Water Fluoride (mg F / kg of dry weight soil)	Sorbed Fluoride Above Background (C_{sds}) (mg F / kg of dry weight soil)
Surficial Sand									
Scrap Yard	GP54	5	340	28		21	5.9	8.2	124
South Landfill	GP60	5	4100	11.8		53	6.3	7.1	3885
	GP63	5	290	26.9		30	8.1	11.0	71
Silt									
Scrap Yard	GP50	10	2200	26.6		10.1	2.7	3.7	1988
	GP54	10	510	29.9		1.5	0.4	0.6	301
South Landfill	GP59	10	680	35.5	265	130	94.1	146	326
		15	3300	28.5	772	750	220	308	2784
		20	2400	33.1	1030	1100	341	510	1682
		25	790	26.4		14	3.7	5.0	577
		30	600	28.3		21	5.9	8.3	384
		35	390	29.2		1.7	0.5	0.7	181
		40	230	20.6		6.6	1.4	1.7	20
	GP60	10	530	19.3		72	13.9	17.2	305
		15	290	30.7		23	7.1	10.2	72
		20	960	31.9	202	160	64.4	95	657
		25	680	29.3	542	310	159	225	247
		30	430	28.4		7	2.0	2.8	219
		35	500	28		7.5	2.1	2.9	289
		40	370	27.8		2.1	0.6	0.8	161
	GP63	10	370	27.7		9.8	2.7	3.8	158
		15	450	33		0.88	0.3	0.4	242
		25	330	30.1		3.5	1.1	1.5	120
		30	440	31.8		2.6	0.8	1.2	231
		35	630	32.3		1	0.3	0.5	422
		40	290	18.8		0.48	0.1	0.1	82
East Potliner	GP65	5	260	21.7	115	110	25.0	31.9	20
		10	1200	23.1	440	446	101.6	132	860
		15	2400	25.6	267	220	68.4	92	2100
		20	1500	29	388	240	112.5	158	1134
		25	660	27.4	174	165	47.7	66	386
		30	540	32.2		3.8	1.2	1.8	330
		35	220	25		9.73	2.4	3.2	9
	GP66	5	2400	26		22.2	5.8	7.8	2184
		10	800	25.1		51.5	12.9	17.3	575
		15	1100	27.3		79.7	21.8	29.9	862
		20	760	31		92.6	28.7	41.6	510
		25	940	31.1	210	108	65.3	95	637
		30	2700	29.9	602	538	180	257	2235

Table G-5

Calculation of Current Sorbed-Phase Fluoride Concentration
South Plant Soil and Debris Areas (Scrap Yard, South Landfill, East Potliner)
Reynolds Metals Company - Troutdale, Oregon

Soil and Debris Area	Station ID	Depth (ft bgs)	Total Soil Fluoride by EPA Method 340.1/340.2 (mg F / kg of dry weight soil)	Soil Moisture Content (% w/wt)	Lab-Measured Groundwater Fluoride (EPA 300.0) (mg/L)	Field-Measured Groundwater Fluoride (Probe) (mg/L)	Calculated Pore Water Fluoride (mg F / kg of wet weight soil)	Calculated Pore Water Fluoride (mg F / kg of dry weight soil)	Sorbed Fluoride Above Background (C_{sds}) (mg F / kg of dry weight soil)
Upper Gray Sand									
Scrap Yard	GP50	15	490	19.7		22.3	4.4	5.5	277
		20	430	19.1		50.6	9.7	11.9	210
		25	590	22.8		20.6	4.7	6.1	376
		30	370	22.4		49.7	11.1	14.3	148
		35	530	19.9		48.3	9.6	12.0	310
	GP54	15	360	28.3		100	28.3	39.5	113
		20	360	28.3		0.4 U	0.1	0.2	152
		25	220	26.6		0.4 U	0.1	0.1	12
		30	180	21.5		0.4 U	0.1	0.1	0
		35	150 U	20.5		0.4 U	0.1	0.1	0
South Landfill	GP59	45	300	20.7		45	9.3	11.7	80
	GP60	45	210	21.4		1.9	0.4	0.5	1
	GP63	45	160	20.3		0.87	0.2	0.2	0
East Potliner	GP65	40	350	23.5	343	328	80.6	105	37
	GP66	35	1200	32.7	570	450	186	277	715
		40	700	24		26.1	6.3	8.2	484
Intermediate Sand									
North of Scrap Yard	MW33	85	210	20		56.8	11.4	14.2	0
		95	180	20		56.8	11.4	14.2	0

