Final Cleanup Action Plan

McFarland Cascade Pole and Lumber Company Site
Tacoma, Washington

Facility/Site ID: 1222
Cleanup Site ID: 3643

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ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Environment
AO	agreed order
ARAR	applicable or relevant and appropriate requirements
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CA-C	copper azole type C
CAP	Cleanup Action Plan
CCA	copper-chromated arsenic
CMP	Groundwater Compliance Monitoring Plan
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPLC	Cascade Pole and Lumber Company
CPOC	conditional point of compliance
CrVI	hexavalent chromium
CUL	cleanup level
Ecology	Washington State Department of Ecology
EO	Enforcement Order
GRO	total petroleum hydrocarbons—gasoline-range organics
IHS	indicator hazardous substance
MCHI	McFarland Cascade Holdings, Inc.
MCPLC	McFarland Cascade Pole and Lumber Company
MFA	Maul Foster & Alongi, Inc.
MKA	MKAssociates, Inc. (land surveyor)
MRC®	Metals Remediation Compound
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
ORC®	Oxygen Release Compound
PAH	polycyclic aromatic hydrocarbon
PCP	pentachlorophenol
PLP	Potentially Liable Person
POC	point of compliance
Port	Port of Tacoma
PPCD	Prospective Purchaser Consent Decree
PQL	practical quantitation limit
Property	Tyee-owned property on which MCPLC conducts its operations, located at 1640 E. Marc Street, Tacoma, Washington
RCW	Revised Code of Washington
REL	remediation level
RETEC	The RETEC Group, Inc.
RI/FS	remedial investigation and feasibility study
Site	McFarland Cascade Pole and Lumber Company Site
SMP	Site Management Plan
SVOC	semivolatile organic compound
TEE	terrestrial ecological evaluation
Tyee	Tyee Management Company, LLC
UPRR Site	Union Pacific Railroad Former Milwaukee Railyard Site

USEPA	U.S. Environmental Protection Agency
USPCI	USPCI Remedial Services
WAC	Washington Administrative Code

1.0 INTRODUCTION

This Cleanup Action Plan (CAP) presents the Washington State Department of Ecology's (Ecology) proposed cleanup action for the McFarland Cascade Pole and Lumber Company (MCPLC) site (the Site) (Facility Site ID: 1222, Cleanup Site ID: 3643). The Site includes the Tyee Management Company, LLC (Tyee) property located at 1640 East Marc Street, Tacoma, in Pierce County, Washington (the Property), as well as a portion of the adjacent Port of Tacoma (the Port) property located at 1119 Milwaukee Way (Figure 1). This document has been prepared pursuant to Agreed Order (AO) No. 92HS-S146 and in accordance with the requirements of the Washington State Model Toxics Control Act (MTCA) (Washington Administrative Code [WAC] 173-340-350). The cleanup action decision is based on the Remedial Investigation and Feasibility Study (RI/FS) (Maul Foster & Alongi, Inc. [MFA] and AECOM Environment [AECOM], 2014) and other relevant documents in the administrative record (see Section 1.2).

Tyee owns the Property. MCPLC operates a treated-wood manufacturing and processing facility on the Property.

The Port property is included in the Union Pacific Railroad Former Milwaukee Railyard cleanup site (Facility Site ID: 1251) (the UPRR Site). A separate cleanup action was completed and groundwater monitoring is ongoing to address petroleum-related contamination on the UPRR Site under Prospective Purchaser Consent Decree (PPCD) No. 95-2-02280-0 and in accordance with MTCA. Impacts from chemicals that can be associated with wood treating exist on a portion of the Port property. These impacts may potentially be attributable to a release from the Property. These impacts were not addressed in the UPRR Site cleanup or the PPCD. The portion of the Port property with these impacts is included in the Site.

This CAP outlines the following:

- The history of operations, ownership, and activities at the Site
- The nature and extent of contamination
- Cleanup levels (CULs) for the Site that are protective of human health and the environment
- The selected remedial action for the Site
- Compliance monitoring and institutional controls

1.1 APPLICABILITY

CULs specified in this CAP are applicable only to the Site. They were developed as a part of an overall remediation process under Ecology oversight, using the authority of MTCA, and should not be considered as setting precedents for other sites.

1.2 ADMINISTRATIVE RECORD

The documents used to make the decisions discussed in this CAP are on file in the administrative record for the Site. Major documents are listed in the reference section. The entire administrative record for the Site is available for public review by appointment at Ecology's Southwest Regional Office, located at 300 Desmond Drive, Lacey, WA 98503-1274. Results from applicable studies and reports are summarized to provide background information pertinent to this CAP. The following is a list of relevant studies and reports for the Site:

Reports associated with the Property:

- Sampling Plan for a Site Investigation (Ecology and U.S. Environmental Protection Agency [USEPA], 1990)
- Interim Report (The RETEC Group, Inc. [RETEC], 1991)
- Final Investigation Report (RETEC, 1992a)
- Draft Interim Action Work Plan for the Proposed Paving, Drip Pad and Transfer Table Areas (RETEC, 1992b)
- Interim Action Sampling Plan (RETEC, 1993a)
- Interim Action Report (RETEC, 1993b)
- Draft Interim Action Plan for the Transfer Table Soils (RETEC, 1994a)
- Final Work Plan for an RI/FS (RETEC, 1994b)
- Groundwater Interim Action Design Report (RETEC, 1995)
- Progress Report (RETEC, 1997)
- Transfer Table Area Plan Interim Action Activities and Drip Pad Conversion (RETEC, 1998)
- Groundwater Interim Action Implementation Report (RETEC, 1999)
- Transfer Table Pit Upgrade Completion Report (RETEC, 2000)
- Work Plan for Slug Test in Deep Wells (RETEC, 2006)
- RI/FS (MFA and AECOM, 2014)

Reports associated with the UPRR Site (the Port property):

- Hydrogeologic Characterization Report (USPCI Remedial Services [USPCI], 1993)
- Report of Additional Investigation (Shaw, 2008)
- Periodic Review (Ecology, 2011)

1.3 Cleanup Process

Cleanup conducted under the MTCA process requires the preparation of specific documents either by the Potentially Liable Person (PLP) or by Ecology. These procedural tasks and resulting documents, along with the MTCA section that requires their completion, are listed below with a brief description of each task:

- Remedial Investigation and Feasibility Study—WAC 173-340-350
  The RI/FS documents the investigations and evaluations conducted at the site from the discovery phase to the completion of the RI/FS document. The RI collects and presents information on the nature and extent of contamination, as well as the risks posed by the contamination. The FS presents and evaluates site cleanup alternatives and proposes a preferred cleanup alternative. The document is prepared by the PLP, is approved by Ecology, and undergoes public comment.
- Cleanup Action Plan—WAC 173-340-380
  The CAP sets CULs and standards for the site and the selected cleanup actions intended to achieve the CULs. The document is prepared by the PLP, then reviewed and issued by Ecology, and then finally undergoes public comment.
- Engineering Design Report, Construction Plans and Specifications—WAC 173-340-400
  The report outlines details of the selected cleanup action, including any engineered systems and design components from the CAP. These may include construction plans and specifications with technical drawings. The document is prepared by the PLP and approved by Ecology. Public comment is optional.
- Operation and Maintenance Plan(s)—WAC 173-340-400
  The plan(s) summarizes the requirements for inspection and maintenance of cleanup actions. It includes any actions required to operate and maintain equipment, structures, or other remedial systems. The document is prepared by the PLP and approved by Ecology.
- Cleanup Action Report—WAC 173-340-400
  The Cleanup Action Report is completed following implementation of the cleanup action, and provides details about the cleanup activities along with documentation of adherence to or variance from the CAP. The document is prepared by the PLP and approved by Ecology.
- Compliance Monitoring Plan—WAC 173-340-410
  The Compliance Monitoring Plan provides details about monitoring activities required to ensure that the cleanup action is performing as intended. It is prepared by the PLP and approved by Ecology.

1.4 Summary of Chosen Cleanup Action (Remedy) for the Site

The final remedy selected for the Site consists of completed interim actions (including installation and operation of a horizontal recovery well system to extract contaminated groundwater, which is reused in facility operations), institutional controls, monitored natural attenuation, and groundwater compliance monitoring. The interim action work plan, design, and completion reports included in the existing administrative record fulfill the requirements for the Engineering Design and Cleanup Action reports listed above. The Groundwater Compliance Monitoring Plan (CMP) and Site Management Plan (SMP) appended to this CAP (see Appendices A and B, respectively) satisfy the Compliance Monitoring Plan and Operation and Maintenance Plan reporting requirements.

2.0 SITE BACKGROUND

2.1 SITE HISTORY AND OPERATIONS

The MCPLC facility is used for the manufacturing and processing of treated-wood products. Figure 2 shows the current layout of the facility. Activities at the facility have included debarking, sizing and framing, incising, staining, pressure- and non-pressure-treating, and distributing finished products to customers. Treated-wood products manufactured at the MCPLC facility include utility poles and dimensional lumber used for decking, fencing, and similar products.

The facility and the Property were originally owned and operated by Cascade Pole and Lumber Company (CPLC). CPLC began leasing the facility, the Property, and equipment to MCPLC in January 2004. CPLC and MCPLC are owned by the same parent company, McFarland Cascade Holdings, Inc. (MCHI). In 2012, Stella-Jones Corporation acquired MCHI. As part of that transaction, CPLC transferred ownership of the Property to Tyee, which continues to lease the Property to MCHI.

CPLC purchased the Property in stages from the late 1960s through the early 1970s and began developing it for use as a wood-treating facility in 1972; wood-treating operations have been conducted on the Property since 1974. Prior to 1974, the northwest portion of the Property was used for a lumber mill and landscape bark operation. The rest of the Property was filled in the early 1970s by the Port. The fill consisted of dredged material and possibly other materials.

Wood-treating activities, including storage and application of wood preservatives, are conducted on the eastern portion of the Property in an area referred to as the "treating area." The treating area includes the drip pads, a transfer table, retorts, and a pentachlorophenol (PCP) thermal butt vat (see Figure 2). Initially, three retorts and the creosote thermal butt vat were used for wood treatment. Additional retorts were added to the facility in 1978 and 2008. Historical and current areas used for storage of treated-wood products are shown in Figures 2 and 3.

Both pressure and non-pressure (i.e., thermal) wood-treating processes are used at the facility. The primary wood-treating chemicals used in these processes have been PCP, copper-chromated arsenic (CCA), copper azole type C (CA-C), and creosote. From 1978 to 1987, CPLC used Chemonite® ammoniacal copper zinc arsenate at the facility. As of December 2004, creosote use was discontinued at the facility. MCPLC continues to use PCP to treat utility poles, but CCA use was discontinued for lumber products in December 2003, and for all products, including those for industrial use, in 2011.

CPLC and MCPLC records indicate that four known spills have occurred at the Property; one of these spills migrated onto the adjacent Port property. Cleanup actions were implemented to address these spills and each was reported to Ecology:

- In August 1985, an overflow of process water from the cooling tower resulted in a release of approximately 100 gallons of water. Cleanup actions were implemented and efforts were made to eliminate the possibility of future spills.
- In March 1986, a cooling tower overflow resulted in the spill of approximately 100 gallons of process water. Cleanup actions were implemented and the system was redesigned to prevent any chance of recurrence.
- In May 1986, a storage tank overflow resulted in the spill of approximately 260 gallons of CCA. Cleanup actions and procedures were implemented to prevent any chance of recurrence.
- In May 2014, a wood-treatment-process work tank release resulted in the spill of approximately 300 gallons of CA-C. The spill migrated into a dry roadside ditch on the adjacent Port property. A project-specific cleanup goal of 146 milligrams per kilogram for copper in soil was developed in coordination with Ecology and the Tacoma-Pierce County Health Department. All soil with copper concentrations above the project-specific cleanup goal was excavated from the ditch (approximately 40 cubic yards [48.29 tons] in total). Ecology approved the spill response and cleanup and determined that no further action associated with this spill was needed.

No other spills or releases have been reported at the MCPLC facility.

The facility is a hazardous-waste generator (ID No. WAD 008 958 357). The facility discharges treated stormwater under a National Pollutant Discharge Elimination System (NPDES) permit (No. WA003795-3). MCPLC's current NPDES permit became effective on September 1, 2014 and has an expiration date of August 31, 2019. MCPLC is also registered with the Puget Sound Clean Air Agency (Registration No. 10398).

Chemicals used in the wood-treating process and their associated compounds and breakdown products, including the following, were identified as chemicals of interest for the Site:

- Total and dissolved arsenic, copper, and chromium (including both trivalent chromium and hexavalent chromium [CrVI])
- Polycyclic aromatic hydrocarbons (PAHs)
- PCP
- Semivolatile organic compounds (SVOCs)

In addition, the following chemicals of interest were identified in association with the PCP carrier oil formerly in use at the facility:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Total petroleum hydrocarbon–gasoline-range organics (GRO)

The carrier oil in use since 2008, and currently in use at the facility, is a 30 percent biodiesel and 70 percent recycled lubrication oil mixture that does not contain BTEX.

Samples of environmental media from the Site were analyzed for these chemicals of interest, and detected chemicals were retained for consideration as indicator hazardous substances (IHSs).

CPLC entered into an AO with Ecology on June 7, 1993, for completion of an RI/FS and interim actions. Interim actions completed before execution of the AO were incorporated into the AO along with additional planned interim actions, including groundwater interim actions. Soil and groundwater investigations completed in association with the interim actions fulfilled the data collection requirements for the RI/FS (MFA and AECOM, 2014).

2.2 Site Investigations

In December 1989, Ecology issued Enforcement Order (EO) DE89-S214 to CPLC to correct certain operational and reporting practices found to be inconsistent with state dangerous-waste regulations. Section 4 of the EO required a site investigation. In 1991, CPLC conducted a site investigation to assess the magnitude and extent of possible soil and groundwater contamination from past releases. In accordance with the EO, the site investigation focused on three areas: (1) the treated-lumber storage area, (2) the retort and transfer table area, and (3) the thermal butt vat. The site investigation demonstrated that past operational practices had resulted in contamination of soil and/or groundwater in these areas of the Property.

Since 1991, additional soil and groundwater investigations have been conducted at the Property in association with the completed interim actions discussed in the next section. Investigations and interim actions completed at the Property are summarized in Table 1. Wood-treating-related chemical impacts were investigated on the Port property during the 1990 to 1992 investigation, as discussed in the Hydrogeologic Characterization Report (USPCI, 1993). Data collected at the Property as part of previous investigations were compiled and reviewed as part of the RI. These data, as well as data collected during investigations completed on the Port property as part of UPRR Site investigations, are discussed in Section 3 of this CAP.

2.3 Interim Actions

Since the early 1990s, CPLC has implemented interim cleanup actions at the Property. The interim actions were completed under the existing AO, with oversight and approval by Ecology. These actions consisted of:

- **Paving Areas—**Soil investigations were conducted in three areas proposed for paving (Paving Areas 1, 2, and 3). Arsenic was detected above its CUL in these Paving Areas (MFA and AECOM, 2014). USEPA and Ecology approved the grading of excess soil from Paving Area 1 into an area on the eastern portion of the Property (see Figure 4). Currently, the Property is paved (including the Paving Areas and the portion of the Property with excess soil from Paving Area 1) or covered with concrete, buildings, or other constructed features (including the drip pad described below). The paved areas are equipped with catch basins and piping to collect stormwater and direct it to on-site filtration/treatment systems. The stormwater is discharged under the site-specific NPDES permit.

- **Drip Pad Construction—**Included excavation and disposal of impacted soils, as well as capping of contaminated soils via installation of a steel-reinforced-concrete drip pad and underlying leak-detection system.
- **Installation and Operation of the Horizontal Recovery Well (HW-01)—**Provides both hydraulic containment and removal of groundwater impacts from beneath the transfer table pit and the adjacent treatment area. Extracted water is reused in facility operations. The horizontal recovery well reduces the migration of chemically impacted shallow groundwater from the transfer table pit and treating area and reduces the mass of IHSs in shallow groundwater.
- **Transfer Table Pit Upgrade—**Included removal and off-site disposal of 860 tons of impacted soil, construction of a concrete containment slab that caps underlying contaminated soils, and construction of a drainage system emergency shutoff valve to prevent potential releases.

Completed interim actions are also summarized in Table 1. Further information associated with each interim remedial action is provided in the RI/FS (MFA and AECOM, 2014).

2.4 PHYSICAL SITE CHARACTERISTICS

2.4.1 SITE LOCATION

The Site is located on the Tacoma tide flats and includes the Property, located at 1640 East Marc Street, and a portion of the adjacent Port property located at 1119 Milwaukee Way, in Tacoma, Washington (Figures 1 and 2). The 43-acre Property is approximately 200 feet east of the Puyallup River and 1,000 feet south of the Milwaukee Waterway, on tax lot 8950000245. The Property contains an operating wood-treatment facility consisting of 15 separate primary structures, including areas for timber fabrication, lumber storage, hazardous-waste storage, workshop activities, and office and administration (Figure 2).

The Property is zoned Port Maritime and Industrial and is surrounded by industrial facilities, including: Maersk Pacific and Horizon Lines storage and shipping yards to the northwest; the UPRR Site (now owned by the Port) to the northeast; Pallet Services, a pallet manufacturing and storage facility, to the east; Fred Tebb and Sons, a lumber mill; and Recovery One, a demolition waste transfer and processing facility, to the south.

2.4.2 TOPOGRAPHY AND CLIMATE

The Site is located along the Puyallup River at approximately 13 feet in elevation and is nearly flat topographically. The Site is located outside the 100- and 500-year floodplain. The climate in the Puget Sound region is typified by cool and comparatively dry summers, and winters are mild, wet, and cloudy. The mean annual temperature is 45 to 62 degrees Fahrenheit and the mean annual precipitation is 39 inches (NOAA, 2013).

2.4.3 Geology and Hydrogeology

The Site is in an alluvial plain of the Puyallup River and is underlain by Puget Lowland glacial deposits (Griffin et al., 1962). The Site geology originally consisted of Puyallup River deltaic deposits overlying the glacial deposits, but has been extensively modified by dredging and in-filling activities. The Site is underlain predominantly by fill consisting of dredge material and possibly other materials of unknown origin that were emplaced prior to development (MFA and AECOM, 2014).

The Site is underlain by a shallow, unconfined aquifer (the shallow aquifer) consisting of 6 to 10 feet of fine to medium sand with some sandy silt intervals underlain by an approximately 6- to 7-foot-thick aquitard consisting of silty clay to clayey silt. A second, approximately 6- to 10-foot-thick, semi-confined aquifer (the deep aquifer) exists below the shallow aquitard consisting of very fine to medium sand with a trace of silt, which is underlain by a second aquitard consisting of a 3-foot-thick sandy to clayey silt zone.

The depth to groundwater beneath the Site ranges from 3 to 10 feet below ground surface (bgs) and fluctuates seasonally by approximately 2 feet. The highest water levels have been measured during the winter months (January through March) and the lowest in the fall (October and November). A groundwater elevation high, or groundwater divide, exists on the boundary between the Property and the Port property, in the vicinity of monitoring wells MW-3 and UPRR-MW-29 (see Figure 2 for monitoring well locations), and hence there is a component of flow toward the Port property at times (USPCI, 1993). Groundwater generally flows toward the southwest on the west side of the divide and toward the northeast on the east side of the divide; no significant seasonal variation in the groundwater flow direction is apparent.

Groundwater from the treating area flows southwest to the Puyallup River, approximately 0.25 mile downgradient of the treating area. Groundwater-level data, hydrographs, and contour maps for the shallow and deep aquifers are included in the CMP (Appendix A).

The horizontal recovery well recovers groundwater from the shallow aquifer and does not appreciably alter the flow paths across the Property, but does cause a slightly increased gradient in its immediate vicinity. Given that the horizontal recovery well has only a localized impact on groundwater flow on the Property, it is not believed to have an appreciable effect on groundwater flow on the Port property.

3.0 Remedial Investigation

An RI was completed to assess the nature and extent of contamination in soil and groundwater. A summary of findings is presented below. A detailed discussion is presented in the RI/FS (MFA and AECOM, 2014).

3.1 SOIL

Arsenic is the only remaining IHS in soil at the Site. Soil with arsenic concentrations above the CUL is vertically bounded between the ground surface and 5 feet bgs and is generally limited to the eastern portion of the Property in areas where wood-treating activities have been conducted. The sole exception is an arsenic exceedance detected at sample location MW-4 (see Figure 4). Areas of the Property with soil arsenic concentrations above the CUL were paved during interim action implementation (see Section 2.3) or are covered by infrastructure, limiting infiltration of stormwater and leaching to groundwater.

Other wood-treating-related chemicals, including metals, SVOCs, PCP, and PAHs, have been detected in soil in the treated-lumber storage area, the transfer table area, and the general treating area, but at concentrations below screening levels; therefore, these compounds were not selected as IHSs (see Section 4.3). These areas of the Site were also paved during interim action implementation (see Section 2.3).

Wood-treating-related chemicals, including arsenic, chromium, zinc, phenanthrene, and PCP, have been detected in soil samples collected from soil borings SSB-5 through SSB-10 and monitoring well UPRR-MW-29, located on the adjacent Port property, but at concentrations below screening levels. Arsenic concentrations were below the CUL on the Port property. Diesel-range petroleum hydrocarbons were also detected in these locations at concentrations exceeding UPRR Site CULs, but are not IHSs associated with the Site.

The sample locations with wood-treating-related chemical detections on the Port property and in the copper azole spill response soil-removal area (as discussed in Section 2.1) are part of the Site, as shown on Figure 4. No further soil remedial actions are required in these areas because the copper azole spill area was cleaned up and Ecology determined that no further action was required.

3.2 GROUNDWATER

Groundwater at the Property has been monitored since 1991; however, during the RI/FS, groundwater data from 2004 to 2013 were determined to be representative of current conditions and were therefore used for selecting IHSs and evaluating the nature and extent of groundwater contamination (MFA and AECOM, 2014). Arsenic, copper, CrVI, PCP, and carcinogenic PAHs (cPAHs) were selected as IHSs in groundwater (see Section 4.3).

3.2.1 SHALLOW GROUNDWATER

IHS concentrations detected in shallow groundwater from 2004 to 2013, during the RI/FS (MFA and AECOM, 2014), and from 2004 to 2015, following a February 2015 groundwater monitoring event (MFA, 2015), were compared to CULs. The four most recent data points, from groundwater monitoring events conducted between 2004 and 2015, were evaluated for each IHS to determine the most recent trend of groundwater exceedances at the Site. Figure 5 shows IHSs that exceed their respective CULs, based on the most recent data. CUL exceedances were detected in all shallow wells sampled, except for monitoring well MW-1, which is located near the southern Property boundary, and sentry well MW-20 (see Figure 5). Arsenic exceeds its CUL in all but one of the shallow groundwater monitoring wells with CUL exceedances. Other IHS exceedances, including copper, PCP, and cPAHs, were detected in fewer locations. The horizontal recovery well has reduced the migration of chemically impacted shallow groundwater from the treating area and reduced the mass of IHSs in shallow groundwater. Arsenic in shallow sentry wells MW-4 and MW-19, and copper in shallow sentry well MW-19, exceeded their CULs. Arsenic and PCP were detected above their CULs in samples collected from the horizontal recovery well (HW-01).

Shallow groundwater quality data from the UPRR Site investigation (USPCI, 1993), and groundwater monitoring conducted by CPLC and MCPLC that included monitoring well UPRR-MW-29, indicate that wood-treating-related chemical impacts are present in that well location on the Port property.

Since 2004, copper, arsenic, PCP, and cPAHs have been detected at least once above Site CULs in monitoring well UPRR-MW-29 (see Figure 5) and may have originated in the treating area of the MCPLC facility (USPCI, 1993). The Site extends onto this affected portion of the Port property. Wood-treating-related chemicals were not detected in other monitoring wells located downgradient of UPRR-MW-29 on the Port property (USPCI, 1993); therefore, wood-treating-related chemical impacts in groundwater on the Port property are limited to the immediate area surrounding UPRR-MW-29. The Site boundary is located on the Port property at the zero concentration arsenic contour line shown in Figure 32 of the Hydrogeologic Characterization Report (USPCI, 1993). The zero concentration contours for the other wood-treating-related chemicals detected in groundwater on the Port property are contained within this zero concentration contour for arsenic. Ecology has determined that discharge to surface water is the highest beneficial use of groundwater, but the Hydrogeologic Characterization Report indicates that IHSs are not migrating to surface water on the Port property.

In general, IHS concentrations in shallow groundwater on the Property show stable or decreasing trends and IHS impacts appear to be limited to the treating area and UPRR-MW-29, with the exception of arsenic at MW-4 and arsenic and copper at MW-19. However, conservative attenuation modeling demonstrates that the arsenic concentration detected at MW-4, and the copper and arsenic concentrations detected at MW-19, will naturally attenuate to below CULs before reaching the downgradient Property boundary (see Section 4.4; MFA, 2015; and MFA and AECOM, 2014).

3.2.2 Deep Groundwater

Three existing deep groundwater monitoring wells are located on the Property: one well upgradient of the treating area (source area well MW-14) and two wells directly downgradient of the treating area (sentry wells MW-7 and MW-18) (see Figure 2). Deep groundwater monitoring data from 2004 to 2013 were evaluated in the RI/FS for CUL exceedances (MFA and AECOM, 2014).

The following IHSs are not monitored in the deep aquifer wells: benzene, ethylbenzene, xylenes, and CrVI (MFA and AECOM, 2014). No exceedances of these IHSs were observed in the shallow aquifer (MFA, 2015; MFA and AECOM, 2014); see Figure 5. Total chromium was monitored in the deep aquifer wells from 2004 to 2013, and the only total chromium concentration above the CrVI CUL in a deep well was detected in the upgradient deep well (source area well MW-14) (MFA and AECOM, 2014).

IHS concentrations are significantly lower in the deep aquifer. The only IHSs that have exceeded a CUL in deep groundwater since 2004 are arsenic, copper, cPAHs, and PCP. Concentrations of all IHSs show declining trends in deep groundwater, and CUL exceedances have not been detected in the downgradient deep groundwater wells (sentry wells MW-7 and MW-18) since 2007 (MFA and AECOM, 2014). During the last four monitoring events, only arsenic and copper exceeded their CULs in the upgradient deep groundwater well (source area well MW-14). This observation indicates that CULs are currently being met in the existing deep sentry wells and suggests that CULs will continue to be met in the future.

No deep wells are located on the Port property, but given the low concentrations detected in deep groundwater on the Property and the lower concentrations of IHSs detected in the shallow groundwater on the Port property, deep groundwater on the Port property is not believed to be impacted by IHSs at levels that could pose a concern to human health or the environment.

3.3 Risks to Human Health and the Environment

The Property and the Port property are zoned Port Maritime and Industrial and are surrounded by industrial facilities. Following cleanup, the Site will continue to be used for industrial operations and is anticipated to operate as an industrial site into the future.

Exposures to human populations (on-site workers) could occur through direct contact with contaminated surface soil on the Property and dust entrained in air. The soil-to-groundwater pathway has been mitigated by the implementation of interim actions at the Property, including soil removal and asphalt pavement. Contaminated soils have been capped on site through the use of asphalt paving, preventing direct contact and/or ingestion of soil by on-site workers. Pavement in the treating areas of the Property limits infiltration of stormwater and leaching of contamination remaining in soil.

The shallow and deep aquifers are not currently used and will not be used in the future as a source of drinking water. Groundwater beneath the Site and surface water in the Puyallup River, to which groundwater discharges, are not considered suitable for use as a domestic water supply. Therefore, the groundwater-ingestion pathway for humans is not complete. Ecology has determined that the highest beneficial use of groundwater at the Site is discharge to surface water. Therefore, human ingestion of contaminated water is not considered a potential risk. In addition, as part the selected remedy, an environmental covenant will be placed on the Property to restrict domestic uses of groundwater. An environmental covenant was recorded for the Port property in 1995 as part of the UPRR Site cleanup implementation and includes restrictions on domestic uses of groundwater.

The Puyallup River is approximately 200 feet west of the Site. Previous groundwater monitoring and modeling indicate that IHS concentrations in groundwater attenuate to undetectable levels before reaching the downgradient Property boundary and will not reach the Puyallup River.

There is no exposure for ecological receptors at the Site. The Site is covered by buildings, pavement, or other physical barriers that prevent plants or wildlife from being exposed. Aquatic life in the Puyallup River could be a receptor; however, groundwater impacts do not reach the river, as noted above, and the installation of a stormwater treatment system in September 2002 significantly reduced the potential adverse impacts to surface water from the Site. Engineered and institutional controls will be maintained to prevent potentially complete exposure pathways for ecological receptors.

4.0 CLEANUP STANDARDS

MTCA requires the establishment of cleanup standards for individual sites. The two primary components of cleanup standards are CULs and points of compliance (POCs). CULs determine the concentration at which a substance does not threaten human health or the environment. All environmental media that exceed a CUL are addressed through a remedy that prevents exposure. POCs represent the locations on the Site where CULs must be met.

4.1 OVERVIEW

The process for establishing CULs involves the following:

- Determining which MTCA Method to use
- Developing CULs for individual contaminants in each medium
- Determining which contaminants contribute most to the overall risk in each medium (IHS)
- Adjusting the CULs, based on total site risk

The MTCA Cleanup Regulation provides three options for establishing CULs: Methods A, B, and C.

- Method A may be used to establish CULs at routine sites or at sites with relatively few hazardous substances.
- Method B is the standard method for establishing CULs and may be used to establish CULs at any site.
- Method C is a conditional method used when a CUL under Method A or B is technically impossible to achieve or may cause significantly greater environmental harm. Method C also may be applied to qualifying industrial properties.

The MTCA administrative rules define the factors used to determine whether a substance should be retained as an indicator for the Site. When defining CULs at a site contaminated with several hazardous substances, Ecology may eliminate from consideration those contaminants that contribute a small percentage of the overall threat to human health and the environment. WAC 173-340-703(2) provides that a substance may be eliminated from further consideration, based on:

- The toxicological characteristics of the substance that influence its ability to adversely affect human health or the environment relative to the concentration of the substance
- The chemical and physical characteristics of the substance that govern its tendency to persist in the environment
- The chemical and physical characteristics of the substance that govern its tendency to move into and through the environment
- The natural background concentration of the substance
- The thoroughness of testing for the substance
- The frequency of detection
- The degradation by-products of the substance

MTCA also considers the limits of analytical chemistry. If the practical quantitation limit (PQL) of a substance is greater than the risk-based CUL, then the CUL can be set equal to the PQL (see WAC 173-340-720[7][c]).

MTCA requires that the total risk from all contaminated media not exceed certain levels. The total site cancer risk shall not exceed $1x10^{-5}$, and the hazard index (calculated for chemicals with similar noncarcinogenic toxicity endpoints) shall not exceed 1. After the CUL for each medium is developed, the risks from each chemical and medium are summed. If the total site cancer risk and/or hazard index exceeds the levels listed above, then the CULs are adjusted downward until cancer risk is less than $1x10^{-5}$ and the hazard index is less than or equal to 1 for each endpoint (see WAC 173-340-700[5][b] and [c]). MTCA does not specify how the risks can be adjusted, as long as the individual CUL standard for each chemical is not violated.

4.2 Terrestrial Ecological Evaluation

WAC 173-340-7490 requires that sites perform a terrestrial ecological evaluation (TEE) to determine the potential effects of soil contamination on ecological receptors. Sites may be removed from further ecological consideration either by documenting an exclusion, using the criteria set forth in WAC 173-340-7491, or by conducting a simplified TEE procedure as set forth in WAC 173-340-7492. The simplified TEE provides an evaluation process that may be used to identify sites that do not have the potential to pose a substantial threat of significant adverse effects to terrestrial ecological receptors, and thus may be removed from further ecological consideration during the RI and cleanup process.

The simplified TEE exposure analysis procedure set forth under WAC 173-340-749(2)(a)(ii) and in MTCA Table 749-1 was completed as part of the RI/FS. The Site meets Exclusion No. 2—that no further evaluation is required "if all soil contaminated with hazardous substances is, or will be, covered by buildings, paved roads, pavement, or other physical barriers that will prevent plants or wildlife from being exposed" (WAC 173-340-7491[1][b]). On this basis, no additional terrestrial evaluation was performed as part of the RI/FS, ecological exposure pathways are deemed incomplete, and CULs for ecological receptors need not be established (MFA and AECOM, 2014).

4.3 Site Cleanup Levels

Previous investigations documented the presence of contamination in soil and groundwater at the Site. CULs were developed for both of these media.

The primary exposure mechanism for soil at the Site is direct contact. The soil-to-groundwater pathway has been mitigated by the implementation of interim actions at the Property, including soil removal and capping contamination with asphalt pavement, concrete, and existing buildings or other constructed features. Capping of soil in the treating areas limits infiltration of stormwater and leaching of contamination that may remain in soil. Therefore, CULs were developed for soil, based on a direct-contact exposure pathway. Terrestrial ecological CULs were not considered, based on the TEE exclusion in which all contaminated soils are or will be covered by buildings, pavement, or other physical barriers.

GRO and BTEX were determined not to be risk drivers for soil and were excluded from the CUL development and risk-assessment process. Based on this finding, soil CULs were not evaluated for GRO and toluene. However, soil CULs were developed for benzene, ethylbenzene, and xylenes, since these constituents were identified as shallow-groundwater IHSs.

CULs for soil were developed using MTCA Method C standard values for industrial properties (WAC 173-340-745) (Table 2). When no Method C values were available, Method A values were evaluated for selection. The CULs were evaluated for adjustment based on natural background. PQLs were not assessed for soil, as it is unlikely that a Method C CUL would be less than a PQL. One IHS (arsenic) was selected for soil; the MTCA Method C carcinogenic risk-based concentration was selected as the CUL (Table 3). Therefore, cumulative site risk was not evaluated for soil, nor was total site risk from both soil and groundwater IHSs evaluated.

Ecology has determined that the highest beneficial use of groundwater at the Site is discharge to surface water. Neither groundwater at the Site, nor the Puyallup River, to which groundwater discharges, is considered suitable for use as a domestic water supply. Therefore, drinking-water standards were not considered in the CUL development.

CULs for groundwater were developed using MTCA Method B surface water standard values and guidance (WAC 173-340-730). According to the guidance, state and federal surface water standards (i.e., applicable or relevant and appropriate requirements [ARARs]), if sufficiently protective, shall be selected as the CULs. If not sufficiently protective, the ARARs shall be downward-adjusted to meet a cancer risk of 1 in 100,000 or a hazard index of 1. If no ARARs are available for a constituent, then the most stringent of the Method B values may be selected. When no ARAR or Method B value was available, the Method A value was selected as the CUL.

Finally, the CULs were evaluated for adjustment based on natural background, PQLs, and cumulative site risk, as applicable.

Based on previous discussions between Ecology and MCPLC, Ecology selected the Method A groundwater CUL for arsenic as the appropriate CUL. The Method A value is based on the groundwater concentration that would result from leaching of arsenic present in soil at the natural background concentration (see WAC 173-340-900, Table 720-1).

Groundwater CULs were developed in accordance with this process and are summarized in Table 4. These CULs were used to select IHSs, as discussed in the previous section (see Table 5). CULs were selected for the IHSs following a cumulative risk assessment (see Table 6). Groundwater CULs did not require adjustment for cumulative risk.

IHSs in soil and groundwater and the final CULs selected are summarized in Table 7.

4.4 Point of Compliance

The MTCA Cleanup Regulation defines the POC as the point or points where CULs shall be attained. Once CULs are met at the POC, the Site is no longer considered a threat to human health or the environment.

WAC 173-340-740(6) gives the POC requirements for soil. WAC 173-340-740(6) states that "for soil CULs based on the protection of groundwater, the POC shall be established in the soils throughout the site," and/or for soil CULs based on direct contact, "the point of compliance shall be established in the soils throughout the site from the ground surface to fifteen feet below the ground surface." This standard POC is applied to soil within the Site boundary shown in Figures 1 to 6.

This CAP establishes a conditional point of compliance (CPOC) for groundwater, based on protection of surface water. Under MTCA, a CPOC may be approved where it can be demonstrated that it is not practicable to meet CULs throughout the Site within a reasonable restoration time frame (see WAC 173-340-720[8][c]). Additional groundwater treatment would be required at the Site in order to meet CULs in groundwater throughout the Site within a reasonable restoration time frame. However, the disproportionate-cost analysis completed as part of the RI/FS indicated that the cost of additional groundwater treatment exceeds the incremental benefits that would be achieved by implementing additional groundwater treatment (MFA and AECOM, 2014). In addition, the arsenic attenuation modeling results indicated that arsenic will not exceed its CUL at the downgradient Property boundary (see Section 5.7.3 of the RI/FS [MFA and AECOM, 2014]). Based on these findings, a CPOC consistent with the Site boundary (as shown in Figures 1 to 6), which includes wood-treating-related chemical impacts in soil and groundwater and the CA-C spill area on the Port property, has been selected for the Site.

A CMP (Appendix A) and an SMP (Appendix B) have been developed to provide details for monitoring for compliance and preventing exposure to Site IHSs within the CPOC. The CMP includes monitoring sentry wells located on the Property to evaluate the potential for discharges to the Puyallup River and confirmational monitoring throughout the Site to assess compliance with groundwater cleanup standards in the future.

5.0 CLEANUP ACTION SELECTION

5.1 REMEDIAL ACTION OBJECTIVES

The remedial action objectives describe the actions necessary to protect human health and the environment through eliminating, reducing, or otherwise controlling risks posed by each exposure pathway and migration route. These objectives are developed by evaluating the characteristics of the contaminated media, the characteristics of the hazardous substances present, migration and exposure pathways, and potential receptor points.

As a result of past activities on the Property, soil on the Property has been contaminated with arsenic, and groundwater at the Site has been contaminated with arsenic, copper, CrVI, cPAHs, benzene, ethylbenzene, xylenes, and PCP. The potentially complete exposure pathway for arsenic in soil is direct contact with contaminated soils by on-site workers. Paving has prevented this pathway and minimized the soil-to-groundwater leaching pathway. Based on the current and reasonably anticipated future use of shallow and deep groundwater, no groundwater receptors were identified. Residential use of the Site is not envisioned for the foreseeable future, given the industrial nature of the surrounding properties. Aquatic life in the Puyallup River could be a receptor; however, modeling and water quality monitoring results indicate that groundwater impacts do not reach the river, and the stormwater treatment system installed at the Property in September 2002 significantly reduces the potential adverse impacts to surface water from the Site.

The following remedial action objectives are intended to address the significant potential exposure pathways:

- Prevent or minimize direct contact with or ingestion of arsenic-contaminated soil by humans and ecological receptors.
- Prevent or minimize ingestion of contaminated groundwater by humans and ecological receptors.
- Ensure that contaminated groundwater is not migrating beyond the CPOC.

5.2 CLEANUP ACTION ALTERNATIVES

Several substantive interim actions have already been completed at the Site. Therefore, a limited FS for the Site was conducted, taking into account additional remedial actions that may be necessary to protect human health and the environment by eliminating, reducing, or otherwise controlling risks posed by the environmental conditions at the Site. Cleanup alternatives were scored and ranked using relevant criteria as described in WAC 173-340-360. Each of the considered alternatives includes a combination of one or more of the following remedial actions:

- Asphalt paving as method of capping in place
- Employment of technologies to eliminate runoff
- Monitored natural attenuation
- In situ groundwater treatment
- Operation of a horizontal recovery well
- Groundwater monitoring
- Soil excavation

These remedial action options were combined to develop four alternatives, each intended to address all contaminated media at the Site.

5.2.1 Alternative 1: Completed Interim Actions and Compliance Monitoring

Alternative 1 includes the completed interim actions (detailed in Section 8.1 of the RI/FS [MFA and AECOM, 2014]), long-term operation and maintenance, and compliance monitoring and sampling. The interim actions completed include:

- **Protective Cap**—Areas of the Property where arsenic concentrations in soil are known to exceed the CUL are referred to in this CAP as the Restricted Areas and are designated on Figure 6. Currently, arsenic-contaminated soil in the Restricted Areas is covered with asphalt pavement, concrete, and buildings or other constructed features (including the drip pad described below), which function as a protective cap (see Figure 6). The protective cap will be maintained in the Restricted Areas as a component of the selected remedy for the Site. The protective cap in the Restricted Areas is equipped with catch basins and piping to collect stormwater and direct it to on-site filtration/treatment systems. The stormwater is discharged under the site-specific NPDES permit.
- **Drip Pad Construction—**Included excavation and disposal of impacted soils, as well as installation of a steel-reinforced-concrete drip pad and underlying leak-detection system, which caps existing soil contamination and will prevent future contamination of soil.
- **Installation and Operation of the Horizontal Recovery Well—**Included the installation of the horizontal recovery well, which limits the migration of impacted shallow groundwater beneath the transfer table pit and the adjacent treatment area. Extracted water is reused in facility operations. The horizontal recovery well reduces the migration of chemically impacted shallow groundwater from the transfer table pit and treating area and reduces the mass of IHSs in shallow groundwater.
- **Transfer Table Pit Upgrade—**Included removal and off-site disposal of 860 tons of impacted soil, construction of a concrete containment slab that caps underlying contaminated soil, and construction of a drainage system emergency shutoff valve to prevent potential releases. These activities removed previous soil contamination and will prevent future contamination of soil.

In addition to the interim actions listed above, Alternative 1 includes monitored natural attenuation and compliance monitoring to address groundwater impacts downgradient of the treating area. Shallow and deep groundwater monitoring indicated that natural degradation processes are reducing IHS concentrations in groundwater downgradient of the treating area. Groundwater monitoring and modeling results also indicate that IHSs are not migrating beyond the downgradient CPOC. Given these findings, monitored natural attenuation will be used to address groundwater impacts downgradient of the treating area, and compliance with CULs at the downgradient CPOC will be assessed through compliance monitoring of sentry wells.

In addition to these completed interim actions and compliance groundwater monitoring, this alternative includes the following institutional and engineered controls: (1) continued maintenance of the protective cap in the area identified on Figure 6 as the Restricted Area; (2) requirements for management of soil excavated in the Restricted Area; (3) prohibition on groundwater use throughout the Site; and (4) the continued operation and maintenance of the horizontal recovery well in the Restricted Area. These institutional controls would be documented in the SMP (Appendix B) and enforced through a restrictive covenant placed on the Property and the existing restrictive covenant on the Port property prohibiting groundwater use.

A comparison of Alternative 1 against applicable MTCA criteria is provided in Table 8.

5.2.2 Alternative 2: Completed Interim Actions, Groundwater Treatment (MRC® and ORC®), and Compliance Monitoring

Alternative 2 includes all the components of Alternative 1, as well as in situ groundwater treatment to immobilize metal contaminants and destroy organic contaminants.

This alternative, which is implementable and protective, includes immobilization of metals in groundwater using Metals Remediation Compound (MRC). MRC's long-term permanence has not yet been proven in the field.

This alternative includes the use of Oxygen Release Compound (ORC) to destroy organic contaminants in situ. ORC is also a permanent solution, as the mechanism is irreversible. Short-term risks associated with implementation of this remedy would be similar to those for MRC implementation and would include operation of a drill rig to deliver the compound to the subsurface.

Neither of these options is required at this time to meet the MTCA requirements for a final remedy.

A comparison of Alternative 2 against applicable MTCA criteria is provided in Table 8.

5.2.3 Alternative 3: Completed Interim Actions, Expansion of Groundwater Recovery System, and Compliance Monitoring

Alternative 3 includes all the components of Alternative 1, as well as expansion of the groundwater recovery system.

Expansion of the groundwater recovery system would increase the area of containment at the Site and further reduce contaminant migration. For cost-estimating purposes, this expansion is assumed to include an additional horizontal recovery well, or two to five pumping wells. The final expansion configuration, if necessary, will be determined based on conditions at the Site.

Current environmental risks at the Site do not warrant additional groundwater extraction, as groundwater impacts are not currently migrating beyond the CPOC and are not likely to migrate in the future, given the relatively flat hydraulic gradient and the ongoing groundwater extraction using the existing horizontal recovery well, and as evidenced by arsenic attenuation modeling. Therefore, expansion of the groundwater recovery system is not required at this time to meet the MTCA requirements for a final remedy.

A comparison of Alternative 3 against applicable MTCA criteria is provided in Table 8.

5.2.4 Alternative 4: Completed Interim Actions, Additional Soil Excavation, and Compliance Monitoring

Alternative 4 includes all the components of Alternative 1, as well as additional soil excavation.

This alternative includes additional excavation of impacted soils above the water table, including confirmation sampling of the excavation sidewalls to ensure compliance with CULs, followed by off-site disposal of the excavated material at a Subtitle C landfill. Excavated soil would be stockpiled or otherwise contained on site before disposal, and the excavation would be backfilled with clean fill.

This excavation alternative could be implemented at the Site and would achieve CULs in accessible soil, but:

- Additional excavation would not eliminate the need for maintenance of the existing cap.
- Additional excavation is not easily implementable—facility operations would be greatly disrupted, and the excavation work likely would require temporary closure of the facility.
- Additional excavation would not remove all impacted soil, as existing facility structures (e.g., retorts) preclude complete removal.
- Short-term risks of additional excavation would be significantly higher.
- The costs associated with this alternative are not warranted, given that this alternative would not provide a significant decrease in risk associated with on-site soils.

Additional soil removal would result in a permanent decrease in contaminant mass at the Site, but would not necessarily result in an overall decrease in risk at the Site, since the existing cap already prevents direct contact with impacted soils. Therefore, additional excavation is not warranted at this time. This remedy would be implemented only if the current containment remedy provides insufficient protection to human health and the environment, and the facility operations ceased such that excavation would be feasible without interfering with ongoing operations. As discussed in Section 8.1.1 of the RI/FS, the existing cap meets MTCA's requirements for a final remedy, given the current Site use and operations (MFA and AECOM, 2014).

A comparison of Alternative 4 against applicable MTCA criteria is provided in Table 8.

5.3 Regulatory Requirements

The MTCA Cleanup Regulation sets forth the minimum requirements and procedures for selecting a cleanup action. A cleanup action must meet each of the minimum requirements specified in WAC 173-340-360(2), including certain threshold and other requirements. This section outlines these cleanup action requirements and procedures as set forth in the regulation. Section 5.4 provides an evaluation of the cleanup alternatives with respect to these criteria.

5.3.1 Threshold Requirements

WAC 173-340-360(2)(a) requires that the cleanup action:

- Protect human health and the environment.
- Comply with cleanup standards.
- Comply with applicable state and federal laws.
- Provide for compliance monitoring.

5.3.2 Other Requirements

In addition, WAC 173-340-360(2)(b) states that the cleanup action shall:

- Use permanent solutions to the maximum extent practicable.
- Provide for a reasonable restoration time frame.
- Consider public concerns.

WAC 173-340-360(3) describes the specific requirements and procedures for determining whether a cleanup action uses permanent solutions to the maximum extent practicable. A permanent solution is defined as one where CULs can be met without further action being required at the Site other than the disposal of residue from the treatment of hazardous substances. To determine whether a cleanup action provides permanent solutions to the maximum extent practicable, a disproportionate-cost analysis is conducted. This analysis compares the costs and benefits of the cleanup action alternatives and involves the consideration of several factors, including:

- Protectiveness
- Permanent reduction of toxicity, mobility, and volume
- Cost
- Long-term effectiveness
- Short-term risk

- Implementability
- Consideration of public concerns

The comparison of benefits and costs may be quantitative, but will often be qualitative and require the use of best professional judgment.

WAC 173-340-360(4) describes the specific requirements and procedures for determining whether a cleanup action provides for a reasonable restoration time frame.

5.3.3 Groundwater Cleanup Action Requirements

For sites with contaminated groundwater, WAC 173-340-360(2)(c) requires that the cleanup action meet certain additional requirements. Permanent cleanup actions shall be taken when possible, and if a nonpermanent action must be conducted, the regulation requires that the following two requirements be met:

1) Treatment or removal of the source of the release shall be conducted for liquid wastes, areas of high contamination, areas of highly mobile contaminants, or substances that cannot be reliably contained.
2) Groundwater containment (such as barriers) or control (such as pumping) shall be implemented to the maximum extent practicable.

5.3.4 Cleanup Action Expectations

WAC 173-340-370 sets forth the following expectations for the development of cleanup action alternatives and the selection of cleanup actions. These expectations represent the types of cleanup actions Ecology considers likely results of the remedy selection process; however, Ecology recognizes that there may be some sites where cleanup actions conforming to these expectations are not appropriate.

- Treatment technologies will be emphasized at sites with liquid wastes and areas with high concentrations of hazardous substances or with highly mobile and/or highly treatable contaminants.
- Hazardous substances will be destroyed, detoxified, and/or removed to concentrations below CULs throughout sites with small volumes of hazardous substances to minimize the need for long-term management of contaminated materials.
- Engineering controls, such as containment, may be required at sites with large volumes of materials with relatively low levels of hazardous substances and where treatment is impracticable.
- Active measures will be taken to prevent precipitation and runoff from coming into contact with contaminated soil or waste materials to minimize the potential for migration of hazardous substances.

- Hazardous substances will be consolidated to the maximum extent practicable where it is necessary to minimize the potential for direct contact with and migration of hazardous substances when they remain on site at concentrations that exceed CULs.
- For sites adjacent to surface water, active measures will be taken to prevent/minimize releases to that water; dilution will not be the sole method for demonstrating compliance.
- Natural attenuation of hazardous substances may be appropriate at sites where (1) source control is conducted to the maximum extent practicable, (2) leaving contaminants on site does not pose an unacceptable risk, (3) there is evidence that natural degradation is occurring and will continue to occur, and (4) appropriate monitoring is taking place.
- Cleanup actions will not result in a significantly greater overall threat to human health and the environment than with other alternatives.

5.3.5 APPLICABLE LOCAL, STATE, AND FEDERAL LAWS

WAC 173-340-710(1) requires that all cleanup actions comply with all applicable state and federal law. It further states that the term "applicable state and federal laws" shall include legally applicable requirements and those requirements that the department determines "…are relevant and appropriate requirements." This section discusses applicable state and federal law, relevant and appropriate requirements, and local permitting requirements that were of primary importance in selecting cleanup requirements. If other requirements are identified at a later date, they will be applied to the cleanup actions at that time.

MTCA provides an exemption from the procedural requirements of several state laws and from any laws authorizing local government permits or approvals for remedial actions conducted under a consent decree, EO, or AO (Revised Code of Washington [RCW] 70.105D.090). However, the substantive requirements of a required permit must be met. The procedural requirements of the following state laws, as they relate to cleanup actions, may be exempted:

- Ch. 70.94 RCW, Washington Clean Air Act and Puget Sound Clean Air Agency Regulations
- Ch. 70.95 RCW, Solid Waste Management, Reduction, and Recycling
- Ch. 70.105 RCW, Hazardous Waste Management
- Ch. 75.20 RCW, Construction Projects in State Waters
- Ch. 90.48 RCW, Water Pollution Control
- Ch. 90.58 RCW, Shoreline Management Act of 1971

WAC 173-340-710(4) sets forth the criteria that Ecology evaluates when determining whether certain requirements are relevant and appropriate for a cleanup action. Table 9 lists the state and federal laws that contain ARARs that apply to the cleanup action at the Site. Local laws, which may be more stringent than specified state and federal laws, may also apply.

5.4 EVALUATION OF CLEANUP ACTION ALTERNATIVES

The requirements and criteria outlined in Section 5.3 are used to conduct a comparative evaluation of Alternatives 1 through 4 and to select a cleanup action from those alternatives. Table 8 provides a summary of the ranking of the alternatives against the various criteria.

5.4.1 THRESHOLD REQUIREMENTS

5.4.1.1 Protection of Human Health and the Environment and Compliance with Cleanup Standards

Protectiveness is a factor by which human health and the environment are protected by the cleanup action, including the degree to which existing risks are reduced; time required to reduce risk at the Site and attain cleanup standards; on-site and off-site risks resulting from implementing the cleanup action alternative; and improvement of the overall environmental quality. Alternatives 1 through 4 reduce or eliminate risk from contaminated soil and groundwater through capping, soil removal, containment, and institutional controls. These remedial actions eliminate exposure pathways, protect human health and the environment, and comply with cleanup standards.

5.4.1.2 Compliance with State and Federal Laws

The selected CULs are consistent with MTCA. Additionally, local, state, and federal laws related to environmental protection, health and safety, transportation, and disposal apply to each proposed alternative. All four alternatives would be performed in compliance with the applicable state and federal laws listed in Table 9. During remedial design, the selected alternative will be designed to comply with ARARs.

5.4.1.3 Provision for Compliance Monitoring

There are three types of compliance monitoring: protection, performance, and confirmational. Protection monitoring is designed to protect human health and the environment during the construction and operation and maintenance phases of the cleanup action. Performance monitoring confirms that the cleanup action has met cleanup and/or performance standards. Confirmational monitoring confirms the long-term effectiveness of the cleanup action once cleanup standards have been met or other performance standards have been attained. All four alternatives require all three types of compliance monitoring and therefore will meet this provision.

5.4.2 OTHER REQUIREMENTS

5.4.2.1 Use of Permanent Solutions to the Maximum Extent Practicable

As discussed previously, to determine whether a cleanup action uses permanent solutions to the maximum extent practicable, the disproportionate-cost analysis specified in the regulation is used. The analysis compares the costs and benefits of the cleanup action alternatives and involves the consideration of several factors. The comparison of costs and benefits may be quantitative, but will often be qualitative and require the use of best professional judgment.

Costs are disproportionate to the benefits if the incremental costs of an alternative are disproportionate to the incremental benefits of that alternative. As noted above, Alternative 1 includes the completed interim actions that satisfy the threshold requirements of WAC 173-340-360(2)(a), in that they are protective of human health and the environment, comply with CULs and applicable state and federal laws, and provide for compliance monitoring. Alternative 1, which has the lowest cost and least short-term risk, is the preferred remedy for the Site.

- Protectiveness

  Protectiveness measures the degree to which existing risks are reduced, the time required to reduce risk and attain cleanup standards, on- and off-site risks resulting from implementing the alternative, and improvement of overall environmental quality. Alternatives 1 through 4 would all be protective. All alternatives comply with applicable federal and state cleanup standards through the use of containment, capping, permanent removal, and institutional controls.

  All alternatives prevent human and ecological exposure to soil exceeding CULs through removal from the Site or capping in place. Alternatives 2 and 3 would permanently remove impacts from groundwater, and therefore receive the highest ranking for overall protectiveness. Alternatives 1 and 4 rely on completed interim actions (i.e., soil removal and the horizontal recovery well), monitored natural attenuation, and compliance monitoring to address groundwater impacts, and therefore receive a moderate ranking for overall protectiveness.

- Permanent Reduction of Toxicity, Mobility, and Volume

  Permanence is a factor by which the cleanup action alternative permanently reduces the toxicity, mobility, and/or volume of hazardous substances. It takes into account the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous-substance releases and sources of releases, the degree of irreversibility of the waste-treatment process, and the characteristics and quantity of treatment residuals generated. Removal of soils is a permanent remedial action because it permanently eliminates the source of releases at the Site.

  All alternatives receive an equivalent permanence ranking for groundwater, since groundwater impacts are permanently removed by natural degradation, treatment, or recovery. Alternatives 1 through 3 receive equivalent permanence rankings for soil, since these alternatives include the permanent removal of soil by excavation from focused areas. Alternative 4 includes a greater volume of soil removal than Alternatives 1 through 3 and receives a slightly higher permanence ranking for soil. In summary, the permanence ranking for groundwater is the same for all alternatives and the permanence ranking for soil is slightly higher for Alternative 4. Therefore, Alternatives 1 through 3 receive a moderate ranking and Alternative 4 receives a high ranking.

- Cleanup Costs

  Costs are approximated based on specific design assumptions for each alternative. Although the costs provided by consultants are estimates based on design assumptions that might change, the relative costs can be used for this evaluation.

  The estimated cost for Alternative 1 ($8,773,000) includes anticipated costs for long-term operation and maintenance and compliance monitoring and sampling. Alternatives 2, 3, and 4 include the anticipated costs from Alternative 1 with additional costs accrued from further actions. Alternative 2 ($9,814,000) includes an additional anticipated cost for in situ groundwater treatment. Alternative 3 ($10,333,000) includes an additional anticipated cost for the expansion of the groundwater recovery system. Alternative 4 ($14,968,000) includes an additional anticipated cost for further soil excavation on the Site and off-site disposal.

- Long-Term Effectiveness

  Long-term effectiveness includes the degree of certainty that the alternative will be successful; the reliability of the alternative for the expected duration of hazardous substances remaining on site at concentrations that exceed CULs; the magnitude of residual risk with the alternative in place; and the effectiveness of controls required to manage treatment residues or remaining wastes.

  Alternatives that include removal of greater volumes of contaminated soils would have greater long-term effectiveness because they would immediately be successful in achieving CULs and would represent lower residual risk. Soil actions that remove less of the contaminated soil would have reduced long-term effectiveness. Groundwater actions will have lower long-term effectiveness if they leave contaminants in groundwater for a longer time (requiring management) or leave behind residual risk after implementation. Alternatives 2 and 4 receive a high ranking for long-term effectiveness, while Alternatives 1 and 3 receive a moderate ranking for long-term effectiveness.

- Short-Term Risk

  Short-term risks to remediation workers, the public, and the environment are assessed under this criterion. Generally, short-term risks are expected to be linearly related to the amount of material handled, treated, and/or transported and disposed of (e.g., worker injury per cubic yard excavated [equipment failure], public exposure per cubic yard-mile transported [highway accident]).

  This factor addresses the risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks. Potential exposure via transport, handling, and excavation required each of the alternatives could lead to short-term risks. Alternative 1 requires the least amount of construction and implementation work and has the lowest potential risk to human health or the environment and is therefore ranked highest. Alternative 4 receives a moderate ranking and Alternatives 2 and 3 receive a low ranking for short-term risk management.

- Implementability

  Implementability considers: whether the alternative is technically possible; the availability of necessary off-site facilities, services, and materials; administrative and regulatory requirements; scheduling; size; complexity; monitoring requirements; access for operations and monitoring; and integration with existing facility operations. All of the alternatives include actions that are well-proven and that have been employed at many sites throughout the United States. Alternative 1 ranks highest for implementability, given the interim actions that have already been completed.

- Consider Public Concerns

  This factor includes considering concerns from individuals; community groups; and local governments, tribes, federal and state agencies, and any other organization that may have an interest in or knowledge of the Site. Each alternative provides opportunity for members of the public to review and comment on plans.

5.4.2.2 Provide a Reasonable Restoration Time Frame

WAC 173-340-360(4) describes the specific requirements and procedures for determining whether a cleanup action provides for a reasonable restoration time frame, as required under Subsection (2)(b)(ii). The factors that are used to determine whether a cleanup action provides a reasonable restoration time frame are set forth in WAC 173-340-360(4)(b) and include:

- Potential risks posed by the site to human health and the environment;
- Practicability of achieving a shorter restoration time frame;
- Current site use and nearby resources that are or may be affected by the site;
- Potential future use of the site and of nearby resources that are or may be affected by the site;
- Availability of alternative water supplies;
- Likely effectiveness and reliability of institutional controls;
- Ability to control and monitor migration of hazardous substances;
- Toxicity of hazardous substances; and
- Natural, documented processes that reduce contaminant concentrations.

Alternatives that rely on removal of soil containing contaminants exceeding CULs provide the shortest restoration time frame, greatest flexibility for current and future site use, and greatest reduction in risk; and relieve reliance on institutional controls. Alternatives that only cap impacted soil on site rely on institutional controls, have residual risk, and increase the restoration time frame by leaving in place a potential source of contamination.

All alternatives rely on soil removal, groundwater recovery, and natural degradation of groundwater impacts to achieve CULs, and include institutional controls. Alternative 1 allows remediation to be conducted with minimal disturbance to business operations, and would allow a restoration time frame of less than five years, if historical trends continue. Alternative 2 requires additional groundwater treatment and would not significantly reduce the restoration time frame of Alternative 1. Alternative 3 requires additional groundwater recovery and may reduce the restoration time frame of Alternative 1 by a year. Alternative 4 would greatly disrupt facility operations and is not expected to significantly reduce the restoration time frame. In summary, Alternative 3 is ranked highest for restoration time frame, with equal rankings among Alternatives 1, 2 and 4.

5.4.3 Groundwater Cleanup Action Requirements

Cleanup actions that address groundwater must meet the specific requirements described in Section 5.3.3 in addition to those listed above (see also WAC 173-340-360[2][c]). Each alternative meets the threshold requirements under WAC 173-340-360(2)(a). All alternatives meet the requirements through natural attenuation, which is a form of treatment, and monitoring will provide evidence that treatment is occurring under natural processes.

5.4.4 Cleanup Action Expectations

Specific cleanup action expectations are outlined in WAC 173-340-370 and are described in Section 5.3.4. Alternatives 1 through 4 address these expectations as follows:

- Alternatives 1 through 4 include removal and capping of contaminated soils (these have been completed as interim actions at the Site), monitored natural attenuation, and groundwater monitoring. Natural attenuation is an effective groundwater treatment because leaving contaminants on site will not pose an unacceptable risk, degradation at the Site has been demonstrated, and regular monitoring will be conducted. The soil removal and capping effectively removed or reduced the overall threat to human health and the environment. Previous groundwater monitoring and modeling indicate that IHS concentrations in groundwater attenuate to undetectable levels before reaching the CPOC and will not reach the Puyallup River, and sentry wells will provide early warning of changes in IHS concentrations downgradient of the treating area. These actions meet the following cleanup expectations:
  - Treatment technologies will be emphasized at sites with liquid wastes and areas with high concentrations of hazardous substances or with highly mobile and/or highly treatable contaminants.
  - To minimize the potential for migration of hazardous substances, active measures will be taken to prevent precipitation and runoff from coming into contact with contaminated soil or waste materials.

- Natural attenuation of hazardous substances may be appropriate at sites where (1) source control is conducted to the maximum extent practicable, (2) leaving contaminants on site does not pose an unacceptable risk, (3) there is evidence that natural degradation is occurring and will continue to occur, and (4) appropriate monitoring is taking place.
- Cleanup actions will not result in a significantly greater overall threat to human health and the environment than other alternatives.
- Engineering controls, such as containment, will be used at sites with large volumes of materials with relatively low levels of hazardous substances and where treatment is impracticable.
- For sites adjacent to surface water, active measures will be taken to prevent/minimize releases to that water; dilution will not be the sole method for demonstrating compliance.
- When hazardous substances remain on site at concentrations that exceed CULs, they will be consolidated to the maximum extent practicable where it is necessary to minimize the potential for direct contact with and migration of hazardous substances.

The following cleanup expectations are not applicable to the Site:

- To minimize the need for long-term management of contaminated materials, hazardous substances will be destroyed, detoxified, and/or removed to concentrations below CULs throughout sites with small volumes of hazardous substances.

5.5 DECISION

Based on the analysis described above, Alternative 1 is the selected remedial action for the Site. Alternative 1 meets each of the minimum requirements for remedial actions and has the lowest cost and a reasonable restoration time frame. As noted above, Alternative 1 includes the completed interim actions, which satisfy the threshold requirements of WAC 173-340-360(2)(a) in that they are protective of human health and the environment, comply with CULs and applicable state and federal laws, and provide for compliance monitoring. The other alternatives also satisfy the threshold requirement, but have only slightly shorter restoration time frames and much higher costs. Table 8 provides a summary of the relative ranking of each alternative in the decision process.

6.0 SELECTED REMEDIAL ACTION

In order to meet CULs for arsenic in the soil, the proposed cleanup action for the contaminated soil on the Site incorporates the interim actions performed to date, as well as ongoing maintenance of the protective cap in the Restricted Area. The containment remedy includes catch basins and piping that were installed to collect stormwater from the protective cap in the

Restricted Area, limiting stormwater contact with impacted soils prior to treatment of the stormwater, and to discharge stormwater from the facility under a site-specific NPDES permit.

This remedy includes a formal SMP (see Appendix B) to address issues related to utility and other subsurface work performed in the Restricted Area, as well as maintenance and repair requirements. The SMP includes the ongoing operation and maintenance of the horizontal recovery well and its associated recovery sump and pump that were installed as an interim action.

This remedy addresses groundwater contamination through groundwater recovery and monitored natural attenuation and includes a compliance monitoring program that relies on sentry wells, remediation levels (RELs) for use at sentry wells and other compliance monitoring network wells, and contingency measures to be implemented should IHS concentrations in sentry wells increase or exceed applicable RELs (see CMP provided in Appendix A). Existing Site wells will be used as sentry wells for the compliance monitoring. RELs were developed using attenuation modeling and have been established for each compliance monitoring well and for potential future compliance monitoring wells, based on distance from the CPOC (see CMP provided in Appendix A). Compliance with RELs will ensure that CULs are not exceeded at the downgradient CPOC, and monitoring of sentry wells will provide early warning of contaminant migration toward the downgradient CPOC. Water-level monitoring will be performed to verify that impacts on the upgradient Property boundary are contained by the natural hydraulic gradient and the horizontal recovery well. Compliance monitoring will continue until it is demonstrated that CULs have been attained in groundwater throughout the Site.

Compliance monitoring will be conducted, as established in the CMP (see Appendix A). Monitoring and institutional controls are required for groundwater until the Site meets MTCA requirements for demonstrating that remediation is complete. The criteria for demonstrating that the groundwater remedy is complete are included in the CMP (see Appendix A).

Institutional controls and ongoing maintenance of the protective cap will be required in perpetuity in order to maintain compliance with CULs in soil.

6.1 GROUNDWATER MONITORING

Groundwater monitoring is required to determine the effectiveness of natural attenuation, and will include the periodic sampling of wells for the groundwater IHSs in accordance with the CMP (see Appendix A). The goals of the groundwater monitoring, as discussed in the CMP, are to:

- Measure the effectiveness of the cleanup during and after operation of the horizontal recovery well.
- Provide criteria for cessation of groundwater extraction from the horizontal recovery well and its eventual decommissioning, decommissioning of monitoring wells, and evaluation of compliance.
- Identify contingencies for additional actions and provide criteria for the conditions that would trigger a contingent action.

- Demonstrate the eventual achievement of CULs and the criteria for cessation of monitoring.

6.2 Institutional Controls

Institutional controls are measures taken to limit or prohibit activities that may interfere with the integrity of a cleanup action or result in exposure to hazardous substances at a site. Such measures are required to ensure both the continued protection of human health and the environment and the integrity of the cleanup action whenever hazardous substances remain at a site at concentrations exceeding applicable CULs. Institutional controls can include both physical measures and legal and administrative mechanisms. WAC 173-340-440 provides information on institutional controls and the conditions under which they may be removed.

Current zoning and City of Tacoma codes restrict Site use. The Property and the Port property are currently zoned Port Maritime and Industrial. City code requires all houses, buildings, and properties used for human occupancy to use public water. In addition, the Puyallup River from the mouth to river mile 1 is not designated as a drinking-water source, as documented in WAC 173-201A. Deed restrictions are required in order to maintain institutional controls for soil in the Restricted Area and for groundwater throughout the Site.

The paving and the drip pad installation interim actions, which are part of the protective cap, and the horizontal recovery well in the Restricted Area require regular maintenance and monitoring. An SMP (see Appendix B) has been developed to provide for long-term maintenance of the protective cap, operation and maintenance of the horizontal recovery well, and management of any soil that is excavated or otherwise exposed in the Restricted Area.

A restrictive covenant will be recorded for the Property in the real property records for Pierce County to require the property owner to implement and comply with the SMP. A standard form of restrictive covenant text is included as an exhibit to the Site Consent Decree. A restrictive covenant has already been recorded for the Port property in conjunction with the UPRR Site cleanup, and it prohibits groundwater use on the Port property portion of the Site.

6.3 Financial Assurances

WAC 173-340-440 requires financial assurance mechanisms at sites where the selected cleanup action includes engineered and/or institutional controls. Financial assurances are required at the Site because engineered controls in the form of a protective cap and the horizontal recovery well in the Restricted Area are used to manage contaminated soil and groundwater at the Site.

6.4 Periodic Review

WAC 173-340-420 states that as long as groundwater CULs have not been achieved at sites where a cleanup action requires an institutional control or financial assurance, a periodic review shall be completed no less frequently than every five years after the initiation of a cleanup action. Additionally, periodic reviews are required at sites that rely on institutional controls as part of the cleanup action. Periodic reviews will be required at this Site, even after groundwater and soil CULs have been achieved, because institutional controls are a part of the remedy.

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TABLES

Table 1
Summary of Previous Investigations and Interim Actions
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Date	Report Title	Data Collected
Dec-90	Sampling Plan for a Site Investigation	Summary of soil quality data collected by Ecology and USEPA
Jun-91	Interim Report	• Shallow soil samples in the treated lumber storage area (paving area 2) • Shallow soil samples in the transfer table area • Well installation and soil sampling in the three areas of concern (MW-1 to MW-11) • First of four groundwater sampling rounds (March 1991) • Water level monitoring and assessing tidal effects on the upper aquifer (February 1991)
Apr-92	Final Investigation Report	• Groundwater sampling (July and October 1991, January 1992) • Monthly gauging
Oct-92	Draft Interim Action Work Plan for the Proposed Paving, Drip Pad and Transfer Table Areas	Results of soil sampling in treated-pole storage area (June 1991; paving area 1)
Feb-93	Interim Action Sampling Plan	
May-93	Interim Action Report	Results of soil sampling in paving areas 1, 2, and 3 (February 1993), and CCA and PCP drip pad areas (March 1993)
Aug-94	Draft Interim Action Plan for the Transfer Table Soils	
Nov-94	Final Work Plan for the RI/FS	
Nov-95	Groundwater Interim Action Design Report	Slug test results (June 1995)—six rising head tests
Jan-97	Progress Report	Installed and sampled three monitoring wells (MW-12 to MW-14; December 1996)
Oct-98	Transfer Table Area Plan Interim Action Activities and Drip Pad Conversion	
May-99	Groundwater Interim Action Implementation Report	Results of groundwater sampling (January 1999)
Jul-00	Transfer Table Pit Upgrade Completion Report	Results of soil sample collected near butt vat (October 1999)

NOTES:

CCA = copper-chromated arsenic.

Ecology = Washington State Department of Ecology.

PCP = pentachlorophenol.

RI/FS = remedial investigation and feasibility study.

USEPA = U.S. Environmental Protection Agency.

Table 2
Soil Cleanup Levels
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Detected Constituents	Soil Criteria (mg/kg)			Natural Background[1] (mg/kg)	CUL (mg/kg)	CUL Basis
	MTCA A, Industrial	MTCA C				
		CAR	NCAR			
4-chloro-3-methylphenol	NA	NA	NA	NV	NV	NV
acenaphthene	NV	NV	**210000**	NV	210000	MTCA C, NCAR
acenaphthylene	NV	NV	NV	NV	NV	NV
anthracene	NV	NV	**1100000**	NV	1100000	MTCA C, NCAR
arsenic, inorganic	20	**88**	1100	7	88	MTCA C, CAR
benzo(g,h,i)perylene	NV	NV	NV	NV	NV	NV
benzo(a)anthracene	NV	**180**	NV	NV	180	MTCA C, CAR
benzo(a)pyrene	2	**18**	NV	NV	18	MTCA C, CAR
benzo(b)fluoranthene	NV	**180**	NV	NV	180	MTCA C, CAR
benzo(k)fluoranthene	NV	**180**	NV	NV	1800	MTCA C, CAR
benzoic acid	NV	NV	**14000000**	NV	14000000	MTCA C, NCAR
chromium (total)	NV	NV	NV	**48**	48	Natural Background
CrIII	2000	NV	**5300000**	NV	5300000	MTCA C, NCAR
CrVI	19	NV	**11000**	NV	11000	MTCA C, NCAR
chrysene	NV	**1800**	NV	NV	18000	MTCA C, CAR
copper	NV	NV	**140000**	36	140000	MTCA C, NCAR
cresol;o-	NV	NV	**180000**	NV	180000	MTCA C, NCAR
cresol;p-	NV	NV	**18000**	NV	18000	MTCA C, NCAR
dibenzo(a,h)anthracene	NV	**180**	NV	NV	18	MTCA C, CAR
dibenzofuran	NV	NV	**3500**	NV	3500	MTCA C, NCAR
fluoranthene	NV	NV	**140000**	NV	140000	MTCA C, NCAR
fluorene	NV	NV	**140000**	NV	140000	MTCA C, NCAR
indeno(1,2,3-cd)pyrene	NV	**180**	NV	NV	180	MTCA C, CAR
methyl naphthalene;2-	NV	NV	**14000**	NV	14000	MTCA C, NCAR
naphthalene	5	NV	**70000**	NV	70000	MTCA C, NCAR
pentachlorophenol	NV	**330**	18000	NV	330	MTCA C, CAR
phenanthrene	NV	NV	NV	NV	NV	NV
pyrene	NV	NV	**110000**	NV	110000	MTCA C, NCAR
zinc	NV	NV	**1100000**	85	1100000	MTCA C, NCAR

NOTES:

Bold and highlighted cells represent the criterion selected as the CUL.

CAR = carcinogen.

CrIII = trivalent chromium.

CrVI = hexavalent chromium.

CUL = cleanup level.

mg/kg = milligrams per kilogram.

MTCA A = Model Toxics Control Act, Method A table values.

MTCA C = Model Toxics Control Act, Method C standard values.

NA = not available.

NCAR = noncarcinogen.

NV = no value.

[1]Based on the Puget Sound natural background concentration obtained from Washington State Department of Ecology, 1994.

Table 3
Soil Indicator Hazardous Substances
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Detected Constituents	MDC (mg/kg)*	MDC Location*	MDC Depth (feet bgs)*	MDC Date*	CUL (mg/kg)	CUL Basis	MDC > CUL	Select as an IHS?**	Rationale for IHS Selection
4-chloro-3-methylphenol	3.4	S-6-2 (MW-6)	1.5-2.0	01/25/1991	NV	NV	NA	NO	no CUL available
acenaphthene	7.4	S-6-2 (MW-6)	1.5-2.0	01/25/1991	210000	MTCA C, NCAR	NO	NO	MDC < CUL
acenaphthylene	2.9	S-6-4.5 (MW-6)	4.0-4.5	01/25/1991	NV	NV	NA	NO	no CUL available
anthracene	3.9	S-6-2 (MW-6)	1.5-2.0	01/25/1991	1100000	MTCA C, NCAR	NO	NO	MDC < CUL
arsenic, inorganic	340	PV-2-2	0-2	02/22/1993	88	MTCA C, CAR	YES	YES	MDC > CUL
benzo(g,h,i)perylene	2	S-6-4.5 (MW-6)	4.0-4.5	01/25/1991	NV	NV	NA	NO	no CUL available
benzo(a)anthracene	NA	S-6-4.5 (MW-6)	4.0-4.5	01/25/1991	180	MTCA C, CAR	NA	NO	assessed as cPAH TEQ
benz(b)fluoranthene	NA	067	0-0.5	06/24/1991	180	MTCA C, CAR	NA	NO	assessed as cPAH TEQ
benzo(k)fluoranthene	NA	S-6-4.5 (MW-6)	4.0-4.5	01/25/1991	1800	MTCA C, CAR	NA	NO	assessed as cPAH TEQ
benzoic acid	0.33	PV3-1	0-2.0	02/23/1991	14000000	MTCA C, NCAR	NO	NO	MDC < CUL
CrIII	750	C3-3	3.0-3.5	03/09/1993	5300000	MTCA C, NCAR	NO	NO	MDC < CUL
CrVI	60	C1-3	3.0-3.5	03/10/1993	11000	MTCA C, NCAR	NO	NO	MDC < CUL
chrysene	NA	S-6-4.5 (MW-6)	4.0-4.5	01/25/1991	18000	MTCA C, CAR	NA	NO	assessed as cPAH TEQ
copper	5400	S-4-3	2.5-3.0	01/23/1991	140000	MTCA C, NCAR	NO	NO	MDC < CUL
cPAH TEQ (benzo[a]pyrene)	6.3	(multiple locations)	NA	NA	18	MTCA C, CAR	NO	NO	MDC < CUL
cresol;o-	0.061	S-7-5 (MW-7)	5	03/20/1991	180000	MTCA C, NCAR	NO	NO	MDC < CUL
cresol;p-	0.097	P15-3	3.0-3.5	03/03/1993	18000	MTCA C, NCAR	NO	NO	MDC < CUL
dibenzo(a,h)anthracene	NA	S-11-2.5 (MW-11)	2.5	03/18/1991	18	MTCA C, CAR	NA	NO	assessed as cPAH TEQ
dibenzofuran	4.2	S-6-2 (MW-6)	1.5-2.0	01/25/1991	3500	MTCA C, NCAR	NO	NO	MDC < CUL
fluoranthene	9.4	S-6-2 (MW-6)	1.5-2.0	01/25/1991	140000	MTCA C, NCAR	NO	NO	MDC < CUL
fluorene	5.1	S-6-2 (MW-6)	1.5-2.0	01/25/1991	140000	MTCA C, NCAR	NO	NO	MDC < CUL
indeno(1,2,3-cd)pyrene	NA	S-6-2 (MW-6)	1.5-2.0	01/25/1991	180	MTCA C, CAR	NA	NO	assessed as cPAH TEQ
methyl naphthalene;2-	5.4	P20-3	3	03/04/1993	14000	MTCA C, NCAR	NO	NO	MDC < CUL
naphthalene	5	S-9-5 (MW-9)	5	03/20/1991	70000	MTCA C, NCAR	NO	NO	MDC < CUL
pentachlorophenol	110	067	0-0.5	06/24/1991	330	MTCA C, CAR	NO	NO	MDC < CUL
phenanthrene	12	S-6-2 (MW-6)	1.5-2.0	01/25/1991	NV	NV	NA	NO	no CUL available
pyrene	10	S-6-4.5 (MW-6)	4.0-4.5	01/25/1991	110000	MTCA C, NCAR	NO	NO	MDC < CUL

Table 3
Soil Indicator Hazardous Substances
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Detected Constituents	MDC (mg/kg)*	MDC Location*	MDC Depth (feet bgs)*	MDC Date*	CUL (mg/kg)	CUL Basis	MDC > CUL	Select as an IHS?**	Rationale for IHS Selection
zinc	590	PV3-1	0-2.0	02/23/1991	1100000	MTCA C, NCAR	NO	NO	MDC < CUL

NOTES:

Highlighted row indicates that constituent was selected as an IHS.

bgs = below ground surface.

CAR = carcinogen.

cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.

CrIII = trivalent chromium.

CrVI = hexavalent chromium.

CUL = cleanup level.

IHS = indicator hazardous substance.

MDC = maximum detected concentration.

mg/kg = milligrams per kilogram.

MTCA C = Model Toxics Control Act, Method C standard values.

NA = not applicable.

NCAR = noncarcinogen.

NV = no value.

*Obtained from Table 1 from the cumulative risk assessment memorandum included in Appendix B of the July 15, 2013 draft remedial investigation and feasibility study prepared by AECOM. The MDC is based on the cPAH TEQ; therefore, concentrations for individual cPAHs are not applicable. Phenol and 2,4-dimethylphenol were listed in Table 1 of the memorandum but are not included in this CUL assessment because they were not detected at the site.

**Constituents with no screening levels were not selected as IHSs.

Table 4
Groundwater Cleanup Levels
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

	Surface Water ARARs										
Detected Constituents	**Marine—Clean Water Act §304 (µg/L)**	**Marine—National Toxics Rule §131 (µg/L)**	**Minimum ARAR Cancer Risk**	**Minimum ARAR Hazard Quotient**	**Is the ARAR sufficiently protective?**	**Adjusted ARAR (µg/L)**	**MTCA B, Surface Water (µg/L)**	**MTCA A, Groundwater (µg/L)**	**PQL (µg/L)**	**CUL (µg/L)**	**CUL Basis**
arsenic, inorganic	0.14	0.14	1.4E-06	0.0078	YES	--	0.098	**5**	1	5	MTCA A as natural background
benzene	**51**	71	2.2E-06	0.026	YES	--	23	5	1	51	SW, ARAR
benzo(a)pyrene	0.018	0.031	6.0E-07	--	YES	--	0.03	0.1	**0.1**	0.1	PQL
ethylbenzene	**2100**	29000	--	0.30	YES	--	6900	700	NV	2100	SW, ARAR
methyl naphthalene;1-	NV	NV	--	--	--	--	NV	NV	NV	NV	NV
methyl naphthalene;2-	NV	NV	--	--	--	--	NV	NV	0.012	NV	NV
naphthalene	NV	NV	--	--	--	--	**4900**	160	0.0094	4900	SW, MTCA B NCAR
toluene	**15000**	200000	--	0.79	YES	--	19000	1000	1	15000	SW, ARAR
xylene;m-	NV	NV	--	--	--	--	NV	NV	1	NV	NV
xylene;o-	NV	NV	--	--	--	--	NV	NV	1	NV	NV
xylene;p-	NV	NV	--	--	--	--	NV	NV	1	NV	NV
xylenes	NV	NV	--	--	--	--	NV	**1000**	1	1000	MTCA A
acenaphthene	990	NV	--	1.5	NO	**640**	640	NV	0.0094	640	SW, Adj ARAR (same as MTCA B NCAR)
acenaphthylene	NV	NV	--	--	--	--	NV	NV	0.0094	NV	NV
anthracene	40000	110000	--	1.5	NO	**26000**	26000	NV	0.0094	26000	SW, Adj ARAR (same as MTCA B NCAR)
CrIII	NV	NV	--	--	--	--	**240000**	NV	1	240000	SW, MTCA B NCAR
CrVI	**50**	**50**	--	0.10	YES	--	490	NV	NV	50	SW, ARAR
copper	3.1	**2.4**	--	0.00083	YES	--	2900	NV	0.001	2.4	SW, ARAR
fluoranthene	140	370	--	1.6	NO	**90**	90	NV	0.0094	90	SW, Adj ARAR (same as MTCA B NCAR)
fluorene	5300	14000	--	1.5	NO	**3500**	3500	NV	0.0094	3500	SW, Adj ARAR (same as MTCA B NCAR)
pyrene	4000	11000	--	1.5	NO	**2600**	2600	NV	0.0094	2600	SW, Adj ARAR (same as MTCA B NCAR)
pentachlorophenol	**3**	7.9	2.0E-06	0.0025	YES	--	1.5	NV	0.0094	3	SW, ARAR
beta-chloronaphthalene	1600	NV	--	1.6	NO	**1000**	1000	NV	0.028	1000	SW, Adj ARAR (same as MTCA B NCAR)
phenanthrene	NV	NV	--	--	--	--	NV	NV	0.0094	NV	NV
tph: gasoline-range organics*	NV	NV	--	--	--	--	NV	**800**	500	800	MTCA A
benzo(a)anthracene	**0.018**	0.031	6.0E-08	--	YES	--	0.3	NV	0.0094	0.018	SW, ARAR
benzo(b)fluoranthene	**0.018**	0.031	6.0E-08	--	YES	--	0.3	NV	0.0094	0.018	SW, ARAR
benzo(k)fluoranthene	**0.018**	0.031	6.0E-09	--	YES	--	3	NV	0.0094	0.018	SW, ARAR
chrysene	**0.018**	0.031	6.0E-10	--	YES	--	30	NV	0.0094	0.018	SW, ARAR
dibenzo(a,h)anthracene	**0.018**	0.031	6.0E-07	--	YES	--	0.03	NV	0.0094	0.018	SW, ARAR
indeno(1,2,3-cd)pyrene	**0.018**	0.031	6.0E-08	--	YES	--	0.3	NV	0.0094	0.018	SW, ARAR

NOTES:
Bold and highlighted cells represent the criterion selected as the CUL.
-- = not applicable.
ARAR = Applicable or Relevant and Appropriate Requirements.
CrIII = trivalent chromium.
CrVI = hexavalent chromium.
CUL = cleanup level.
MTCA A = Model Toxics Control Act, Method A table value for groundwater.
MTCA B = Model Toxics Control Act, Method B standard method value for surface water.
µg/L = micrograms per liter.
NV = no value.
PQL = practical quantitation limit.
SW, Adj ARAR = surface water ARAR adjusted downward for risk.
SW, ARAR = surface water ARAR.
SW, MTCA B NCAR = Model Toxics Control Act, Method B, noncarcinogen for surface water.
tph = total petroleum hydrocarbons.
*The gasoline-range organics screening value assumes that benzene is present.

Table 5
Groundwater Indicator Hazardous Substances
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Detected Constituents	MDC* (µg/L)	MDC Location	MDC Date	CUL (µg/L)	CUL Basis	MDC>CUL?	Selected IHS?	Basis for IHS Selection
acenaphthene	312	MW-9	09/08/2004	640	SW, Adj ARAR	NO	NO	MDC < CUL
acenaphthylene	189	MW-9	01/08/2009	NV	NV	NA	NO	no CUL available
anthracene	857	HW-01	02/06/2004	26000	SW, Adj ARAR	NO	NO	MDC < CUL
arsenic, inorganic	12500	MW-13	02/05/2004	5	MTCA A	YES	YES	MDC > CUL
benzene	680	MW-9	01/08/1992	51	SW, ARAR	YES	YES	MDC > CUL
benzo(a)anthracene	NA	NA	NA	0.018	SW, ARAR	NA	NO	assessed as cPAH TEQ
benzo(a)pyrene	223	HW-01	02/06/2004	0.1	PQL	YES	YES	MDC > CUL
benzo(b)fluoranthene	NA	NA	NA	0.018	SW, ARAR	NA	NO	assessed as cPAH TEQ
benzo(k)fluoranthene	NA	NA	NA	0.018	SW, ARAR	NA	NO	assessed as cPAH TEQ
beta-chloronaphthalene	95.2	MW-16	02/02/2007	1000	SW, Adj ARAR	NO	NO	MDC < CUL
CrIII**	1680	MW-3	01/24/2006	240000	SW, MTCA B NCAR	NO	NO	MDC < CUL
CrVI	180000	MW-3	07/11/1991	50	SW, ARAR	YES	YES	MDC > CUL
chrysene	NA	NA	NA	0.018	SW, ARAR	NA	NO	assessed as cPAH TEQ
copper	287	MW-3	02/05/2004	2.4	SW, ARAR	YES	YES	MDC > CUL
dibenzo(a,h)anthracene	NA	NA	NA	0.018	SW, ARAR	NA	NO	assessed as cPAH TEQ
ethylbenzene	8600	MW-9	10/03/1991	2100	SW, ARAR	YES	YES	MDC > CUL
fluoranthene	1460	HW-01	02/06/2004	90	SW, Adj ARAR	YES	NO	MDC > CUL; however, consistently detected below the CUL at all locations except HW-01 (horizontal recovery well). HW-01 had only one exceedance in 2004; concentrations observed during the last 12 sampling events have been below the CUL.
fluorene	365	HW-01	02/06/2004	3500	SW, Adj ARAR	NO	NO	MDC < CUL
indeno(1,2,3-cd)pyrene	NA	NA	NA	0.018	SW, ARAR	NA	NO	assessed as cPAH TEQ
methyl naphthalene;1-	189	MW-9	01/28/2009	NV	NV	NA	NO	no CUL available
methyl naphthalene;2-	189	MW-9	01/28/2009	NV	NV	NA	NO	no CUL available
naphthalene	6480	MW-9	01/27/2005	4900	SW, MTCA B NCAR	YES	NO	MDC > CUL; however, consistently detected below the CUL at all locations except MW-09. The most recent exceedance at MW-09 was observed in 2009. Concentrations observed during the last five sampling events conducted since 2009 have been below the CUL.
pentachlorophenol	1160	HW-01	02/06/2004	3	SW, ARAR	YES	YES	MDC > CUL
phenanthrene	1120	HW-01	02/06/2004	NV	NV	NA	NO	no CUL available
pyrene	970	HW-01	02/06/2004	2600	SW, Adj ARAR	NO	NO	MDC < CUL
toluene	3100	MW-9	01/08/1992	15000	SW, ARAR	NO	NO	MDC < CUL
tph: gasoline-range organics	41000	MW-9	09/08/2004	800	MTCA A	YES	NO	MDC > CUL; however, only limited testing (three samples collected from MW-9) because not considered an environmental driver for the site, per the draft RI/FS. Benzene, ethylbenzene, and xylenes have been retained as IHSs.
xylenes	5900	MW-9	01/08/1992	1000	MTCA A	YES	YES	MDC > CUL

Table 5
Groundwater Indicator Hazardous Substances
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

NOTES:
Highlighted rows indicate constituents selected as IHSs.
Metals concentrations are the maximum of the total and dissolved fractions, when both were analyzed.
Adj ARAR = ARAR adjusted downward to be sufficiently protective.
ARAR = applicable and relevant or appropriate requirements.
BTEX = benzene, toluene, ethylbenzene, and xylenes.
CrIII = trivalent chromium.
CrVI = hexavalent chromium.
cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.
CUL = cleanup level.
IHS = indicator hazardous substance.
MDC = maximum detected concentration.
MTCA A = Model Toxics Control Act, Method A, table value.
MTCA B NCAR = Model Toxics Control Act, Method B, noncarcinogen, standard formula value.
µg/L = micrograms per liter.
NA = not assessed individually; constituent assessed according to the total of the isomer fractions or toxic equivalency.
NV = no value.
PQL = practical quantitation limit.
RI/FS = remedial investigation and feasibility study.
SW = surface water.
tph = total petroleum hydrocarbons.
*Data from 2004 to 2013 were included for most constituents. All data were included for gasoline-range hydrocarbons, CrVI, and BTEX.
**Maximum detected concentration provided is for total chromium. CrIII has not been analyzed in samples from the site.

Table 6
Groundwater Cumulative Risk Assessment
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Indicator Hazardous Substance	CUL (µg/L)	CUL Basis	Risk Basis	Carcinogenic Risk	Hazard Index	Notes
arsenic, inorganic	5	MTCA A as natural background	NA	NA	NA	exclude from cumulative risk calculation; based on natural background
benzene	51	SW, ARAR	CAR / NCAR	2.2E-06	2.6E-02	
benzo(a)pyrene	0.1	PQL	NA	NA	NA	exclude from cumulative risk calculation; based on PQL
CrVI	50	SW, ARAR	NCAR	NA	1.0E-01	
copper	2.4	SW, ARAR	NCAR	NA	8.3E-04	
ethylbenzene	2100	SW, ARAR	NCAR	NA	3.0E-01	
pentachlorophenol	3	SW, ARAR	CAR / NCAR	2.0E-06	2.5E-03	
xylenes	1000	MTCA A	NA	NA	NA	exclude from cumulative risk calculation; no risk-based values available
			Cumulative Site Risk:	4.2E-06	4.4E-01	no adjustment necessary

NOTES:

ARAR = Applicable or Relevant and Appropriate Requirements.

CAR = carcinogen.

CrVI = hexavalent chromium.

CUL = cleanup level.

MTCA A = Model Toxics Control Act, Method A table value for groundwater.

µg/L = micrograms per liter.

NA = not applicable.

NCAR = noncarcinogen.

PQL = practical quantitation limit.

SW, ARAR = surface water ARAR.

Table 7
Final Cleanup Levels
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Indicator Hazardous Substance	Groundwater CUL (µg/L)	Groundwater CUL Basis	Soil CUL (mg/kg)	Soil CUL Basis
arsenic	5	MTCA A	88	MTCA C, CAR
benzene	51	SW, ARAR	--	--
CrVI	50	SW, ARAR	--	--
copper	2.4	SW, ARAR	--	--
cPAH TEQ (benzo[a]pyrene)	0.1	PQL	--	--
ethylbenzene	2100	SW, ARAR	--	--
pentachlorophenol	3	SW, ARAR	--	--
xylenes	1000	MTCA A	--	--

NOTES:

-- = not selected as an indicator hazardous substance for soil.

CrVI = hexavalent chromium.

cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.

CUL = cleanup level.

mg/kg = milligrams per kilogram.

MTCA A = Model Toxics Control Act, Method A table value for groundwater.

MTCA C, CAR = Model Toxics Control Act, Method C, carcinogen standard values.

µg/L = micrograms per liter.

PQL = practical quantitation limit.

SW, ARAR = surface water Applicable or Relevant and Appropriate Requirement.

Alternative Number **Probable Cost** **Alternative Description**	**Alternative 1** **$8,773,000** **Completed Interim Actions and Compliance Monitoring**	**Alternative 2** **$9,814,000** **Completed Interim Actions, Groundwater Treatment (MRC and ORC), and Compliance Monitoring**	**Alternative 3** **$10,333,000** **Completed Interim Actions, Expansion of Groundwater Recovery System, and Compliance Monitoring**	**Alternative 4** **$14,968,000** **Completed Interim Actions, Additional Soil Excavation to Remove Arsenic, and Compliance Monitoring**
Basis for Alternative Ranking under MTCA				
1 Compliance with MTCA Threshold Criteria *(WAC 173-340-360(2)(a))*				
Protection of Human Health & Environment	This alternative protects human health and the environment through capping, soil removal, containment, and institutional controls. For groundwater, applicable state and federal cleanup standards are achieved within the conditional point of compliance	This alternative protects human health and the environment through capping, soil removal, containment, and institutional controls. For groundwater, applicable state and federal cleanup standards are achieved within the conditional point of compliance.	This alternative protects human health and the environment through capping, soil removal, containment, and institutional controls. For groundwater, applicable state and federal cleanup standards are achieved within the conditional point of compliance.	This alternative protects human health and the environment through capping, soil removal, containment, and institutional controls. For groundwater, applicable state and federal cleanup standards are achieved within the conditional point of compliance.
Compliance with Cleanup Standards	Ongoing operation of the horizontal recovery well reduces the migration of contaminated groundwater and reduces the chemical mass in groundwater, allowing groundwater flowing off site to comply with cleanup standards at the conditional point of compliance. Soil exceedances on site have been partially excavated and remaining exceedances have been capped.	In addition to the components included in Alternative 1, this alternative includes additional groundwater treatment using enhanced biodegradation and immobilization within the treating area and would further reduce contaminant concentrations so that cleanup levels are not exceeded beyond the conditional point of compliance.	In addition to the components included in Alternative 1, this alternative includes expansion of the horizontal recovery well, which would further reduce the migration of contaminated groundwater and reduce the chemical mass in groundwater, allowing groundwater flowing off site to comply with cleanup standards at the conditional point of compliance.	In addition to the components included in Alternative 1, this alternative complies with the soil cleanup standards through additional excavation and off-site disposal. Soil with cleanup level exceedances that is not accessible for excavation will remain capped.
Compliance with Applicable State & Federal Laws	This alternative complies with all applicable state and federal laws.	This alternative complies with all applicable state and federal laws.	This alternative complies with all applicable state and federal laws.	This alternative complies with all applicable state and federal laws.
Provision for Compliance Monitoring	This alternative provides for compliance monitoring to demonstrate that concentrations decrease or remain stable and do not exceed cleanup levels beyond the conditional point of compliance.	This alternative provides for compliance monitoring to demonstrate that concentrations decrease or remain stable and do not exceed cleanup levels beyond the conditional point of compliance.	This alternative provides for compliance monitoring to demonstrate that concentrations decrease or remain stable and do not exceed cleanup levels beyond the conditional point of compliance.	This alternative provides for compliance monitoring to demonstrate that concentrations decrease or remain stable and do not exceed cleanup levels beyond the conditional point of compliance.
2 Restoration Time-Frame *(WAC 173-340-360(2)(b)(ii))*				
	The interim actions have been completed; the only remaining work is compliance monitoring. Monitoring during the operational period of the horizontal recovery well (i.e., protection monitoring) is expected to continue for the next four years.	This alternative includes all the elements of Alternative 1 plus additional groundwater treatment. Because attenuation rates of mobile organic contaminants does not change with this alternative, it does not significantly reduce the restoration time frame achieved by Alternative 1.	This alternative includes all the elements of Alternative 1 plus additional groundwater recovery. Additional extraction wells may reduce the restoration time frame, but only by a year.	The primary objective of this alternative is removal of metals in soil, specifically arsenic. Following excavation, the monitoring period during the operational phase of the horizontal recovery well (i.e., protection monitoring) is expected to be shorter than for Alternative 1, but it does not significantly reduce the time frame achieved by Alternative 1 because contaminated soil that is not accessible for excavation will remain.

Alternative Number **Probable Cost** **Alternative Description**	**Alternative 1** **$8,773,000** **Completed Interim Actions and Compliance Monitoring**	**Alternative 2** **$9,814,000** **Completed Interim Actions, Groundwater Treatment (MRC and ORC), and Compliance Monitoring**	**Alternative 3** **$10,333,000** **Completed Interim Actions, Expansion of Groundwater Recovery System, and Compliance Monitoring**	**Alternative 4** **$14,968,000** **Completed Interim Actions, Additional Soil Excavation to Remove Arsenic, and Compliance Monitoring**
3 Evaluation of Permanence Using MTCA Disproportionate Cost Analysis *(WAC 173-340-360(2)(b)(i) & WAC 173-340-360(3)(f))*				
Overall Protectiveness	Alternative 1 protects human health and the environment by complying with applicable federal and state cleanup standards through the use of containment, capping, permanent removal, and institutional controls. This alternative leaves contaminated soil in place and receives a moderate ranking.	Alternative 2 protects human health and the environment by complying with applicable federal and state cleanup standards through the use of containment, capping, permanent removal, and institutional controls. Additionally, this alternative permanently removes impacts from groundwater and receives a high ranking.	Alternative 3 protects human health and the environment by complying with applicable federal and state cleanup standards through the use of containment, capping, permanent removal, and institutional controls. Additionally, this alternative permanently removes impacts from groundwater and receives a high ranking.	Alternative 4 protects human health and the environment by complying with applicable federal and state cleanup standards through the use of containment, capping, permanent removal, and institutional controls. Additionally, this alternative permanently removes impacts from the soil. This alternative may not treat all on-site area residual soil contamination (because of the site limitations), and receives a moderate ranking.
Permanence	This alternative includes the permanent removal of soil (focused areas) and the permanent removal of groundwater impacts through natural degradation processes. However, this alternative leaves impacted soils in place and receives a moderate ranking.	This alternative includes the permanent removal of soil (focused areas) and the permanent removal of organic groundwater impacts through natural degradation processes and inorganic groundwater impacts through degradation and immobilization processes. However, this alternative leaves impacted soils in place and receives a moderate ranking.	This alternative includes the permanent removal of soil (focused areas) and the permanent removal of groundwater impacts through natural degradation processes. This alternative includes faster removal of groundwater impacts than Alternative 1 through the expanded recovery system; however, this alternative leaves impacted soils in place and receives a moderate ranking.	This alternative includes the permanent removal of soil impacts through excavation and the permanent removal of groundwater impacts through natural degradation processes. This alternative receives a high ranking because it includes a larger volume of soil removal than Alternatives 1 to 3.
Long-Term Effectiveness	This alternative includes higher-preference remediation technologies, such as removal, as defined under MTCA. However, this alternative also includes containment and capping, which are not considered higher-preference remediation technologies. This alternative receives a moderate ranking for long-term effectiveness.	This alternative includes a combination of higher-preference remediation technologies; such as removal, MRC, and ORC; and lower-preference remediation technologies, such as containment and capping, as defined under MTCA. Since this alternative uses more higher-preference remediation technologies than Alternatives 1 and 3, it receives a high ranking for long term effectiveness	This alternative includes higher-preference remediation technologies, such as removal, as defined under MTCA. However, this alternative also includes containment and capping, which are not considered higher-preference remediation technologies. This alternative receives a moderate ranking for long-term effectiveness	This alternative includes higher- preference remediation technologies, such as removal, as defined under MTCA. This alternative also includes lower-preference remediation technologies, such as containment and capping, but since more soil is removed in this alternative, it receives a high ranking for long-term effectiveness.
Short-Term Risk Management	This alternative includes the least amount of construction and implementation work. This alternative has the lowest potential risk to human health and the environment during short-term activities. This receives the highest ranking for short-term risk management.	This alternative includes significant drilling/injection, which has the highest short-term potential exposure to site works and the environment. These risks can be reduced through proper construction management and staging; however, compared to Alternative 1, this receives a low ranking for short-term risk management.	This alternative includes significant excavation work and construction work which has the highest short-term potential exposure to site workers and the environment. These risks can be reduced through proper construction management and staging; however, compared to Alternative 1, this receives a low ranking for short-term risk management.	This alternative includes significant excavation work, which has the highest short-term potential exposure to site workers and the environment. These risks can be reduced through proper construction management and staging; however, compared to Alternative 1, this receives a moderate ranking for short-term risk management.
Implementability	The interim actions included in this alternative have been completed and have shown this alternative to be highly practicable and implementable.	This alternative is practicable and implementable; however, compared to Alternative 1, it includes challenges related to the injection and delivery of ORC and MRC. These difficulties can be minimized with proper planning and management.	This alternative is practicable and implementable; however, compared to Alternative 1, it includes significant excavation and construction related to the expansion of the groundwater recovery system. These difficulties can be minimized with proper planning and management.	This alternative is practicable and implementable; however, compared to Alternative 1, it includes significant challenges related to the excavation of soils near processing units, availability of contractors, and additional capping. These difficulties can be minimized with proper planning and management.

Alternative Number **Probable Cost** **Alternative Description**	**Alternative 1** **$8,773,000** **Completed Interim Actions and Compliance Monitoring**	**Alternative 2** **$9,814,000** **Completed Interim Actions, Groundwater Treatment (MRC and ORC), and Compliance Monitoring**	**Alternative 3** **$10,333,000** **Completed Interim Actions, Expansion of Groundwater Recovery System, and Compliance Monitoring**	**Alternative 4** **$14,968,000** **Completed Interim Actions, Additional Soil Excavation to Remove Arsenic, and Compliance Monitoring**
Consideration of Public Concerns	Each alternative provides opportunity for members of the public to review and comment on plans. Public comments will be addressed as part of the draft CAP review process.	Each alternative provides opportunity for members of the public to review and comment on plans. Public comments will be addressed as part of the draft CAP review process.	Each alternative provides opportunity for members of the public to review and comment on plans. Public comments will be addressed as part of the draft CAP review process.	Each alternative provides opportunity for members of the public to review and comment on plans. Public comments will be addressed as part of the draft CAP review process.

NOTES:
CAP = Cleanup Action Plan.
MRC = Metals Remediation Compound.
MTCA = Model Toxics Control Act.
ORC = Oxygen Release Compound.
WAC = Washington Administrative Code.

Table 9
Applicable or Relevant and Appropriate Requirements
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Action	Citation	Comment
Cleanup Action Construction	29 CFR 1910	Occupational Safety and Health Act
	Chapter 43.21 RCW	State Environmental Policy Act
	Chapter 173-303 WAC	Washington Dangerous Waste Regulations
	Chapter 173-160 WAC	Minimum Standards for Construction and Maintenance of Wells
	Chapter 296-155 WAC	Safety Standard for Construction
	Chapter 173-340 WAC	Model Toxics Control Act
	Pierce County Municipal Code, Title 17A	Building and Construction
	Pierce County Municipal Code, Chapter 18D.10	State Environment Policy Act compliance
Cleanup Standards	Chapter 173-340 WAC	Model Toxics Control Act
	40 CFR 131	National Toxics Rule - Federal Water Quality Standards
	WAC 173-201A	Washington Surface Water Quality Standards
Groundwater Remediation	Chapter 173-340 WAC	Model Toxics Control Act
	40 CFR 144	USEPA Underground Injection Control Regulations
	40 CFR 141, subparts F and G and 143.3	Safe Drinking Water Act MCLs
	Chapters 173-150 and 173-154 WAC	State Water Code and Water Rights
	Pierce County Municipal Code, Chapter 13.04	Use of Public Sewers

NOTES:
CFR = Code of Federal Regulations.
RCW = Revised Code of Washington.
USC = U. S. Code.
USEPA = U.S. Environmental Protection Agency.
WAC = Washington Administrative Code.

FIGURES

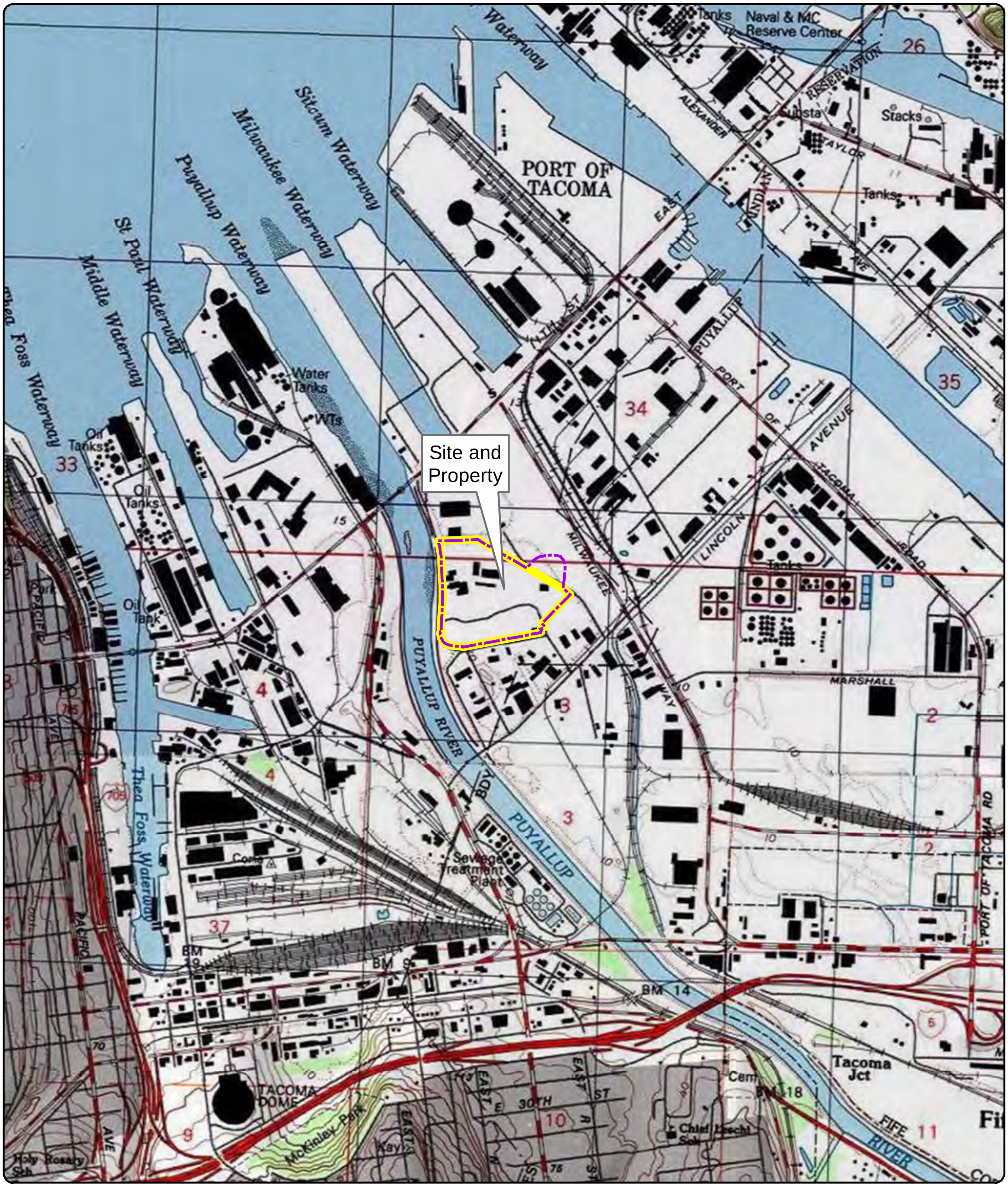
Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CAP\Projects\Fig1_Site Location.mxd

Print Date: 9/17/2014

Approved By: hhirsch

Produced By: rmaronn

Project: 9081.01.04-04



Site Address: 1640 East Marc Street, Tacoma, Washington
Source: US Geological Survey (1990) 7.5-minute topographic quadrangle: Tacoma North
Section 3, Township 20 North, Range 3 East and
Section 34, Township 21 North, Range 3 East

Legend

Site Boundary

Property Boundary

Note: The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero arsenic concentration contour as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 1,000 2,000

Feet

Figure 1
Site Location

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

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Figure 2
Site Features

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary
- Protective Cap (Currently Paved) and Soil Restricted Area

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. PCP = pentachlorophenol.
4. SWTS = stormwater treatment system.
5. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property, in the vicinity of monitoring well UPRR-MW-29, is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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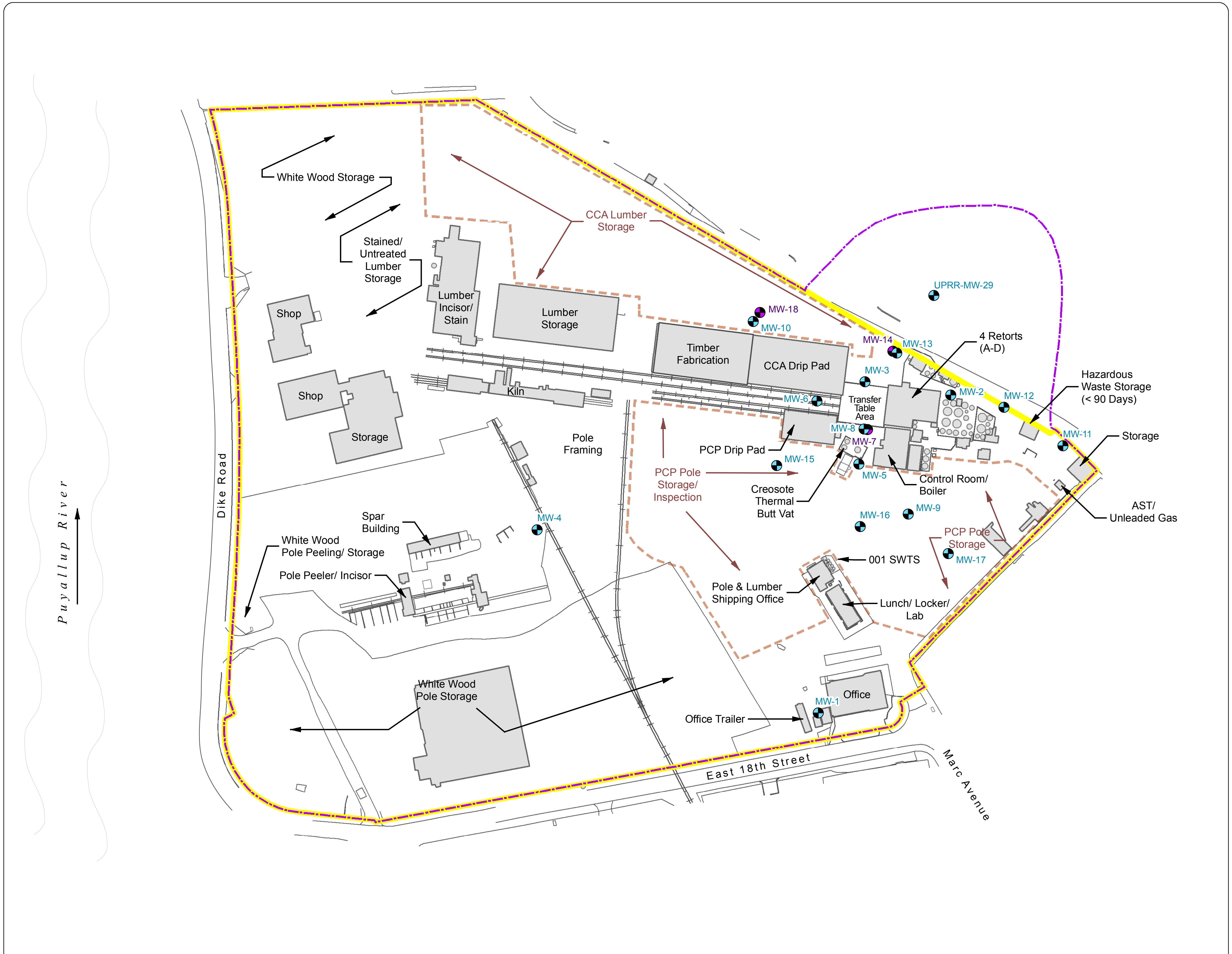
Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CMP\Projects\Fig2_Site Features.mxd
Print Date: 10/16/2014
Approved By: hhirsch
Produced By: apadilla
Project: 9081.01.04-00

Figure 3
Historical Site Features

McFarland Cascade Pole and Lumber Company
Tacoma, Washington



Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary
- Historical Treated Wood Storage Area

Notes:
1. Site features correspond to those present until approximately the late 1990s.
2. AST = aboveground storage tank.
3. CCA = chromated copper arsenate.
4. PCP = pentachlorophenol.
5. SWTS = stormwater treatment system.
6. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property, in the vicinity of monitoring well UPRR-MW-29) is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI.

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Project: 9081.01.04-00 Produced By: rmaronn Approved By: hhirsch Print Date: 10/16/2014
Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CAP\Projects\Fig3_Historical Site Features.mxd

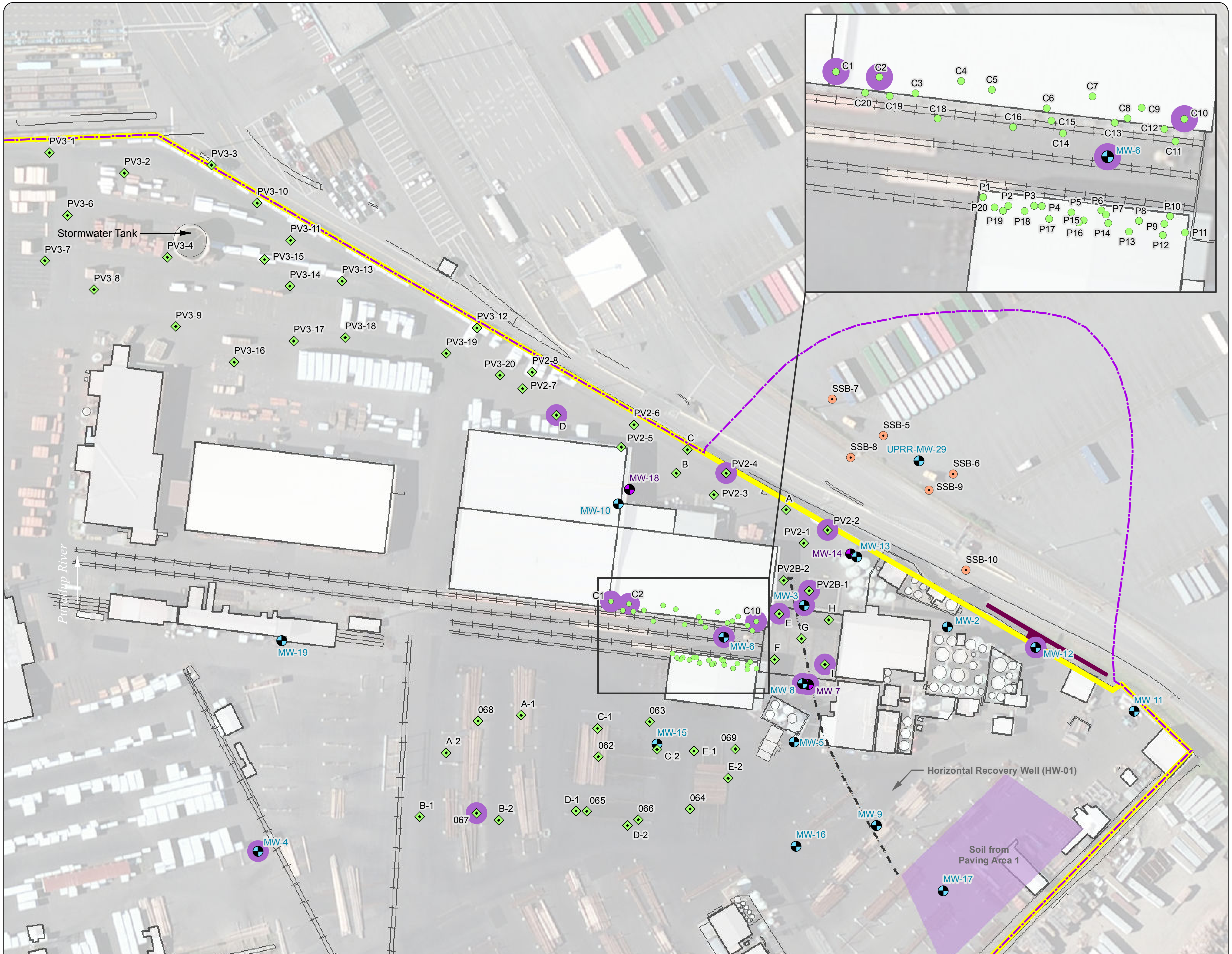

Figure 4
Areas of Concern in Soil

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

- Drip Pad Soil Sample Location
- Paving Area & Transfer Table Soil Sample Location
- UPRR Site Soil Boring
- Shallow Monitoring Well
- Deep Monitoring Well
- Arsenic CUL Exceedance (Soil)
- Railroad
- Copper Azole Soil Removal
- Site Boundary
- Property Boundary

Notes:
1. Arsenic cleanup level = 88 mg/kg.
2. Arsenic data are included in the final Remedial Investigation and Feasibility Study (MFA and AECOM, 2014).
3. No arsenic exceedances were observed in soil samples collected from depths greater than 5 feet. The maximum depth sampled was 24 feet.
4. CUL = cleanup level.
5. mg/kg = milligrams per kilogram (parts per million).
6. UPRR Site = Union Pacific Railroad, Former Milwaukee Railyard site.
7. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 60 120
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI.

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Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CAP\Projects\Fig4_Areas of Concern in Soil.mxd
Print Date: 10/16/2014
Approved By: hhirsch
Produced By: apadilla
Project: 9081.01.04-04

Figure 5
Groundwater Exceedances 2004 to 2015

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

Exceedances

- Arsenic—5 ug/L CUL
- Copper—2.4 ug/L CUL
- PCP—3 ug/L CUL
- cPAH TEQ—0.1 ug/L CUL
- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary

Notes:
1. This figure shows indicator hazardous substances for which the maximum detected concentration observed in groundwater was above CULs. Data from the four most recent monitoring events conducted between 2004 and 2015 for each well location were evaluated. During the 2004 to 2015 timeframe, monitoring wells MW-1, MW-19, and MW-20 were monitored only once, and MW-4 was monitored only twice.
2. Samples have not been collected from monitoring well location MW-11 since 2002.
3. Hexavalent chromium, benzene, ethylbenzene, and xylenes were below their respective cleanup levels during the four most recent monitoring events.
4. Total and dissolved metals were analyzed in some locations. When both were available, the greater of the two was used.
5. cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.
6. CUL = cleanup level.
7. PCP = pentachlorophenol.
8. ug/L = micrograms per liter.
9. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI.

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Project: 9081.01.04-04 Produced By: apadilla Approved By: hhirsch Print Date: 4/3/2015 Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CAP\Projects\Fig5_Groundwater Exceedances.mxd

Figure 6
Soil Restricted Area and Protective Cap

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

- Drip Pad Soil Sample Location
- Paving Area & Transfer Table Soil Sample Location
- Shallow Monitoring Well
- Deep Monitoring Well
- Arsenic CUL Exceedance (Soil)
- Railroad
- Site Boundary
- Property Boundary
- Protective Cap (Currently Paved) and Soil Restricted Area

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. CUL = cleanup level.
4. PCP = pentachlorophenol.
5. SWTS = stormwater treatment system.
6. Arsenic cleanup level = 88 mg/kg.
7. Arsenic data are included in the final Remedial Investigation and Feasibility Study (MFA and AECOM, 2014).
8. No arsenic exceedances were observed in soil samples collected from depths greater than 5 feet. The maximum depth sampled was 24 feet.
9. mg/kg = milligrams per kilogram (parts per million).
10. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Project: 9081.01.04-00 Produced By: apadilla Approved By: hhirsch Print Date: 3/27/2015 Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CAP\Projects\Fig6_Soil Restricted Area and Protective Cap.mxd

APPENDIX A

FINAL GROUNDWATER COMPLIANCE MONITORING PLAN

FINAL GROUNDWATER COMPLIANCE MONITORING PLAN

MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

Prepared for

MCFARLAND CASCADE HOLDINGS, INC.

A STELLA-JONES COMPANY

TYEE MANAGEMENT COMPANY, LLC

January 12, 2016

Project No. 0999.01.01

Prepared by

Maul Foster & Alongi, Inc.

1329 N State Street, Suite 301, Bellingham WA 98225

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ALONGI

FINAL GROUNDWATER COMPLIANCE MONITORING PLAN

MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE

TACOMA, WASHINGTON

The material and data in this plan were prepared under the supervision and direction of the undersigned.

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ACRONYMS AND ABBREVIATIONS

AO	Agreed Order
BTEX	benzene, toluene, ethylbenzene, and xylenes
CA-C	copper azole type C
CAP	cleanup action plan
CCA	copper-chromated arsenic
CMP	groundwater compliance monitoring plan
COI	chemical of interest
COPC	chemical of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPLC	Cascade Pole and Lumber Company
CPOC	conditional point of compliance
CrVI	hexavalent chromium
CUL	cleanup level
Ecology	Washington State Department of Ecology
HW-01	horizontal recovery well
IHS	indicator hazardous substance
MCHI	McFarland Cascade Holdings, Inc.
MCPLC	McFarland Cascade Pole and Lumber Company
MFA	Maul Foster & Alongi, Inc.
MKA	MKAssociates, Inc. (land surveyor)
modeling report	modeling report submitted to Ecology within three months of Ecology's approval of the proposed model
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
PCP	pentachlorophenol
the Port	Port of Tacoma
the Property	property, owned by Tyee, on which MCPLC conducts its operations
QA	quality assurance
QC	quality control
REL	remediation level
Restricted Area	the area of the Property with residual soil contamination covered by a protective cap
RI/FS	remedial investigation and feasibility study
SAP	sampling and analysis plan
SIM	selective ion monitoring
Site	McFarland Cascade Pole and Lumber Company site
SMP	site management plan
Tyee	Tyee Management Company, LLC
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code

EXECUTIVE SUMMARY

This groundwater compliance monitoring plan (CMP) provides procedures for groundwater monitoring associated with the groundwater remedial action for the McFarland Cascade Pole and Lumber Company Site (the Site) in Tacoma, Washington. The Site includes property owned by Tyee Management Company, Inc., and a portion of the adjoining property owned by the Port of Tacoma (the Port). Indicator hazardous substance (IHS) concentrations in groundwater exceed cleanup levels (CULs) in portions of the Site. These CUL exceedances are addressed by the final groundwater remedy for the Site, which includes groundwater extraction and containment using a horizontal recovery well, monitored natural attenuation, compliance monitoring, and a prohibition on groundwater use.

PURPOSE AND OBJECTIVES

Groundwater compliance monitoring at the Site will be conducted for the following purposes:

- Assessment of the ongoing effectiveness and performance of the groundwater extraction and containment remedial action.
- Evaluation of conditions for termination of groundwater extraction and containment activities.
- Monitoring progression of the monitored natural attenuation remedy component through assessment of groundwater flow conditions and IHS concentration trends.
- Evaluation of compliance with CULs at the conditional point of compliance (CPOC) at the Site boundary.
- Evaluation of whether IHS concentrations in groundwater indicate the potential for exceedance of a CUL at the CPOC, and whether they meet the criteria for triggering a contingent action.
- Evaluation of compliance with CULs throughout the Site; compliance will allow for termination of the compliance monitoring program and decommissioning of the horizontal recovery well and groundwater monitoring wells.

STAGES OF MONITORING

Compliance groundwater monitoring will be conducted in the following three stages, consistent with the Model Toxics Control Act (Washington Administrative Code 173-340-410):

1) **Performance Monitoring:** Confirm that human health and the environment are protected during groundwater extraction and containment activities (i.e., operation of the horizontal recovery well).
2) **Protection Monitoring:** Confirm that once attained, remediation levels (RELs) continue to be met following termination of the horizontal recovery well's operation.

3) **Confirmational Monitoring:** Confirm the long-term effectiveness of the groundwater extraction and containment remedy component following completion of protection monitoring. This stage of monitoring also includes a "final closure monitoring" stage to confirm the long-term effectiveness of the groundwater remedy once CULs have been attained throughout the Site and to determine that the groundwater monitoring program can be terminated.

GROUNDWATER MONITORING NETWORK

Monitoring activities will be conducted for both the shallow and the deep groundwater aquifers under the Site, using a combination of water level monitoring network wells, compliance monitoring network wells, and final closure monitoring network wells, as discussed below.

Water Level Monitoring Network

Water levels will be measured during all stages of monitoring in all existing Site wells in order to evaluate hydraulic gradients in the shallow and deep aquifers.

Compliance Monitoring Network

During the protection, performance, and confirmational stages of monitoring, groundwater samples will be collected from the compliance monitoring network wells and analyzed. The compliance monitoring network includes the following wells:

- **Horizontal recovery well:** HW-01.
- **Sentry wells:** MW-4, MW-19, and MW-20 in the shallow aquifer; MW-7 and MW-18 in the deep aquifer; and any additional sentry wells installed as part of a Tier 3 contingency.
- **Source area monitoring wells:** MW-3 and MW-8 in the shallow aquifer; MW-14 in the deep aquifer.

Final Closure Monitoring Network

During the final closure stage of monitoring, groundwater samples will be collected from all remaining Site monitoring wells.

Monitoring Well UPRR-MW-29

During all stages of monitoring, groundwater samples will be collected from shallow aquifer monitoring well UPRR-MW-29—located on the Port property—and analyzed. However, the Washington State Department of Ecology has determined that discharge to surface water is the highest beneficial use of groundwater at the Site, and groundwater monitoring results indicate that IHSs are not migrating to surface water on the Port property. Therefore, UPRR-MW-29 will not be used as a sentry well and is not included in the compliance monitoring network. During the protection, performance, and confirmational stages of monitoring, sample results will be used to evaluate IHS concentration trends and hydraulic gradients, but will not be evaluated for compliance with RELs or CULs. However, UPRR-MW-29 is included in the final closure monitoring network, and during the final closure stage of monitoring, sample results will be evaluated for compliance with CULs.

EVALUATING CLEANUP LEVEL COMPLIANCE

During all three stages of monitoring, groundwater monitoring will be conducted to evaluate compliance with CULs at the CPOC. Sentry wells are located to allow for monitoring between the source area and the CPOC. To demonstrate that CULs are being met at the CPOC, sentry wells will be monitored for compliance with RELs. RELs were derived from attenuation modeling and, if reached in a sentry monitoring well, indicate the potential for exceedance of a CUL at the CPOC, which would trigger additional assessment.

In response to REL exceedances in a sentry well, contingent actions will be implemented using a tiered approach. As described in this CMP, there are four tiers of activity, and contingencies may include more frequent monitoring, restarting the horizontal recovery well, more robust attenuation modeling to potentially revise RELs, installation of additional sentry wells, and additional subsurface investigation and/or source characterization to assess the potential need for additional remedial action.

RELs will also be used to assess remedy effectiveness in the source area (i.e., in source area wells and the horizontal recovery well); however, REL exceedances in the source area do not indicate the potential for CUL exceedances at the CPOC, given that the horizontal recovery well will contain groundwater contamination within the source area. Therefore, REL exceedances in the source area will not trigger additional assessment.

1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA) has prepared this groundwater compliance monitoring plan (CMP) on behalf of McFarland Cascade Holdings, Inc. (MCHI) and Tyee Management Company, LLC (Tyee) for the McFarland Cascade Pole and Lumber Company (MCPLC) site (Site) in Tacoma, Washington (see Figure 1). For purposes of this CMP, Property (unless otherwise specified) refers to the property on which MCPLC conducts its operations, which is owned by Tyee and leased to MCHI. Site refers to anywhere that contamination from MCPLC's historical operations has come to lie, irrespective of property ownership. The Site includes the Property and a limited portion of the adjacent former Union Pacific Railroad/Milwaukee Railyard property to the northeast that is currently owned by the Port of Tacoma (the Port) (see Figure 2). The Maersk Pacific and Horizon Lines storage and shipping yards currently conduct operations on the Port property.

This CMP has been prepared to meet the groundwater monitoring requirements under the Washington State Department of Ecology (Ecology) - adopted cleanup action plan (CAP) (Ecology, 2016). This CMP was developed in accordance with the compliance monitoring requirements put forth in the Washington State Model Toxics Control Act (MTCA) (Washington Administrative Code [WAC] 173-340-410). The approach described in this CMP is consistent with the Ecology-approved final remedial investigation and feasibility study (RI/FS) (MFA and AECOM, 2014) and the CMP technical memorandum (MFA, 2014) and subsequent revisions as requested by Ecology.

1.1 Purpose of Groundwater Compliance Monitoring Plan

The final remedy for the Site, as described in the CAP (Ecology, 2016), includes:

- Continued operation and maintenance of the completed remedial actions (e.g., the protective cap and the horizontal recovery well)
- Institutional controls to be recorded in environmental covenants
- Monitored natural attenuation
- Groundwater compliance monitoring

A site management plan (SMP) (MFA, 2016) is included as an appendix to the CAP (Ecology, 2016). The SMP includes policies and procedures for the operation and maintenance of the protective remedial action measures that remain in place, including the horizontal recovery well, and for conducting work in the Restricted Area of the Site. The Restricted Area, which includes a protective cap for soil, includes areas of the Property where arsenic concentrations in soil exceed the arsenic MTCA cleanup level (CUL). Groundwater restrictions apply throughout the Site.

The goals of this CMP are to:

- Identify existing wells for inclusion in the compliance monitoring network and provide criteria for siting and installing potential future monitoring wells.
- Describe the development of remediation levels (RELs) and CULs to be used at existing and potential future compliance monitoring wells.
- Provide guidelines and criteria for each stage of monitoring, including criteria for assessing compliance with RELs and CULs, as applicable, and monitoring frequency.
- Identify contingent actions to be implemented in response to noncompliance with RELs in a sentry well and the criteria for triggering these actions.
- Provide criteria for ceasing operation of the horizontal recovery well and for its eventual decommissioning.
- Provide criteria for decommissioning monitoring wells.
- Define requirements for terminating the monitoring program and removing groundwater restrictions (i.e., an environmental covenant).

Ecology has determined that the highest and only beneficial use of groundwater affected by the Site is protection of surface water. Groundwater CULs (based on protection of surface water) and a conditional point of compliance (CPOC) at the Site boundary were established in the CAP (Ecology, 2016).

Groundwater data collected at the Site from 2004 to 2015 and attenuation modeling show that indicator hazardous substance (IHS) concentrations do not exceed CULs at or beyond the Site boundary (Ecology, 2016; MFA and AECOM, 2014). These findings support the selection of a CPOC at the Site boundary and the use of sentry wells and RELs (see Section 4) for monitoring CUL compliance at the CPOC.

2 BACKGROUND

2.1 Site Description

The Site is located on the Tacoma tide flats and includes the Property located at 1640 East Marc Street and a portion of the adjacent Port property located at 1119 Milwaukee Way, in Tacoma, Washington (Figures 1 and 2). The 43-acre Property is located approximately 200 feet east of the Puyallup River and 1,000 feet south of the Milwaukee Waterway. The Property is zoned Port Maritime and Industrial and is surrounded by industrial facilities, including Maersk Pacific and Horizon Lines storage and shipping yards to the northwest; the former Union Pacific Railroad Milwaukee Railyard to the northeast; Pallet Services (a pallet manufacturing and storage facility) to the east; and Fred Tebb and Sons (a lumber mill) and Recovery One (a demolition waste transfer and processing facility) to the south. The Site includes a small area on the former Union Pacific Railroad Milwaukee Railyard property (currently owned by the Port). The Milwaukee Railyard is no longer active, and the Port has completed remedial actions to address free-phase diesel fuel and areas of related contamination. A restrictive covenant is in place on the Port property, and groundwater monitoring and cap maintenance activities are ongoing. The Port has also redeveloped the Port property to allow for the expansion of the Maersk Pacific Terminal.

2.2 Site History and Operations

The MCPLC facility is used for the manufacturing and processing of treated-wood products. Figure 2 shows the current layout of the facility. Activities at the facility have included debarking, sizing and framing, incising, staining, pressure- and non-pressure-treating, and distributing finished products to customers. Treated-wood products manufactured at the MCPLC facility include utility poles and dimensional lumber used for decking, fencing, and similar products.

The facility and Property were originally owned and operated by Cascade Pole and Lumber Company (CPLC). CPLC began leasing the facility, the Property, and equipment to MCPLC in January 2004. CPLC and MCPLC are owned by the same parent company, MCHI. In 2012, Stella-Jones Corporation acquired MCHI. As part of that transaction, CPLC transferred ownership of the property to Tyee, which continues to lease the Property to MCHI.

CPLC purchased the Property in stages from the late 1960s through the early 1970s and began developing it for use as a wood-treating facility in 1972; wood-treating operations have been conducted on the Property since 1974. Before 1974, the northwest portion of the Property was used for a lumber mill and landscape bark operation. The rest of the Property was filled in the early 1970s by the Port. The fill consisted of dredged material and possibly other materials.

Wood-treating activities, including storage and application of wood preservatives, are conducted on the eastern portion of the Property in an area referred to as the "treating area." The treating area includes the drip pads, a transfer table, retorts, and a pentachlorophenol (PCP) thermal butt vat (see Figure 2). The facility layout shown in Figure 2 has been in use since the late 1990s. The facility layout prior to the late 1990s is discussed in the RI/FS (MFA and AECOM, 2014) and the CAP (Ecology, 2016).

Both pressure and non-pressure (i.e., thermal) processes are used at the facility. The wood-treating chemicals primarily used in these processes have been PCP, copper-chromated arsenic (CCA), copper azole type C (CA-C), and creosote. From 1978 to 1987, CPLC used Chemonite® ammoniacal copper zinc arsenate at the facility. As of December 2004, creosote use was discontinued at the facility. MCPLC continues to use PCP to treat utility poles, but CCA use was discontinued for lumber products in December 2003, and for all products, including those for industrial use, in 2011.

CPLC and MCPLC records indicate that four known spills have occurred at the Property; one of these spills migrated onto the adjacent Port property. Cleanup actions were implemented to address these spills, and each was reported to Ecology:

- In August 1985, an overflow of process water from the cooling tower resulted in a release of approximately 100 gallons of water. Cleanup actions were implemented and efforts were made to eliminate the possibility of future spills.
- In March 1986, a cooling tower overflow resulted in the spill of approximately 100 gallons of process water. Cleanup actions were implemented and the system was redesigned to prevent any chance of recurrence.
- In May 1986, a storage tank overflow resulted in the spill of approximately 260 gallons of CCA. Cleanup actions and procedures were implemented to prevent any chance of recurrence.
- In May 2014, a wood-treatment-process work tank release resulted in the spill of approximately 300 gallons of CA-C. The spill migrated into a dry roadside ditch on the adjacent Port property. A project-specific cleanup goal of 146 milligrams per kilogram for copper in soil was developed in coordination with Ecology and the Tacoma-Pierce County Health Department. All soil with copper concentrations above the project-specific cleanup goal was excavated from the ditch (approximately 40 cubic yards [48.29 tons] in total). Ecology approved the spill response and cleanup and indicated that no further action associated with this spill was needed.

No other spills or releases have been reported at the MCPLC facility.

The MCPLC facility is a hazardous-waste generator (ID No. WAD 008 958 357). The facility discharges treated stormwater under a National Pollutant Discharge Elimination System (NPDES) permit (No. WA003795-3). MCPLC's current NPDES permit became effective on September 1, 2014, and has an expiration date of August 13, 2019. MCPLC is also registered with the Puget Sound Clean Air Agency (Registration No. 10398).

Chemicals used in the wood-treating process and their associated compounds and breakdown products, including the following, were identified as chemicals of interest (COIs) for the Site:

- Total and dissolved arsenic, copper, and chromium (including both trivalent chromium and hexavalent chromium [CrVI])
- Polycyclic aromatic hydrocarbons
- PCP
- Semivolatile organic compounds

In addition, the following COIs were identified in association with the PCP carrier oil formerly in use at the facility:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Total petroleum hydrocarbon–gasoline-range organics

The carrier oil in use since 2008, and currently in use at the facility, is a 30 percent biodiesel and 70 percent recycled lubrication oil mixture that does not contain BTEX.

Samples of environmental media from the Site were analyzed for these COIs, and detected chemicals were retained for consideration as IHSs.

CPLC entered into an Agreed Order (AO) with Ecology on June 7, 1993, for completion of an RI/FS and interim actions. Interim actions completed before execution of the AO were incorporated into the AO along with additional planned interim actions, including groundwater interim actions. Soil and groundwater investigations completed in association with the interim actions fulfilled the data collection requirements for the RI/FS. Site investigation details are discussed in the RI/FS (MFA and AECOM, 2014) and the CAP (Ecology, 2016).

2.3 Remedial Action Description

Since the early 1990s, CPLC has conducted numerous upgrades (interim actions) at the facility. The interim actions were completed under the existing AO, with consent and approval from Ecology, and are part of the selected remedy for the Site. These actions consisted of:

- **Protective Cap—**Arsenic-contaminated soil in the Restricted Area is covered with a protective cap, which consists of asphalt pavement, concrete, buildings, or other constructed features (including the drip pad and transfer table containment slab described below). The protective cap will be maintained in the Restricted Area as a component of the Site remedy. The protective cap in the Restricted Area is equipped with catch basins and piping to collect stormwater and direct it to on-site filtration/treatment systems. The stormwater is discharged under the site-specific NPDES permit.
- **Drip Pad Soil Excavation and Capping—**Impacted soil was excavated and disposed of off site as part of the installation of a new, steel-reinforced-concrete drip pad. The drip pad also serves as a cap for remaining soil impacts.
- **Installation and Operation of the Horizontal Recovery Well—**A horizontal recovery well and its associated recovery sump and pump provide both hydraulic containment and removal of shallow groundwater impacts beneath the transfer table pit and the adjacent treatment area. Extracted water is reused in facility operations.
- **Transfer Table Pit Soil Excavation and Capping—**860 tons of impacted soil was excavated and disposed of off site as part of the transfer table pit upgrade, which included construction of a concrete containment slab that caps remaining contaminated soil.

Further information associated with each interim remedial action is provided in the RI/FS (MFA and AECOM, 2014) and the CAP (Ecology, 2016).

In addition to the interim actions listed above, the selected remedial action includes monitored natural attenuation and compliance monitoring to address groundwater impacts at the Site, as discussed in this CMP. The selected remedial action also includes the following institutional controls: (1) continued maintenance of the protective cap and requirements for management of soil excavated from beneath the protective cap, as discussed in the SMP; (2) prohibition on groundwater use throughout the Site; and (3) operation and maintenance of the horizontal recovery well. These institutional controls will be documented and enforced through a restrictive covenant placed on the Property and the existing covenant on the Port property prohibiting groundwater use.

2.4 Conditional Point of Compliance

A CPOC at the Site boundary, which includes the Property and a portion of the Port property, was selected for groundwater (see Figure 2). Site CULs, based on protection of surface water, apply at the CPOC. There are no surface-water-exposure pathways on the Port property (Ecology, 2016); however, monitoring well UPRR-MW-29, located on the Port property, will be monitored during the compliance monitoring program to evaluate potential contamination migration onto the Port property, as well as hydraulic and chemical concentration trends.

Under this compliance monitoring program, to demonstrate that CULs are being met at the CPOC, which is at the downgradient boundary of the Property, sentry wells will be monitored for compliance with RELs. Sentry wells are located to allow monitoring between the source area and the nearest potential receptor, the Puyallup River. RELs are attenuation-modeling-derived concentrations of IHSs to apply at sentry wells (for monitoring CUL compliance at the CPOC) and at other compliance monitoring network wells to monitor remedy effectiveness. RELs, if reached in a sentry monitoring well, would indicate the potential for exceedance of a CUL at the CPOC. REL development is discussed in Section 4 of this CMP.

3 CONCEPTUAL SITE MODEL

The following is a summary of the investigation findings and the resultant conceptual site model as presented in the RI/FS (MFA and AECOM, 2014).

3.1 Geology and Hydrogeology

The Site is in an alluvial plain of the Puyallup River and is underlain by Puget Lowland glacial deposits (Griffin et al., 1962). The Site geology originally consisted of Puyallup River deltaic deposits overlying the glacial deposits, but has been extensively modified by dredging and infilling activities. The Site is underlain predominantly by fill consisting of dredge material and possibly other materials of unknown origin that were emplaced before development (MFA and AECOM, 2014).

The Site is underlain by a shallow, unconfined aquifer (the shallow aquifer) consisting of 6 to 10 feet of fine to medium sand with some sandy silt intervals underlain by an approximately 6- to 7-foot-thick aquitard consisting of silty clay to clayey silt. A second, approximately 6- to 10-foot-thick, semi-confined aquifer (the deep aquifer) exists below the shallow aquitard, consisting of very fine to medium sand with a trace of silt, which is underlain by a second aquitard consisting of a 3-foot-thick sandy to clayey silt zone.

Groundwater level data, hydrographs, and contour maps for the shallow and deep aquifers are provided as Appendix A. The depth to groundwater beneath the Site ranges from 3 to 10 feet below ground surface and fluctuates seasonally by approximately 2 feet. The highest water levels have been measured during the winter months (January through March) and the lowest in the fall (October and November). Groundwater from the treating area generally flows southwest to the Puyallup River, approximately 0.25 mile downgradient of the treating area. A groundwater elevation high, or groundwater divide, exists on the boundary between the Property and Port property, in the vicinity of monitoring wells MW-3 and UPRR-MW-29; hence there is a component of flow toward the Port property at times (USPCI, 1993). Groundwater generally flows southwest on the west side of the divide and northeast on the east side of the divide; no significant seasonal variation in the groundwater flow direction is apparent.

The horizontal recovery well recovers groundwater from the shallow aquifer and does not appreciably alter the flow paths across the Property, but does cause a slightly increased gradient in its immediate vicinity. Given that the horizontal recovery well has a localized impact on groundwater flow on the Property, it is not believed to have an appreciable effect on groundwater flow on the Port property.

3.2 Residual Contamination

The Site includes residual soil contamination in the Restricted Area beneath the protective cap (see Figure 2) and residual wood-treating-related chemicals in groundwater throughout the Site. Releases of wood-treating chemicals from the treating area of the MCPLC facility have been identified as a source of impacts in soil and groundwater at the Site. Groundwater data from previous investigations indicate that the source area in the deep aquifer is in the vicinity of deep monitoring well MW-14, which is slightly upgradient of the treating area (see Figure 2).

3.2.1 Indicator Hazardous Substances

During the development of the RI/FS (MFA and AECOM, 2014), data were screened for determination of Site IHSs specific to soil and groundwater. COIs were identified based on historical and current operations (see Section 2.2), and COIs that were detected in soil or groundwater during prior environmental investigations were retained as chemicals of potential concern (COPCs). Soil- and groundwater-specific IHSs were then defined through screening the maximum detected concentration of COPCs against site-specific CULs, which had been developed using applicable state and federal standards.

The sole IHS identified for site soil is arsenic.

IHSs identified for site groundwater are:

- Metals: arsenic, CrVI, and copper

- PCP
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)
- Volatile organic compounds: benzene, ethylbenzene, and xylenes

The selected remedy for the Site addresses these IHSs.

3.2.2 Distribution of Indicator Hazardous Substances in Groundwater

Groundwater monitoring data from 2004 to 2015 were evaluated for each IHS to assess groundwater exceedances at the Site. Figure 3 shows IHSs that were detected at concentrations above their respective CULs, based on recent data. Site data and attenuation modeling indicate that IHS concentrations in groundwater do not exceed CULs outside the CPOC (MFA and AECOM, 2014).

3.2.2.1 Shallow Groundwater

During the last four monitoring events, CUL exceedances were detected in all shallow wells sampled, with the exception of monitoring well MW-1, which is located near the southern boundary of the Property, and sentry well MW-20 (see Figure 3). Arsenic exceeds its CUL in all but one of the shallow groundwater monitoring wells with CUL exceedances. Other IHS exceedances, including copper, PCP, and cPAHs, were detected in fewer locations. Arsenic in shallow sentry wells MW-4 and MW-19, and copper in shallow sentry well MW-19, exceeded their CULs. Arsenic and PCP exceeded their CULs in the horizontal recovery well (HW-01).

Shallow groundwater quality data collected from monitoring well UPRR-MW-29 indicate that wood-treating-related chemical impacts are present on the Port property. Since 2004, copper, arsenic, PCP, and cPAHs have been detected at least once above Site CULs in this well (see Figure 3) and may have originated in the treating area of the MCPLC facility (USPCI, 1993). Based on these findings, the Site boundary extends onto this potentially affected portion of the Port property. The Site boundary (see Figure 2) is located on the Port property at the zero concentration arsenic contour line in groundwater shown in Figure 32 of the hydrogeologic characterization report (USPCI, 1993). The zero concentration contours for the other wood-treating-related chemicals detected in groundwater on the Port property are contained within this zero concentration contour for arsenic.

In general, IHS concentrations in shallow groundwater under the Property show stable or decreasing trends and IHS impacts appear to be limited to the treating area, with the exception of arsenic at sentry well MW-4, and arsenic and copper at sentry well MW-19. However, comparison of arsenic and copper concentrations in those sentry wells to RELs (MFA, 2015), which are based on conservative attenuation modeling (see Section 4), indicates that arsenic and copper concentrations will naturally attenuate to below their CULs before reaching the CPOC at the downgradient Property boundary (i.e., the Property boundary along Dike Road parallel to the Puyallup River).

3.2.2.2 Deep Groundwater

There are three existing deep groundwater monitoring wells on the Property: one well upgradient of the treating area (MW-14) and two wells directly downgradient of the treating area (MW-7 and MW-18; see Figure 2). Deep groundwater monitoring data from 2004 to 2013 were evaluated in the RI/FS for CUL exceedances (MFA and AECOM, 2014).

The following IHSs are not monitored in the deep aquifer wells: benzene, ethylbenzene, xylenes, and CrVI (MFA and AECOM, 2014). However, no exceedances of these IHSs were observed in the shallow aquifer (see Figure 3). Total chromium was monitored in the deep aquifer wells from 2004 to 2013, and the only total chromium concentration above the CrVI CUL was in the upgradient deep well (MW-14) (see Table 1).

IHS concentrations are significantly lower in the deeper aquifer. The only IHSs that have exceeded a CUL in deep groundwater since 2004 are arsenic, copper, cPAHs, and PCP (see Table 1). Concentrations of all IHSs monitored in deep groundwater show declining trends, and CUL exceedances have not been detected in the downgradient deep wells (MW-7 and MW-18) since 2007 (Table 1) (MFA and AECOM, 2014). During the last four monitoring events, the only IHSs exceeding their CULs in the upgradient deep groundwater well (MW-14) were arsenic and copper (see Table 1 and Figure 3). These observations indicate that CULs are currently being met in the existing deep groundwater wells and suggest that CULs will continue to be met in the future.

No deep wells are located on the Port property, but given the low concentrations detected in deep groundwater on the Property and the lower concentrations of IHSs detected in the shallow groundwater on the Port property relative to the Property, deep groundwater on the Port property is believed not to be impacted by IHSs at levels that could pose a concern regarding human health or the environment.

3.3 Risk Evaluation

The Property and the Port property are zoned Port Maritime and Industrial and are surrounded by industrial facilities. Following cleanup, the Site will continue to be used for industrial operations indefinitely.

Exposures to human populations (on-site workers) could occur through:

- Direct contact with, ingestion of, or inhalation of dust entrained in air from contaminated shallow soil in the Restricted Area if soil beneath the protective cap is exposed
- Direct contact with shallow groundwater throughout the Site

The soil-to-groundwater pathway has been mitigated by the implementation of remedial actions at the Property, including soil removal and the protective cap in the Restricted Area, which limits infiltration of stormwater and leaching of contamination remaining in soil.

Groundwater from the shallow and deep aquifers is not currently used and will not be used in the future as a source of drinking water. Groundwater beneath the Site and surface water in the Puyallup River, to which groundwater discharges, are not considered suitable for use as a domestic water supply. In addition, as part of the Consent Decree, an environmental covenant will be placed on the Property to restrict domestic uses of groundwater. Therefore, the groundwater-ingestion pathway for humans is not complete and human ingestion of contaminated water is not considered a potential risk.

Ecology has determined that the highest beneficial use of groundwater at the Site is discharge to surface water. The Puyallup River is approximately 200 feet west of the Site. Groundwater on the Property likely discharges to the Puyallup River; however, the horizontal recovery well contains and removes contaminated groundwater in the source area, eliminating the groundwater-to-surface-water pathway, and previous groundwater monitoring and attenuation modeling indicate that IHS concentrations in groundwater attenuate to undetectable levels before reaching the CPOC at the downgradient Property boundary.

There is no exposure for ecological receptors at the Site. The Site is covered by buildings, pavement, or other physical barriers that prevent plants or wildlife from being exposed. Aquatic life in the Puyallup River could be a receptor; however, as noted above, modeling and water quality monitoring results indicate that groundwater impacts do not reach the river, and the installation of a stormwater treatment system significantly reduced the potential adverse impacts to surface water from the Site. Engineered and institutional controls will be maintained to prevent potentially complete exposure pathways for ecological receptors.

3.4 Post-Remedial-Action Conditions

The primary objectives of the groundwater compliance monitoring discussed in this CMP are to demonstrate that the Site remedy is protective of receptors in surface water and to provide early warning, via sentry wells, of changes in groundwater conditions indicative of potential contaminant migration to the Puyallup River (see Section 5 for further details). The surface-water-exposure pathway has been eliminated by the completed remedial actions at the Site, which include capping to mitigate the soil-to-groundwater pathway and operation of the horizontal recovery well to eliminate the groundwater-to-surface-water pathway. Monitoring will continue in accordance with this CMP to ensure continued protection of surface water receptors.

4 REMEDIATION LEVELS

The compliance monitoring program put forth in this CMP relies on sentry wells and RELs to provide early warning of a possible exceedance of groundwater CULs at the CPOC. RELs are attenuation-modeling-derived concentrations that, if not exceeded, indicate that IHS concentrations in groundwater will not exceed CULs at the CPOC.

An REL exceedance in a sentry well would provide early detection of possible IHS migration from the source area at concentrations that could be of concern at the CPOC. Groundwater in the source area is captured and removed by the horizontal recovery well; therefore, in the source area, RELs will be used to assess the need for continuing groundwater treatment, but not for compliance purposes. REL exceedances would be a concern only if detected in sentry wells, all of which are located downgradient of the source area.

The rationale for using RELs as opposed to CULs is that it is overly conservative to apply CULs at the selected compliance monitoring network wells because they are not located at the CPOC—they are located either in the source area or immediately downgradient of the source area (e.g., sentry wells)—and attenuation is expected to occur between the compliance monitoring wells and the CPOC.

Conservative attenuation modeling was conducted in order to develop RELs based on estimates of the amount of attenuation that will occur between a well and the CPOC. Attenuation modeling using BIOSCREEN was conducted as part of the RI/FS (MFA and AECOM, 2014). This same modeling approach was used to develop RELs.

BIOSCREEN input values are summarized in Table 2. CULs (as selected in the CAP [Ecology, 2016]) to be met at the CPOC and modeling-derived RELs for each compliance monitoring well are shown in Table 3. The selection of wells for use in the compliance monitoring network is discussed in Section 5.2.

RELs were developed using the following steps:

- Aquifer-specific hydraulic conductivity (K), hydraulic gradient (i), and effective porosity values (n) (as shown in Table 2) were used to calculate seepage velocities (v) for each aquifer, using the following equation:

$$v = (K)(i)/n$$

- The seepage velocities were used to estimate the time of travel (t) required for groundwater to migrate the distance (d) from each sentry well to the CPOC (i.e., the Property boundary), as follows (as a conservative estimate, no retardation was included):

$$t = d/v$$

- The aquifer-specific seepage velocities were used as inputs to BIOSCREEN. All other model input values remained the same as in the RI/FS, with the exception of the dispersivity values for the deep aquifer. Dispersivity values were calculated for the deep aquifer by the same methodology documented in the RI/FS, using an assumed plume length of 160 feet, which is equal to the approximate distance from upgradient deep monitoring well MW-14 to downgradient deep monitoring well MW-7.
- The BIOSCREEN model was run for a simulation time equal to the time of travel from each well to the CPOC. Source concentrations were increased until the resulting concentration at the CPOC was equal to a CUL.

- The source concentration that resulted in a concentration equal to a CUL at the CPOC was selected as the REL for each well.

RELs were also established, based on distance from the CPOC, according to the procedure described above. The time of travel for each increment of distance from the CPOC was calculated and used as the simulation time in BIOSCREEN. RELs for each IHS were estimated at 25-foot increments from the CPOC (see Table 4). RELs will be selected from Table 4 for any new sentry wells installed at the Site (if needed; see Section 6), based on the well's distance from the CPOC.

The seepage velocities and dispersivities (longitudinal and transverse) differ between the shallow and the deep aquifers. Since the seepage velocity is greater in the deep aquifer, the travel time to the CPOC at a given distance is shorter in the deep aquifer; however, the seepage velocity and longitudinal and transverse dispersivities have a negligible effect on attenuation in this model, and therefore the RELs at a given distance are the same in both the shallow and the deep aquifers. The longitudinal and transverse dispersivities are tied to the decay rate, which is assumed to be zero; therefore, varying the longitudinal and transverse dispersivities has a negligible effect on attenuation. In this no-decay simulation, attenuation is most sensitive to the vertical dispersivity, which is not affected by travel time in the aquifer and is assumed to be the same in the shallow and deep aquifers. Therefore, the RELs included in Table 4 are applicable to either shallow or deep sentry wells.

Note that RELs were not calculated for benzene, ethylbenzene, xylenes, and CrVI in deep groundwater because, although these IHSs are not monitored in the deep aquifer wells, they were not detected above CULs in shallow groundwater from 2004 to 2015 (MFA, 2015) and total chromium has not been detected above the CrVI CUL in the downgradient deep groundwater wells (MW-7 and MW-18) since 2004 (MFA and AECOM, 2014). Therefore, this monitoring program will not include analysis for these IHSs in deep groundwater samples (see Section 5.4).

The following section discusses how RELs will be applied in the compliance monitoring program.

5 MONITORING PROGRAM

This section provides the monitoring program objectives and details, including selection of the monitoring network, stages of monitoring, and the sampling and analysis program.

5.1 Monitoring Objectives

The primary objectives of the groundwater-related remedial actions at the Site are to reduce source area concentrations in groundwater, protect groundwater from further contamination, and prevent contaminant migration to the Puyallup River. The groundwater monitoring program will:

- Provide confirmation of the ongoing effectiveness of the Site remedy.

- Provide information about the ongoing performance of the horizontal recovery well and soil remedial actions on the Property.
- Ensure that CULs are met at the CPOC.
- Provide early warning, via sentry wells, of the potential for future CUL exceedances at the CPOC.
- Prevent exceedances of CULs at the CPOC through implementation of contingency measures, if needed.

5.2 Groundwater Monitoring Network

Monitoring activities will be conducted for both the shallow and the deep groundwater aquifers under the Site, using a combination of water level monitoring network wells, compliance monitoring network wells, and final closure monitoring network wells, as discussed below (see Table 5 and Figures 4 to 6).

Well logs for MW-4 and MW-15 through MW-20 are provided in Appendix B. Well logs for the other existing wells are unavailable.

Water Level Monitoring Network

Water levels will be monitored during all stages of monitoring in all existing Site wells in order to evaluate hydraulic gradients in the shallow and deep aquifers (see Table 5 and Figure 4).

Compliance Monitoring Network

During the protection, performance, and confirmational stages of monitoring, groundwater samples will be collected from the compliance monitoring network wells and analyzed (see Sections 5.3.1 to 5.3.3). The compliance monitoring network includes the following wells (see Figure 5):

- **Horizontal recovery well: HW-01.**
- **Sentry wells:** MW-4, MW-19, and MW-20 in the shallow aquifer; MW-7 and MW-18 in the deep aquifer; and any additional sentry wells installed as part of a Tier 3 contingency (see Section 6.3).
- **Source area monitoring wells:** MW-3 and MW-8 in the shallow aquifer; MW-14 in the deep aquifer.

Final Closure Monitoring Network

During the final closure stage of monitoring, groundwater samples will be collected from all remaining Site monitoring wells (see Table 5 and Figure 6) and analyzed (see Section 5.3.3).

Monitoring Well UPRR-MW-29

During all stages of monitoring, groundwater samples will be collected from shallow aquifer monitoring well UPRR-MW-29—located on the Port property—and analyzed. However, Ecology has determined that discharge to surface water is the highest beneficial use of groundwater at the Site, and groundwater monitoring results indicate that IHSs are not migrating to surface water on the Port property (Ecology, 2016). Therefore, UPRR-MW-29 will not be used as a sentry well and is not included in the compliance monitoring network (see Table 5 and Figure 5). During the protection, performance, or confirmational stages of monitoring, sample results from UPRR-MW-29 will be used to evaluate IHS concentration trends and hydraulic gradients, but will not be evaluated for compliance with RELs or CULs. However, UPRR-MW-29 is included in the final closure monitoring network (see Table 5 and Figure 6), and during the final closure stage of monitoring, sample results from this well will be evaluated for compliance with CULs.

5.2.1 Monitoring Well Installation

Future monitoring wells will be installed in accordance with Washington State well construction standards (WAC 173-160) and the procedures outlined in the attached sampling and analysis plan (SAP) (Appendix C). Soil lithology and any evidence of contamination (e.g., odors, staining) will be recorded during well installations. Ecology will be notified at least 30 days before installation of new groundwater monitoring network wells.

5.2.2 Monitoring Well Decommissioning

Monitoring wells will be maintained in order to meet the functional well standards put forth in the Washington State Minimum Standards for Construction and Maintenance of Wells (WAC 173-160); however, in the event that a monitoring well becomes damaged and requires replacement; becomes operationally problematic to maintain; is deemed no longer needed for final closure monitoring (e.g., following a demonstration of compliance with CULs for those wells not included in the compliance monitoring network or for the deep aquifer compliance monitoring network wells, as discussed in Section 5.3.3); or following termination of the groundwater monitoring program (see Section 5.3.3), the well may be decommissioned with Ecology's approval. Ecology will be notified 30 days before any planned well-decommissioning activities. Monitoring well decommissioning will be completed by a licensed well driller, in accordance with WAC 173-160 and the procedures outlined in the SAP (Appendix C).

The horizontal recovery well is completed in the shallow aquifer and is included in the compliance monitoring network (see Section 5.2, Table 5, and Figure 5); therefore, it will be maintained for monitoring during the final closure monitoring stage and for potential restarting in response to a triggered contingent action (see Section 6), even after its eventual shutdown following completion of the protection monitoring stage (as discussed in the next section). The horizontal recovery well will not be decommissioned until the criteria for terminating the monitoring program have been met, as discussed in Section 5.3.3.

5.3 Stages of Monitoring

Compliance monitoring at the Site will be conducted in three stages: protection, performance, and confirmational, in accordance with MTCA compliance monitoring requirements (WAC 173-340-410), as described below:

- **Protection monitoring:** Confirm that human health and the environment are adequately protected during the construction, operation, and maintenance periods of an interim action or cleanup action.
- **Performance monitoring:** Confirm that once attained, RELs continue to be met following termination of the horizontal recovery well's operation.
- **Confirmational monitoring:** Confirm the long-term effectiveness of the groundwater extraction and containment remedy component following completion of protection monitoring. This stage of monitoring also includes a "final closure monitoring" stage to confirm the long-term effectiveness of the groundwater remedy once CULs have been attained throughout the Site and to determine that the groundwater monitoring program can be terminated.

This section includes detailed information on how each of these three stages of monitoring will be applied at the Site, as illustrated in flow charts (see Figures 7A through 7C), including:

- Monitoring frequency
- Applicable cleanup standards (e.g., RELs or CULs)
- Ecology notification requirements
- Criteria for proceeding from one stage of monitoring to the next
- Conditions triggering contingent measures
- Criteria for terminating operation of the horizontal recovery well
- Criteria for the eventual termination of the compliance monitoring program

The monitoring program relies primarily on semiannual and annual monitoring. Seasonal fluctuations in groundwater elevations were evaluated as part of the RI/FS (MFA and AECOM, 2014). In general, the highest groundwater elevations were measured in January and February and the lowest in September and October. Therefore, the semiannual monitoring included in this CMP will be conducted during the high (January or February) and low (September or October) groundwater periods. Annual monitoring events will be conducted in January or February, consistent with sampling conducted during the RI/FS and as described in the Groundwater Interim Action Implementation Report (ThermoRetec, 1999).

Groundwater monitoring in the deep aquifer will be discontinued once the requirements outlined in Section 5.5 have been met.

During any stage of monitoring, a demonstration of compliance with CULs may be made for an individual monitoring well. The criteria for demonstrating compliance with CULs are discussed in Section 5.3.3. Following a demonstration of compliance and with Ecology approval, monitoring of the well may be terminated and the well decommissioned.

5.3.1 Protection Monitoring

Protection monitoring will be conducted during the period of active groundwater treatment (i.e., while the horizontal recovery well is operational) (see Table 5 and Figure 7A).

Protection monitoring includes the following activities:

- Groundwater sample collection and analysis from all compliance monitoring network wells (see Table 5 and Figure 5) for evaluation of compliance with RELs while the horizontal recovery well is operational
- Water level measurements in all water level monitoring network wells (see Table 5 and Figure 4) for evaluation of hydraulic gradients

During the protection monitoring stage, groundwater samples will also be collected from monitoring well UPRR-MW-29 and analyzed to evaluate IHS concentration trends; however, the results will not be evaluated for compliance with RELs or CULs.

Protection monitoring includes the following steps, as depicted in Figure 7A:

- Operate the horizontal recovery well until RELs have been attained in all compliance monitoring network wells.
- Monitor compliance monitoring network wells semiannually for two years. After two years of semiannual monitoring have been completed, the monitoring frequency will be reduced to annual.
- Quarterly monitoring will begin after two consecutive years of annual protection monitoring have been completed, during which IHS concentrations have been below RELs in all compliance monitoring wells concurrently. Quarterly monitoring will be used to determine whether the horizontal recovery well can be shut down.
- Shut down the horizontal recovery well and proceed to the performance monitoring stage after IHS concentrations have been below RELs in all compliance monitoring network wells for four consecutive quarters. Until this milestone is achieved, the horizontal recovery well will continue to operate and protection monitoring will continue. Ecology will be notified at least 30 days before shutdown of the horizontal recovery well.
- If an REL is exceeded during the quarterly monitoring period, the monitoring frequency may revert to an annual schedule or continue on a more frequent basis, at the discretion of the Property owner.

At any point during the protection monitoring stage, if an IHS concentration exceeds its REL in a sentry well during two consecutive monitoring events or two consecutive high- or low-groundwater monitoring events, then the contingency measures, as outlined in Section 6 and illustrated in Figures 8A and 8B, will go into effect and will be conducted concurrently with other protection monitoring activities. Ecology will be notified within 30 days following any event that triggers contingency measures.

Groundwater treatment will be considered complete once it has been demonstrated that RELs have been attained in all compliance monitoring network wells, consistent with the monitoring program shown in Figure 7A. Once groundwater treatment is complete, the horizontal recovery well will be shut down and monitoring will proceed to the performance monitoring stage, as discussed in the next section of this CMP.

5.3.2 Performance Monitoring

Performance monitoring will begin after shutdown of the horizontal recovery well and will provide data to evaluate whether the completed groundwater treatment remedy (i.e., groundwater extraction and containment via the recovery well) has attained RELs or if additional groundwater treatment is required (i.e., restarting the horizontal recovery well).

Performance monitoring includes the following activities:

- Groundwater sample collection from all compliance monitoring network wells (see Table 5 and Figure 5) and analysis for evaluation of compliance with RELs after shutdown of the horizontal recovery well.
- Water level measurements in all water level monitoring network wells (see Table 5 and Figure 4) for evaluation of hydraulic gradients.

During the performance monitoring stage, groundwater samples will also be collected from monitoring well UPRR-MW-29 and analyzed to evaluate IHS concentration trends; however, the results will not be evaluated for compliance with RELs or CULs.

Performance monitoring includes the following steps, as depicted in Figure 7B:

- Monitor compliance monitoring network wells semiannually for at least two years.
- If an IHS concentration exceeds its REL during two consecutive monitoring events or during two consecutive high- or low-groundwater monitoring events in any one compliance monitoring network well, restart the horizontal recovery well and revert to the protection monitoring stage. If the REL exceedances were detected in a sentry well, also initiate contingency measures (see Section 6 and Figures 8A and 8B).
- Proceed to the confirmational monitoring stage after two consecutive years of semiannual monitoring (four consecutive monitoring events) have been completed without two consecutive REL exceedances in any one compliance monitoring well (i.e., during two consecutive monitoring events or during two consecutive high- or low-groundwater monitoring events).

Ecology will be notified within at least 30 days after any of the following activities:

- Initiating confirmational monitoring
- Restarting the horizontal recovery well and reverting to protection monitoring
- Initiating contingency measures

A higher density of water level measurement points is recommended during active operation of the horizontal recovery well in order to characterize flow directions for monitoring containment of contaminated groundwater in the treating area. However, following completion of the performance monitoring stage, fewer wells may be needed to provide sufficient coverage for monitoring hydraulic gradients under normal flow conditions (i.e., after shutdown of the horizontal recovery well). For those wells no longer needed for monitoring water levels, a request for terminating monitoring and decommissioning the well may be made following a demonstration of compliance with CULs, as discussed in the next section.

Monitoring will proceed to the confirmational monitoring stage, as discussed in the next section of this CMP, once RELs have been attained in all compliance monitoring wells for two consecutive years following shutdown of the horizontal recovery well.

5.3.3 Confirmational Monitoring

Confirmational monitoring will begin following completion of the performance monitoring, and results will be used to evaluate the following:

- Long-term compliance with RELs following completion of the groundwater remedy (i.e., after shutdown of the horizontal recovery well)
- Ultimately, attainment of CULs

Final closure monitoring results will be used to demonstrate the following:

- Long-term compliance with CULs.
- The requirements have been met for termination of the groundwater monitoring program.

Confirmational monitoring includes the following activities, as depicted in Figure 7C:

- Groundwater sample collection and analysis from all compliance monitoring network wells (see Table 5 and Figure 5) for evaluation of long-term compliance with RELs and, ultimately, attainment of CULs.
- Water level measurements in all water level monitoring network wells (see Table 5 and Figure 4) for evaluation of hydraulic gradients. Water levels will be monitored in the water level monitoring network wells as long as the wells are present at the Site (see discussion below regarding demonstrating compliance with CULs on a well-by-well basis).
- Monitor compliance monitoring network wells at a minimum frequency of once every five years during the high-groundwater period (i.e., January or February). The first confirmational monitoring event will be conducted in January or February of the fifth year after completion of performance monitoring and every five years thereafter.
- Proceed to the final closure monitoring stage at any time after the first confirmational monitoring event where IHS concentrations in all compliance monitoring network wells

concurrently are below CULs. At least one confirmational monitoring event will be performed before the start of final closure monitoring.

- Revert to the performance monitoring stage if an IHS concentration in a sentry well exceeds its REL during any one confirmational monitoring event.

Ecology will be notified within at least 30 days after reversion to the performance monitoring stage.

During the confirmational monitoring stage, groundwater samples will also be collected from monitoring well UPRR-MW-29 and analyzed to evaluate IHS concentration trends, but the results will not be evaluated for compliance with RELs or CULs. However, during final closure monitoring, groundwater samples will be collected from monitoring well UPRR-MW-29 and analyzed to evaluate compliance with CULs, as discussed below.

Absent Ecology approval of an alternate response, the following actions will be taken if a once-every-five-years monitoring event is not conducted (i.e., the event is administratively overlooked):

- Ecology will be notified within 30 days following identification of the oversight.
- A confirmational monitoring event will be conducted as soon as possible following the missed event and then the normal monitoring schedule will resume. However, if a monitoring event is not conducted within three years of the due date of the original event, then two annual monitoring events will be conducted after the missed event. Following that, the once-every-five-years monitoring frequency will resume.
- During the course of the compliance monitoring program, if two five-year monitoring events are missed by 30 or more days, then the confirmational monitoring frequency will decrease to once every three years.

Final closure monitoring includes the following activities, as depicted in Figure 7C:

- Groundwater sample collection and analysis from all final closure monitoring network wells (see Section 5.2, Table 5, and Figure 6) to evaluate compliance with CULs.
- Water level measurements in all water level monitoring network wells (see Table 5 and Figure 4) to evaluate hydraulic gradients. Water levels will be monitored in the water level monitoring network wells as long as the wells remain active (see discussion below regarding demonstrating compliance with CULs on a well-by-well basis).
- Monitor final compliance monitoring network wells at a minimum frequency of once every five years; the frequency of the final closure monitoring will be determined by the Property owner and operator.
- Revert to the performance monitoring stage if an IHS concentration in a sentry well exceeds its REL during any one groundwater monitoring event.
- Terminate the compliance monitoring program after it has been demonstrated that concentrations of all IHSs are in compliance with CULs in all final closure monitoring network wells.

Compliance with CULs may be demonstrated by meeting one or more of the following requirements:

- IHS concentrations have been below CULs during the last four consecutive confirmational monitoring events.
- A statistical determination of compliance with CULs has been made in accordance with the requirements put forth in MTCA (173-340-720[9]).

It is necessary to obtain compliance with CULs in all final closure monitoring wells (see Table 5 and Figure 6) before termination of the monitoring program.

A demonstration of compliance with CULs, and a request for terminating monitoring and decommissioning an individual well, may be made on a well-by-well basis for only those "other monitoring wells" included in the final closure monitoring network or the deep aquifer wells (see Table 5 and Figure 6).

Termination of monitoring and decommissioning of the shallow aquifer "compliance monitoring network wells" (see Section 5.2, Table 5, and Figure 5; these include those final closure monitoring network wells completed in the shallow aquifer that are designated for use as sentry wells or source area wells and the horizontal recovery well) will not be completed until a demonstration of compliance with CULs has been made for all, or all remaining, "final closure monitoring network wells" concurrently and that the criteria for termination of the compliance monitoring program have been met.

The Property owner will notify Ecology of its intent to terminate the compliance monitoring program at least 60 days before the next scheduled monitoring event; this notification will include monitoring data demonstrating that the termination criteria have been met. If the termination criteria have been met, Ecology will approve termination of all groundwater compliance monitoring activities and decommissioning of all wells.

The Property owner will notify Ecology of its intent to terminate monitoring of "other monitoring wells" (see Table 5 and Figure 6) on a well-by-well basis, at least 60 days before the next scheduled monitoring event; this notification will include monitoring data demonstrating that the termination criteria have been met for the individual well. If the termination criteria have been met, Ecology will approve termination of groundwater monitoring activities and decommissioning of the well.

5.4 Sampling and Analysis

Groundwater monitoring will include measuring water levels and water quality parameters (e.g., dissolved oxygen, pH, temperature, and specific conductance) and the collection and analysis of groundwater samples. Groundwater monitoring activities will be conducted in accordance with the methods and protocol outlined in the SAP (see Appendix C).

Groundwater samples collected in association with compliance monitoring activities will be analyzed for IHSs, using the following analytical methods or comparable analytical methods deemed by Ecology to be suitable alternatives and approved for use:

- Dissolved arsenic and copper by U.S. Environmental Protection Agency (USEPA) Method SW6020 or 200.8.
- Total CrVI by USEPA Method SM3500CR-B or 7196A (only shallow groundwater).
- Benzene, ethylbenzene, and xylenes by USEPA Method SW8260 or SW8021 (only shallow groundwater).
- cPAHs by USEPA Method SW8270-selective ion monitoring (SIM).
- PCP by USEPA Method SW8270-SIM.

Note that benzene, ethylbenzene, xylenes, and CrVI will not be analyzed in deep groundwater samples because these IHSs have not been detected above CULs in deep groundwater since 2004 (see Section 3.2.2.2 and MFA and AECOM, 2014).

The contractor will confirm that the method reporting limits do not exceed the CULs shown in the REL tables (see Tables 3 and 4).

During all stages of monitoring, if at any time the quality of data for a sample is believed to be compromised by a quality assurance and quality control (QA/QC) issue, a second sample may be collected within 30 days.

Groundwater monitoring and horizontal recovery well operation and maintenance activities at the Site will comply with provisions outlined in the Site's specific health and safety plan. The contractor will be required, before beginning work, to prepare a health and safety plan, which is to be available for review by Ecology upon request.

5.5 Deep Groundwater

A summary of deep groundwater analytical results compared to CULs and well-specific RELs is included as Table 1. Annual groundwater monitoring results indicate little to no downgradient migration of IHSs in deep groundwater. IHSs either have not been detected, or they have been detected at concentrations below CULs, in Ecology-approved downgradient deep wells (MW-7 and MW-18) since 2008. During the most recent monitoring event, conducted in 2015 (MFA, 2015), arsenic and copper were the only IHSs detected above their CULs and RELs in the deep source area well (MW-14).

Monitoring of the deep aquifer will continue until sufficient data have been collected to demonstrate long-term compliance with cleanup standards and to terminate monitoring, as evidenced by meeting the following:

- IHS concentrations in the shallow source area well (MW-8) and horizontal recovery well (HW-01) show stable or decreasing trends;
- IHS concentrations in the source area deep well (MW-14) have been below RELs for four consecutive monitoring events; and
- IHS concentrations in the deep sentry wells (MW-7 and MW-18) have been below CULs for four consecutive monitoring events.

Once the MTCA requirements have been met, deep groundwater monitoring will be discontinued. The compliance monitoring program and schedule described in the previous section and shown in Figures 7A through 7C, and the contingency measures discussed in the next section, apply if these requirements are not met in the deep aquifer.

The Property owner will notify Ecology of its intent to terminate groundwater monitoring in the deep aquifer wells at least 60 days before the next scheduled monitoring event; this notification shall include monitoring data demonstrating that the termination criteria have been met. Ecology will approve termination of deep groundwater compliance monitoring activities if the termination criteria have been met.

Once the criteria for termination of deep groundwater monitoring have been met, the Property owner may also request Ecology approval to decommission a deep groundwater monitoring well if the criteria for decommissioning a well have also been met (see Section 5.3.3). For the source area deep well (MW-14), a demonstration of compliance with CULs is not required in order to terminate deep groundwater monitoring (see criteria listed above), but is required prior to decommissioning the well or terminating the monitoring program for the Site (see Section 5.3.3).

6 CONTINGENCY MEASURES

Sentry wells are included in the water level monitoring network, compliance monitoring network, and final closure monitoring network (see Section 5.2, Figures 4 to 6, and Table 5) and will be monitored during all three stages of the compliance monitoring program (protection, performance, and confirmational), as discussed in the previous section. If an REL is exceeded during two consecutive monitoring events or two consecutive high- or low-groundwater monitoring events in a sentry well at any point during the three stages of monitoring, then contingency measures will be implemented, as described in this section.

Contingency measures are specific actions that will be implemented in response to defined triggers and are grouped into four tiers, as discussed below and illustrated in Figures 8A and 8B.

6.1 Tier 1

Tier 1 contingencies are triggered when an IHS concentration in a sentry well exceeds its REL during two consecutive monitoring events or two consecutive high- or low-groundwater monitoring events, and include the following actions (see Figure 8A):

- More frequent monitoring (quarterly frequency) of the affected sentry well to determine whether the REL exceedances were an isolated occurrence or are indicative of increasing concentration trends
- Restarting the horizontal recovery well and reverting to the protection monitoring stage (if those activities are not currently being conducted)
- Notifying Ecology within 30 days after a final laboratory report is obtained showing the second consecutive REL exceedance in a sentry well

Quarterly monitoring will be initiated in the affected sentry well within three months after the sampling date of the second consecutive REL exceedance. Quarterly samples will be analyzed only for those IHSs that exceeded an REL. While Tier 1 contingencies are in effect, the horizontal recovery well will be operational and monitoring of the affected sentry well and all other compliance monitoring wells at the Site will continue in accordance with the protection monitoring requirements, as discussed in Section 5.3.

If IHS concentrations in the affected sentry well are below RELs for four consecutive quarters:

- Monitoring will resume on a semiannual/annual basis consistent with the current stage of protection monitoring.
- Tier 1 contingencies will be considered complete.

If after two years of quarterly monitoring (eight quarters), IHS concentrations show a declining trend, and no detected IHS concentration is greater than two times an REL, quarterly monitoring will be continued. After two years of monitoring, the determination of whether to continue quarterly monitoring shall be made based on these two criteria after each quarterly monitoring event.

If after two years of quarterly monitoring (eight quarters), IHS concentrations have not been below RELs for at least four consecutive quarters and the criteria for extending quarterly monitoring are not met, Tier 2 contingencies will be triggered. However, if (a) IHS concentrations are above RELs for four consecutive quarters, and (b) IHS concentrations in a sentry well exceed two times the REL during two consecutive monitoring events or two consecutive high or low groundwater monitoring events, then Tier 3 contingencies will be triggered.

6.2 Tier 2

Ecology will be notified within 30 days after a final laboratory report is received indicating that Tier 2 contingencies have been triggered (see previous section). Tier 2 contingencies involve performing more robust groundwater modeling to evaluate the RELs currently in use at the Site (see Figure 8B).

A groundwater modeling proposal will be submitted to Ecology for approval within three months of receipt of a final laboratory report indicating that Tier 2 contingencies have been triggered.

A specific groundwater model to use for the Tier 2 modeling is not proposed at this time, but an appropriate model will be selected using the criteria listed below. The primary objective will be to select a fate and transport model that is more robust than the BIOSCREEN model used previously; the selection will be based on the ability to model the following conditions:

- Plume geometry (e.g., two or three plume dimensions)
- Chemical-specific degradation by biological and/or geochemical processes (as appropriate to the IHS)
- Chemical dispersion in two or three dimensions
- Hydraulic boundary conditions and features (e.g., no-flow boundaries and/or sinks)
- Aquifer heterogeneities

Other factors may also be considered in the model selection specific to the modeling conditions, including the IHS(s) being modeled, aquifer conditions, and other site-specific parameters. Currently available models that would potentially satisfy the modeling criteria listed above include the numerical models MODFLOW and Groundwater Modeling System.

The modeling will be completed and documented in a modeling report submitted to Ecology within three months of Ecology's approval of the proposed model (the "modeling report"). If the modeling supports use of revised RELs, the modeling report will recommend revised RELs, and will include an assessment of whether IHS concentrations in sentry wells as of that date would trigger Tier 1 or Tier 2 contingencies when compared to the revised RELs. Based on the modeling report, Ecology will determine whether to approve revised RELs. If approved by Ecology, the revised RELs will be compared to the previous monitoring data and a new determination will be made about whether Tier 1 or Tier 2 contingencies are triggered following the logic and applying the criteria set forth in Section 6.1. Throughout Tier 2, quarterly monitoring of the affected sentry well will continue as in Tier 1.

Tier 3 contingencies will be triggered if any of the following events occur:

- Ecology does not approve the proposed groundwater model within three months after Ecology's receipt of the modeling report; this deadline may be extended by Ecology.
- The modeling report does not support revised RELs.
- The modeling report indicates that IHS monitoring data collected to date will still trigger Tier 2 contingencies, or would trigger Tier 3 contingencies, when compared to revised RELs.

If Tier 3 contingencies are not triggered, the IHS monitoring results collected to date will be compared to the revised RELs to select the appropriate stage of monitoring, and then compliance monitoring activities will be resumed in accordance with this CMP.

6.3 Tier 3

Tier 3 involves the installation of up to two additional sentry well(s) in the immediate vicinity, either downgradient or crossgradient, of the existing sentry well (or wells) with the REL exceedances. The purpose of installing a new sentry well(s) in the vicinity of the original, affected sentry well is to determine whether the REL exceedances observed in the original well are localized or represent widespread groundwater contamination and/or IHS migration at concentrations that exceed RELs.

New sentry wells will be installed within three months of the event triggering Tier 3. New sentry wells will be installed in accordance with the policies and procedures discussed in Section 5.2.1 and the SAP (Appendix C). Applicable RELs for new sentry wells will be selected from Table 4 on the basis of the well's straight-line distance from the CPOC in the inferred direction of groundwater flow (see Appendix A); or revised RELs will be selected from the modeling report. Monitoring in the affected sentry wells will continue on a quarterly basis while the Tier 3 sentry well locations are selected and the new wells are installed and developed.

Following installation and development, the new sentry wells will be monitored on a quarterly basis and concentrations compared to RELs. If RELs are exceeded in the new wells during any of the next four quarters, Tier 4 contingency measures, as discussed below, will be triggered. The new sentry wells will be incorporated into the compliance monitoring network, and monitoring will proceed according the current stage of monitoring.

Monitoring of the original sentry well will continue in accordance with the current stage of monitoring, and the well will be included in the final closure monitoring network, but ongoing REL exceedances in the original sentry well will not trigger additional contingent actions once a Tier 3 response has been triggered by the well.

6.4 Tier 4

Tier 4 involves additional subsurface investigation and/or source characterization for the purpose of determining whether additional or different remedial action(s) is necessary to ensure that CULs are met at the CPOC.

Within six months of the event triggering a Tier 4 contingency, the Property owner or its representative will produce and submit to Ecology a work plan with proposed additional subsurface characterization and/or source characterization activities and a schedule for completion for Ecology's review and approval. Tier 4 investigation activities will focus on the upgradient source areas, as identified in the RI/FS (MFA and AECOM, 2014). Following additional characterization activities, any determination of whether additional or different remedial action is necessary will be made by Ecology and will be governed by the terms of the Consent Decree and MTCA.

7 NOTIFICATION AND REPORTING

Ecology will be notified at least 30 days before the following activities are conducted:

- Installation, decommissioning, or replacement of any site monitoring wells
- Terminating operation of the horizontal recovery well and proceeding to the performance monitoring stage

Ecology will be notified within 30 days after the following activities:

- Restarting operation of the horizontal recovery well;
- Required shutdown of the horizontal recovery well (e.g., for cleaning or repair) during any stage of the groundwater monitoring program where operation of the horizontal recovery well is required (see Section 5.3) that results in it being nonoperational for 30 consecutive days or more (see the SMP [MFA, 2016]). Notice is required within 30 days of the 30th consecutive day of shutdown (i.e., 60 days following the first day of the shutdown);
- Reverting to a previous stage of the monitoring program (e.g., from performance monitoring to protection monitoring);
- Initiating confirmational monitoring;
- Determination that a once-every-five-years confirmational monitoring event was missed; or
- Events triggering contingent actions, including the following:
  - Receipt of a final laboratory report showing a second consecutive REL exceedance in a sentry well; or
  - Receipt of a final laboratory report showing that Tier 2 has been triggered.

Additional Ecology notification and reporting requirements are listed below:

- Ecology will be notified at least 60 days before the intended date for terminating monitoring and decommissioning of wells in response to:
  - Attainment of cleanup criteria in deep aquifer wells in accordance with the requirements put forth in Section 5.5.
  - Attainment of CULs for an individual monitoring well (see Section 5.3.3 for eligible wells).

- Attainment of CULs in all final closure monitoring wells and intended termination of the compliance monitoring program.

- A groundwater modeling proposal will be submitted to Ecology for approval within three months of receipt of a final laboratory report indicating that Tier 2 contingencies have been triggered.

- Groundwater modeling work conducted under a Tier 2 contingency will be completed and documented in the modeling report submitted to Ecology within three months of Ecology's approval of the proposed model.

- Within six months of the event triggering a Tier 4 contingency, the Property owner or its representative will produce, and submit for Ecology's review and approval, a work plan with proposed additional subsurface characterization and/or source characterization activities and a schedule for completion.

- Groundwater monitoring reports will be submitted to Ecology by April 1 each year during the protection and performance stages of monitoring and by April 1 every five years during the confirmational monitoring stage. The reports will provide a description of sampling activities, analytical data, field measurements of groundwater quality parameters and groundwater levels, a discussion of analytical data trends, and data validation reports. The data validation reports will provide a review of all raw data to verify that the laboratory has supplied the required QA/QC deliverables. The data will be validated against USEPA, Washington State, and laboratory-specific criteria for completeness and usability. The reports will also include (if applicable) information regarding the performance of the horizontal recovery well, including monthly inspection forms (as provided in the SMP [MFA, 2016]), monthly volumes of water pumped, pumping rate(s), operational failures and/or outages, duration of such conditions, remedies taken, etc. The reports will also include monitoring worksheets for the protective cap (as provided in the SMP [MFA, 2016]).