Notes:

1) Soil and groundwater analytical results are from Geoprobe samples collected during Summer 1998. Blank entries mean no lab measurements were conducted.
2) Fluoride by 340.1 / 340.2 = total fluoride by sulfuric acid digestion. Fluoride by 300.0 method or by field method = soluble fluoride.
3) *Soil moisture content %w/w = ((weight of water) / (weight of water + weight of soil)) x 100. These units are equivalent to kilograms of water per kilogram of "wet soil."*
4) A background mineral fluoride concentration of 208 mg/kg fluoride was assumed (see sorbed fluoride calculation below), based on soil samples upgradient of the source areas.
5) For the intermediate sand, the soil moisture content is an assumed typical value based on UGS data, and the groundwater concentration is from the first sampling event at well MW33-095.
In addition, the Freundlich coefficients (K and n) are assumed to be the same in the intermediate zone as in the UGS.

Abbreviations:

mg/kg = milligrams per kilograms. mg/L = milligrams per liter. % w/wt = percent water by weight. ft bgs = feet below ground surface. U = not detected.

Calculations:

Pore Water Fluoride as mg/kg wet weight soil = (Soil moisture content/100) * (Groundwater Fluoride Concentration) / (Density of Water)

where: Pore water fluoride is in units of mg fluoride / kg wet soil
Groundwater fluoride concentration is in units of mg fluoride / L H2O
Soil moisture content is in units of kg H2O / kg wet soil
Density of water is 1 kg/L

The relationship for the measurement units in the above equation is: mg/kg soil = mg fluoride / kg wet soil = (kg H2O / kg wet soil) * (mg fluoride / L H2O) * (1 L H2O / 1 kg H2O)

Pore Water Fluoride as mg/kg dry weight soil = (Pore Water Fluoride as mg/kg wet weight soil) / ([100 - Soil moisture content] / [Soil moisture content])
Used laboratory result for groundwater fluoride concentration where available

C_{sds} = Adsorbed Fluoride = Total Soil Fluoride - Mineral Fluoride - Pore Water Fluoride, *where all concentrations are in mg/kg dry weight of soil*
Mineral fluoride = 208 mg fluoride /kg dry weight of soil

Table G-6

Estimated Equilibrium Groundwater Concentrations Associated With Fluoride Soil Sampling Data
South Plant Soil and Debris Areas (Scrap Yard, South Landfill, East Potliner)
Reynolds Metals Company - Troutdale, Oregon

Soil and Debris Area	Station ID	Depth (ft bgs)	Sorbed Fluoride Concentration Above Background (C_{ads}) [a] (mg F / kg dry weight soil)	Equilibrium Groundwater Concentration: Geometric Mean Freundlich K Coefficient (mg/kg)	Equilibrium Groundwater Concentration: Geometric Mean Freundlich K Coefficient (unitless)	Equilibrium Groundwater Concentration: Calculated Equilibrium Groundwater Concentration (mg/L)
Surficial Sand						
Scrap Yard	GP54	5	124	480	2.3	0.8
South Landfill	GP60	5	3885	510	2.4	2,484
	GP63	5	71	510	2.4	0.20
Silt						
Scrap Yard	GP50	10	1988	610	2.0	202
	GP54	10	301	610	2.0	4.6
South Landfill	GP59	10	326	590	2.4	4.6
		15	2784	590	2.4	787
		20	1682	590	2.4	235
		25	577	590	2.4	18
		30	384	590	2.4	6.8
		35	181	590	2.4	1.1
		40	20	590	2.4	Not Detectable
	GP60	10	305	590	2.4	3.9
		15	72	590	2.4	0.10
		20	657	590	2.4	25
		25	247	590	2.4	2.4
		30	219	590	2.4	1.8
		35	289	590	2.4	3.4
		40	161	590	2.4	0.8
	GP63	10	158	590	2.4	0.8
		15	242	590	2.4	2.2
		25	120	590	2.4	0.4
		30	231	590	2.4	2.0
		35	422	590	2.4	8.5
		40	82	590	2.4	0.17
East Potliner	GP65	5	20	210	1.9	0.2
		10	860	210	1.9	277
		15	2100	210	1.9	1,509
		20	1134	210	1.9	468
		25	386	210	1.9	61
		30	330	210	1.9	45
		35	9	210	1.9	Not Detectable
	GP66	5	2184	210	1.9	1626
		10	575	210	1.9	129
		15	862	210	1.9	278
		20	510	210	1.9	103
		25	637	210	1.9	157
		30	2235	210	1.9	1,699