8 SCHEDULE

Compliance monitoring activities, as outlined in this CMP, will begin within six months following execution of the Consent Decree and Ecology's approval of this CMP.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

REFERENCES

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TABLES

Table 1
Deep Groundwater Analytical Results
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

		IHS:*	Arsenic, inorganic	Chromium (total)	Copper	Penta-chlorophenol	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Total Benzofluoranthenes	Chrysene	Dibenzo(a,h) anthracene	Indeno(1,2,3-cd) pyrene	cPAH TEQ (Calculated)
		CUL (ug/L):	5	50	2.4	3	NA	0.1	NA	NA	NA	NA	NA	NA	0.1
Location	Date														
MW-7		MW-7 RELs:	43	430	20	25	NA	NA	NA	NA	NA	NA	NA	NA	0.86
	02/04/2004		3.79	5.25	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
	05/25/2004		**5.62**	7.84	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
	09/08/2004		**5.69**	4.98	1 U	0.708	0.1 U	**0.146**	0.188	0.104	NA	0.125	0.1 U	0.125	**0.19**
	01/28/2005		4.92	6.11	1 U	**139**	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
	02/23/2005		--	--	--	0.5 U	--	--	--	--	NA	--	--	--	--
	01/25/2006		4.86	4.68	1 U	0.476 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	NA	0.0952 U	0.0952 U	0.0952 U	ND
	02/02/2007		10 U	6.85	1 U	1.6	0.0748	0.0913	0.0808	0.102	NA	0.086	0.00952 U	0.108	**0.13**
	01/30/2008		3.67	5.03	1 U	0.509	0.0943 U	0.0943 U	0.0943 U	0.0943 U	NA	0.0943 U	0.0943 U	0.0943 U	ND
	01/27/2009		2.41	5.37	1 U	1.79	0.043	0.0578	0.0567	0.0588	NA	0.0657	0.00943 U	0.046	0.079
	01/21/2010		2 U	18	5 U	0.049	0.023	0.025	0.038	0.013	NA	0.022	0.0095 U	0.016	0.034
	02/09/2011		2 U	5.1	5 U	0.094 U	0.094 U	0.19 U	0.094 U	0.094 U	NA	0.094 U	0.094 U	0.094 U	ND
	02/08/2012		5 U	2 U	5 U	0.028	0.019 U	0.038 U	0.021	0.019 U	NA	0.019 U	0.019 U	0.019 U	0.0021
	02/05/2013		5 U	3.9	5 U	0.044	0.0094 U	0.019 U	0.0094 U	0.0094 U	NA	0.0094 U	0.0094 U	0.0094 U	ND
	02/26/2015		2.9	NA	1.7	0.5 U	0.10 U	0.10 U	NA	NA	0.20 U	0.10 U	0.10 U	0.10 U	ND
MW-14		MW-14 RELs:	47	470	22	28	NA	NA	NA	NA	NA	NA	NA	NA	0.94
	02/05/2004		**154**	**75.2**	**82.6**	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
	05/25/2004		**152**	**101**	**62.7**	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
	09/08/2004		**112**	**67.6**	**54.2**	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.151	0.1 U	0.015
	01/27/2005		**215**	**201**	**136**	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
	01/24/2006		**51.4**	34.8	**37.4**	0.476 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	NA	0.0952 U	0.0952 U	0.0952 U	ND
	02/02/2007		**64**	**60.5**	**39.1**	0.472 U	0.00943 U	0.00943 U	0.00943 U	0.00943 U	NA	0.00943 U	0.00943 U	0.00943 U	ND
	01/31/2008		**40.9**	**59.9**	1 U	0.495	0.0952 U	0.0952 U	0.0952 U	0.0952 U	NA	0.0952 U	0.0952 U	0.0952 U	ND
	01/28/2009		**8.84**	7.41	1 U	0.472 U	0.00943 U	0.00943 U	0.00943 U	0.00943 U	NA	0.00943 U	0.00943 U	0.00943 U	ND
	01/21/2010		2 U	30	5 U	0.036	0.0094 U	0.019 U	0.0094 U	0.0094 U	NA	0.0094 U	0.0094 U	0.0094 U	ND
	02/09/2011		2 U	18	5 U	0.095 U	0.095 U	0.19 U	0.095 U	0.095 U	NA	0.095 U	0.095 U	0.095 U	ND
	02/07/2012		**60**	**110**	5 U	0.019 U	0.019 U	0.038 U	0.019 U	0.019 U	NA	0.019 U	0.019 U	0.019 U	ND
	02/05/2013		**6.6**	14	5 U	0.042	0.0095 U	0.019 U	0.0095 U	0.0095 U	NA	0.0095 U	0.0095 U	0.0095 U	ND
	02/27/2015		**270**	NA	**505**	0.5 U	0.10 U	0.10 U	NA	NA	0.20 U	0.10 U	0.10 U	0.10 U	ND
MW-18		MW-18 RELs:	42	420	20	25	NA	NA	NA	NA	NA	NA	NA	NA	0.85
	02/05/2004		1.22	5.58	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
	05/25/2004		1.36	6.71	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
	09/08/2004		1 U	5.06	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.113	0.132	0.1 U	0.014
	01/27/2005		1.79	7.66	1.97	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
	01/25/2006		1 U	6.9	1 U	0.476 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	NA	0.0952 U	0.0952 U	0.0952 U	ND
	02/02/2007		1 U	8.87	1 U	0.472 U	0.00943 U	0.00943 U	0.00943 U	0.00943 U	NA	0.00943 U	0.00943 U	0.00943 U	ND
	02/27/2015		0.8	NA	1.9	0.5 U	0.10 U	0.10 U	NA	NA	0.20 U	0.10 U	0.10 U	0.10 U	ND

Table 1
Deep Groundwater Analytical Results
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

NOTES:

Bold values indicate a CUL exceedance. MRLs for non-detect results were not compared to CULs.

Bold and highlighted values indicate an REL exceedance. MRLs for non-detect results were not compared to RELs.

Since hexavalent chromium data are unavailable, total chromium concentrations are compared to the hexavalent chromium cleanup level.

Metals results are the maximum of the total or dissolved fraction concentrations, whichever is greater, when both fractions were analyzed.

-- = not sampled.

cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient. Non-detects were set equal to zero in the cPAH TEQ calculation.

CUL = cleanup level.

IHS = indicator hazardous substance.

MRL = method reporting limit.

NA = not applicable.

ND = not detected.

REL = remediation level. Values obtained from Table 3.

U = analyte not detected at or above specified MRL.

ug/L = micrograms per liter.

*Benzene, ethylbenzene, xylenes, and hexavalent chromium were not analyzed in deep groundwater samples from 2004 to 2013.

Input	Definition	Value—Shallow Aquifer	Value—Deep Aquifer	Units	Source
Hydrogeology					
n_e	effective porosity	0.3	0.3	unitless	Effective porosity for a silty, fine-grained sand from Weight and Sonderegger, 2001.
K	hydraulic conductivity	1.91E-04	6.70E-03	cm/s	Average values from slug tests.
i	hydraulic gradient	0.005	0.001	ft/ft	Average gradients observed in 2004, excluding the anomalously high gradient in the shallow aquifer observed in November 2004 (MFA and AECOM, 2014).
V_s	seepage velocity	7.6	23	ft/y	Calculated from above inputs.
Dispersion					
a_x	longitudinal dispersivity	10	6	ft	Conservative estimate calculated, per Xu and Eckstein, 1995, using a plume length of 625 ft (shallow aquifer) and 160 ft (deep aquifer).
a_y	transverse dispersivity	1	0.6	ft	Conservative estimate calculated, per Xu and Eckstein, 1995, and Gelhar et al., 1992, using a plume length of 625 ft (shallow aquifer) and 160 ft (deep aquifer).
a_z	vertical dispersivity	0.5	0.5	ft	Conservative estimate calculated, per ASTM, 1995, and USEPA, 1986, using on a plume length of 625 ft (shallow aquifer) and 160 ft (deep aquifer), .
Adsorption					
R	retardation factor	1	1	unitless	No retardation.
Biodegradation					
Lambda	attenuation rate	0	0	1/day	No biodegradation.
Source Data					
Source Thickness in Saturated Zone		10	10	ft	The maximum observed aquifer thicknesses; includes both the saturated and unsaturated sections for the shallow aquifer.
Source Concentration	concentration observed in a sentry well	--	--	ug/L	Source concentrations were varied until the maximum concentration that resulted in a concentration equal to the cleanup level was achieved at the property boundary. These are the remediation levels presented in Tables 3 and 4. Values are dependent on the attenuation length and target concentration (i.e., the target cleanup level). Values converted to mg/L for input into the model.
Source Width		1509	1509	ft	Conservative maximum source width; equal to the entire property width near MW-4.
Soluble Mass		0.0001	0.0001	kg	Minimal soluble mass in the soil, based on the assumption that arsenic is present primarily in the dissolved phase.
For Evaluating Model Runs					
Target Concentration	cleanup level to be met at a specified distance	--	--	ug/L	Equal to the final cleanup levels for each groundwater indicator hazardous substance. Values converted to mg/L for input into the model.
Target Attenuation Length	distance to the conditional point of compliance	--	--	ft	Distance to the downgradient property boundary.

NOTES:
-- = multiple values used, as discussed in the "Source" comments.
ASTM = American Society for Testing and Materials.
cm/s = centimeters per second.
ft = feet.
ft/ft = feet per foot.
ft/y = feet per year.
kg = kilograms.
mg/L = milligrams per liter.
ug/L = micrograms per liter.
USEPA = U.S. Environmental Protection Agency.

Table 3
Remediation Levels by Compliance Monitoring Network Well
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

		Indicator Hazardous Substance:	Arsenic	Benzene	Chromium (VI)	Copper	cPAHs	Ethylbenzene	PCP	Xylenes
		Cleanup Level (ug/L):	5	51	50	2.4	0.1	2100	3	1000
Compliance Monitoring Network Well	Distance from CPOC (feet)*	Travel Time from Well to CPOC (years)	Remediation Level (ug/L)							
Shallow Aquifer										
Horizontal Recovery Well (HW-01)	1350	178	46	470	460	22	0.93	19000	27	9300
MW-3 (Source Area Well)	1290	170	45	460	450	21	0.91	19000	27	9100
MW-4 (Sentry Well)	625	82	32	320	320	15	0.64	13000	19	6400
MW-8 (Source Area Well)	1340	176	46	470	460	22	0.93	19000	27	9300
MW-19 (Sentry Well)	700	92	33	340	330	16	0.67	14000	20	6700
MW-20 (Sentry Well)	520	68	29	300	290	14	0.58	12000	17	5800
Deep Aquifer										
MW-7 (Sentry Well)	1150	50	43	NA	430	20	0.86	NA	25	NA
MW-14 (Source Area Well)	1380	60	47	NA	470	22	0.94	NA	28	NA
MW-18 (Sentry Well)	1130	49	42	NA	420	20	0.85	NA	25	NA

NOTES:

chromium (VI) = hexavalent chromium.

cPAH = carcinogenic polycyclic aromatic hydrocarbon. Calculated as the toxic equivalency quotient for comparison to the benzo(a)pyrene cleanup level.

CPOC = conditional point of compliance (i.e., the property boundary).

NA = not applicable. Deep groundwater samples will not be analyzed for these indicator hazardous substances.

PCP = pentachlorophenol.

ug/L = micrograms per liter.

*The approximate minimum straight-line distance from the sentry well to the downgradient CPOC (i.e., the property boundary).

Table 4
Remediation Levels by Distance
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

		Indicator Hazardous Substance:	Arsenic	Benzene	Chromium (VI)	Copper	cPAHs	Ethyl-benzene	Pentachloro-phenol	Xylenes
		CUL (ug/L):	5	51	50	2.4	0.1	2100	3	1000
Distance from CPOC (feet)*	Travel Time to CPOC—Shallow Aquifer (years)	Travel Time to CPOC—Deep Aquifer (years)	Remediation Level (ug/L)							
25	3	1	10	100	100	5.0	0.20	4400	6.2	2000
50	7	2	11	120	110	5.6	0.23	4900	7.1	2300
75	10	3	13	130	130	6.3	0.26	5500	8	2600
100	13	4	14	140	140	7.0	0.29	6100	9	2900
125	16	5	15	160	150	8	0.31	6600	10	3100
150	20	7	17	170	170	8	0.34	7100	10	3400
175	23	8	18	180	180	9	0.36	7600	10	3600
200	26	9	19	190	190	9	0.38	8000	11	3800
225	30	10	20	200	200	10	0.40	8400	12	4000
250	33	11	21	210	210	10	0.42	8800	12	4200
275	36	12	22	220	220	10	0.44	9200	13	4400
300	39	13	22	230	220	11	0.45	9600	13	4500
325	43	14	23	240	230	11	0.47	9900	14	4700
350	46	15	24	250	240	11	0.49	10000	14	4900
375	49	16	25	250	250	12	0.50	10000	15	5000
400	53	17	26	260	260	12	0.52	10000	15	5200
425	56	18	26	270	260	12	0.53	11000	16	5300
450	59	20	27	280	270	13	0.55	11000	16	5500
475	63	21	28	280	280	13	0.56	11000	16	5600
500	66	22	28	290	280	13	0.57	12000	17	5700
525	69	23	29	300	290	14	0.59	12000	17	5900
550	72	24	30	300	300	14	0.60	12000	18	6000
575	76	25	30	310	300	14	0.61	12000	18	6100
600	79	26	31	320	310	15	0.63	13000	18	6300

Table 4
Remediation Levels by Distance
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

		Indicator Hazardous Substance:	Arsenic	Benzene	Chromium (VI)	Copper	cPAHs	Ethyl-benzene	Pentachloro-phenol	Xylenes
		CUL (ug/L):	5	51	50	2.4	0.1	2100	3	1000
Distance from CPOC (feet)*	Travel Time to CPOC—Shallow Aquifer (years)	Travel Time to CPOC—Deep Aquifer (years)	Remediation Level (ug/L)							
625	82	27	32	320	320	15	0.64	13000	19	6400
650	86	28	32	330	320	15	0.65	13000	19	6500
675	89	29	33	340	330	16	0.66	14000	20	6600
700	92	30	33	340	330	16	0.67	14000	20	6700
725	95	32	34	350	340	16	0.69	14000	20	6900
750	99	33	35	350	350	16	0.70	14000	21	7000
775	102	34	35	360	350	17	0.71	14000	21	7100
800	105	35	36	360	360	17	0.72	15000	21	7200
825	109	36	36	370	360	17	0.73	15000	22	7300
850	112	37	37	380	370	17	0.74	15000	22	7400
875	115	38	37	380	370	18	0.75	15000	22	7500
900	118	39	38	390	380	18	0.76	16000	22	7600
925	122	40	38	390	380	18	0.77	16000	23	7700
950	125	41	39	400	390	18	0.78	16000	23	7800
975	128	42	39	400	390	19	0.79	16000	23	7900
1000	132	43	40	410	400	19	0.80	16000	24	8000
1025	135	45	40	410	400	19	0.81	17000	24	8100
1050	138	46	41	420	410	19	0.82	17000	24	8200
1075	141	47	41	420	410	20	0.83	17000	25	8300
1100	145	48	42	430	420	20	0.84	17000	25	8400
1125	148	49	42	430	420	20	0.85	17000	25	8500
1150	151	50	43	430	430	20	0.86	18000	25	8600
1175	155	51	43	440	430	20	0.87	18000	26	8700
1200	158	52	44	440	440	21	0.88	18000	26	8800

Table 4
Remediation Levels by Distance
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

		Indicator Hazardous Substance:	Arsenic	Benzene	Chromium (VI)	Copper	cPAHs	Ethyl-benzene	Pentachloro-phenol	Xylenes
		CUL (ug/L):	5	51	50	2.4	0.1	2100	3	1000
Distance from CPOC (feet)*	Travel Time to CPOC— Shallow Aquifer (years)	Travel Time to CPOC— Deep Aquifer (years)	Remediation Level (ug/L)							
1225	161	53	44	450	440	21	0.88	18000	26	8800
1250	164	54	44	450	440	21	0.89	18000	26	8900
1275	168	55	45	460	450	21	0.90	19000	27	9000
1300	171	57	45	460	450	21	0.91	19000	27	9100
1325	174	58	46	470	460	22	0.92	19000	27	9200
1350	178	59	46	470	460	22	0.93	19000	27	9300
1375	181	60	47	470	470	22	0.94	19000	28	9400
1400	184	61	47	480	470	22	0.94	19000	28	9400
1425	188	62	47	480	470	22	1.0	20000	28	9500
1450	191	63	48	490	480	23	1.0	20000	28	9600
1475	194	64	48	490	480	23	1.0	20000	29	9700
1500	197	65	49	500	490	23	1.0	20000	29	9800

NOTES:

The travel times differ between the deep and shallow aquifers, but the remediation levels at a given distance are the same and apply to both the shallow and deep aquifers.

chromium (VI) = hexavalent chromium.

cPAH = carcinogenic polycyclic aromatic hydrocarbons. Calculated as the toxic equivalency quotient for comparison to the benzo(a)pyrene cleanup level.

CPOC = conditional point of compliance (i.e., the property boundary).

CUL = cleanup level.

ug/L = micrograms per liter.

*The minimum straight-line to the downgradient CPOC (i.e., the property boundary).

Table 5
Groundwater Monitoring Network
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Well ID	Aquifer	Well Type	Water Level Monitoring Network (Figure 4)[c]	Stage of Monitoring[a,b]: Compliance Monitoring Network (Figure 5): Protection	Performance	Confirmational	Final Closure Monitoring Network (Figure 6)[d]
HW-01	Shallow	Horizontal Recovery Well		X	X	X	X
MW-1	Shallow	Other Monitoring Well	X				X
MW-10	Shallow	Other Monitoring Well	X				X
MW-11	Shallow	Other Monitoring Well	X				X
MW-12	Shallow	Other Monitoring Well	X				X
MW-13	Shallow	Other Monitoring Well	X				X
MW-14	Deep	Source Area Well	X	X	X	X	X
MW-15	Shallow	Other Monitoring Well	X				X
MW-16	Shallow	Other Monitoring Well	X				X
MW-17	Shallow	Other Monitoring Well	X				X
MW-18	Deep	Sentry Well	X	X	X	X	X
MW-19	Shallow	Sentry Well	X	X	X	X	X
MW-2	Shallow	Other Monitoring Well	X				X
MW-20	Shallow	Sentry Well	X	X	X	X	X
MW-3	Shallow	Source Area Well	X	X	X	X	X
MW-4	Shallow	Sentry Well	X	X	X	X	X
MW-5	Shallow	Other Monitoring Well	X				X
MW-6	Shallow	Other Monitoring Well	X				X
MW-7	Deep	Sentry Well	X	X	X	X	X
MW-8	Shallow	Source Area Well	X	X	X	X	X
MW-9	Shallow	Other Monitoring Well	X				X
UPRR-MW-29[b]	Shallow	Other Monitoring Well	X	b	b	b	X

NOTES:

CULs = cleanup levels.

RELs = remediation levels.

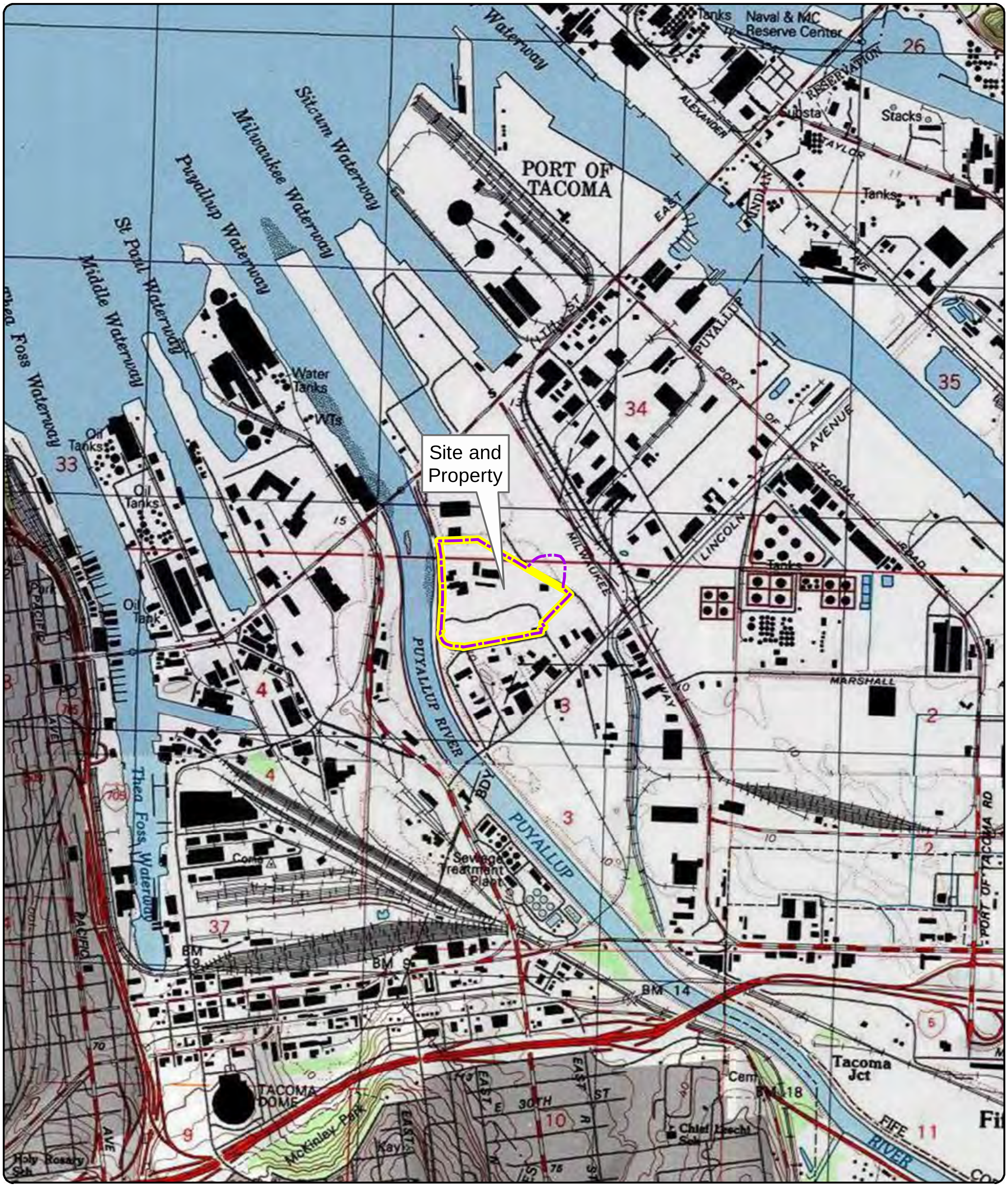
[a]Source area wells, sentry wells, and the horizontal recovery well will be monitored for compliance with RELs during all stages of monitoring. However, in order for the monitoring program to be terminated, a demonstration of compliance with CULs must be made for the "Final Closure Monitoring Network" wells (includes source area wells, sentry wells, the horizontal recovery well, and "Other Monitoring Wells").

[b]Port of Tacoma property well, UPRR-MW-29, is not a sentry well and is not included in the compliance monitoring network. It will be monitored during the "Protection," "Performance," and "Confirmational" stages of monitoring to evaluate indicator hazardous substance concentration and hydraulic gradient trends, but will not be evaluated for compliance with RELs or CULs. However, this well is included in the final closure monitoring network and will be monitored for compliance with CULs during the "Final Closure" stage of monitoring.

[c]Water levels will be measured in these wells during all stages of monitoring.

[d]All remaining Site monitoring wells will be monitored during the final closure monitoring stage, which may include some or all of the monitoring wells listed here.

FIGURES



Site Address: 1640 East Marc Street, Tacoma, Washington
Source: US Geological Survey (1990) 7.5-minute topographic quadrangle: Tacoma North
Section 3, Township 20 North, Range 3 East and
Section 34, Township 21 North, Range 3 East

Legend

Site Boundary

Property Boundary

Note: The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero arsenic contour as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 1,000 2,000
Feet

Figure 1
Site Location

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

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Project: 9081.01.04-04 Produced By: rmaronn Approved By: hhirsch Print Date: 9/17/2014 Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CMP\Projects\Fig1_Site Location.mxd

Figure 2
Site Features

McFarland Cascade Pole
and Lumber Company
Tacoma, Washington

Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary
- Protective Cap (Currently Paved) and Soil Restricted Area

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. PCP = pentachlorophenol.
4. SWTS = stormwater treatment system.
5. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property, in the vicinity of monitoring well UPRR-MW-29, is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Print Date: 10/16/2014
Approved By: hhirsch
Produced By: apadilla
Project: 9081.01.04-00

Figure 3
Groundwater Exceedances 2004 to 2015

McFarland Cascade Pole
and Lumber Company
Tacoma, Washington

Legend

Exceedances

- Arsenic—5 ug/L CUL
- Copper—2.4 ug/L CUL
- PCP—3 ug/L CUL
- cPAH TEQ—0.1 ug/L CUL
- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary

Notes:
1. This figure shows indicator hazardous substances for which the maximum detected concentration observed in groundwater was above CULs. Data from the four most recent monitoring events conducted between 2004 and 2015 for each well location were evaluated. During the 2004 to 2015 timeframe, monitoring wells MW-1, MW-19, and MW-20 were monitored only once, and MW-4 was monitored only twice.
2. Samples have not been collected from monitoring well location MW-11 since 2002.
3. Hexavalent chromium, benzene, ethylbenzene, and xylenes were below their respective cleanup levels during the four most recent monitoring events.
4. Total and dissolved metals were analyzed in some locations. When both were available, the greater of the two was used.
5. cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.
6. CUL = cleanup level.
7. PCP = pentachlorophenol.
8. ug/L = micrograms per liter.
9. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI.

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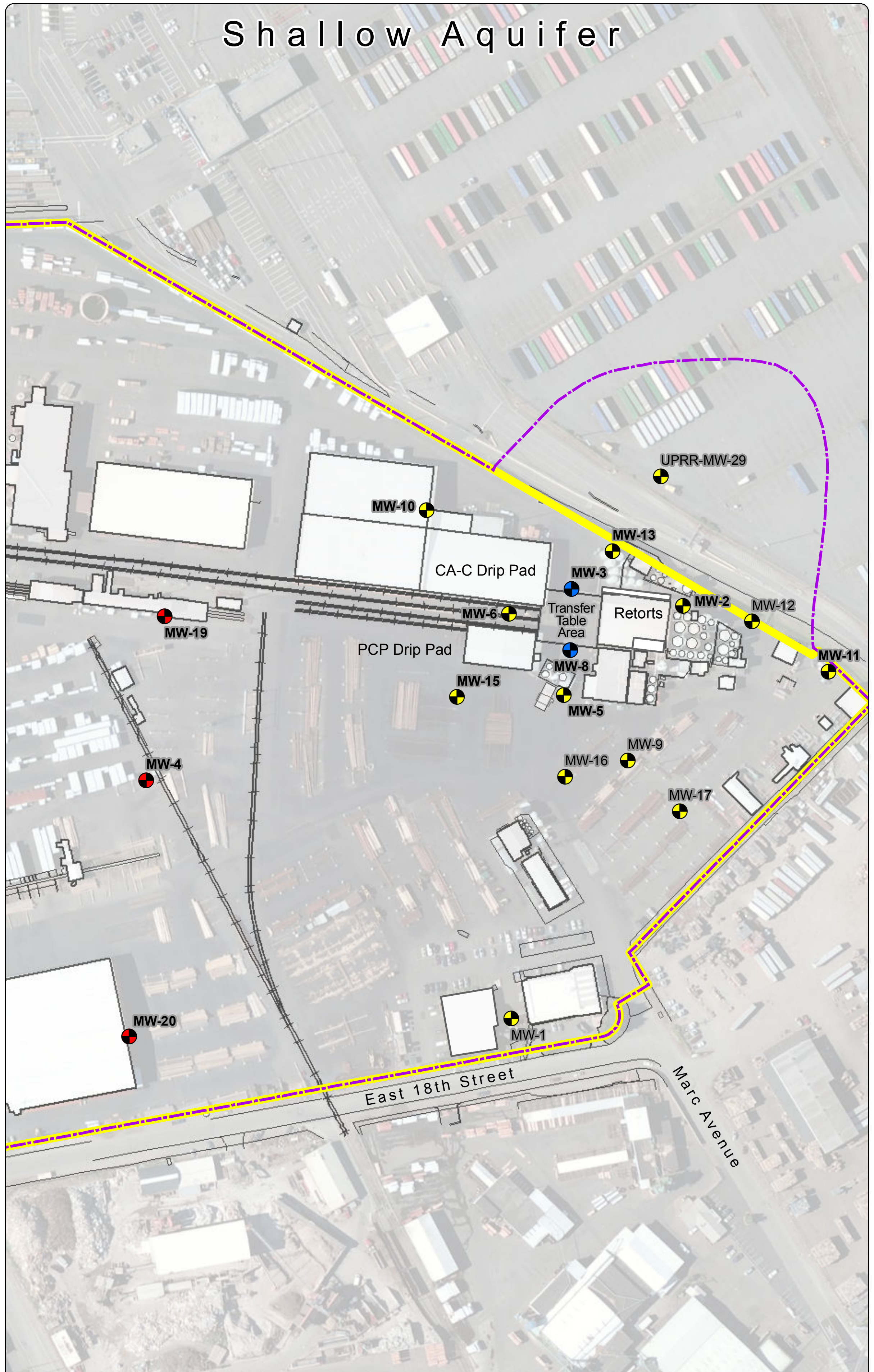
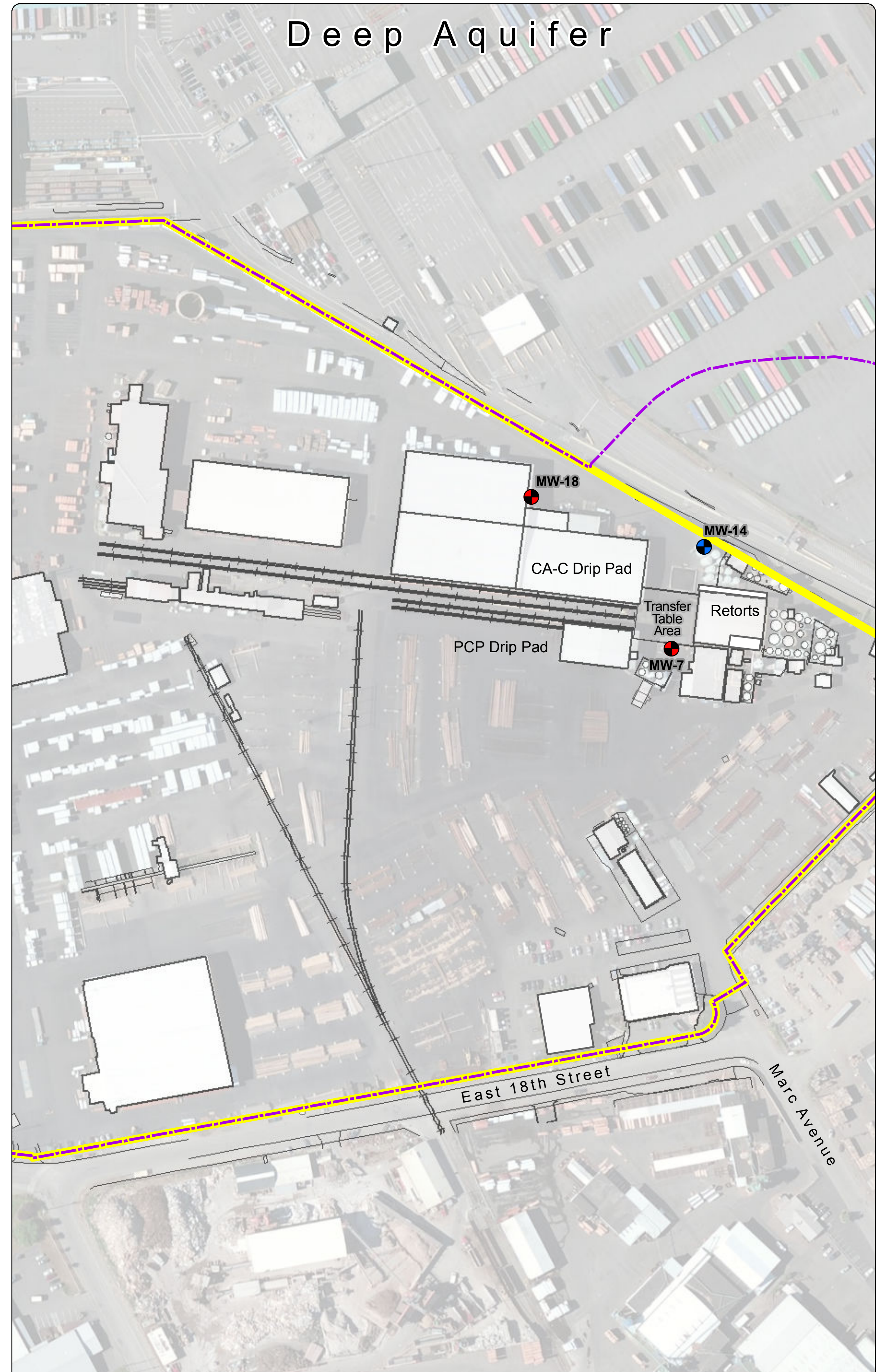
Path: X:\10999.01 Cascade Pole\01_MTCA Closure\02_CMP\Projects\Fig3_Groundwater Exceedances.mxd
Print Date: 4/3/2015
Approved By: hhirsch
Produced By: jmiller
Project: 9081.01.04-04

Figure 4
Water Level Monitoring Network

McFarland Cascade Pole
and Lumber Company
Tacoma, Washington





Legend

- Railroad
- Site Boundary
- Property Boundary

Water Level Monitoring Well Network Includes:

- Sentry Well
- Source Area Well
- Other Monitoring Well

Notes:
1. CA-C = copper azole - type C.
2. PCP = pentachlorophenol.

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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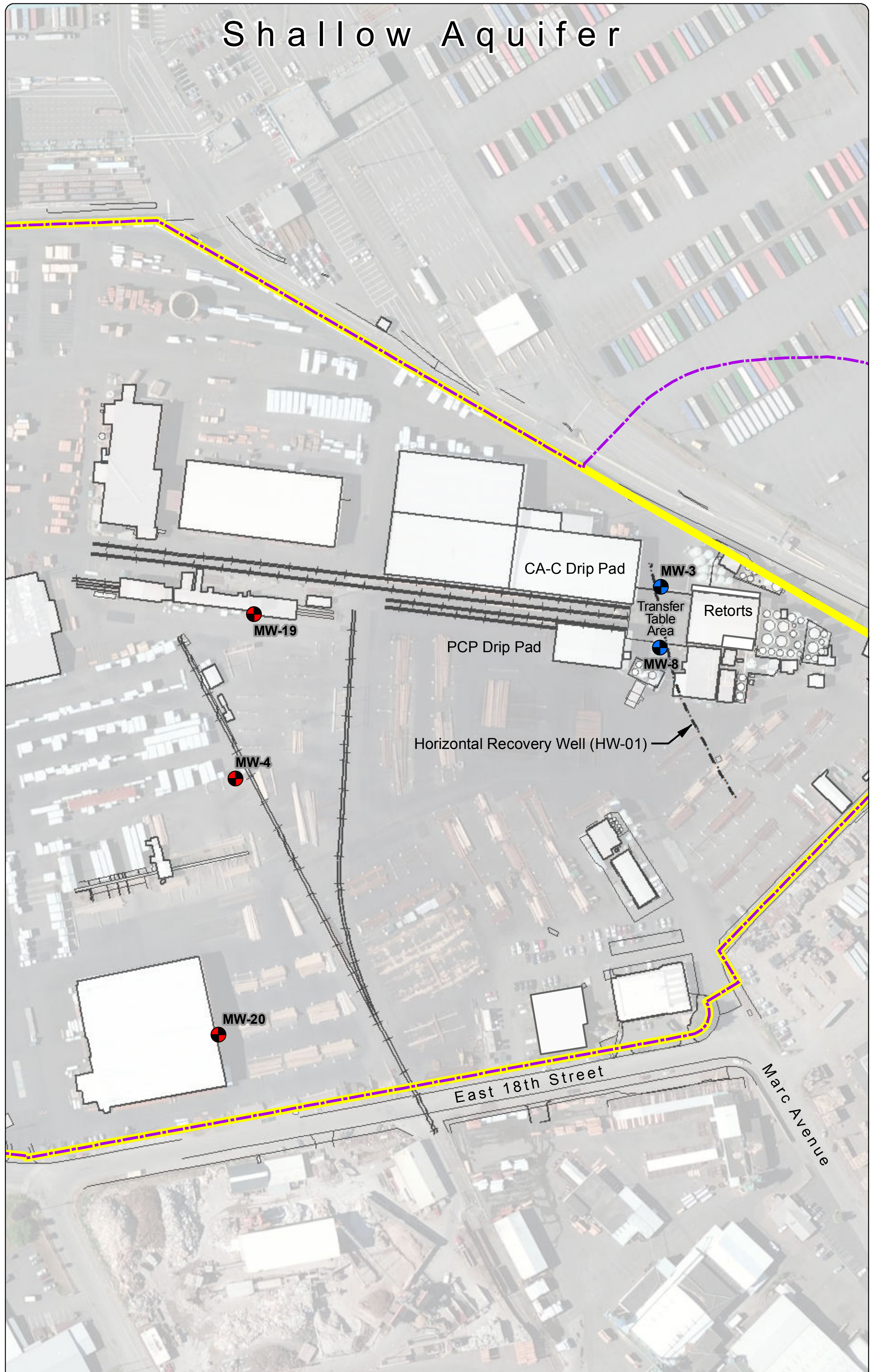
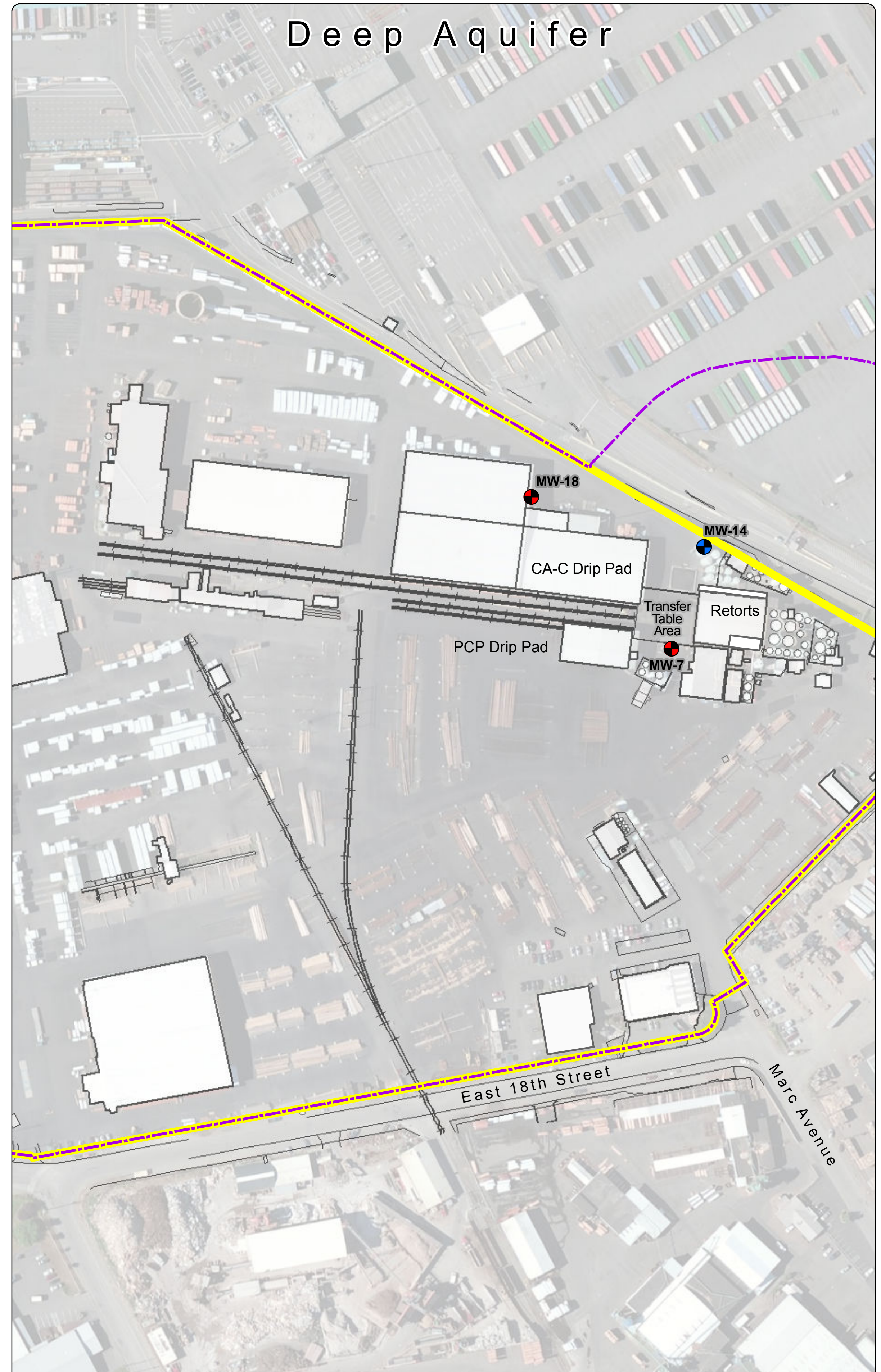
Figure 5
Compliance Monitoring Network

McFarland Cascade Pole and Lumber Company
Tacoma, Washington





Legend

- Railroad
- Site Boundary
- Property Boundary

Compliance Monitoring Network Includes:

- Sentry Well
- Source Area Well

Notes:
1. CA-C = copper azole - type C.
2. PCP = pentachlorophenol.
3. Water levels will not be monitored in the horizontal recovery well (HW-01).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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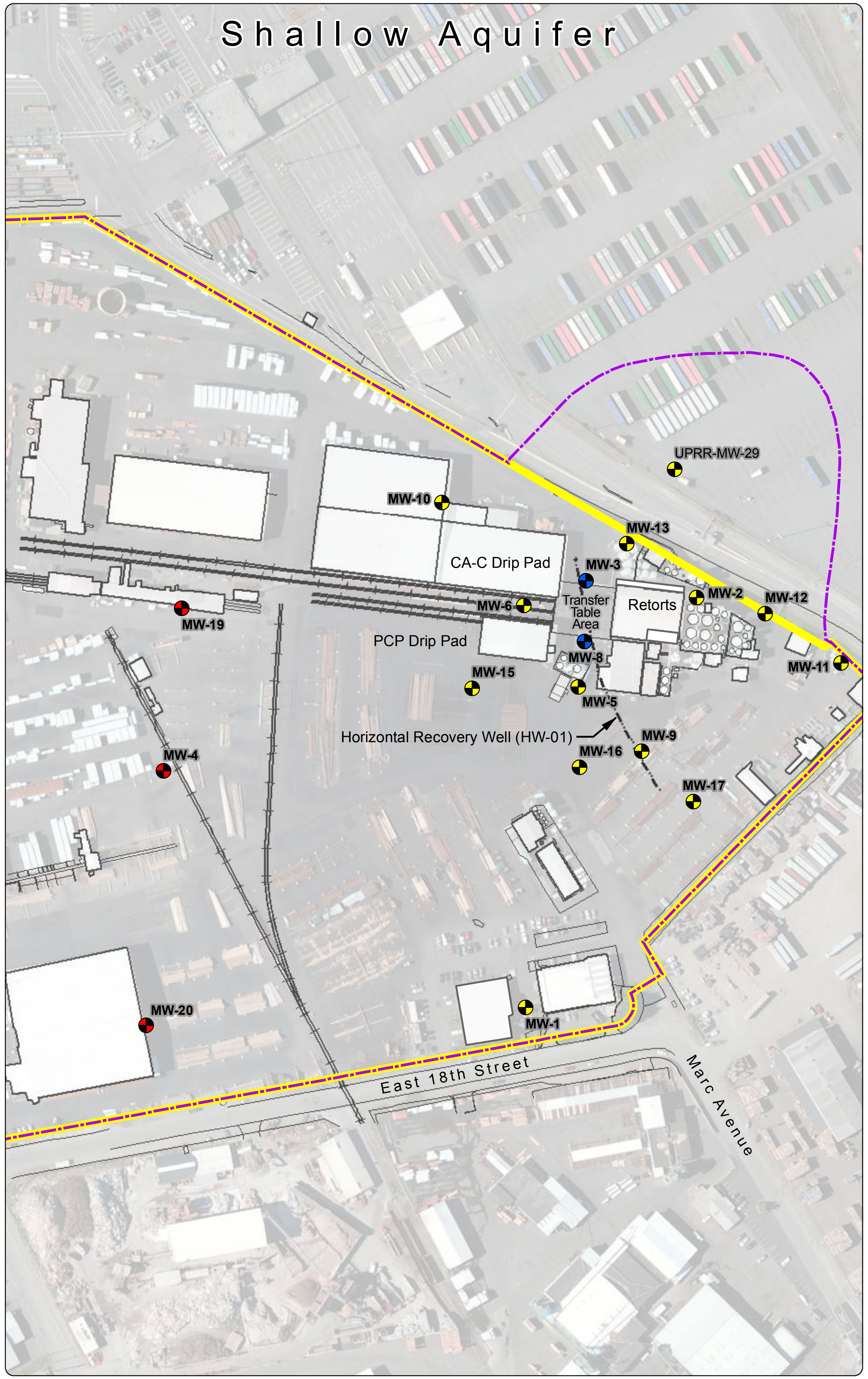

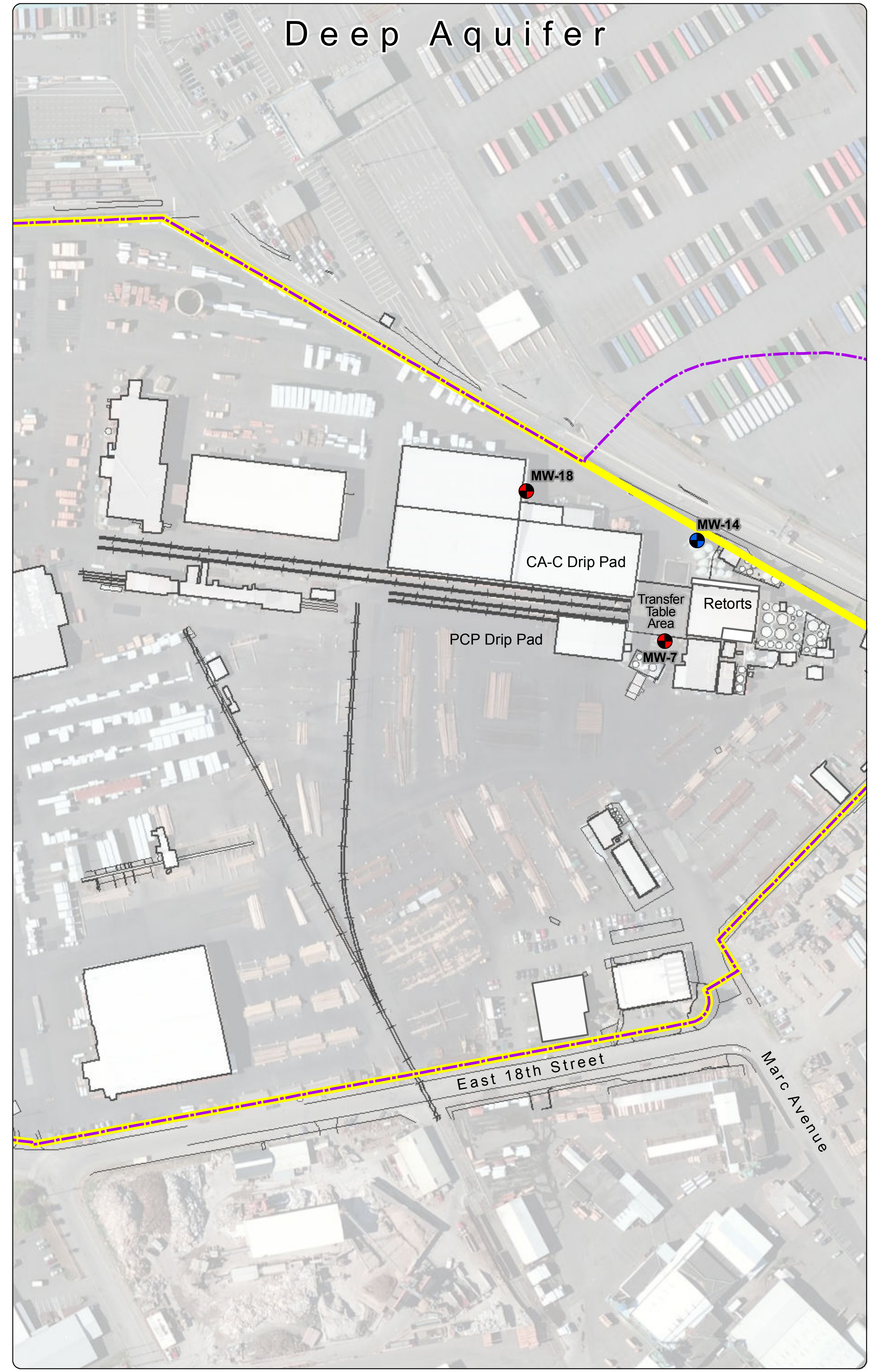

Figure 6
Final Closure Monitoring Network

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

Railroad
Site Boundary
Property Boundary

Final Confirmation Monitoring Network Includes:

Sentry Well
Source Area Well
Other Monitoring Well

Notes:
1. CA-C = copper azole - type C.
2. PCP = pentachlorophenol.
3. Water levels will not be monitored in the horizontal recovery well (HW-01).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CMP\Projects\Fig6_Final Closure Monitoring Network.mxd
Print Date: 8/4/2015
Approved By: hhirsch
Produced By: jschane
Project: 9081.01.04-00

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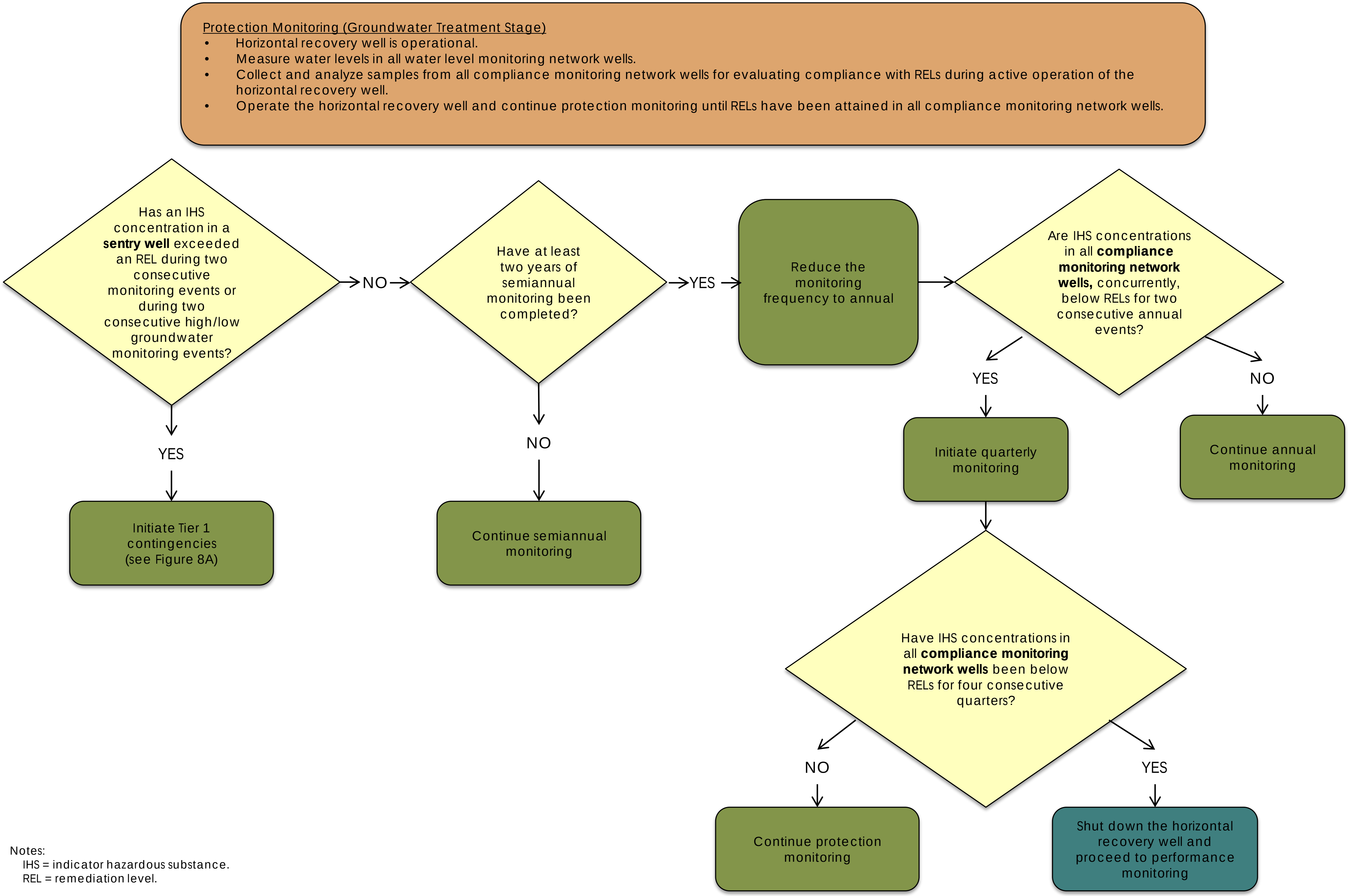
Figure 7A—Protection Monitoring
McFarland Cascade Pole and Lumber Company
Tacoma, Washington



Notes:
IHS = indicator hazardous substance.
REL = remediation level.

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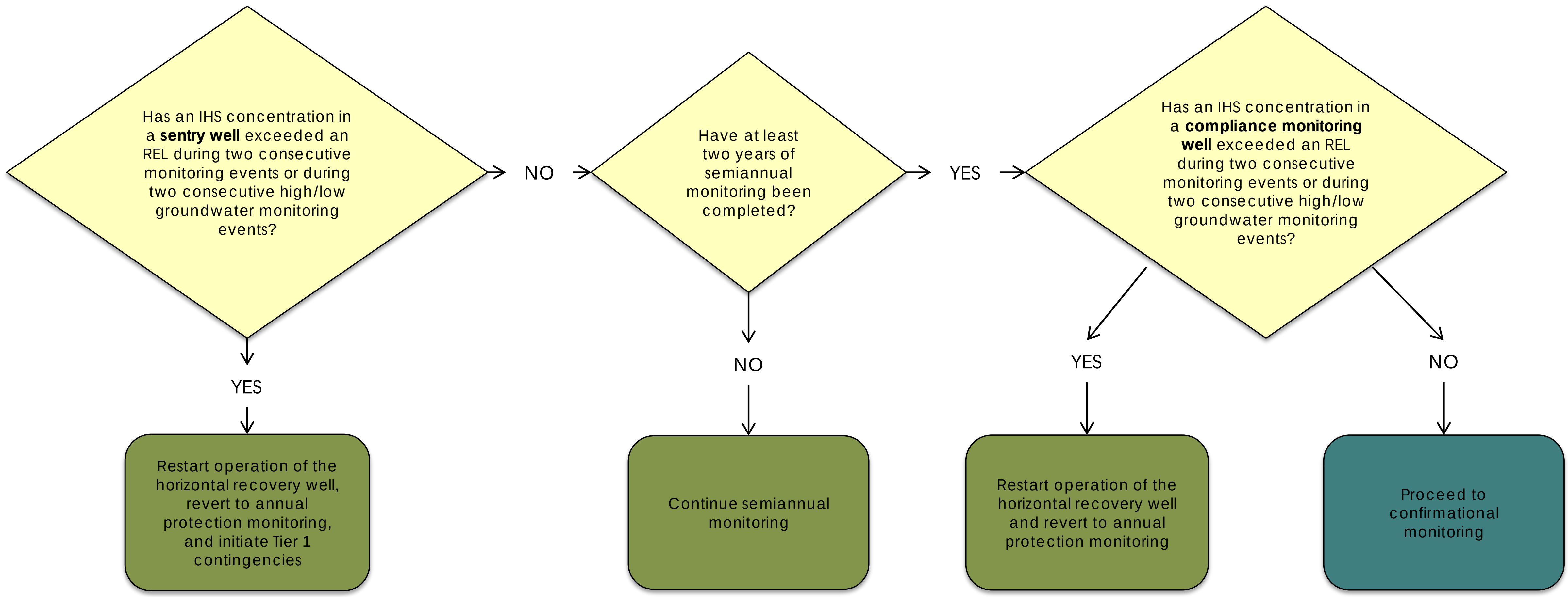
Figure 7B—Performance Monitoring
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Performance Monitoring (Post Groundwater Treatment Stage)

- Horizontal recovery well has been shut down.
- Measure water levels in all water level monitoring network wells.
- Collect and analyze samples from all compliance monitoring network wells on a semiannual basis for evaluating compliance with RELs following shutdown of the horizontal recovery well.
- Continue performance monitoring until RELs have been attained in all compliance monitoring network wells.



Notes:
IHS = indicator hazardous substance.
REL = remediation level.

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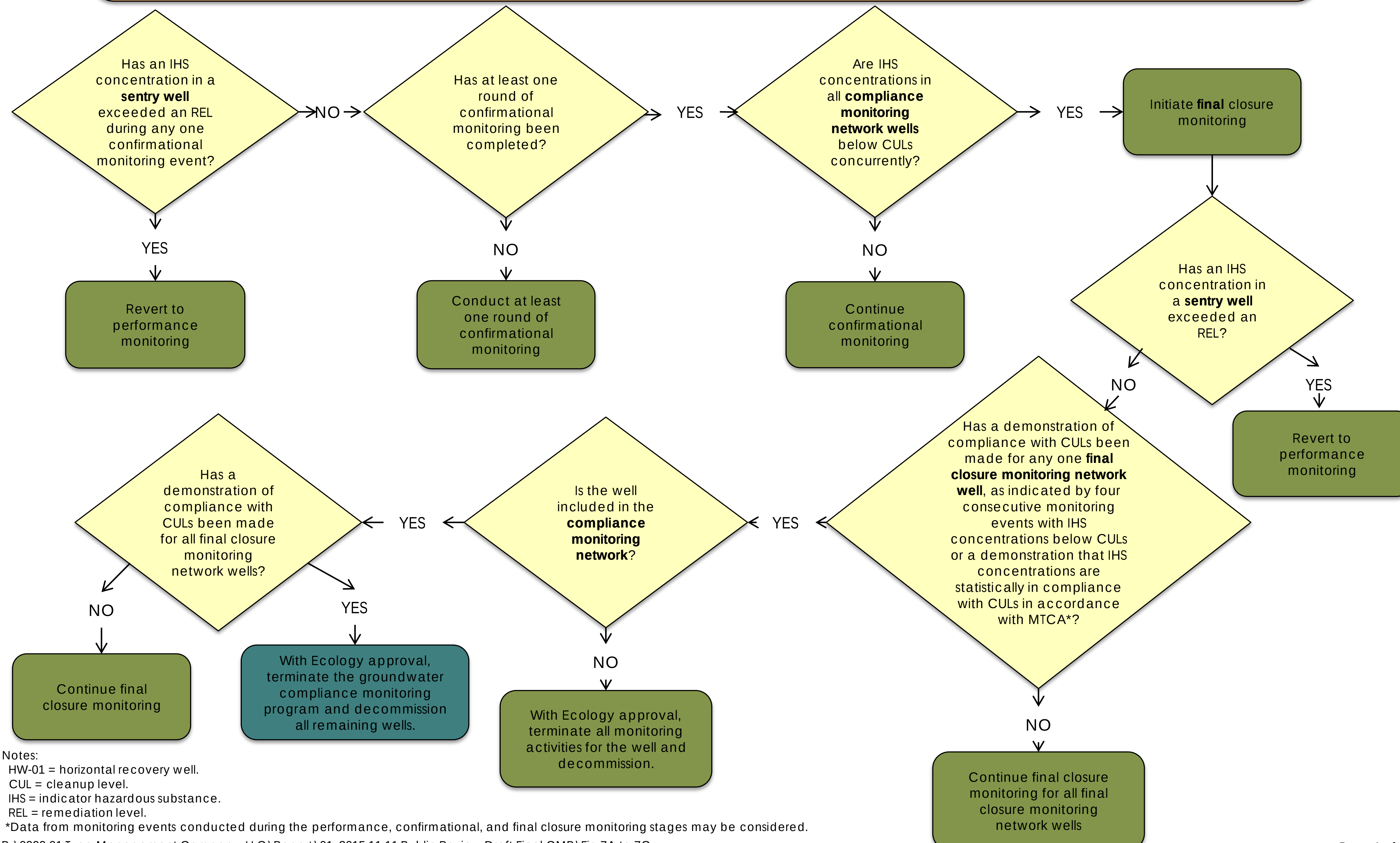
Figure 7C—Confirmational Monitoring
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

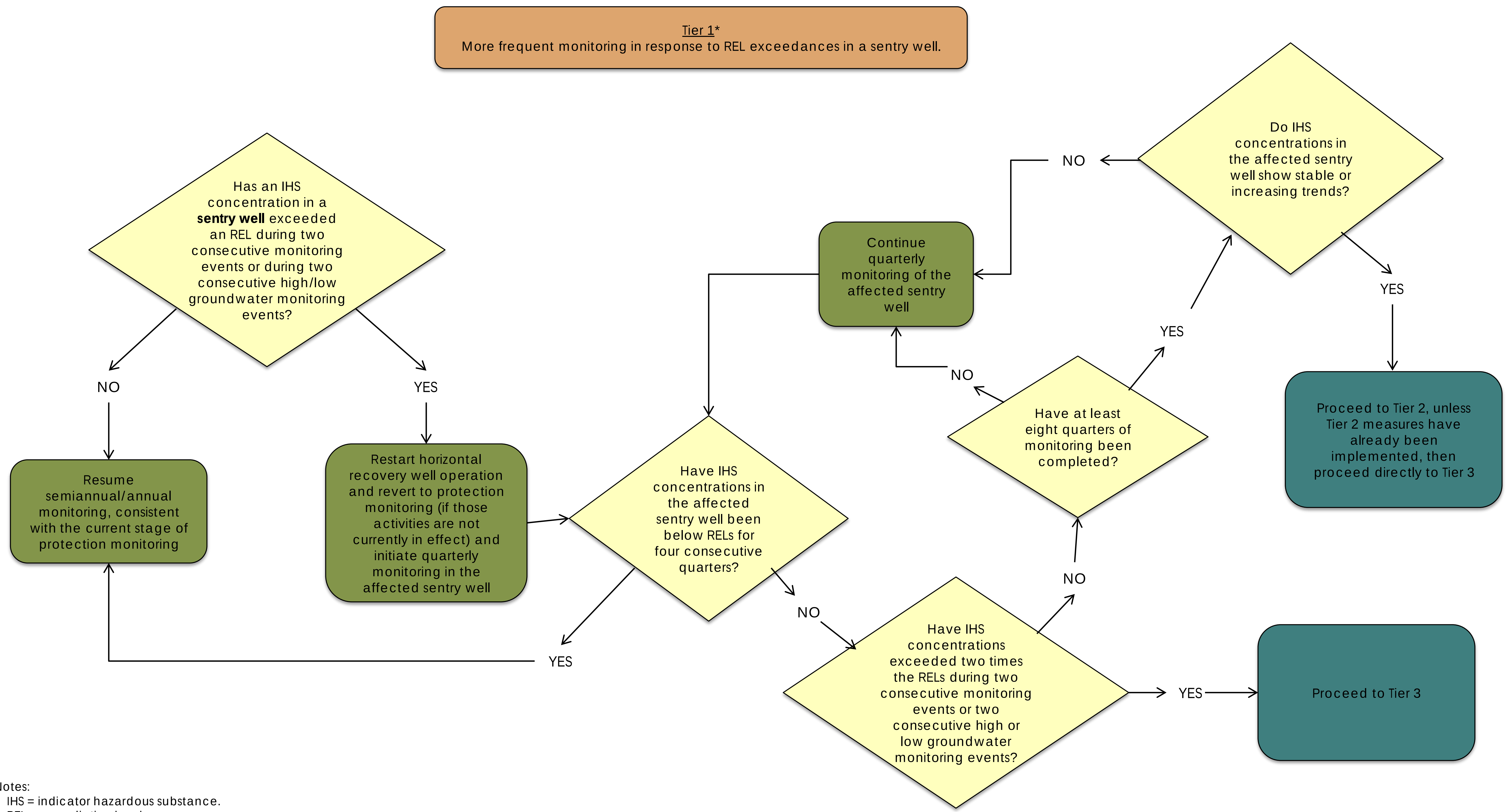
Confirmational Monitoring (Long-Term Compliance Monitoring Stage)

- Horizontal recovery well has been shut down.
- Measure water levels in all remaining water level monitoring network wells (wells used only for monitoring water levels may be decommissioned).
- Collect and analyze samples from all compliance monitoring network wells to evaluate long-term compliance with RELs following shutdown of the horizontal recovery well.
- Initiate final closure monitoring once CULs have been attained in all compliance monitoring network wells.
- Collect and analyze samples from all final closure monitoring network wells to evaluate compliance with CULs.
- Terminate the monitoring program and decommission all wells once it has been demonstrated that CULs have been met in all final closure monitoring wells.



Notes:
HW-01 = horizontal recovery well.
CUL = cleanup level.
IHS = indicator hazardous substance.
REL = remediation level.
*Data from monitoring events conducted during the performance, confirmational, and final closure monitoring stages may be considered.

Figure 8A—Contingency Measures: Tier 1
McFarland Cascade Pole and Lumber Company
Tacoma, Washington



Notes:
IHS = indicator hazardous substance.
REL = remediation level.
*Refer to the report text for Ecology notification requirements and deadlines for notification and implementing contingency actions.

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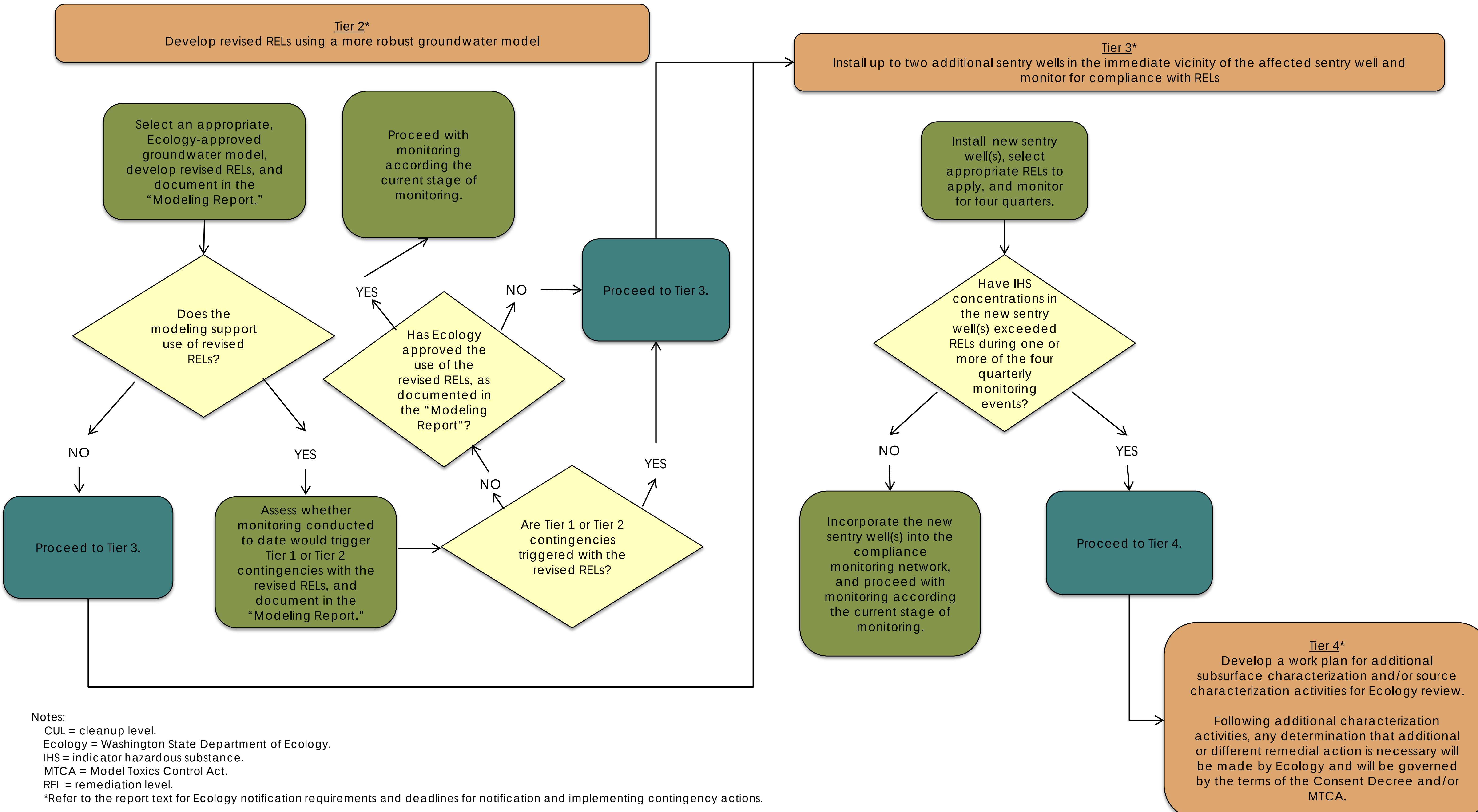
Figure 8B—Contingency Measures: Tiers 2 through 4
McFarland Cascade Pole and Lumber Company
Tacoma, Washington



Notes:
CUL = cleanup level.
Ecology = Washington State Department of Ecology.
IHS = indicator hazardous substance.
MTCA = Model Toxics Control Act.
REL = remediation level.
*Refer to the report text for Ecology notification requirements and deadlines for notification and implementing contingency actions.

APPENDIX A
GROUNDWATER-LEVEL RESULTS

Table 1 Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 21, 1999		February 11, 1999		March 31, 1999		April 30, 1999		May 31, 1999		June 29, 1999	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	---	---	---	---	---	---	---	---	---	---	---	---
MW-2	19.38	3.80	7.95	3.75	8.00	3.82	7.93	4.34	7.41	4.76	6.99	5.16	6.59
MW-3	20.16	4.15	8.85	3.86	9.14	4.14	8.86	4.94	8.06	5.11	7.89	6.00	7.00
MW-4	19.00	---	---	---	---	---	---	---	---	---	---	---	---
MW-5	20.17	---	---	---	---	---	---	---	---	---	---	---	---
MW-6	20.17	3.58	9.01	3.88	8.71	4.36	8.23	5.14	7.45	5.12	7.47	6.10	6.49
MW-7	19.44	6.91	4.87	6.85	4.93	7.20	4.58	8.12	3.66	8.30	3.48	8.59	3.19
MW-8	21.49	4.96	8.93	5.63	8.26	6.10	7.79	6.54	7.35	7.16	6.73	7.43	6.46
MW-9	18.44	4.02	7.27	4.13	7.16	4.10	7.19	4.31	6.98	4.65	6.64	5.17	6.12
MW-10	19.57	---	---	---	---	---	---	---	---	---	---	---	---
MW-11	19.21	---	---	---	---	---	---	---	---	---	---	---	---
MW-12	19.79	4.82	8.13	4.69	8.26	4.76	8.19	5.06	7.89	5.30	7.65	5.58	7.37
MW-13	19.81	3.68	9.27	3.89	9.06	4.04	8.91	---	---	---	---	5.68	7.27
MW-14	19.76	6.76	6.21	6.62	6.35	7.18	5.79	---	---	---	---	8.68	4.29

Well Number	August 6, 1999		August 31, 1999		September 30, 1999		October 22, 1999		October 29, 1999		November 30, 1999		December 29, 1999	
	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	5.58	6.17	5.90	13.48	6.22	13.16	6.30	13.08	6.60	12.78	5.05	14.33	4.81	14.57
MW-3	6.50	6.50	6.82	13.34	7.08	13.08	7.20	12.96	7.46	12.70	6.61	13.55	6.27	13.89
MW-4	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	6.47	6.12	6.81	13.36	7.18	12.99	7.14	13.03	7.13	13.04	5.10	15.07	5.78	14.39
MW-7	8.86	2.92	9.26	10.18	9.66	9.78	9.80	9.64	9.60	9.84	8.04	11.40	7.82	11.62
MW-8	7.92	5.97	8.30	13.19	8.74	12.75	8.68	12.81	8.90	12.59	8.33	13.16	8.06	13.43
MW-9	5.16	6.13	5.39	13.05	5.68	12.76	5.90	12.54	5.98	12.46	5.56	12.88	5.33	13.11
MW-10	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	6.02	6.93	6.34	13.45	6.66	13.13	6.66	13.13	5.94	13.85	5.17	14.62	5.26	14.53
MW-13	6.11	6.84	6.38	13.43	NM	NM	6.80	13.01	9.82	9.99	5.75	14.06	5.34	14.47
MW-14	9.07	3.90	9.46	10.30	NM	NM	9.99	9.77	9.86	9.90	NM	NM	7.81	11.95

Table 1 Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 24, 2000		February 24, 2000		March 24, 2000		April 28, 2000		May 24, 2000		June 30, 2000		August 1, 2000		August 31, 2000		September 29, 2000		October 31, 2000		November 30, 2000		January 5, 2001	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	5.94	13.19	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	4.46	14.92	4.36	15.02	4.24	15.14	4.70	14.68	5.10	14.28	5.54	13.84	5.82	13.56	6.18	13.20	6.40	12.98	5.96	13.42	5.66	13.72	5.48	13.90
MW-3	20.16	6.06	14.10	6.02	14.14	5.78	14.38	6.36	13.80	6.74	13.42	6.58	13.58	6.72	13.44	7.32	12.84	7.61	12.55	7.31	12.85	7.40	12.76	7.28	12.88
MW-4	19.00	6.94	12.06	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	7.14	13.03	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	5.36	14.81	5.55	14.62	4.89	15.28	6.08	14.09	6.34	13.83	6.62	13.55	6.90	13.27	7.24	12.93	7.50	12.67	7.24	12.93	7.01	13.16	7.20	12.97
MW-7	19.44	7.67	11.77	7.76	11.68	7.72	11.72	8.30	11.14	8.44	11.00	8.54	10.90	8.90	10.54	9.08	10.36	9.38	10.06	9.36	10.08	9.27	10.17	9.12	10.32
MW-8	21.49	7.96	13.53	7.84	13.65	7.59	13.90	7.92	13.57	8.26	13.23	8.26	13.23	8.40	13.09	8.83	12.66	9.18	12.31	8.95	12.54	9.01	12.48	8.86	12.63
MW-9	18.44	5.24	13.20	5.23	13.21	4.80	13.64	4.46	13.98	5.29	13.15	5.26	13.18	5.42	13.02	5.70	12.74	5.98	12.46	5.92	12.52	5.89	12.55	5.78	12.66
MW-10	19.57	5.50	14.07	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	4.80	14.41	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	4.96	14.83	5.02	14.77	4.94	14.85	5.20	14.59	5.44	14.35	5.92	13.87	6.24	13.55	6.46	13.33	6.82	12.97	6.12	13.67	5.67	14.12	5.26	14.53
MW-13	19.81	4.94	14.87	4.78	15.03	4.58	15.23	5.38	14.43	5.82	13.99	6.08	13.73	6.30	13.51	6.71	13.10	6.99	12.82	6.70	13.11	6.50	13.31	6.44	13.37
MW-14	19.76	7.68	12.08	7.76	12.00	7.18	12.58	8.36	11.40	8.57	11.19	8.78	10.98	9.14	10.62	9.30	10.46	9.60	10.16	9.52	10.24	9.39	10.37	9.20	10.56

Table 1 Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 31, 2001		February 27, 2001		March 27, 2001		April 30, 2001		May 30, 2001		June 30, 2001		August 1, 2001		August 31, 2001		September 27, 2001		October 31, 2001		November 30, 2001		January 3, 2002	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	NM	NM	2.05	17.08	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	5.53	13.85	5.50	13.88	5.30	14.08	5.20	14.18	5.52	13.86	5.56	13.82	6.10	13.28	5.96	13.42	6.16	13.22	5.84	13.54	4.88	14.50	4.46	14.92
MW-3	20.16	7.15	13.01	7.08	13.08	6.94	13.22	6.80	13.36	6.82	13.34	7.00	13.16	7.24	12.92	7.28	12.88	7.49	12.67	7.50	12.66	6.39	13.77	5.76	14.40
MW-4	19.00	NM	NM	8.02	10.98	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	NM	NM	8.15	12.02	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	6.86	13.31	6.56	13.61	6.68	13.49	6.46	13.71	6.57	13.60	6.75	13.42	7.21	12.96	7.28	12.89	7.40	12.77	6.98	13.19	5.45	14.72	5.05	15.12
MW-7	19.44	9.15	10.29	9.14	10.30	8.89	10.55	8.54	10.90	8.81	10.63	8.88	10.56	9.00	10.44	9.04	10.40	9.21	10.23	9.23	10.21	7.70	11.74	7.60	11.84
MW-8	21.49	8.76	12.73	8.68	12.81	8.54	12.95	8.44	13.05	8.50	12.99	8.51	12.98	8.84	12.65	8.80	12.69	9.02	12.47	9.14	12.35	7.80	13.69	7.76	13.73
MW-9	18.44	5.67	12.77	5.64	12.80	5.48	12.96	5.44	13.00	5.45	12.99	5.60	12.84	5.76	12.68	5.76	12.68	5.95	12.49	6.12	12.32	5.64	12.80	5.20	13.24
MW-10	19.57	NM	NM	7.05	12.52	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	NM	NM	5.78	13.43	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	5.68	14.11	5.78	14.01	5.46	14.33	5.24	14.55	5.81	13.98	5.64	14.15	6.42	13.37	6.32	13.47	6.10	13.69	5.55	14.24	5.05	14.74	5.00	14.79
MW-13	19.81	6.34	13.47	6.26	13.55	6.13	13.68	6.04	13.77	6.20	13.61	6.28	13.53	6.62	13.19	6.64	13.17	6.88	12.93	6.79	13.02	5.50	14.31	4.76	15.05
MW-14	19.76	9.13	10.63	9.16	10.60	9.00	10.76	8.70	11.06	8.81	10.95	9.00	10.76	9.14	10.62	9.67	10.09	9.35	10.41	9.38	10.38	7.68	12.08	7.54	12.22

Table 1 Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 24, 2002		February 27, 2002		March 29, 2002		April 30, 2002		May 30, 2002		July 2, 2002		July 31, 2002		August 30, 2002		September 30, 2002		October 31, 2002		November 27, 2002		December 31, 2002	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	6.04	13.09	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	4.28	15.10	4.26	15.12	4.30	15.08	4.60	14.78	4.99	14.39	5.42	13.96	5.74	13.64	6.12	13.26	6.34	13.04	6.50	12.88	6.20	13.18	5.32	14.06
MW-3	20.16	5.66	14.50	5.62	14.54	5.78	14.38	5.70	14.46	6.03	14.13	6.30	13.86	6.60	13.56	6.88	13.28	7.24	12.92	7.60	12.56	7.53	12.63	6.94	13.22
MW-4	19.00	7.02	11.98	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	6.24	13.93	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	5.46	14.71	4.84	15.33	5.09	15.08	5.54	14.63	6.10	14.07	6.53	13.64	NM	NM	7.00	13.17	7.33	12.84	7.72	12.45	7.25	12.92	6.60	13.57
MW-7	19.44	7.78	11.66	7.60	11.84	7.90	11.54	7.94	11.50	8.21	11.23	8.68	10.76	9.21	10.23	9.32	10.12	9.40	10.04	9.80	9.64	9.35	10.09	8.30	11.14
MW-8	21.49	7.40	14.09	7.30	14.19	7.45	14.04	7.30	14.19	7.67	13.82	7.94	13.55	8.27	13.22	8.37	13.12	8.82	12.67	9.15	12.34	9.10	12.39	8.72	12.77
MW-9	18.44	4.88	13.56	4.76	13.68	5.08	13.36	4.60	13.84	4.77	13.67	5.20	13.24	5.25	13.19	5.53	12.91	5.88	12.56	5.75	12.69	6.00	12.44	5.82	12.62
MW-10	19.57	5.24	14.33	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	5.18	14.03	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	4.96	14.83	4.92	14.87	5.10	14.69	5.20	14.59	5.36	14.43	5.79	14.00	8.16	11.63	6.58	13.21	6.80	12.99	6.95	12.84	6.35	13.44	5.17	14.62
MW-13	19.81	4.48	15.33	4.62	15.19	4.70	15.11	5.00	14.81	5.54	14.27	5.88	13.93	6.25	13.56	6.50	13.31	6.81	13.00	7.04	12.77	6.90	12.91	6.19	13.62
MW-14	19.76	7.70	12.06	7.60	12.16	7.88	11.88	8.02	11.74	8.38	11.38	8.86	10.90	9.50	10.26	9.45	10.31	9.60	10.16	9.93	9.83	9.50	10.26	8.45	11.31

NOTES: NM - Not measured.

Table 1-Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 30, 2003		February 27, 2003		March 14, 2003		April 28, 2003		May 29, 2003		June 30, 2003	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	6.25	12.88	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	4.78	14.60	4.92	14.46	4.56	14.82	4.59	14.79	5.11	14.27	5.66	13.72
MW-3	20.16	6.52	13.64	6.51	13.65	6.39	13.77	6.22	13.94	6.61	13.55	6.94	13.22
MW-4	19.00	7.44	11.56	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	7.40	12.77	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	6.05	14.12	6.31	13.86	6.08	14.09	7.63	12.54	6.65	13.52	6.95	13.22
MW-7	19.44	7.56	11.88	8.01	11.43	7.54	11.90	7.96	11.48	8.50	10.94	8.84	10.60
MW-8	21.49	8.38	13.11	8.31	13.18	8.16	13.33	7.94	13.55	8.10	13.39	8.33	13.16
MW-9	18.44	5.43	13.01	5.21	13.23	5.17	13.27	5.75	12.69	5.10	13.34	5.27	13.17
MW-10	19.57	8.80	10.77	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	4.93	14.28	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	5.08	14.71	5.27	14.52	4.98	14.81	5.10	14.69	5.57	14.22	5.94	13.85
MW-13	19.81	5.42	14.39	5.60	14.21	5.25	14.56	5.25	14.56	5.87	13.94	6.26	13.55
MW-14	19.76	7.48	12.28	8.07	11.69	7.63	12.13	8.00	11.76	8.62	11.14	9.02	10.74

Notes: NM - Not measured.

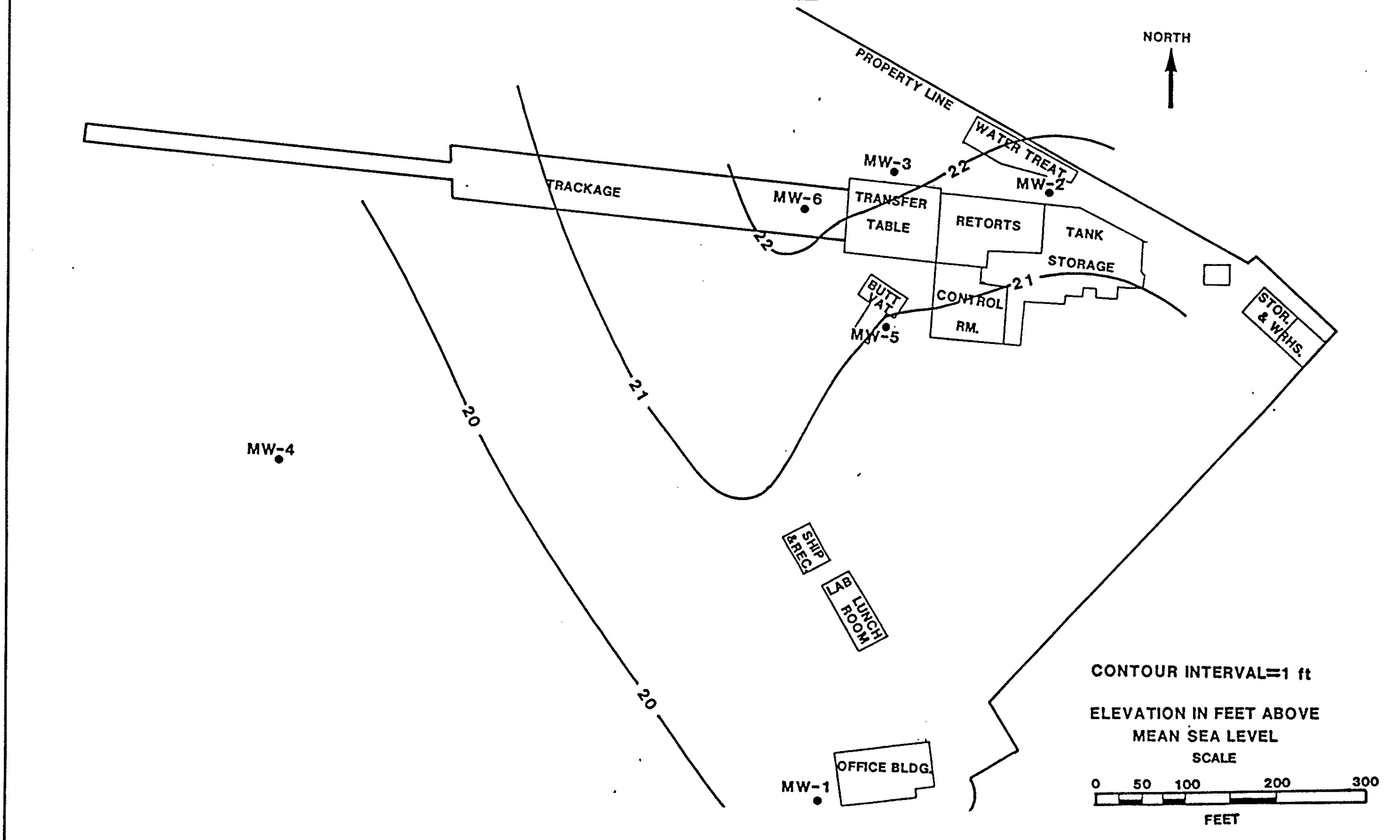
Well Number	PVC Elevation (feet)	July 31, 2003		August 28, 2003		September 29, 2003		October 31, 2003		November 26, 2003		December 24, 2003	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	5.92	13.46	6.60	12.78	6.34	13.04	5.48	13.90	5.10	14.28	4.58	14.80
MW-3	20.16	7.18	12.98	7.40	12.76	7.62	12.54	7.08	13.08	6.88	13.28	6.28	13.88
MW-4	19.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	7.19	12.98	7.40	12.77	7.62	12.55	7.02	13.15	6.78	13.39	6.40	13.77
MW-7	19.44	8.97	10.47	9.15	10.29	9.34	10.10	8.67	10.77	8.28	11.16	7.42	12.02
MW-8	21.49	8.52	12.97	8.70	12.79	8.92	12.57	8.53	12.96	8.40	13.09	7.92	13.57
MW-9	18.44	5.43	13.01	5.60	12.84	5.74	12.70	5.52	12.92	5.40	13.04	5.06	13.38
MW-10	19.57	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	6.38	13.41	6.60	13.19	6.72	13.07	5.76	14.03	5.28	14.51	5.12	14.67
MW-13	19.81	6.54	13.27	6.80	13.01	7.04	12.77	6.12	13.69	5.92	13.89	5.42	14.39
MW-14	19.76	9.15	10.61	9.35	10.41	9.56	10.20	8.78	10.98	8.40	11.36	7.54	12.22

Table 1 Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 30, 2004 Depth to Water (feet)	January 30, 2004 Groundwater Elevation (feet MSL)	February 4, 2004 Depth to Water (feet)	February 4, 2004 Groundwater Elevation (feet MSL)	February 27, 2004 Depth to Water (feet)	February 27, 2004 Groundwater Elevation (feet MSL)	March 31, 2004 Depth to Water (feet)	March 31, 2004 Groundwater Elevation (feet MSL)	April 28, 2004 Depth to Water (feet)	April 28, 2004 Groundwater Elevation (feet MSL)	May 26, 2004 Depth to Water (feet)	May 26, 2004 Groundwater Elevation (feet MSL)	June 29, 2004 Depth to Water (feet)	June 29, 2004 Groundwater Elevation (feet MSL)
MW-1	19.13	NM	NM	5.85	13.28	NM	NM	NM	NM	NM	NM	6.35	12.78	NM	NM
MW-2	19.38	4.16	15.22	4.14	15.24	4.22	15.16	4.60	14.78	5.00	14.38	5.32	14.06	5.62	13.76
MW-3	20.16	5.70	14.46	5.75	14.41	5.74	14.42	6.80	13.36	6.42	13.74	6.65	13.51	6.86	13.30
MW-4	19.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	7.23	11.77	NM	NM
MW-5	20.17	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	7.58	12.59	NM	NM
MW-6	20.17	5.72	14.45	5.76	14.41	5.86	14.31	6.24	13.93	6.52	13.65	6.75	13.42	6.88	13.29
MW-7	19.44	7.34	12.10	7.40	12.04	7.66	11.78	8.28	11.16	7.86	11.58	8.55	10.89	8.68	10.76
MW-8	21.49	7.62	13.87	7.65	13.84	7.58	13.91	7.68	13.81	8.54	12.95	8.01	13.48	8.10	13.39
MW-9	18.44	4.62	13.82	4.56	13.88	4.46	13.98	4.54	13.90	4.94	13.50	5.12	13.32	5.16	13.28
MW-10	19.57	NM	NM	5.64	13.93	NM	NM	5.64	13.93	NM	NM	6.09	13.48	NM	NM
MW-11	19.21	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	5.98	13.23	NM	NM
MW-12	19.79	4.90	14.89	4.81	14.98	4.96	14.83	5.12	14.67	5.42	14.37	5.76	14.03	6.08	13.71
MW-13	19.81	4.66	15.15	4.65	15.16	4.78	15.03	5.32	14.49	5.70	14.11	6.00	13.81	6.26	13.55
MW-14	19.76	7.36	12.40	7.40	12.36	7.68	12.08	8.38	11.38	8.70	11.06	8.74	11.02	8.90	10.86
MW-15	19.42	NM	NM	6.87	12.55	6.80	12.62	7.10	12.32	7.36	12.06	7.45	11.97	7.56	11.86
MW-16	18.22	NM	NM	4.74	13.48	5.20	13.02	5.20	13.02	5.00	13.22	5.33	12.89	5.44	12.78
MW-17	21.04	NM	NM	8.11	12.93	8.08	12.96	8.20	12.84	8.16	12.88	8.23	12.81	8.32	12.72
MW-18	19.69	NM	NM	7.76	11.93	8.00	11.69	8.60	11.09	8.94	10.75	8.92	10.77	8.90	10.79
UPRR-29	16.50	NM	NM	0.05	16.45	NM	NM	NM	NM	NM	NM	2.60	13.90	NM	NM

NOTES: NM - Not measured.

Well Number	PVC Elevation (feet)	July 31, 2004 Depth to Water (feet)	July 31, 2004 Groundwater Elevation (feet MSL)	August 28, 2004 Depth to Water (feet)	August 28, 2004 Groundwater Elevation (feet MSL)	September 7, 2004 Depth to Water (feet)	September 7, 2004 Groundwater Elevation (feet MSL)	September 30, 2004 Depth to Water (feet)	September 30, 2004 Groundwater Elevation (feet MSL)	October 29, 2004 Depth to Water (feet)	October 29, 2004 Groundwater Elevation (feet MSL)	November 30, 2004 Depth to Water (feet)	November 30, 2004 Groundwater Elevation (feet MSL)	January 27, 2005 Depth to Water (feet)	January 27, 2005 Groundwater Elevation (feet MSL)
MW-1	19.13	NM	NM	NM	NM	6.59	12.54	NM	NM	NM	NM	NM	NM	6.44	12.69
MW-2	19.38	5.96	13.42	5.74	13.64	6.00	13.38	5.86	13.52	5.72	13.66	5.56	13.82	4.94	14.44
MW-3	20.16	7.14	13.02	7.30	12.86	7.31	12.85	7.22	12.94	7.18	12.98	7.16	13.00	6.54	13.62
MW-4	19.00	NM	NM	NM	NM	7.53	11.47	NM	NM	NM	NM	NM	NM	7.39	11.61
MW-5	20.17	NM	NM	NM	NM	7.71	12.46	NM	NM	NM	NM	NM	NM	7.00	13.17
MW-6	20.17	7.14	13.03	7.18	12.99	7.26	12.91	7.20	12.97	7.16	13.01	7.14	13.03	6.33	13.84
MW-7	19.44	8.78	10.66	8.78	10.66	9.08	10.36	9.00	10.44	8.92	10.52	8.88	10.56	7.91	11.53
MW-8	21.49	8.34	13.15	8.50	12.99	8.49	13.00	8.60	12.89	8.52	12.97	8.52	12.97	7.95	13.54
MW-9	18.44	5.26	13.18	5.40	13.04	5.41	13.03	5.44	13.00	5.50	12.94	5.38	13.06	4.99	13.45
MW-10	19.57	NM	NM	6.74	12.83	6.75	12.82	9.78	9.79	6.80	12.77	6.82	12.75	6.36	13.21
MW-11	19.21	NM	NM	NM	NM	6.45	12.76	NM	NM	NM	NM	NM	NM	5.32	13.89
MW-12	19.79	6.40	13.39	5.86	13.93	6.33	13.46	6.14	13.65	5.96	13.83	5.40	14.39	5.29	14.50
MW-13	19.81	6.62	13.19	6.68	13.13	6.73	13.08	6.62	13.19	6.50	13.31	6.46	13.35	5.65	14.16
MW-14	19.76	9.02	10.74	9.06	10.70	9.33	10.43	9.22	10.54	9.14	10.62	6.06	13.70	7.91	11.85
MW-15	19.42	7.72	11.70	7.70	11.72	7.65	11.77	7.80	11.62	8.00	11.42	8.08	11.34	7.63	11.79
MW-16	18.22	5.52	12.70	5.60	12.62	5.54	12.68	5.60	12.62	5.76	12.46	5.76	12.46	5.18	13.04
MW-17	21.04	8.52	12.52	8.80	12.24	8.59	12.45	8.72	12.32	9.02	12.02	8.94	12.10	8.39	12.65
MW-18	19.69	9.10	10.59	9.16	10.53	9.54	10.15	9.40	10.29	9.32	10.37	9.30	10.39	8.20	11.49
UPRR-29	16.50	NM	NM	NM	NM	3.34	13.16	NM	NM	NM	NM	NM	NM	8.80	7.70

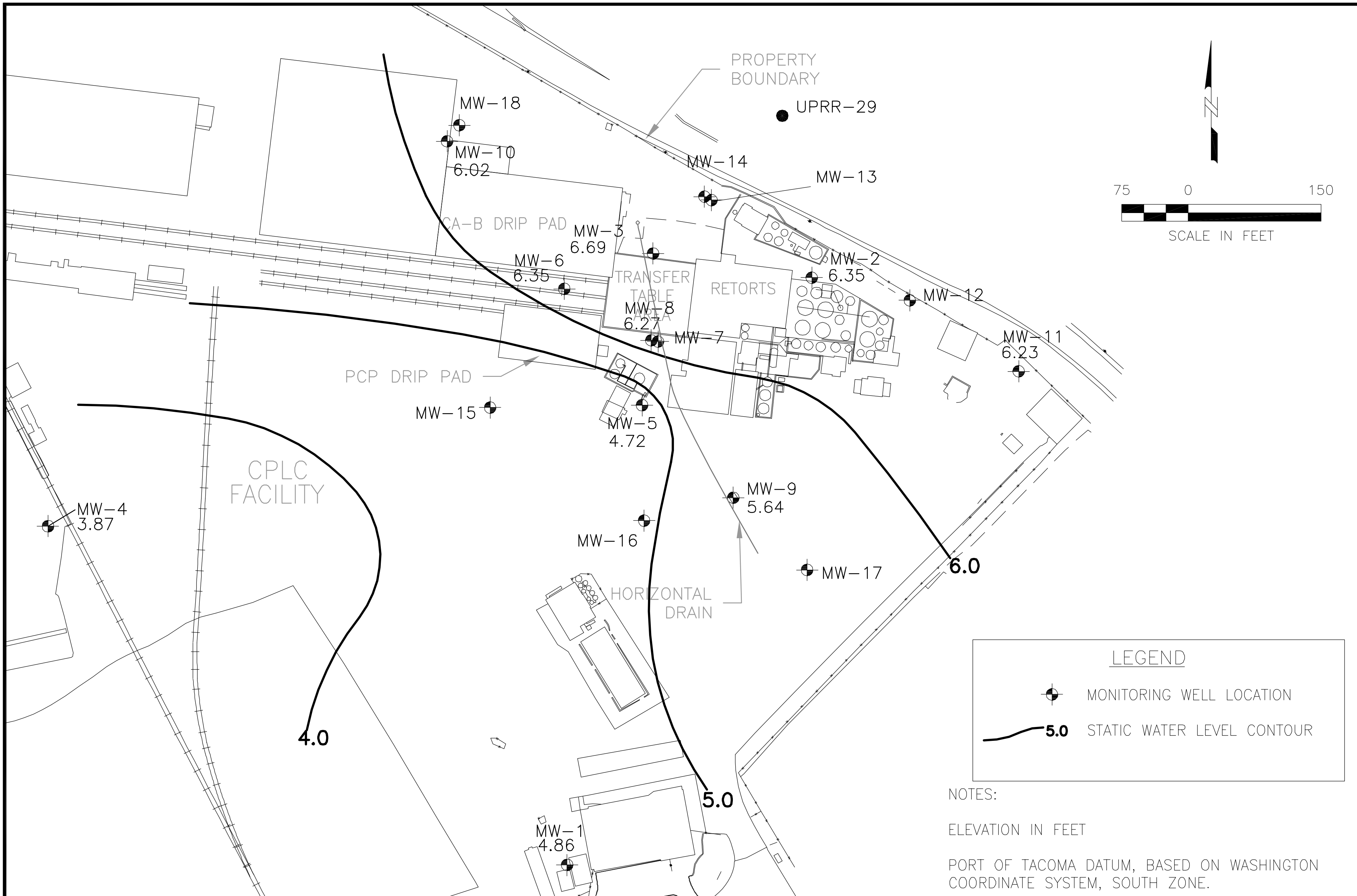


GROUNDWATER CONTOUR MAP FOR JANUARY 28, 1991

CASCADE POLE COMPANY

FIGURE 2

File: L:\Cascade Lumber\REVISED RI-FS\poten_01-94.dwg Layout: FIGURE User: MarshallE Plotted: Dec 08, 2009 - 2:22pm Xref's:



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

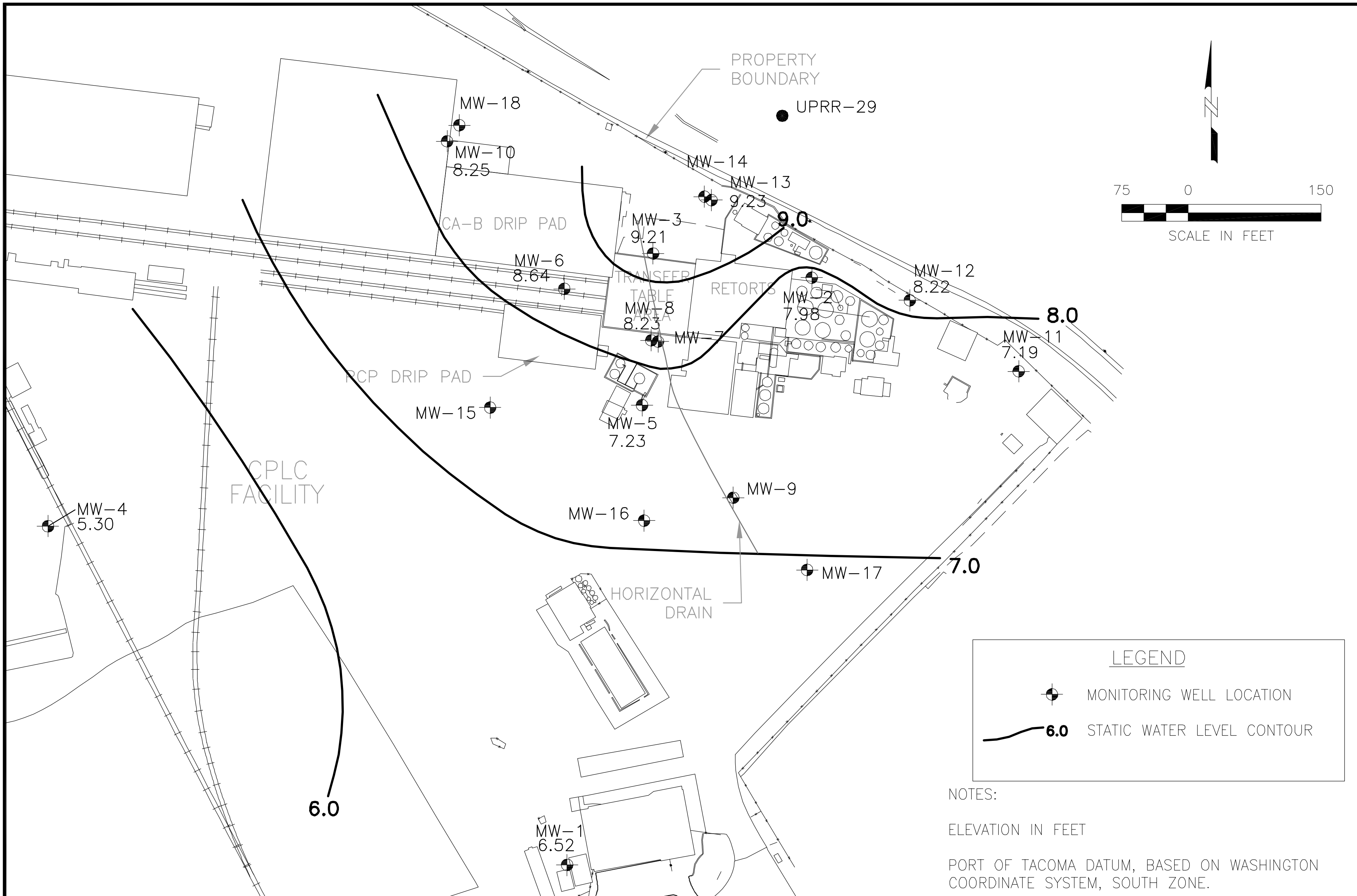
60137201-0200

DATE: 12/08/09 DRWN: E.M./SEA

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
JANUARY 10, 1994

FIGURE

File: L:\Cascade Lumber\REVISED RI-FS\poten_01-97.dwg Layout: FIGURE User: MarshallE Plotted: Dec 08, 2009 - 2:22pm Xref's:



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

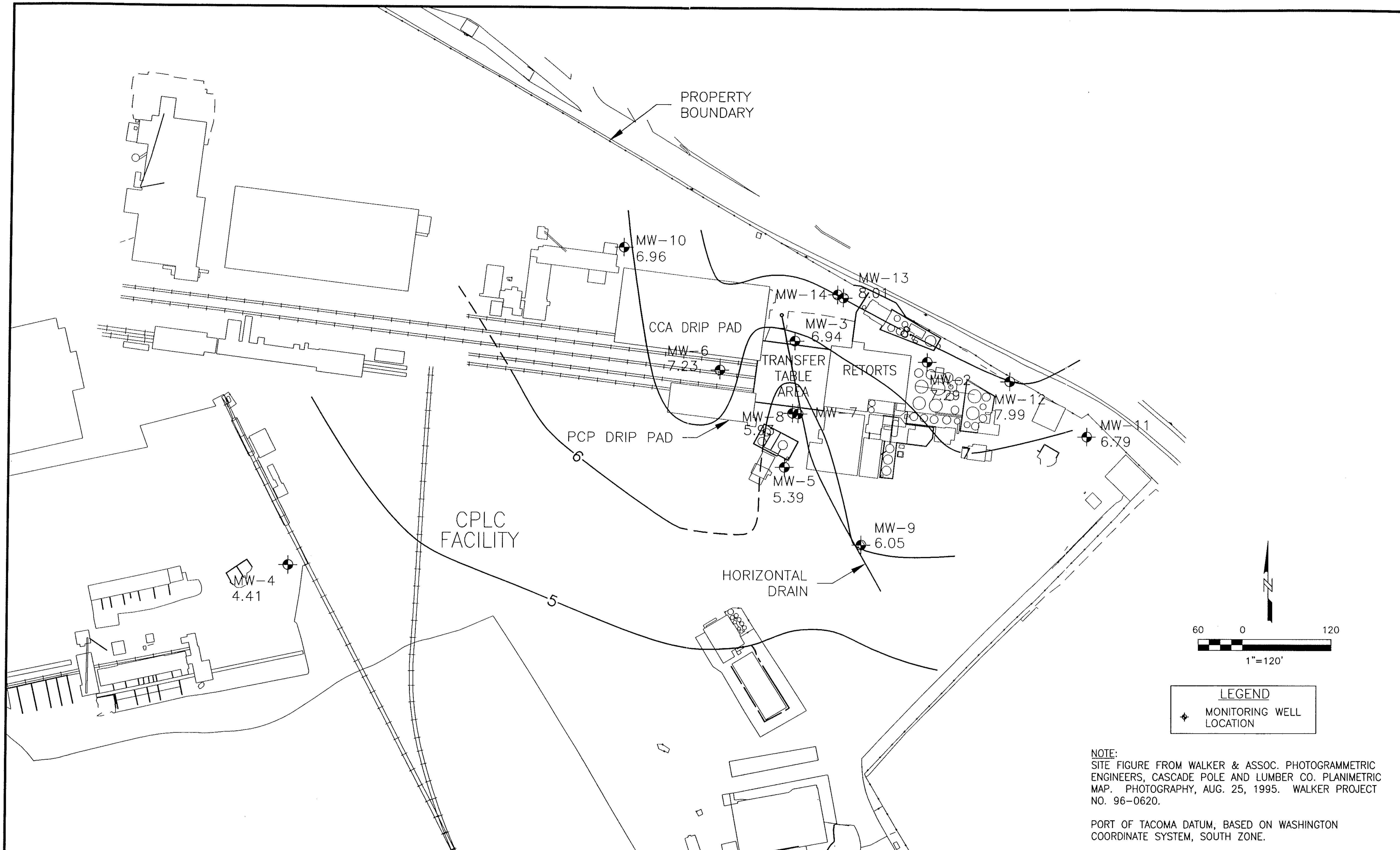
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

60137201-0200

DATE: 12/08/09 | DRWN: E.M./SEA

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
JANUARY 27, 1997

FIGURE

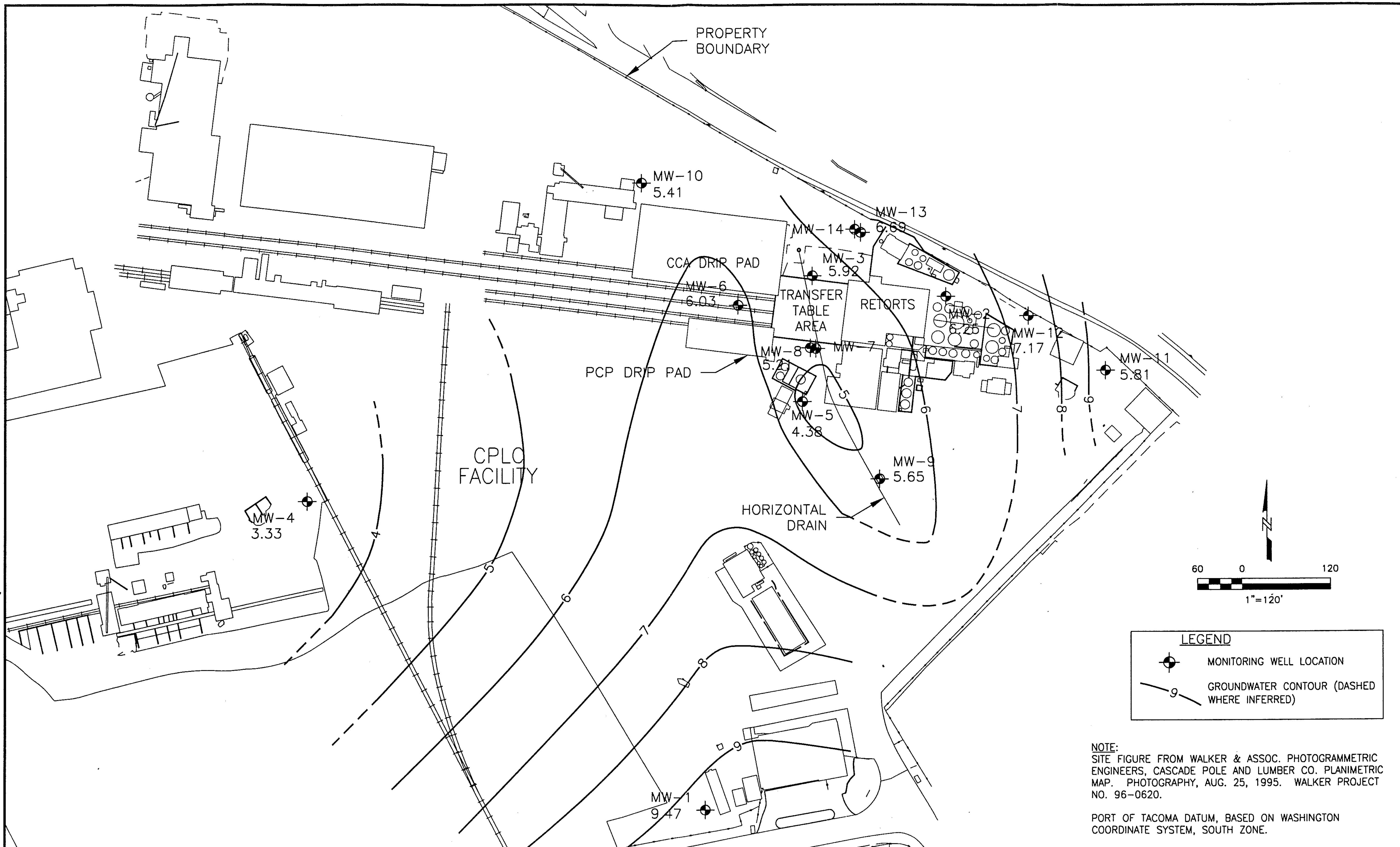


NOTE:
SITE FIGURE FROM WALKER & ASSOC. PHOTOGRAMMETRIC ENGINEERS, CASCADE POLE AND LUMBER CO. PLANIMETRIC MAP. PHOTOGRAPHY, AUG. 25, 1995. WALKER PROJECT NO. 96-0620.

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

ThermoRetec

CASCADE POLE AND LUMBER COMPANY CPLC1-04199-420			POTENTIOMETRIC SURFACE MAP JANUARY 2000 CASCADE POLE & LUMBER CO. TACOMA, WASHINGTON
DATE: 2/28/00	DRWN: N.S.	FILE: 4199S054	FIGURE 1



NOTE:
SITE FIGURE FROM WALKER & ASSOC. PHOTOGRAMMETRIC ENGINEERS, CASCADE POLE AND LUMBER CO. PLANIMETRIC MAP. PHOTOGRAPHY, AUG. 25, 1995. WALKER PROJECT NO. 96-0620.

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

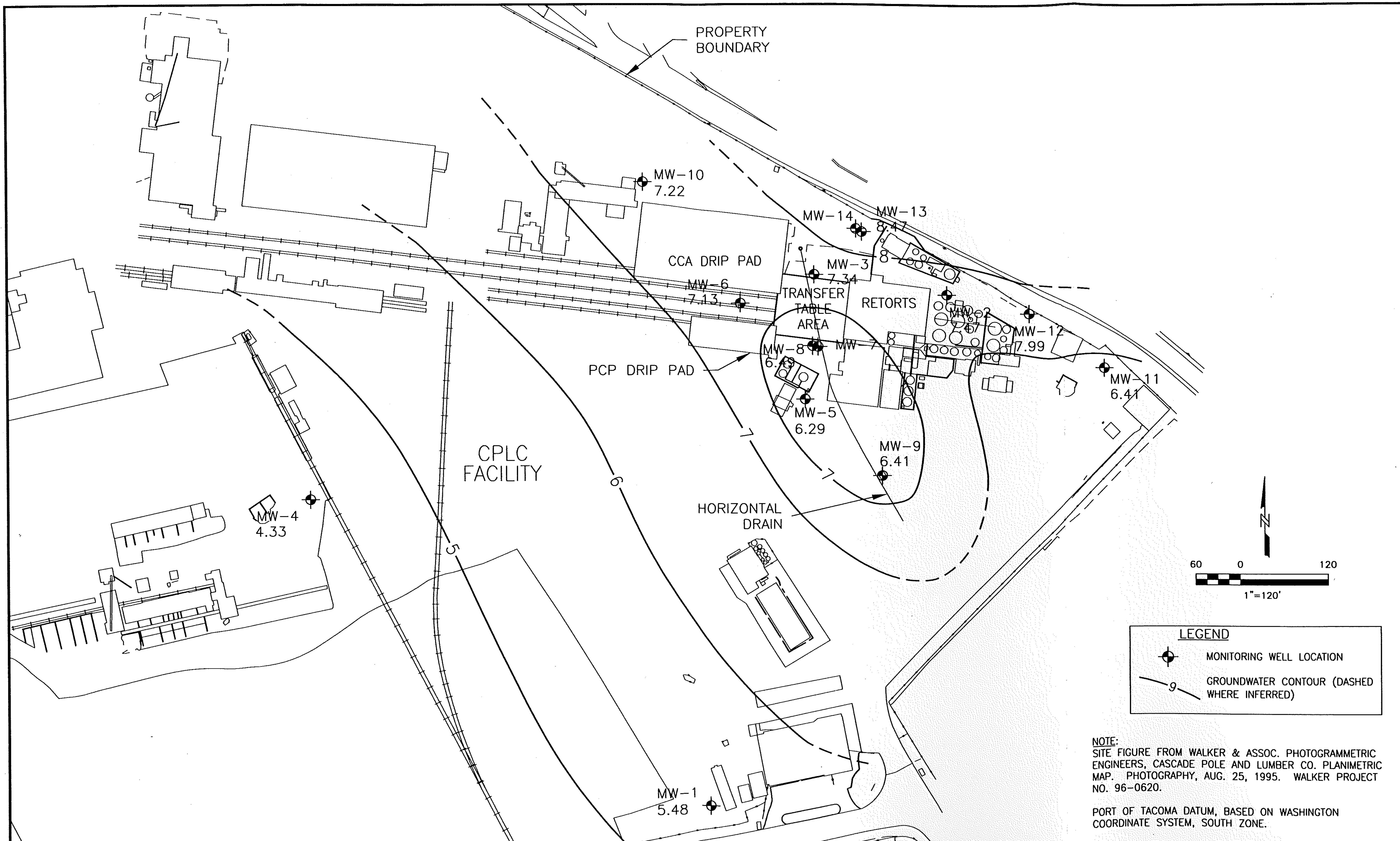
ThermoRetec

CASCADE POLE AND
LUMBER COMPANY
CPLC1-04199-420

DATE: 03/06/01 | DRWN: N.S. | FILE: 4199s068

POTENTIOMETRIC SURFACE MAP
FEBRUARY 27, 2001
CASCADE POLE & LUMBER CO.
TACOMA, WASHINGTON

FIGURE 6



RETEC

CASCADE POLE AND LUMBER COMPANY

CPLC1-04199-420

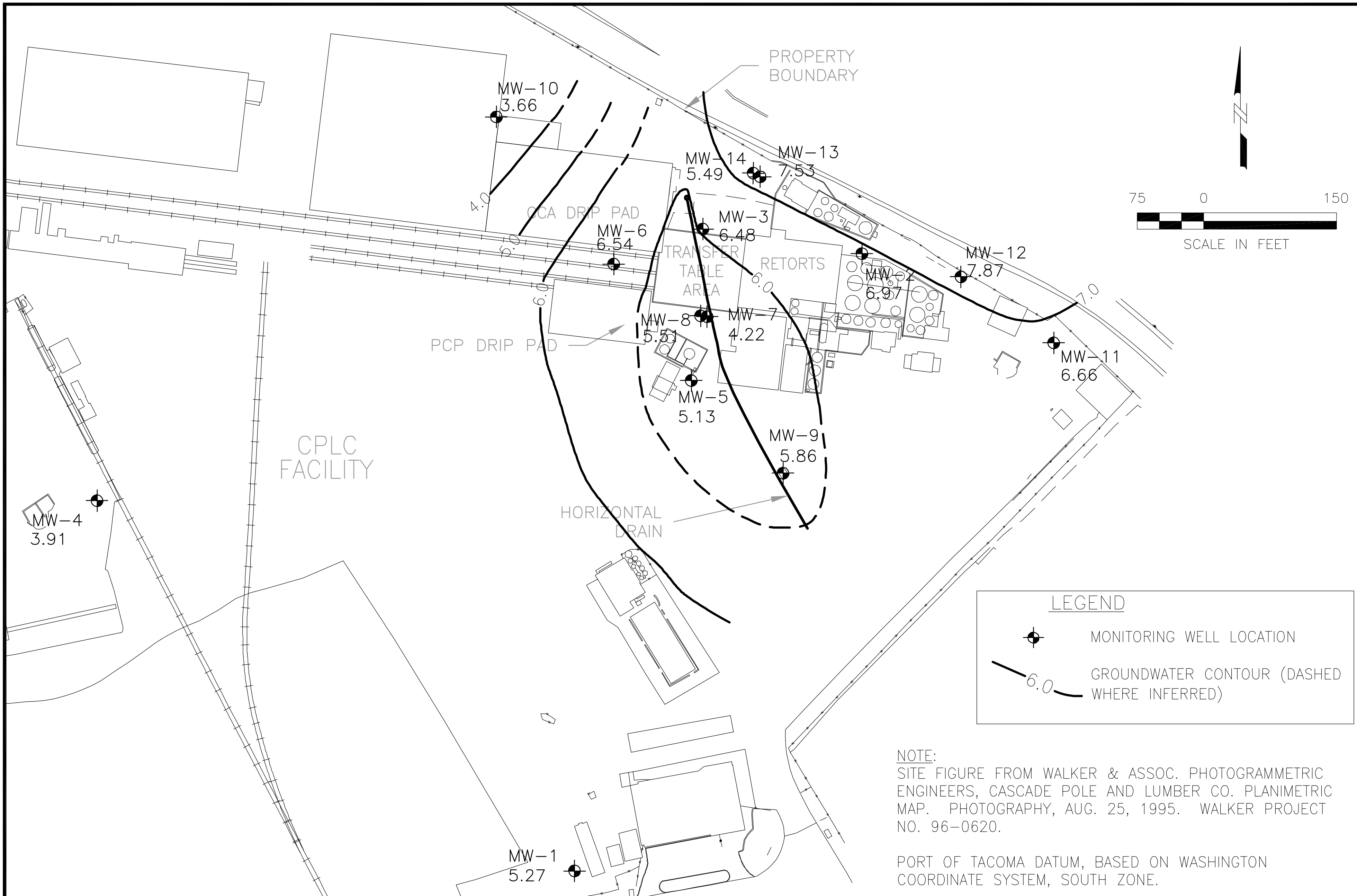
DATE: 4/10/02 | DRWN: N.J.S./SEA | FILE: 4199s096

POTENTIOMETRIC SURFACE MAP
JANUARY 24, 2002
CASCADE POLE & LUMBER CO.
TACOMA, WASHINGTON

LAYOUT: Layout1

FIGURE 6

File: L:\Cascade Lumber\REVISED RI-FS\4199s111.dwg Layout: ANSI_AI-LJ User: MarshallE Plotted: Dec 08, 2009 - 2:38pm Xref's:



NOTE: SITE FIGURE FROM WALKER & ASSOC. PHOTOGRAMMETRIC ENGINEERS, CASCADE POLE AND LUMBER CO. PLANIMETRIC MAP. PHOTOGRAPHY, AUG. 25, 1995. WALKER PROJECT NO. 96-0620.

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

CASCADE POLE AND LUMBER COMPANY

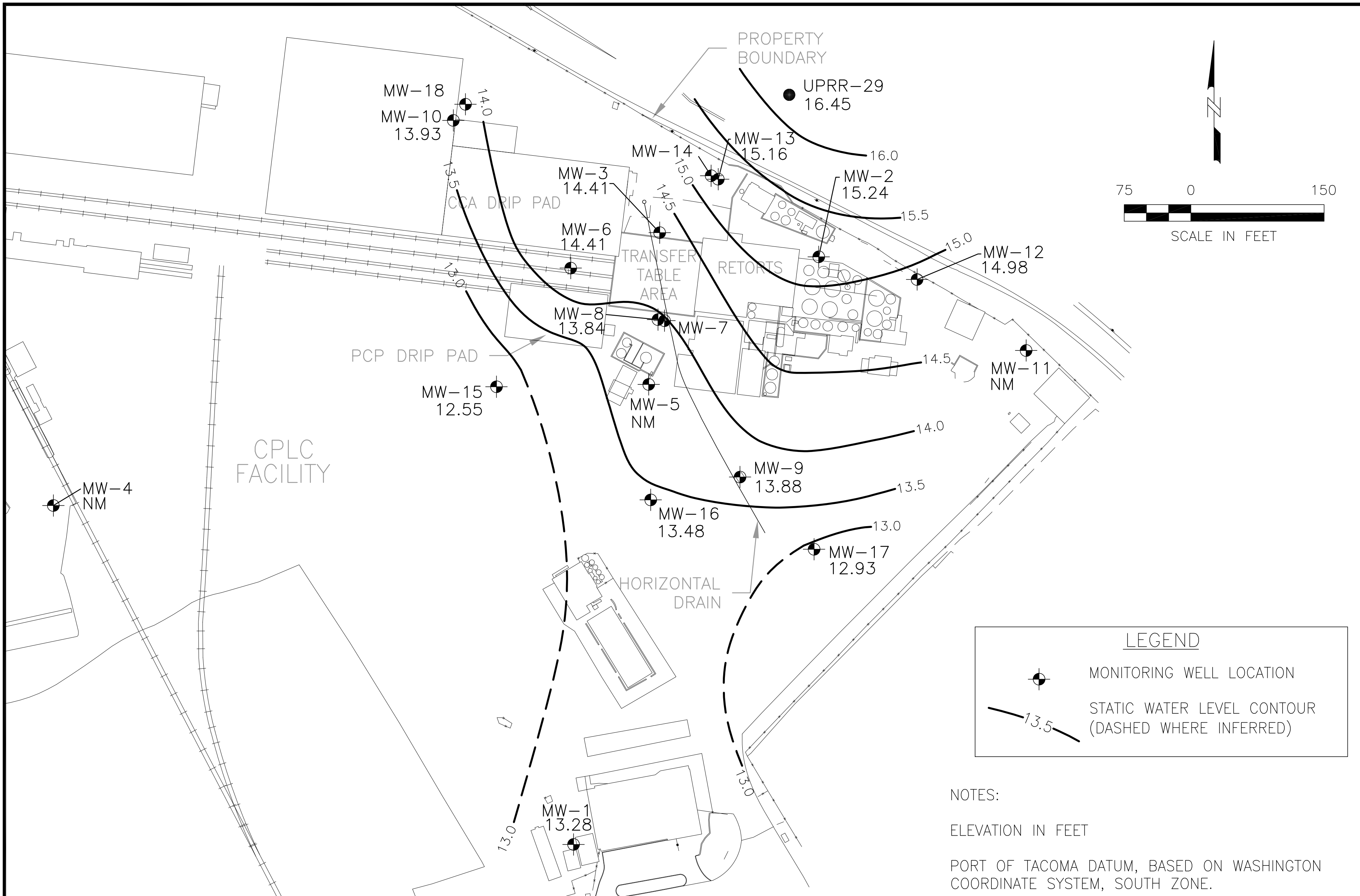
60137201-0200

DATE: 12/08/09 DRWN: E.M./SEA

POTENTIOMETRIC SURFACE MAP JANUARY 31, 2003

CASCADE POLE & LUMBER CO. TACOMA, WASHINGTON

FIGURE 3-12



RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

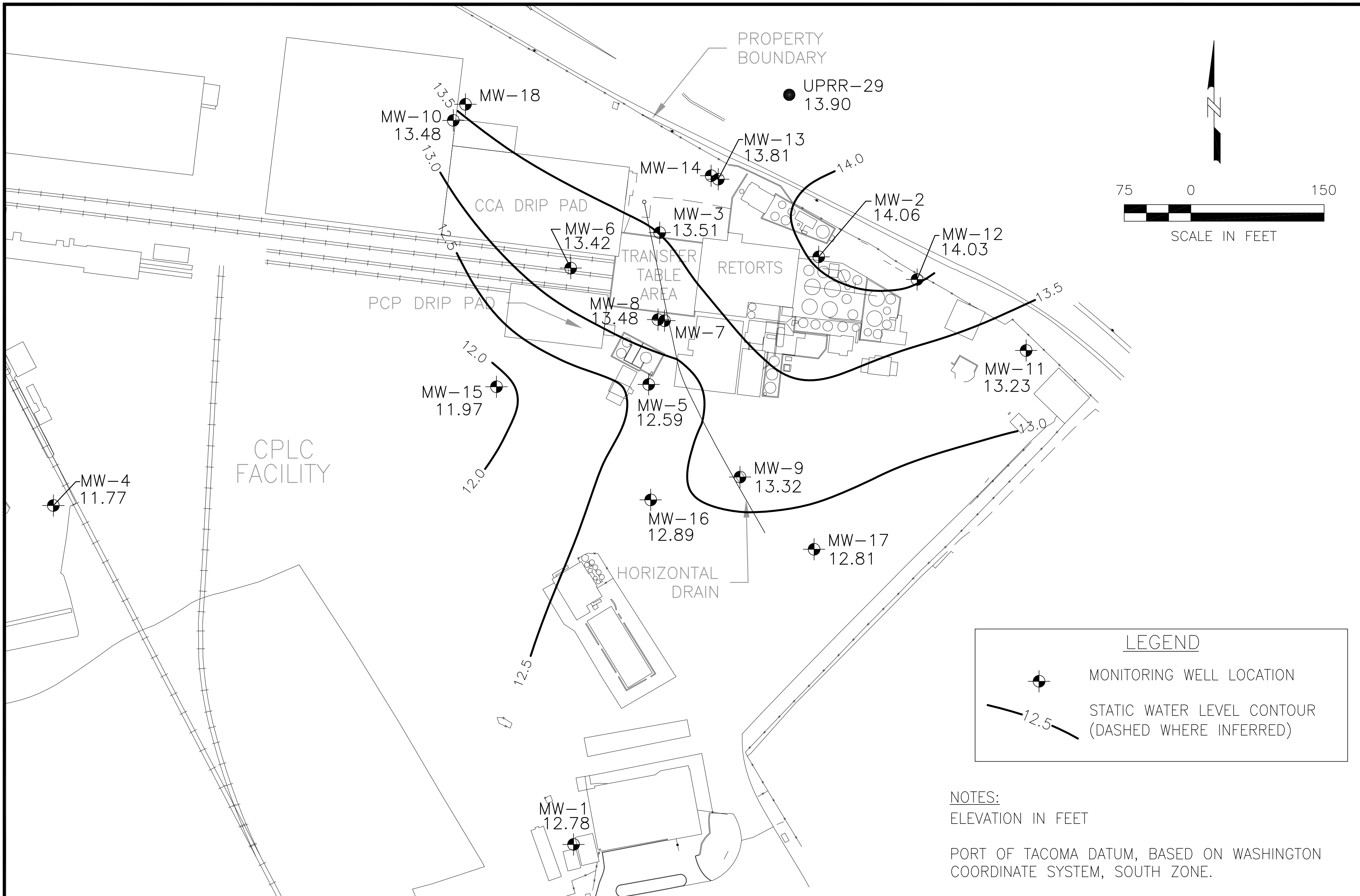
CPLU1-16832-500

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
FEBRUARY 4, 2004

DATE: 04/11/05 | DRWN: A.S./SEA

FIGURE 3-2

File: P:\CADD\Cascade Lumber\16832S014.dwg Layout: Layout1 User: oliveriam Plotted: Mar 09, 2011 - 12:30pm Xref's:



NOTES:
ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

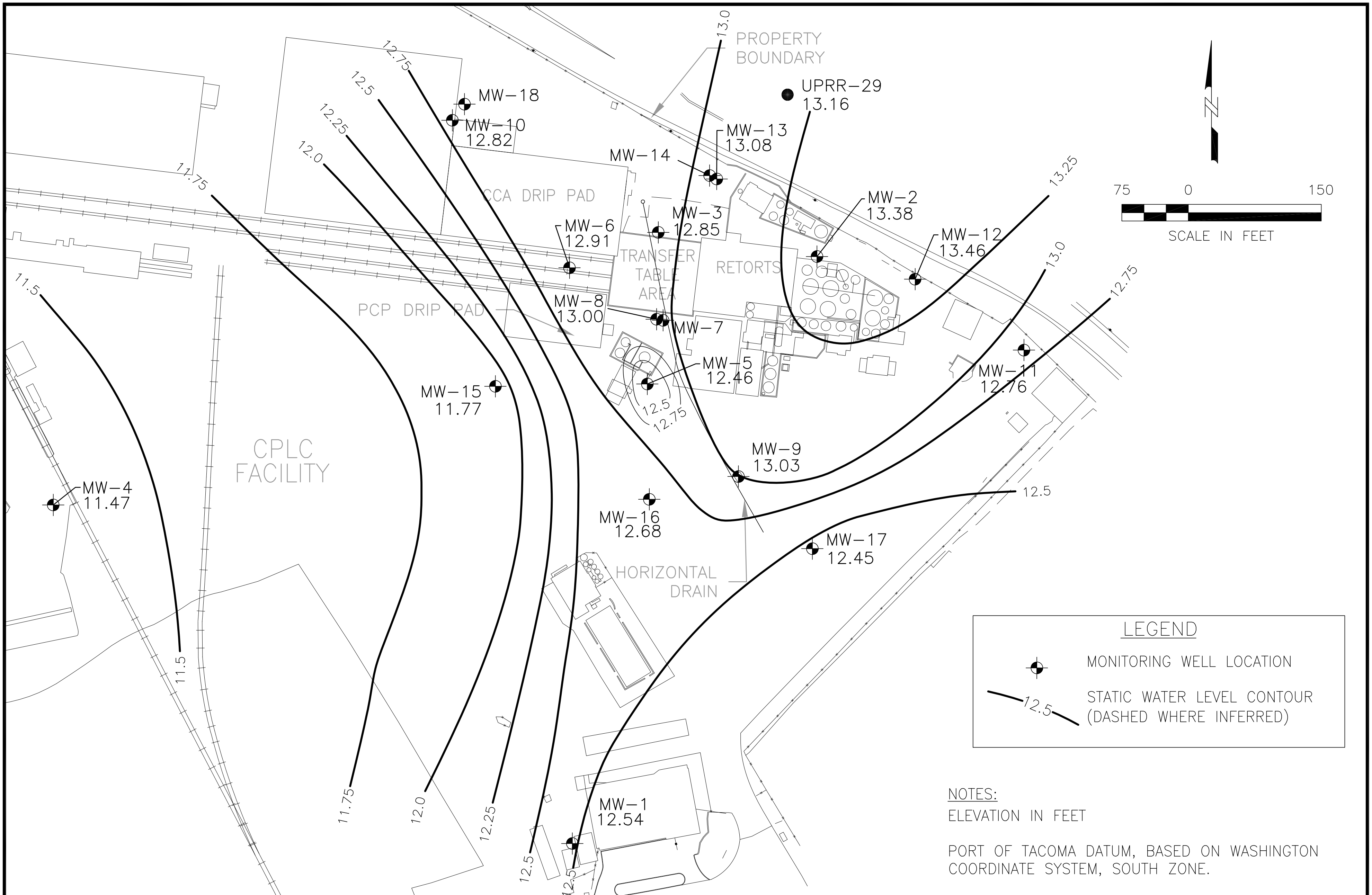
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON
CPLU1-16832-500

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
MAY 26, 2004

DATE: 04/11/05 | DRWN: A.S./SEA

FIGURE 3-3

File: P:\CADD\Cascade Lumber\16832S052.dwg Layout: FIGURE 3-4 User: oliveriam Plotted: Mar 09, 2011 - 12:31pm Xref's:



LEGEND

MONITORING WELL LOCATION

STATIC WATER LEVEL CONTOUR (DASHED WHERE INFERRED)

NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

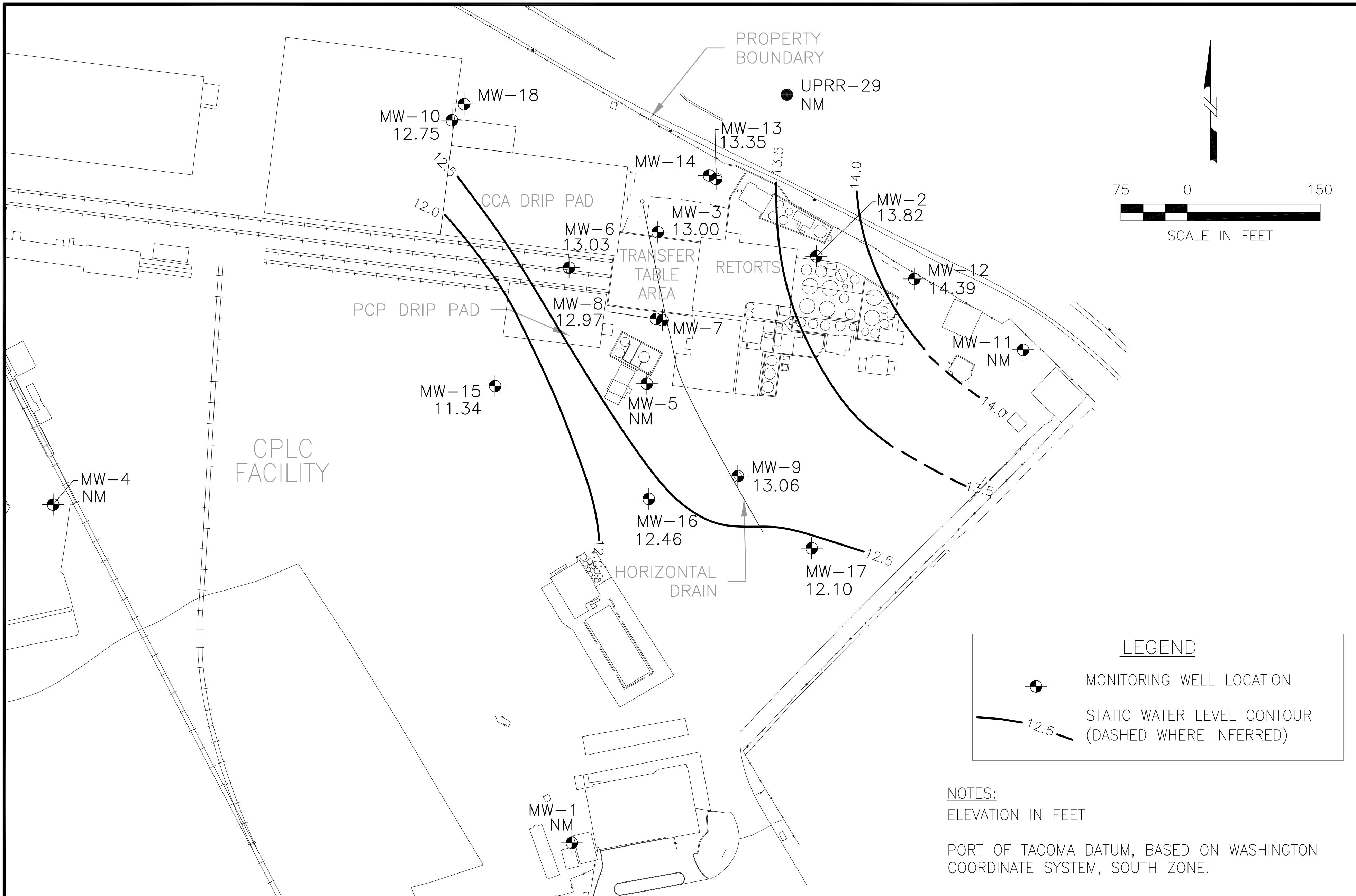
CPLU1-16832-500

DATE: 05/03/05 DRWN: A.S./SEA

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
SEPTEMBER 7, 2004

FIGURE 3-4

File: P:\CADD\Cascade Lumber\16832S023.dwg Layout: Layout1 User: oliveriam Plotted: Mar 09, 2011 - 12:33pm Xref's:



RETEC

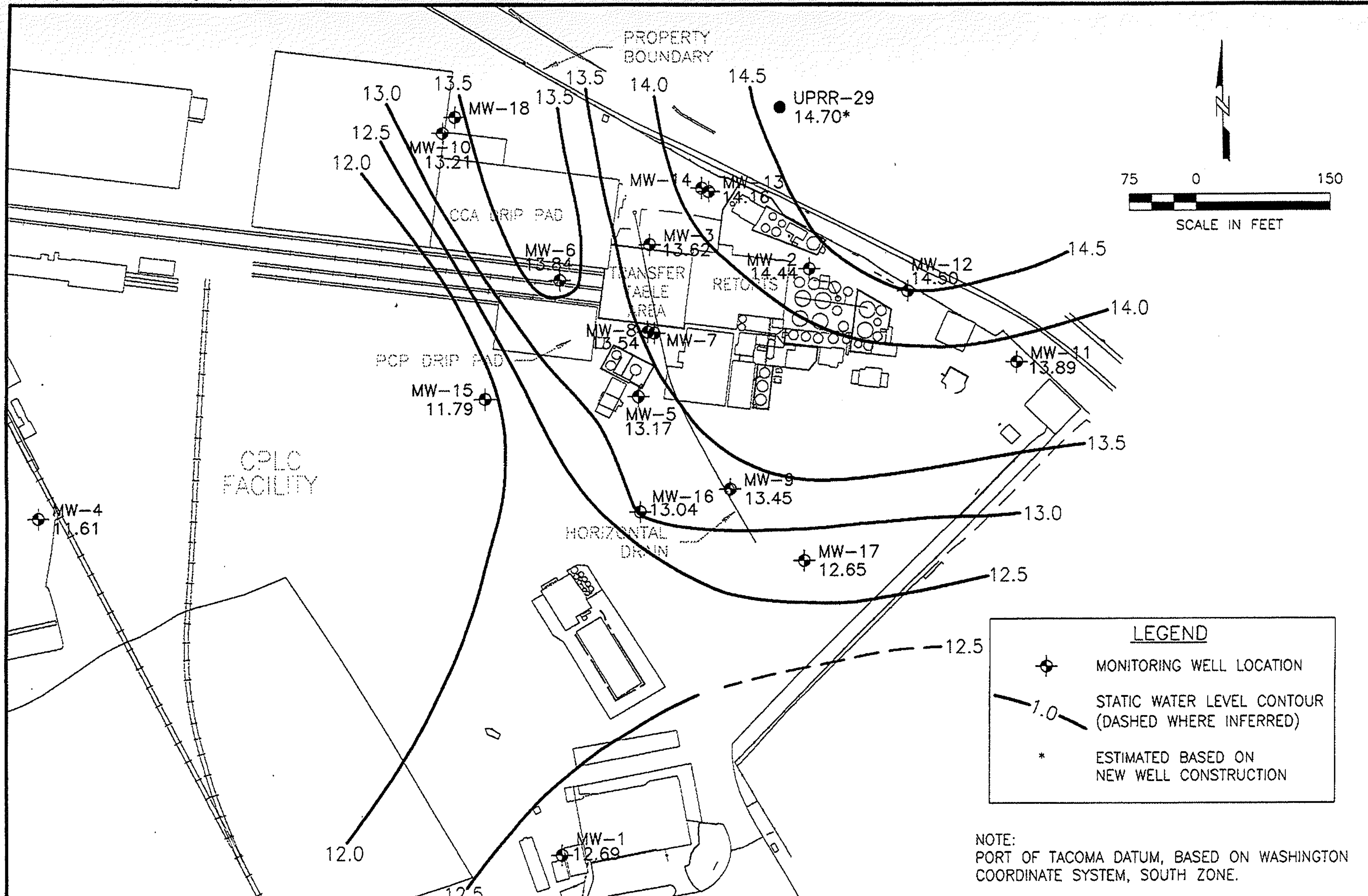
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

CPLU1-16832-500

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
NOVEMBER 30th, 2004

DATE: 04/11/05	DRWN: A.S./SEA		**FIGURE 3-5**

File: J:\16832\16832S064.dwg Layout: FIGURE 11 User: mwilliamson Plotted: May 02, 2005 - 12:12pm Xref's:



RETEC

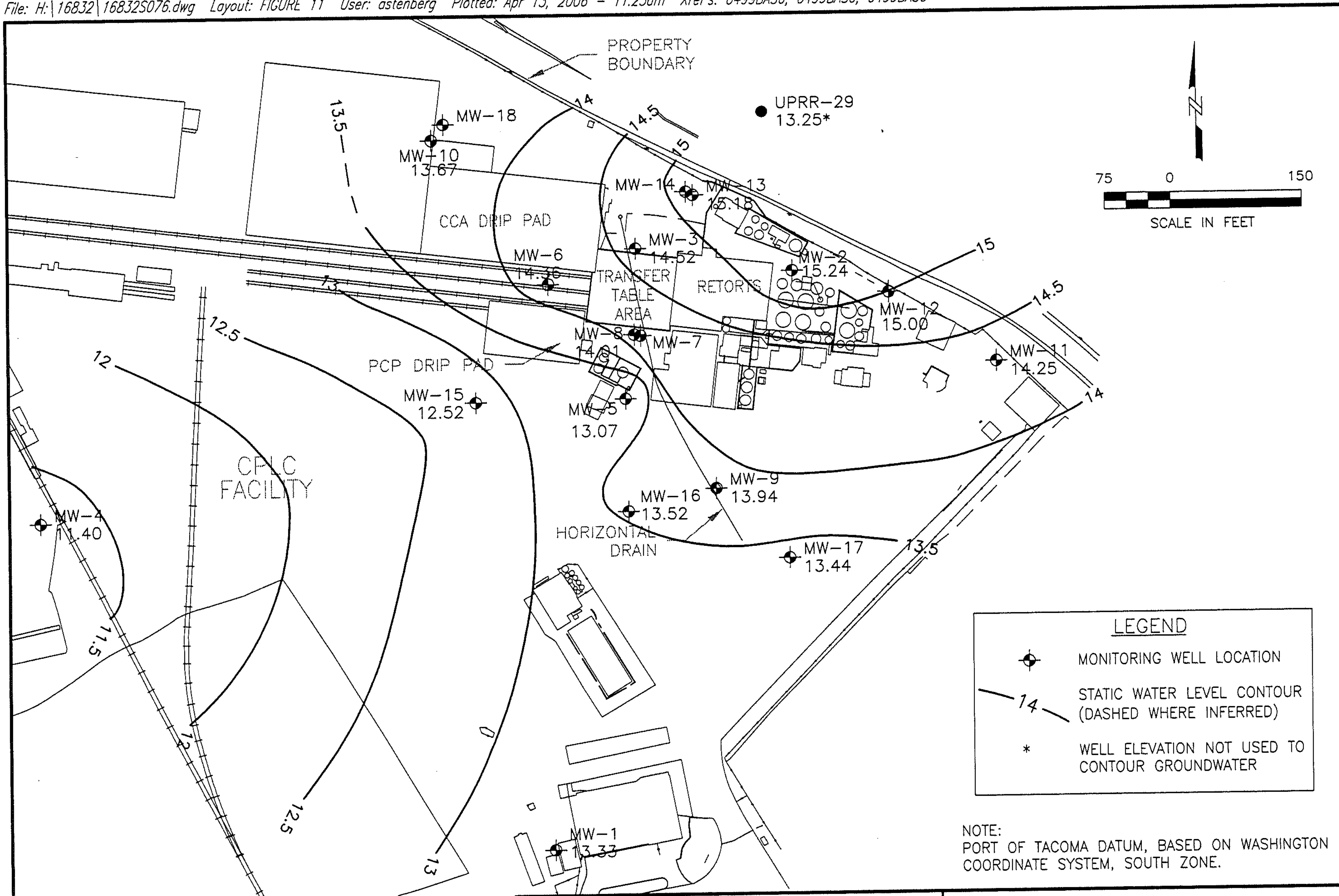
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON
CPLU1-16832-500

DATE: 5/02/05 | DRWN: A.S./SEA

POTENTIOMETRIC SURFACE
SHALLOW AQUIFER
JANUARY 27, 2005

FIGURE 11

File: H:\16832\16832S076.dwg Layout: FIGURE 11 User: astenberg Plotted: Apr 13, 2006 - 11:23am Xref's: 0499BAS6, 0499BAS6, 0499BAS6



RETEC

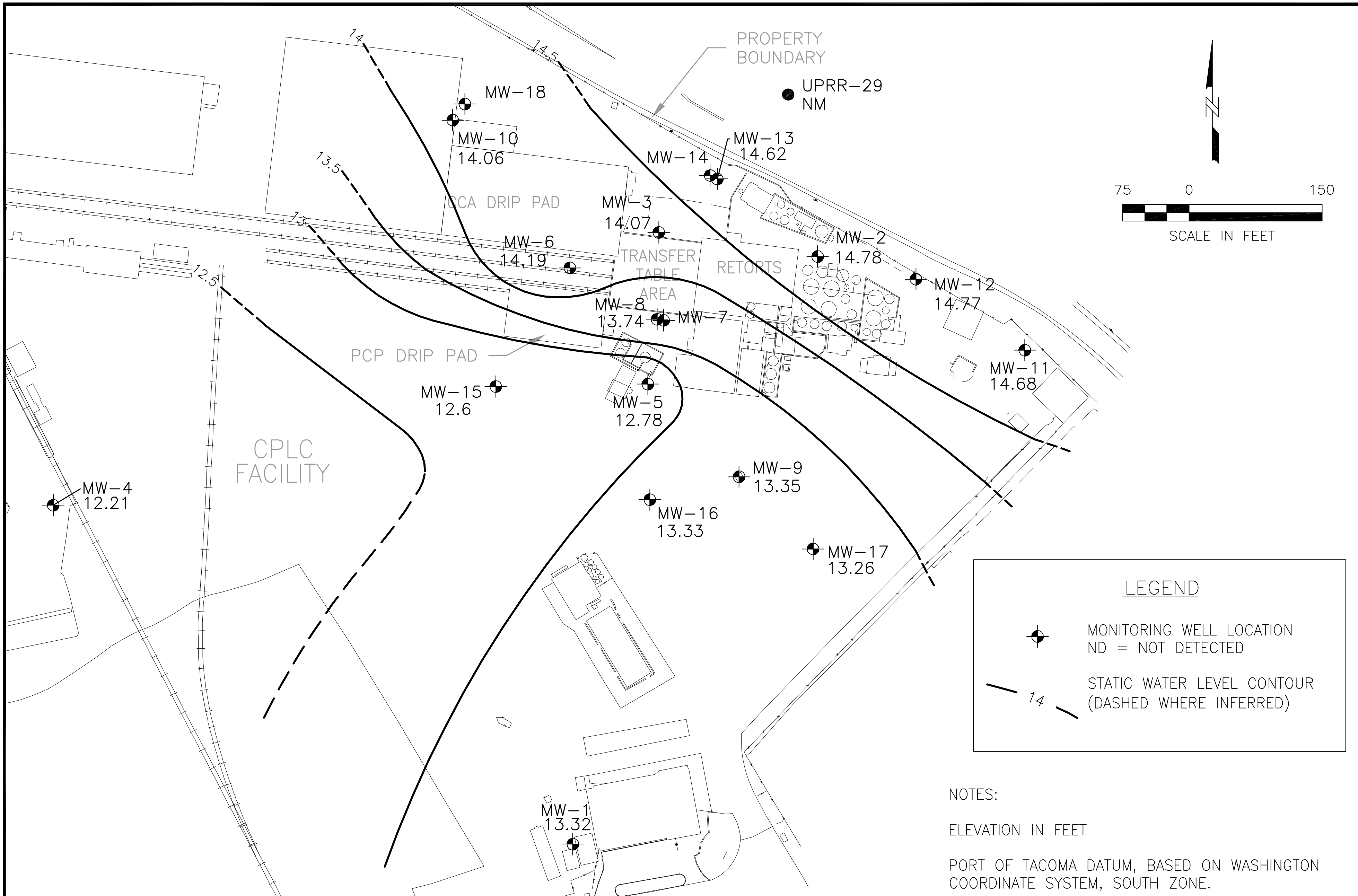
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

CPLU1-16832-500

DATE: 04/13/06 DRWN: A.S./SEA

POTENTIOMETRIC SURFACE SHALLOW AQUIFER JANUARY 2006

FIGURE 11



LEGEND

MONITORING WELL LOCATION
ND = NOT DETECTED

STATIC WATER LEVEL CONTOUR (DASHED WHERE INFERRED)

NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

ENSR | AECOM

Merged with ENSR in 2007

RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

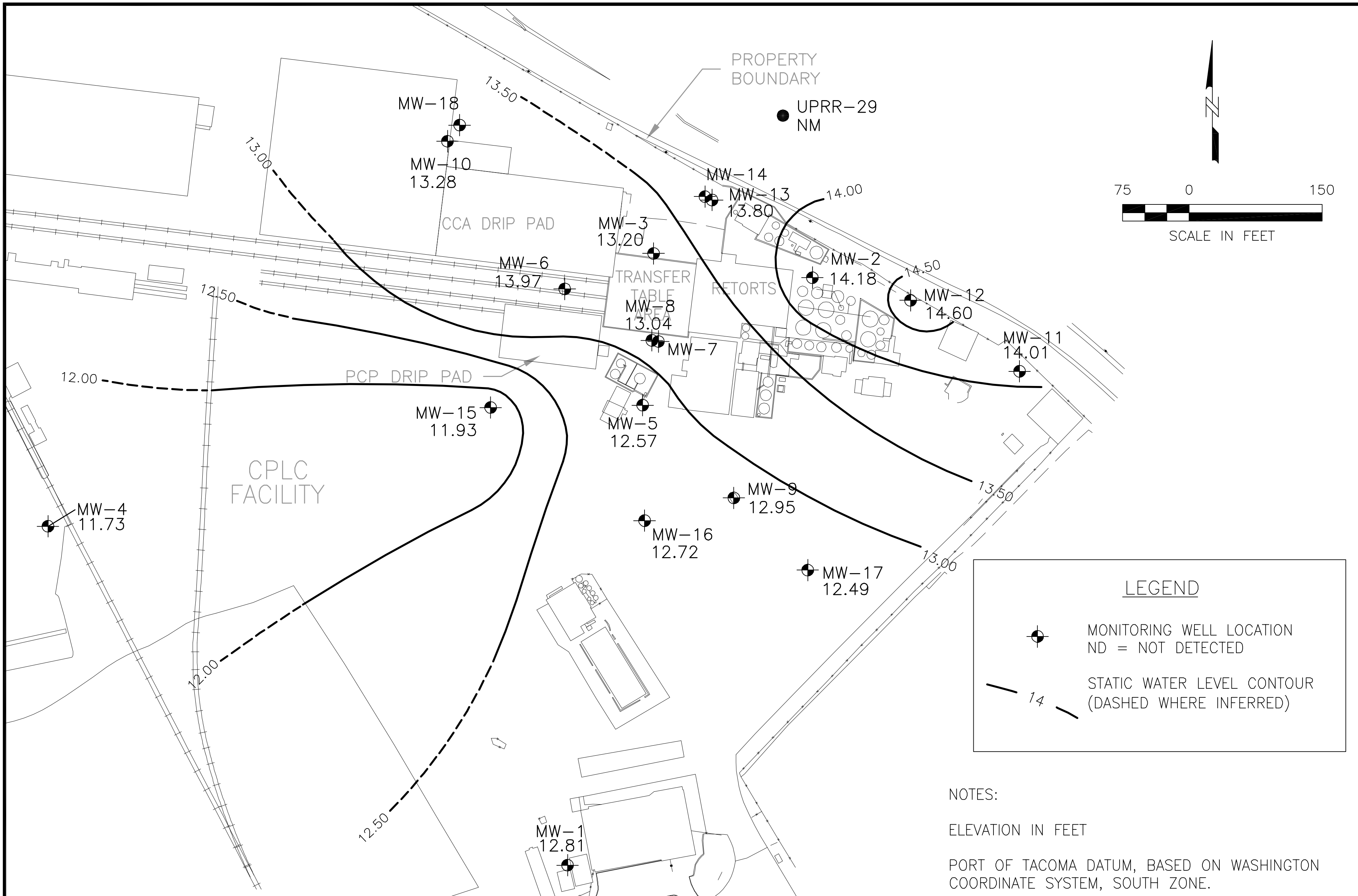
CPLC1-16832-500

POTENTIOMETRIC SURFACE
SHALLOW AQUIFER
FEBRUARY 2007

DATE: 05/03/07 | DRWN: E.M./SEA

FIGURE 11

File: L:\Cascade Lumber\04530-015-S002.dwg Layout: FIG 11 User: emarshall Plotted: Mar 10, 2008 - 2:31pm Xref's:



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

ENSR | AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

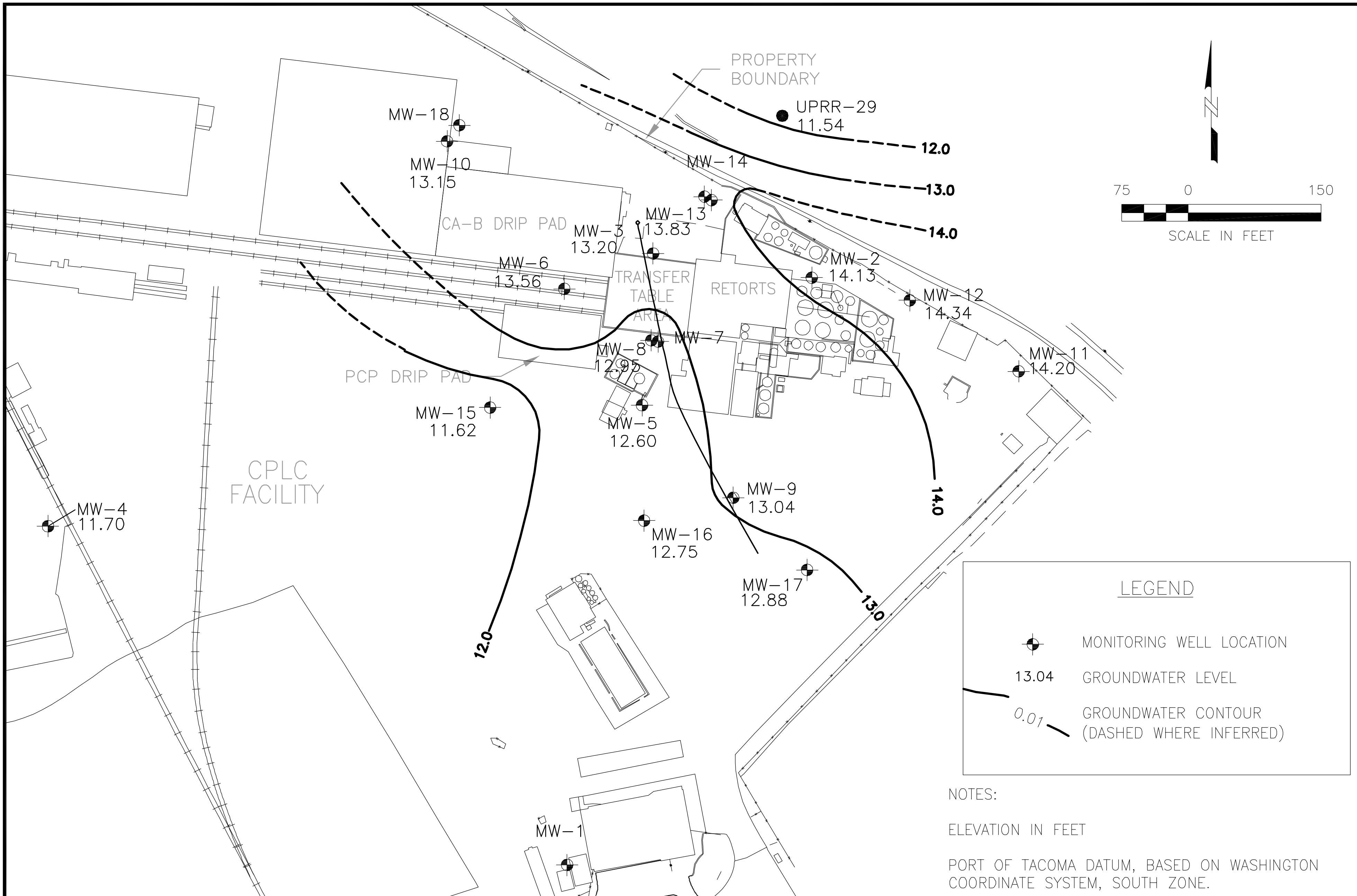
CPLC1-16832-500

POTENTIOMETRIC SURFACE
SHALLOW AQUIFER
JANUARY 2008

DATE: 03/10/08 | DRWN: E.M./SEA

FIGURE 11

File: P:\CADD\Cascade Lumber\gw_level.dwg Layout: FIGURE 11 User: MarshallE Plotted: Apr 17, 2009 - 9:30am Xref's:



LEGEND

MONITORING WELL LOCATION

13.04 GROUNDWATER LEVEL

0.01 GROUNDWATER CONTOUR (DASHED WHERE INFERRED)

NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

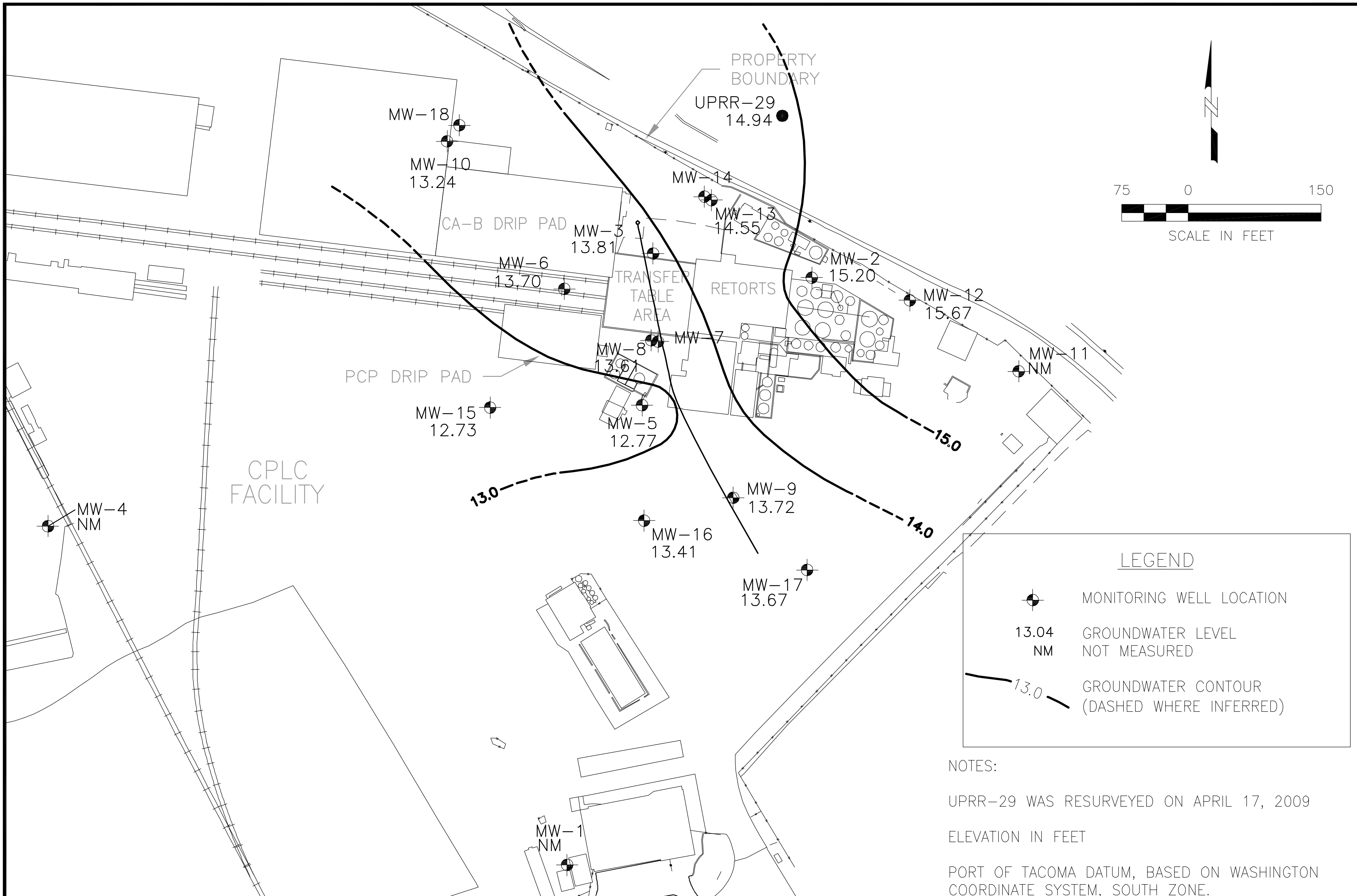
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

04530-015-300

GROUNDWATER LEVELS
JANUARY 2009

DATE: 04/16/09 | DRWN: E.M./SEA

FIGURE 11



NOTES:

UPRR-29 WAS RESURVEYED ON APRIL 17, 2009

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

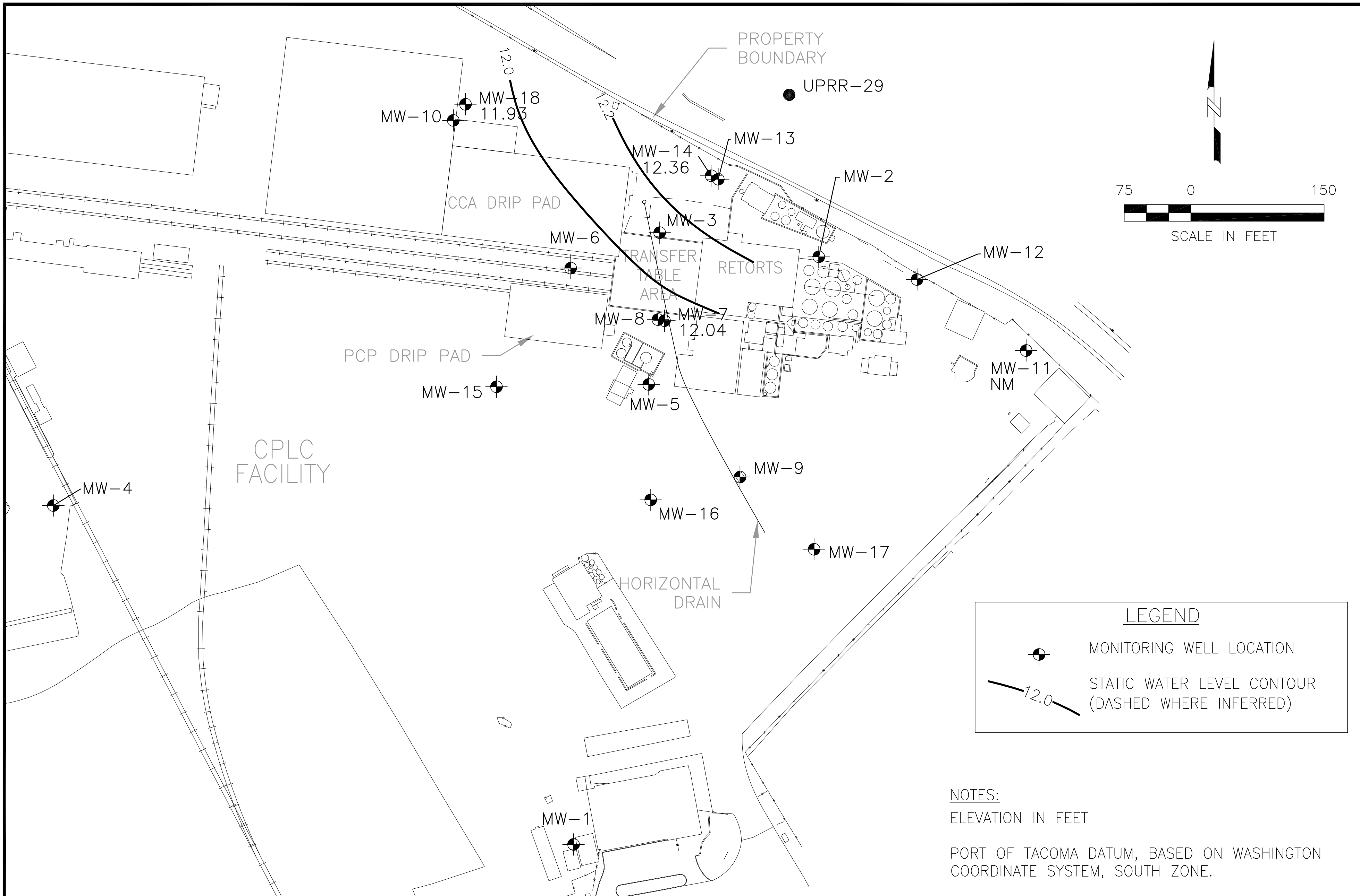
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON
60137021-0300

GROUNDWATER LEVELS
JANUARY 2010

DATE: 03/25/10 | DRWN: E.M./SEA

FIGURE 11

File: P:\CADD\Cascade Lumber\16832S033.dwg Layout: Layout1 User: oliveriam Plotted: Mar 09, 2011 - 12:37pm Xref's:



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

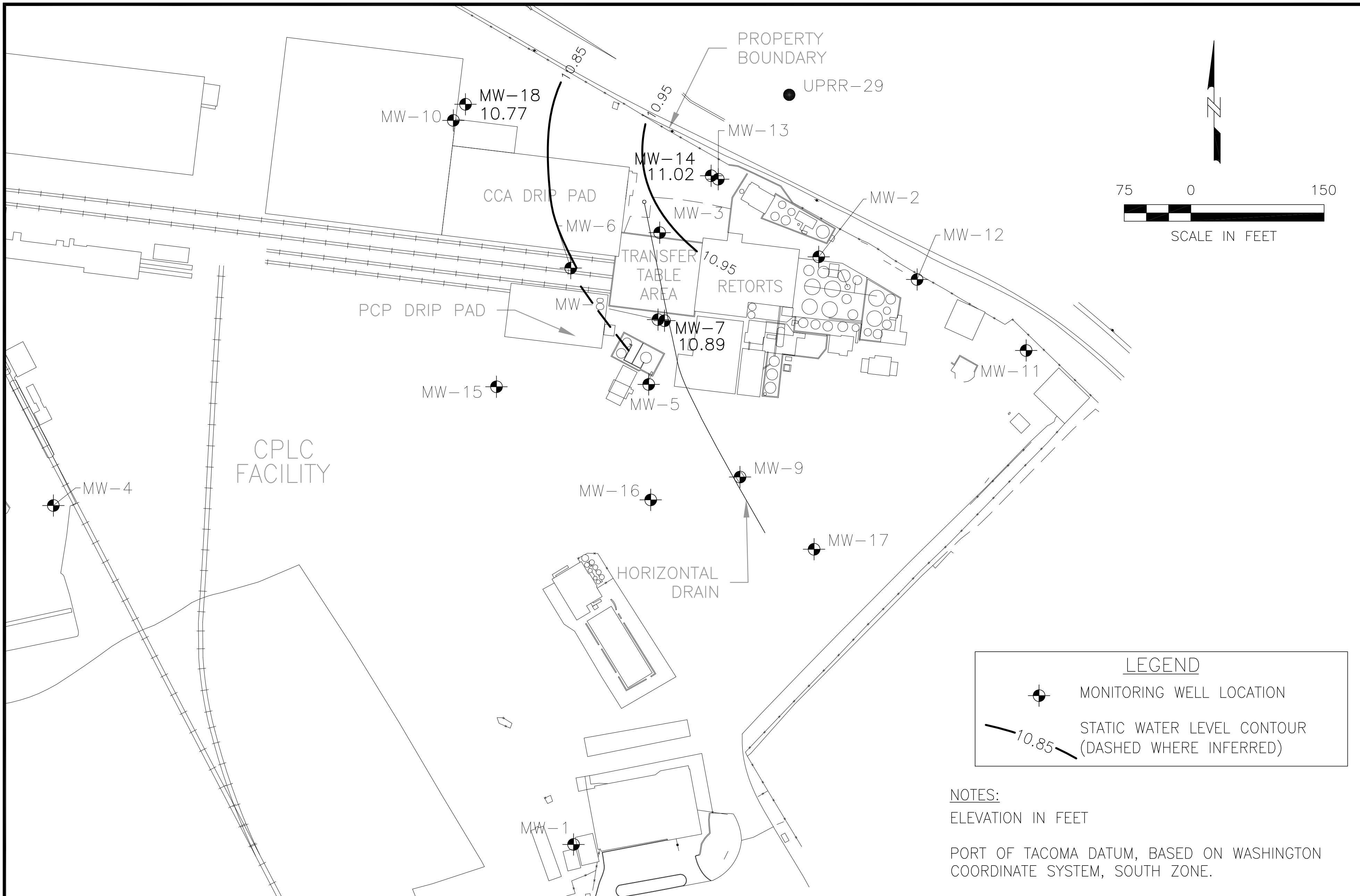
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

CPLU1-16832-500

POTENTIOMETRIC SURFACE MAP
DEEPER AQUIFER
FEBRUARY 4, 2004

DATE: 04/11/05 | DRWN: A.S./SEA

FIGURE 3-8



RETEC

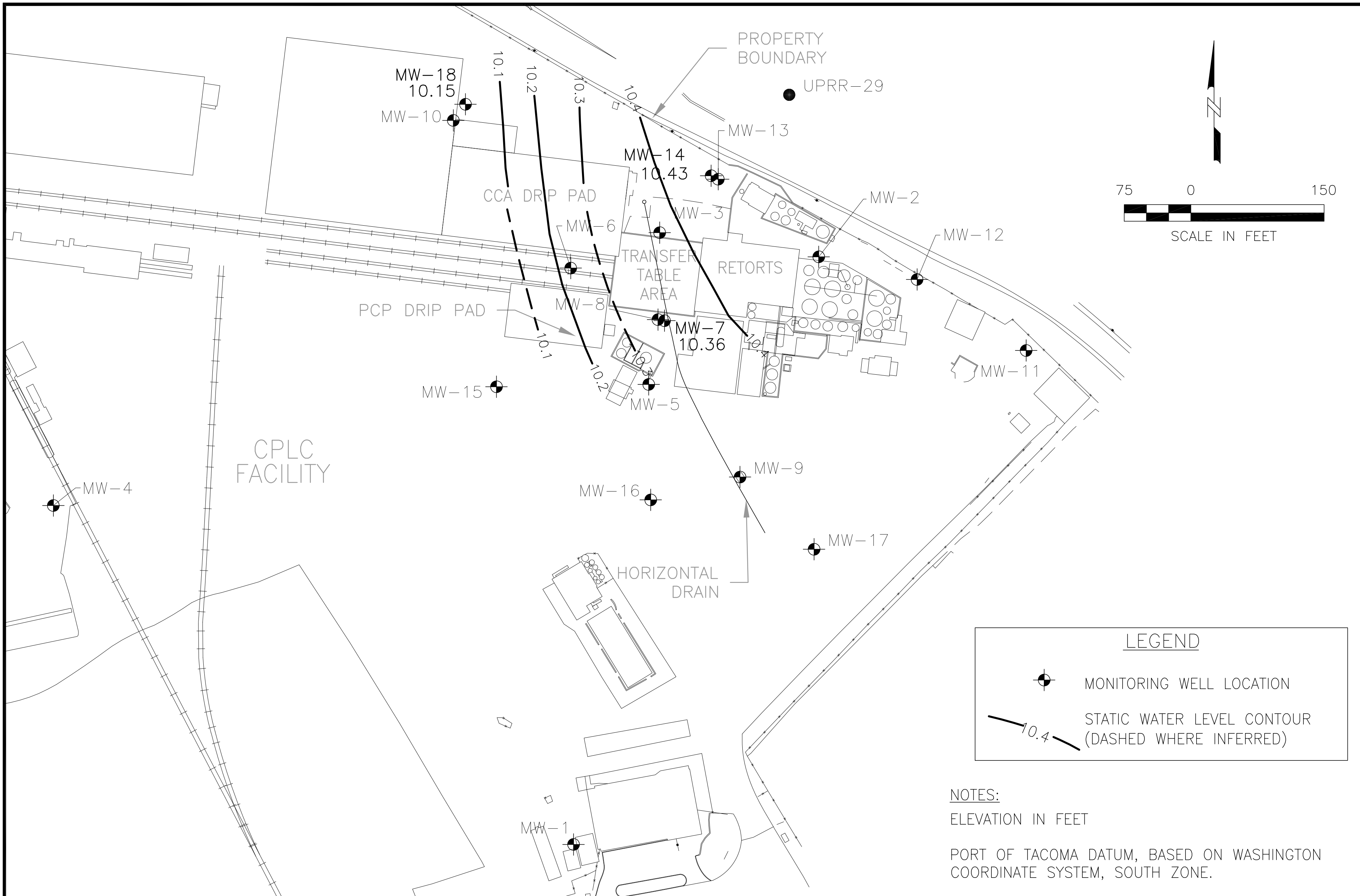
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

CPLU1-16832-500

DATE: 04/11/05 DRWN: A.S./SEA

POTENTIOMETRIC SURFACE MAP
DEEPER AQUIFER
MAY 26, 2004

FIGURE 3-9



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

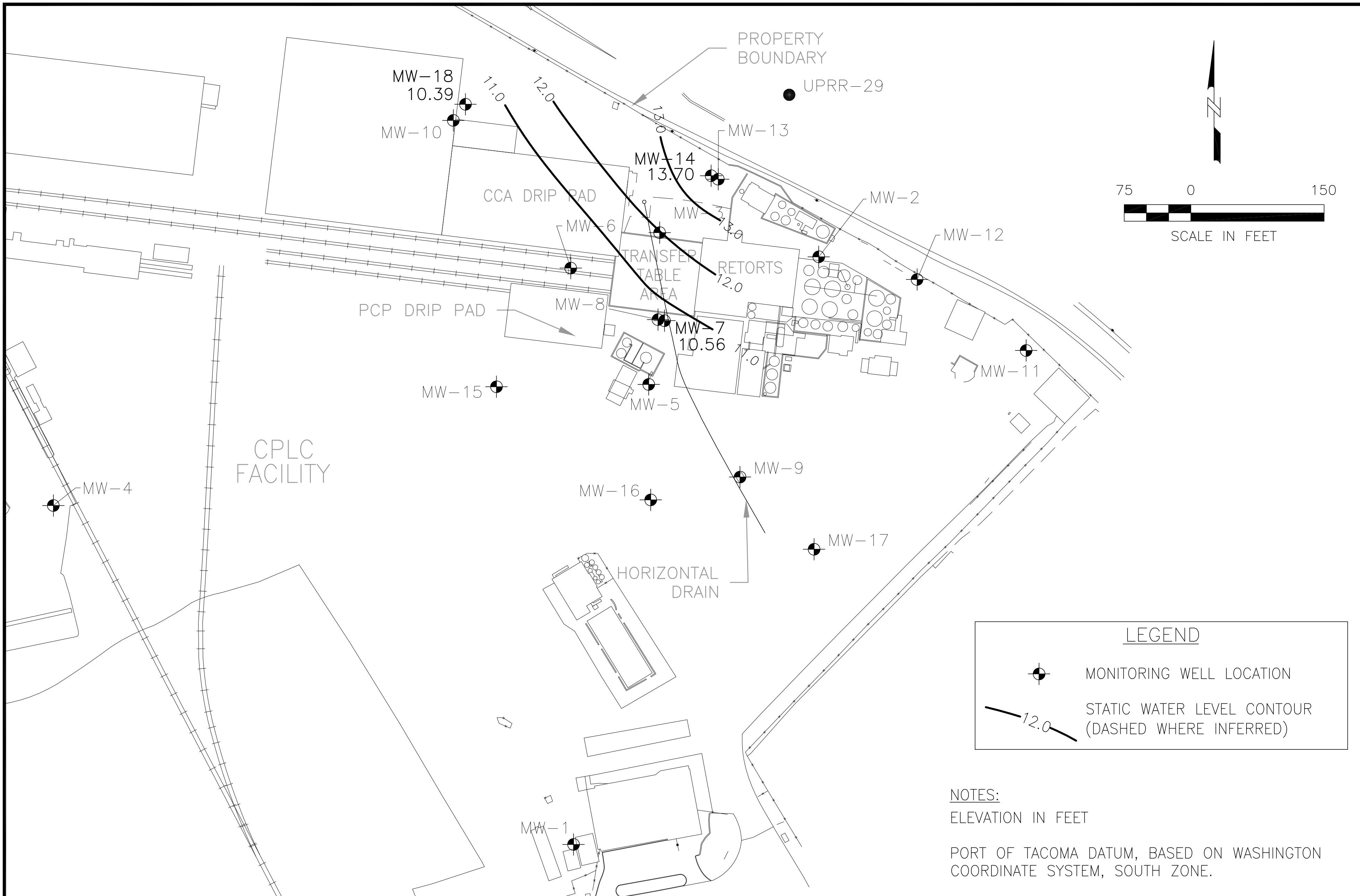
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

CPLU1-16832-500

DATE: 05/03/05 | DRWN: A.S./SEA

POTENTIOMETRIC SURFACE MAP
DEEPER AQUIFER
SEPTEMBER 7, 2004

FIGURE 3-10



LEGEND

MONITORING WELL LOCATION

12.0 STATIC WATER LEVEL CONTOUR (DASHED WHERE INFERRED)

NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

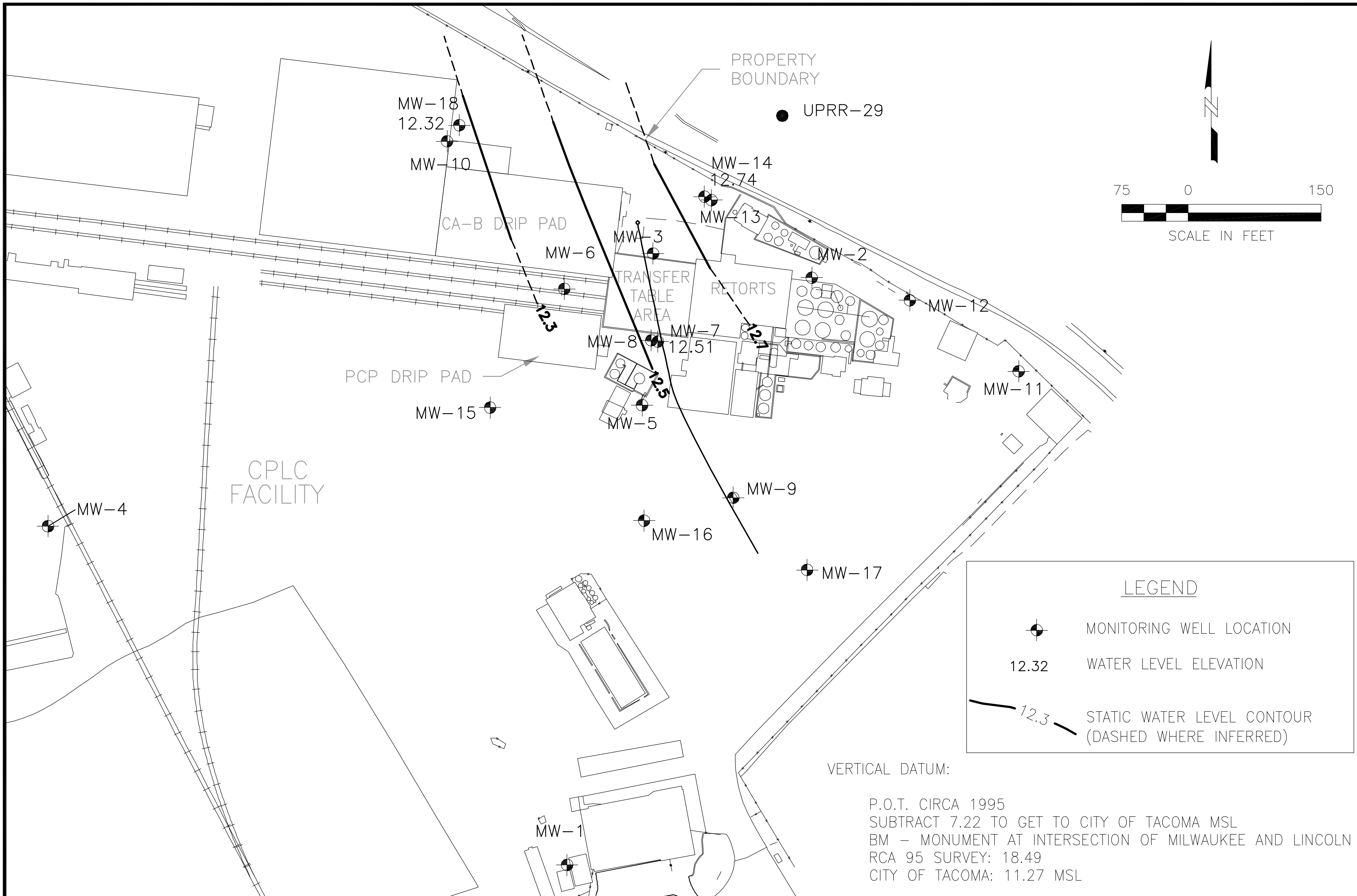
CPLU1-16832-500

DATE: 04/11/05 DRWN: A.S./SEA

POTENTIOMETRIC SURFACE MAP
DEEPER AQUIFER
NOVEMBER 30, 2004

FIGURE 3-11

File: M:\Cascade Lumber\Annual GW Report\2010\potentio_deep_1-10.dwg Layout: FIGURE 12 User: MarshallE Plotted: Mar 25, 2010 - 10:12am Xref's:



AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

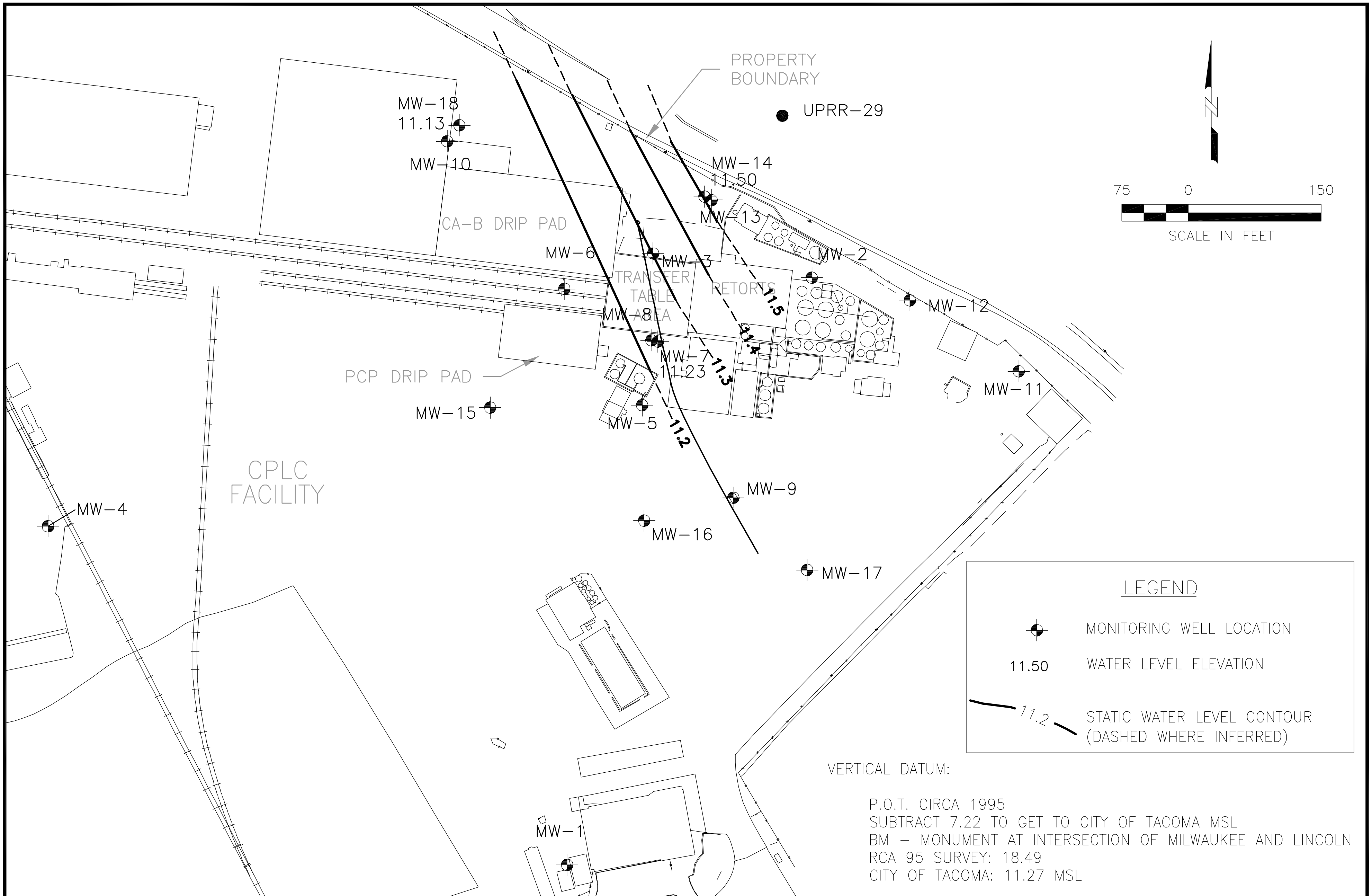
60137201-0300

DATE: 03/25/10 DRWN: E.M./SEA

POTENTIOMETRIC SURFACE MAP
DEEP AQUIFER
JANUARY 2010

FIGURE 12

File: P:\CADD\Cascade Lumber\potentio_deep_1-09.dwg Layout: FIGURE 12 User: MarshallE Plotted: Mar 24, 2009 - 11:02am Xref's:



AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

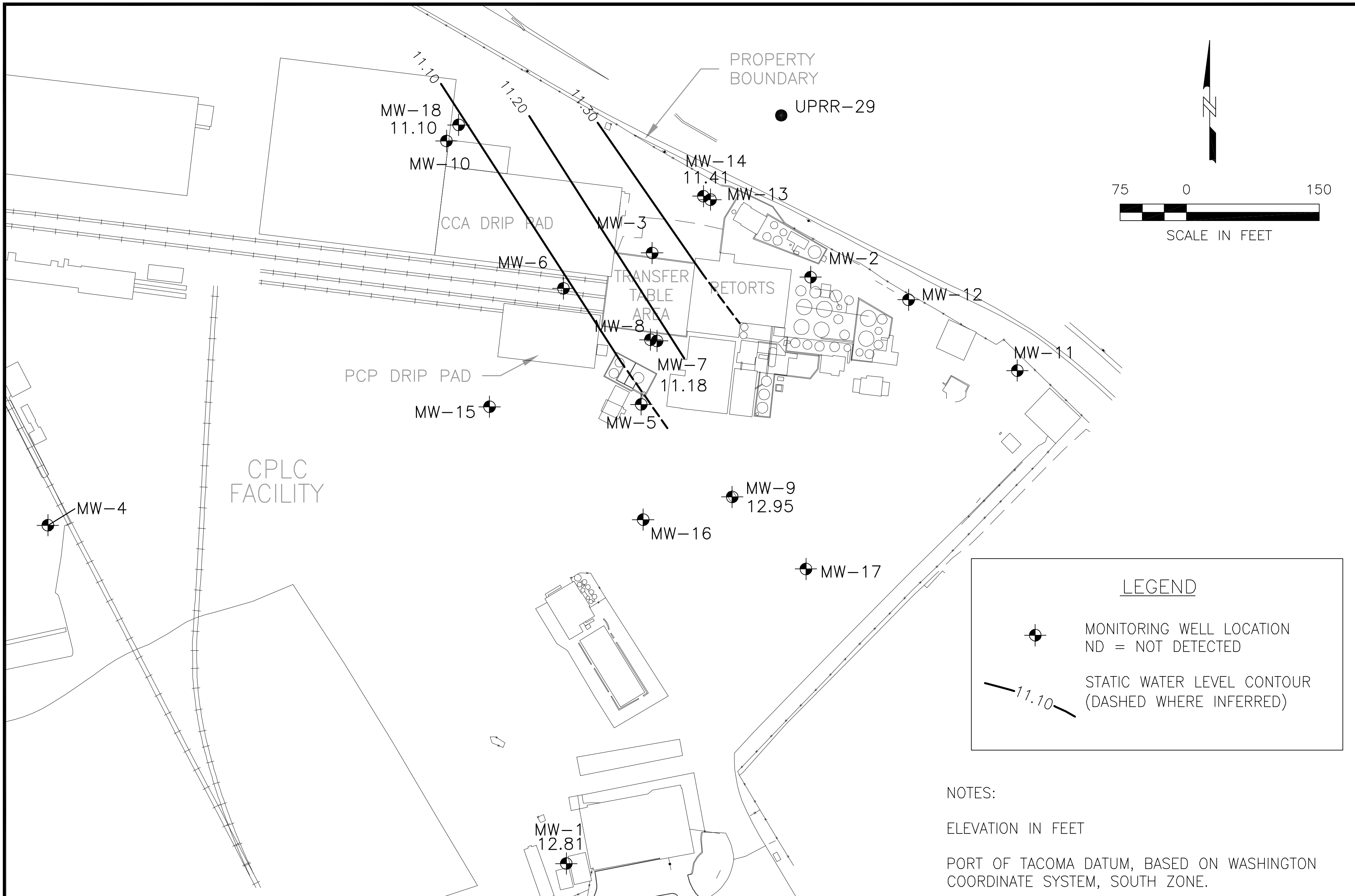
04530-015-0300

DATE: 03/19/09 | DRWN: E.M./SEA

POTENTIOMETRIC SURFACE MAP
DEEP AQUIFER
JANUARY 2009

FIGURE 12

File: L:\Cascade Lumber\04530-015-S003.dwg Layout: FIG 12 User: emarshall Plotted: Mar 10, 2008 - 2:34pm Xref's:



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

ENSR | AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

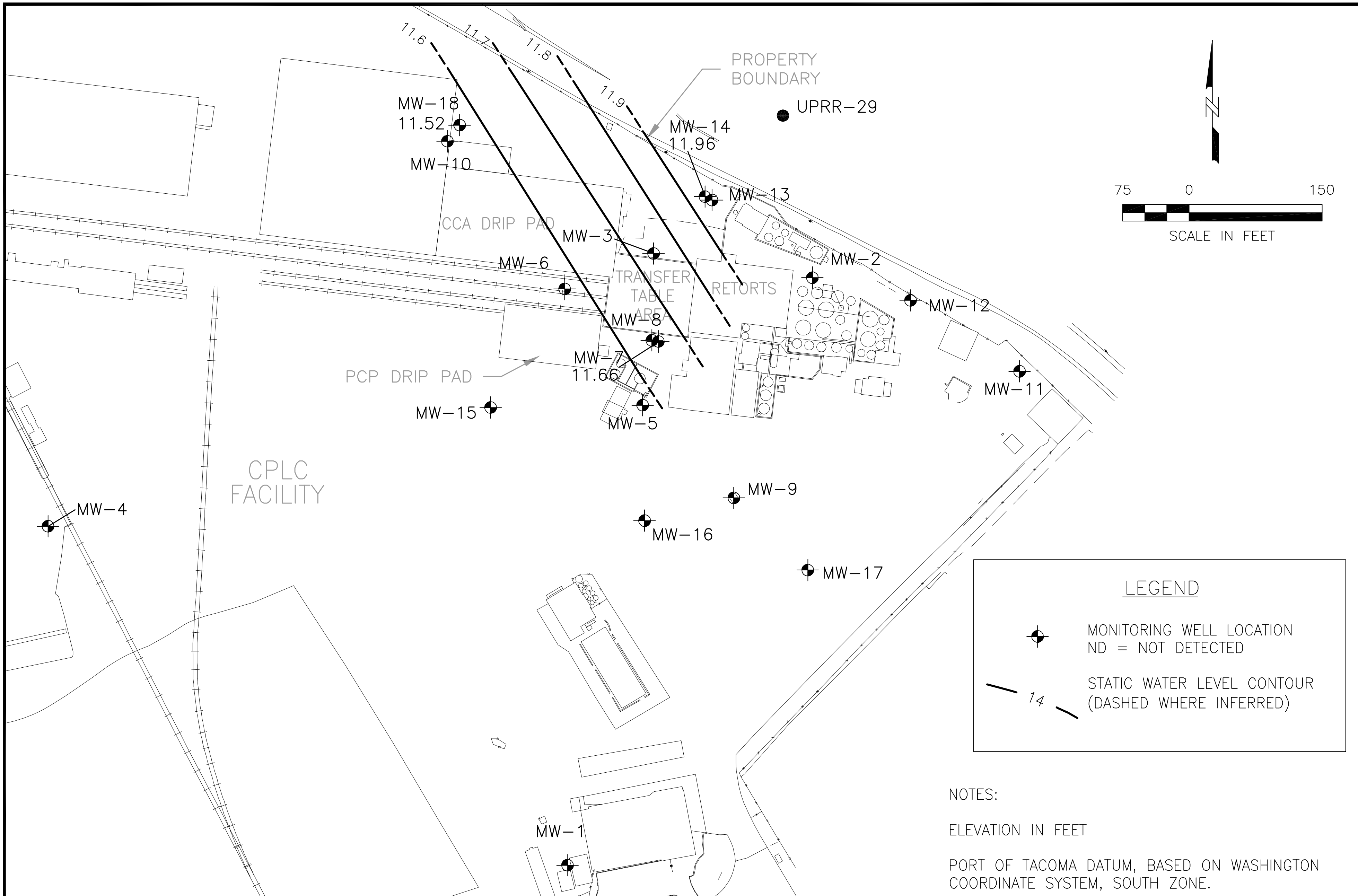
04530-015-300

POTENTIOMETRIC SURFACE
DEEP AQUIFER
JANUARY 2008

DATE: 03/10/08 DRWN: E.M./SEA

FIGURE 12

File: H:\16832\16832S111.dwg Layout: FIG User: emarshall Plotted: May 03, 2007 - 8:58am Xref's:



LEGEND

MONITORING WELL LOCATION
ND = NOT DETECTED

14

STATIC WATER LEVEL CONTOUR
(DASHED WHERE INFERRED)

NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

ENSR | AECOM

Merged with ENSR in 2007

RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

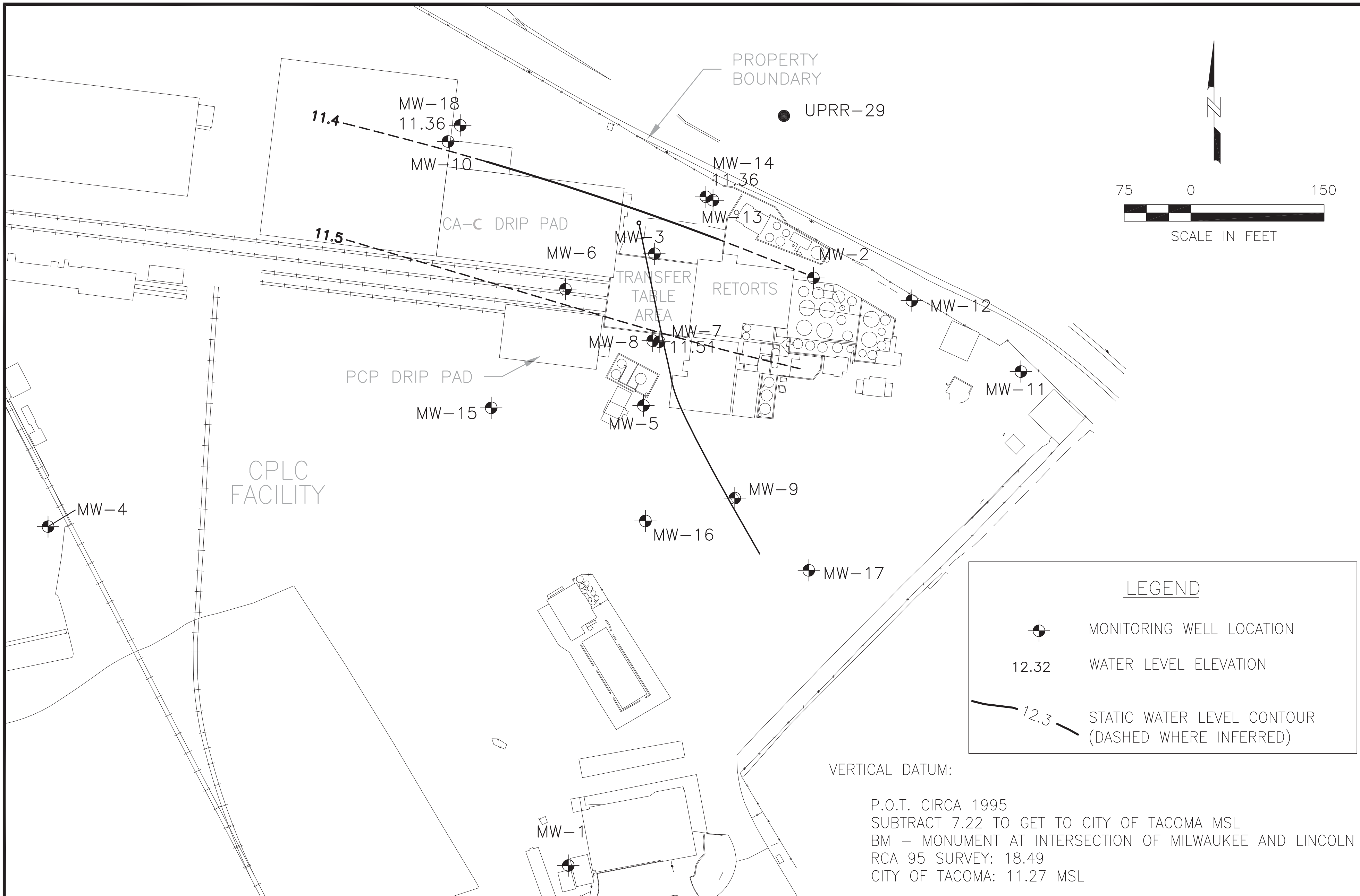
CPLC1-16832-500

DATE: 05/03/07

DRWN: E.M./SEA

POTENTIOMETRIC SURFACE
DEEP AQUIFER
FEBRUARY 2007

FIGURE 12



VERTICAL DATUM:

P.O.T. CIRCA 1995
SUBTRACT 7.22 TO GET TO CITY OF TACOMA MSL
BM – MONUMENT AT INTERSECTION OF MILWAUKEE AND LINCOLN
RCA 95 SURVEY: 18.49
CITY OF TACOMA: 11.27 MSL

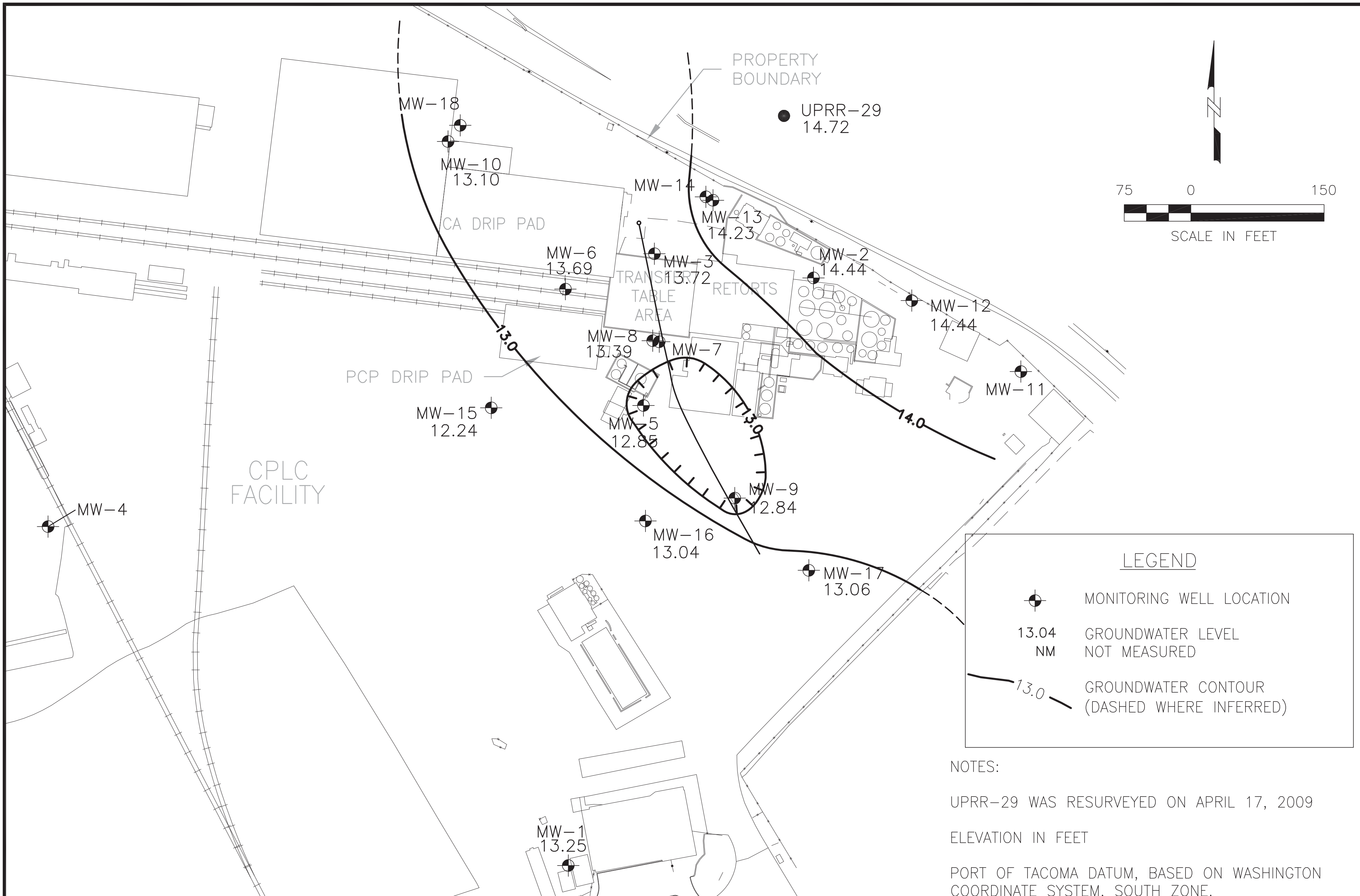
AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON
60137201-0300

POTENTIOMETRIC SURFACE MAP
DEEP AQUIFER
FEBRUARY 2012

DATE: 03/21/12 | DRWN: M.O./SEA

FIGURE 3-4



NOTES:

UPRR-29 WAS RESURVEYED ON APRIL 17, 2009

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

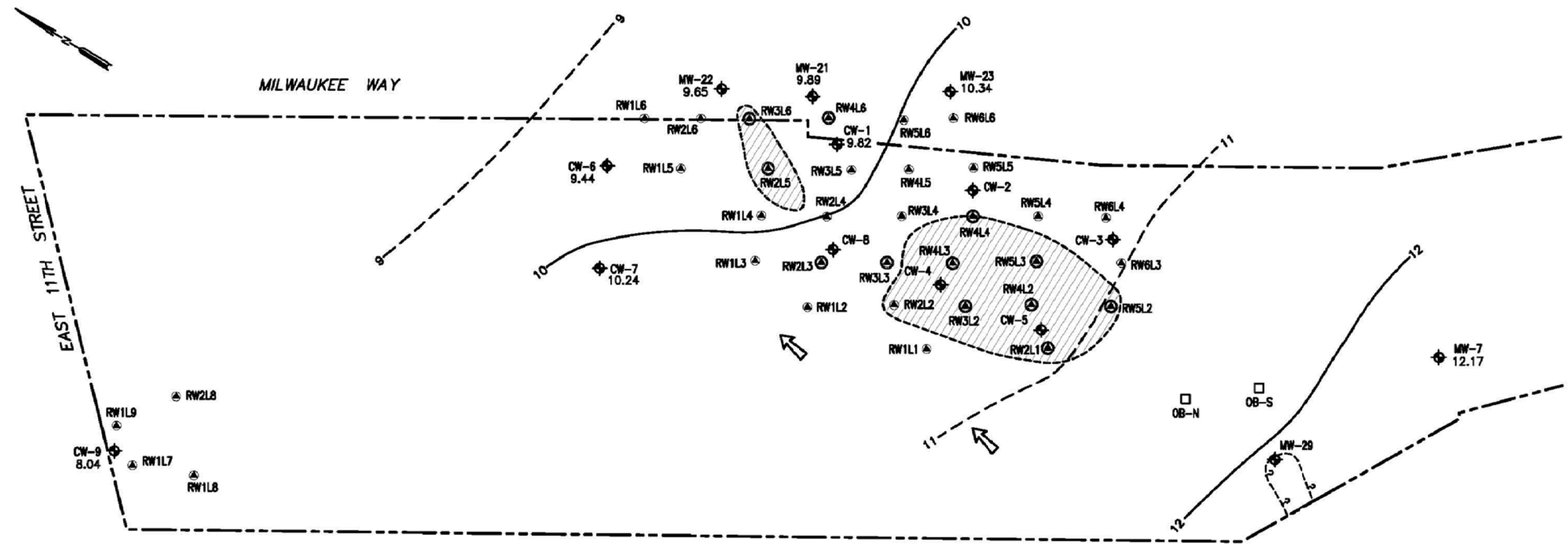
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

60137021-0300

DATE: 03/21/12 | DRWN: M.O./SEA

GROUNDWTER ELEVATION CONTOUR MAP
SHALLOW AQUIFER
FEBRUARY 2012

FIGURE 3-1



LEGEND:

9.65 Groundwater Elevation (Feet Above MSL)

——12—— Inferred Groundwater Elevation Contour (feet)

General Groundwater Flow Direction

Current Free Product Plume (Dashed Where Inferred) As of October, 2004

MW-21 Compliance Monitoring Well Location

RW2L8 Groundwater Recovery Well with No Above Ground Stickup

RW2L8 Groundwater Recovery Well with Above Ground Stickup

OB-1 Reinfiltration Trench Piezometer Location

Approximate Property Boundary

NOTES:

1. Product was present in CW-4 and CW-5 but could not be measured due to high viscosity.
2. Water elevations measured with the groundwater extraction system operating.

SCALE 0 200 400 FEET

SOURCE: DOWL ENGINEERS, A DIVISION OF DOWL, INC.

Shaw® Shaw Environmental, Inc. 19909 120th Avenue N.E., Suite 101 Bothell, Washington 98011 Phone (425) 485-5000 Fax. (425) 486-9766

GROUNDWATER ELEVATION CONTOUR MAP - FEBRUARY 2005
PORT OF TACOMA
FORMER MILWAUKEE RAILYARD SITE
TACOMA, WASHINGTON

DRAWN BY	CHECKED BY	APPROVED BY	OFFICE	DRAWING NUMBER
MPortacio 3/05			BOTHELL	111487.01

XREF Files: IMAGE Files:
File: N:\Project\final\PortofTacoma\111487\Drawings\BT-GWCMAP-2-05-F1.dwg user: maria.portacio March 8, 2005

File: P:\CADD\Cascade Lumber\16832S051.dwg Layout: FIGURE 3-6 User: oliveriam Plotted: Mar 09, 2011 - 12:36pm Xref's:

RETEC

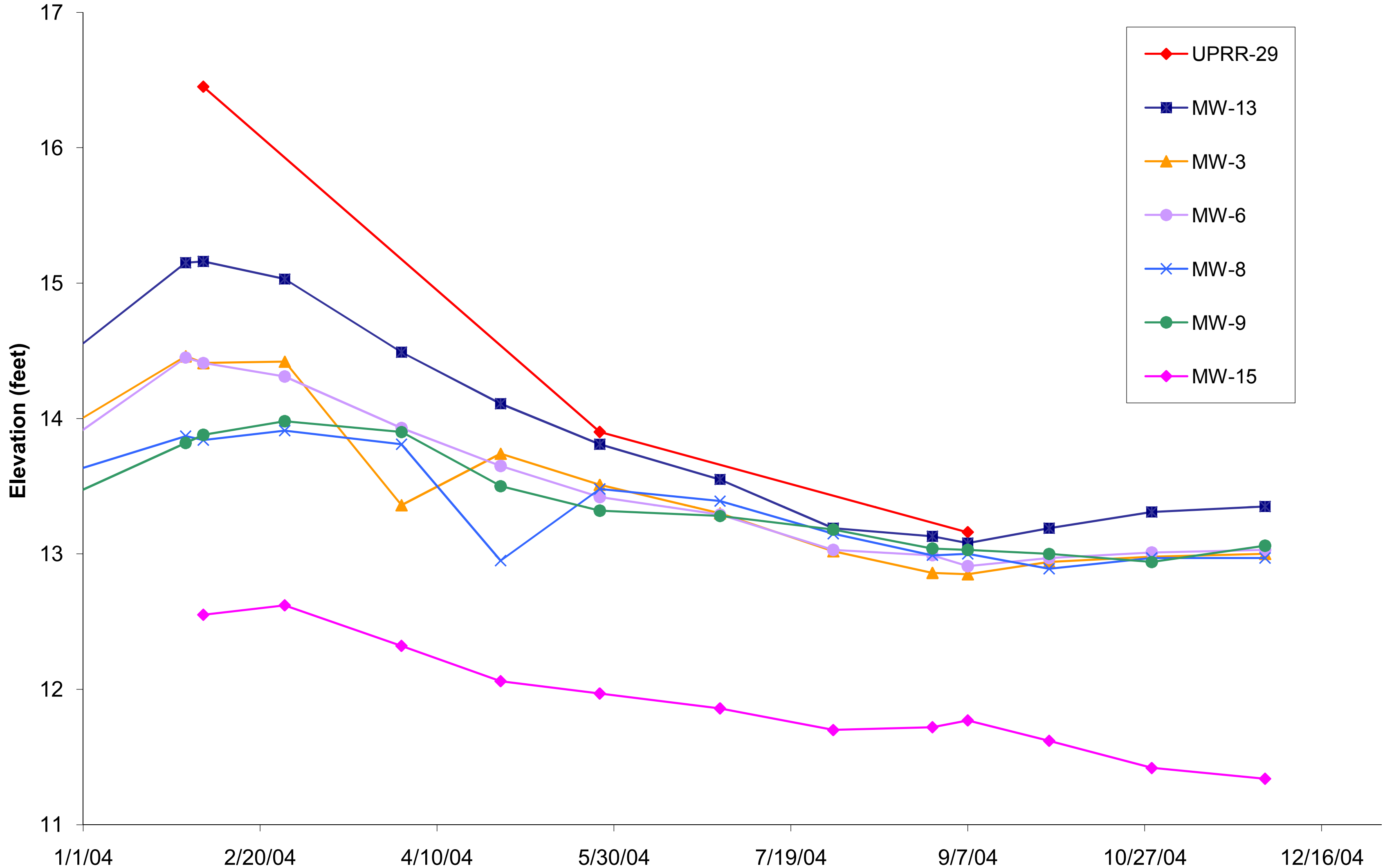
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON
CPLU1-16832-500

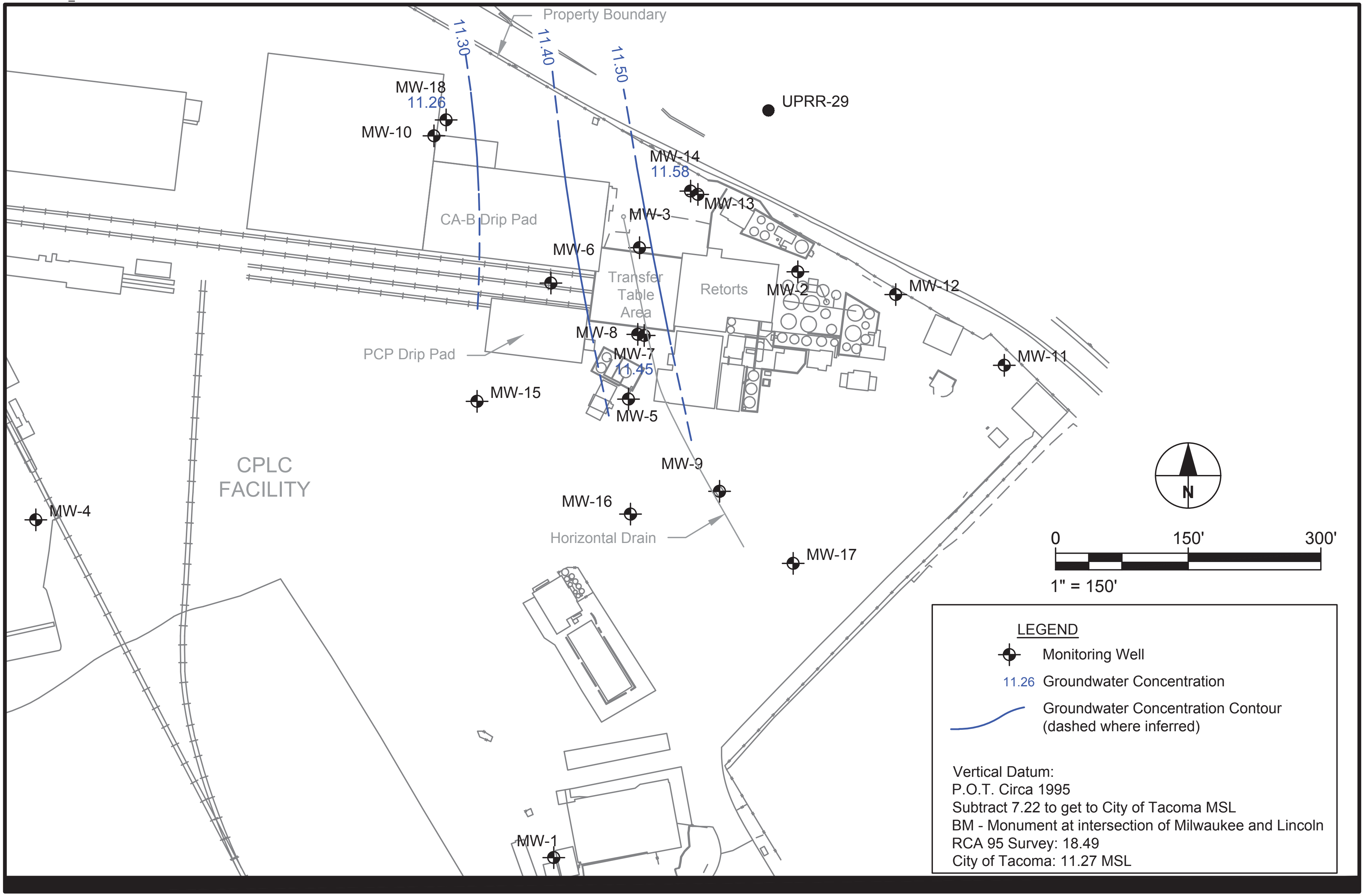
DATE: 04/18/05 DRWN: A.S./SEA

GROUNDWATER LEVATION CONTOUR MAP
UPRR SITE
FEBRUARY 2005

FIGURE 3-2

Figure 3-3 Groundwater Elevation Hydrograph





Cascade Pole and Lumber Company
2013 Annual Groundwater Report
Tacoma, Washington
Project No.: 60220510 Date: 2013-04-26

Potentiometric Surface Map in Deep Aquifer February 2013

AECOM

Figure 3-4

APPENDIX B
WELL LOGS

REI EC REMEDIATION TECHNOLOGIES INC

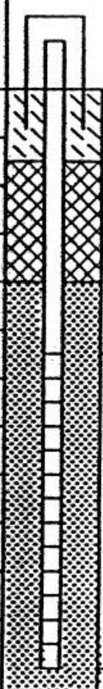
MONITORING WELL LOG

WELL NUMBER: MW-4

SHEET 1 **OF** 1

PROJECT NAME/NUMBER: 30-499-310	**DRILLING CO:** Soil Sampling Service
LOCATION: North of the bark chipper	**DRILLER:** M. Marquardi
SCHEDULE — **INITIATED:** 1/23/91 0930 **COMPLETED:** 1/23/91 1040	**RIG TYPE:** B-61
WATER LEVEL — **DEPTH:** 6.35 **DATE:** 1/23/91 1143	**METHOD:** HSA
BORING DEPTH: 12.5' / **BORING DIAMETER:** 7.25"	**LOGGED BY:** L. Baker

WELL CONSTRUCTION (DEPTH IN FEET: 0, 5, 10, 15, 20, 25)



- Cement (0 – 1.5')
- Benton. chips (1.5' – 4')
- 2".01PVC screen @6'
- Sand 10-20 (4' – 12')
- 12'
- TD

SOIL DESCRIPTION

USCS	Description
GM	SAND (top 2"): very dark gray (2.5YN/3), medium sand, some silt, trace clay, wet. GRAVEL AND WOOD DEBRIS (2"): olive brown(2.5Y4/4), moist, no odor, PID run on primarily this material. SANDY GRAVEL (6"): light olive brown(2.5Y5/4), damp, no odor.
SM & ML	SILTY SAND(12"): olive yellow (2.5Y6/6) grades downward to olive (5Y5/4). SILT(6"):black(N2/0), organic rich silt, some clay, wood chips, damp to moist, sand at very tip of core, sampled.
SM	SILTY SAND: black (N2/0) with thin olive yellow silty clay-.1-.5" layers, fine to medium sand, trace clay, moderate sorting with variable amounts of silt and clay 5-35%, wet, sewage odor, saturated
SM	SAND: black (N2/0), very fine to medium, medium sorting, saturated, mild sewage-like odor.
SM & ML	SAND (4"): black (N2/0), very fine to medium, medium sorting, saturated, no odor. SILTY CLAY TO CLAYEY SILT: laminated black(N2/0) and grayish brown (2.5Y5/2), wet no odor, soft, root traces.

SAMPLE DATA

TYPE	DEPTH	BLOWS	%RECOV	PID ppm
S	A	20 50 4	50	2.7
S	A X	7 9 9	100	1.6
S	A X	4 7 9	100	5.2
S	X	5 7 6	100	4.5
S	X	1 2 2	100	6.0 *

NOTE:
PID for empty plastic bag is 2.1 ppm. Sand immediately above clay is 9 pmm peak. Getting PID readings but no product odor.

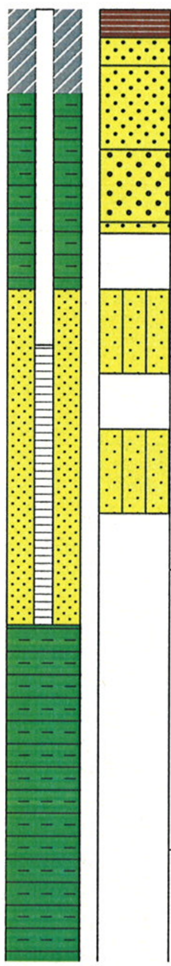
REMARKS:
S - Split spoon sample
X - Sample depth
* - Second test is 5.4 ppm
A - Sample sent to laboratory for analysis

Boring/Well Log

Well #: MW-15
Sheet 1 of 2

Project: **Cascade Pole**	Monument: **Heavy duty flush mount**	Stick Up:
Project #: **CPLU1-16832**	Northing: Easting:	Ground Elevation:
Location:	Drill Rig Type: **B-59 Foremost**	MP Elevation:
Client: **McFarland Cascade**	Method: **Hollow stem auger**	Total Depth: **19.5'**
Start Date & Time: **12/15/03 1215**	Casing ID: **8"**	Filter Pack: **5-12' 10/20 silica sand**
Finish Date & Time: **12/15/03 1430**	Boring ID: **4"**	Seal: **1.5-5' 3/8" benonite chips**
Contractor: **Holt Drilling**	Bit Type:	Grout:
Operator: **Michael Reynolds**	Logged By: **N. Bacher**	Screen: **6-11' 0.010-slot Sch. 40 PVC**

Soil and Rock Description
Classification Scheme: **USCS**



Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)	Depth (ft.)	Soil and Rock Description	Elevation (ft.)	Comments
GS	0-0.5	100		1.6	0	(0-0.5') ASPHALT.	0	
						(0.5-1') SLIGHTLY GRAVELLY SAND. Slightly moist, dense, dark gray, some wood fragments. Gravel up to 1/4". No OVC.		
SS	2.5-4	100	7/8/15	1.6		(1-2.5') Same as above. Logged cuttings.		
						(2.5-3.8') MEDIUM SAND. Slightly moist, medium dense, black, trace silt. No OVC.		
SS	5-6.5	75	5/5/6	0	5	(3.8-4.0') SLIGHTLY GRAVELLY SAND. Slightly moist, medium dense, black. Gravel is up to 1/4" and rounded. No OVC.	-5	
						(5-6.5') VERY SILTY FINE SAND. Moist, medium dense, brownish gray. No OVC.		
SS	7.5-9	35	4/3/3	0		(7.5-9') SILTY SAND. Wet, medium dense, dark brown, trace gravel, some wood. Slight odor, no visual contamination. Drilled through a brick at 8.5-9'.		
SS	10-11.5	5	1/1/0	NM	10	(10-11.5') WOOD. Wet, soft, black, sandy. Slight organic odor, no visual contamination. Poor recovery.	-10	
SS	11.5-13	5	0/0/0	0		(11.5-13') Same as above. Poor recovery.		
SS	13-14.5	5	3/2/1	NM		(13-14.5') Wood chunk stuck in shoe. No recovery.		
SS	15-16.5	0	3/1/1	NM	15	(15-16.5') Wood chunk stuck in shoe. No recovery. Slight organic odor on wood, no visual contamination.	-15	

Remarks and Datum Used: Slight methane odor in hole during backfill.
No blacklight response on any sample.

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Fax: (206) 624-2839

Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)

Boring/Well Log

RETEC

Sample: Type & #	Sample: Depth Range	Sample: % Rec	Sample: Blows per 6"	Sample: PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS)	Elevation (ft.)	Comments
	18-19.5	0	0/0/0	NM				(18-19.5) CLAYEY SILT TO SILTY CLAY. Wet, soft, gray, some wood fragments. No OVC. Logged what was on the core catcher only. Poor recovery.		

Remarks and Datum Used:

Slight methane odor in hole during backfill.

No blacklight response on any sample.

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Sample Type

N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)

Boring/Well Log

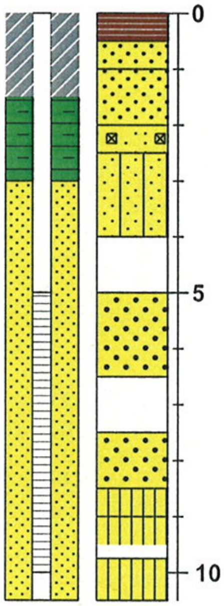
Well #: MW-16
Sheet 1 of 1

Project: **Cascade Pole**	Monument: **Heavy duty flush mount**	Stick Up:
Project #: **CPLU1-16832**	Northing: Easting:	Ground Elevation:
Location:	Drill Rig Type: **B-59 Foremost**	MP Elevation:
Client: **McFarland Cascade**	Method: **Hollow stem auger**	Total Depth: **10.5'**
Start Date & Time: **12/15/03 1500**	Casing ID: **8"**	Filter Pack: **3-10.5' 10/20 silica sand**
Finish Date & Time: **12/15/03 1700**	Boring ID: **4"**	Seal: **1.5-3' 3/8" bentonite chips**
Contractor: **Holt Drilling**	Bit Type:	Grout:
Operator: **Michael Reynolds**	Logged By: **N. Bacher**	Screen: **5-10' 0.010-slot Sch. 40 PVC**

Soil and Rock Description

Classification Scheme: **USCS**

Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)
GS	0-0.5	100		1.6
SS	2.5-4	50	4/5/5	1.6
SS	5-6.5	50	3/5/4	3.2
SS	7.5-9	100	1/18"	1.6
SS	9-10.5	80	NA	1.6



(0-0.5') ASPHALT.

(0.5-1') SLIGHTLY GRAVELLY SAND. Moist to dry, dense, brownish black. Gravel up to 1/4". No OVC.

(1-2') Same as above but moist. Logged cuttings.

(2-2.5') GRAVEL. Minor sand, gravel is 1" and rounded. Logged cuttings.

(2.5-4') SILTY SAND. Moist, medium dense, gray, w/ 1/4" subrounded gravel. No OVC.

(5-6.5') SAND. Moist to wet, medium dense, black, w/ some wood fragments. Slight to moderate odor, no visual contamination.

(7.5-8.5') Same as above but no wood or no OVC.

(8.5-9') SILTY CLAY. Moist to wet, medium soft, gray, w/ organics (reeds, grasses). No OVC.

(9-9.5') Same as above.

(9.5-9.75') WOOD wet, fibrous. No OVC.

(9.75-10.5') SILTY CLAY. Moist to wet, medium soft, gray, w/ organics (reeds, grasses). No OVC.

Remarks and Datum Used: Moderate methane odor in hole.

No blacklight response on any sample.

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)

Boring/Well Log

RETEC

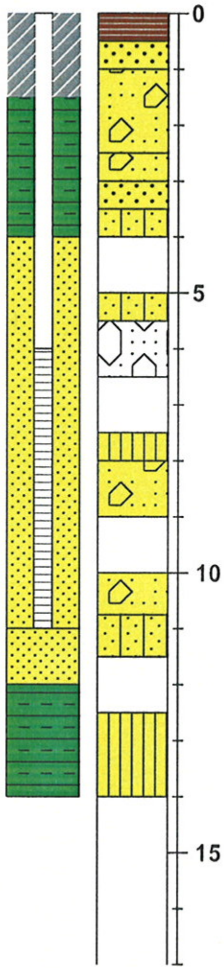
Well #: MW-17

Project: **Cascade Pole**	Monument: **Heavy duty flush mount**	Stick Up:
Project #: **CPLU1-16832**	Northing: Easting:	Ground Elevation:
Location:	Drill Rig Type: **B-59 Foremost**	MP Elevation:
Client: **McFarland Cascade**	Method: **Hollow stem auger**	Total Depth: **19.5 ft**
Start Date & Time: **12/15/03 0845**	Casing ID: **8"**	Filter Pack: **4-14' 10/20 silica sand**
Finish Date & Time: **12/15/03 1115**	Boring ID: **4"**	Seal: **1.5-4' 3/8" bentonite chips**
Contractor: **Holt Drilling**	Bit Type:	Grout:
Operator: **Michael Reynolds**	Logged By: **N. Bacher**	Screen: **6-11' 0.010-slot Sch. 40 PVC**

Sample

Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)
GS				1.6
SS	2.5-4	80	21/37/24	1.6
SS	5-6.5	60	5/7/8	1.6
SS	7.5-9	100	9/10/7	1.6
SS	10-11.5	50	1/2/1	0
SS	12.5-14	100	1/18"	1.6

Well Completion Log / Graphic / Depth (ft.)



Soil and Rock Description

Classification Scheme: **USCS**

- (0-0.5') ASPHALT.
- (0.5-1') GRAVELLY SAND. Moist, dense, blackish brown. Gravel up to 1/2" and rounded. No OVC.
- (1-2.5') Grading to SANDY GRAVEL. Logged cuttings only.
- (2.5-3') SANDY GRAVEL. Moist, dense, greyish black, trace silt. Wood chunks. No OVC.
- (3-3.5') SLIGHTLY GRAVELLY SAND. Dry to moist, medium dense, light brown. No OVC.
- (3.5-4') SILTY SAND. Moist, medium dense, gray brown. No OVC.
- (5-5.5') SLIGHTY SILTY SAND. Moist, medium dense, black. No OVC.
- (5.5-6.5') Hammered through red bricks.
- (7.5-8') CLAYEY SILT. Moist to wet, medium dense, gray, minor sand. No OVC.
- (8-9') SANDY GRAVEL. Moist, fairly loose, light brown. Gravel up to 1/2" and subrounded. No OVC.
- (10-10.75') Same as above.
- (10.75-11.5') SILTY SAND. Wet, medium soft, gray, minor gravel. No OVC.
- (12.5-14') SILTY CLAY. Moist, medium soft, gray. Abundant plant fragments (grasses, reeds). Slight organic (rotten) odor. No OVC.

Elevation (ft.): 0, -5, -10, -15

Comments

Remarks and Datum Used: **PID calibrated to 98.9 ppm at 1030**

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Sample Type

N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)

Boring/Well Log

Sample					Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description Classification Scheme: USCS	Elevation (ft.)	Comments
Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)						

Remarks and Datum Used:	PID calibrated to 98.9 ppm at 1030

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)

RETEC Boring/Well Log

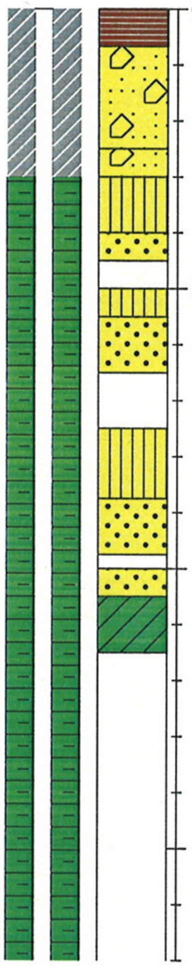
Well #: MW-18
Sheet 1 of 2

Project: **Cascade Pole**	Monument: **Heavy duty flush mount**	Stick Up:
Project #: **CPLU1-16832**	Northing: Easting:	Ground Elevation:
Location:	Drill Rig Type: **B-59 Foremost**	MP Elevation:
Client: **McFarland Cascade**	Method: **Hollow stem auger**	Total Depth: **29 ft**
Start Date & Time: **12/16/03 0855**	Casing ID: **8 (10)**	Filter Pack: **21-29' 10/20 silica sand**
Finish Date & Time: **12/16/03 1500**	Boring ID: **4 (6)**	Seal: **3-21' 3/8" bentonite chips**
Contractor: **Holt Drilling**	Bit Type:	Grout:
Operator: **Michael Reynolds**	Logged By: **N. Bacher**	Screen: **22-27' 0.010-slot Sch.40 PVC**

Sample

Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)
SS	2.5-4	100	2/5/9	1.6
SS	5-6.5	70	2/2/8	1.6
SS	7.5-9	60	1/1/1	1.6
SS	10-11.5	100	1/18"	1.6
SS	12.5-14	10	2/4/5	3.2
SS	15-16.5	0	3/5/4	NM

Well Completion Log | Graphic | Depth (ft.)



Soil and Rock Description

Classification Scheme: **USCS**

Elevation (ft.) | Comments

- (0-0.67') ASPHALT.
- (0.67-2.5') SANDY GRAVEL (GW). moist, loose to medium dense, black gray. No OVC. Logged cuttings.
- (2.5-3') Same as above.
- (3-4') SILT WITH TRACE CLAY (ML). moist to dry, stiff, gray, some oxidation mottling. No OVC.
- (4-4.5) MEDIUM TO FINE SAND (SP). moist, medium dense, blackish brown. No OVC.
- (5-5.5') SLOUGH (ML). Gray silt from above sloughed in hole.
- (5.5-6.5') MEDIUM SAND (SP). moist, medium dense, blackish brown. No OVC.
- (7.5-8.75') SLOUGH (ML). Gray silt from above slough in hole.
- (8.75-9.75') MEDIUM SAND (SP). moist, medium dense, blackish brown. No OVC
- (10-10.5') Same as above.
- (10.5-11.5') SILTY CLAY (CL). moist to wet, medium stiff, gray. Black organic fibers, slight organic odor. No OVC.
- (12.5-14') SHREDDED WOOD (WOOD). Poor recovery. Wet, some gray silty clay, slight odor. No OVC. Wood stuck in shoe.
- (15-16.5') NO RECOVERY. Spoon full of gray water.

Depth (ft.): 0, 5, 10, 15 — Elevation (ft.): 0, -5, -10, -15

Remarks and Datum Used: Telescoped from 10" to 8" augers at 11'.

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)

RETEC

Boring/Well Log

Sample Type & #	Sample Depth Range	% Rec	Blows per 6"	PID (ppm)	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS)	Elevation (ft.)	Comments
SS	17.5-19	0	1/18"	NM		(17.5-19') NO RECOVERY. Spoon full of gray water.		
SS	20-21.5	50	1/1/1	1.6	20	(20-21.5') MEDIUM SAND WITH MINOR SILT (SP). wet, loose to medium dense, gray, trace wood shreds. No OVC.	-20	
SS	22.5-24	100	2/4/7	0		(22.5-24') MEDIUM SAND WITH MINOR TO TRACE SILT (SP). wet, medium dense, blackish gray, red brick fragments (<1mm) in matrix. No OVC.		
SS	25-26.5	100	6/6/6	1.6	25	(25-26.5') Same as above.	-25	
SS	27.5-29	60	1/18"	0		(27.5-29') Same as above but very wet. Trace clayey silt on shoe. No OVC.		

Remarks and Datum Used: Telescoped from 10" to 8" augers at 11'.

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Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

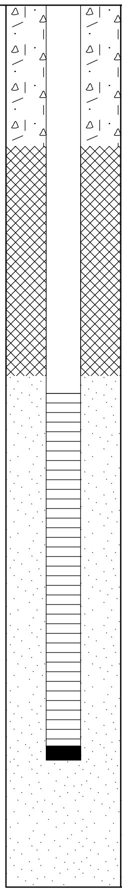
Groundwater		
Date	Time	Depth (ft.)

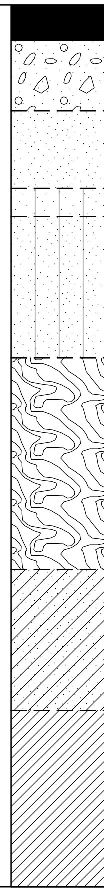
Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0999.01.02	**MW-19**	**1 of 1**

Project Name	**McFarland Cascade Pole & Lumber**	TOC Elevation (feet)	
Project Location	**1640 East Marc Street, Tacoma, WA**	Surface Elevation (feet)	
Start/End Date	**2/16/2015 to 2/16/2015**	Northing	
Driller/Equipment	**Cascade Drilling LLP/Sonicore 50K**	Easting	
Geologist/Engineer	**Heather Good**	Hole Depth	**12.5-feet**
Sample Method		Outer Hole Diam	**8-inch**





Depth (feet, BGS)	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Soil Description
0–0.5							0.0 to 0.5 feet: ASPHALT.
1		**100%**	**CB**				0.5 to 1.5 feet: SANDY GRAVEL (GW); dark brown to light bluish gray; 5% fines; 35% sand, fine to coarse; 60% gravel; fine to coarse, subrounded; few cobbles; moist.
2							1.5 to 2.6 feet: SAND (SP); dark brown; 5% fines; 90% sand, fine, very loose; 5% gravel, fine, subrounded; moist.
3		**100%**	**CB**				2.6 to 3.0 feet: SANDY SILT (MLS); bluish-gray; 75% fines, stiff, nonplastic; 20% sand, fine to coarse; 5% gravel, fine to medium, subrounded; trace greenish-brown mottles; moist.
4							3.0 to 5.0 feet: SILTY SAND with GRAVEL (SM); dark brown; 15% fines, soft, nonplastic; 70% sand, fine to coarse, loose; 15% gravel, fine to medium, subrounded; few rootlets and cobbles, wood, glass, tile and brick fragments; moist to wet at 4.5 feet.
5		**80%**	**CB**				5.0 to 8.0 feet: WOOD (WOODY DEBRIS); dark brown; 80% wood fragments; 15% sand, fine; 5% gravel, fine to medium, subrounded; hydrocarbon-like odor; moist.
8							8.0 to 10.0 feet: SILTY CLAYEY SAND (SC); dark gray; 85% fines; nonplastic, very soft; 15% sand, fine; abundant wood at 8.0 to 8.5 feet, few gravel, subrounded; hydrocarbon-like odor; wet.
10							10.0 to 12.5 feet: SILTY CLAY (CL); dark gray to black; 90% fines, high plasticity, very soft; 10% sand, fine; few rootlets; hydrocarbon-like odor; dark gray to black laminations; wet.

Total Depth = 12.5 feet below ground surface.

Boring Completion Details:
0.0 to 5.0 feet: 8-inch boring.
5.0-12.5 feet: 4.5 inch boring.
0.0 to 2.0 feet: concrete.
2.0 to 5.0 feet: bentonite chips hydrated with potable water.
5.25 to 12.5 feet: 10X20 silica sand.

Monitoring Well Completion Details
Stick-up completion.
+3.0 to 5.5 feet: 2-inch, schedule 40, polyvinyl chloride, riser pipe.
5.5 to 10.5 feet: 2-inch, schedule 40, polyvinyl chloride, 0.010-inch machine slot, well screen.
10.5 to 10.7 feet: 2-inch, schedule 40, polyvinyl chloride pipe end cap.

NOTES: CB = Core barrel.
Hole Diameter: 8" to 5', 4.5" to 12.5'

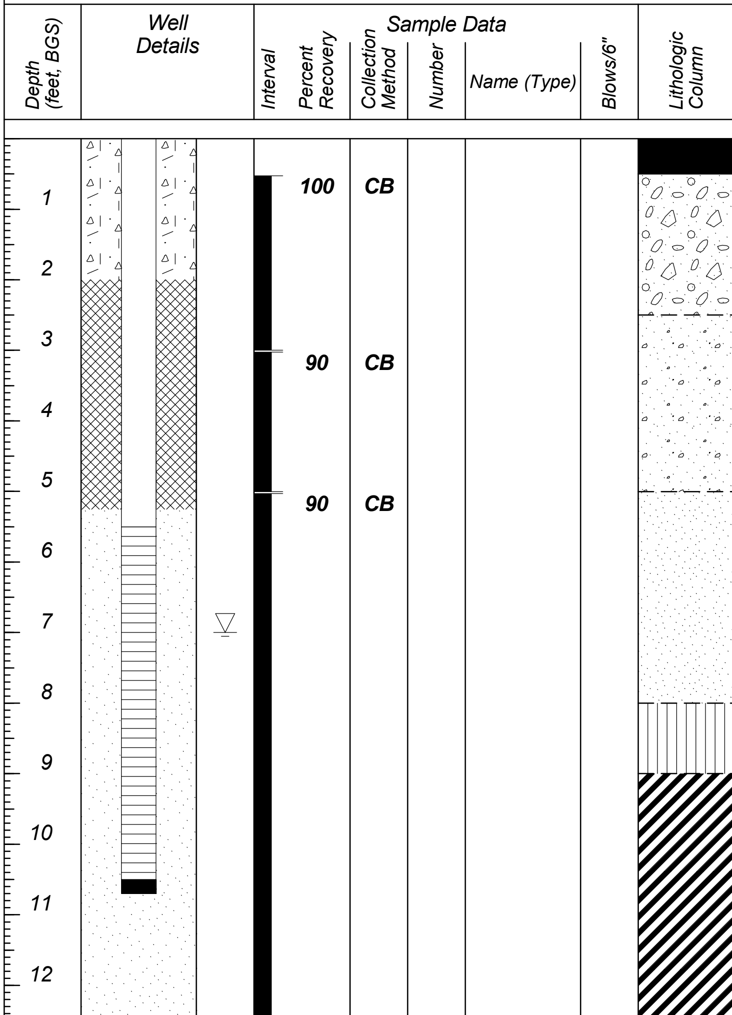
▽ **Based on soil observation.**

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0999.01.02	**MW-20**	**1 of 1**

Project Name	**McFarland Cascade Pole & Lumber**	TOC Elevation (feet)	
Project Location	**1640 East Marc Street, Tacoma, WA**	Surface Elevation (feet)	
Start/End Date	**2/16/2015 to 2/16/2015**	Northing	
Driller/Equipment	**Cascade Drilling LLP/Sonicore 50K**	Easting	
Geologist/Engineer	**Heather Good**	Hole Depth	**12.5-feet**
Sample Method		Outer Hole Diam	**8-inch**



Depth (feet, BGS)	Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Soil Description
0.0–0.5							0.0 to 0.5 feet: ASPHALT.
0.5–2.5		**100**	**CB**				0.5 to 2.5 feet: SANDY GRAVEL (GW); dark grayish brown; 5% fines, 35% sand, fine to coarse; 60% sand, fine to medium, subrounded; few cobbles; moist.
2.5–5.0		**90**	**CB**				2.5 to 5.0 feet: SAND (SW); dark gray; 5% fines; 90% sand, fine, very loose; 5% gravel, fine, subrounded; moist.
5.0–8.0		**90**	**CB**				5.0 to 8.0 feet: SAND (SP); dark gray; 5% fines; 95% sand, fine, very loose; moist to wet at 7.0 feet.
8.0–9.0							8.0 to 9.0 feet: CLAYEY SILT (ML); dark gray; 95% fines, soft, low plasticity; 5% sand, fine; few rootlets; wet.
9.0–12.5							9.0 to 12.5 feet: SILTY CLAY (CH); black to dark grayish brown; 100% fines, very soft, high plasticity; abundant organics, including rootlets and plant fragments; laminated black to dark grayish brown; wet.

Total Depth = 12.5 feet below ground surface.

<u>Boring Completion Details:</u>
0.0 to 5.0 feet: 8-inch boring.
5.0-12.5 feet: 4.5 inch boring.
0.0 to 2.0 feet: concrete.
2.0 to 5.25 feet: bentonite chips hydrated with potable water.
5.25 to 12.5 feet: 10X20 silica sand.

<u>Monitoring Well Completion Details</u>
Stick-up completion, step-down well install.
+3.0 to 5.5 feet: 2-inch, schedule 40, polyvinyl chloride, riser pipe.
5.5 to 10.5 feet: 2-inch, schedule 40, polyvinyl chloride, 0.010-inch machine slot, well screen.
10.5 to 10.7 feet: 2-inch, schedule 40, polyvinyl chloride pipe end cap.

NOTES: CB = Core barrel.
Hole Diameter: 8" to 5', 4.5" to 12.5'

▽ **Based on soil observation.**

APPENDIX C
SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN

MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

Prepared for

MCFARLAND CASCADE HOLDINGS, INC.

A STELLA-JONES COMPANY

TYEE MANAGEMENT COMPANY, LLC

January 12, 2016

Project No. 0999.01.01

MAUL
FOSTER
ALONGI

Prepared by

Maul Foster & Alongi, Inc.

1329 N State Street, Suite 301, Bellingham WA 98225

SAMPLING AND ANALYSIS PLAN
MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

The material and data in this plan were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

Carolyn Wise, GIT
Staff Geologist

Heather R. Good, LHG
Project Hydrogeologist

CONTENTS

FOLLOWING PLAN:

TABLE

GROUNDWATER SAMPLE HANDLING SUMMARY

ACRONYMS AND ABBREVIATIONS

CMP	groundwater compliance monitoring plan
COC	chain of custody
cPAH	carcinogenic polycyclic aromatic hydrocarbon
Ecology	Washington State Department of Ecology
FSDS	field sampling data sheet
IDW	investigation-derived waste
IHS	indicator hazardous substance
LCS	laboratory control sample
LDS	laboratory duplicate sample
MCHI	McFarland Cascade Holdings, Inc.
MCPLC	McFarland Cascade Pole and Lumber Company
MFA	Maul Foster & Alongi, Inc.
MS/MSD	matrix spike and matrix spike duplicate
PCP	pentachlorophenol
Property	Property, owned by Tyee, on which MCPLC conducts its operations
QA	quality assurance
QC	quality control
SAP	sampling and analysis plan
SIM	selective ion monitoring
Site	McFarland Cascade Pole and Lumber Company site
Tyee	Tyee Management Company, LLC
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

1 INTRODUCTION

Maul Foster and Alongi, Inc. (MFA) has prepared this sampling and analysis plan (SAP), including quality assurance project plan elements, consistent with the requirements of Washington Administrative Code (WAC) 173-340-820, on behalf of McFarland Cascade Holdings, Inc. (MCHI) and Tyee Management Company, LLC (Tyee) for the McFarland Cascade Pole and Lumber Company (MCPLC) site (Site) in Tacoma, Washington, to guide the collection of groundwater samples during groundwater compliance monitoring events. For purposes of this plan, "Property" (unless otherwise specified) refers to the property on which MCPLC conducts its operations, which is owned by Tyee and is leased to MCHI. The Site includes the Property and a limited portion of the adjacent former Union Pacific Railroad Milwaukee Railyard property to the northeast that is currently owned by the Port of Tacoma (see Figure 2 of the groundwater compliance monitoring plan [CMP]) (MFA, 2016a). The Site has been an active wood-treating facility since 1974; previous operations at the Site included a lumber mill and a landscape bark operation.

This SAP has been prepared consistent with the requirements of the Washington State Department of Ecology's (Ecology) Guidance on Sampling and Data Analysis Methods (Ecology, 1995), Guidance for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology, 2004), and the 1993 Model Toxics Control Act (WAC Chapter 173-340).

1.1 Investigation Objectives

The primary objective of this SAP is to establish procedures for the collection of data of sufficient quality to evaluate the nature and extent of impacted groundwater at the Site. The CMP references the relevant procedures and protocols from this SAP and the locations, frequency, and types of field or laboratory analyses that will be conducted. This SAP is meant to ensure that reliable data are obtained in support of remedial actions at the Site if such actions are necessary for the protection of human health and the environment. It provides a consistent set of procedures that will be used throughout the various work phases identified in the CMP (MFA, 2016a).

If a phase of work or an otherwise unforeseen change in methodology requires modification to this SAP, an addendum may be prepared that describes the specific revision(s) or the alternative procedures. Procedures are provided that will be used to direct the investigation process so that the following conditions are met:

- Data collected are of high quality, representative, and verifiable.
- Use of resources is cost effective.
- Data can be used by the Property owner and operator and by Ecology to support compliance monitoring for the selected Site remedy.

This SAP provides guidance on procedures for groundwater sampling, monitoring well installation and decommissioning, and management of investigation-derived waste (IDW). It also includes procedures for collecting, analyzing, evaluating, and reporting useful data. The document includes quality assurance (QA) procedures for field activities, sampling QA and quality control (QC) procedures, and data validation. The goal of the procedures outlined in this SAP is to obtain reliable data about physical, environmental, and chemical conditions at the Site in order to support the goals and objectives of the CMP.

2 ACCESS AND SITE PREPARATION

2.1 Access

MFA personnel will be on the Site during compliance monitoring activities. Access to the Site is allowed at all reasonable times for the purpose of performing work. Work activities resulting in loud noises will generally be confined to the hours between 7 a.m. and 7 p.m. MFA will notify MCHI before beginning work at the Site.

2.2 Site Preparation

Before any subsurface field activities (e.g., monitoring well installation) begin at the Site, public and private utility-locating services will be used to check for underground utilities and pipelines near each proposed well or boring location. MFA will coordinate fieldwork with MCPLC to define the locations of possible on-site utilities, piping, and other subsurface obstructions. Ecology will be notified a minimum of 48 hours before activities begin at the Site.

3 GROUNDWATER ASSESSMENT

Existing monitoring well locations are shown on Figure 4 of the CMP (MFA, 2016a). Any additional wells to be installed at the Site will be installed using a direct-push drill rig (i.e., Geoprobe™) in accordance with the installation details described below, and subsurface soil will be logged during well installation. In the event that refusal is met before the desired well installation depth is reached (i.e., significant debris, cobbles, or bedrock are encountered), a different type of drilling technology may be considered.

3.1 Monitoring Well Installation

Monitoring wells will be constructed according to the Washington well construction standards (Chapter 173-160 WAC) and as described below.

- Monitoring wells will be constructed with 2-inch-diameter polyvinyl chloride or stainless steel riser pipe and screened sections consisting of 0.010-inch machine slots. The monitoring wells may be constructed with prepacked well screen with 10 x 20 washed silica sand or by placing materials downhole, following the WAC regulation listed above.
- Additional filter pack may be placed around the prepacked screen (if used). The additional filter pack will consist of graded 10 x 20 washed silica sand and will extend a maximum of 1 foot below the bottom of the screen and 3 feet above the top of the screen. A weighted line will be used to monitor the level of the filter pack during installation. The filter pack may be surged during installation.
- Bentonite grout or hydrated chips (e.g., 0.75-inch minus) will be used to seal the annulus above the filter pack. Potable water will be used. A weighted line will be used to measure the top of the bentonite chips as they are poured into place.
- At least 24 hours after installation of a well, the well will be developed by surging, bailing, or pumping to remove sediment that may have accumulated during installation and to improve the hydraulic connection with the water-bearing zone.
- Water quality field parameters such as specific conductance, pH, temperature, and turbidity will be measured during well development as deemed appropriate. The wells will be developed until the turbidity measurements are 10 nephelometric turbidity units or less, or until there is no noticeable decrease in turbidity. To the extent practical, water quality field parameters will be considered stable when the specific conductance is within 10 percent of the previous reading, pH is within 0.1 standard unit of the previous reading, and temperature is within 0.1 degree Celsius of the previous reading.

3.2 Soil Logging

During well installation, a log of the soil will be prepared by a geologist or hydrogeologist licensed by the State of Washington or a person working under the direct supervision of a geologist or hydrogeologist licensed by the State of Washington. Site characterization is complete and soil samples will not be collected for chemical analysis. Soil logs will include information such as the project name and location, the name of the drilling contractor, the drilling method, the sampling method, sample depths, blow counts (if applicable), a description of soil encountered, and screened intervals. Soils will be described using American Society for Testing and Materials designation D2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedures). The information will be recorded on an MFA boring log form, as shown in Appendix A, or in the field notes.

3.3 Groundwater Elevations

Water level measurements to the nearest 0.01 foot will be taken, using an electronic water level indicator. If the total well or boring depth is not known, the total depth will also be measured. The depth to water will be measured from the designated measuring point (typically the top of the casing, which is typically a polyvinyl chloride riser pipe) The measuring point will be marked so that readings are measured from the same reference point each time, and the measuring point elevation will be surveyed. During monitoring events, the well condition (including the condition of the lock, monument integrity, and legibility of well labels) will be recorded for each location. The water level indicator will be decontaminated between wells in accordance with the procedures outlined in Section 3.6.

3.4 Monitoring Well Decommissioning

Wells to be decommissioned (see the CMP, MFA, 2016a) will be decommissioned with bentonite chips or with bentonite grout in accordance with the WAC for Minimum Standards for Construction and Maintenance of Wells (WAC 173-160, 1998).

3.5 Surveying

The installation locations for proposed wells and other features of interest will be surveyed using a global positioning unit (e.g., Trimble™) capable of submeter accuracy. The location and measuring point elevation for newly installed monitoring wells will be surveyed by a licensed surveyor.

3.6 Equipment Cleaning and Decontamination

3.6.1 Drilling Equipment

The working area of the drill rig and downhole drilling equipment will be steam-cleaned or pressure-washed after arrival on the Property and after use in each borehole or monitoring well. Decontamination fluids will be transferred to drums approved by the Washington State Department of Transportation (WSDOT), and will be managed according to the procedures outlined in Section 3.7.

3.6.2 Sampling Equipment

Nondisposable sampling equipment and reusable materials that contact the soil or water will be decontaminated on site and before and after each sample and sampling location. Decontamination will consist of the following:

- Tap-water rinse (may consist of an equivalent high-pressure or hot-water rinse). Visible soil to be removed by scrubbing.
- Nonphosphate detergent wash, consisting of a dilute mixture of Liqui-Nox® (or equivalent) and tap water.
- Distilled-water rinse.
- Methanol solution rinse (1:1 solution of methanol with distilled water).
- Distilled-water rinse.

Decontamination fluids will be transferred to drums for management.

3.7 Management of Investigation-Derived Waste

IDW may include items such as soil cuttings, purged groundwater, decontamination fluids, sampling debris, and personal protective equipment. The IDW will be segregated into solids, liquids, and sampling debris (e.g., personal protective equipment, tubing, bailers). IDW will be stored in a designated area on the Site in WSDOT-approved drums.

Drums will be labeled with their contents, the approximate volume of material, the date of collection, and the origin of the material. The drums will be sealed, secured, and transferred to a designated area on the Site, pending characterization. Analytical data from groundwater sampling activities previously described may be used to characterize the soil cuttings, drilling fluids, purge water, and decontamination fluids generated during drilling and monitoring well sampling.

4 GROUNDWATER SAMPLING

Groundwater samples will be collected from monitoring wells and the horizontal recovery well following the procedures outlined below. Groundwater samples that will be analyzed for dissolved metals will be field-filtered (see Section 5).

4.1 Monitoring Well Groundwater Sampling

If a peristaltic pump is used, standard low-flow sampling techniques will be used to collect groundwater samples from monitoring wells. If possible, groundwater samples should be collected from the middle of the screened interval or, if the water level is below the top of the screen, from the middle of the water column. New, disposable tubing will be used at each monitoring location.

Before collection of groundwater samples, the water level will be measured and the well will be purged. If a peristaltic pump is used, the well should be purged at a low flow rate (e.g., 0.1 to 0.5 liter per minute). A minimum of one well volume will be purged before sample collection or until selected water quality field parameters (e.g., temperature, specific conductance, pH, turbidity) have stabilized. If the well goes dry during purging, a sample can be collected once the well recharges enough water. During purging, the flow rates, water levels, and water quality parameters will be recorded on an appropriate field form or in the field notes. Groundwater will be transferred directly into laboratory-supplied containers specific to the analysis required.

4.2 Horizontal Recovery Well Groundwater Sampling

Groundwater samples will be collected from the horizontal recovery well at the point where the drain discharges into the recovery sump, which is accessible from a manhole located north of monitoring well MW-3 (see Appendix B-1 of the site management plan [MFA, 2016b]). Samples will be collected directly into laboratory-supplied containers specific to the analysis required.

A water level and water quality parameter measurements will not be collected and the well will not be purged prior to sample collection. However, if the recovery sump and pump have been inactive (i.e., operation of the horizontal recovery well was terminated in accordance with the CMP), then a minimum of one well volume will be purged prior to sample collection.

4.3 Nomenclature

Groundwater samples will be labeled with a prefix to describe the sampling location identification number, a "GW" to indicate a groundwater sample matrix, and the date of collection. For example, a groundwater sample collected from a monitoring well at location MW4 and on January 1, 2015 will have the sample nomenclature of MW4-GW-010115.

Duplicate groundwater samples will replace the location number with "DUP," and the sample will have the same sample time as the primary sample. To avoid confusion, avoid collecting more than one duplicate sample during the same date and time. A duplicate sample of the abovementioned sample would appear as MWDUP-GW-010115.

Relevant sample information will be documented on the exploratory boring log (see Appendix A) or a field sampling data sheet (FSDS) (see Appendix B); documentation may include items such as the screened interval or open space, equipment used, water quality field parameters, and the amount of water purged before sampling. The screened interval or open borehole will be recorded on the boring log.

5 ANALYTICAL METHODS

5.1 Chemicals of Interest

The following chemicals have been identified as indicator hazardous substances (IHSs) for Site groundwater:

- Metals: arsenic, chromium, and copper
- Volatile organic compounds: benzene, ethylbenzene, and xylenes
- Pentachlorophenol (PCP)
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)

Analytical methods and sample handling procedures for these IHSs are included in the attached table.

5.2 Laboratory Test Methods and Reporting Limits

5.2.1 Groundwater

In accordance with the QA/QC requirements set forth in this SAP, a Washington State-accredited laboratory may perform the following analyses. Laboratory methods are summarized below and in the attached table:

- Dissolved arsenic and copper by U.S. Environmental Protection Agency (USEPA) Method SW6020 or 200.8
- Total hexavalent chromium by USEPA Method SM3500CR-B or 7196A
- Benzene, ethylbenzene, and xylenes by USEPA Method SW8260 or SW8021
- cPAHs by USEPA Method SW8270-selective ion monitoring (SIM)
- PCP by USEPA SW8270-SIM

5.3 QA/QC Samples Generated in Field

To ensure that field samples and quantitative field measurements are representative of the media collected and conditions being measured, sample collection and measurement methods will follow procedures documented in Section 4.1. QC samples collected in the field include field equipment rinsate blanks, trip blanks, and field duplicates. Field QC samples will be identified on the FSDSs. Field and trip blank results may indicate possible contamination introduced by field or laboratory procedures; field duplicates indicate precision in both field and laboratory procedures.

5.4 Laboratory Operations

In the laboratory, QC samples may include matrix spike and matrix spike duplicate (MS/MSD) samples, laboratory control samples (LCSs), surrogate spike samples, and method blanks, as well as other QC samples and procedures as required by the individual methods.

5.5 Sample Containers, Preservation, and Handling

5.5.1 Preservation

Water samples will be collected in laboratory-supplied containers, as generally specified, as summarized in the table. Samples to be analyzed for dissolved metals will be field-filtered.

The groundwater samples will be stored in iced coolers at approximately 4 degrees Celsius.

5.5.2 Sample Packaging and Shipping

Groundwater samples will be stored in shipping containers with ice or a refrigerator designated for samples and transported to the analytical laboratory.

5.6 Sample Custody

Sample custody will be tracked from point of origin through analysis and disposal, using a chain-of-custody (COC) form, which will be filled out with the appropriate sample and analytical information after samples are collected.

The following items will be recorded on the COC form:

- Project name
- Project number
- MFA project manager
- Sampler name(s)
- Sample number, date and time collected, media, number of bottles submitted
- Requested analyses for each sample
- Type of data package required
- Turnaround requirements
- Signature, printed name, and organization name of persons having custody of samples, and date and time of transfer
- Additional instructions or considerations that would affect analysis (nonaqueous layers, archiving, etc.)

Persons in possession of the samples will be required to sign and date the COC form whenever samples are transferred between individuals or organizations. The COC will be included in the shipping containers. The laboratory will implement its in-house custody procedures, which begin when sample custody is transferred to laboratory personnel.

If samples are shipped via air or ground transportation (by a third party), the following custody procedures will be followed. The COC will be signed and custody will be relinquished to the carrier. The signed COC(s) will be packed in shipping containers with the samples, and a custody seal will be placed on the container. The shipping documentation will be used by the carrier to document custody of the package while it is in transit to the laboratory.

At the analytical laboratory, a designated sample custodian will accept custody of the samples and will verify that the COC form matches the samples received. The shipping container or set of containers is given a laboratory identification number, and each sample is assigned a unique sequential identification number.

5.7 Instrumentation

5.7.1 Field Instrumentation

Field instruments will be used during the investigations. The following field equipment may require calibration before use and periodically during sampling activities:

- pH meter
- Conductivity meter
- Dissolved-oxygen meter
- Oxygen/reduction potential meter
- Turbidity meter
- Thermometer
- Photoionization detector
- Electronic water-level probe

Field-instrument calibration and preventive maintenance will follow the manufacturers' guidelines, and deviations from the established guidelines will be documented.

5.7.1.1 Field Calibration

Generally, field instruments should be calibrated daily before work begins. Field personnel may decide to calibrate more than once a day if inconsistent or unusual readings occur, or if conditions warrant more frequent calibration. Calibration activities should be recorded in logbooks or field notebooks. To ensure that field instruments are properly calibrated and remain operable, the following procedures will be used, at a minimum:

- Operation, maintenance, and calibration will be performed in accordance with the instrument manufacturers' specifications.

- Standards used to calibrate field instruments will meet the minimum requirements for source and purity recommended in the equipment operation manual. Standards will be checked for expiration dates that may be printed on the bottle. Standards that have expired should not be used.

- Acceptable criteria for calibration will be based on the limits set in the operations manual.

- Users of the equipment should be trained in the proper calibration and operation of the instrument.

- Operation and maintenance manuals for each field instrument should be available to persons using the equipment.

- Field instruments will be inspected before they are taken to the Site.
- Field instruments will be calibrated at the start of each workday. Meters will be recalibrated, as necessary, during the work period.
- Calibration procedures (including items such as time, standards used, and calibration results) should be recorded in a field notebook. The information should be available if problems are encountered.

5.7.1.2 Preventive Maintenance

Preventive maintenance of field instruments and equipment will follow the operations manuals. A schedule of preventive-maintenance activities should be followed to minimize downtime and ensure the accuracy of measurement systems. Maintenance will be documented in the field notebook.

5.7.2 Laboratory Instrumentation

Specific laboratory instrument calibration procedures, frequency of calibration, and preparation of calibration standards will be according to the method requirements as developed by the USEPA, following procedures presented in SW-846 (USEPA, 1986).

5.7.2.1 Laboratory Calibration and Preventive Maintenance

The laboratory calibration ranges specified in SW-846 (USEPA, 1986) will be followed.

Preventive maintenance of laboratory equipment will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments and inspection and monitoring of carrier gases, solvents, and glassware used in analyses. The preventive-maintenance approach for specific equipment should follow the manufacturers' specifications, good laboratory practices, and industry standard techniques.

Precision and accuracy data will be examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance should be performed when an instrument begins to change, as indicated by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet any of the QC criteria.

5.8 Laboratory QA/QC Samples

The laboratory QC samples will be used to assess the accuracy and precision of the laboratory analysis. Each category of laboratory QA/QC will be performed by the laboratory as required by method-specific guidelines. The acceptance criteria presented in the guidelines will be adhered to, and samples that do not meet the criteria will be reanalyzed or qualified, as appropriate.

5.8.1 Calibration Verification

Instruments will initially be calibrated at the start of the project or sample run, as required, and when any ongoing calibration does not meet control criteria. The number of points used in the initial calibration is defined in the analytical method. Calibration will be continued as specified in the analytical method to track instrument performance. If a continuing calibration does not meet control limits, analysis of project samples will be suspended until the source of the control failure is either eliminated or reduced to within control specifications.

5.8.2 Matrix Spike/Matrix Spike Duplicate

MS samples are analyzed to assess the matrix effects on the accuracy of analytical measurements. MS/MSD samples will be prepared by spiking investigative samples with known amounts of analytes before extraction and preparation and analysis. The recoveries for the MS/MSD samples will be used to assess the accuracy and precision in the analytical method by measuring how well the analytical method recovers the target compounds in the investigative matrices. For each matrix type, at least one set of MS/MSD samples will be analyzed for each batch of samples (consisting of 20 or fewer samples) received.

5.8.3 Method Blanks

Method blanks are prepared using analyte-free (reagent) water and are processed with the same methodology (e.g., extraction, digestion) as the associated investigative samples. Method blanks are used to document contamination resulting in the laboratory from the analytical process. A method blank shall be prepared and analyzed in every analytical batch. The method blank results are used to verify that reagents and preparation do not impart unacceptable bias to the investigative sample results. The presence of analytes in the method blank sample will be evaluated against method-specific thresholds. If analytes are present in the method blank above the method-specific threshold, corrective action will be taken to eliminate the source of contamination before proceeding with analysis. Investigative samples of an analytical batch associated with method blank results outside acceptance limits will be appropriately qualified by the data validation contractor.

5.8.4 Laboratory Control Samples

LCSs are prepared by spiking laboratory-certified, reagent-grade water with the analytes of interest or a certified reference material that has been prepared and analyzed. The result for percent recovery of the LCS is a data quality indicator of the accuracy of the analytical method and laboratory performance.

5.8.5 Laboratory Duplicate Samples

Laboratory duplicate samples (LDSs) are prepared by the laboratory by splitting an investigative sample into two separate aliquots and performing separate sample preparation and analysis on each aliquot. The results for relative percent difference of the primary investigative sample and the respective LDSs are used to measure precision in the analytical method and laboratory performance. For nonaqueous matrices, sample heterogeneity may affect the measured precision for the LDSs.

5.9 Field QC

The following samples will be prepared by the sampling personnel in the field and submitted to the laboratory:

- **Equipment Rinsate Blanks—**To ensure that decontamination procedures are sufficient, an equipment rinsate blank will be collected when nondedicated, nondisposable equipment is used. At least one equipment rinsate blank will be collected for every 20 samples collected. If more than 20 samples are collected with the same equipment, or if high concentrations of contaminants are encountered, additional equipment rinsate blanks may be collected. Equipment rinsate blanks will be collected by passing laboratory deionized/distilled water through or over nondisposable sampling equipment.
- **Trip Blanks—**A trip blank monitors the potential for sample contamination during sample collection and transport. A trip blank consists of reagent-grade water in a new sample container, which is prepared at the same time as the sample containers. The trip blank will accompany the samples throughout collection, shipment, and storage. At least one trip blank should be included with each cooler in which samples for volatile organic compound analyses are stored.
- **Field Duplicates—**Field duplicates are collected to measure sampling and laboratory precision. At least one duplicate sample will be collected for every 20 samples.

5.10 Data Reduction, Validation, and Reporting

The analytical laboratory will submit analytical data packages that include laboratory QA/QC results to permit independent and conclusive determination of data quality. Data quality will be determined by MFA, using the data evaluation procedures described in this section. The results of the MFA evaluation will be used to determine if the project data quality objectives are being met.

5.10.1 Field Data Reduction

Daily internal QC checks will be performed for field activities. Checks will consist of reviewing field notes and field activity memoranda to confirm that the specified measurements, calibrations, and procedures are being followed. The need for corrective action will be assessed on an ongoing basis, in consultation with the project manager.

5.10.2 Laboratory Evaluation

Initial data reduction, evaluation, and reporting at the analytical laboratory will be carried out as described in USEPA SW-846 manuals for analyses (USEPA, 1986), as appropriate. Additional laboratory data qualifiers may be defined and reported to further explain the laboratory's QC concerns about a particular sample result. Additional data qualifiers will be defined in the laboratory's case narrative reports.

5.10.3 Data Deliverables

Laboratory data deliverables are listed below. Electronic deliverables will contain the same data that are presented in the hard-copy report.

- Transmittal cover letter
- Case narrative
- Analytical results
- COC
- Surrogate recoveries
- Method blank results
- MS/MSD results
- Laboratory duplicate results

5.10.4 MFA Evaluation

5.10.4.1 Data QA/QC Review

MFA will evaluate the laboratory data for precision, completeness, accuracy, and compliance with the analytical method. MFA will review data according to applicable sections of USEPA organics and inorganic procedures (USEPA, 2008, 2010), as well as appropriate laboratory method-specific guidelines (USEPA, 1986).

Data qualifiers, as defined by the USEPA, are used to classify sample data according to their conformance to QC requirements. Common qualifiers are listed below:

- J—Estimate, qualitatively correct but quantitatively suspect.
- R—Reject, data not suitable for any purpose.
- U—Not detected at a specified reporting limit.

Poor surrogate recovery, blank contamination, or calibration problems, among other things, can require qualification of the sample data. When sample data are qualified, the reasons for the qualification should be stated in the data evaluation report.

QC criteria not defined in the guidelines for evaluating analytical data are adopted, where appropriate, from the analytical method.

The following information will be reviewed during data evaluation, as applicable:

- Sampling locations and blind sample numbers
- Sampling dates

- Requested analysis
- COC documentation
- Sample preservation
- Holding times
- Method blanks
- Surrogate recoveries
- MS/MSD results
- Laboratory duplicates (if analyzed)
- Field duplicates
- Field blanks
- LCSs
- Method reporting limits above requested levels
- Additional comments or difficulties reported by the laboratory
- Overall assessment

The results of the data evaluation review will be summarized for each data package. Data qualifiers will be assigned to sample results on the basis of USEPA guidelines, as applicable.

5.10.4.2 Data Management and Reduction

MFA uses a database (e.g., EQuIS™) to manage laboratory data. The laboratory will provide the analytical results in electronic, EQuIS-compatible format. Following data evaluation, data qualifiers will be entered into the database.

Data may be reduced to summarize particular data sets and to aid interpretation of the results. Statistical analyses may also be applied to results. Data reduction QC checks will be performed on hand-entered data, calculations, and data graphically displayed. Data may be further reduced and managed using one or more of the following computer software applications:

- Microsoft Excel® (spreadsheet)
- EQuIS™ (database)
- Microsoft Access® (database)
- AutoCad and/or Arc GIS (graphics)
- USEPA ProUCL (statistical software)

6 REPORTING

After the data are received, MFA will generate a data report, which will summarize and screen the data against the applicable criteria.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

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TABLE

Table
Groundwater Sample Handling Summary
McFarland Cascade Pole and Lumber Company Site
Tacoma, Washington

Analyte	Method	Suggested Volume	Container	Number of Containers	Preservative	Storage Temperature	Holding Time from Collection
Dissolved Arsenic and Copper	USEPA SW6020 or 200.8	500 milliliter	Polyethylene	1	Field-filter and HNO_3 pH < 2	4 degrees C	six months
Total Hexavalent Chromium	USEPA SM3500CR-B or 7196A	500 milliliter	High-Density Polyethylene	1	none	4 degrees C	24 hours
cPAHs	USEPA Method SW8270-SIM	1 liter	Amber Glass	2	none	4 degrees C	seven days
PCP	USEPA Method SW8270-SIM	500 milliliter	Amber Glass	2	none	4 degrees C	seven days
BEX	USEPA Method SW8260 or SW8021	40 milliliter	VOA	3	HCL pH <2	4 degrees C	14 days

NOTES:

BEX = benzene, ethylbenzene, and xylenes.

C = Celsius.

cPAH = polycyclic aromatic hydrocarbon.

HCL = hydrochloric acid.

HNO_3 = nitric acid.

NaOH = sodium hydroxide.

PCP = pentachlorophenol.

SIM = selective ion monitoring.

SM = standard method.

SW = solid waste.

USEPA = U.S. Environmental Protection Agency.

VOA = volatile organic analysis vial.

APPENDIX A
BORING LOG FORM

MAUL FOSTER ALONGI

Boring Log Form

Boring/Well No.:	
Site:	
Location:	
Project #:	

Drill Rig		MFA Staff:		Hole Dia:		Total Depth:	
Drilling Co.:			Water Level:		WLE Note:		
Start Date:		End Date:	Water Level:		WLE Note:		

Completion		Sample				Lithology					
		Top:		Time:	Depth:	Soil Type:		Color:			
		Length:				Top:		Fines:		Moisture:	
		Type:		Sample ID		Bottom:		Sand:		PID:	
		% Recov:				Soil Class:		Gravel:		Line Type:	
						Trace:		Impacts:			
						Notes:					
		Top:		Time:	Depth:	Soil Type:		Color:			
		Length:				Top:		Fines:		Moisture:	
		Type:		Sample ID		Bottom:		Sand:		PID:	
		% Recov:				Soil Class:		Gravel:		Line Type:	
						Trace:		Impacts:			
						Notes:					
		Top:		Time:	Depth:	Soil Type:		Color:			
		Length:				Top:		Fines:		Moisture:	
		Type:		Sample ID		Bottom:		Sand:		PID:	
		% Recov:				Soil Class:		Gravel:		Line Type:	
						Trace:		Impacts:			
						Notes:					
		Top:		Time:	Depth:	Soil Type:		Color:			
		Length:				Top:		Fines:		Moisture:	
		Type:		Sample ID		Bottom:		Sand:		PID:	
		% Recov:				Soil Class:		Gravel:		Line Type:	
						Trace:		Impacts:			
						Notes:					
		Top:		Time:	Depth:	Soil Type:		Color:			
		Length:				Top:		Fines:		Moisture:	
		Type:		Sample ID		Bottom:		Sand:		PID:	
		% Recov:				Soil Class:		Gravel:		Line Type:	
						Trace:		Impacts:			
						Notes:					
		Top:		Time:	Depth:	Soil Type:		Color:			
		Length:				Top:		Fines:		Moisture:	
		Type:		Sample ID		Bottom:		Sand:		PID:	
		% Recov:				Soil Class:		Gravel:		Line Type:	
						Trace:		Impacts:			
						Notes:					
		Top:		Time:	Depth:	Soil Type:		Color:			
		Length:				Top:		Fines:		Moisture:	
		Type:		Sample ID		Bottom:		Sand:		PID:	
		% Recov:				Soil Class:		Gravel:		Line Type:	
						Trace:		Impacts:			
						Notes:					
Borehole Notes:											

APPENDIX B

FIELD SAMPLING DATA SHEET FORM

Maul Foster & Alongi, Inc.
7223 NE Hazel Dell Avenue, Suite B, Vancouver, WA 98665 (360) 694-2691 Fax. (360) 906-1958

Soil Field Sampling Data Sheet

Client Name		**Sample Location**	
Project Number		**Sampler**	
Project Name		**Sampling Date**	
Sampling Event		**Sample Name**	
Sub Area		**Sample Depth**	
FSDS QA:		**Easting**	

Easting		**Northing**		**TOC**	

Sample Information

Sampling Method	Sample Type	Sample Category	PID/FID	Sampling Time	Container Code	#
(1) Backhoe	Liquid	Composite			2 oz. soil	
					4 oz. soil	
					8 oz. soil	
					Other	
					Total Containers	0

Sample Description:

General Sampling Comments

Sampling Method Code:

(1) Backhoe, (2) Hand Auger, (3) Drill Bit Cutting Head, (4) Geoprobe, (5) Split Spoon, (6) Shelbey Tube, (7) Grab, (8) Other (Specify)

Signature ________________________________

Maul Foster & Alongi, Inc.

7223 NE Hazel Dell Avenue, Suite B, Vancouver, WA 98665 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name		**Sample Location**	
Project #		**Sampler**	
Project Name		**Sampling Date**	
Sampling Event		**Sample Name**	
Sub Area		**Sample Depth**	
FSDS QA:		**Easting**	

Northing		**TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
	Groundwater		VOA-Glass		
			Amber Glass		
			White Poly		
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly		
			Total Bottles	0	

General Sampling Comments

Signature ______________________________

APPENDIX B

FINAL SITE MANAGEMENT PLAN

FINAL SITE MANAGEMENT PLAN

MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

Prepared for

MCFARLAND CASCADE HOLDINGS, INC.

A STELLA-JONES COMPANY

TYEE MANAGEMENT COMPANY, LLC

January 12, 2016

Project No. 0999.01.01

MAUL FOSTER ALONGI

Prepared by

Maul Foster & Alongi, Inc.

1329 North State Street, Suite 301

Bellingham, WA 98225

FINAL SITE MANAGEMENT PLAN
MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

The material and data in this plan were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

JUSTIN LEE CLARY
STATE OF WASHINGTON
37246
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES: 2/8/2016

Justin L. Clary, PE
Principal Engineer

Heather Good, LHG
Project Hydrogeologist

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ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Environment
AO	Agreed Order
BTEX	benzene, toluene, ethylbenzene, and xylenes
CA-C	copper azole type C
CAP	Cleanup Action Plan
CCA	copper-chromated arsenic
CFR	Code of Federal Regulations
CMP	Groundwater Compliance Monitoring Plan
COI	chemical of interest
COPC	chemical of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPLC	Cascade Pole and Lumber Company
CPOC	conditional point of compliance
CrVI	hexavalent chromium
CUL	cleanup level
Ecology	Washington State Department of Ecology
gpm	gallons per minute
GPS	global positioning system
HAZWOPER	Hazardous Waste Operations and Emergency Response
IHS	indicator hazardous substance
MCHI	McFarland Cascade Holdings, Inc.
MCPLC	McFarland Cascade Pole and Lumber Company
MFA	Maul Foster & Alongi, Inc.
MKA	MKAssociates, Inc. (land surveyor)
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Act
PCP	pentachlorophenol
the Port	Port of Tacoma
Property	property on which MCPLC conducts its operations that is owned by Tyee Management Company, LLC
QA	quality assurance
QC	quality control
recovery system	the horizontal recovery well and the associated components
Restricted Area	portion of the Site where soil management restrictions apply
RI/FS	Remedial Investigation and Feasibility Study
Site	anywhere that contamination from MCPLC's historical operations has come to lie, irrespective of property ownership
SMP	site management plan

ACRONYMS AND ABBREVIATIONS (CONTINUED)

Tyee	Tyee Management Company, LLC
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code

1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA) has prepared this site management plan (SMP) on behalf of McFarland Cascade Holdings, Inc. (MCHI) and Tyee Management Company, LLC (Tyee) for the McFarland Cascade Pole and Lumber Company (MCPLC) facility in Tacoma, Washington (see Figure 1). For purposes of this plan, Property (unless otherwise specified) refers to the property on which MCPLC conducts its operations, which is owned by Tyee and is leased to MCHI. Site refers to anywhere that contamination from MCPLC's historical operations has come to lie, irrespective of property ownership. The Site includes the Property and a limited portion of the adjacent former Union Pacific Railroad Milwaukee Railyard property to the northeast that is currently owned by the Port of Tacoma (the Port) (see Figure 2). The Maersk Pacific and Horizon Lines storage and shipping yards currently conduct operations on the Port property. This document has been prepared pursuant to Agreed Order (AO) No. 92HS-S146 and in accordance with the requirements of Washington Administrative Code (WAC) 173-340-440 and related provisions of the Washington State Model Toxics Control Act (MTCA) (WAC 173-340-350).

1.1 Purpose of Site Management Plan

The purpose of this SMP is to provide guidance for future site activities during which contact with contaminated media that have been left in place following past remedial actions may occur and also to provide guidance for monitoring and maintenance associated with the protective remedial action measures that remain in place. This SMP also provides guidelines for assessing soil and groundwater contamination that may be encountered during future construction at the Site, and outlines precautions and procedures necessary for the protection of human health and the environment. This SMP identifies indicator hazardous substances (IHSs); excavation protocols; soil handling procedures; waste characterization and disposal; groundwater management requirements; erosion and dust control; and stormwater protection measures.

The area of the Property where residual soil contamination remains in place is referred to as the Restricted Area. The selected remedy for the Site includes a protective cap that covers contaminated soil in the Restricted Area. Any activity in the Restricted Area that will compromise the integrity of the protective cap is prohibited, except in compliance with this SMP or other prior written approval by the Washington State Department of Ecology (Ecology). The site management guidelines and procedures outlined in this SMP are to be implemented during activities that involve contact with or extraction of groundwater, breaching of the protective cap, and/or disturbances to potentially contaminated soil underlying the cap.

1.2 Site Description

The Site is located on the Tacoma tide flats and includes the Property located at 1640 East Marc Street and a portion of the adjacent Port property located at 1119 Milwaukee Way, in Tacoma, Washington (Figures 1 and 2). The 43-acre Property is approximately 200 feet east of the Puyallup

River and 1,000 feet south of the Milwaukee Waterway. The Property is surrounded by industrial facilities, including Maersk Pacific and Horizon Lines storage and shipping yards to the northwest; the former Union Pacific Railroad Milwaukee Railyard to the northeast; Pallet Services (a pallet manufacturing and storage facility) to the east; and Fred Tebb and Sons (a lumber mill) and Recovery One (a demolition waste transfer and processing facility) to the south. The Site includes a small area on the former Union Pacific Milwaukee Railyard property (currently owned by the Port). The Milwaukee Railyard is no longer active and the Port has completed remedial actions to address free-phase diesel fuel and areas of related contamination. A restrictive covenant is in place on the Port property, and groundwater monitoring and cap maintenance activities are ongoing. The Port has also redeveloped its property to allow for the expansion of the Maersk Pacific Terminal.

1.3 Site History and Operations

The MCPLC facility is used for the manufacturing and processing of treated-wood products. Figure 2 shows the current layout of the facility. Activities at the facility have included debarking, sizing and framing, incising, staining, pressure- and non-pressure-treating, and distributing finished products to customers. Treated-wood products manufactured at the MCPLC facility include utility poles and dimensional lumber used for decking, fencing, and similar products.

The facility and the Property were originally owned and operated by Cascade Pole and Lumber Company (CPLC). CPLC began leasing the facility, the Property, and equipment to MCPLC in January 2004. CPLC and MCPLC are owned by the same parent company, MCHI. In 2012, Stella-Jones Corporation acquired MCHI. As part of that transaction, CPLC transferred ownership of the property to Tyee, which continues to lease the Property to MCHI.

CPLC purchased the Property in stages from the late 1960s through the early 1970s and began developing it for use as a wood-treating facility in 1972; wood-treating operations have been conducted on the Property since 1974. Before 1974, the northwest portion of the Property was used for a lumber mill and landscape bark operation. The rest of the Property was filled in the early 1970s by the Port. The fill consisted of dredged material and possibly other materials.

Wood-treating activities, including storage and application of wood preservatives, are conducted on the eastern portion of the Property in an area referred to as the “treating area.” The drip pads, a transfer table, retorts, and a pentachlorophenol (PCP) thermal butt vat (see Figure 2) comprise the treating area. The facility layout shown in Figure 2 has been in use since the late 1990s. The facility layout prior to the late 1990s is discussed in the Remedial Investigation and Feasibility Study (RI/FS) (MFA and AECOM, 2014) and the Cleanup Action Plan (CAP) (Ecology, 2016).

Both pressure and non-pressure (i.e., thermal) processes are used at the facility. The wood-treating chemicals primarily used in these processes have been PCP, copper-chromated arsenic (CCA), copper azole type C (CA-C), and creosote. From 1978 to 1987, CPLC used Chemonite® ammoniacal copper zinc arsenate at the facility. As of December 2004, creosote use was discontinued at the facility. MCPLC continues to use PCP to treat utility poles, but CCA use was discontinued for lumber products in December 2003, and for all products, including those for industrial use, in 2011.

CPLC and MCPLC records indicate that four known spills have occurred at the Property; one of these spills migrated onto the adjacent Port property. Cleanup actions were implemented to address these spills and each was reported to Ecology:

- In August 1985, an overflow of process water from the cooling tower resulted in a release of approximately 100 gallons of water. Cleanup actions were implemented and efforts were made to eliminate the possibility of future spills.
- In March 1986, a cooling tower overflow resulted in the spill of approximately 100 gallons of process water. Cleanup actions were implemented and the system was redesigned to prevent any chance of recurrence.
- In May 1986, a storage tank overflow resulted in the spill of approximately 260 gallons of CCA. Cleanup actions and procedures were implemented to prevent any chance of recurrence.
- In May 2014, a wood-treatment-process work tank release resulted in the spill of approximately 300 gallons of CA-C. The spill migrated into a dry roadside ditch on the adjacent Port property. A project-specific cleanup goal of 146 milligrams per kilogram for copper in soil was developed in coordination with Ecology and the Tacoma-Pierce County Health Department. All soil with copper concentrations above the project-specific cleanup goal was excavated from the ditch (approximately 40 cubic yards [48.29 tons] in total). Ecology approved the spill response and cleanup and indicated that no further action associated with this spill was needed.

No other spills or releases have been reported at the MCPLC facility.