Table G-6

Estimated Equilibrium Groundwater Concentrations Associated With Fluoride Soil Sampling Data
South Plant Soil and Debris Areas (Scrap Yard, South Landfill, East Potliner)
Reynolds Metals Company - Troutdale, Oregon

Soil and Debris Area	Station ID	Depth (ft bgs)	Sorbed Fluoride Concentration Above Background (C_{ads}) [a] (mg F / kg dry weight soil)	Equilibrium Groundwater Concentration: Geometric Mean Freundlich K Coefficient (mg/kg)	Equilibrium Groundwater Concentration: Geometric Mean Freundlich K Coefficient (unitless)	Equilibrium Groundwater Concentration: Calculated Equilibrium Groundwater Concentration (mg/L)
Upper Gray Sand						
Scrap Yard	GP50	15	277	280	3.2	18
		20	210	280	3.2	7.6
		25	376	280	3.2	49
		30	148	280	3.2	2.5
		35	310	280	3.2	26
	GP54	15	113	280	3.2	1.0
		20	152	280	3.2	2.7
		25	12	280	3.2	Not Detectable
		30	0	280	3.2	Not Detectable
		35	0	280	3.2	Not Detectable
South Landfill	GP59	45	80	280	3.2	0.3
	GP60	45	1	280	3.2	Not Detectable
	GP63	45	0	280	3.2	Not Detectable
East Potliner	GP65	40	37	280	3.2	Not Detectable
	GP66	35	715	280	3.2	382
		40	484	280	3.2	109
Intermediate Sand						
North of Scrap Yard	MW33	85	0	280	3.2	Not Detectable
		95	0	280	3.2	Not Detectable

Notes:
(a) *From Table G-5*

Abbreviations:
mg/L = milligrams per liter.
mg/kg = milligrams per kilograms.
ft/bgs = feet below ground surface.

Calculations:
Equilibrium groundwater concentration is calculated from the sorbed concentration above background using the Freundlich isotherm equation as follows:

$$Cgw = 19*\{C_{ads}/K\}^n\}$$

Table G-7

Comparison of Measured and Estimated Equilibrium Groundwater Concentrations
South Plant Soil and Debris Areas (Scrap Yard, South Landfill, East Potliner)
Reynolds Metals Company - Troutdale, Oregon

Soil and Debris Area	Station ID	Depth (ft bgs)	Laboratory Groundwater Fluoride (EPA 300.0) (mg/L)	Field Groundwater Fluoride (Probe) (mg/L)	Calculated Equilibrium Groundwater Concentration (mg/L)	Is the Measured Concentration Above the Calculated Equilibrium Concentration? (Y/N)	Is the Equilibrium Below the MCL (4 mg/L)? (Y/N)
Surficial Sand							
Scrap Yard	GP54	5		**21**	**0.8**	**Yes**	**Yes**
South Landfill	GP60	5		53	2,484	No	No
	GP63	5		**30**	**0.20**	**Yes**	**Yes**
Silt							
Scrap Yard	GP50	10		10.1	202	No	No
	GP54	10		1.5	4.6	No	No
South Landfill	GP59	10	265	130	4.6	Yes	No
		15	772	750	787	No	No
		20	1030	1100	235	Yes	No
		25		14	18	No	No
		30		21	6.8	Yes	No
		35		**1.7**	**1.1**	**Yes**	**Yes**
		40		**6.6**	**Not Detectable**	**Yes**	**Yes**
	GP60	10		**72**	**3.9**	**Yes**	**Yes**
		15		**23**	**0.10**	**Yes**	**Yes**
		20	202	160	25	Yes	No
		25	**542**	**310**	**2.4**	**Yes**	**Yes**
		30		**7**	**1.8**	**Yes**	**Yes**
		35		**7.5**	**3.4**	**Yes**	**Yes**
		40		**2.1**	**0.8**	**Yes**	**Yes**
	GP63	10		**9.8**	**0.8**	**Yes**	**Yes**
		15		**0.88**	**2.2**	No	**Yes**
		25		**3.5**	**0.4**	**Yes**	**Yes**
		30		**2.6**	**2.0**	**Yes**	**Yes**
		35		1	8.5	No	No
		40		**0.48**	**0.17**	**Yes**	**Yes**
East Potliner	GP65	5	**115**	**110**	**0.2**	**Yes**	**Yes**
		10	440	446	277	Yes	No
		15	267	220	1,509	No	No
		20	388	240	468	No	No
		25	174	165	61	Yes	No
		30		3.8	45	No	No
		35		**9.73**	**Not Detectable**	**Yes**	**Yes**
	GP66	5		22.2	1,626	No	No
		10		51.5	129	No	No
		15		79.7	278	No	No
		20		92.6	103	No	No
		25	210	108	157	No	No
		30	602	538	1,699	No	No