The MCPLC facility is a hazardous-waste generator (ID No. WAD 008 958 357). The facility discharges treated stormwater under a National Pollutant Discharge Elimination System (NPDES) permit (No. WA003795-3). MCPLC's current NPDES permit became effective on September 1, 2014 and has an expiration date of August 13, 2019. MCPLC is also registered with the Puget Sound Clean Air Agency (Registration No. 10398).

Chemicals used in the wood-treating process and their associated compounds and breakdown products, including the following, were identified as chemicals of interest (COIs) for the Site:

- Total and dissolved arsenic, copper, and chromium (including both trivalent chromium and hexavalent chromium [CrVI])
- Polycyclic aromatic hydrocarbons
- PCP
- Semivolatile organic compounds

In addition, the following COIs were identified in association with the PCP carrier oil formerly in use at the Site:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX)

- Total petroleum hydrocarbon–gasoline-range organics

The carrier oil in use since 2008 and currently in use at the facility is a 30 percent biodiesel and 70 percent recycled lubrication oil mixture that does not contain BTEX.

Samples of environmental media from the Site were analyzed for these COIs and detected chemicals were retained for consideration as IHSs.

CPLC entered into an AO with Ecology on June 7, 1993, for completion of a RI/FS and interim actions. Interim actions completed before execution of the AO were incorporated into the AO along with additional planned interim actions, including groundwater interim actions. Soil and groundwater investigations completed in association with the interim actions fulfilled the data collection requirements for the RI/FS. Site investigation details are discussed in the RI/FS (MFA and AECOM Environment [AECOM], 2014) and CAP (Ecology, 2016).

1.4 Remedial Action Description

Since the early 1990s, CPLC has conducted numerous upgrades (interim actions) at the facility. The interim actions were completed under the existing AO, with consent and approval by Ecology, and are part of the selected remedy for the Site. These actions consisted of:

- **Protective Cap—**Areas of the Property where arsenic concentrations in soil are known to exceed its cleanup level (CUL) are referred to in this plan as the Restricted Area and are designated on Figure 3. Currently, arsenic-contaminated soil in the Restricted Area is covered with asphalt pavement, concrete, buildings, or other constructed features (including the drip pad and transfer table containment slab described below), which function as a protective cap (Figure 3). The protective cap will be maintained in the Restricted Area as a component of the Site remedy. The protective cap in the Restricted Area is equipped with catch basins and piping to collect stormwater and direct it to on-site filtration/treatment systems. The stormwater is discharged under the site-specific NPDES permit.

- **Drip Pad Construction—**Included excavation and disposal of impacted soils, as well as installation of a steel-reinforced-concrete drip pad and underlying leak-detection system, which caps existing soil contamination and will prevent future contamination of soil.

- **Installation and Operation of the Horizontal Recovery Well—**Provides both hydraulic containment and removal of groundwater impacts from beneath the transfer table pit and the adjacent treatment area. Extracted water is reused in facility operations. The horizontal recovery well recovers groundwater from the shallow aquifer (see Section 2.2.2), which reduces the migration of chemically impacted shallow groundwater from the transfer table pit and treating area and reduces the mass of contaminants in shallow groundwater.

- **Transfer Table Pit Upgrade—**Included removal and off-site disposal of 860 tons of impacted soil, construction of a concrete containment slab that caps underlying contaminated soil, and construction of a drainage system emergency shutoff valve to prevent potential releases. These activities removed previous soil contamination and will prevent future contamination of soil.

Further information associated with each interim remedial action is provided in the RI/FS (MFA and AECOM, 2014).

In addition to the interim actions listed above, the selected remedial action includes monitored natural attenuation and compliance monitoring to address groundwater impacts at the Site. Groundwater compliance monitoring is discussed in the Groundwater Compliance Monitoring Plan (CMP) (MFA, 2016), which is provided as an attachment to the CAP (Ecology, 2016). Compliance with CULs at the downgradient conditional point of compliance (CPOC) is assessed through compliance monitoring of sentry wells.

The selected remedial action also includes the following institutional controls: (1) continued maintenance of the protective cap in the Restricted Area; (2) requirements for management of soil excavated from the Restricted Area; (3) prohibition on groundwater use throughout the Site; and (4) operation and maintenance of the horizontal recovery well in the Restricted Area. These institutional controls will be documented and enforced through a restrictive covenant placed on the Property and the existing restrictive covenant on the Port property prohibiting groundwater use.

2 NATURE AND EXTENT OF RESIDUAL CONTAMINATION

2.1 Residual Contamination

The Site includes residual soil contamination in the Restricted Area beneath the protective cap (i.e., existing paving, the drip pad, the transfer table pit containment slab, and facility buildings) (see Figure 3) and residual wood-treating chemicals in groundwater on the Property and a portion of the Port property, as defined by the Site boundary shown in Figures 1 through 4. IHS exceedances in groundwater are shown in Figure 4.

Through development of the RI/FS (MFA and AECOM, 2014), data were screened for determination of Site IHSs specific to soil and groundwater. COIs were identified based on historical and current operations, as discussed above, and those COIs that were detected in soil or groundwater during prior environmental investigations were retained as chemicals of potential concern (COPCs). A list of the site COPCs detected in soil is provided in Table 1. Soil- and groundwater-specific IHSs were then defined through screening the maximum detected concentration of COPCs against site-specific CULs, which had been developed using applicable state and federal standards.

The sole IHS identified for site soils is arsenic.

IHSs identified for site groundwater are:

- Metals: arsenic, CrVI, and copper
- PCP
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)
- Volatile organic compounds: benzene, ethylbenzene, and xylenes

The selected remedy for the Site addresses these IHSs.

2.2 Distribution of Indicator Hazardous Substances

IHSs are assumed to be present in soil in the Restricted Area, as shown in Figure 3, and in groundwater throughout the Site. A summary table from the CAP showing the final CULs for the Site is provided as Table 2.

Although a number of the soil COPCs are not considered IHSs, based on historical operations and the potential for future contamination, the complete list of soil COPCs has been provided in this SMP to allow workers involved with future site work in which contact with contaminated soil may occur to be aware of all site COPCs (see Table 1). The site-specific CUL for arsenic in soil is based on MTCA Method C for direct contact (see Table 2). For reference, MTCA Method C for direct contact CULs are also provided for the soil COPCs in Table 1.

2.2.1 Soil

During previous investigations, the arsenic CUL was exceeded in several sample locations across the Property, all of which are in the Restricted Area and were paved during interim action implementation or are covered by existing infrastructure (e.g., buildings, drip pads, transfer table) (see Figure 3). As part of the RI/FS, soil samples were collected from areas of the Property proposed for paving. Soil from one of these paving areas (Paving Area 1) was consolidated in an area on the eastern end of the Property, under an agreement with the U.S. Environmental Protection Agency (USEPA), and then paved (see Section 4.1 of the RI/FS and Figure 3). Because an arsenic CUL exceedance was detected in Paving Area 1, this area of soil is included in the soil Restricted Area and is covered by the protective cap (see Figure 3).

The potential exists for site COPCs to be present in soil at concentrations above MTCA Method C for direct-contact CULs in portions of the treating area where soil characterization has not been completed because of sampling access constraints or where potential soil impacts were not addressed by earlier interim actions. The portions of the treating area with potential COPC impacts in soil include the drip pads, transfer table, retorts, control room, tank farm, and PCP thermal butt vat (see Figure 2). The treating area is included in the soil Restricted Area as shown in Figure 3.

2.2.2 Groundwater

The depth to groundwater beneath the Site ranges from 3 to 10 feet below ground surface. Shallow groundwater is present in an unconfined aquifer consisting of approximately 6 to 10 feet of fine to medium sand with some sandy silt intervals. An aquitard underlies the shallow aquifer and consists of an approximately 6- to 7-foot-thick layer of silty clay to clayey silt. A semi-confined, deep aquifer consisting of a 6- to 10-foot-thick layer of very fine to medium sand with a trace of silt underlies the aquitard. A second aquitard underlies the deep aquifer and consists of a 3-foot-thick layer of sandy to clayey silt.

2.2.2.1 Shallow Groundwater

IHS concentrations detected in shallow groundwater from 2004 to 2013, during the RI/FS (MFA and AECOM, 2014), and from 2004 to 2015, following a February 2015 groundwater monitoring event (MFA, 2015), were compared to CULs. The four most recent data points, from groundwater monitoring events conducted between 2004 and 2015, were evaluated for each IHS to determine the most recent trend of groundwater exceedances at the Site. Figure 4 shows IHSs that were detected at concentrations above their respective CULs, based on the most recent data. CUL exceedances were detected in all shallow wells sampled, with the exception of monitoring well MW-1, which is located near the southern boundary of the Property, and sentry well MW-20 (see Figure 4). Arsenic exceeds its CUL in all but one of the shallow groundwater monitoring wells with CUL exceedances. Other IHS exceedances, including copper, PCP, and cPAHs, were detected in fewer locations. Arsenic in shallow sentry wells MW-4 and MW-19, and copper in shallow sentry well MW-19, exceeded their CULs. Arsenic and PCP were detected above their CULs in samples collected from the horizontal recovery well (HW-01).

Shallow groundwater quality data collected from monitoring well UPRR-MW-29 indicate that wood-treating-related chemical impacts are present on the Port property. Since 2004, copper, arsenic, PCP, and cPAHs have been detected at least once above Site CULs in this well (see Figure 4) and may have originated in the treating area of the MCPLC facility (USPCI, 1993). As a result, the Site boundary extends onto this potentially affected portion of the Port property. The Site boundary is located on the Port property at the zero concentration arsenic contour line in groundwater shown in Figure 32 of the Hydrogeologic Characterization Report (USPCI, 1993). The zero concentration contours for the other wood-treating-related chemicals detected in groundwater on the Port property are contained within this zero concentration contour for arsenic.

In general, IHS concentrations in shallow groundwater under the Property show stable or decreasing trends, and IHS impacts appear to be limited to the treating area, with the exception of arsenic at MW-4 and arsenic and copper at MW-19. However, conservative attenuation modeling demonstrated that the arsenic concentration detected at MW-4, and the copper and arsenic concentrations at MW-19, will naturally attenuate to below their CULs before reaching the CPOC at the downgradient Property boundary (i.e., the Property boundary along Dike Road parallel to the Puyallup River) (MFA, 2015; MFA and AECOM, 2014).

2.2.2.2 Deep Groundwater

There are three existing deep groundwater monitoring wells on the Property: one well upgradient of the treating area (MW-14) and two wells directly downgradient of the treating area (MW-7 and MW-18; see Figure 2). Deep groundwater monitoring data from 2004 to 2013 were evaluated in the RI/FS for CUL exceedances.

The following IHSs are not monitored in the deep aquifer wells: benzene, ethylbenzene, xylenes, and CrVI (MFA and AECOM, 2014). No exceedances of these IHSs were observed in the shallow aquifer (MFA, 2015; MFA and AECOM, 2014; also see Figure 4). Total chromium was monitored in the deep aquifer wells from 2004 to 2013, and the only total chromium concentration above the CrVI CUL in a deep well was detected in the upgradient deep well (MW-14) (MFA and AECOM, 2014).

IHS concentrations are significantly lower in the deeper aquifer. The only IHSs that have exceeded a CUL in deep groundwater since 2004 are arsenic, copper, cPAHs, and PCP. Concentrations of all IHSs show declining trends in deep groundwater, and CUL exceedances have not been detected in the downgradient deep groundwater wells (MW-7 and MW-18) since 2007 (MFA and AECOM, 2014). During the last four monitoring events, only arsenic and copper exceeded their CULs in the upgradient deep groundwater well (MW-14) (see Figure 4). This observation indicates that CULs are currently being met in the existing downgradient deep groundwater wells and suggests that CULs will continue to be met in the future.

No deep wells are located on the Port property, but given the low concentrations detected in deep groundwater on the Property and the lower concentrations of IHSs detected in the shallow groundwater on the Port property, deep groundwater on the Port property is not believed to be impacted by IHSs at levels that could pose a concern to human health or the environment.

3 PROTECTIVE CAP

The CAP requires maintaining a physical barrier that protects human health and the environment from IHSs identified in the Site soil (Ecology, 2016). A protective cap is required for the Restricted Area as shown on Figure 3. The protective cap is integrated with ongoing operations and includes the following cap types:

- Asphalt pavement cap
- Concrete cap
- Building cap

Table 3 summarizes each cap type, and the following subsections describe each of the cap components, including minimum design standards that would be applicable should any of the protective caps be removed or altered as a result of future development or maintenance activities. The Property owner may also use other capping materials at its discretion, provided the new material has hydraulic and structural properties similar to those listed below. If the Property owner proposes a new capping material that does not have hydraulic and structural properties similar to those listed below, Ecology must be notified at least 30 days prior to the action.

3.1 Asphalt Pavement Cap Description

The pavement cap consists of a 4- to 6-inch-thick layer of asphalt. The asphalt layer was constructed on an approximately 4-inch-thick layer of clean, compacted structural fill. The pavement was placed in a minimum of two lifts.

3.2 Drip Pad Concrete Cap Description

Two existing drip pads, located to the west of the transfer table area, effectively prevent exposure to underlying contaminated soils by creating a physical barrier and are included as part of the protective cap. The drip pads were constructed in 1993 in accordance with 40 Code of Federal Regulations (CFR) § 265, Subpart W. Construction of the drip pads also included removal and off-site disposal of contaminated soil. The pads are constructed of steel-reinforced concrete, and include an underlying leak-detection system above a high-density polyethylene sub-liner. Since their construction, the drip pad concrete surfaces have been maintained with penetrating and topcoat epoxies.

The drip pads will be inspected and maintained in accordance with Subpart W requirements, as discussed in Sections 8.1.2 and 8.3.2. Subpart W requires inspection of the integrity of the drip pad surface—the portion of the drip pad that serves as a protective cap; therefore, Subpart W inspections will ensure performance of the drip pad as a protective cap, as required under this SMP. Subpart W also requires inspection of other drip pad components that are not considered part of the protective cap (e.g., the leak-detection system topcoat epoxy, run-on and runoff controls). Inspection and maintenance of those components are not required under this SMP.

3.3 Transfer Table Concrete Cap Description

The transfer table pit was upgraded in 1999 and is described in greater detail in the Transfer Table Upgrade Completion Report (RETEC, 2000). The containment pad is constructed of 7-inch-thick, steel-reinforced concrete overlying a 12-inch-thick compacted base course layer.

3.4 Building Cap Description

Existing facility buildings effectively prevent exposure to underlying contaminated soils. Existing buildings are constructed with steel-reinforced concrete stem-walls and footings, or slab-on-grade or pier footing foundations. The interior areas of all buildings have finished floors constructed of concrete, asphalt, or wood.

4 SOIL MANAGEMENT PROCEDURES

This section describes protocols for managing potentially contaminated soils resulting from excavations, building construction or demolition, and other soil-disturbing activities in the Restricted

Area as shown in Figure 3 and discussed in Section 1.2. All activities that disturb soil beneath the protective cap in the Restricted Area must be conducted or overseen by workers who have appropriate hazardous site operations training (see Section 6.1). For all projects in the Restricted Area that will disturb soils (e.g., general earthwork or utility construction or repair), detailed records will be maintained at the facility of related activities and cap repair or replacement confirmation and specifications.

4.1 Protective Cap

Depending on the type of project, construction activities may be limited to disturbance of the protective cap zone without disturbance of the soil beneath the cap. Protective cap disturbances (i.e., above the bottom of the asphalt pavement layer, concrete pad, or building foundation) do not require any special handling or health and safety requirements (outside the standard construction health and safety protocol). If the protective cap is disturbed in the Restricted Area, repair will be required. Additional detail regarding cap construction requirements is provided in Section 3.

4.2 Potentially Contaminated Soil

All soil excavated from the Restricted Area shall be managed according to this plan or other prior written approval by Ecology. If activities require excavation in the Restricted Area below the cap (e.g., the cap is fully penetrated and underlying soils are contacted), then the protocol presented in this section will be followed. Worker safety requirements pertaining to handling of contaminated soil are provided in Section 6.1.

Further description of cap repair for each type of capping material is provided in Section 3. If activities in the Restricted Area are expected to result in handling of contaminated soils by a method that is inconsistent with this plan or using a cap material different from that previously approved, Ecology must be notified at least 30 days prior to the action.

4.2.1 Excavation and Handling

Soil excavated from the Restricted Area will be assumed to be contaminated unless analytical testing conducted in accordance with this SMP demonstrates otherwise and is approved by Ecology. However, analytical testing of soil excavated from the Restricted Area is not required unless approval is being sought to place the soil on a portion of the Property outside the Restricted Area or unless the soil will be disposed of off site, as discussed below.

Solid waste is defined in 40 CFR 261 and Chapter 173-303 WAC as any "discarded material" that is abandoned, recycled, or considered inherently waste-like. Disposal is defined in Chapter 173-303 as the discharging, discarding or abandoning of dangerous (hazardous) wastes into or on any land, air, or, water. To be a hazardous waste, a waste must first be designated as a solid waste. USEPA has made a distinction between material that may be designated as a solid waste and environmental media (i.e., soil, water, or air). USEPA has determined that in place environmental media does not meet the definition of a waste.

Further, the USEPA in its Area of Contamination policy has recognized that movement of contaminated soil within an area of contamination does not constitute a new act of treatment, storage, or disposal for purposes of RCRA (USEPA, 1996).

Temporary stockpiles of contaminated soil in the Restricted Area will be managed in accordance with the procedures outlined in Section 4.2.2. The following is a summary of the stockpile management options and associated testing, notification, and approval requirements for each:

- **Re-placement in the original excavation**—Ecology notification and preapproval and analytical testing are not required before the material is placed back in the original excavation in the Restricted Area, as described in Section 4.2.3.
- **Placement in a new location in the Restricted Area**—Analytical testing is not required, but Ecology notification and preapproval are required before the material is placed in a new location, outside the original excavation but within the Restricted Area boundary, as discussed in Section 4.2.4.
- **Placement on the Property outside the Restricted Area**—Following analytical testing consistent with this SMP and with Ecology's prior approval, soil excavated from the Restricted Area may be placed on the Property outside the Restricted Area, as described in Section 4.2.4.
- **Off-site disposal**—Contaminated material to be disposed of off site will be subject to Resource Conservation and Recovery Act testing and disposal requirements, as described in Section 4.2.5.

If excavated soil is not returned to the original excavation, the excavation will be backfilled with clean material (soil or other media). Contaminated soil excavated from beneath the cap will be segregated from any imported, clean backfill to avoid contamination of the backfill material. Excavation will be completed in a manner that minimizes dust generation and incorporates appropriate erosion-control procedures that prevent stormwater from contacting soil in the open excavation or from migrating onto the protective cap or off site.

4.2.2 Stockpiling

Temporary soil stockpiles will be managed consistent with this SMP, best management practices, and regulatory requirements. Stockpiled soil will be handled in a manner that minimizes erosion, contact with stormwater runoff, dust generation, and worker or public contact, unless the soil is loaded directly into trucks for immediate off-site disposal. Stockpiles will either be placed on an impermeable liner (e.g., impervious plastic sheeting with a minimum 10-mil thickness) or stored in Washington State Department of Transportation-approved containers. If the stockpile is placed on an impermeable liner, the existing ground surface will be cleared of debris and any objects that have the potential to puncture the liner. A berm constructed of clean soil, compost socks, or equivalent material approved by the project engineer will be installed along the perimeter of the stockpile. The bottom liner must extend up and over the perimeter berm. The cover will be secured with sandbags or other appropriate restraint. The stockpile will be covered with plastic sheeting or equivalent material and secured by sandbags at the end of each workday to prevent erosion, dust generation, and direct contact by humans. The sheeting that covers the stockpile must be regularly inspected to ensure that it remains functional and protective of human health and the environment.

Stockpiles to be disposed of off site will be characterized as described in Section 4.2.5 before removal. After stockpile removal, the area beneath the separation material will be inspected, and any remaining stockpile soil will be scraped, swept, or otherwise removed and properly disposed of.

4.2.3 Replacement in Original Excavation Location

Analytical testing and Ecology notification and approval are not required if soil excavated from the Restricted Area is intended to be returned to the original excavation. Prior to re-placement in the original excavation, the soil will be managed in temporary stockpiles in the Restricted Area in accordance with the stockpile management practices described in the previous section.

4.2.4 New Placement Location

All soil originating from the Restricted Area will be assumed to contain contaminants above CULs until sampling and analysis, described below, demonstrate otherwise. Soil excavated from the Restricted Area that is not returned to the original excavation may be placed in a new location in the Restricted Area, with Ecology's approval.

Instances that may potentially warrant a new placement location include large excavations for subgrade footings or utility trenches. Soil testing is not required to place soil in a new location in the Restricted Area. Any placement of soil in the Restricted Area must be capped consistent with the approved cap construction requirements outlined in Section 3. Ecology will be notified and approval requested at least 30 days prior to placement. The new placement location will be documented as described in Section 7 of this SMP.

Soil may be placed in a new location within the Property boundaries but outside the Restricted Area only if approved in advance by Ecology. As a condition of approval, Ecology will require sampling and analysis of the excavated soil and will base its decision on the analytical results. Depending on the analytical results, Ecology may require that the new placement area be capped consistent with the approved cap construction requirements outlined in Section 3. If capping is required for the new placement area, this plan will be amended to include the new area in the Restricted Area. Soil may be temporarily stored in stockpiles in the Restricted Area prior to placement in the new location according to the stockpiling procedures set forth in the previous section.

4.2.5 Off-site Disposal

Soil with contaminant concentrations above CULs may be reused on the Site if re-placed in the original excavation location (see Section 4.2.3) or if Ecology approves placement in a new location (see Section 4.2.4). However, if soil with contaminant concentrations above CULs will not be reused on the Site, as described above, then it must be disposed of appropriately at a licensed Treatment, Storage and/or Disposal Facility.

Soil removed from the Restricted Area may contain levels of IHS (arsenic), and soil removed from the treating area may have levels of COPCs (see Table 1), that are regulated under MTCA or as Dangerous Waste. The soil must be adequately characterized for disposal before its removal from the Property to ensure compliance with federal and state waste-management regulations. Excavated soil will be stockpiled methodically in order to facilitate the sampling method and organization. Composite sampling will be conducted to best characterize each stockpile in order to complete a waste profile for the disposal facility. Waste characterization samples will be obtained directly from the excavated soil stockpiles. As a general guideline, a sampling frequency of approximately one composite sample per 100 cubic yards of soil may be collected. The analytical methods used for waste characterization will be developed in coordination with the waste disposal facility to ensure that they meet the facility's criteria.

Composite samples will be collected from each stockpile section that is to be disposed of off site. In order to develop a representative sample of each delineated section, discrete samples of equal size will be collected from the stockpile section at a frequency to be determined by the project engineer and in accordance with the requirements of the disposal facility. These discrete samples will be compiled into a composite sample. As a general guideline, five-point composite samples may be obtained from each 100-cubic-yard stockpile section that is to be disposed of off site. A standard stainless-steel hand auger may be used to collect the samples from various depths within the stockpile. The sampler will avoid collecting samples from the stockpile surface. The stockpile section will be divided into subsections and one sample collected from each subsection and from the center of the section. As a general guideline, each 100-cubic-yard stockpile may be divided into four quadrants, with one subsample collected from each quadrant and a fifth subsample collected from the center of the 100-cubic-yard section. One subsection sample will be collected from each of the following depths: a shallow depth, a mid-depth, and the bottom of the stockpile; and two samples will be collected from randomly selected depths.

Samples will be composited using a stainless-steel bowl with a stainless-steel spoon. Rocks and other debris will be removed from the sample. Part of the composited sample will be placed in the laboratory-provided containers and sealed. The sampling equipment will be decontaminated after each composite sample is collected. The samples will be placed on ice in a shipping container with chain-of-custody paperwork and transported to an accredited laboratory for analysis.

Obtaining samples in this manner is intended to generate data that are representative of the contaminants in that particular section of the stockpile, and accounts for the variability of the soil generated from different excavation locations. The soil in each stockpile is expected to be homogenized through the on-site handling procedures of excavation, placement in a dump truck, and dumping into a pile. Composite sampling, combined with the on-site homogenization, should result in a sample that is representative of the pile. Variability of the soil from different excavations will be addressed by collecting one composite sample per every 100 cubic yards of soil. Laboratory quality assurance and quality control (QA/QC) data, along with sample results, will be validated before handling procedures are determined for any soil. To facilitate management of the soil in an effective timeframe, this review will be conducted as laboratory reports are received.

The data quality objectives for this sampling approach address precision, accuracy, representativeness, comparability, and completeness:

- The term "precision" refers to the ability of an analytical method or instrument to reproduce a measurement. Review of laboratory-generated QA/QC documentation will allow assessment of laboratory precision.
- Accuracy is assessed by evaluating how close a measurement is to the true or expected value. Accuracy is evaluated by reviewing laboratory QC data, such as blank and spiked samples.
- Representativeness of the data is an indication of how well data represent an expected environmental condition. The compositing approach has been designed to obtain samples that are representative of the individual stockpile sections.
- Comparability, or the confidence in evaluating one data set in relation to another, will be established through the use of consistent field techniques, standard analytical methods, standard reporting formats, equipment calibration, and analysis of reference materials.
- The data will be assessed for completeness by summarizing the number of valid results versus the total number of samples collected. Because only valid laboratory results will be acceptable for disposal determination, the results will be 100 percent complete.

Analysis of soil to be disposed of off site must be conducted by an accredited laboratory for disposal characterization purposes specified by the licensed disposal facility.

5 GROUNDWATER MANAGEMENT PROCEDURES

Groundwater may be impacted with the IHSs for groundwater listed in Table 2.

Extraction (from the horizontal recovery well) and on-site reuse of groundwater will continue, as described in Section 1.4. Management of groundwater extracted from the horizontal recovery well will continue according to the following procedures, which are generally consistent with past practices (see Appendix A for detailed information on the horizontal recovery well system):

- Extracted groundwater is pumped into an immediate-transfer tank located in the treatment plant containment area.
- The transfer tank is equipped with an automatic pumping system that allows for immediate transfer of recovered groundwater into a preservative solution make-up water tank system.
- The transfer tank configuration prevents the inadvertent back flow of preservative solution make-up water into the subgrade pumping vault.
- Extracted groundwater may be temporarily stored in the transfer tank during temporary shutdowns of treatment operations (e.g., extended periods of freezing weather). Alternatively, the pumping system will be turned off to prevent the accumulation of groundwater in the transfer tank and/or the preservative solution make-up water tanks.

If groundwater extracted from the horizontal recovery well is no longer used in facility operations, the horizontal recovery well will continue to operate in accordance with the CMP (see Appendix A of the CAP; Ecology, 2016). Groundwater extracted from the horizontal recovery well that will not be used on site will be assumed to contain Dangerous Waste and will be managed and disposed of in compliance with the Dangerous Waste requirements, until sampling and analysis demonstrate that it does not contain Dangerous Waste.

Because groundwater under the Site is present at shallow depths, it is possible that groundwater may be generated during on-site work (e.g., dewatering of excavations). Any groundwater generated during construction will be reused on site consistent with the reuse of groundwater from the horizontal recovery well extraction system, if determined to be feasible.

Construction-related groundwater or extracted groundwater that cannot be reused on site must be appropriately disposed of off site. Groundwater will be placed in containers or tanks for temporary storage. Once containers are full, or groundwater discharge activities are complete, water samples will be collected and analyzed by an accredited laboratory as specified by the licensed disposal facility. Construction-related or extracted water will not be stored for more than 90 days unless testing shows that it is not a Dangerous Waste.

6 SITE CONTROLS

The following controls are required in order to protect the environment and reduce potential exposure of site workers to any potentially contaminated material that remains at the Site.

6.1 Worker Health and Safety

All future activities that penetrate the cap in the Restricted Area or that have the potential to expose workers to shallow groundwater within the Site boundary are to be conducted according to WAC 173-340-810; the Occupational Safety and Health Act (OSHA) of 1970 (29 U.S. Code Sec. 651 et seq.); the Washington Industrial Safety and Health Act (Chapter 49.17 Revised Code of Washington); and relevant regulations. Special worker qualifications and training apply to:

- Soil-disturbing activities that penetrate the cap in the Restricted Area
- Activities that may encounter groundwater throughout the Site (e.g., excavations that extend below the top of the water table or that generate groundwater by dewatering)

Shallow groundwater typically is present between 3 and 10 feet below ground surface. Under this SMP, no special worker qualifications or training are required for activities that do not penetrate the protective cap and that do not expose workers to shallow groundwater.

The contractor will be required, before beginning work, to prepare a health and safety plan, which is to be available for review by Ecology upon request. The health and safety plan will include the following:

- Current standard Hazardous Waste Operations and Emergency Response (HAZWOPER) certification for workers disturbing impacted soil in the area underlying the protective cap
- IHSs and site background
- Personal protective equipment
- Personal hygiene and decontamination protocols
- Medical surveillance
- Hazard communication and site control
- Recordkeeping and reporting

6.1.1 Qualified Personnel

The contractor will complete construction work in compliance with OSHA regulations (29 CFR § 1910.120 and § 1926.65); workers in any portion of the Restricted Area (Figure 3) where the cap is penetrated and not yet repaired and any workers who will come in contact with potentially contaminated soil from beneath the protective cap area must be "qualified personnel." The qualified personnel must have current standard HAZWOPER training, if required. Managers and supervisors directly overseeing the working crew must have received additional specialized training in hazardous-waste-management supervision.

6.2 Access Restriction

In the event of construction in the Restricted Area with the potential to generate contaminated soil, fencing will be maintained in order to restrict access of personnel who are not HAZWOPER certified to areas that are no longer contained by a cap (i.e., "controlled areas"). Signage will be posted on the fencing separating the personnel who are not HAZWOPER certified from the controlled areas.

6.3 Decontamination Procedures

Soil will be removed from equipment before the equipment leaves the controlled area. Soil must be removed from vehicle tires that contact contaminated soil by brushing, wheel wash, or another method that is appropriate to the work being performed before the vehicle leaves the controlled area to prevent tracking of potentially contaminated soil to clean portions of the Site or off site. Decontamination will be conducted in a manner that prevents contamination of the protective cap.

Decontamination will be managed so that washwater does not migrate from the decontamination area.

Equipment and personnel decontamination procedures will be defined in the activity-specific health and safety plan.

6.4 Groundwater Use Restrictions

As a requirement of the restrictive covenant for the Property and the preexisting restrictive covenant for the Port property, groundwater for domestic use will not be extracted from the Site by wells or by other means. This restriction does not apply to groundwater that is extracted for the purpose of dewatering for temporary construction activities, development, or the installation of sewer or utilities. Groundwater management is discussed in Section 5.

7 NOTIFICATION AND REPORTING

The contractor will maintain weekly reports of field activities during any active construction that disturbs soil or other cap material in the Restricted Area. The Property owner will prepare a project completion report to document the management of impacted soil for each project in which such work is conducted. The report will document the management techniques used, approximate volumes of materials handled, placement or disposal information, disposal manifests, and analytical data generated during management of the impacted material. These reports will be retained at the facility to be made available for inspection or at Ecology's request.

7.1 Notification

Ecology notification will be required for the following actions:

- If the Property owner proposes a new capping material that does not have hydraulic and structural properties similar to those listed in Section 3, Ecology must be notified at least 30 days prior to the action.
- Soil excavated from the Restricted Area that is not returned to the original excavation may be placed in a new location within the Property boundaries with prior Ecology approval. Ecology approval will be requested at least 30 days before soil placement, and the new placement location will be documented as described below.
- If Ecology approves the placement of soil excavated from the Restricted Area to a new location within the Property boundaries but outside the Restricted Area, the new placement location, and details of the cap construction (if required), will be documented as described below. If a cap is required, this SMP will also be amended to include the new area in the Restricted Area.
- If activities in the Restricted Area are expected to result in handling of contaminated soils by a method that is inconsistent with this SMP or using a cap material different from that previously approved, Ecology must be notified at least 30 days prior to the action.

7.2 Recordkeeping

Each time the protective cap is penetrated, the Property owner will prepare a report documenting the activity that penetrated the cap. The report will include at least the following:

- Location and extent of the cap penetration. Location coordinates for each corner of the penetration perimeter will be collected using a global positioning system (GPS) unit and included in the report. These coordinates will also be recorded in a geographic information system database, which will be maintained in association with the Property records.
- Estimated volume of soil excavated.
- Disposition of the excavated soil.
  - If excavated soil is placed on the Property, the location of the area where it was placed (including location coordinates, as described above) will be recorded if the soil is disposed of in an area different from the excavation area.
  - If excavated soil is disposed of off site, documentation will include characterization of soil, waste profile for disposal, manifests or trip tickets, disposal certificates, and agreement with disposal facility.
- How the cap was repaired, including work orders, repair materials, construction details, and identity of contractor that made the repair.

Each report prepared under this section will be filed in the permanent records for the Property to be provided to future Property owners or to Ecology by request.

8 PROTECTIVE CAP MONITORING AND MAINTENANCE

The protective cap requires regular and routine inspection for evaluation and maintenance of its integrity. Monitoring and, if required, maintenance will be conducted annually, at a minimum. This frequency will provide an opportunity to correct small, localized failures before they become larger, more detrimental failures. In addition to annual inspection, an inspection will take place after a large natural disaster occurs in close proximity to the Property, or any other large-scale disturbance occurs near or at the Property. This section outlines the monitoring and inspection procedure for each of the protective capping materials.

The person conducting the monitoring will complete the monitoring worksheet provided as Appendix B. The worksheet will be filed in the permanent records for the Property to be provided to future Property owners or to Ecology upon request and will also be included in the groundwater monitoring reports that will be prepared in accordance with the schedule described in the CMP

(MFA, 2016). The main purpose of the monitoring event is to document current conditions of capping materials. The documentation will be used as a reference to evaluate the severity of cap degradation and to determine if corrective action is required.

8.1 Protective Cap Inspection

This section describes the minimum observation and monitoring requirements per inspection for each component of the overall protective cap in the Restricted Area.

8.1.1 Pavement Cap

The following defines the minimum observation and monitoring requirements per inspection for all pavement-related caps in the Restricted Area. As appropriate, recorded observations will be accompanied by documenting photographs:

- Overall cap condition
- Evidence of cracking, buckling, or subgrade shifting
- Observed alligatored areas (i.e., areas with numerous intersecting cracks that extend through the cross section of the cap)

8.1.2 Drip Pad Concrete Cap

Monitoring and maintenance of drip pads associated with wood-treating facilities, and associated reporting, are required to be completed in accordance with Subpart W (40 CFR § 265.443 and 265.444). While a drip pad is in operation, weekly inspections are required under Subpart W, which include inspection of the drip pad surface—the portion of the drip pad that serves as a protective cap. The physical presence of the drip pad structure ensures that the integrity of the protective cap is maintained. No other inspection or monitoring specific to this SMP is required. Inspections of other drip pad components (e.g., leak-detection system, epoxy coating) are also required under Subpart W, but are not required in association with this SMP.

8.1.3 Transfer Table Concrete Cap

The following defines the minimum observation and monitoring requirements per inspection for the transfer table concrete cap. As appropriate, recorded observations will be accompanied by documenting photographs:

- Overall cap condition
- Evidence of cracking, buckling, or subgrade shifting

8.1.4 Building Cap

The following defines the minimum observation and monitoring requirements per inspection for building caps. As appropriate, recorded observations will be accompanied by documenting photographs:

- Overall cap condition
- Visible cracks in the foundation

8.2 Corrective Action

If evidence of erosion or failure is observed in any of the abovementioned caps, the person conducting the inspection and reporting will consult with an engineer licensed in the state of Washington. The engineer will decide if additional analysis or observation is necessary to determine if the damage will reduce the effectiveness of the protective cap. Corrective action will be evaluated on a case-by-case basis according to the type and/or severity of damage and the urgency. The following will be conducted in order to document damage and to evaluate the need for corrective action:

1. Engineer's internal review of inspection reports and photographs
2. Site visit by the engineer to review damage
3. Additional measurement or analysis (survey, sample collection, or analysis)
4. Consultation with Ecology regarding the damage or deterioration and the engineering assessment
5. Proposal for repair prepared by the engineer (if determined necessary)
6. Contract with an appropriately certified and licensed contractor for completion of repair work (if needed)

8.3 Protective-Cap Maintenance

This section describes the minimum maintenance requirements for each component of the overall protective cap.

8.3.1 Pavement Cap

Pavement cap maintenance will be conducted if evidence of significant cracking or buckling (e.g., formation of potholes) is observed. Areas that show these failures will be maintained by the application of a corrective patch of asphalt or concrete, or the application of a sealer, as appropriate. Areas of failure that are entirely removed will be replaced to match existing thicknesses/materials. Specific to asphalt pavement, significant alligatored areas requiring removal will be replaced with asphalt 2.5 inches thick; insignificant alligatored areas may be repaired as cracks. If buckling results in cracking, the cracks will be repaired.

8.3.2 Drip Pad Concrete Cap

As discussed above, maintenance of drip pads associated with wood-treating facilities is required to be completed in accordance with Subpart W (40 CFR § 265.443). Subpart W requires that the physical integrity of the drip pads, as well as other components of the pads (e.g., leak-detection system, topcoat epoxy), be maintained in order to prevent leakage of hazardous substances to the subsurface. These Subpart W requirements will also ensure that the integrity of the drip pads as a protective cap will be maintained; therefore, compliance with Subpart W maintenance requirements is sufficient for the purposes of this SMP, and no other maintenance activities specific to this SMP are required.

8.3.3 Transfer Table Concrete Cap

The transfer pit concrete containment pad will be maintained as a protective cap for preventing exposure to potentially contaminated soil below. Maintenance of the transfer table concrete cap will be conducted if evidence of significant cracking is observed. Cracks will be repaired by the application of a corrective patch of concrete, or another material (as appropriate) that is compatible with the concrete, and will not be compromised by the potential presence of wood-treating chemicals that may be released from above.

8.3.4 Building Cap

Building foundations are not anticipated to require significant maintenance over the life of the building. Any maintenance will be completed in accordance with a licensed structural engineer's recommendations (building foundation).

9 HORIZONTAL RECOVERY WELL OPERATION AND MAINTENANCE

Detailed information on the design, construction, and development of the horizontal recovery well and the associated components (referred to collectively as the "recovery system") are provided in the Groundwater Interim Action Implementation Report (ThermoRetec, 1999). A map showing the locations of the recovery system components, a schematic profile drawing of the horizontal recovery well, a piping and instrumentation diagram, and an inspection form, all excerpted from the Groundwater Interim Action Implementation Report (ThermoRetec, 1999), are included as Appendix A. Inspections will be conducted on a monthly basis, using the inspection form provided in Appendix A. Inspection forms will be filed in the permanent records for the Property to be provided to future Property owners or to Ecology upon request, and will also be included in the groundwater monitoring reports that will be prepared in accordance with the schedule described in the CMP (MFA, 2016).

Operation of the horizontal recovery well is a required component of the groundwater treatment; therefore, it will continue to operate in accordance with the requirements outlined in the CMP (MFA, 2016); and it will be maintained until the criteria for decommissioning it have been met and Ecology approves decommissioning. In the event that groundwater extracted from the horizontal recovery well is no longer used in facility operations or the facility is shut down or closed, operation and maintenance of the horizontal recovery well will continue in accordance with the CMP (MFA, 2016). If shutdown of the horizontal recovery well is required for 30 consecutive days or more (e.g., for cleaning or repair) during any stage of the groundwater monitoring program when operation of the horizontal recovery well is required (see the CMP [MFA, 2016]), Ecology will be notified within 60 days of the first day of the 30-consecutive-day shutdown.

Discharge rates from the horizontal recovery well are generally higher following initial restarting of the system following a shutdown. As the aquifer is dewatered, discharge rates generally begin to decrease. Based on operations to date, recovery rates are generally approximately 4 gallons per minute (gpm) following an initial system restart and approximately 2 gpm once steady-state conditions are met. Discharge rates will be measured periodically in association with system operations to ensure that flows are optimized.

Recovery system equipment and piping will be inspected monthly, as described above, to ensure proper operation. However, it should be noted that the recovery system is located in an active part of the facility; therefore, any potential malfunctions that occurred between inspections likely would be detected immediately during standard plant operations. Visual inspections will include the wellhead vault and all equipment and piping. Leaks or malfunctioning equipment will be attended to promptly.

The horizontal recovery well may be redeveloped as needed to improve recovery and performance. Redevelopment may be performed in accordance with the procedures outlined in the Groundwater Interim Action Implementation Report (ThermoRetec, 1999) or using other industry standard well-development methods.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

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TABLES

Table 1
Chemicals of Potential Concern in Soil
McFarland Cascade Holdings, Inc. and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Chemicals of Potential Concern in Soil	MTCA C Direct-Contact CUL (mg/kg)
Metals	
arsenic, inorganic*	88
CrIII	5,300,000
CrVI	11,000
copper	140,000
zinc	1,100,000
PAHs	
acenaphthene	210,000
acenaphthylene	NV
anthracene	1,100,000
benzo(g,h,i)perylene	NV
benzo(a)anthracene	180
benzo(b)fluoranthene	180
benzo(k)fluoranthene	1,800
chrysene	18,000
cPAH TEQ (benzo[a]pyrene)	18
dibenzo(a,h)anthracene	18
fluoranthene	140,000
fluorene	140,000
indeno(1,2,3-cd)pyrene	180
methyl naphthalene;2-	14,000
naphthalene	70,000
phenanthrene	NV
pyrene	110,000
SVOCs	
4-chloro-3-methylphenol	NV
benzoic acid	14,000,000
cresol;o-	180,000
cresol;p-	18,000
dibenzofuran	3,500
pentachlorophenol	330

NOTES:
The soil chemicals of potential concern are chemicals of interest that have been detected in soil at the site.
cPAH TEQ = carcinogenic PAH toxic equivalency quotient.
CrIII = trivalent chromium.
CrVI = hexavalent chromium.
CUL = cleanup level.
mg/kg = milligrams per kilogram.
MTCA = Model Toxics Control Act.
NV = no value.
PAH = polycyclic aromatic hydrocarbon.
SVOC = semivolatile organic compound.
*Arsenic was selected as an indicator hazardous substance.

Table 2
Final Cleanup Levels
McFarland Cascade Holdings, Inc. and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Indicator Hazardous Substance	Groundwater CUL (ug/L)	Groundwater CUL Basis	Soil CUL (mg/kg)	Soil CUL Basis
arsenic	5	MTCA A	88	MTCA C, CAR
benzene	51	SW, ARAR	--	--
CrVI	50	SW, ARAR	--	--
copper	2.4	SW, ARAR	--	--
cPAH TEQ (benzo[a]pyrene)	0.1	PQL	--	--
ethylbenzene	2100	SW, ARAR	--	--
pentachlorophenol	3	SW, ARAR	--	--
xylenes	1000	MTCA A	--	--

NOTES:

-- = not selected as an indicator hazardous substance for soil.
CrVI = hexavalent chromium.
CUL = cleanup level.
cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.
mg/kg = milligrams per kilogram.
MTCA A = Model Toxics Control Act, Method A table value for groundwater.
MTCA C, CAR = Model Toxics Control Act, Method C, carcinogen standard values.
ug/L = micrograms per liter.
PQL = practical quantitation limit.
SW, ARAR = surface water Applicable or Relevant and Appropriate Requirements.

Table 3
Capping Options
McFarland Cascade Holdings, Inc. and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Type of Use	Typical Section
Asphalt Pavement	Low-permeability surface (minimum thickness 4 inches) with sub-base as necessary for construction
Drip Pad	Low-permeability surface (minimum thickness 4 inches) constructed of steel-reinforced concrete with sub-base as necessary for construction*
Transfer Table Pit Containment Slab	Low-permeability surface (minimum thickness 7 inches) constructed of steel-reinforced concrete with sub-base as necessary for construction
Building/structure	—Stem wall/footing steel-reinforced concrete foundation with sub-base as necessary for construction —Slab-on-grade steel-reinforced concrete (minimum thickness 3 inches) with sub-base as necessary for construction

*The drip pad minimum thickness is relative to the capping requirement and does not necessarily comply with the drip pad requirements put forth in 40 CFR 265, Subpart W.

FIGURES

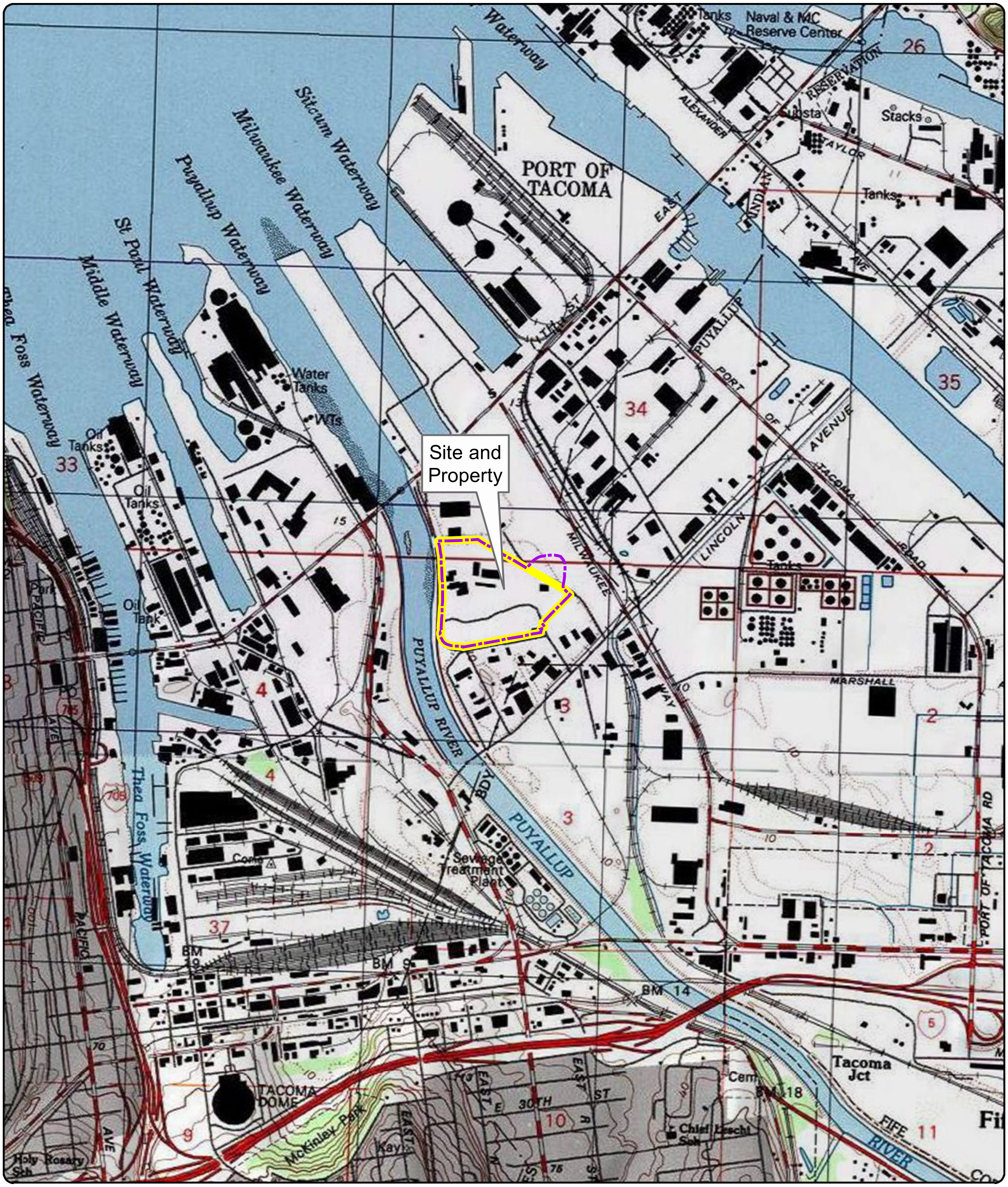
Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CMP\Projects\Fig1_Site Location.mxd

Print Date: 9/17/2014

Approved By: hhirsch

Produced By: jmiller

Project: 9081.01.04-04



Site Address: 1640 East Marc Street, Tacoma, Washington
Source: US Geological Survey (1990) 7.5-minute topographic quadrangle: Tacoma North
Section 3, Township 20 North, Range 3 East and
Section 34, Township 21 North, Range 3 East

Legend

Site Boundary

Property Boundary

Figure 1
Site Location

McFarland Cascade Pole
and Lumber Company
Tacoma, Washington

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Note: The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero arsenic concentration contour as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 1,000 2,000
Feet

Figure 2
Site Features

McFarland Cascade Pole
and Lumber Company
Tacoma, Washington

Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary
- Protective Cap (Currently Paved) and Soil Restricted Area

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. PCP = pentachlorophenol.
4. SWTS = stormwater treatment system.
5. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property, in the vicinity of monitoring well UPRR-MW-29, is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Print Date: 10/16/2014
Approved By: hhirsch
Produced By: apadilla
Project: 9081.01.04-00

Figure 3
Soil Restricted Area and Protective Cap
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend
- Drip Pad Soil Sample Location
- Paving Area & Transfer Table Soil Sample Location
- Shallow Monitoring Well
- Deep Monitoring Well
- Arsenic CUL Exceedance (Soil)
- Railroad
- Site Boundary
- Property Boundary
- Protective Cap (Currently Paved) and Soil Restricted Area

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. CUL = cleanup level.
4. PCP = pentachlorophenol.
5. SWTS = stormwater treatment system.
6. Arsenic cleanup level = 88 mg/kg.
7. Arsenic data are included in the final Remedial Investigation and Feasibility Study (MFA and AECOM, 2014).
8. No arsenic exceedances were observed in soil samples collected from depths greater than 5 feet. The maximum depth sampled was 24 feet.
9. mg/kg = milligrams per kilogram (parts per million).
10. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_SMP\Projects\Fig3_Soil Restricted Area and Protective Cap.mxd
Print Date: 8/4/2015
Approved By: hhirsch
Produced By: jmiller
Project: 9081.01.04-00

Figure 4
Groundwater Exceedances 2004 to 2015

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

Exceedances

- Arsenic—5 ug/L CUL
- Copper—2.4 ug/L CUL
- PCP—3 ug/L CUL
- cPAH TEQ—0.1 ug/L CUL
- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary

Notes:

1. This figure shows indicator hazardous substances for which the maximum detected concentration observed in groundwater was above CULs. Data from the four most recent monitoring events conducted between 2004 and 2015 for each well location were evaluated. During the 2004 to 2015 timeframe, monitoring wells MW-1, MW-19, and MW-20 were monitored only once, and MW-4 was monitored only twice.
2. Samples have not been collected from monitoring well location MW-11 since 2002.
3. Hexavalent chromium, benzene, ethylbenzene, and xylenes were below their respective cleanup levels during the four most recent monitoring events.
4. Total and dissolved metals were analyzed in some locations. When both were available, the greater of the two was used.
5. cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.
6. CUL = cleanup level.
7. PCP = pentachlorophenol.
8. ug/L = micrograms per liter.
9. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI.

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Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_SMP\Projects\Fig4_Groundwater Exceedances.mxd
Print Date: 11/4/2015
Approved By: hhirsch
Produced By: jmiller
Project: 9081.01.04-04

APPENDIX A

HORIZONTAL RECOVERY WELL DRAWINGS AND INSPECTION FORM

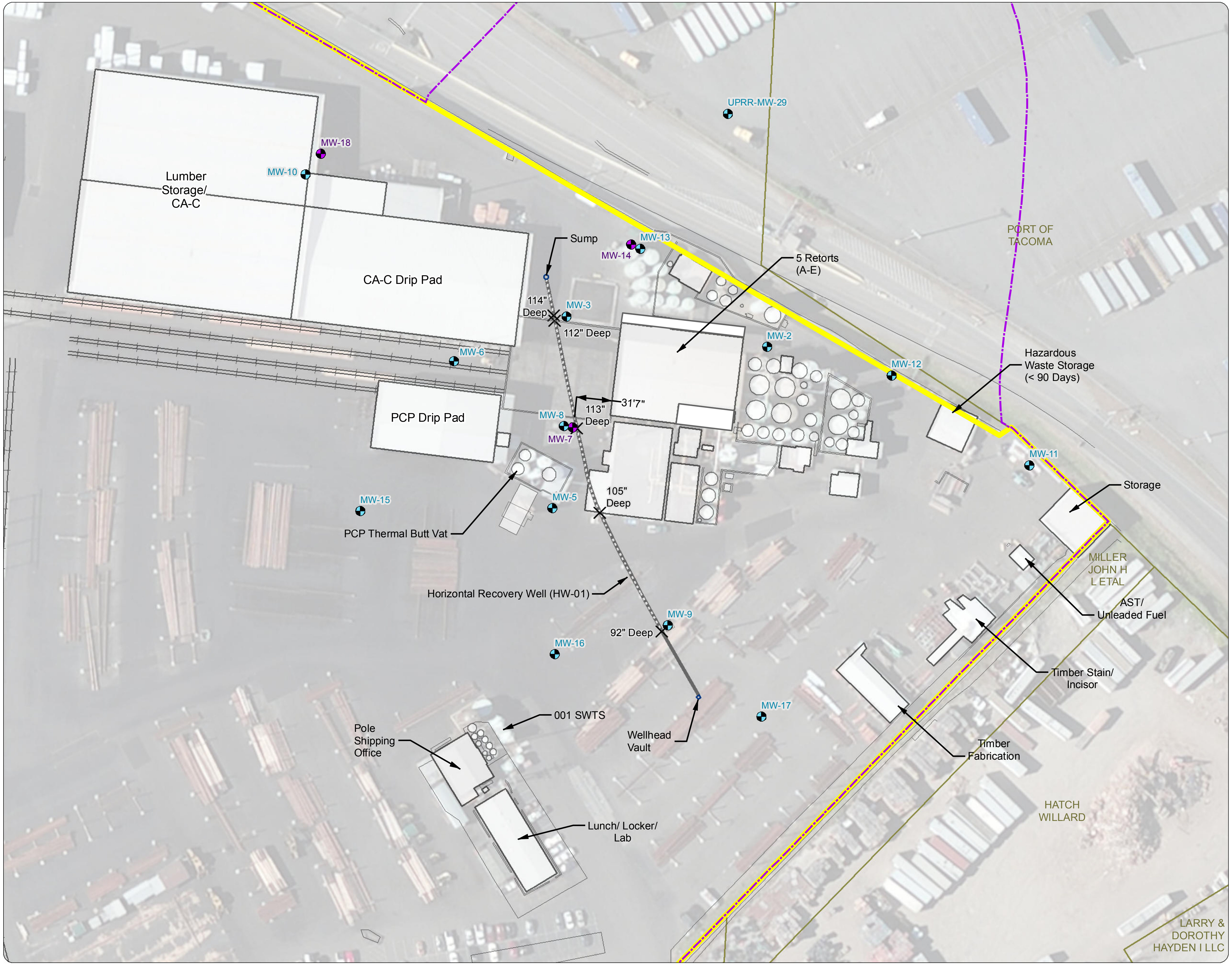

Figure A-1
Horizontal Recovery Well Location

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Pierce County Parcels
- Property Boundary

Horizontal Recovery Well

- Blank Casing
- Screened Casing

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. PCP = pentachlorophenol.
4. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 50 100
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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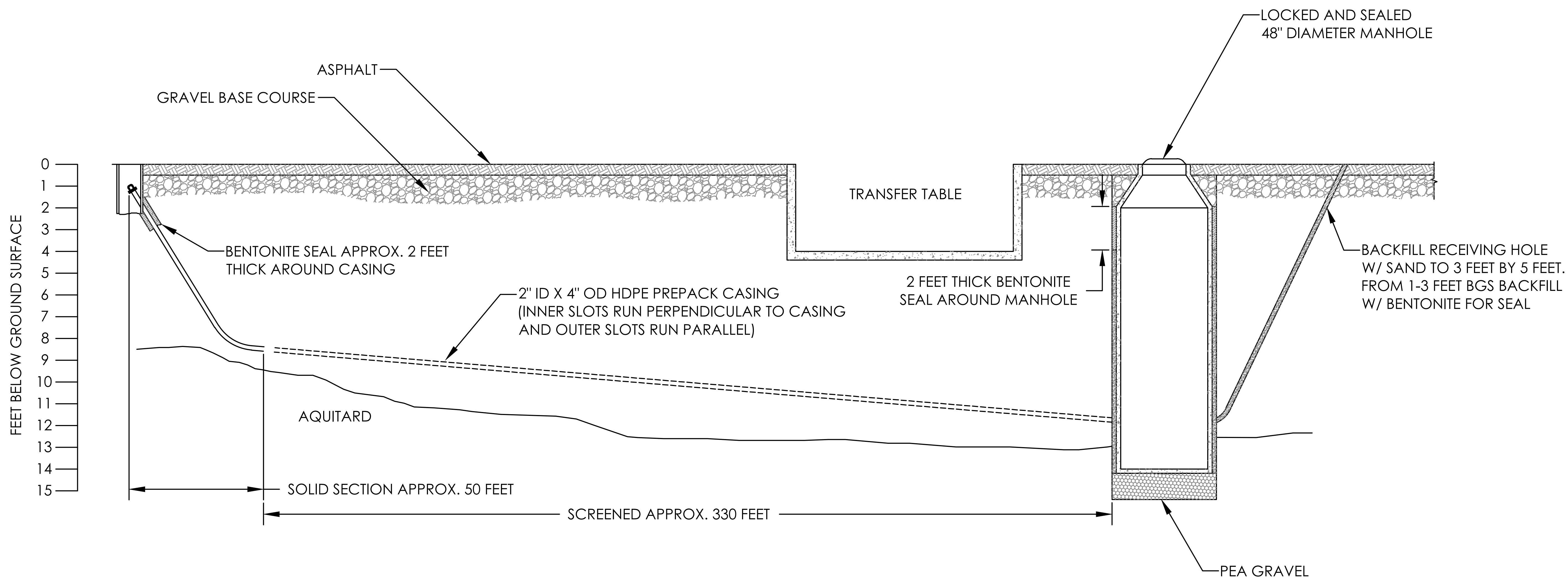
Path: X:\9081.01 Cascade Pole\04 MTCA Closure Tacoma Facility\00_Projects\FigB-1_Horizontal Recovery Well Location.mxd
Print Date: 11/4/2015
Approved By: hhirsch
Produced By: jmiller
Project: 9081.01.04-00



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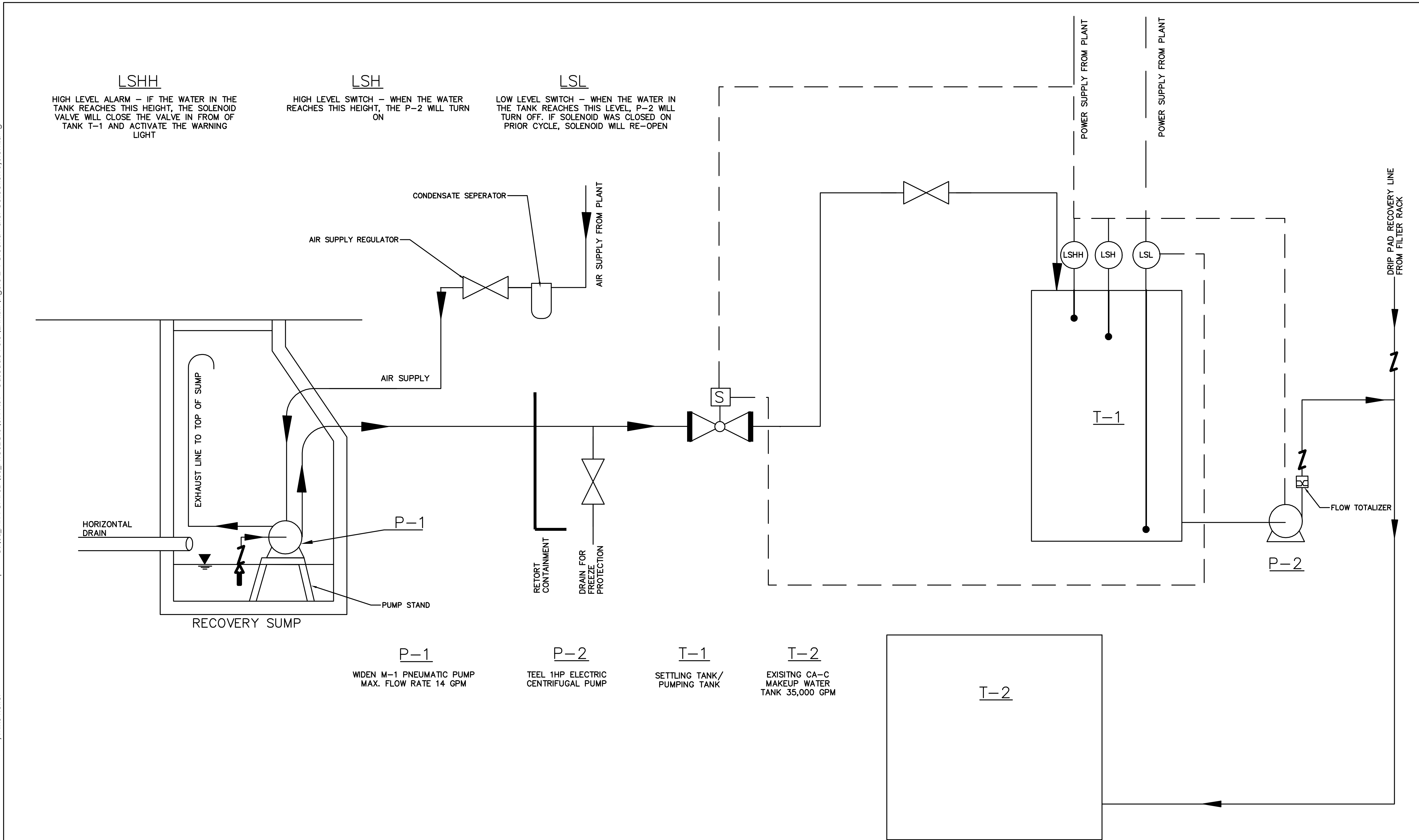
NOTES:
BGS = BELOW GROUND SURFACE
ID = INNER DIAMETER
OD = OUTER DIAMETER

DRAWING NOT TO SCALE

Figure A-2
Horizontal Recovery Well Profile

McFarland Cascade Pole & Lumber Co.
Tacoma, Washington



Filepath:G:\00_MFA Civil 3D\00_PROJECTS\0999.01 - Cascade Pole\EXHIBIT\Figure 2-4 Groundwater Collection System.dwg

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Date:11/4/2015 2:25:34 PM

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This figure prepared as supplemental visual information only and should not be used for construction purposes. Only plan sheets approved, stamped and signed by a registered professional engineer in the state of governing jurisdiction shall be used for construction. Additionally, only plans approved by the applicable governing jurisdiction(s) shall be used for final construction unless otherwise expressly noted in writing by the engineer of record.

NOTES:
CA–C = Copper Azole–Type C
GPM = Gallons Per Minute
HP = Horsepower
Drawing not to scale

Figure A-3
Groundwater Collection System
McFarland Cascade Pole and Lumber Co.
Tacoma, Washington

Groundwater Recovery System Check Form
Cascade Pole and Lumber Company
Tacoma, Washington

Date: ______________________________ Time: ____________________

Checked By: ________________________ Weather: ________________

1) Discharge pump operating? YES _____________ NO _____________

2) Water level in tank ______________________ ft

3) Alarm light on? YES ___________ NO ___________

4) Pipes leaking? YES ___________ NO ___________

5) Discharge TOTALIZER reading ____________________ gallons

6) Describe any activities performed:

____

____

____

EMERGENCY SHUTDOWN PROCEDURES

Turn off WELL PUMP (air supply)
Turn off TRANSFER PUMP (at electrical panel)

System Administration and Responsible Individual:
Ted Smith (253) 597-3319

INSPECTION FREQUENCY

Inspections are to be conducted on a monthly basis.

RECORDING PROCEDURES

File this form in the permanent records for the Property to be provided to future Property owners or to Ecology by request and also include in the groundwater monitoring reports to be prepared in accordance with the schedule described in the Groundwater Compliance Monitoring Plan.

ECOLOGY NOTIFICATION OF SHUTDOWN

If the horizontal recovery well is non-operational for 30 days or more during periods when operation of the horizontal recovery well is a required component of the groundwater treatment (i.e., during the protection stage of monitoring; see the groundwater compliance monitoring plan [MFA, 2016]), Ecology must be notified within 30 days after the 30th consecutive day on which the well is not operated (i.e., within 60 days of the first day of the 30-consecutive-day shutdown).

APPENDIX B

SITE INSPECTION SUMMARY REPORT FORM

SITE INSPECTION SUMMARY REPORT - CAP VISUAL MONITORING
CASCADE POLE AND LUMBER COMPANY

Date:	
Weather:	
Precipitation (prior 24 hrs):	
Completed By:	

Photograph Requirements:

Overview photograph of each cap component to capture composite view of entire cap.

Any noted changes or damage to the cap.

General Observations:

General cap condition.

Stormwater flow characteristics (if monitoring conducted during wet weather).

Activity on the site.

Visible changes since previous inspection.

Standing water or areas of concentrated surface water flow.

Visible demarcation fabric.

Specific Observations: To be noted with photographs, measurements, and locations:

Pavement Cap:

- Settling or bulging indicating differential settlement or heaving.
- Cracking or buckling indicating lateral expansion or contraction.

Drip Pad Cap:

- Inspections to be completed separately and in accordance with 40 CFR 264/265.

Transfer Table Pit Cap:

- Settling or bulging indicating differential settlement or heaving.
- Cracking or buckling indicating lateral expansion or contraction.

Building Cap:

- Cracking of foundation.
- Penetration of vapor intrusion barrier (spread footing foundations).

Measurements:

Length and depth of any surface erosion or damage.

Estimated areal coverage of vegetation/landscaping material on soil cap.

Depth of soil cap at edges adjacent to pavement/building cap.

Recording:

This worksheet will be filed in the permanent records for the Property to be provided to future Property owners or to Ecology by request and will also be included in the groundwater monitoring reports that will be prepared in accordance with the schedule described in the Groundwater Compliance Monitoring Plan.

SITE INSPECTION SUMMARY REPORT - CAP VISUAL MONITORING
CASCADE POLE AND LUMBER COMPANY

Date:	
Weather:	
Precipitation (prior 24 hrs):	
Completed By:	

General Observations:

Specific Observations: To be noted with photographs, measurements, and locations:

Pavement Cap:

Drip Pad Cap:

Transfer Table Pit Cap:

Building Cap:

Measurements:

SITE INSPECTION SUMMARY REPORT - CAP VISUAL MONITORING
CASCADE POLE AND LUMBER COMPANY

Date:		
Location (Station or Coordinates)	**Observations**	**Photo Log**
Precipitation (prior 24 hrs):		

FINAL GROUNDWATER COMPLIANCE MONITORING PLAN

MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

Prepared for

MCFARLAND CASCADE HOLDINGS, INC.

A STELLA-JONES COMPANY

TYEE MANAGEMENT COMPANY, LLC

January 12, 2016

Project No. 0999.01.01

Prepared by

Maul Foster & Alongi, Inc.

1329 N State Street, Suite 301, Bellingham WA 98225

MAUL FOSTER ALONGI

FINAL GROUNDWATER COMPLIANCE MONITORING PLAN
MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

The material and data in this plan were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

State of Washington
Hydrogeologist
2819
Licensed Geologist
Heather Rose Good

Heather R. Good, LHG
Project Hydrogeologist

James J. Maul, LHG
President and Principal Hydrogeologist

CONTENTS

TABLES AND ILLUSTRATIONS

FOLLOWING PLAN:

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

AO	Agreed Order
BTEX	benzene, toluene, ethylbenzene, and xylenes
CA-C	copper azole type C
CAP	cleanup action plan
CCA	copper-chromated arsenic
CMP	groundwater compliance monitoring plan
COI	chemical of interest
COPC	chemical of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPLC	Cascade Pole and Lumber Company
CPOC	conditional point of compliance
CrVI	hexavalent chromium
CUL	cleanup level
Ecology	Washington State Department of Ecology
HW-01	horizontal recovery well
IHS	indicator hazardous substance
MCHI	McFarland Cascade Holdings, Inc.
MCPLC	McFarland Cascade Pole and Lumber Company
MFA	Maul Foster & Alongi, Inc.
MKA	MKAssociates, Inc. (land surveyor)
modeling report	modeling report submitted to Ecology within three months of Ecology's approval of the proposed model
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
PCP	pentachlorophenol
the Port	Port of Tacoma
the Property	property, owned by Tyee, on which MCPLC conducts its operations
QA	quality assurance
QC	quality control
REL	remediation level
Restricted Area	the area of the Property with residual soil contamination covered by a protective cap
RI/FS	remedial investigation and feasibility study
SAP	sampling and analysis plan
SIM	selective ion monitoring
Site	McFarland Cascade Pole and Lumber Company site
SMP	site management plan
Tyee	Tyee Management Company, LLC
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code

EXECUTIVE SUMMARY

This groundwater compliance monitoring plan (CMP) provides procedures for groundwater monitoring associated with the groundwater remedial action for the McFarland Cascade Pole and Lumber Company Site (the Site) in Tacoma, Washington. The Site includes property owned by Tyee Management Company, Inc., and a portion of the adjoining property owned by the Port of Tacoma (the Port). Indicator hazardous substance (IHS) concentrations in groundwater exceed cleanup levels (CULs) in portions of the Site. These CUL exceedances are addressed by the final groundwater remedy for the Site, which includes groundwater extraction and containment using a horizontal recovery well, monitored natural attenuation, compliance monitoring, and a prohibition on groundwater use.

PURPOSE AND OBJECTIVES

Groundwater compliance monitoring at the Site will be conducted for the following purposes:

- Assessment of the ongoing effectiveness and performance of the groundwater extraction and containment remedial action.
- Evaluation of conditions for termination of groundwater extraction and containment activities.
- Monitoring progression of the monitored natural attenuation remedy component through assessment of groundwater flow conditions and IHS concentration trends.
- Evaluation of compliance with CULs at the conditional point of compliance (CPOC) at the Site boundary.
- Evaluation of whether IHS concentrations in groundwater indicate the potential for exceedance of a CUL at the CPOC, and whether they meet the criteria for triggering a contingent action.
- Evaluation of compliance with CULs throughout the Site; compliance will allow for termination of the compliance monitoring program and decommissioning of the horizontal recovery well and groundwater monitoring wells.

STAGES OF MONITORING

Compliance groundwater monitoring will be conducted in the following three stages, consistent with the Model Toxics Control Act (Washington Administrative Code 173-340-410):

1) **Performance Monitoring:** Confirm that human health and the environment are protected during groundwater extraction and containment activities (i.e., operation of the horizontal recovery well).
2) **Protection Monitoring:** Confirm that once attained, remediation levels (RELs) continue to be met following termination of the horizontal recovery well's operation.

3) **Confirmational Monitoring:** Confirm the long-term effectiveness of the groundwater extraction and containment remedy component following completion of protection monitoring. This stage of monitoring also includes a "final closure monitoring" stage to confirm the long-term effectiveness of the groundwater remedy once CULs have been attained throughout the Site and to determine that the groundwater monitoring program can be terminated.

GROUNDWATER MONITORING NETWORK

Monitoring activities will be conducted for both the shallow and the deep groundwater aquifers under the Site, using a combination of water level monitoring network wells, compliance monitoring network wells, and final closure monitoring network wells, as discussed below.

Water Level Monitoring Network

Water levels will be measured during all stages of monitoring in all existing Site wells in order to evaluate hydraulic gradients in the shallow and deep aquifers.

Compliance Monitoring Network

During the protection, performance, and confirmational stages of monitoring, groundwater samples will be collected from the compliance monitoring network wells and analyzed. The compliance monitoring network includes the following wells:

- **Horizontal recovery well:** HW-01.
- **Sentry wells:** MW-4, MW-19, and MW-20 in the shallow aquifer; MW-7 and MW-18 in the deep aquifer; and any additional sentry wells installed as part of a Tier 3 contingency.
- **Source area monitoring wells:** MW-3 and MW-8 in the shallow aquifer; MW-14 in the deep aquifer.

Final Closure Monitoring Network

During the final closure stage of monitoring, groundwater samples will be collected from all remaining Site monitoring wells.

Monitoring Well UPRR-MW-29

During all stages of monitoring, groundwater samples will be collected from shallow aquifer monitoring well UPRR-MW-29—located on the Port property—and analyzed. However, the Washington State Department of Ecology has determined that discharge to surface water is the highest beneficial use of groundwater at the Site, and groundwater monitoring results indicate that IHSs are not migrating to surface water on the Port property. Therefore, UPRR-MW-29 will not be used as a sentry well and is not included in the compliance monitoring network. During the protection, performance, and confirmational stages of monitoring, sample results will be used to evaluate IHS concentration trends and hydraulic gradients, but will not be evaluated for compliance with RELs or CULs. However, UPRR-MW-29 is included in the final closure monitoring network, and during the final closure stage of monitoring, sample results will be evaluated for compliance with CULs.

EVALUATING CLEANUP LEVEL COMPLIANCE

During all three stages of monitoring, groundwater monitoring will be conducted to evaluate compliance with CULs at the CPOC. Sentry wells are located to allow for monitoring between the source area and the CPOC. To demonstrate that CULs are being met at the CPOC, sentry wells will be monitored for compliance with RELs. RELs were derived from attenuation modeling and, if reached in a sentry monitoring well, indicate the potential for exceedance of a CUL at the CPOC, which would trigger additional assessment.

In response to REL exceedances in a sentry well, contingent actions will be implemented using a tiered approach. As described in this CMP, there are four tiers of activity, and contingencies may include more frequent monitoring, restarting the horizontal recovery well, more robust attenuation modeling to potentially revise RELs, installation of additional sentry wells, and additional subsurface investigation and/or source characterization to assess the potential need for additional remedial action.

RELs will also be used to assess remedy effectiveness in the source area (i.e., in source area wells and the horizontal recovery well); however, REL exceedances in the source area do not indicate the potential for CUL exceedances at the CPOC, given that the horizontal recovery well will contain groundwater contamination within the source area. Therefore, REL exceedances in the source area will not trigger additional assessment.

1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA) has prepared this groundwater compliance monitoring plan (CMP) on behalf of McFarland Cascade Holdings, Inc. (MCHI) and Tyee Management Company, LLC (Tyee) for the McFarland Cascade Pole and Lumber Company (MCPLC) site (Site) in Tacoma, Washington (see Figure 1). For purposes of this CMP, Property (unless otherwise specified) refers to the property on which MCPLC conducts its operations, which is owned by Tyee and leased to MCHI. Site refers to anywhere that contamination from MCPLC's historical operations has come to lie, irrespective of property ownership. The Site includes the Property and a limited portion of the adjacent former Union Pacific Railroad/Milwaukee Railyard property to the northeast that is currently owned by the Port of Tacoma (the Port) (see Figure 2). The Maersk Pacific and Horizon Lines storage and shipping yards currently conduct operations on the Port property.

This CMP has been prepared to meet the groundwater monitoring requirements under the Washington State Department of Ecology (Ecology) - adopted cleanup action plan (CAP) (Ecology, 2016). This CMP was developed in accordance with the compliance monitoring requirements put forth in the Washington State Model Toxics Control Act (MTCA) (Washington Administrative Code [WAC] 173-340-410). The approach described in this CMP is consistent with the Ecology-approved final remedial investigation and feasibility study (RI/FS) (MFA and AECOM, 2014) and the CMP technical memorandum (MFA, 2014) and subsequent revisions as requested by Ecology.

1.1 Purpose of Groundwater Compliance Monitoring Plan

The final remedy for the Site, as described in the CAP (Ecology, 2016), includes:

- Continued operation and maintenance of the completed remedial actions (e.g., the protective cap and the horizontal recovery well)
- Institutional controls to be recorded in environmental covenants
- Monitored natural attenuation
- Groundwater compliance monitoring

A site management plan (SMP) (MFA, 2016) is included as an appendix to the CAP (Ecology, 2016). The SMP includes policies and procedures for the operation and maintenance of the protective remedial action measures that remain in place, including the horizontal recovery well, and for conducting work in the Restricted Area of the Site. The Restricted Area, which includes a protective cap for soil, includes areas of the Property where arsenic concentrations in soil exceed the arsenic MTCA cleanup level (CUL). Groundwater restrictions apply throughout the Site.

The goals of this CMP are to:

- Identify existing wells for inclusion in the compliance monitoring network and provide criteria for siting and installing potential future monitoring wells.
- Describe the development of remediation levels (RELs) and CULs to be used at existing and potential future compliance monitoring wells.
- Provide guidelines and criteria for each stage of monitoring, including criteria for assessing compliance with RELs and CULs, as applicable, and monitoring frequency.
- Identify contingent actions to be implemented in response to noncompliance with RELs in a sentry well and the criteria for triggering these actions.
- Provide criteria for ceasing operation of the horizontal recovery well and for its eventual decommissioning.
- Provide criteria for decommissioning monitoring wells.
- Define requirements for terminating the monitoring program and removing groundwater restrictions (i.e., an environmental covenant).

Ecology has determined that the highest and only beneficial use of groundwater affected by the Site is protection of surface water. Groundwater CULs (based on protection of surface water) and a conditional point of compliance (CPOC) at the Site boundary were established in the CAP (Ecology, 2016).

Groundwater data collected at the Site from 2004 to 2015 and attenuation modeling show that indicator hazardous substance (IHS) concentrations do not exceed CULs at or beyond the Site boundary (Ecology, 2016; MFA and AECOM, 2014). These findings support the selection of a CPOC at the Site boundary and the use of sentry wells and RELs (see Section 4) for monitoring CUL compliance at the CPOC.

2 BACKGROUND

2.1 Site Description

The Site is located on the Tacoma tide flats and includes the Property located at 1640 East Marc Street and a portion of the adjacent Port property located at 1119 Milwaukee Way, in Tacoma, Washington (Figures 1 and 2). The 43-acre Property is located approximately 200 feet east of the Puyallup River and 1,000 feet south of the Milwaukee Waterway. The Property is zoned Port Maritime and Industrial and is surrounded by industrial facilities, including Maersk Pacific and Horizon Lines storage and shipping yards to the northwest; the former Union Pacific Railroad Milwaukee Railyard to the northeast; Pallet Services (a pallet manufacturing and storage facility) to the east; and Fred Tebb and Sons (a lumber mill) and Recovery One (a demolition waste transfer and processing facility) to the south. The Site includes a small area on the former Union Pacific Railroad Milwaukee Railyard property (currently owned by the Port). The Milwaukee Railyard is no longer active, and the Port has completed remedial actions to address free-phase diesel fuel and areas of related contamination. A restrictive covenant is in place on the Port property, and groundwater monitoring and cap maintenance activities are ongoing. The Port has also redeveloped the Port property to allow for the expansion of the Maersk Pacific Terminal.

2.2 Site History and Operations

The MCPLC facility is used for the manufacturing and processing of treated-wood products. Figure 2 shows the current layout of the facility. Activities at the facility have included debarking, sizing and framing, incising, staining, pressure- and non-pressure-treating, and distributing finished products to customers. Treated-wood products manufactured at the MCPLC facility include utility poles and dimensional lumber used for decking, fencing, and similar products.

The facility and Property were originally owned and operated by Cascade Pole and Lumber Company (CPLC). CPLC began leasing the facility, the Property, and equipment to MCPLC in January 2004. CPLC and MCPLC are owned by the same parent company, MCHI. In 2012, Stella-Jones Corporation acquired MCHI. As part of that transaction, CPLC transferred ownership of the property to Tyee, which continues to lease the Property to MCHI.

CPLC purchased the Property in stages from the late 1960s through the early 1970s and began developing it for use as a wood-treating facility in 1972; wood-treating operations have been conducted on the Property since 1974. Before 1974, the northwest portion of the Property was used for a lumber mill and landscape bark operation. The rest of the Property was filled in the early 1970s by the Port. The fill consisted of dredged material and possibly other materials.

Wood-treating activities, including storage and application of wood preservatives, are conducted on the eastern portion of the Property in an area referred to as the "treating area." The treating area includes the drip pads, a transfer table, retorts, and a pentachlorophenol (PCP) thermal butt vat (see Figure 2). The facility layout shown in Figure 2 has been in use since the late 1990s. The facility layout prior to the late 1990s is discussed in the RI/FS (MFA and AECOM, 2014) and the CAP (Ecology, 2016).

Both pressure and non-pressure (i.e., thermal) processes are used at the facility. The wood-treating chemicals primarily used in these processes have been PCP, copper-chromated arsenic (CCA), copper azole type C (CA-C), and creosote. From 1978 to 1987, CPLC used Chemonite® ammoniacal copper zinc arsenate at the facility. As of December 2004, creosote use was discontinued at the facility. MCPLC continues to use PCP to treat utility poles, but CCA use was discontinued for lumber products in December 2003, and for all products, including those for industrial use, in 2011.

CPLC and MCPLC records indicate that four known spills have occurred at the Property; one of these spills migrated onto the adjacent Port property. Cleanup actions were implemented to address these spills, and each was reported to Ecology:

- In August 1985, an overflow of process water from the cooling tower resulted in a release of approximately 100 gallons of water. Cleanup actions were implemented and efforts were made to eliminate the possibility of future spills.
- In March 1986, a cooling tower overflow resulted in the spill of approximately 100 gallons of process water. Cleanup actions were implemented and the system was redesigned to prevent any chance of recurrence.
- In May 1986, a storage tank overflow resulted in the spill of approximately 260 gallons of CCA. Cleanup actions and procedures were implemented to prevent any chance of recurrence.
- In May 2014, a wood-treatment-process work tank release resulted in the spill of approximately 300 gallons of CA-C. The spill migrated into a dry roadside ditch on the adjacent Port property. A project-specific cleanup goal of 146 milligrams per kilogram for copper in soil was developed in coordination with Ecology and the Tacoma-Pierce County Health Department. All soil with copper concentrations above the project-specific cleanup goal was excavated from the ditch (approximately 40 cubic yards [48.29 tons] in total). Ecology approved the spill response and cleanup and indicated that no further action associated with this spill was needed.

No other spills or releases have been reported at the MCPLC facility.

The MCPLC facility is a hazardous-waste generator (ID No. WAD 008 958 357). The facility discharges treated stormwater under a National Pollutant Discharge Elimination System (NPDES) permit (No. WA003795-3). MCPLC's current NPDES permit became effective on September 1, 2014, and has an expiration date of August 13, 2019. MCPLC is also registered with the Puget Sound Clean Air Agency (Registration No. 10398).

Chemicals used in the wood-treating process and their associated compounds and breakdown products, including the following, were identified as chemicals of interest (COIs) for the Site:

- Total and dissolved arsenic, copper, and chromium (including both trivalent chromium and hexavalent chromium [CrVI])
- Polycyclic aromatic hydrocarbons
- PCP
- Semivolatile organic compounds

In addition, the following COIs were identified in association with the PCP carrier oil formerly in use at the facility:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Total petroleum hydrocarbon–gasoline-range organics

The carrier oil in use since 2008, and currently in use at the facility, is a 30 percent biodiesel and 70 percent recycled lubrication oil mixture that does not contain BTEX.

Samples of environmental media from the Site were analyzed for these COIs, and detected chemicals were retained for consideration as IHSs.

CPLC entered into an Agreed Order (AO) with Ecology on June 7, 1993, for completion of an RI/FS and interim actions. Interim actions completed before execution of the AO were incorporated into the AO along with additional planned interim actions, including groundwater interim actions. Soil and groundwater investigations completed in association with the interim actions fulfilled the data collection requirements for the RI/FS. Site investigation details are discussed in the RI/FS (MFA and AECOM, 2014) and the CAP (Ecology, 2016).

2.3 Remedial Action Description

Since the early 1990s, CPLC has conducted numerous upgrades (interim actions) at the facility. The interim actions were completed under the existing AO, with consent and approval from Ecology, and are part of the selected remedy for the Site. These actions consisted of:

- **Protective Cap—**Arsenic-contaminated soil in the Restricted Area is covered with a protective cap, which consists of asphalt pavement, concrete, buildings, or other constructed features (including the drip pad and transfer table containment slab described below). The protective cap will be maintained in the Restricted Area as a component of the Site remedy. The protective cap in the Restricted Area is equipped with catch basins and piping to collect stormwater and direct it to on-site filtration/treatment systems. The stormwater is discharged under the site-specific NPDES permit.

- **Drip Pad Soil Excavation and Capping—**Impacted soil was excavated and disposed of off site as part of the installation of a new, steel-reinforced-concrete drip pad. The drip pad also serves as a cap for remaining soil impacts.

- **Installation and Operation of the Horizontal Recovery Well—**A horizontal recovery well and its associated recovery sump and pump provide both hydraulic containment and removal of shallow groundwater impacts beneath the transfer table pit and the adjacent treatment area. Extracted water is reused in facility operations.

- **Transfer Table Pit Soil Excavation and Capping—**860 tons of impacted soil was excavated and disposed of off site as part of the transfer table pit upgrade, which included construction of a concrete containment slab that caps remaining contaminated soil.

Further information associated with each interim remedial action is provided in the RI/FS (MFA and AECOM, 2014) and the CAP (Ecology, 2016).

In addition to the interim actions listed above, the selected remedial action includes monitored natural attenuation and compliance monitoring to address groundwater impacts at the Site, as discussed in this CMP. The selected remedial action also includes the following institutional controls: (1) continued maintenance of the protective cap and requirements for management of soil excavated from beneath the protective cap, as discussed in the SMP; (2) prohibition on groundwater use throughout the Site; and (3) operation and maintenance of the horizontal recovery well. These institutional controls will be documented and enforced through a restrictive covenant placed on the Property and the existing covenant on the Port property prohibiting groundwater use.

2.4 Conditional Point of Compliance

A CPOC at the Site boundary, which includes the Property and a portion of the Port property, was selected for groundwater (see Figure 2). Site CULs, based on protection of surface water, apply at the CPOC. There are no surface-water-exposure pathways on the Port property (Ecology, 2016); however, monitoring well UPRR-MW-29, located on the Port property, will be monitored during the compliance monitoring program to evaluate potential contamination migration onto the Port property, as well as hydraulic and chemical concentration trends.

Under this compliance monitoring program, to demonstrate that CULs are being met at the CPOC, which is at the downgradient boundary of the Property, sentry wells will be monitored for compliance with RELs. Sentry wells are located to allow monitoring between the source area and the nearest potential receptor, the Puyallup River. RELs are attenuation-modeling-derived concentrations of IHSs to apply at sentry wells (for monitoring CUL compliance at the CPOC) and at other compliance monitoring network wells to monitor remedy effectiveness. RELs, if reached in a sentry monitoring well, would indicate the potential for exceedance of a CUL at the CPOC. REL development is discussed in Section 4 of this CMP.

3 CONCEPTUAL SITE MODEL

The following is a summary of the investigation findings and the resultant conceptual site model as presented in the RI/FS (MFA and AECOM, 2014).

3.1 Geology and Hydrogeology

The Site is in an alluvial plain of the Puyallup River and is underlain by Puget Lowland glacial deposits (Griffin et al., 1962). The Site geology originally consisted of Puyallup River deltaic deposits overlying the glacial deposits, but has been extensively modified by dredging and infilling activities. The Site is underlain predominantly by fill consisting of dredge material and possibly other materials of unknown origin that were emplaced before development (MFA and AECOM, 2014).

The Site is underlain by a shallow, unconfined aquifer (the shallow aquifer) consisting of 6 to 10 feet of fine to medium sand with some sandy silt intervals underlain by an approximately 6- to 7-foot-thick aquitard consisting of silty clay to clayey silt. A second, approximately 6- to 10-foot-thick, semi-confined aquifer (the deep aquifer) exists below the shallow aquitard, consisting of very fine to medium sand with a trace of silt, which is underlain by a second aquitard consisting of a 3-foot-thick sandy to clayey silt zone.

Groundwater level data, hydrographs, and contour maps for the shallow and deep aquifers are provided as Appendix A. The depth to groundwater beneath the Site ranges from 3 to 10 feet below ground surface and fluctuates seasonally by approximately 2 feet. The highest water levels have been measured during the winter months (January through March) and the lowest in the fall (October and November). Groundwater from the treating area generally flows southwest to the Puyallup River, approximately 0.25 mile downgradient of the treating area. A groundwater elevation high, or groundwater divide, exists on the boundary between the Property and Port property, in the vicinity of monitoring wells MW-3 and UPRR-MW-29; hence there is a component of flow toward the Port property at times (USPCI, 1993). Groundwater generally flows southwest on the west side of the divide and northeast on the east side of the divide; no significant seasonal variation in the groundwater flow direction is apparent.

The horizontal recovery well recovers groundwater from the shallow aquifer and does not appreciably alter the flow paths across the Property, but does cause a slightly increased gradient in its immediate vicinity. Given that the horizontal recovery well has a localized impact on groundwater flow on the Property, it is not believed to have an appreciable effect on groundwater flow on the Port property.

3.2 Residual Contamination

The Site includes residual soil contamination in the Restricted Area beneath the protective cap (see Figure 2) and residual wood-treating-related chemicals in groundwater throughout the Site. Releases of wood-treating chemicals from the treating area of the MCPLC facility have been identified as a source of impacts in soil and groundwater at the Site. Groundwater data from previous investigations indicate that the source area in the deep aquifer is in the vicinity of deep monitoring well MW-14, which is slightly upgradient of the treating area (see Figure 2).

3.2.1 Indicator Hazardous Substances

During the development of the RI/FS (MFA and AECOM, 2014), data were screened for determination of Site IHSs specific to soil and groundwater. COIs were identified based on historical and current operations (see Section 2.2), and COIs that were detected in soil or groundwater during prior environmental investigations were retained as chemicals of potential concern (COPCs). Soil- and groundwater-specific IHSs were then defined through screening the maximum detected concentration of COPCs against site-specific CULs, which had been developed using applicable state and federal standards.

The sole IHS identified for site soil is arsenic.

IHSs identified for site groundwater are:

- Metals: arsenic, CrVI, and copper

- PCP
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)
- Volatile organic compounds: benzene, ethylbenzene, and xylenes

The selected remedy for the Site addresses these IHSs.

3.2.2 Distribution of Indicator Hazardous Substances in Groundwater

Groundwater monitoring data from 2004 to 2015 were evaluated for each IHS to assess groundwater exceedances at the Site. Figure 3 shows IHSs that were detected at concentrations above their respective CULs, based on recent data. Site data and attenuation modeling indicate that IHS concentrations in groundwater do not exceed CULs outside the CPOC (MFA and AECOM, 2014).

3.2.2.1 Shallow Groundwater

During the last four monitoring events, CUL exceedances were detected in all shallow wells sampled, with the exception of monitoring well MW-1, which is located near the southern boundary of the Property, and sentry well MW-20 (see Figure 3). Arsenic exceeds its CUL in all but one of the shallow groundwater monitoring wells with CUL exceedances. Other IHS exceedances, including copper, PCP, and cPAHs, were detected in fewer locations. Arsenic in shallow sentry wells MW-4 and MW-19, and copper in shallow sentry well MW-19, exceeded their CULs. Arsenic and PCP exceeded their CULs in the horizontal recovery well (HW-01).

Shallow groundwater quality data collected from monitoring well UPRR-MW-29 indicate that wood-treating-related chemical impacts are present on the Port property. Since 2004, copper, arsenic, PCP, and cPAHs have been detected at least once above Site CULs in this well (see Figure 3) and may have originated in the treating area of the MCPLC facility (USPCI, 1993). Based on these findings, the Site boundary extends onto this potentially affected portion of the Port property. The Site boundary (see Figure 2) is located on the Port property at the zero concentration arsenic contour line in groundwater shown in Figure 32 of the hydrogeologic characterization report (USPCI, 1993). The zero concentration contours for the other wood-treating-related chemicals detected in groundwater on the Port property are contained within this zero concentration contour for arsenic.

In general, IHS concentrations in shallow groundwater under the Property show stable or decreasing trends and IHS impacts appear to be limited to the treating area, with the exception of arsenic at sentry well MW-4, and arsenic and copper at sentry well MW-19. However, comparison of arsenic and copper concentrations in those sentry wells to RELs (MFA, 2015), which are based on conservative attenuation modeling (see Section 4), indicates that arsenic and copper concentrations will naturally attenuate to below their CULs before reaching the CPOC at the downgradient Property boundary (i.e., the Property boundary along Dike Road parallel to the Puyallup River).

3.2.2.2 Deep Groundwater

There are three existing deep groundwater monitoring wells on the Property: one well upgradient of the treating area (MW-14) and two wells directly downgradient of the treating area (MW-7 and MW-18; see Figure 2). Deep groundwater monitoring data from 2004 to 2013 were evaluated in the RI/FS for CUL exceedances (MFA and AECOM, 2014).

The following IHSs are not monitored in the deep aquifer wells: benzene, ethylbenzene, xylenes, and CrVI (MFA and AECOM, 2014). However, no exceedances of these IHSs were observed in the shallow aquifer (see Figure 3). Total chromium was monitored in the deep aquifer wells from 2004 to 2013, and the only total chromium concentration above the CrVI CUL was in the upgradient deep well (MW-14) (see Table 1).

IHS concentrations are significantly lower in the deeper aquifer. The only IHSs that have exceeded a CUL in deep groundwater since 2004 are arsenic, copper, cPAHs, and PCP (see Table 1). Concentrations of all IHSs monitored in deep groundwater show declining trends, and CUL exceedances have not been detected in the downgradient deep wells (MW-7 and MW-18) since 2007 (Table 1) (MFA and AECOM, 2014). During the last four monitoring events, the only IHSs exceeding their CULs in the upgradient deep groundwater well (MW-14) were arsenic and copper (see Table 1 and Figure 3). These observations indicate that CULs are currently being met in the existing deep groundwater wells and suggest that CULs will continue to be met in the future.

No deep wells are located on the Port property, but given the low concentrations detected in deep groundwater on the Property and the lower concentrations of IHSs detected in the shallow groundwater on the Port property relative to the Property, deep groundwater on the Port property is believed not to be impacted by IHSs at levels that could pose a concern regarding human health or the environment.

3.3 Risk Evaluation

The Property and the Port property are zoned Port Maritime and Industrial and are surrounded by industrial facilities. Following cleanup, the Site will continue to be used for industrial operations indefinitely.

Exposures to human populations (on-site workers) could occur through:

- Direct contact with, ingestion of, or inhalation of dust entrained in air from contaminated shallow soil in the Restricted Area if soil beneath the protective cap is exposed
- Direct contact with shallow groundwater throughout the Site

The soil-to-groundwater pathway has been mitigated by the implementation of remedial actions at the Property, including soil removal and the protective cap in the Restricted Area, which limits infiltration of stormwater and leaching of contamination remaining in soil.

Groundwater from the shallow and deep aquifers is not currently used and will not be used in the future as a source of drinking water. Groundwater beneath the Site and surface water in the Puyallup River, to which groundwater discharges, are not considered suitable for use as a domestic water supply. In addition, as part of the Consent Decree, an environmental covenant will be placed on the Property to restrict domestic uses of groundwater. Therefore, the groundwater-ingestion pathway for humans is not complete and human ingestion of contaminated water is not considered a potential risk.

Ecology has determined that the highest beneficial use of groundwater at the Site is discharge to surface water. The Puyallup River is approximately 200 feet west of the Site. Groundwater on the Property likely discharges to the Puyallup River; however, the horizontal recovery well contains and removes contaminated groundwater in the source area, eliminating the groundwater-to-surface-water pathway, and previous groundwater monitoring and attenuation modeling indicate that IHS concentrations in groundwater attenuate to undetectable levels before reaching the CPOC at the downgradient Property boundary.

There is no exposure for ecological receptors at the Site. The Site is covered by buildings, pavement, or other physical barriers that prevent plants or wildlife from being exposed. Aquatic life in the Puyallup River could be a receptor; however, as noted above, modeling and water quality monitoring results indicate that groundwater impacts do not reach the river, and the installation of a stormwater treatment system significantly reduced the potential adverse impacts to surface water from the Site. Engineered and institutional controls will be maintained to prevent potentially complete exposure pathways for ecological receptors.

3.4 Post-Remedial-Action Conditions

The primary objectives of the groundwater compliance monitoring discussed in this CMP are to demonstrate that the Site remedy is protective of receptors in surface water and to provide early warning, via sentry wells, of changes in groundwater conditions indicative of potential contaminant migration to the Puyallup River (see Section 5 for further details). The surface-water-exposure pathway has been eliminated by the completed remedial actions at the Site, which include capping to mitigate the soil-to-groundwater pathway and operation of the horizontal recovery well to eliminate the groundwater-to-surface-water pathway. Monitoring will continue in accordance with this CMP to ensure continued protection of surface water receptors.

4 REMEDIATION LEVELS

The compliance monitoring program put forth in this CMP relies on sentry wells and RELs to provide early warning of a possible exceedance of groundwater CULs at the CPOC. RELs are attenuation-modeling-derived concentrations that, if not exceeded, indicate that IHS concentrations in groundwater will not exceed CULs at the CPOC.

An REL exceedance in a sentry well would provide early detection of possible IHS migration from the source area at concentrations that could be of concern at the CPOC. Groundwater in the source area is captured and removed by the horizontal recovery well; therefore, in the source area, RELs will be used to assess the need for continuing groundwater treatment, but not for compliance purposes. REL exceedances would be a concern only if detected in sentry wells, all of which are located downgradient of the source area.

The rationale for using RELs as opposed to CULs is that it is overly conservative to apply CULs at the selected compliance monitoring network wells because they are not located at the CPOC—they are located either in the source area or immediately downgradient of the source area (e.g., sentry wells)—and attenuation is expected to occur between the compliance monitoring wells and the CPOC.

Conservative attenuation modeling was conducted in order to develop RELs based on estimates of the amount of attenuation that will occur between a well and the CPOC. Attenuation modeling using BIOSCREEN was conducted as part of the RI/FS (MFA and AECOM, 2014). This same modeling approach was used to develop RELs.

BIOSCREEN input values are summarized in Table 2. CULs (as selected in the CAP [Ecology, 2016]) to be met at the CPOC and modeling-derived RELs for each compliance monitoring well are shown in Table 3. The selection of wells for use in the compliance monitoring network is discussed in Section 5.2.

RELs were developed using the following steps:

- Aquifer-specific hydraulic conductivity (K), hydraulic gradient (i), and effective porosity values (n) (as shown in Table 2) were used to calculate seepage velocities (v) for each aquifer, using the following equation:

$$v = (K)(i)/n$$

- The seepage velocities were used to estimate the time of travel (t) required for groundwater to migrate the distance (d) from each sentry well to the CPOC (i.e., the Property boundary), as follows (as a conservative estimate, no retardation was included):

$$t = d/v$$

- The aquifer-specific seepage velocities were used as inputs to BIOSCREEN. All other model input values remained the same as in the RI/FS, with the exception of the dispersivity values for the deep aquifer. Dispersivity values were calculated for the deep aquifer by the same methodology documented in the RI/FS, using an assumed plume length of 160 feet, which is equal to the approximate distance from upgradient deep monitoring well MW-14 to downgradient deep monitoring well MW-7.

- The BIOSCREEN model was run for a simulation time equal to the time of travel from each well to the CPOC. Source concentrations were increased until the resulting concentration at the CPOC was equal to a CUL.

- The source concentration that resulted in a concentration equal to a CUL at the CPOC was selected as the REL for each well.

RELs were also established, based on distance from the CPOC, according to the procedure described above. The time of travel for each increment of distance from the CPOC was calculated and used as the simulation time in BIOSCREEN. RELs for each IHS were estimated at 25-foot increments from the CPOC (see Table 4). RELs will be selected from Table 4 for any new sentry wells installed at the Site (if needed; see Section 6), based on the well's distance from the CPOC.

The seepage velocities and dispersivities (longitudinal and transverse) differ between the shallow and the deep aquifers. Since the seepage velocity is greater in the deep aquifer, the travel time to the CPOC at a given distance is shorter in the deep aquifer; however, the seepage velocity and longitudinal and transverse dispersivities have a negligible effect on attenuation in this model, and therefore the RELs at a given distance are the same in both the shallow and the deep aquifers. The longitudinal and transverse dispersivities are tied to the decay rate, which is assumed to be zero; therefore, varying the longitudinal and transverse dispersivities has a negligible effect on attenuation. In this no-decay simulation, attenuation is most sensitive to the vertical dispersivity, which is not affected by travel time in the aquifer and is assumed to be the same in the shallow and deep aquifers. Therefore, the RELs included in Table 4 are applicable to either shallow or deep sentry wells.

Note that RELs were not calculated for benzene, ethylbenzene, xylenes, and CrVI in deep groundwater because, although these IHSs are not monitored in the deep aquifer wells, they were not detected above CULs in shallow groundwater from 2004 to 2015 (MFA, 2015) and total chromium has not been detected above the CrVI CUL in the downgradient deep groundwater wells (MW-7 and MW-18) since 2004 (MFA and AECOM, 2014). Therefore, this monitoring program will not include analysis for these IHSs in deep groundwater samples (see Section 5.4).

The following section discusses how RELs will be applied in the compliance monitoring program.

5 MONITORING PROGRAM

This section provides the monitoring program objectives and details, including selection of the monitoring network, stages of monitoring, and the sampling and analysis program.

5.1 Monitoring Objectives

The primary objectives of the groundwater-related remedial actions at the Site are to reduce source area concentrations in groundwater, protect groundwater from further contamination, and prevent contaminant migration to the Puyallup River. The groundwater monitoring program will:

- Provide confirmation of the ongoing effectiveness of the Site remedy.

- Provide information about the ongoing performance of the horizontal recovery well and soil remedial actions on the Property.
- Ensure that CULs are met at the CPOC.
- Provide early warning, via sentry wells, of the potential for future CUL exceedances at the CPOC.
- Prevent exceedances of CULs at the CPOC through implementation of contingency measures, if needed.

5.2 Groundwater Monitoring Network

Monitoring activities will be conducted for both the shallow and the deep groundwater aquifers under the Site, using a combination of water level monitoring network wells, compliance monitoring network wells, and final closure monitoring network wells, as discussed below (see Table 5 and Figures 4 to 6).

Well logs for MW-4 and MW-15 through MW-20 are provided in Appendix B. Well logs for the other existing wells are unavailable.

Water Level Monitoring Network

Water levels will be monitored during all stages of monitoring in all existing Site wells in order to evaluate hydraulic gradients in the shallow and deep aquifers (see Table 5 and Figure 4).

Compliance Monitoring Network

During the protection, performance, and confirmational stages of monitoring, groundwater samples will be collected from the compliance monitoring network wells and analyzed (see Sections 5.3.1 to 5.3.3). The compliance monitoring network includes the following wells (see Figure 5):

- **Horizontal recovery well: HW-01.**
- **Sentry wells:** MW-4, MW-19, and MW-20 in the shallow aquifer; MW-7 and MW-18 in the deep aquifer; and any additional sentry wells installed as part of a Tier 3 contingency (see Section 6.3).
- **Source area monitoring wells:** MW-3 and MW-8 in the shallow aquifer; MW-14 in the deep aquifer.

Final Closure Monitoring Network

During the final closure stage of monitoring, groundwater samples will be collected from all remaining Site monitoring wells (see Table 5 and Figure 6) and analyzed (see Section 5.3.3).

Monitoring Well UPRR-MW-29

During all stages of monitoring, groundwater samples will be collected from shallow aquifer monitoring well UPRR-MW-29—located on the Port property—and analyzed. However, Ecology has determined that discharge to surface water is the highest beneficial use of groundwater at the Site, and groundwater monitoring results indicate that IHSs are not migrating to surface water on the Port property (Ecology, 2016). Therefore, UPRR-MW-29 will not be used as a sentry well and is not included in the compliance monitoring network (see Table 5 and Figure 5). During the protection, performance, or confirmational stages of monitoring, sample results from UPRR-MW-29 will be used to evaluate IHS concentration trends and hydraulic gradients, but will not be evaluated for compliance with RELs or CULs. However, UPRR-MW-29 is included in the final closure monitoring network (see Table 5 and Figure 6), and during the final closure stage of monitoring, sample results from this well will be evaluated for compliance with CULs.

5.2.1 Monitoring Well Installation

Future monitoring wells will be installed in accordance with Washington State well construction standards (WAC 173-160) and the procedures outlined in the attached sampling and analysis plan (SAP) (Appendix C). Soil lithology and any evidence of contamination (e.g., odors, staining) will be recorded during well installations. Ecology will be notified at least 30 days before installation of new groundwater monitoring network wells.

5.2.2 Monitoring Well Decommissioning

Monitoring wells will be maintained in order to meet the functional well standards put forth in the Washington State Minimum Standards for Construction and Maintenance of Wells (WAC 173-160); however, in the event that a monitoring well becomes damaged and requires replacement; becomes operationally problematic to maintain; is deemed no longer needed for final closure monitoring (e.g., following a demonstration of compliance with CULs for those wells not included in the compliance monitoring network or for the deep aquifer compliance monitoring network wells, as discussed in Section 5.3.3); or following termination of the groundwater monitoring program (see Section 5.3.3), the well may be decommissioned with Ecology's approval. Ecology will be notified 30 days before any planned well-decommissioning activities. Monitoring well decommissioning will be completed by a licensed well driller, in accordance with WAC 173-160 and the procedures outlined in the SAP (Appendix C).

The horizontal recovery well is completed in the shallow aquifer and is included in the compliance monitoring network (see Section 5.2, Table 5, and Figure 5); therefore, it will be maintained for monitoring during the final closure monitoring stage and for potential restarting in response to a triggered contingent action (see Section 6), even after its eventual shutdown following completion of the protection monitoring stage (as discussed in the next section). The horizontal recovery well will not be decommissioned until the criteria for terminating the monitoring program have been met, as discussed in Section 5.3.3.

5.3 Stages of Monitoring

Compliance monitoring at the Site will be conducted in three stages: protection, performance, and confirmational, in accordance with MTCA compliance monitoring requirements (WAC 173-340-410), as described below:

- **Protection monitoring:** Confirm that human health and the environment are adequately protected during the construction, operation, and maintenance periods of an interim action or cleanup action.
- **Performance monitoring:** Confirm that once attained, RELs continue to be met following termination of the horizontal recovery well's operation.
- **Confirmational monitoring:** Confirm the long-term effectiveness of the groundwater extraction and containment remedy component following completion of protection monitoring. This stage of monitoring also includes a "final closure monitoring" stage to confirm the long-term effectiveness of the groundwater remedy once CULs have been attained throughout the Site and to determine that the groundwater monitoring program can be terminated.

This section includes detailed information on how each of these three stages of monitoring will be applied at the Site, as illustrated in flow charts (see Figures 7A through 7C), including:

- Monitoring frequency
- Applicable cleanup standards (e.g., RELs or CULs)
- Ecology notification requirements
- Criteria for proceeding from one stage of monitoring to the next
- Conditions triggering contingent measures
- Criteria for terminating operation of the horizontal recovery well
- Criteria for the eventual termination of the compliance monitoring program

The monitoring program relies primarily on semiannual and annual monitoring. Seasonal fluctuations in groundwater elevations were evaluated as part of the RI/FS (MFA and AECOM, 2014). In general, the highest groundwater elevations were measured in January and February and the lowest in September and October. Therefore, the semiannual monitoring included in this CMP will be conducted during the high (January or February) and low (September or October) groundwater periods. Annual monitoring events will be conducted in January or February, consistent with sampling conducted during the RI/FS and as described in the Groundwater Interim Action Implementation Report (ThermoRetec, 1999).

Groundwater monitoring in the deep aquifer will be discontinued once the requirements outlined in Section 5.5 have been met.

During any stage of monitoring, a demonstration of compliance with CULs may be made for an individual monitoring well. The criteria for demonstrating compliance with CULs are discussed in Section 5.3.3. Following a demonstration of compliance and with Ecology approval, monitoring of the well may be terminated and the well decommissioned.

5.3.1 Protection Monitoring

Protection monitoring will be conducted during the period of active groundwater treatment (i.e., while the horizontal recovery well is operational) (see Table 5 and Figure 7A).

Protection monitoring includes the following activities:

- Groundwater sample collection and analysis from all compliance monitoring network wells (see Table 5 and Figure 5) for evaluation of compliance with RELs while the horizontal recovery well is operational
- Water level measurements in all water level monitoring network wells (see Table 5 and Figure 4) for evaluation of hydraulic gradients

During the protection monitoring stage, groundwater samples will also be collected from monitoring well UPRR-MW-29 and analyzed to evaluate IHS concentration trends; however, the results will not be evaluated for compliance with RELs or CULs.

Protection monitoring includes the following steps, as depicted in Figure 7A:

- Operate the horizontal recovery well until RELs have been attained in all compliance monitoring network wells.
- Monitor compliance monitoring network wells semiannually for two years. After two years of semiannual monitoring have been completed, the monitoring frequency will be reduced to annual.
- Quarterly monitoring will begin after two consecutive years of annual protection monitoring have been completed, during which IHS concentrations have been below RELs in all compliance monitoring wells concurrently. Quarterly monitoring will be used to determine whether the horizontal recovery well can be shut down.
- Shut down the horizontal recovery well and proceed to the performance monitoring stage after IHS concentrations have been below RELs in all compliance monitoring network wells for four consecutive quarters. Until this milestone is achieved, the horizontal recovery well will continue to operate and protection monitoring will continue. Ecology will be notified at least 30 days before shutdown of the horizontal recovery well.
- If an REL is exceeded during the quarterly monitoring period, the monitoring frequency may revert to an annual schedule or continue on a more frequent basis, at the discretion of the Property owner.

At any point during the protection monitoring stage, if an IHS concentration exceeds its REL in a sentry well during two consecutive monitoring events or two consecutive high- or low-groundwater monitoring events, then the contingency measures, as outlined in Section 6 and illustrated in Figures 8A and 8B, will go into effect and will be conducted concurrently with other protection monitoring activities. Ecology will be notified within 30 days following any event that triggers contingency measures.

Groundwater treatment will be considered complete once it has been demonstrated that RELs have been attained in all compliance monitoring network wells, consistent with the monitoring program shown in Figure 7A. Once groundwater treatment is complete, the horizontal recovery well will be shut down and monitoring will proceed to the performance monitoring stage, as discussed in the next section of this CMP.

5.3.2 Performance Monitoring

Performance monitoring will begin after shutdown of the horizontal recovery well and will provide data to evaluate whether the completed groundwater treatment remedy (i.e., groundwater extraction and containment via the recovery well) has attained RELs or if additional groundwater treatment is required (i.e., restarting the horizontal recovery well).

Performance monitoring includes the following activities:

- Groundwater sample collection from all compliance monitoring network wells (see Table 5 and Figure 5) and analysis for evaluation of compliance with RELs after shutdown of the horizontal recovery well.
- Water level measurements in all water level monitoring network wells (see Table 5 and Figure 4) for evaluation of hydraulic gradients.

During the performance monitoring stage, groundwater samples will also be collected from monitoring well UPRR-MW-29 and analyzed to evaluate IHS concentration trends; however, the results will not be evaluated for compliance with RELs or CULs.

Performance monitoring includes the following steps, as depicted in Figure 7B:

- Monitor compliance monitoring network wells semiannually for at least two years.
- If an IHS concentration exceeds its REL during two consecutive monitoring events or during two consecutive high- or low-groundwater monitoring events in any one compliance monitoring network well, restart the horizontal recovery well and revert to the protection monitoring stage. If the REL exceedances were detected in a sentry well, also initiate contingency measures (see Section 6 and Figures 8A and 8B).
- Proceed to the confirmational monitoring stage after two consecutive years of semiannual monitoring (four consecutive monitoring events) have been completed without two consecutive REL exceedances in any one compliance monitoring well (i.e., during two consecutive monitoring events or during two consecutive high- or low-groundwater monitoring events).

Ecology will be notified within at least 30 days after any of the following activities:

- Initiating confirmational monitoring
- Restarting the horizontal recovery well and reverting to protection monitoring
- Initiating contingency measures

A higher density of water level measurement points is recommended during active operation of the horizontal recovery well in order to characterize flow directions for monitoring containment of contaminated groundwater in the treating area. However, following completion of the performance monitoring stage, fewer wells may be needed to provide sufficient coverage for monitoring hydraulic gradients under normal flow conditions (i.e., after shutdown of the horizontal recovery well). For those wells no longer needed for monitoring water levels, a request for terminating monitoring and decommissioning the well may be made following a demonstration of compliance with CULs, as discussed in the next section.

Monitoring will proceed to the confirmational monitoring stage, as discussed in the next section of this CMP, once RELs have been attained in all compliance monitoring wells for two consecutive years following shutdown of the horizontal recovery well.

5.3.3 Confirmational Monitoring

Confirmational monitoring will begin following completion of the performance monitoring, and results will be used to evaluate the following:

- Long-term compliance with RELs following completion of the groundwater remedy (i.e., after shutdown of the horizontal recovery well)
- Ultimately, attainment of CULs

Final closure monitoring results will be used to demonstrate the following:

- Long-term compliance with CULs.
- The requirements have been met for termination of the groundwater monitoring program.

Confirmational monitoring includes the following activities, as depicted in Figure 7C:

- Groundwater sample collection and analysis from all compliance monitoring network wells (see Table 5 and Figure 5) for evaluation of long-term compliance with RELs and, ultimately, attainment of CULs.
- Water level measurements in all water level monitoring network wells (see Table 5 and Figure 4) for evaluation of hydraulic gradients. Water levels will be monitored in the water level monitoring network wells as long as the wells are present at the Site (see discussion below regarding demonstrating compliance with CULs on a well-by-well basis).
- Monitor compliance monitoring network wells at a minimum frequency of once every five years during the high-groundwater period (i.e., January or February). The first confirmational monitoring event will be conducted in January or February of the fifth year after completion of performance monitoring and every five years thereafter.
- Proceed to the final closure monitoring stage at any time after the first confirmational monitoring event where IHS concentrations in all compliance monitoring network wells

concurrently are below CULs. At least one confirmational monitoring event will be performed before the start of final closure monitoring.

- Revert to the performance monitoring stage if an IHS concentration in a sentry well exceeds its REL during any one confirmational monitoring event.

Ecology will be notified within at least 30 days after reversion to the performance monitoring stage.

During the confirmational monitoring stage, groundwater samples will also be collected from monitoring well UPRR-MW-29 and analyzed to evaluate IHS concentration trends, but the results will not be evaluated for compliance with RELs or CULs. However, during final closure monitoring, groundwater samples will be collected from monitoring well UPRR-MW-29 and analyzed to evaluate compliance with CULs, as discussed below.

Absent Ecology approval of an alternate response, the following actions will be taken if a once-every-five-years monitoring event is not conducted (i.e., the event is administratively overlooked):

- Ecology will be notified within 30 days following identification of the oversight.
- A confirmational monitoring event will be conducted as soon as possible following the missed event and then the normal monitoring schedule will resume. However, if a monitoring event is not conducted within three years of the due date of the original event, then two annual monitoring events will be conducted after the missed event. Following that, the once-every-five-years monitoring frequency will resume.
- During the course of the compliance monitoring program, if two five-year monitoring events are missed by 30 or more days, then the confirmational monitoring frequency will decrease to once every three years.

Final closure monitoring includes the following activities, as depicted in Figure 7C:

- Groundwater sample collection and analysis from all final closure monitoring network wells (see Section 5.2, Table 5, and Figure 6) to evaluate compliance with CULs.
- Water level measurements in all water level monitoring network wells (see Table 5 and Figure 4) to evaluate hydraulic gradients. Water levels will be monitored in the water level monitoring network wells as long as the wells remain active (see discussion below regarding demonstrating compliance with CULs on a well-by-well basis).
- Monitor final compliance monitoring network wells at a minimum frequency of once every five years; the frequency of the final closure monitoring will be determined by the Property owner and operator.
- Revert to the performance monitoring stage if an IHS concentration in a sentry well exceeds its REL during any one groundwater monitoring event.
- Terminate the compliance monitoring program after it has been demonstrated that concentrations of all IHSs are in compliance with CULs in all final closure monitoring network wells.

Compliance with CULs may be demonstrated by meeting one or more of the following requirements:

- IHS concentrations have been below CULs during the last four consecutive confirmational monitoring events.
- A statistical determination of compliance with CULs has been made in accordance with the requirements put forth in MTCA (173-340-720[9]).

It is necessary to obtain compliance with CULs in all final closure monitoring wells (see Table 5 and Figure 6) before termination of the monitoring program.

A demonstration of compliance with CULs, and a request for terminating monitoring and decommissioning an individual well, may be made on a well-by-well basis for only those “other monitoring wells” included in the final closure monitoring network or the deep aquifer wells (see Table 5 and Figure 6).

Termination of monitoring and decommissioning of the shallow aquifer “compliance monitoring network wells” (see Section 5.2, Table 5, and Figure 5; these include those final closure monitoring network wells completed in the shallow aquifer that are designated for use as sentry wells or source area wells and the horizontal recovery well) will not be completed until a demonstration of compliance with CULs has been made for all, or all remaining, “final closure monitoring network wells” concurrently and that the criteria for termination of the compliance monitoring program have been met.

The Property owner will notify Ecology of its intent to terminate the compliance monitoring program at least 60 days before the next scheduled monitoring event; this notification will include monitoring data demonstrating that the termination criteria have been met. If the termination criteria have been met, Ecology will approve termination of all groundwater compliance monitoring activities and decommissioning of all wells.

The Property owner will notify Ecology of its intent to terminate monitoring of “other monitoring wells” (see Table 5 and Figure 6) on a well-by-well basis, at least 60 days before the next scheduled monitoring event; this notification will include monitoring data demonstrating that the termination criteria have been met for the individual well. If the termination criteria have been met, Ecology will approve termination of groundwater monitoring activities and decommissioning of the well.

5.4 Sampling and Analysis

Groundwater monitoring will include measuring water levels and water quality parameters (e.g., dissolved oxygen, pH, temperature, and specific conductance) and the collection and analysis of groundwater samples. Groundwater monitoring activities will be conducted in accordance with the methods and protocol outlined in the SAP (see Appendix C).

Groundwater samples collected in association with compliance monitoring activities will be analyzed for IHSs, using the following analytical methods or comparable analytical methods deemed by Ecology to be suitable alternatives and approved for use:

- Dissolved arsenic and copper by U.S. Environmental Protection Agency (USEPA) Method SW6020 or 200.8.
- Total CrVI by USEPA Method SM3500CR-B or 7196A (only shallow groundwater).
- Benzene, ethylbenzene, and xylenes by USEPA Method SW8260 or SW8021 (only shallow groundwater).
- cPAHs by USEPA Method SW8270-selective ion monitoring (SIM).
- PCP by USEPA Method SW8270-SIM.

Note that benzene, ethylbenzene, xylenes, and CrVI will not be analyzed in deep groundwater samples because these IHSs have not been detected above CULs in deep groundwater since 2004 (see Section 3.2.2.2 and MFA and AECOM, 2014).

The contractor will confirm that the method reporting limits do not exceed the CULs shown in the REL tables (see Tables 3 and 4).

During all stages of monitoring, if at any time the quality of data for a sample is believed to be compromised by a quality assurance and quality control (QA/QC) issue, a second sample may be collected within 30 days.

Groundwater monitoring and horizontal recovery well operation and maintenance activities at the Site will comply with provisions outlined in the Site's specific health and safety plan. The contractor will be required, before beginning work, to prepare a health and safety plan, which is to be available for review by Ecology upon request.

5.5 Deep Groundwater

A summary of deep groundwater analytical results compared to CULs and well-specific RELs is included as Table 1. Annual groundwater monitoring results indicate little to no downgradient migration of IHSs in deep groundwater. IHSs either have not been detected, or they have been detected at concentrations below CULs, in Ecology-approved downgradient deep wells (MW-7 and MW-18) since 2008. During the most recent monitoring event, conducted in 2015 (MFA, 2015), arsenic and copper were the only IHSs detected above their CULs and RELs in the deep source area well (MW-14).

Monitoring of the deep aquifer will continue until sufficient data have been collected to demonstrate long-term compliance with cleanup standards and to terminate monitoring, as evidenced by meeting the following:

- IHS concentrations in the shallow source area well (MW-8) and horizontal recovery well (HW-01) show stable or decreasing trends;
- IHS concentrations in the source area deep well (MW-14) have been below RELs for four consecutive monitoring events; and
- IHS concentrations in the deep sentry wells (MW-7 and MW-18) have been below CULs for four consecutive monitoring events.

Once the MTCA requirements have been met, deep groundwater monitoring will be discontinued. The compliance monitoring program and schedule described in the previous section and shown in Figures 7A through 7C, and the contingency measures discussed in the next section, apply if these requirements are not met in the deep aquifer.

The Property owner will notify Ecology of its intent to terminate groundwater monitoring in the deep aquifer wells at least 60 days before the next scheduled monitoring event; this notification shall include monitoring data demonstrating that the termination criteria have been met. Ecology will approve termination of deep groundwater compliance monitoring activities if the termination criteria have been met.

Once the criteria for termination of deep groundwater monitoring have been met, the Property owner may also request Ecology approval to decommission a deep groundwater monitoring well if the criteria for decommissioning a well have also been met (see Section 5.3.3). For the source area deep well (MW-14), a demonstration of compliance with CULs is not required in order to terminate deep groundwater monitoring (see criteria listed above), but is required prior to decommissioning the well or terminating the monitoring program for the Site (see Section 5.3.3).

6 CONTINGENCY MEASURES

Sentry wells are included in the water level monitoring network, compliance monitoring network, and final closure monitoring network (see Section 5.2, Figures 4 to 6, and Table 5) and will be monitored during all three stages of the compliance monitoring program (protection, performance, and confirmational), as discussed in the previous section. If an REL is exceeded during two consecutive monitoring events or two consecutive high- or low-groundwater monitoring events in a sentry well at any point during the three stages of monitoring, then contingency measures will be implemented, as described in this section.

Contingency measures are specific actions that will be implemented in response to defined triggers and are grouped into four tiers, as discussed below and illustrated in Figures 8A and 8B.

6.1 Tier 1

Tier 1 contingencies are triggered when an IHS concentration in a sentry well exceeds its REL during two consecutive monitoring events or two consecutive high- or low-groundwater monitoring events, and include the following actions (see Figure 8A):

- More frequent monitoring (quarterly frequency) of the affected sentry well to determine whether the REL exceedances were an isolated occurrence or are indicative of increasing concentration trends
- Restarting the horizontal recovery well and reverting to the protection monitoring stage (if those activities are not currently being conducted)
- Notifying Ecology within 30 days after a final laboratory report is obtained showing the second consecutive REL exceedance in a sentry well

Quarterly monitoring will be initiated in the affected sentry well within three months after the sampling date of the second consecutive REL exceedance. Quarterly samples will be analyzed only for those IHSs that exceeded an REL. While Tier 1 contingencies are in effect, the horizontal recovery well will be operational and monitoring of the affected sentry well and all other compliance monitoring wells at the Site will continue in accordance with the protection monitoring requirements, as discussed in Section 5.3.

If IHS concentrations in the affected sentry well are below RELs for four consecutive quarters:

- Monitoring will resume on a semiannual/annual basis consistent with the current stage of protection monitoring.
- Tier 1 contingencies will be considered complete.

If after two years of quarterly monitoring (eight quarters), IHS concentrations show a declining trend, and no detected IHS concentration is greater than two times an REL, quarterly monitoring will be continued. After two years of monitoring, the determination of whether to continue quarterly monitoring shall be made based on these two criteria after each quarterly monitoring event.

If after two years of quarterly monitoring (eight quarters), IHS concentrations have not been below RELs for at least four consecutive quarters and the criteria for extending quarterly monitoring are not met, Tier 2 contingencies will be triggered. However, if (a) IHS concentrations are above RELs for four consecutive quarters, and (b) IHS concentrations in a sentry well exceed two times the REL during two consecutive monitoring events or two consecutive high or low groundwater monitoring events, then Tier 3 contingencies will be triggered.

6.2 Tier 2

Ecology will be notified within 30 days after a final laboratory report is received indicating that Tier 2 contingencies have been triggered (see previous section). Tier 2 contingencies involve performing more robust groundwater modeling to evaluate the RELs currently in use at the Site (see Figure 8B).

A groundwater modeling proposal will be submitted to Ecology for approval within three months of receipt of a final laboratory report indicating that Tier 2 contingencies have been triggered.

A specific groundwater model to use for the Tier 2 modeling is not proposed at this time, but an appropriate model will be selected using the criteria listed below. The primary objective will be to select a fate and transport model that is more robust than the BIOSCREEN model used previously; the selection will be based on the ability to model the following conditions:

- Plume geometry (e.g., two or three plume dimensions)
- Chemical-specific degradation by biological and/or geochemical processes (as appropriate to the IHS)
- Chemical dispersion in two or three dimensions
- Hydraulic boundary conditions and features (e.g., no-flow boundaries and/or sinks)
- Aquifer heterogeneities

Other factors may also be considered in the model selection specific to the modeling conditions, including the IHS(s) being modeled, aquifer conditions, and other site-specific parameters. Currently available models that would potentially satisfy the modeling criteria listed above include the numerical models MODFLOW and Groundwater Modeling System.

The modeling will be completed and documented in a modeling report submitted to Ecology within three months of Ecology's approval of the proposed model (the "modeling report"). If the modeling supports use of revised RELs, the modeling report will recommend revised RELs, and will include an assessment of whether IHS concentrations in sentry wells as of that date would trigger Tier 1 or Tier 2 contingencies when compared to the revised RELs. Based on the modeling report, Ecology will determine whether to approve revised RELs. If approved by Ecology, the revised RELs will be compared to the previous monitoring data and a new determination will be made about whether Tier 1 or Tier 2 contingencies are triggered following the logic and applying the criteria set forth in Section 6.1. Throughout Tier 2, quarterly monitoring of the affected sentry well will continue as in Tier 1.

Tier 3 contingencies will be triggered if any of the following events occur:

- Ecology does not approve the proposed groundwater model within three months after Ecology's receipt of the modeling report; this deadline may be extended by Ecology.
- The modeling report does not support revised RELs.
- The modeling report indicates that IHS monitoring data collected to date will still trigger Tier 2 contingencies, or would trigger Tier 3 contingencies, when compared to revised RELs.

If Tier 3 contingencies are not triggered, the IHS monitoring results collected to date will be compared to the revised RELs to select the appropriate stage of monitoring, and then compliance monitoring activities will be resumed in accordance with this CMP.

6.3 Tier 3

Tier 3 involves the installation of up to two additional sentry well(s) in the immediate vicinity, either downgradient or crossgradient, of the existing sentry well (or wells) with the REL exceedances. The purpose of installing a new sentry well(s) in the vicinity of the original, affected sentry well is to determine whether the REL exceedances observed in the original well are localized or represent widespread groundwater contamination and/or IHS migration at concentrations that exceed RELs.

New sentry wells will be installed within three months of the event triggering Tier 3. New sentry wells will be installed in accordance with the policies and procedures discussed in Section 5.2.1 and the SAP (Appendix C). Applicable RELs for new sentry wells will be selected from Table 4 on the basis of the well's straight-line distance from the CPOC in the inferred direction of groundwater flow (see Appendix A); or revised RELs will be selected from the modeling report. Monitoring in the affected sentry wells will continue on a quarterly basis while the Tier 3 sentry well locations are selected and the new wells are installed and developed.

Following installation and development, the new sentry wells will be monitored on a quarterly basis and concentrations compared to RELs. If RELs are exceeded in the new wells during any of the next four quarters, Tier 4 contingency measures, as discussed below, will be triggered. The new sentry wells will be incorporated into the compliance monitoring network, and monitoring will proceed according the current stage of monitoring.

Monitoring of the original sentry well will continue in accordance with the current stage of monitoring, and the well will be included in the final closure monitoring network, but ongoing REL exceedances in the original sentry well will not trigger additional contingent actions once a Tier 3 response has been triggered by the well.

6.4 Tier 4

Tier 4 involves additional subsurface investigation and/or source characterization for the purpose of determining whether additional or different remedial action(s) is necessary to ensure that CULs are met at the CPOC.

Within six months of the event triggering a Tier 4 contingency, the Property owner or its representative will produce and submit to Ecology a work plan with proposed additional subsurface characterization and/or source characterization activities and a schedule for completion for Ecology's review and approval. Tier 4 investigation activities will focus on the upgradient source areas, as identified in the RI/FS (MFA and AECOM, 2014). Following additional characterization activities, any determination of whether additional or different remedial action is necessary will be made by Ecology and will be governed by the terms of the Consent Decree and MTCA.

7 NOTIFICATION AND REPORTING

Ecology will be notified at least 30 days before the following activities are conducted:

- Installation, decommissioning, or replacement of any site monitoring wells
- Terminating operation of the horizontal recovery well and proceeding to the performance monitoring stage

Ecology will be notified within 30 days after the following activities:

- Restarting operation of the horizontal recovery well;
- Required shutdown of the horizontal recovery well (e.g., for cleaning or repair) during any stage of the groundwater monitoring program where operation of the horizontal recovery well is required (see Section 5.3) that results in it being nonoperational for 30 consecutive days or more (see the SMP [MFA, 2016]). Notice is required within 30 days of the 30th consecutive day of shutdown (i.e., 60 days following the first day of the shutdown);
- Reverting to a previous stage of the monitoring program (e.g., from performance monitoring to protection monitoring);
- Initiating confirmational monitoring;
- Determination that a once-every-five-years confirmational monitoring event was missed; or
- Events triggering contingent actions, including the following:
  - Receipt of a final laboratory report showing a second consecutive REL exceedance in a sentry well; or
  - Receipt of a final laboratory report showing that Tier 2 has been triggered.

Additional Ecology notification and reporting requirements are listed below:

- Ecology will be notified at least 60 days before the intended date for terminating monitoring and decommissioning of wells in response to:
  - Attainment of cleanup criteria in deep aquifer wells in accordance with the requirements put forth in Section 5.5.
  - Attainment of CULs for an individual monitoring well (see Section 5.3.3 for eligible wells).

- Attainment of CULs in all final closure monitoring wells and intended termination of the compliance monitoring program.

- A groundwater modeling proposal will be submitted to Ecology for approval within three months of receipt of a final laboratory report indicating that Tier 2 contingencies have been triggered.
- Groundwater modeling work conducted under a Tier 2 contingency will be completed and documented in the modeling report submitted to Ecology within three months of Ecology's approval of the proposed model.
- Within six months of the event triggering a Tier 4 contingency, the Property owner or its representative will produce, and submit for Ecology's review and approval, a work plan with proposed additional subsurface characterization and/or source characterization activities and a schedule for completion.
- Groundwater monitoring reports will be submitted to Ecology by April 1 each year during the protection and performance stages of monitoring and by April 1 every five years during the confirmational monitoring stage. The reports will provide a description of sampling activities, analytical data, field measurements of groundwater quality parameters and groundwater levels, a discussion of analytical data trends, and data validation reports. The data validation reports will provide a review of all raw data to verify that the laboratory has supplied the required QA/QC deliverables. The data will be validated against USEPA, Washington State, and laboratory-specific criteria for completeness and usability. The reports will also include (if applicable) information regarding the performance of the horizontal recovery well, including monthly inspection forms (as provided in the SMP [MFA, 2016]), monthly volumes of water pumped, pumping rate(s), operational failures and/or outages, duration of such conditions, remedies taken, etc. The reports will also include monitoring worksheets for the protective cap (as provided in the SMP [MFA, 2016]).

8 SCHEDULE

Compliance monitoring activities, as outlined in this CMP, will begin within six months following execution of the Consent Decree and Ecology's approval of this CMP.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

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TABLES

Table 1
Deep Groundwater Analytical Results
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Location	Date	IHS:*	Arsenic, inorganic	Chromium (total)	Copper	Penta-chlorophenol	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Total Benzofluoranthenes	Chrysene	Dibenzo(a,h) anthracene	Indeno(1,2,3-cd) pyrene	cPAH TEQ (Calculated)
		CUL (ug/L):	5	50	2.4	3	NA	0.1	NA	NA	NA	NA	NA	NA	0.1
MW-7		MW-7 RELs:	43	430	20	25	NA	NA	NA	NA	NA	NA	NA	NA	0.86
MW-7	02/04/2004		3.79	5.25	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
MW-7	05/25/2004		**5.62**	7.84	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
MW-7	09/08/2004		**5.69**	4.98	1 U	0.708	0.1 U	**0.146**	0.188	0.104	NA	0.125	0.1 U	0.125	**0.19**
MW-7	01/28/2005		4.92	6.11	1 U	**139**	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
MW-7	02/23/2005		--	--	--	0.5 U	--	--	--	--	NA	--	--	--	--
MW-7	01/25/2006		4.86	4.68	1 U	0.476 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	NA	0.0952 U	0.0952 U	0.0952 U	ND
MW-7	02/02/2007		10 U	6.85	1 U	1.6	0.0748	0.0913	0.0808	0.102	NA	0.086	0.00952 U	0.108	**0.13**
MW-7	01/30/2008		3.67	5.03	1 U	0.509	0.0943 U	0.0943 U	0.0943 U	0.0943 U	NA	0.0943 U	0.0943 U	0.0943 U	ND
MW-7	01/27/2009		2.41	5.37	1 U	1.79	0.043	0.0578	0.0567	0.0588	NA	0.0657	0.00943 U	0.046	0.079
MW-7	01/21/2010		2 U	18	5 U	0.049	0.023	0.025	0.038	0.013	NA	0.022	0.0095 U	0.016	0.034
MW-7	02/09/2011		2 U	5.1	5 U	0.094 U	0.094 U	0.19 U	0.094 U	0.094 U	NA	0.094 U	0.094 U	0.094 U	ND
MW-7	02/08/2012		5 U	2 U	5 U	0.028	0.019 U	0.038 U	0.021	0.019 U	NA	0.019 U	0.019 U	0.019 U	0.0021
MW-7	02/05/2013		5 U	3.9	5 U	0.044	0.0094 U	0.019 U	0.0094 U	0.0094 U	NA	0.0094 U	0.0094 U	0.0094 U	ND
MW-7	02/26/2015		2.9	NA	1.7	0.5 U	0.10 U	0.10 U	NA	NA	0.20 U	0.10 U	0.10 U	0.10 U	ND
MW-14		MW-14 RELs:	47	470	22	28	NA	NA	NA	NA	NA	NA	NA	NA	0.94
MW-14	02/05/2004		**154**	**75.2**	**82.6**	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
MW-14	05/25/2004		**152**	**101**	**62.7**	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
MW-14	09/08/2004		**112**	**67.6**	**54.2**	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.151	0.1 U	0.015
MW-14	01/27/2005		**215**	**201**	**136**	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
MW-14	01/24/2006		**51.4**	34.8	**37.4**	0.476 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	NA	0.0952 U	0.0952 U	0.0952 U	ND
MW-14	02/02/2007		**64**	**60.5**	**39.1**	0.472 U	0.00943 U	0.00943 U	0.00943 U	0.00943 U	NA	0.00943 U	0.00943 U	0.00943 U	ND
MW-14	01/31/2008		**40.9**	**59.9**	1 U	0.495	0.0952 U	0.0952 U	0.0952 U	0.0952 U	NA	0.0952 U	0.0952 U	0.0952 U	ND
MW-14	01/28/2009		**8.84**	7.41	1 U	0.472 U	0.00943 U	0.00943 U	0.00943 U	0.00943 U	NA	0.00943 U	0.00943 U	0.00943 U	ND
MW-14	01/21/2010		2 U	30	5 U	0.036	0.0094 U	0.019 U	0.0094 U	0.0094 U	NA	0.0094 U	0.0094 U	0.0094 U	ND
MW-14	02/09/2011		2 U	18	5 U	0.095 U	0.095 U	0.19 U	0.095 U	0.095 U	NA	0.095 U	0.095 U	0.095 U	ND
MW-14	02/07/2012		**60**	**110**	5 U	0.019 U	0.019 U	0.038 U	0.019 U	0.019 U	NA	0.019 U	0.019 U	0.019 U	ND
MW-14	02/05/2013		**6.6**	14	5 U	0.042	0.0095 U	0.019 U	0.0095 U	0.0095 U	NA	0.0095 U	0.0095 U	0.0095 U	ND
MW-14	02/27/2015		**270**	NA	**505**	0.5 U	0.10 U	0.10 U	NA	NA	0.20 U	0.10 U	0.10 U	0.10 U	ND
MW-18		MW-18 RELs:	42	420	20	25	NA	NA	NA	NA	NA	NA	NA	NA	0.85
MW-18	02/05/2004		1.22	5.58	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
MW-18	05/25/2004		1.36	6.71	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
MW-18	09/08/2004		1 U	5.06	1 U	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.113	0.132	0.1 U	0.014
MW-18	01/27/2005		1.79	7.66	1.97	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	NA	0.1 U	0.1 U	0.1 U	ND
MW-18	01/25/2006		1 U	6.9	1 U	0.476 U	0.0952 U	0.0952 U	0.0952 U	0.0952 U	NA	0.0952 U	0.0952 U	0.0952 U	ND
MW-18	02/02/2007		1 U	8.87	1 U	0.472 U	0.00943 U	0.00943 U	0.00943 U	0.00943 U	NA	0.00943 U	0.00943 U	0.00943 U	ND
MW-18	02/27/2015		0.8	NA	1.9	0.5 U	0.10 U	0.10 U	NA	NA	0.20 U	0.10 U	0.10 U	0.10 U	ND

NOTES:

Bold values indicate a CUL exceedance. MRLs for non-detect results were not compared to CULs.

Bold and highlighted values indicate an REL exceedance. MRLs for non-detect results were not compared to RELs.

Since hexavalent chromium data are unavailable, total chromium concentrations are compared to the hexavalent chromium cleanup level.

Metals results are the maximum of the total or dissolved fraction concentrations, whichever is greater, when both fractions were analyzed.

-- = not sampled.

cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient. Non-detects were set equal to zero in the cPAH TEQ calculation.

CUL = cleanup level.

IHS = indicator hazardous substance.

MRL = method reporting limit.

NA = not applicable.

ND = not detected.

REL = remediation level. Values obtained from Table 3.

U = analyte not detected at or above specified MRL.

ug/L = micrograms per liter.

*Benzene, ethylbenzene, xylenes, and hexavalent chromium were not analyzed in deep groundwater samples from 2004 to 2013.

Table 2
BIOSCREEN Inputs
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Input	Definition	Value—Shallow Aquifer	Value—Deep Aquifer	Units	Source
Hydrogeology					
n_e	effective porosity	0.3	0.3	unitless	Effective porosity for a silty, fine-grained sand from Weight and Sonderegger, 2001.
K	hydraulic conductivity	1.91E-04	6.70E-03	cm/s	Average values from slug tests.
i	hydraulic gradient	0.005	0.001	ft/ft	Average gradients observed in 2004, excluding the anomalously high gradient in the shallow aquifer observed in November 2004 (MFA and AECOM, 2014).
V_s	seepage velocity	7.6	23	ft/y	Calculated from above inputs.
Dispersion					
a_x	longitudinal dispersivity	10	6	ft	Conservative estimate calculated, per Xu and Eckstein, 1995, using a plume length of 625 ft (shallow aquifer) and 160 ft (deep aquifer).
a_y	transverse dispersivity	1	0.6	ft	Conservative estimate calculated, per Xu and Eckstein, 1995, and Gelhar et al., 1992, using a plume length of 625 ft (shallow aquifer) and 160 ft (deep aquifer).
a_z	vertical dispersivity	0.5	0.5	ft	Conservative estimate calculated, per ASTM, 1995, and USEPA, 1986, using on a plume length of 625 ft (shallow aquifer) and 160 ft (deep aquifer), .
Adsorption					
R	retardation factor	1	1	unitless	No retardation.
Biodegradation					
Lambda	attenuation rate	0	0	1/day	No biodegradation.
Source Data					
Source Thickness in Saturated Zone		10	10	ft	The maximum observed aquifer thicknesses; includes both the saturated and unsaturated sections for the shallow aquifer.
Source Concentration	concentration observed in a sentry well	--	--	ug/L	Source concentrations were varied until the maximum concentration that resulted in a concentration equal to the cleanup level was achieved at the property boundary. These are the remediation levels presented in Tables 3 and 4. Values are dependent on the attenuation length and target concentration (i.e., the target cleanup level). Values converted to mg/L for input into the model.
Source Width		1509	1509	ft	Conservative maximum source width; equal to the entire property width near MW-4.
Soluble Mass		0.0001	0.0001	kg	Minimal soluble mass in the soil, based on the assumption that arsenic is present primarily in the dissolved phase.
For Evaluating Model Runs					
Target Concentration	cleanup level to be met at a specified distance	--	--	ug/L	Equal to the final cleanup levels for each groundwater indicator hazardous substance. Values converted to mg/L for input into the model.
Target Attenuation Length	distance to the conditional point of compliance	--	--	ft	Distance to the downgradient property boundary.

NOTES:
-- = multiple values used, as discussed in the "Source" comments.
ASTM = American Society for Testing and Materials.
cm/s = centimeters per second.
ft = feet.
ft/ft = feet per foot.
ft/y = feet per year.
kg = kilograms.
mg/L = milligrams per liter.
ug/L = micrograms per liter.
USEPA = U.S. Environmental Protection Agency.

Table 3
Remediation Levels by Compliance Monitoring Network Well
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Indicator Hazardous Substance:			Arsenic	Benzene	Chromium (VI)	Copper	cPAHs	Ethylbenzene	PCP	Xylenes
Cleanup Level (ug/L):			5	51	50	2.4	0.1	2100	3	1000
Compliance Monitoring Network Well	Distance from CPOC (feet)*	Travel Time from Well to CPOC (years)	Remediation Level (ug/L)							
Shallow Aquifer										
Horizontal Recovery Well (HW-01)	1350	178	46	470	460	22	0.93	19000	27	9300
MW-3 (Source Area Well)	1290	170	45	460	450	21	0.91	19000	27	9100
MW-4 (Sentry Well)	625	82	32	320	320	15	0.64	13000	19	6400
MW-8 (Source Area Well)	1340	176	46	470	460	22	0.93	19000	27	9300
MW-19 (Sentry Well)	700	92	33	340	330	16	0.67	14000	20	6700
MW-20 (Sentry Well)	520	68	29	300	290	14	0.58	12000	17	5800
Deep Aquifer										
MW-7 (Sentry Well)	1150	50	43	NA	430	20	0.86	NA	25	NA
MW-14 (Source Area Well)	1380	60	47	NA	470	22	0.94	NA	28	NA
MW-18 (Sentry Well)	1130	49	42	NA	420	20	0.85	NA	25	NA

NOTES:
chromium (VI) = hexavalent chromium.
cPAH = carcinogenic polycyclic aromatic hydrocarbon. Calculated as the toxic equivalency quotient for comparison to the benzo(a)pyrene cleanup level.
CPOC = conditional point of compliance (i.e., the property boundary).
NA = not applicable. Deep groundwater samples will not be analyzed for these indicator hazardous substances.
PCP = pentachlorophenol.
ug/L = micrograms per liter.
*The approximate minimum straight-line distance from the sentry well to the downgradient CPOC (i.e., the property boundary).

Table 4
Remediation Levels by Distance
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

		Indicator Hazardous Substance:	Arsenic	Benzene	Chromium (VI)	Copper	cPAHs	Ethyl-benzene	Pentachloro-phenol	Xylenes
		CUL (ug/L):	5	51	50	2.4	0.1	2100	3	1000
Distance from CPOC (feet)*	Travel Time to CPOC—Shallow Aquifer (years)	Travel Time to CPOC—Deep Aquifer (years)	Remediation Level (ug/L)							
25	3	1	10	100	100	5.0	0.20	4400	6.2	2000
50	7	2	11	120	110	5.6	0.23	4900	7.1	2300
75	10	3	13	130	130	6.3	0.26	5500	8	2600
100	13	4	14	140	140	7.0	0.29	6100	9	2900
125	16	5	15	160	150	8	0.31	6600	10	3100
150	20	7	17	170	170	8	0.34	7100	10	3400
175	23	8	18	180	180	9	0.36	7600	10	3600
200	26	9	19	190	190	9	0.38	8000	11	3800
225	30	10	20	200	200	10	0.40	8400	12	4000
250	33	11	21	210	210	10	0.42	8800	12	4200
275	36	12	22	220	220	10	0.44	9200	13	4400
300	39	13	22	230	220	11	0.45	9600	13	4500
325	43	14	23	240	230	11	0.47	9900	14	4700
350	46	15	24	250	240	11	0.49	10000	14	4900
375	49	16	25	250	250	12	0.50	10000	15	5000
400	53	17	26	260	260	12	0.52	10000	15	5200
425	56	18	26	270	260	12	0.53	11000	16	5300
450	59	20	27	280	270	13	0.55	11000	16	5500
475	63	21	28	280	280	13	0.56	11000	16	5600
500	66	22	28	290	280	13	0.57	12000	17	5700
525	69	23	29	300	290	14	0.59	12000	17	5900
550	72	24	30	300	300	14	0.60	12000	18	6000
575	76	25	30	310	300	14	0.61	12000	18	6100
600	79	26	31	320	310	15	0.63	13000	18	6300

Table 4
Remediation Levels by Distance
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

		Indicator Hazardous Substance:	Arsenic	Benzene	Chromium (VI)	Copper	cPAHs	Ethyl-benzene	Pentachloro-phenol	Xylenes
		CUL (ug/L):	5	51	50	2.4	0.1	2100	3	1000
Distance from CPOC (feet)*	Travel Time to CPOC—Shallow Aquifer (years)	Travel Time to CPOC—Deep Aquifer (years)	Remediation Level (ug/L)							
625	82	27	32	320	320	15	0.64	13000	19	6400
650	86	28	32	330	320	15	0.65	13000	19	6500
675	89	29	33	340	330	16	0.66	14000	20	6600
700	92	30	33	340	330	16	0.67	14000	20	6700
725	95	32	34	350	340	16	0.69	14000	20	6900
750	99	33	35	350	350	16	0.70	14000	21	7000
775	102	34	35	360	350	17	0.71	14000	21	7100
800	105	35	36	360	360	17	0.72	15000	21	7200
825	109	36	36	370	360	17	0.73	15000	22	7300
850	112	37	37	380	370	17	0.74	15000	22	7400
875	115	38	37	380	370	18	0.75	15000	22	7500
900	118	39	38	390	380	18	0.76	16000	22	7600
925	122	40	38	390	380	18	0.77	16000	23	7700
950	125	41	39	400	390	18	0.78	16000	23	7800
975	128	42	39	400	390	19	0.79	16000	23	7900
1000	132	43	40	410	400	19	0.80	16000	24	8000
1025	135	45	40	410	400	19	0.81	17000	24	8100
1050	138	46	41	420	410	19	0.82	17000	24	8200
1075	141	47	41	420	410	20	0.83	17000	25	8300
1100	145	48	42	430	420	20	0.84	17000	25	8400
1125	148	49	42	430	420	20	0.85	17000	25	8500
1150	151	50	43	430	430	20	0.86	18000	25	8600
1175	155	51	43	440	430	20	0.87	18000	26	8700
1200	158	52	44	440	440	21	0.88	18000	26	8800

Table 4
Remediation Levels by Distance
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

		Indicator Hazardous Substance:	Arsenic	Benzene	Chromium (VI)	Copper	cPAHs	Ethyl-benzene	Pentachloro-phenol	Xylenes
		CUL (ug/L):	5	51	50	2.4	0.1	2100	3	1000
Distance from CPOC (feet)*	Travel Time to CPOC— Shallow Aquifer (years)	Travel Time to CPOC— Deep Aquifer (years)	Remediation Level (ug/L)							
1225	161	53	44	450	440	21	0.88	18000	26	8800
1250	164	54	44	450	440	21	0.89	18000	26	8900
1275	168	55	45	460	450	21	0.90	19000	27	9000
1300	171	57	45	460	450	21	0.91	19000	27	9100
1325	174	58	46	470	460	22	0.92	19000	27	9200
1350	178	59	46	470	460	22	0.93	19000	27	9300
1375	181	60	47	470	470	22	0.94	19000	28	9400
1400	184	61	47	480	470	22	0.94	19000	28	9400
1425	188	62	47	480	470	22	1.0	20000	28	9500
1450	191	63	48	490	480	23	1.0	20000	28	9600
1475	194	64	48	490	480	23	1.0	20000	29	9700
1500	197	65	49	500	490	23	1.0	20000	29	9800

NOTES:

The travel times differ between the deep and shallow aquifers, but the remediation levels at a given distance are the same and apply to both the shallow and deep aquifers.

chromium (VI) = hexavalent chromium.

cPAH = carcinogenic polycyclic aromatic hydrocarbons. Calculated as the toxic equivalency quotient for comparison to the benzo(a)pyrene cleanup level.

CPOC = conditional point of compliance (i.e., the property boundary).

CUL = cleanup level.

ug/L = micrograms per liter.

*The minimum straight-line to the downgradient CPOC (i.e., the property boundary).

Table 5
Groundwater Monitoring Network
McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

				Stage of Monitoring[a,b]			
				Compliance Monitoring Network (Figure 5)			Final Closure Monitoring Network (Figure 6)[d]
Well ID	Aquifer	Well Type	Water Level Monitoring Network (Figure 4)[c]	Protection	Performance	Confirmational	
HW-01	Shallow	Horizontal Recovery Well		X	X	X	X
MW-1	Shallow	Other Monitoring Well	X				X
MW-10	Shallow	Other Monitoring Well	X				X
MW-11	Shallow	Other Monitoring Well	X				X
MW-12	Shallow	Other Monitoring Well	X				X
MW-13	Shallow	Other Monitoring Well	X				X
MW-14	Deep	Source Area Well	X	X	X	X	X
MW-15	Shallow	Other Monitoring Well	X				X
MW-16	Shallow	Other Monitoring Well	X				X
MW-17	Shallow	Other Monitoring Well	X				X
MW-18	Deep	Sentry Well	X	X	X	X	X
MW-19	Shallow	Sentry Well	X	X	X	X	X
MW-2	Shallow	Other Monitoring Well	X				X
MW-20	Shallow	Sentry Well	X	X	X	X	X
MW-3	Shallow	Source Area Well	X	X	X	X	X
MW-4	Shallow	Sentry Well	X	X	X	X	X
MW-5	Shallow	Other Monitoring Well	X				X
MW-6	Shallow	Other Monitoring Well	X				X
MW-7	Deep	Sentry Well	X	X	X	X	X
MW-8	Shallow	Source Area Well	X	X	X	X	X
MW-9	Shallow	Other Monitoring Well	X				X
UPRR-MW-29[b]	Shallow	Other Monitoring Well	X	[b]	[b]	[b]	X

NOTES:

CULs = cleanup levels.

RELs = remediation levels.

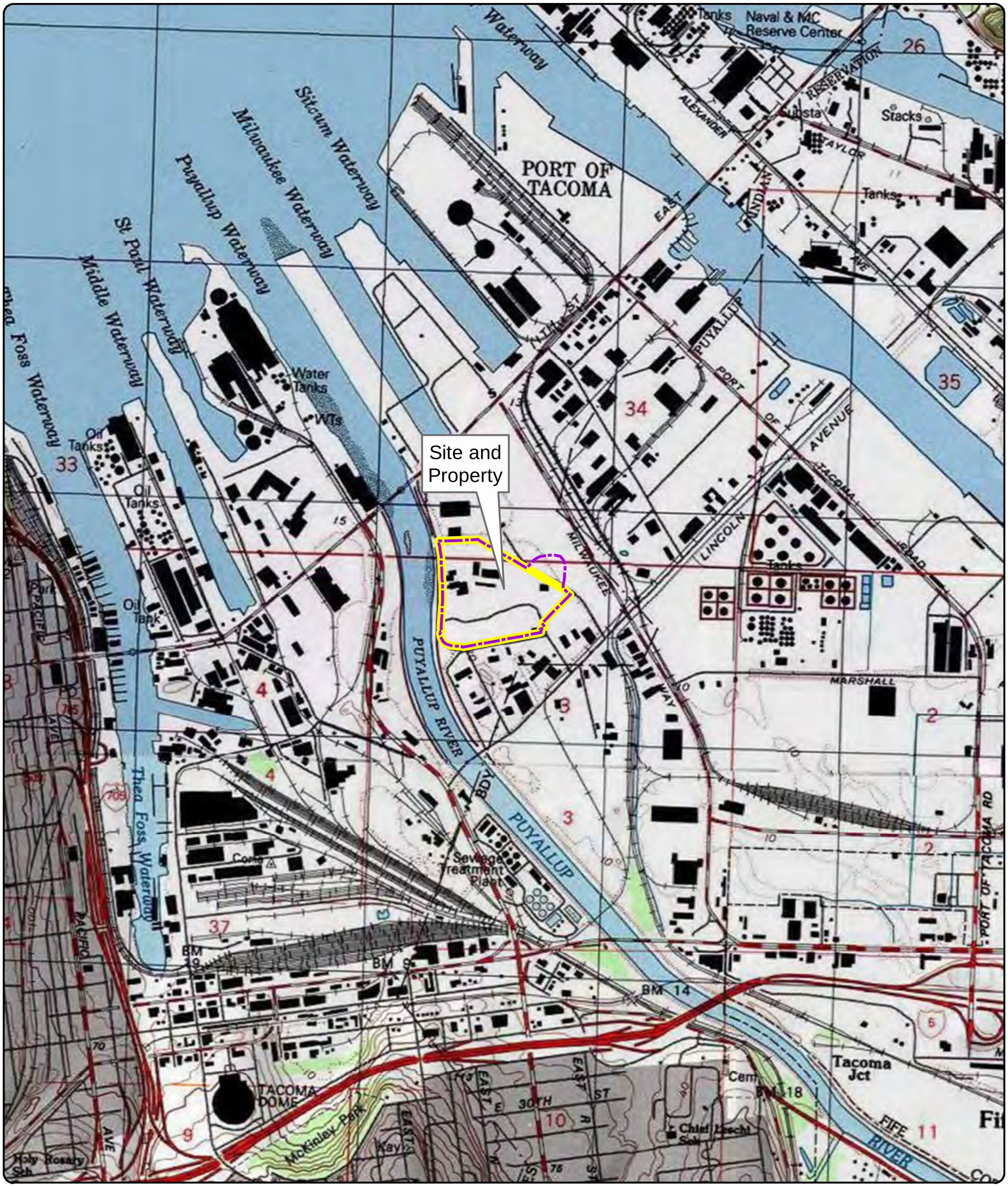
[a]Source area wells, sentry wells, and the horizontal recovery well will be monitored for compliance with RELs during all stages of monitoring. However, in order for the monitoring program to be terminated, a demonstration of compliance with CULs must be made for the "Final Closure Monitoring Network" wells (includes source area wells, sentry wells, the horizontal recovery well, and "Other Monitoring Wells").

[b]Port of Tacoma property well, UPRR-MW-29, is not a sentry well and is not included in the compliance monitoring network. It will be monitored during the "Protection," "Performance," and "Confirmational" stages of monitoring to evaluate indicator hazardous substance concentration and hydraulic gradient trends, but will not be evaluated for compliance with RELs or CULs. However, this well is included in the final closure monitoring network and will be monitored for compliance with CULs during the "Final Closure" stage of monitoring.

[c]Water levels will be measured in these wells during all stages of monitoring.

[d]All remaining Site monitoring wells will be monitored during the final closure monitoring stage, which may include some or all of the monitoring wells listed here.

FIGURES



Site Address: 1640 East Marc Street, Tacoma, Washington
Source: US Geological Survey (1990) 7.5-minute topographic quadrangle: Tacoma North
Section 3, Township 20 North, Range 3 East and
Section 34, Township 21 North, Range 3 East

Legend

Site Boundary

Property Boundary

Note: The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero arsenic concentration contour as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 1,000 2,000
Feet

Figure 1
Site Location

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

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Project: 9081.01.04-04 Produced By: rmaronn Approved By: hhirsch Print Date: 9/17/2014 Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CMP\Projects\Fig1_Site Location.mxd

Figure 2
Site Features

McFarland Cascade Pole
and Lumber Company
Tacoma, Washington

Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary
- Protective Cap (Currently Paved) and Soil Restricted Area

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. PCP = pentachlorophenol.
4. SWTS = stormwater treatment system.
5. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property, in the vicinity of monitoring well UPRR-MW-29, is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Project: 9081.01.04-00 Produced By: apadilla Approved By: hhirsch Print Date: 10/16/2014 Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CMP\Projects\Fig2_Site Features.mxd

Figure 3
Groundwater Exceedances 2004 to 2015

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

Exceedances

- Arsenic—5 ug/L CUL
- Copper—2.4 ug/L CUL
- PCP—3 ug/L CUL
- cPAH TEQ—0.1 ug/L CUL
- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary

Notes:
1. This figure shows indicator hazardous substances for which the maximum detected concentration observed in groundwater was above CULs. Data from the four most recent monitoring events conducted between 2004 and 2015 for each well location were evaluated. During the 2004 to 2015 timeframe, monitoring wells MW-1, MW-19, and MW-20 were monitored only once, and MW-4 was monitored only twice.
2. Samples have not been collected from monitoring well location MW-11 since 2002.
3. Hexavalent chromium, benzene, ethylbenzene, and xylenes were below their respective cleanup levels during the four most recent monitoring events.
4. Total and dissolved metals were analyzed in some locations. When both were available, the greater of the two was used.
5. cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.
6. CUL = cleanup level.
7. PCP = pentachlorophenol.
8. ug/L = micrograms per liter.
9. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI.

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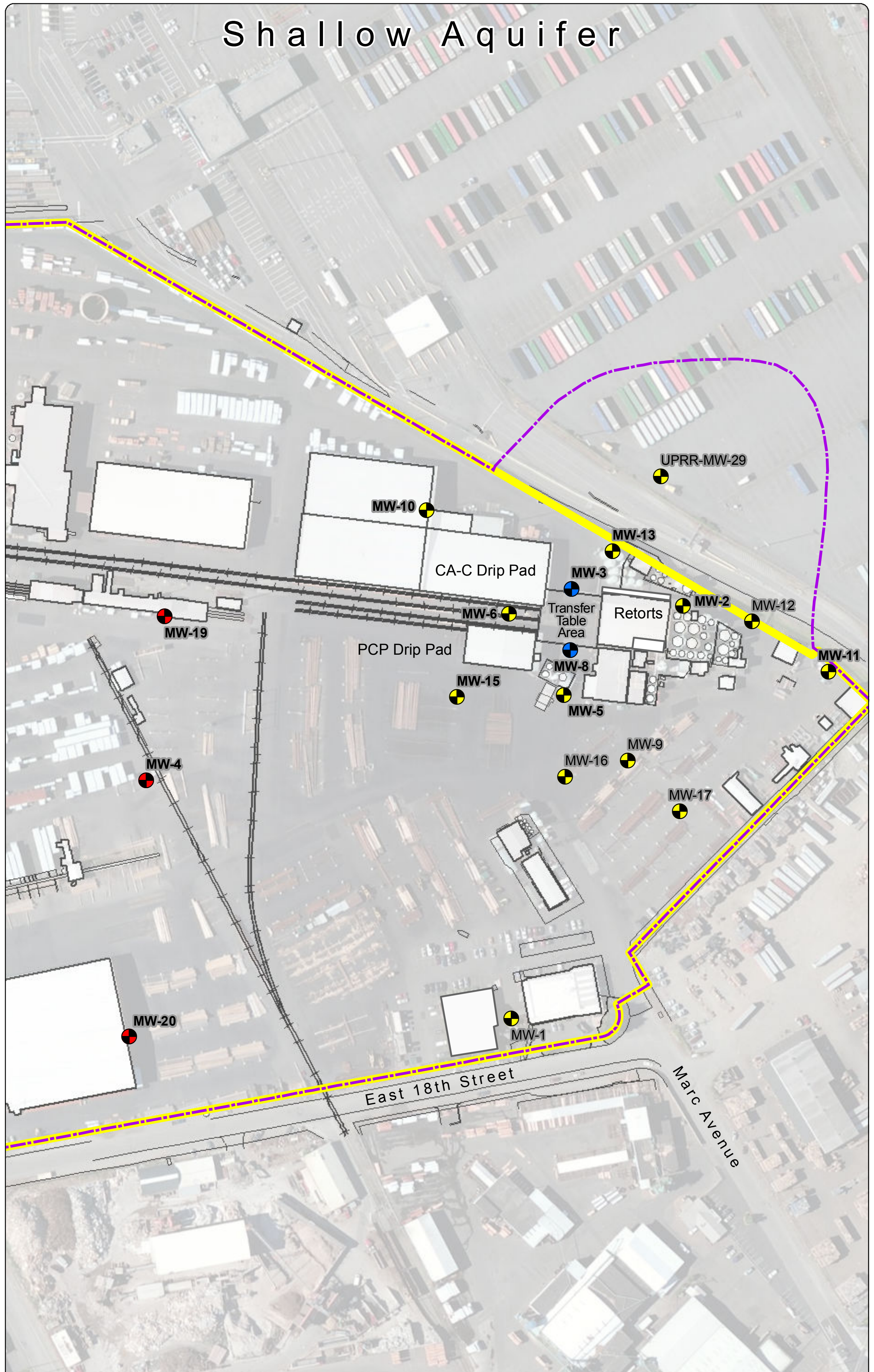
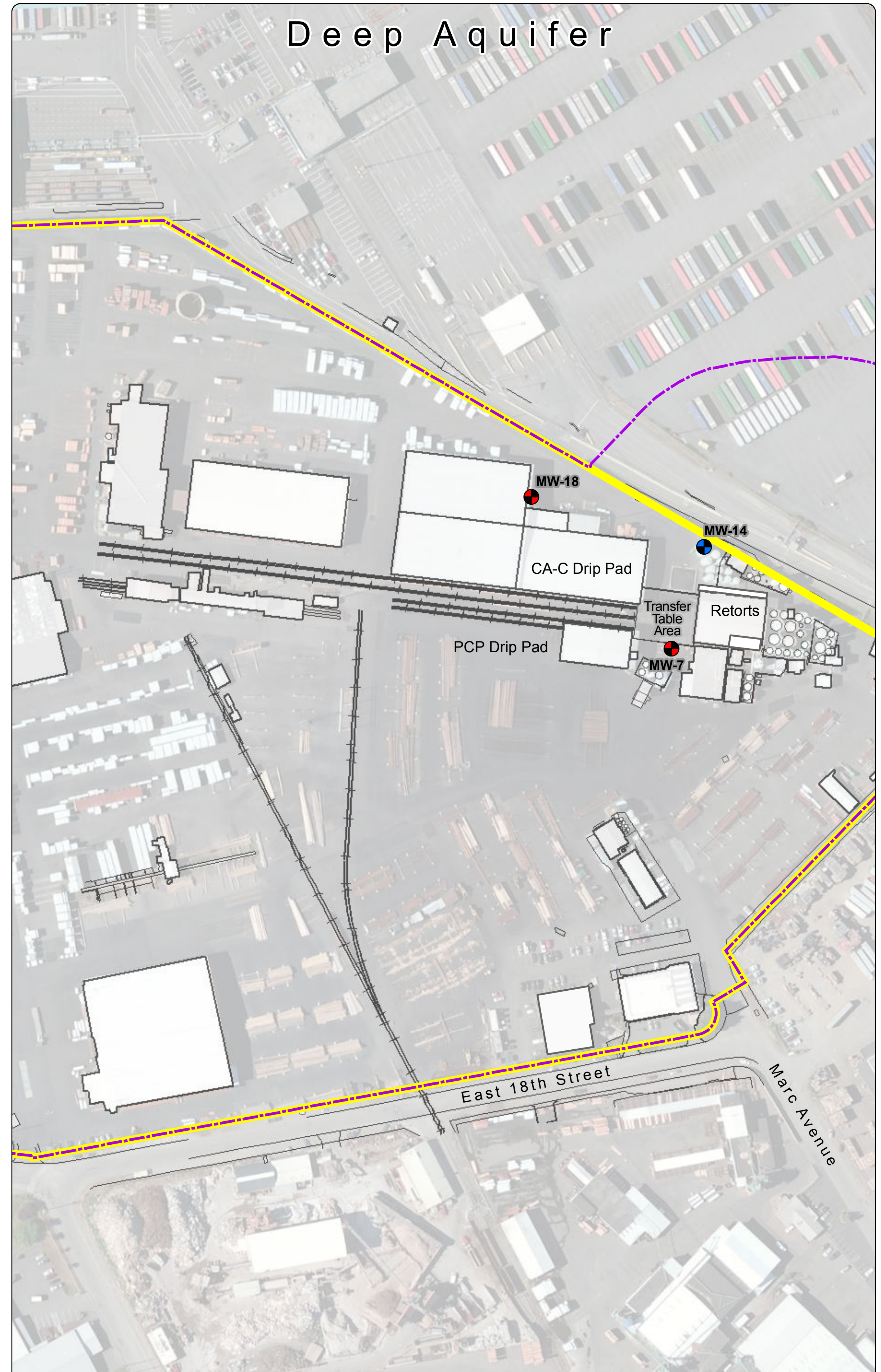
Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CMP\Projects\Fig3_Groundwater Exceedances.mxd
Print Date: 4/3/2015
Approved By: hhirsch
Produced By: jmiller
Project: 9081.01.04-04

Figure 4
Water Level Monitoring Network

McFarland Cascade Pole and Lumber Company
Tacoma, Washington





Legend

- Railroad
- Site Boundary
- Property Boundary

Water Level Monitoring Well Network Includes:

- Sentry Well
- Source Area Well
- Other Monitoring Well

Notes:
1. CA-C = copper azole - type C.
2. PCP = pentachlorophenol.

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Figure 5
Compliance Monitoring Network

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

- Railroad
- Site Boundary
- Property Boundary

Compliance Monitoring Network Includes:

- Sentry Well
- Source Area Well

Notes:
1. CA-C = copper azole - type C.
2. PCP = pentachlorophenol.
3. Water levels will not be monitored in the horizontal recovery well (HW-01).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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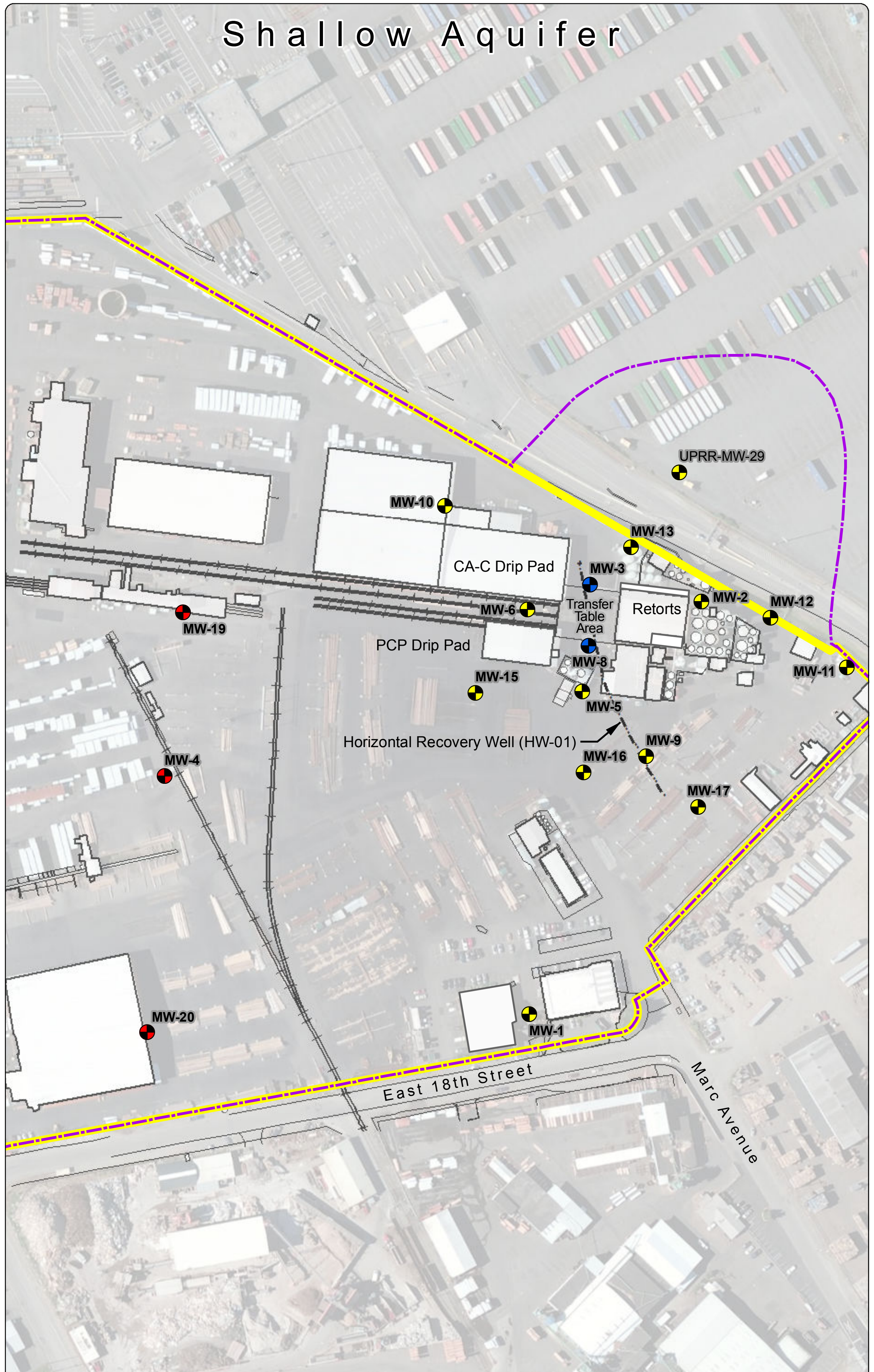
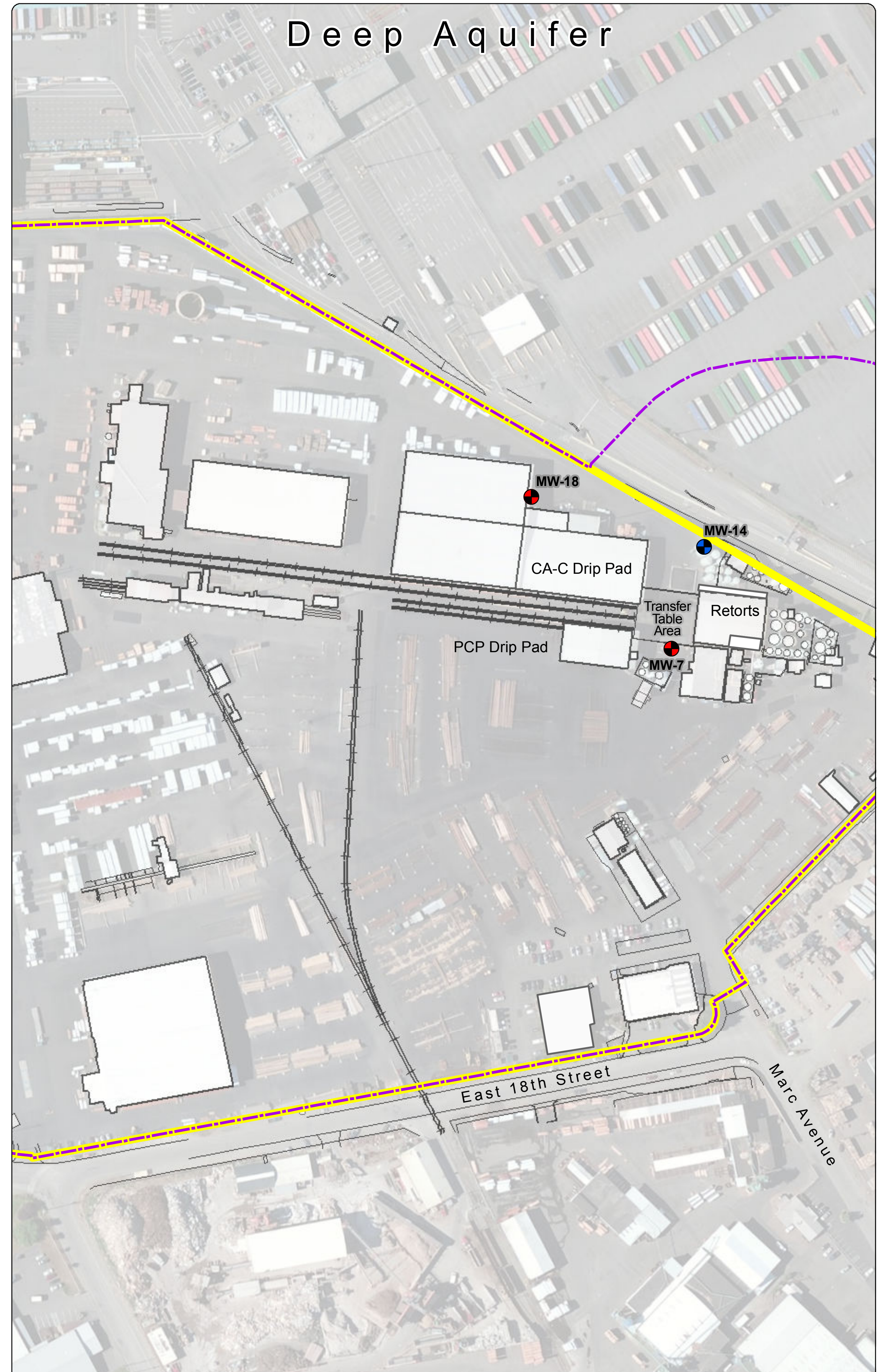
Figure 6
Final Closure Monitoring Network

McFarland Cascade Pole and Lumber Company
Tacoma, Washington





Legend

- Railroad
- Site Boundary
- Property Boundary

Final Confirmation Monitoring Network Includes:

- Sentry Well
- Source Area Well
- Other Monitoring Well

Notes:
1. CA-C = copper azole - type C.
2. PCP = pentachlorophenol.
3. Water levels will not be monitored in the horizontal recovery well (HW-01).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Project: 9081.01.04-00 Produced By: jschane Approved By: hhirsch Print Date: 8/4/2015 Path: X:\0999.01 Cascade Pole\01_MTCA Closure\02_CMP\Projects\Fig6_Final Closure Monitoring Network.mxd

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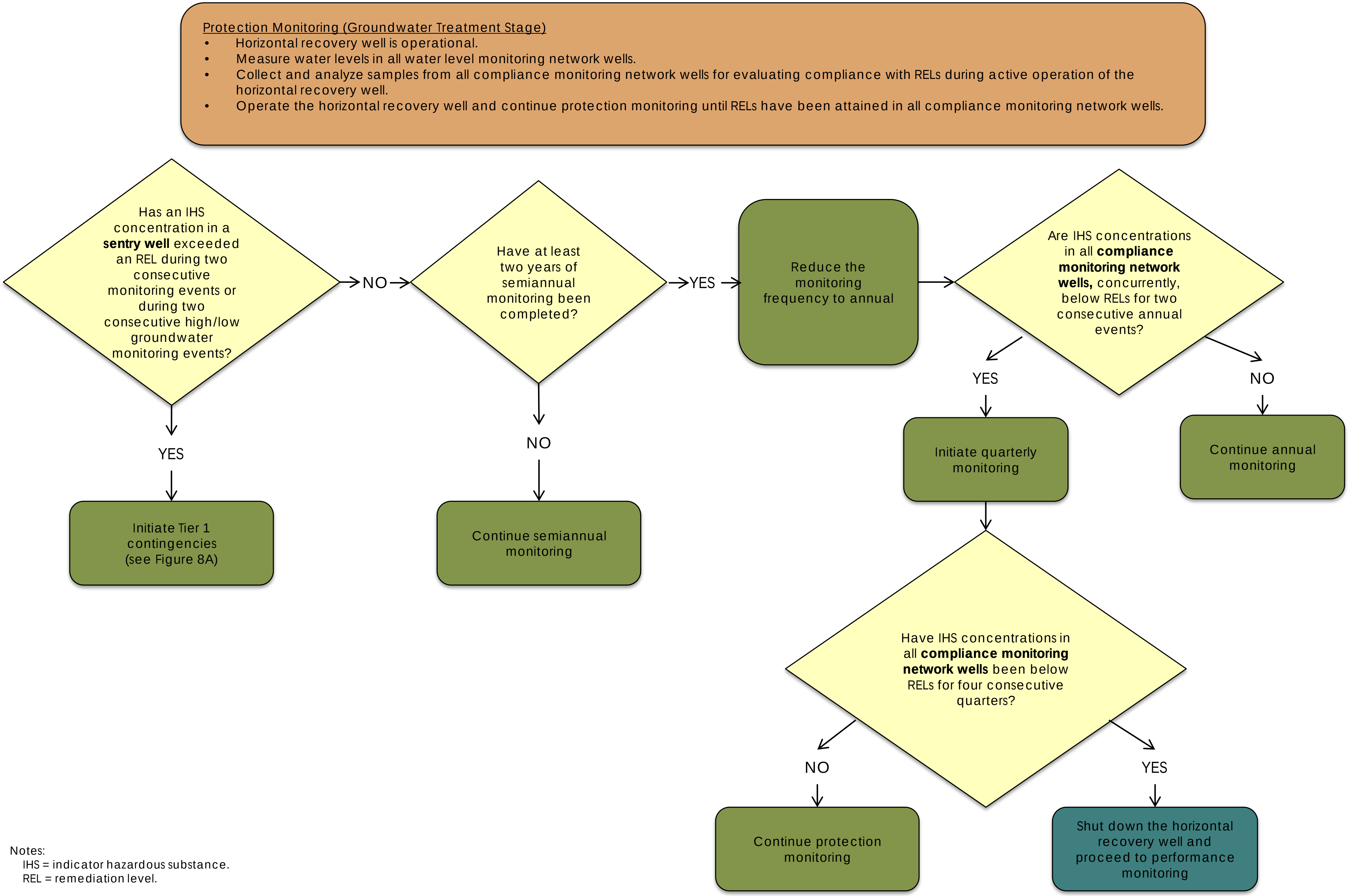
Figure 7A—Protection Monitoring
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

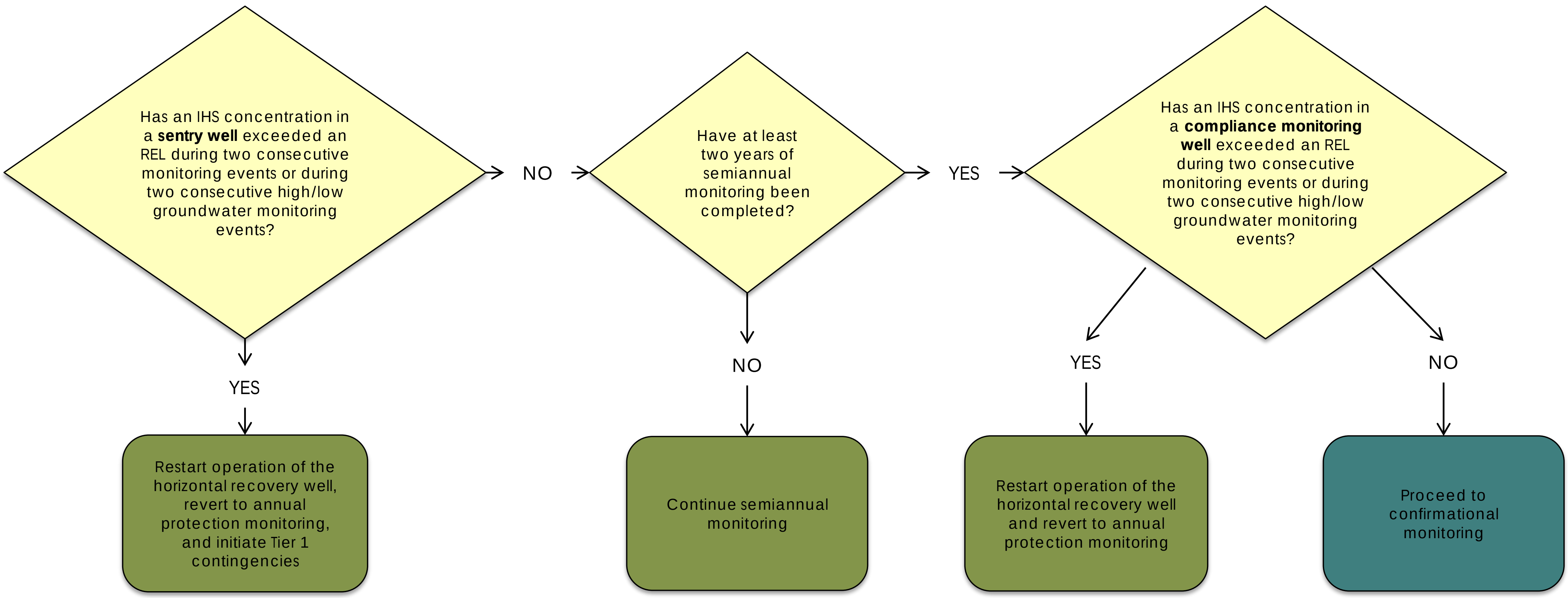


Notes:
IHS = indicator hazardous substance.
REL = remediation level.

Figure 7B—Performance Monitoring
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Performance Monitoring (Post Groundwater Treatment Stage)

- Horizontal recovery well has been shut down.
- Measure water levels in all water level monitoring network wells.
- Collect and analyze samples from all compliance monitoring network wells on a semiannual basis for evaluating compliance with RELs following shutdown of the horizontal recovery well.
- Continue performance monitoring until RELs have been attained in all compliance monitoring network wells.

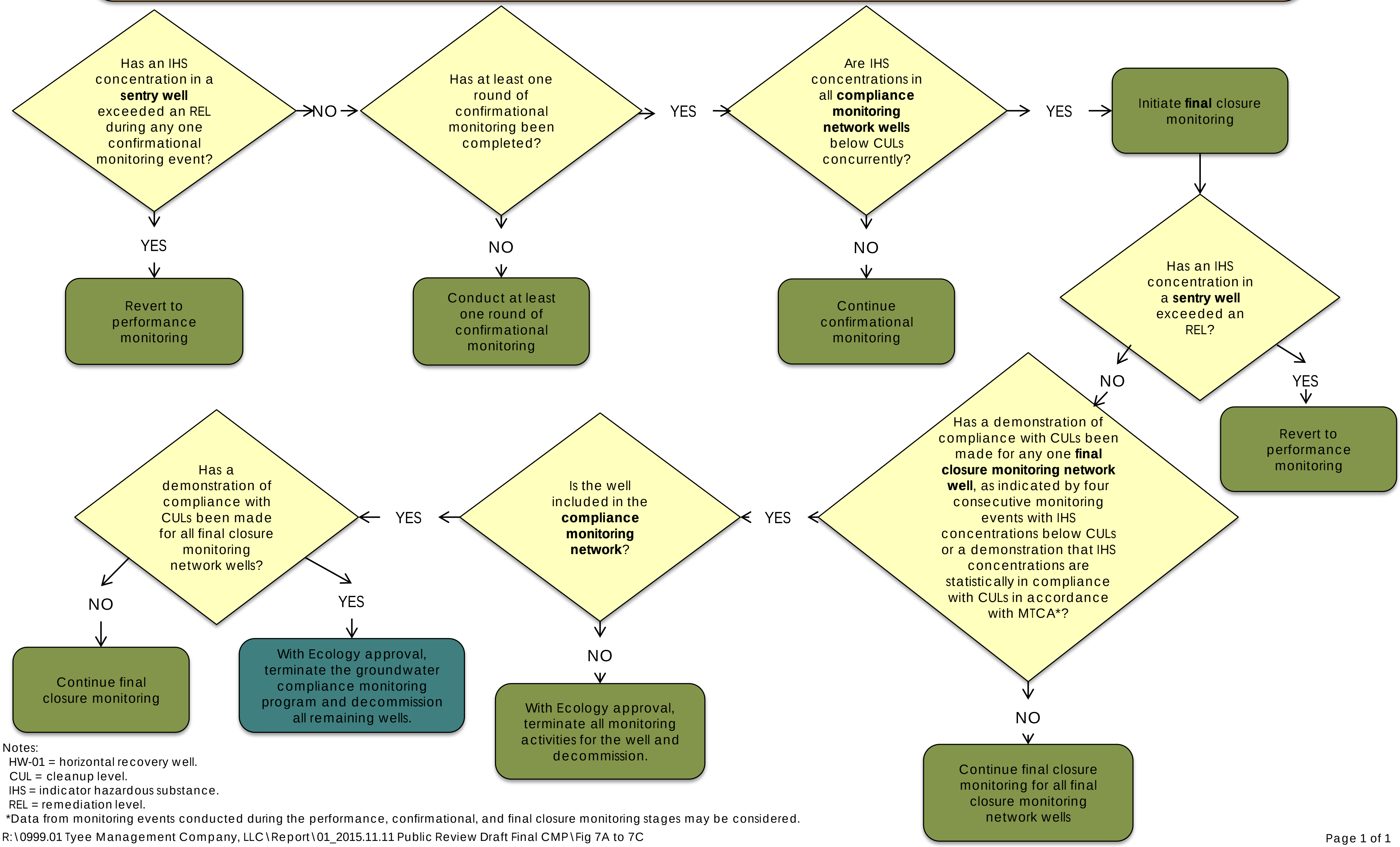


Notes:
IHS = indicator hazardous substance.
REL = remediation level.

Figure 7C—Confirmational Monitoring
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

<u>Confirmational Monitoring (Long-Term Compliance Monitoring Stage)</u>

- Horizontal recovery well has been shut down.
- Measure water levels in all remaining water level monitoring network wells (wells used only for monitoring water levels may be decommissioned).
- Collect and analyze samples from all compliance monitoring network wells to evaluate long-term compliance with RELs following shutdown of the horizontal recovery well.
- Initiate final closure monitoring once CULs have been attained in all compliance monitoring network wells.
- Collect and analyze samples from all final closure monitoring network wells to evaluate compliance with CULs.
- Terminate the monitoring program and decommission all wells once it has been demonstrated that CULs have been met in all final closure monitoring wells.



Notes:
HW-01 = horizontal recovery well.
CUL = cleanup level.
IHS = indicator hazardous substance.
REL = remediation level.
*Data from monitoring events conducted during the performance, confirmational, and final closure monitoring stages may be considered.