Table G-7

Comparison of Measured and Estimated Equilibrium Groundwater Concentrations
South Plant Soil and Debris Areas (Scrap Yard, South Landfill, East Potliner)
Reynolds Metals Company - Troutdale, Oregon

Soil and Debris Area	Station ID	Depth (ft bgs)	Laboratory Groundwater Fluoride (EPA 300.0) (mg/L)	Field Groundwater Fluoride (Probe) (mg/L)	Calculated Equilibrium Groundwater Concentration (mg/L)	Is the Measured Concentration Above the Calculated Equilibrium Concentration? (Y/N)	Is the Equilibrium Below the MCL (4 mg/L)? (Y/N)
Upper Gray Sand							
Scrap Yard	GP50	15		22.3	18	Yes	No
		20		50.6	7.6	Yes	No
		25		20.6	49	No	No
		30		**49.7**	**2.5**	**Yes**	**Yes**
		35		48.3	26	Yes	No
	GP54	15		**100**	**1.0**	**Yes**	**Yes**
		20		**0.4 U**	**2.7**	No	**Yes**
		25		**0.4 U**	**Not Detectable**	**Yes**	**Yes**
		30		**0.4 U**	**Not Detectable**	**Yes**	**Yes**
		35		**0.4 U**	**Not Detectable**	**Yes**	**Yes**
South Landfill	GP59	45		**45**	**0.3**	**Yes**	**Yes**
	GP60	45		**1.9**	**Not Detectable**	**Yes**	**Yes**
	GP63	45		**0.87**	**Not Detectable**	**Yes**	**Yes**
East Potliner	GP65	40	**343**	**328**	**Not Detectable**	**Yes**	**Yes**
	GP66	35	570	450	382	Yes	No
		40		26.1	109	No	No
Intermediate Sand							
North of Scrap Yard	MW33	85		**56.8**	**Not Detectable**	**Yes**	**Yes**
		95		**56.8**	**Not Detectable**	**Yes**	**Yes**

Note: Highlighted rows are those where equilibrium concentrations are below the MCL. For several of these rows, the equilibrium concentratoins are also below the measured concentrations.

Abbreviations:
ft/bgs = feet below ground surface.
mg/L = milligrams per liter.
MCL = maximum contaminant level.

Table G-8

Estimated Degree of Reversibility of Fluoride Adsorption in Site Soils
South Plant Soil and Debris Areas (Scrap Yard, South Landfill, East Potliner)
Reynolds Metals Company - Troutdale, Oregon

Soil and Debris Area	Station ID	Depth (ft bgs)	Estimated Sorbed Fluoride Concentration Above Background From Table F-5 (C_{ads}) (mg F / kg dry weight soil)	Lab-Measured Groundwater Fluoride (EPA 300.0) (mg/L)	Field-Measured Groundwater Fluoride (Probe) (mg/L)	Calculated Sorbed Soil Fluoride In Equilibrium With Measured Groundwater Fluoride (mg F / kg dry weight soil)	Ratio of Calculated and Measured Sorbed Soil Fluoride Concentrations (Degree of Reversibility of Adsorption) (dimensionless)
Surficial Sand							
South Landfill	GP60	5	3885		53	784	0.20
Silt							
Scrap Yard	GP50	10	1988		10.1	445	0.22
East Potliner	GP65	15	2100	267	220	844	0.40
	GP66	5	2184		22.2	228	0.10
		15	862		79.7	447	0.52
		30	2235	602	538	1294	0.58
UGS							
East Potliner	GP66	40	484		26.1	309	0.64

Notes:

1) The sorbed soil fluoride concentration in equilibrium with the measured groundwater fluoride concentration is calculated using the Freundlich isotherm coefficients listed in Table G-5 for each soil sample. This concentration does not include background or pore water concentrations.

2) Blank entries for the lab-measured groundwater fluoride means no lab measurements were conducted.

3) The ratio of the calculated and estimated sorbed soil fluoride concentrations (in the last column) is the indicator of the possible degree of reversibility of the adsorption process.

Abbreviations:
mg/kg = milligrams per kilograms. mg/L = milligrams per liter.