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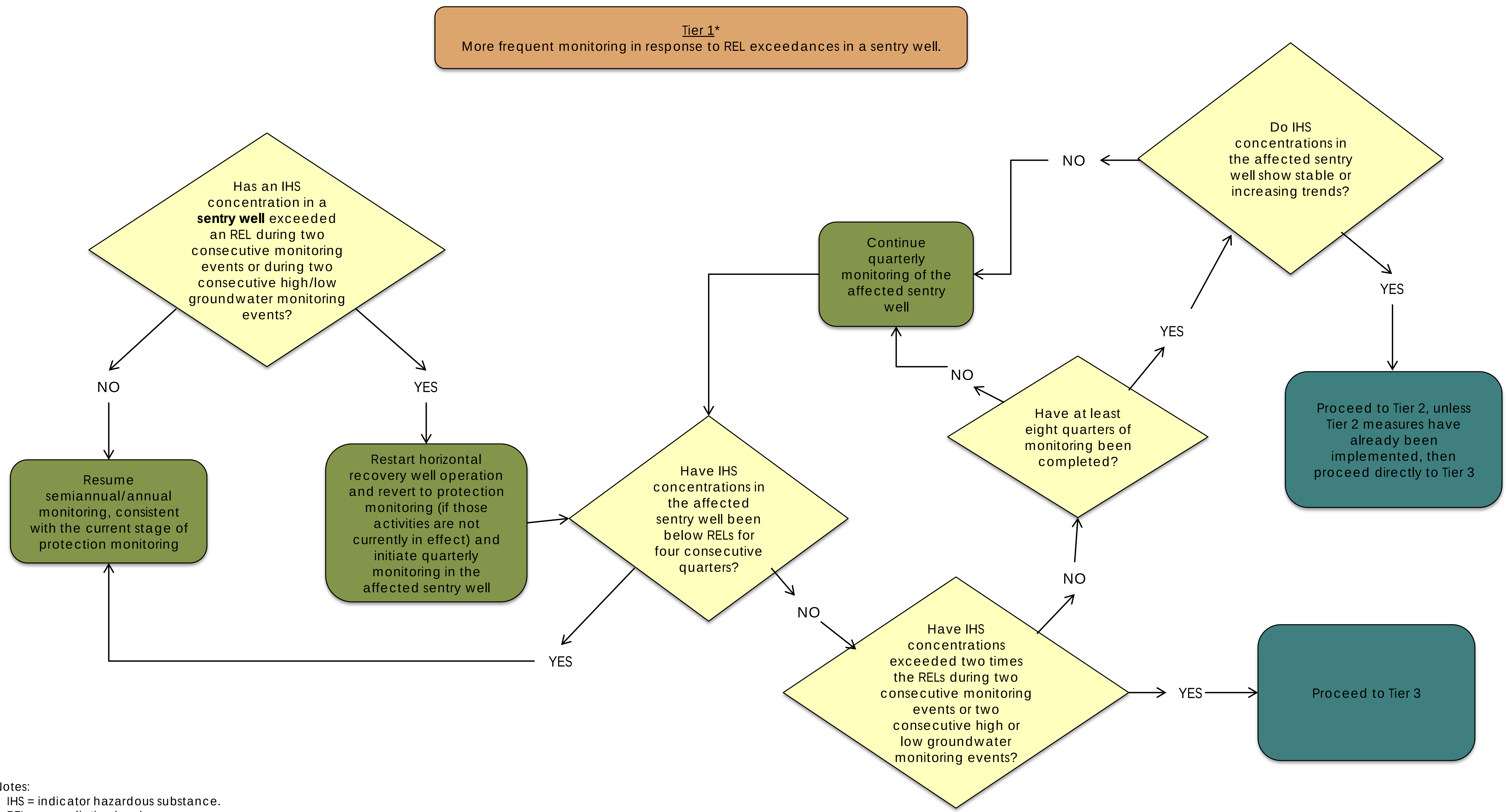
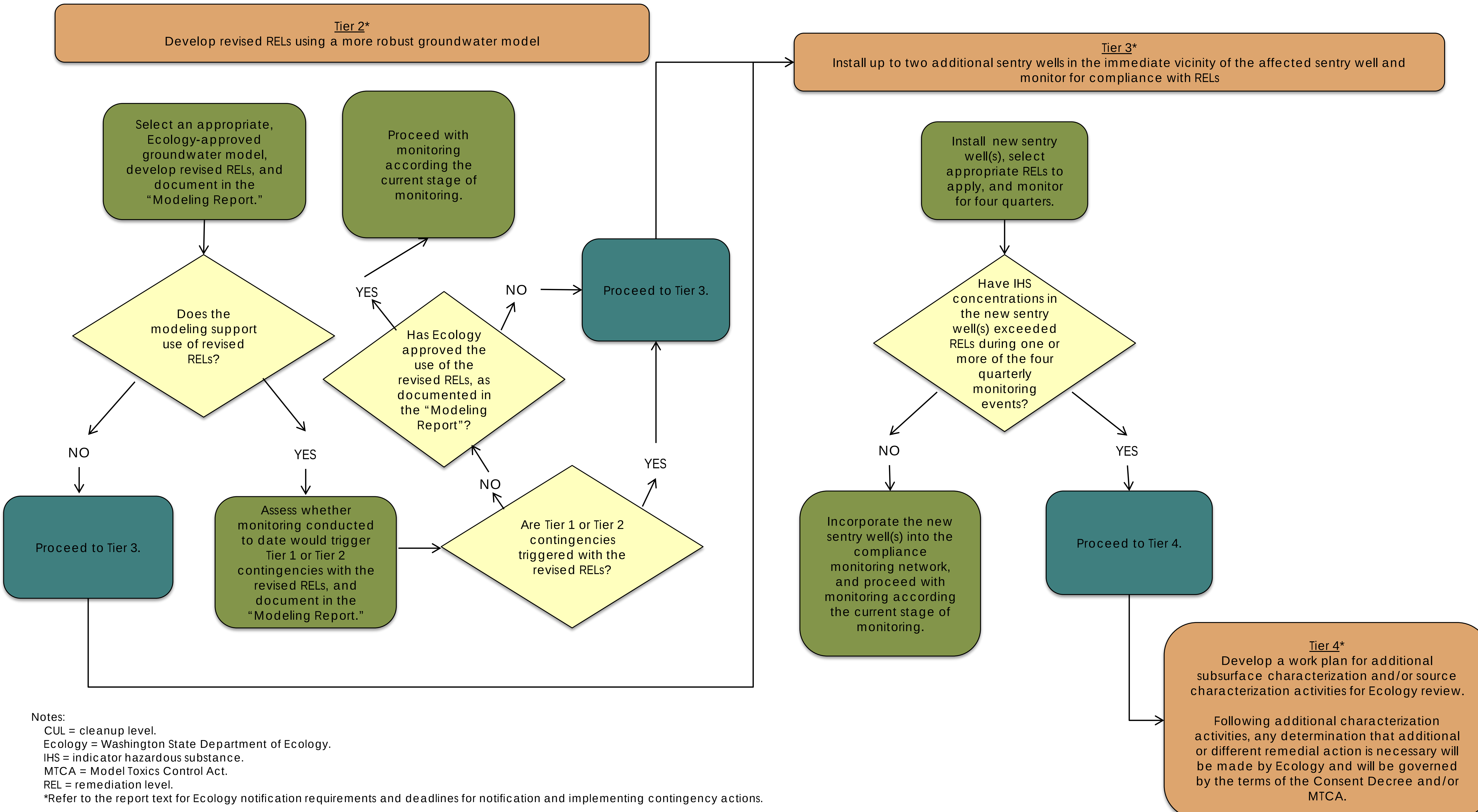
Figure 8A—Contingency Measures: Tier 1
McFarland Cascade Pole and Lumber Company
Tacoma, Washington



Notes:
IHS = indicator hazardous substance.
REL = remediation level.
*Refer to the report text for Ecology notification requirements and deadlines for notification and implementing contingency actions.

Figure 8B—Contingency Measures: Tiers 2 through 4
McFarland Cascade Pole and Lumber Company
Tacoma, Washington



Notes:
CUL = cleanup level.
Ecology = Washington State Department of Ecology.
IHS = indicator hazardous substance.
MTCA = Model Toxics Control Act.
REL = remediation level.
*Refer to the report text for Ecology notification requirements and deadlines for notification and implementing contingency actions.

APPENDIX A

GROUNDWATER-LEVEL RESULTS

Table 1 Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 21, 1999		February 11, 1999		March 31, 1999		April 30, 1999		May 31, 1999		June 29, 1999		August 6, 1999		August 31, 1999		September 30, 1999		October 22, 1999		October 29, 1999		November 30, 1999		December 29, 1999	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	3.80	7.95	3.75	8.00	3.82	7.93	4.34	7.41	4.76	6.99	5.16	6.59	5.58	6.17	5.90	13.48	6.22	13.16	6.30	13.08	6.60	12.78	5.05	14.33	4.81	14.57
MW-3	20.16	4.15	8.85	3.86	9.14	4.14	8.86	4.94	8.06	5.11	7.89	6.00	7.00	6.50	6.50	6.82	13.34	7.08	13.08	7.20	12.96	7.46	12.70	6.61	13.55	6.27	13.89
MW-4	19.00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	3.58	9.01	3.88	8.71	4.36	8.23	5.14	7.45	5.12	7.47	6.10	6.49	6.47	6.12	6.81	13.36	7.18	12.99	7.14	13.03	7.13	13.04	5.10	15.07	5.78	14.39
MW-7	19.44	6.91	4.87	6.85	4.93	7.20	4.58	8.12	3.66	8.30	3.48	8.59	3.19	8.86	2.92	9.26	10.18	9.66	9.78	9.80	9.64	9.60	9.84	8.04	11.40	7.82	11.62
MW-8	21.49	4.96	8.93	5.63	8.26	6.10	7.79	6.54	7.35	7.16	6.73	7.43	6.46	7.92	5.97	8.30	13.19	8.74	12.75	8.68	12.81	8.90	12.59	8.33	13.16	8.06	13.43
MW-9	18.44	4.02	7.27	4.13	7.16	4.10	7.19	4.31	6.98	4.65	6.64	5.17	6.12	5.16	6.13	5.39	13.05	5.68	12.76	5.90	12.54	5.98	12.46	5.56	12.88	5.33	13.11
MW-10	19.57	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	4.82	8.13	4.69	8.26	4.76	8.19	5.06	7.89	5.30	7.65	5.58	7.37	6.02	6.93	6.34	13.45	6.66	13.13	6.66	13.13	5.94	13.85	5.17	14.62	5.26	14.53
MW-13	19.81	3.68	9.27	3.89	9.06	4.04	8.91	---	---	---	---	5.68	7.27	6.11	6.84	6.38	13.43	NM	NM	6.80	13.01	9.82	9.99	5.75	14.06	5.34	14.47
MW-14	19.76	6.76	6.21	6.62	6.35	7.18	5.79	---	---	---	---	8.68	4.29	9.07	3.90	9.46	10.30	NM	NM	9.99	9.77	9.86	9.90	NM	NM	7.81	11.95

Table 1 Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 24, 2000		February 24, 2000		March 24, 2000		April 28, 2000		May 24, 2000		June 30, 2000	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	5.94	13.19	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	4.46	14.92	4.36	15.02	4.24	15.14	4.70	14.68	5.10	14.28	5.54	13.84
MW-3	20.16	6.06	14.10	6.02	14.14	5.78	14.38	6.36	13.80	6.74	13.42	6.58	13.58
MW-4	19.00	6.94	12.06	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	7.14	13.03	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	5.36	14.81	5.55	14.62	4.89	15.28	6.08	14.09	6.34	13.83	6.62	13.55
MW-7	19.44	7.67	11.77	7.76	11.68	7.72	11.72	8.30	11.14	8.44	11.00	8.54	10.90
MW-8	21.49	7.96	13.53	7.84	13.65	7.59	13.90	7.92	13.57	8.26	13.23	8.26	13.23
MW-9	18.44	5.24	13.20	5.23	13.21	4.80	13.64	4.46	13.98	5.29	13.15	5.26	13.18
MW-10	19.57	5.50	14.07	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	4.80	14.41	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	4.96	14.83	5.02	14.77	4.94	14.85	5.20	14.59	5.44	14.35	5.92	13.87
MW-13	19.81	4.94	14.87	4.78	15.03	4.58	15.23	5.38	14.43	5.82	13.99	6.08	13.73
MW-14	19.76	7.68	12.08	7.76	12.00	7.18	12.58	8.36	11.40	8.57	11.19	8.78	10.98

Well Number	August 1, 2000		August 31, 2000		September 29, 2000		October 31, 2000		November 30, 2000		January 5, 2001	
	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	5.82	13.56	6.18	13.20	6.40	12.98	5.96	13.42	5.66	13.72	5.48	13.90
MW-3	6.72	13.44	7.32	12.84	7.61	12.55	7.31	12.85	7.40	12.76	7.28	12.88
MW-4	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	6.90	13.27	7.24	12.93	7.50	12.67	7.24	12.93	7.01	13.16	7.20	12.97
MW-7	8.90	10.54	9.08	10.36	9.38	10.06	9.36	10.08	9.27	10.17	9.12	10.32
MW-8	8.40	13.09	8.83	12.66	9.18	12.31	8.95	12.54	9.01	12.48	8.86	12.63
MW-9	5.42	13.02	5.70	12.74	5.98	12.46	5.92	12.52	5.89	12.55	5.78	12.66
MW-10	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	6.24	13.55	6.46	13.33	6.82	12.97	6.12	13.67	5.67	14.12	5.26	14.53
MW-13	6.30	13.51	6.71	13.10	6.99	12.82	6.70	13.11	6.50	13.31	6.44	13.37
MW-14	9.14	10.62	9.30	10.46	9.60	10.16	9.52	10.24	9.39	10.37	9.20	10.56

Table 1 Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 31, 2001		February 27, 2001		March 27, 2001		April 30, 2001		May 30, 2001		June 30, 2001		August 1, 2001		August 31, 2001		September 27, 2001		October 31, 2001		November 30, 2001		January 3, 2002	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	NM	NM	2.05	17.08	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	5.53	13.85	5.50	13.88	5.30	14.08	5.20	14.18	5.52	13.86	5.56	13.82	6.10	13.28	5.96	13.42	6.16	13.22	5.84	13.54	4.88	14.50	4.46	14.92
MW-3	20.16	7.15	13.01	7.08	13.08	6.94	13.22	6.80	13.36	6.82	13.34	7.00	13.16	7.24	12.92	7.28	12.88	7.49	12.67	7.50	12.66	6.39	13.77	5.76	14.40
MW-4	19.00	NM	NM	8.02	10.98	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	NM	NM	8.15	12.02	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	6.86	13.31	6.56	13.61	6.68	13.49	6.46	13.71	6.57	13.60	6.75	13.42	7.21	12.96	7.28	12.89	7.40	12.77	6.98	13.19	5.45	14.72	5.05	15.12
MW-7	19.44	9.15	10.29	9.14	10.30	8.89	10.55	8.54	10.90	8.81	10.63	8.88	10.56	9.00	10.44	9.04	10.40	9.21	10.23	9.23	10.21	7.70	11.74	7.60	11.84
MW-8	21.49	8.76	12.73	8.68	12.81	8.54	12.95	8.44	13.05	8.50	12.99	8.51	12.98	8.84	12.65	8.80	12.69	9.02	12.47	9.14	12.35	7.80	13.69	7.76	13.73
MW-9	18.44	5.67	12.77	5.64	12.80	5.48	12.96	5.44	13.00	5.45	12.99	5.60	12.84	5.76	12.68	5.76	12.68	5.95	12.49	6.12	12.32	5.64	12.80	5.20	13.24
MW-10	19.57	NM	NM	7.05	12.52	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	NM	NM	5.78	13.43	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	5.68	14.11	5.78	14.01	5.46	14.33	5.24	14.55	5.81	13.98	5.64	14.15	6.42	13.37	6.32	13.47	6.10	13.69	5.55	14.24	5.05	14.74	5.00	14.79
MW-13	19.81	6.34	13.47	6.26	13.55	6.13	13.68	6.04	13.77	6.20	13.61	6.28	13.53	6.62	13.19	6.64	13.17	6.88	12.93	6.79	13.02	5.50	14.31	4.76	15.05
MW-14	19.76	9.13	10.63	9.16	10.60	9.00	10.76	8.70	11.06	8.81	10.95	9.00	10.76	9.14	10.62	9.67	10.09	9.35	10.41	9.38	10.38	7.68	12.08	7.54	12.22

Table 1   Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 24, 2002		February 27, 2002		March 29, 2002		April 30, 2002		May 30, 2002		July 2, 2002	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	6.04	13.09	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	4.28	15.10	4.26	15.12	4.30	15.08	4.60	14.78	4.99	14.39	5.42	13.96
MW-3	20.16	5.66	14.50	5.62	14.54	5.78	14.38	5.70	14.46	6.03	14.13	6.30	13.86
MW-4	19.00	7.02	11.98	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	6.24	13.93	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	5.46	14.71	4.84	15.33	5.09	15.08	5.54	14.63	6.10	14.07	6.53	13.64
MW-7	19.44	7.78	11.66	7.60	11.84	7.90	11.54	7.94	11.50	8.21	11.23	8.68	10.76
MW-8	21.49	7.40	14.09	7.30	14.19	7.45	14.04	7.30	14.19	7.67	13.82	7.94	13.55
MW-9	18.44	4.88	13.56	4.76	13.68	5.08	13.36	4.60	13.84	4.77	13.67	5.20	13.24
MW-10	19.57	5.24	14.33	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	5.18	14.03	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	4.96	14.83	4.92	14.87	5.10	14.69	5.20	14.59	5.36	14.43	5.79	14.00
MW-13	19.81	4.48	15.33	4.62	15.19	4.70	15.11	5.00	14.81	5.54	14.27	5.88	13.93
MW-14	19.76	7.70	12.06	7.60	12.16	7.88	11.88	8.02	11.74	8.38	11.38	8.86	10.90

Well Number	July 31, 2002		August 30, 2002		September 30, 2002		October 31, 2002		November 27, 2002		December 31, 2002	
	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	5.74	13.64	6.12	13.26	6.34	13.04	6.50	12.88	6.20	13.18	5.32	14.06
MW-3	6.60	13.56	6.88	13.28	7.24	12.92	7.60	12.56	7.53	12.63	6.94	13.22
MW-4	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	NM	NM	7.00	13.17	7.33	12.84	7.72	12.45	7.25	12.92	6.60	13.57
MW-7	9.21	10.23	9.32	10.12	9.40	10.04	9.80	9.64	9.35	10.09	8.30	11.14
MW-8	8.27	13.22	8.37	13.12	8.82	12.67	9.15	12.34	9.10	12.39	8.72	12.77
MW-9	5.25	13.19	5.53	12.91	5.88	12.56	5.75	12.69	6.00	12.44	5.82	12.62
MW-10	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	8.16	11.63	6.58	13.21	6.80	12.99	6.95	12.84	6.35	13.44	5.17	14.62
MW-13	6.25	13.56	6.50	13.31	6.81	13.00	7.04	12.77	6.90	12.91	6.19	13.62
MW-14	9.50	10.26	9.45	10.31	9.60	10.16	9.93	9.83	9.50	10.26	8.45	11.31

NOTES: NM - Not measured.

Table 1-Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 30, 2003		February 27, 2003		March 14, 2003		April 28, 2003		May 29, 2003		June 30, 2003	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	6.25	12.88	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	4.78	14.60	4.92	14.46	4.56	14.82	4.59	14.79	5.11	14.27	5.66	13.72
MW-3	20.16	6.52	13.64	6.51	13.65	6.39	13.77	6.22	13.94	6.61	13.55	6.94	13.22
MW-4	19.00	7.44	11.56	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	7.40	12.77	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	6.05	14.12	6.31	13.86	6.08	14.09	7.63	12.54	6.65	13.52	6.95	13.22
MW-7	19.44	7.56	11.88	8.01	11.43	7.54	11.90	7.96	11.48	8.50	10.94	8.84	10.60
MW-8	21.49	8.38	13.11	8.31	13.18	8.16	13.33	7.94	13.55	8.10	13.39	8.33	13.16
MW-9	18.44	5.43	13.01	5.21	13.23	5.17	13.27	5.75	12.69	5.10	13.34	5.27	13.17
MW-10	19.57	8.80	10.77	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	4.93	14.28	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	5.08	14.71	5.27	14.52	4.98	14.81	5.10	14.69	5.57	14.22	5.94	13.85
MW-13	19.81	5.42	14.39	5.60	14.21	5.25	14.56	5.25	14.56	5.87	13.94	6.26	13.55
MW-14	19.76	7.48	12.28	8.07	11.69	7.63	12.13	8.00	11.76	8.62	11.14	9.02	10.74

Notes: NM - Not measured.

Well Number	PVC Elevation (feet)	July 31, 2003		August 28, 2003		September 29, 2003		October 31, 2003		November 26, 2003		December 24, 2003	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2	19.38	5.92	13.46	6.60	12.78	6.34	13.04	5.48	13.90	5.10	14.28	4.58	14.80
MW-3	20.16	7.18	12.98	7.40	12.76	7.62	12.54	7.08	13.08	6.88	13.28	6.28	13.88
MW-4	19.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-5	20.17	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-6	20.17	7.19	12.98	7.40	12.77	7.62	12.55	7.02	13.15	6.78	13.39	6.40	13.77
MW-7	19.44	8.97	10.47	9.15	10.29	9.34	10.10	8.67	10.77	8.28	11.16	7.42	12.02
MW-8	21.49	8.52	12.97	8.70	12.79	8.92	12.57	8.53	12.96	8.40	13.09	7.92	13.57
MW-9	18.44	5.43	13.01	5.60	12.84	5.74	12.70	5.52	12.92	5.40	13.04	5.06	13.38
MW-10	19.57	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-11	19.21	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-12	19.79	6.38	13.41	6.60	13.19	6.72	13.07	5.76	14.03	5.28	14.51	5.12	14.67
MW-13	19.81	6.54	13.27	6.80	13.01	7.04	12.77	6.12	13.69	5.92	13.89	5.42	14.39
MW-14	19.76	9.15	10.61	9.35	10.41	9.56	10.20	8.78	10.98	8.40	11.36	7.54	12.22

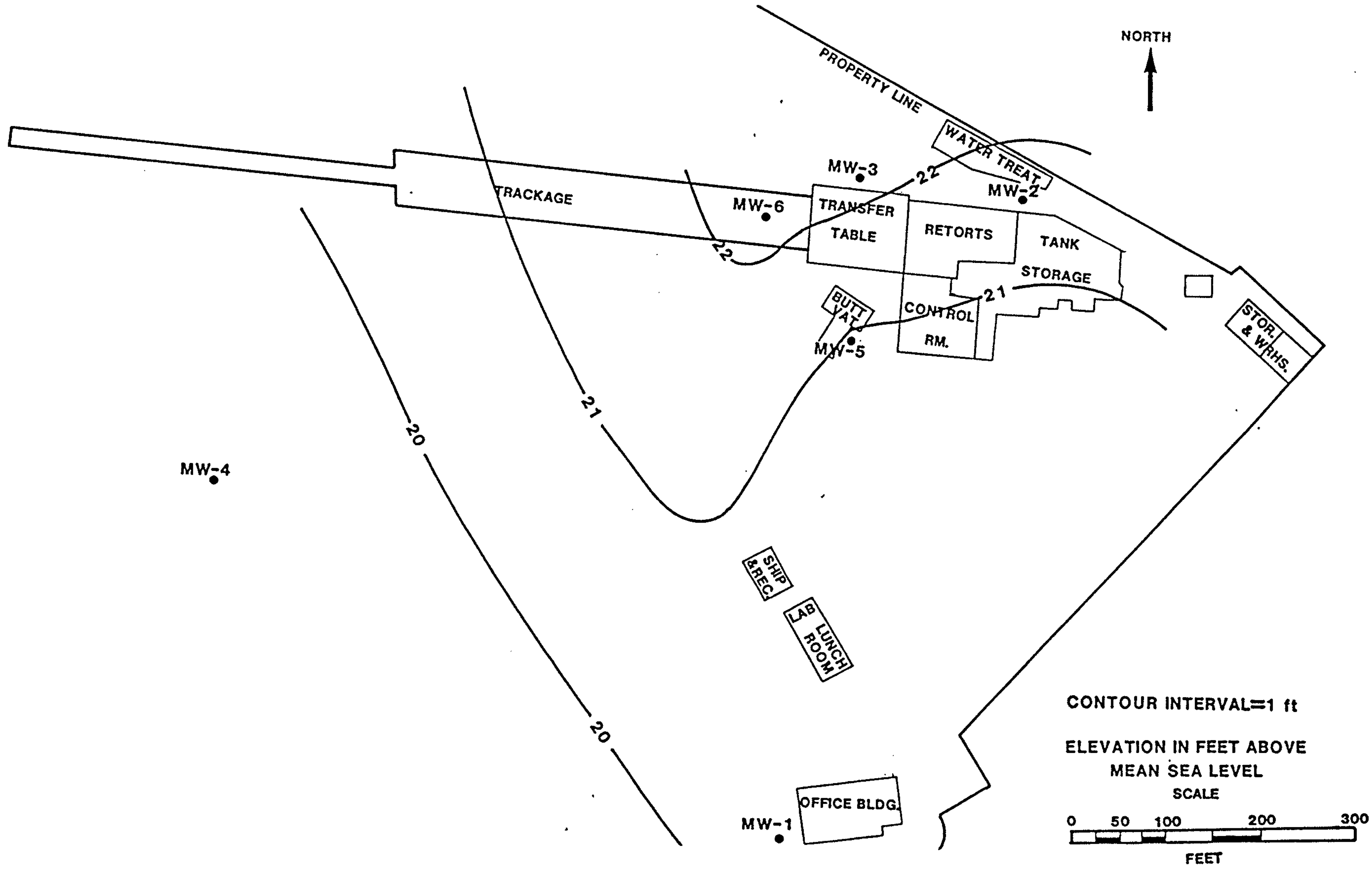
Table 1 Groundwater Elevation Data for the Cascade Pole & Lumber Company Tacoma Facility

Well Number	PVC Elevation (feet)	January 30, 2004		February 4, 2004		February 27, 2004		March 31, 2004		April 28, 2004		May 26, 2004		June 29, 2004	
		Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)	Depth to Water (feet)	Groundwater Elevation (feet MSL)
MW-1	19.13	NM	NM	5.85	13.28	NM	NM	NM	NM	NM	NM	6.35	12.78	NM	NM
MW-2	19.38	4.16	15.22	4.14	15.24	4.22	15.16	4.60	14.78	5.00	14.38	5.32	14.06	5.62	13.76
MW-3	20.16	5.70	14.46	5.75	14.41	5.74	14.42	6.80	13.36	6.42	13.74	6.65	13.51	6.86	13.30
MW-4	19.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	7.23	11.77	NM	NM
MW-5	20.17	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	7.58	12.59	NM	NM
MW-6	20.17	5.72	14.45	5.76	14.41	5.86	14.31	6.24	13.93	6.52	13.65	6.75	13.42	6.88	13.29
MW-7	19.44	7.34	12.10	7.40	12.04	7.66	11.78	8.28	11.16	7.86	11.58	8.55	10.89	8.68	10.76
MW-8	21.49	7.62	13.87	7.65	13.84	7.58	13.91	7.68	13.81	8.54	12.95	8.01	13.48	8.10	13.39
MW-9	18.44	4.62	13.82	4.56	13.88	4.46	13.98	4.54	13.90	4.94	13.50	5.12	13.32	5.16	13.28
MW-10	19.57	NM	NM	5.64	13.93	NM	NM	5.64	13.93	NM	NM	6.09	13.48	NM	NM
MW-11	19.21	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	5.98	13.23	NM	NM
MW-12	19.79	4.90	14.89	4.81	14.98	4.96	14.83	5.12	14.67	5.42	14.37	5.76	14.03	6.08	13.71
MW-13	19.81	4.66	15.15	4.65	15.16	4.78	15.03	5.32	14.49	5.70	14.11	6.00	13.81	6.26	13.55
MW-14	19.76	7.36	12.40	7.40	12.36	7.68	12.08	8.38	11.38	8.70	11.06	8.74	11.02	8.90	10.86
MW-15	19.42	NM	NM	6.87	12.55	6.80	12.62	7.10	12.32	7.36	12.06	7.45	11.97	7.56	11.86
MW-16	18.22	NM	NM	4.74	13.48	5.20	13.02	5.20	13.02	5.00	13.22	5.33	12.89	5.44	12.78
MW-17	21.04	NM	NM	8.11	12.93	8.08	12.96	8.20	12.84	8.16	12.88	8.23	12.81	8.32	12.72
MW-18	19.69	NM	NM	7.76	11.93	8.00	11.69	8.60	11.09	8.94	10.75	8.92	10.77	8.90	10.79
UPRR-29	16.50	NM	NM	0.05	16.45	NM	NM	NM	NM	NM	NM	2.60	13.90	NM	NM

NOTES: NM - Not measured.

Well Number	PVC Elevation (feet)	July 31, 2004 Depth to Water (feet)	July 31, 2004 Groundwater Elevation (feet MSL)	August 28, 2004 Depth to Water (feet)	August 28, 2004 Groundwater Elevation (feet MSL)	September 7, 2004 Depth to Water (feet)	September 7, 2004 Groundwater Elevation (feet MSL)	September 30, 2004 Depth to Water (feet)	September 30, 2004 Groundwater Elevation (feet MSL)	October 29, 2004 Depth to Water (feet)	October 29, 2004 Groundwater Elevation (feet MSL)	November 30, 2004 Depth to Water (feet)	November 30, 2004 Groundwater Elevation (feet MSL)	January 27, 2005 Depth to Water (feet)	January 27, 2005 Groundwater Elevation (feet MSL)
MW-1	19.13	NM	NM	NM	NM	6.59	12.54	NM	NM	NM	NM	NM	NM	6.44	12.69
MW-2	19.38	5.96	13.42	5.74	13.64	6.00	13.38	5.86	13.52	5.72	13.66	5.56	13.82	4.94	14.44
MW-3	20.16	7.14	13.02	7.30	12.86	7.31	12.85	7.22	12.94	7.18	12.98	7.16	13.00	6.54	13.62
MW-4	19.00	NM	NM	NM	NM	7.53	11.47	NM	NM	NM	NM	NM	NM	7.39	11.61
MW-5	20.17	NM	NM	NM	NM	7.71	12.46	NM	NM	NM	NM	NM	NM	7.00	13.17
MW-6	20.17	7.14	13.03	7.18	12.99	7.26	12.91	7.20	12.97	7.16	13.01	7.14	13.03	6.33	13.84
MW-7	19.44	8.78	10.66	8.78	10.66	9.08	10.36	9.00	10.44	8.92	10.52	8.88	10.56	7.91	11.53
MW-8	21.49	8.34	13.15	8.50	12.99	8.49	13.00	8.60	12.89	8.52	12.97	8.52	12.97	7.95	13.54
MW-9	18.44	5.26	13.18	5.40	13.04	5.41	13.03	5.44	13.00	5.50	12.94	5.38	13.06	4.99	13.45
MW-10	19.57	NM	NM	6.74	12.83	6.75	12.82	9.78	9.79	6.80	12.77	6.82	12.75	6.36	13.21
MW-11	19.21	NM	NM	NM	NM	6.45	12.76	NM	NM	NM	NM	NM	NM	5.32	13.89
MW-12	19.79	6.40	13.39	5.86	13.93	6.33	13.46	6.14	13.65	5.96	13.83	5.40	14.39	5.29	14.50
MW-13	19.81	6.62	13.19	6.68	13.13	6.73	13.08	6.62	13.19	6.50	13.31	6.46	13.35	5.65	14.16
MW-14	19.76	9.02	10.74	9.06	10.70	9.33	10.43	9.22	10.54	9.14	10.62	6.06	13.70	7.91	11.85
MW-15	19.42	7.72	11.70	7.70	11.72	7.65	11.77	7.80	11.62	8.00	11.42	8.08	11.34	7.63	11.79
MW-16	18.22	5.52	12.70	5.60	12.62	5.54	12.68	5.60	12.62	5.76	12.46	5.76	12.46	5.18	13.04
MW-17	21.04	8.52	12.52	8.80	12.24	8.59	12.45	8.72	12.32	9.02	12.02	8.94	12.10	8.39	12.65
MW-18	19.69	9.10	10.59	9.16	10.53	9.54	10.15	9.40	10.29	9.32	10.37	9.30	10.39	8.20	11.49
UPRR-29	16.50	NM	NM	NM	NM	3.34	13.16	NM	NM	NM	NM	NM	NM	8.80	7.70

RETEC

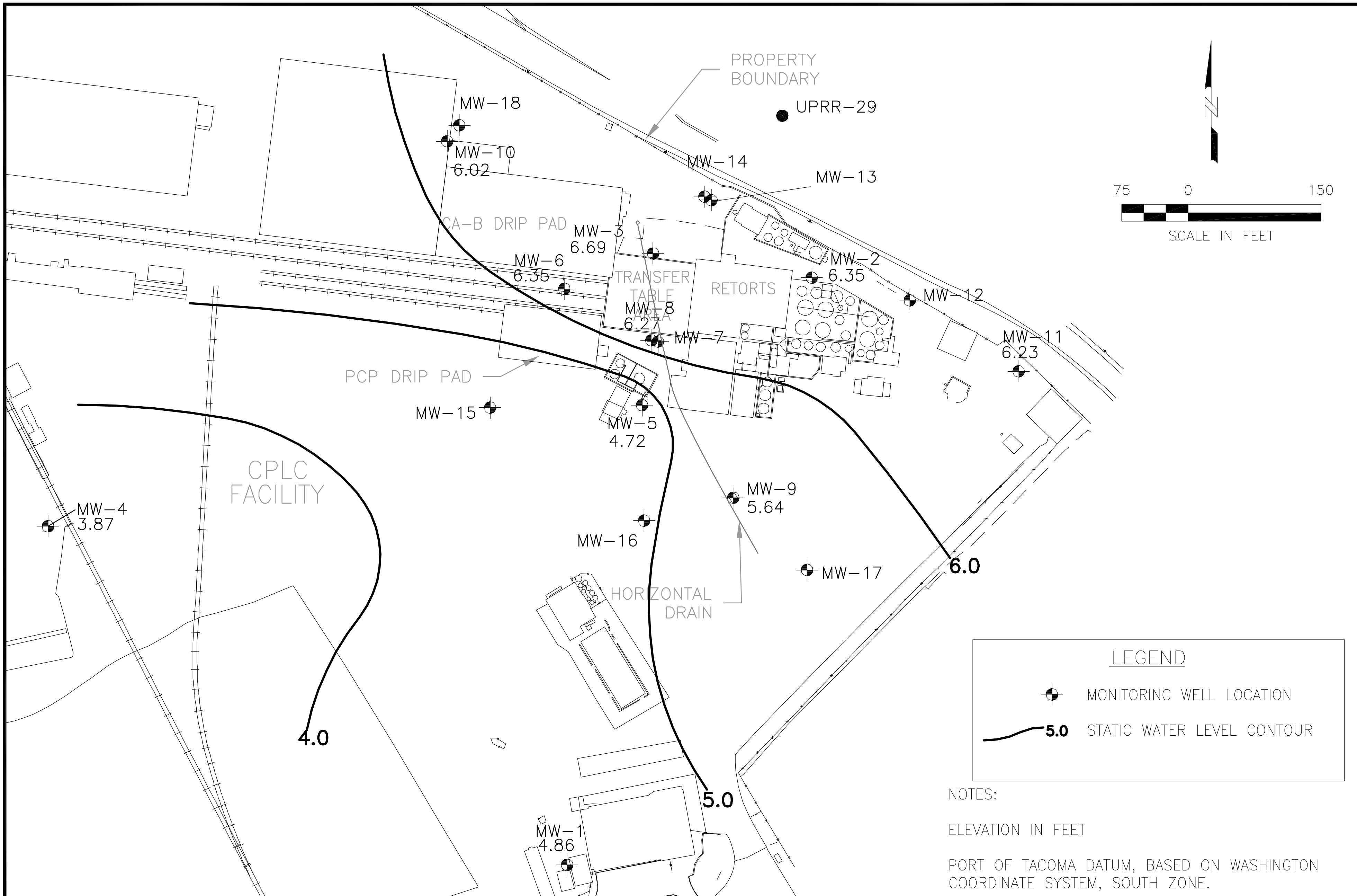


GROUNDWATER CONTOUR MAP FOR JANUARY 28, 1991

CASCADE POLE COMPANY

FIGURE 2

File: L:\Cascade Lumber\REVISED RI-FS\poten_01-94.dwg Layout: FIGURE User: MarshallE Plotted: Dec 08, 2009 - 2:22pm Xref's:

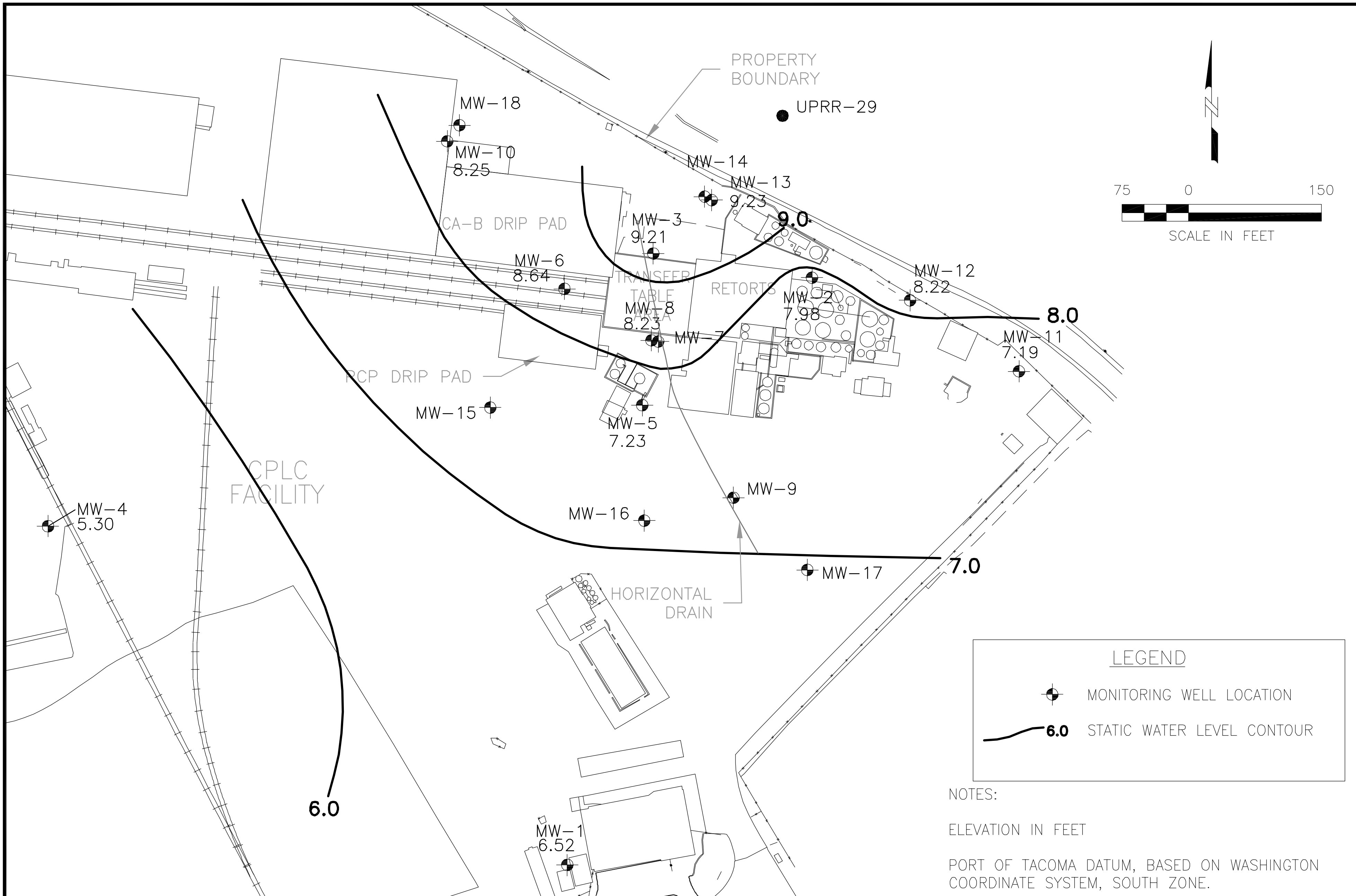


NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM	CASCADE POLE AND LUMBER COMPANY TACOMA, WASHINGTON 60137201-0200	**POTENTIOMETRIC SURFACE MAP** **SHALLOW AQUIFER** **JANUARY 10, 1994**
	DATE: 12/08/09 DRWN: E.M./SEA	**FIGURE**



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

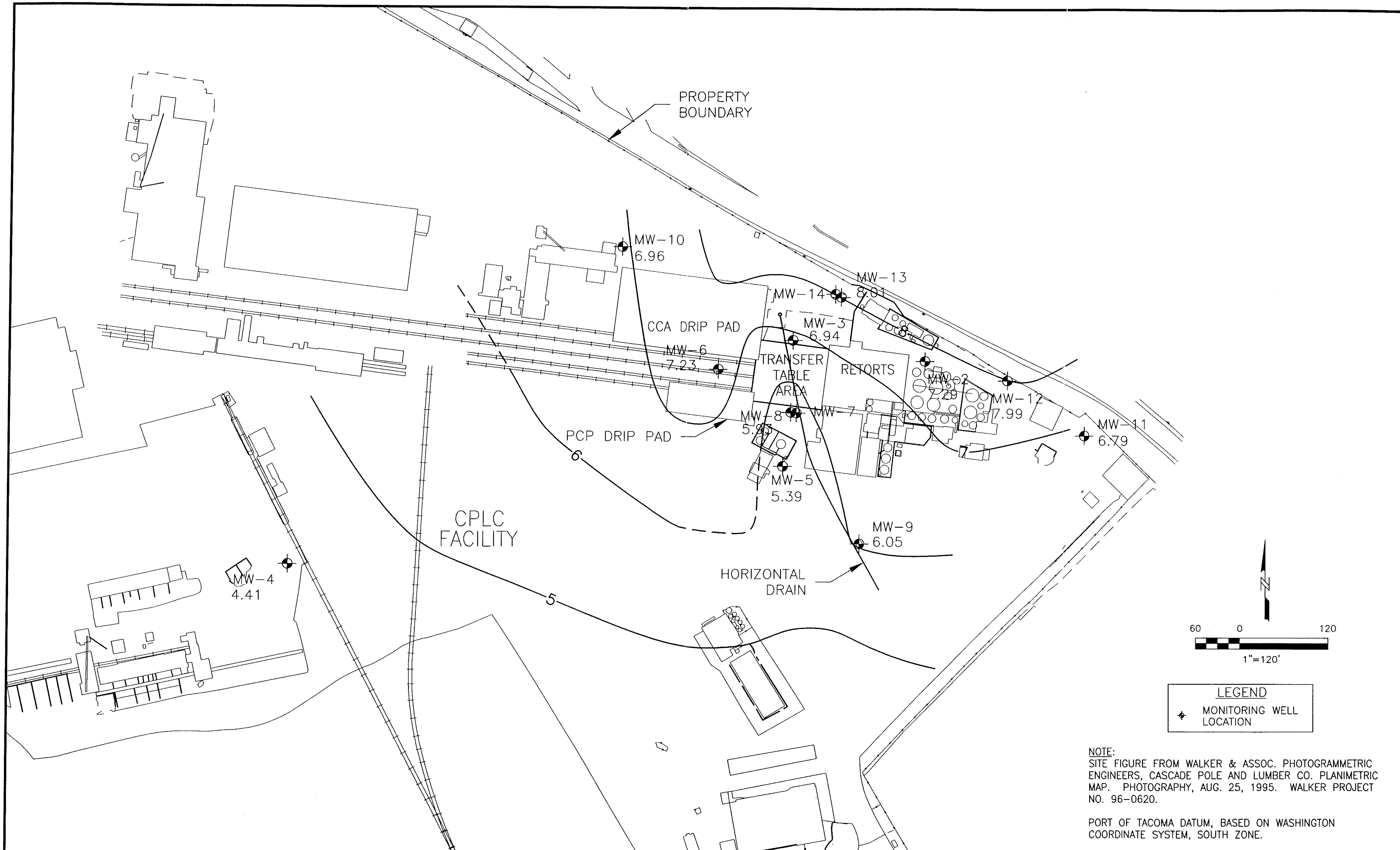
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

60137201-0200

DATE: 12/08/09 | DRWN: E.M./SEA

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
JANUARY 27, 1997

FIGURE



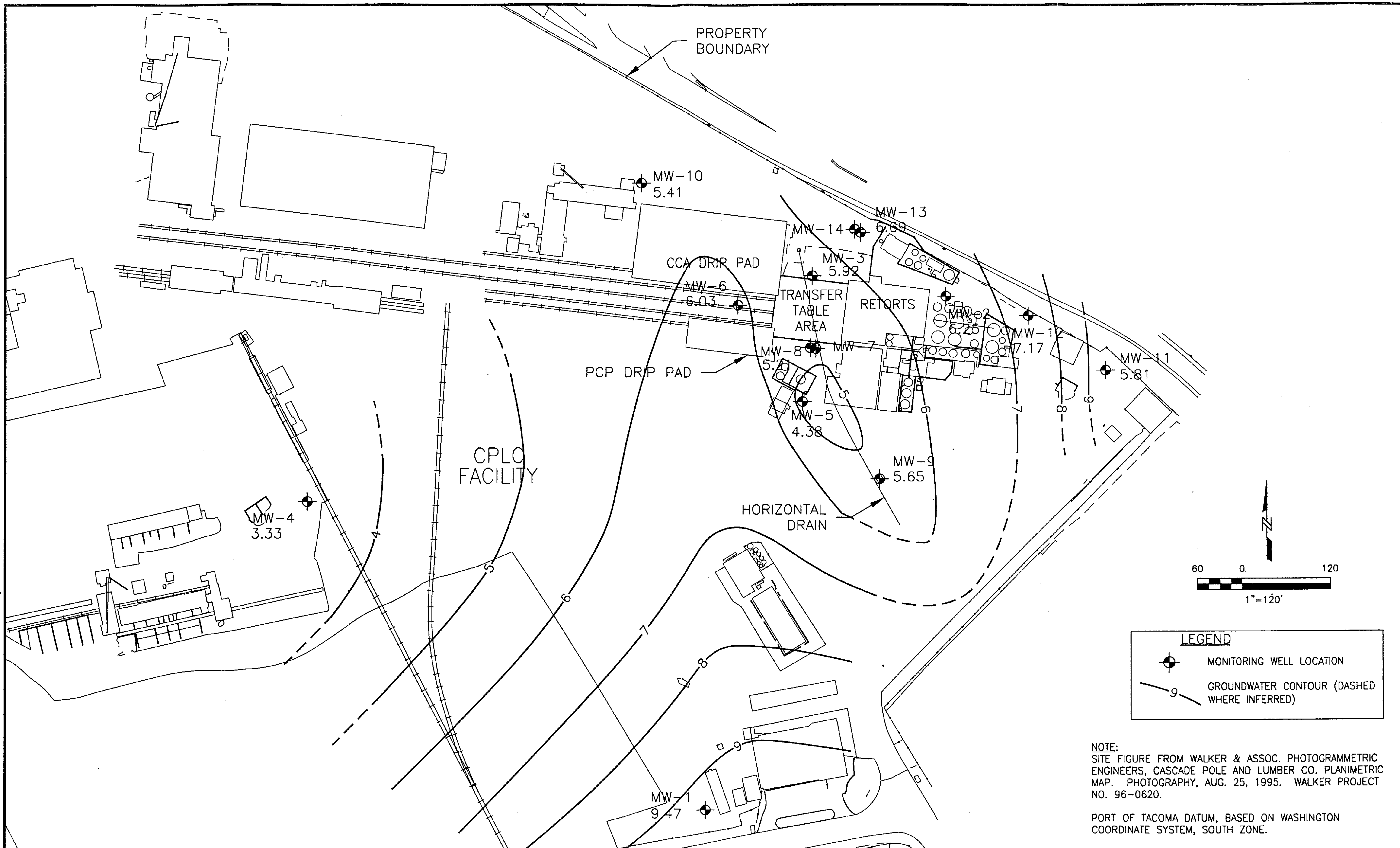
ThermoRetec

CASCADE POLE AND LUMBER COMPANY
CPLC1-04199-420

POTENTIOMETRIC SURFACE MAP JANUARY 2000 CASCADE POLE & LUMBER CO. TACOMA, WASHINGTON

DATE: 2/28/00 | DRWN: N.S. | FILE: 4199S054

FIGURE 1



ThermoRetec

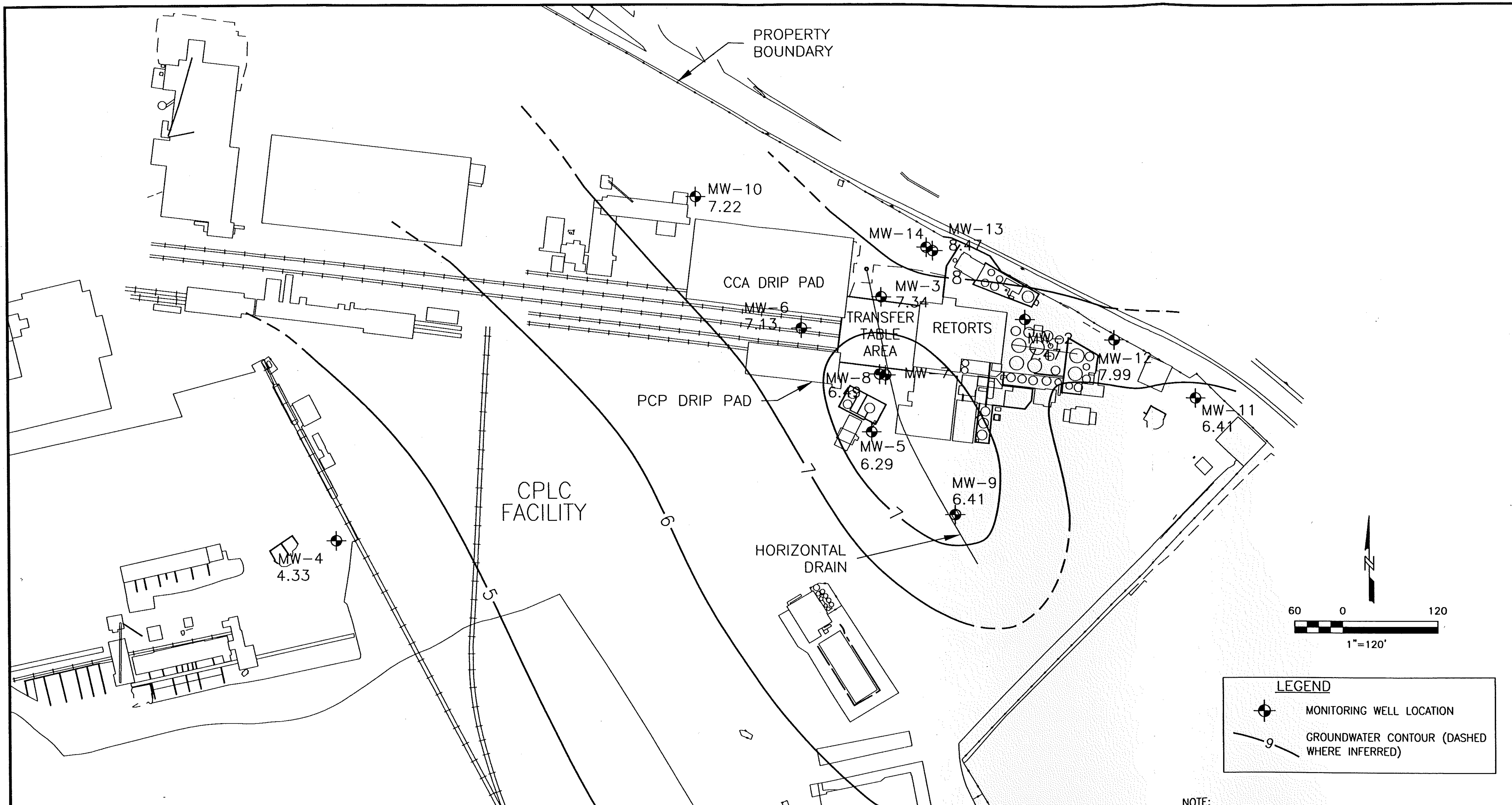
CASCADE POLE AND LUMBER COMPANY

CPLC1-04199-420

DATE: 03/06/01 | DRWN: N.S. | FILE: 4199s068

POTENTIOMETRIC SURFACE MAP
FEBRUARY 27, 2001
CASCADE POLE & LUMBER CO.
TACOMA, WASHINGTON

FIGURE 6



NOTE:
SITE FIGURE FROM WALKER & ASSOC. PHOTOGRAMMETRIC ENGINEERS, CASCADE POLE AND LUMBER CO. PLANIMETRIC MAP. PHOTOGRAPHY, AUG. 25, 1995. WALKER PROJECT NO. 96-0620.

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

CASCADE POLE AND LUMBER COMPANY

CPLC1-04199-420

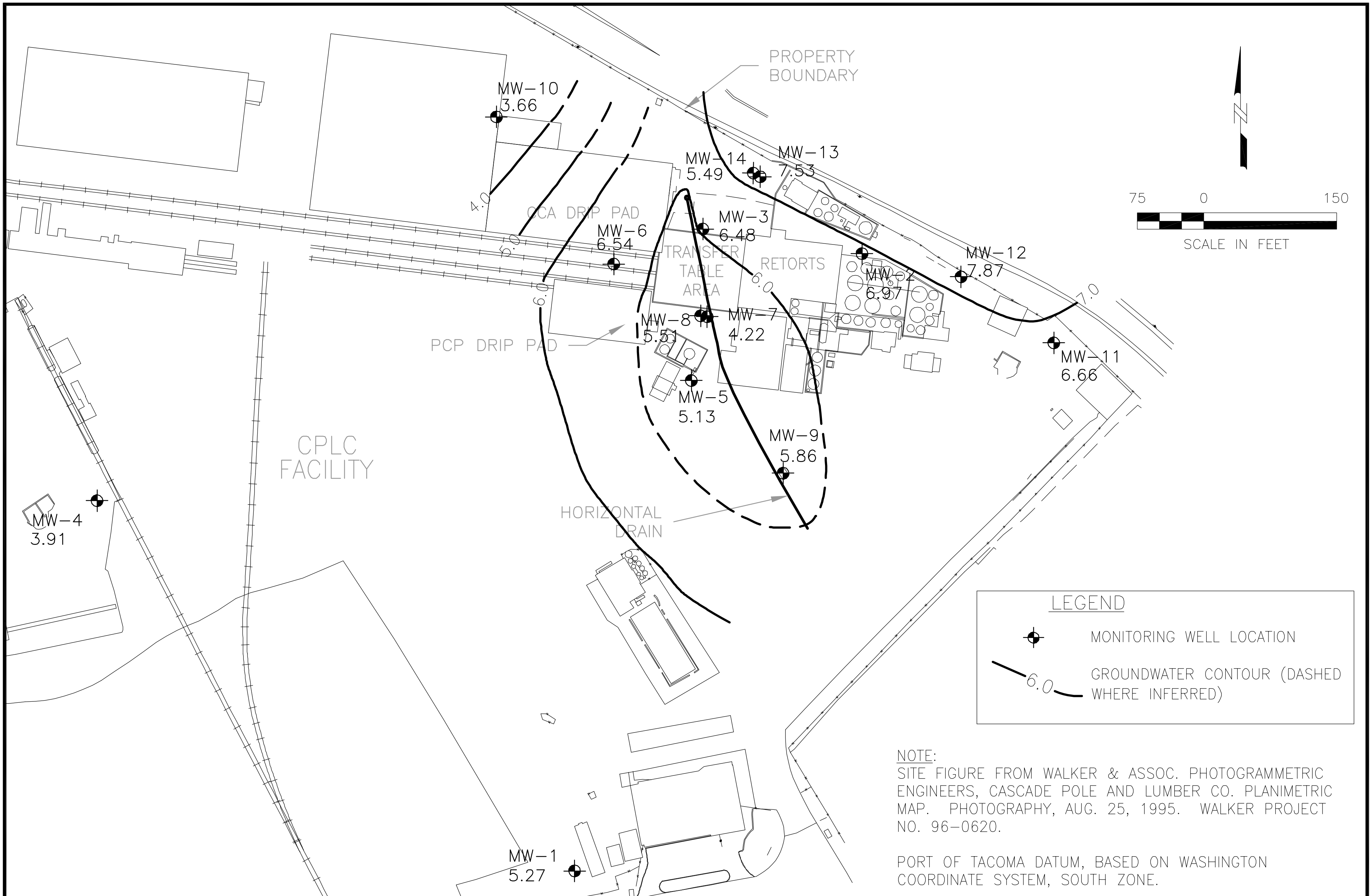
DATE: 4/10/02 | DRWN: N.J.S./SEA | FILE: 4199s096

POTENTIOMETRIC SURFACE MAP
JANUARY 24, 2002
CASCADE POLE & LUMBER CO.
TACOMA, WASHINGTON

LAYOUT: Layout1

FIGURE 6

File: L:\Cascade Lumber\REVISED RI-FS\4199s111.dwg Layout: ANSI_AI-LJ User: MarshallE Plotted: Dec 08, 2009 - 2:38pm Xref's:



AECOM

CASCADE POLE AND LUMBER COMPANY

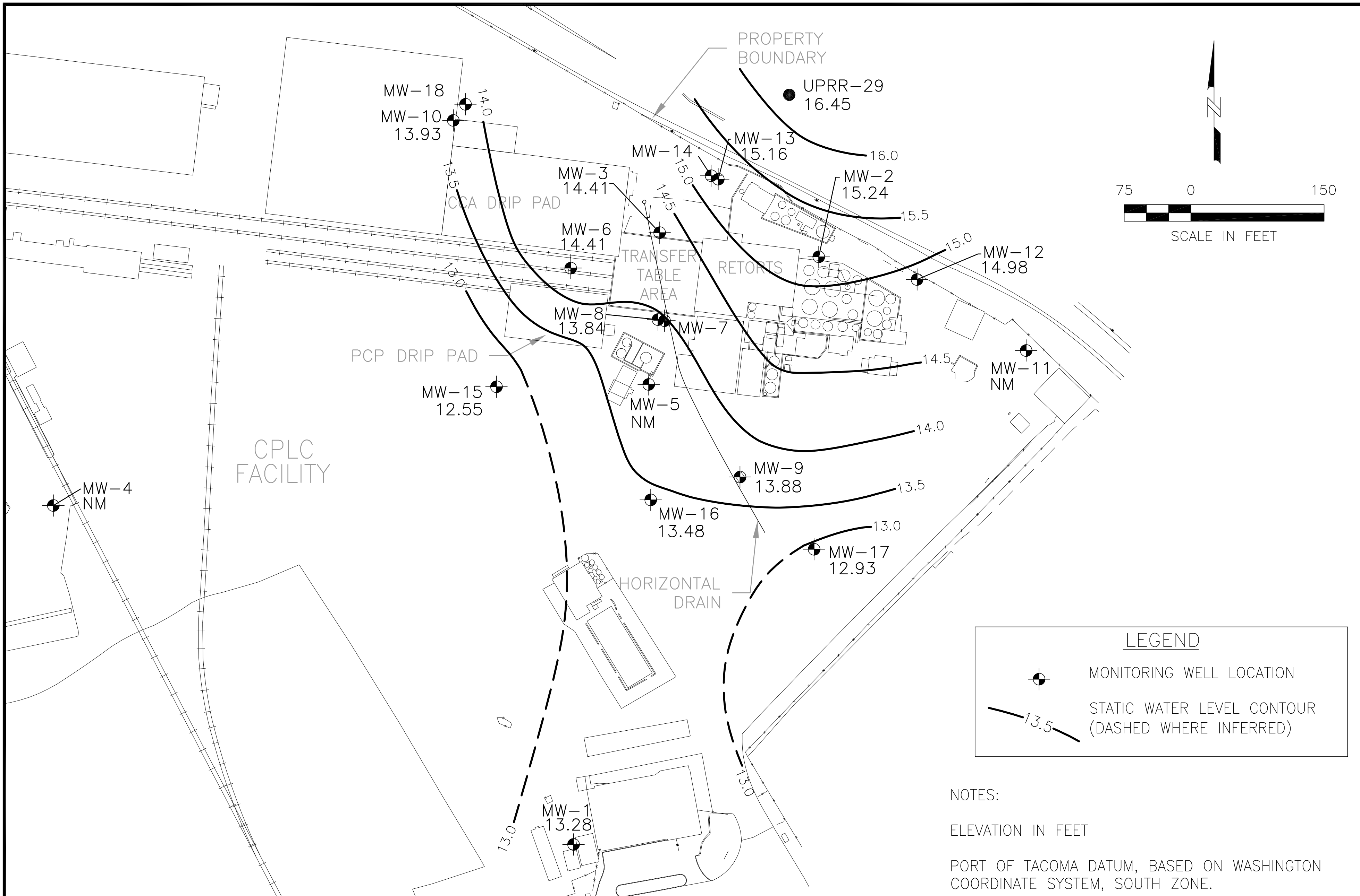
60137201-0200

DATE: 12/08/09 DRWN: E.M./SEA

POTENTIOMETRIC SURFACE MAP JANUARY 31, 2003

CASCADE POLE & LUMBER CO. TACOMA, WASHINGTON

FIGURE 3-12



LEGEND

MONITORING WELL LOCATION

STATIC WATER LEVEL CONTOUR (DASHED WHERE INFERRED)

NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

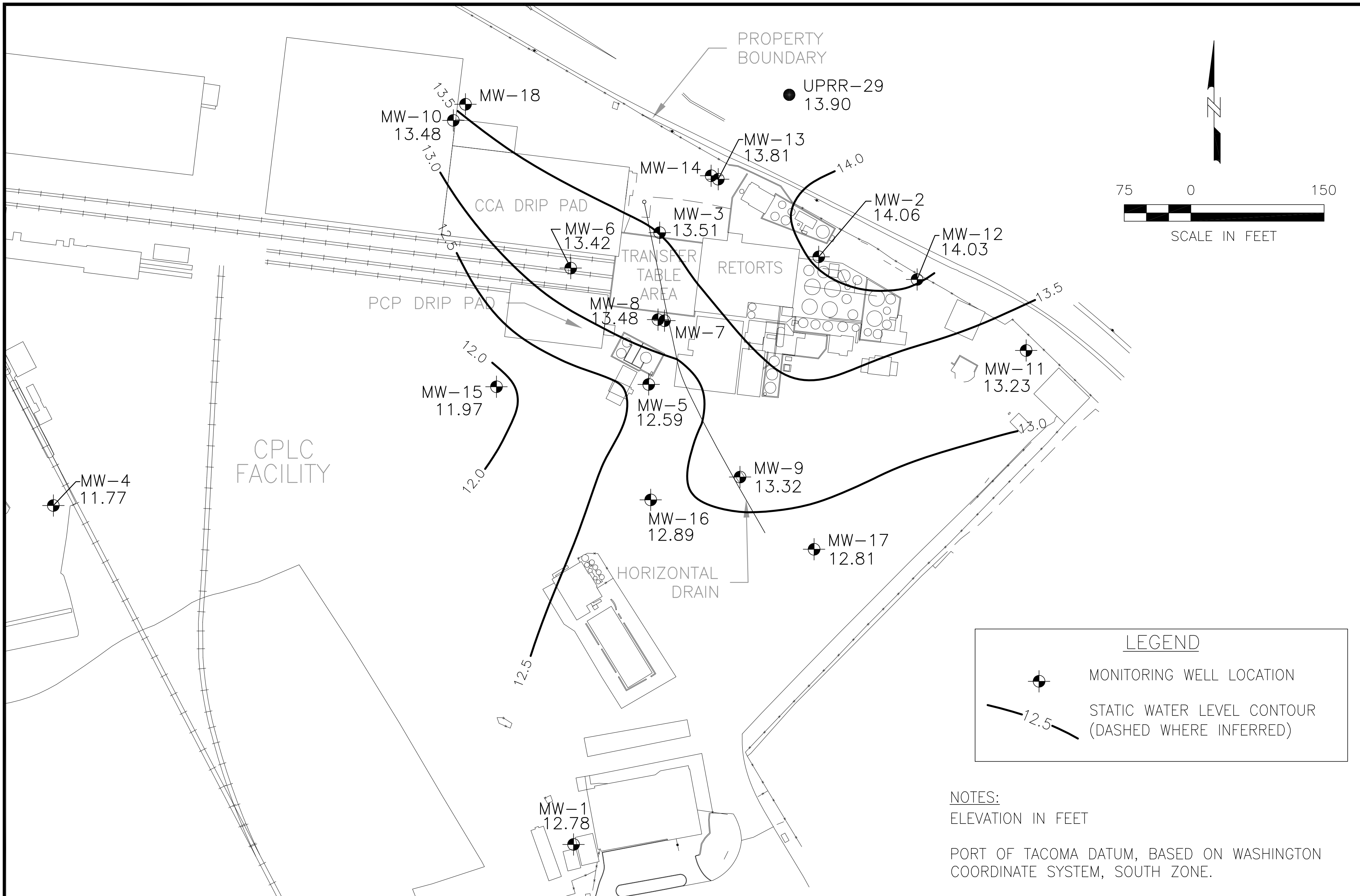
CPLU1-16832-500

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
FEBRUARY 4, 2004

DATE: 04/11/05 | DRWN: A.S./SEA

FIGURE 3-2

File: P:\CADD\Cascade Lumber\16832S014.dwg Layout: Layout1 User: oliveriam Plotted: Mar 09, 2011 - 12:30pm Xref's:



NOTES:
ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

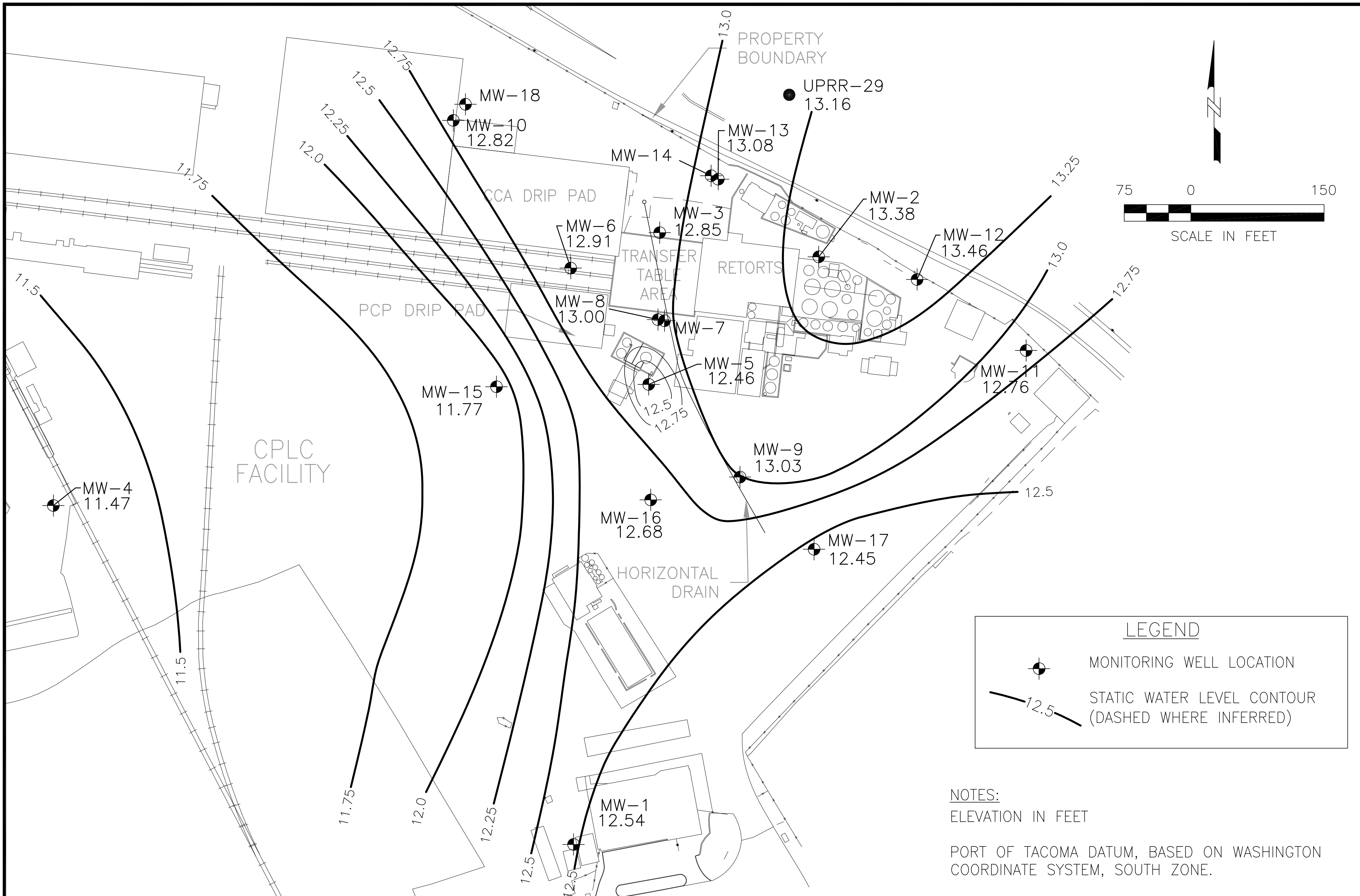
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

CPLU1-16832-500

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
MAY 26, 2004

DATE: 04/11/05 | DRWN: A.S./SEA

FIGURE 3-3



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

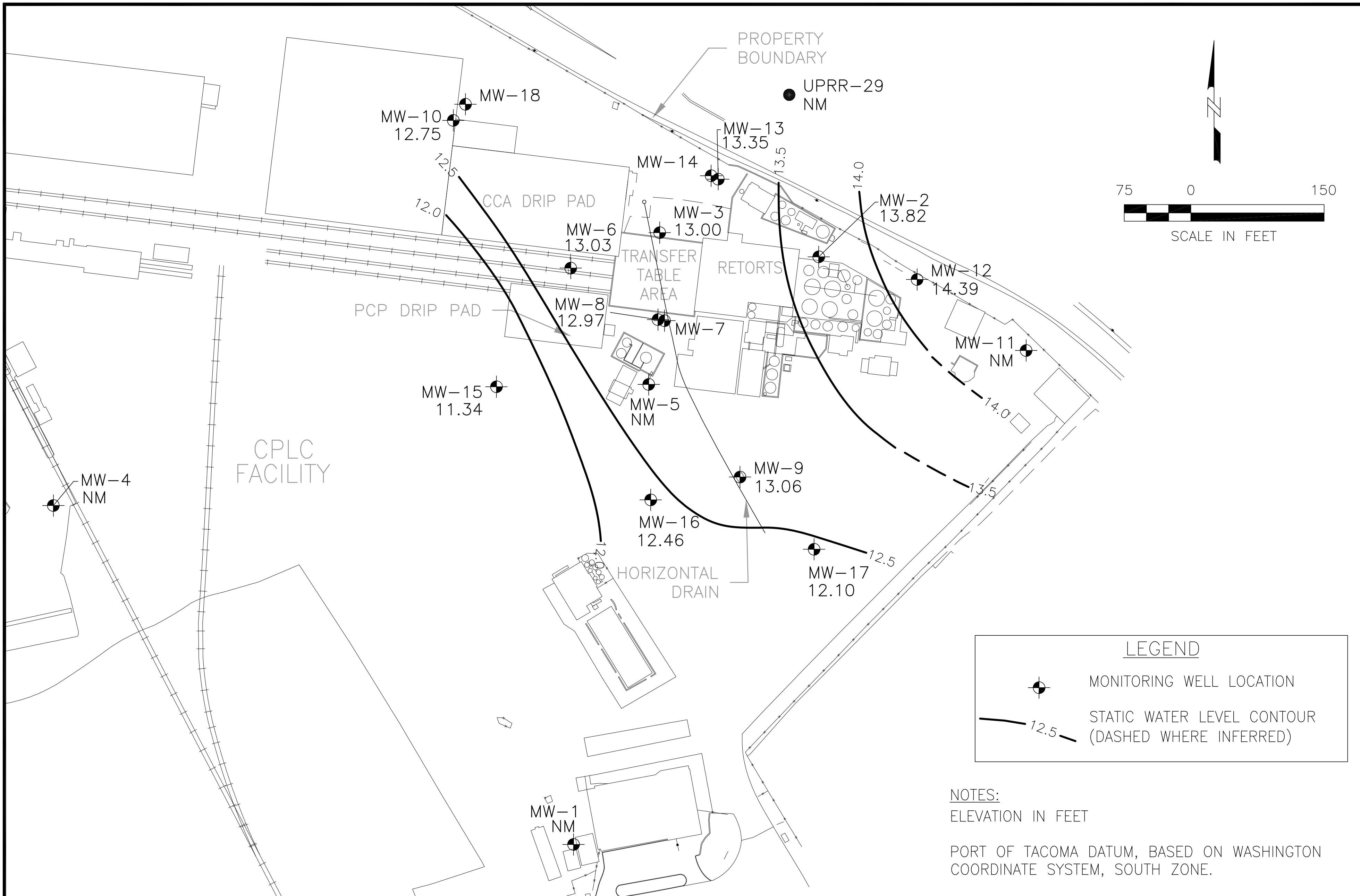
CPLU1-16832-500

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
SEPTEMBER 7, 2004

DATE: 05/03/05 | DRWN: A.S./SEA

FIGURE 3-4

File: P:\CADD\Cascade Lumber\16832S023.dwg Layout: Layout1 User: oliveriam Plotted: Mar 09, 2011 - 12:33pm Xref's:



NOTES:
ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

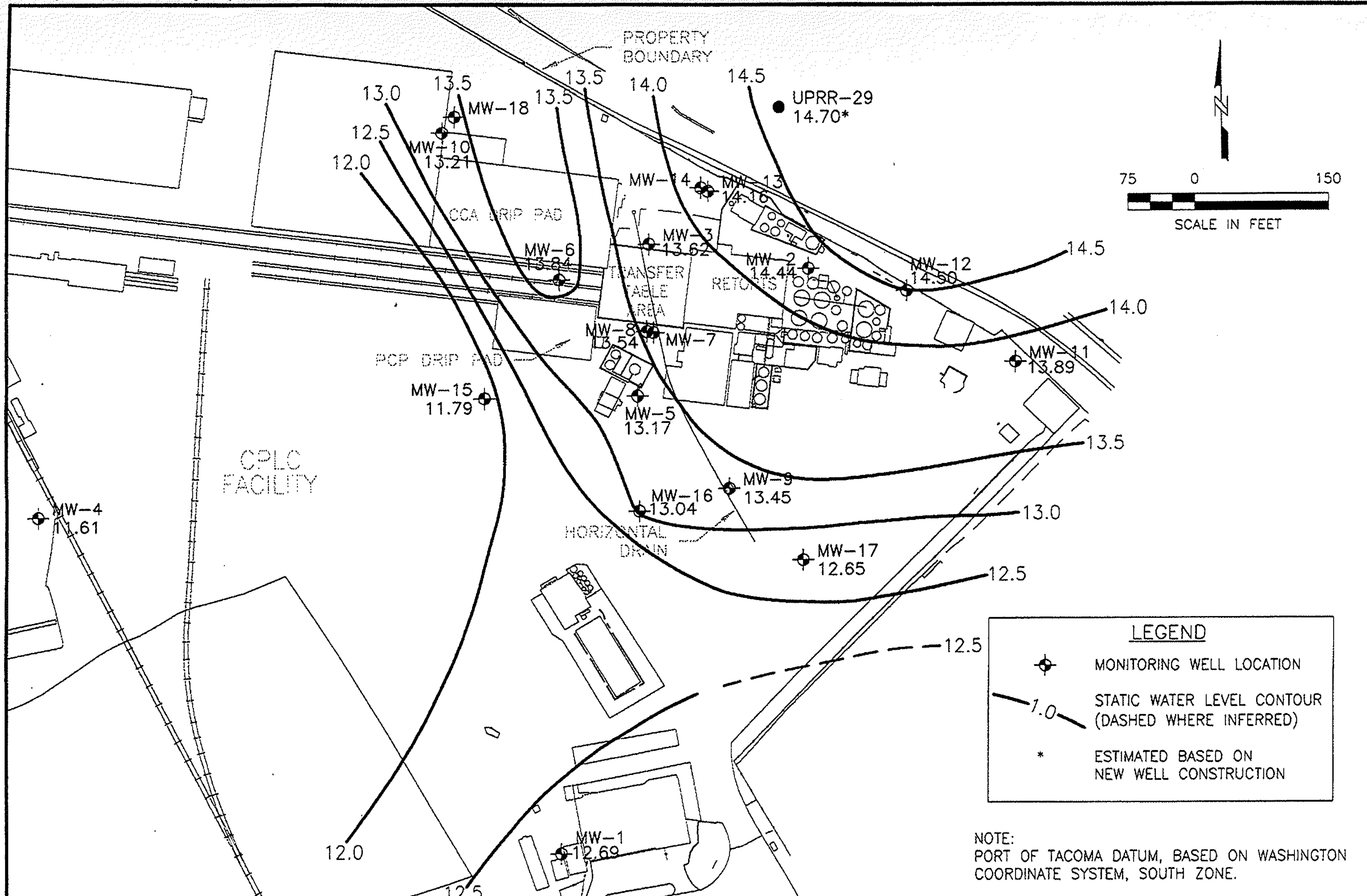
CPLU1-16832-500

DATE: 04/11/05 | DRWN: A.S./SEA

POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER
NOVEMBER 30th, 2004

FIGURE 3-5

File: J:\16832\16832S064.dwg Layout: FIGURE 11 User: mwilliamson Plotted: May 02, 2005 - 12:12pm Xref's:



RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

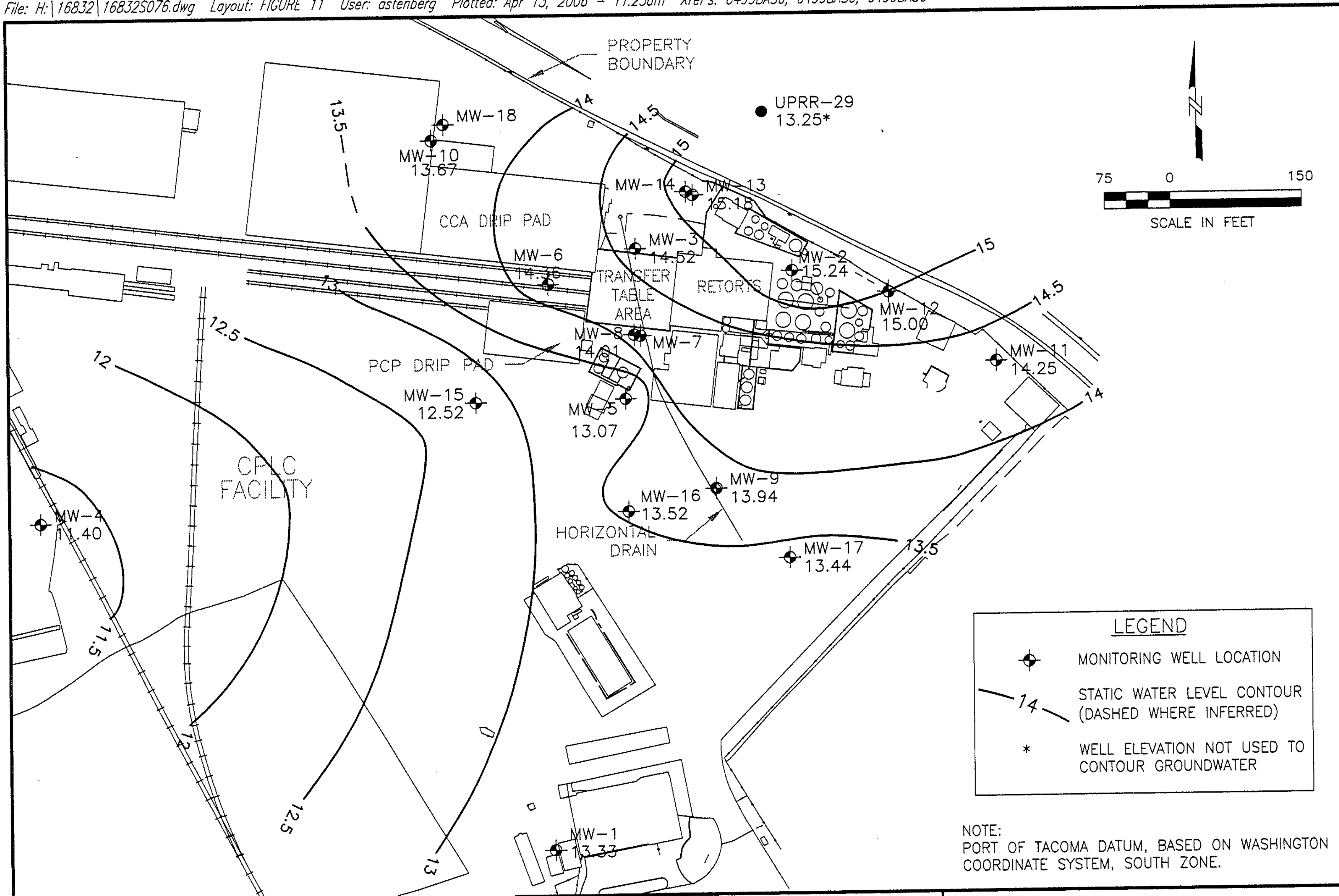
CPLU1-16832-500

DATE: 5/02/05 | DRWN: A.S./SEA

POTENTIOMETRIC SURFACE
SHALLOW AQUIFER
JANUARY 27, 2005

FIGURE 11

File: H:\16832\16832S076.dwg Layout: FIGURE 11 User: astenberg Plotted: Apr 13, 2006 - 11:23am Xref's: 0499BAS6, 0499BAS6, 0499BAS6



RETEC

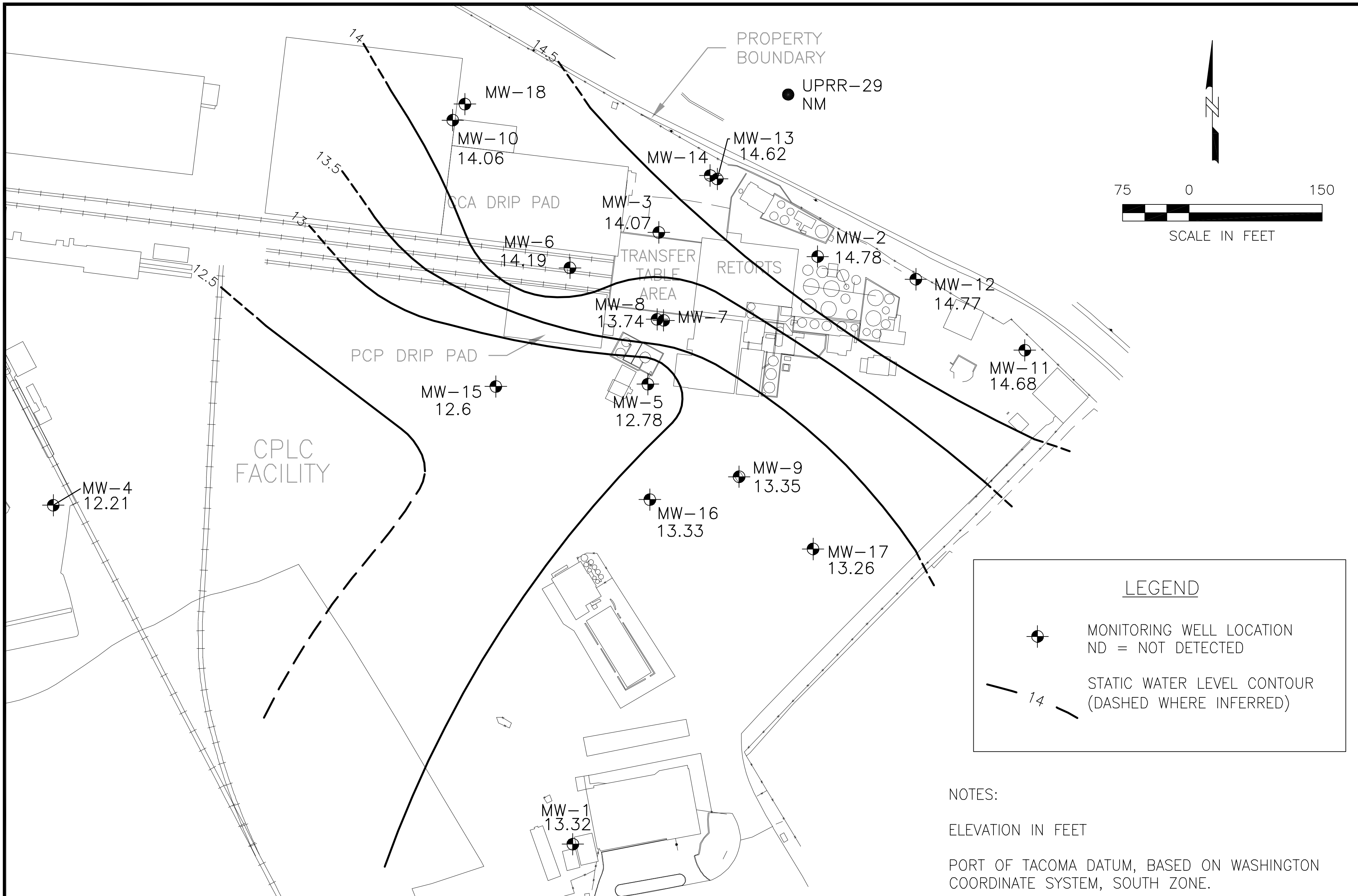
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

CPLU1-16832-500

DATE: 04/13/06 DRWN: A.S./SEA

POTENTIOMETRIC SURFACE SHALLOW AQUIFER JANUARY 2006

FIGURE 11



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

ENSR | AECOM

Merged with ENSR in 2007

RETEC

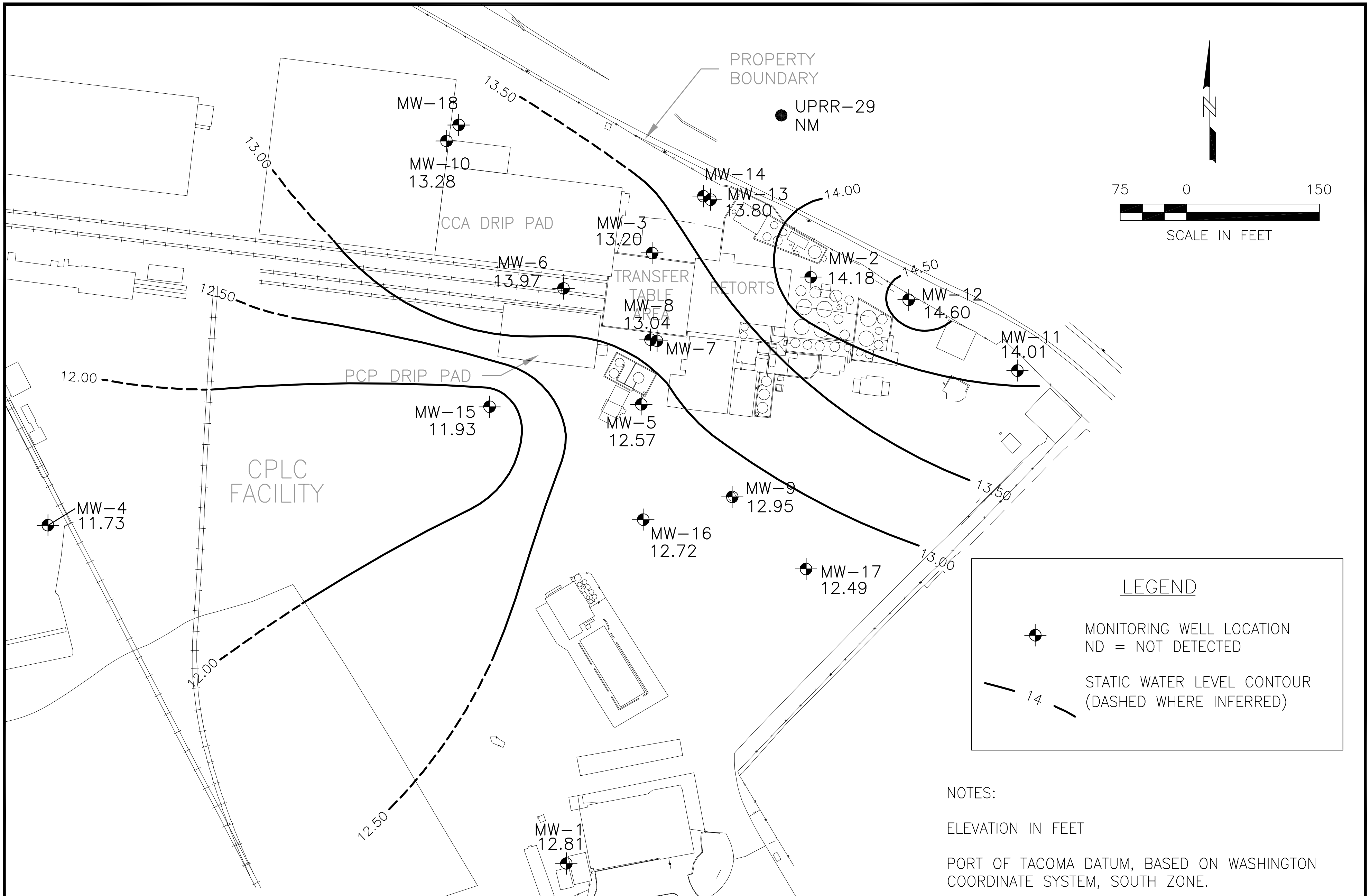
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

CPLC1-16832-500

POTENTIOMETRIC SURFACE
SHALLOW AQUIFER
FEBRUARY 2007

DATE: 05/03/07	DRWN: E.M./SEA		**FIGURE 11**

File: L:\Cascade Lumber\04530-015-S002.dwg Layout: FIG 11 User: emarshall Plotted: Mar 10, 2008 - 2:31pm Xref's:



ENSR | AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

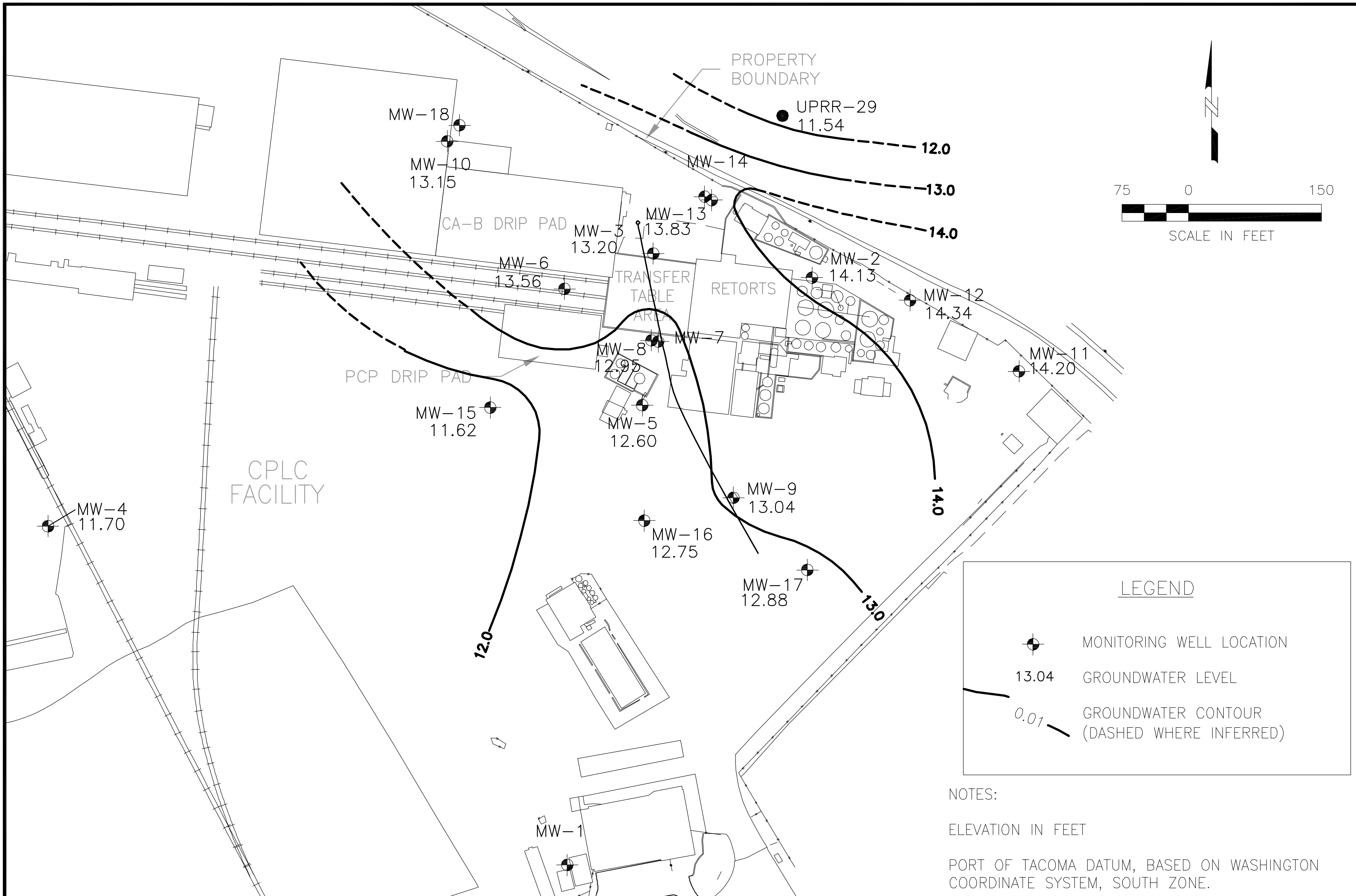
CPLC1-16832-500

POTENTIOMETRIC SURFACE
SHALLOW AQUIFER
JANUARY 2008

DATE: 03/10/08 | DRWN: E.M./SEA

FIGURE 11

File: P:\CADD\Cascade Lumber\gw_level.dwg Layout: FIGURE 11 User: MarshallE Plotted: Apr 17, 2009 - 9:30am Xref's:



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

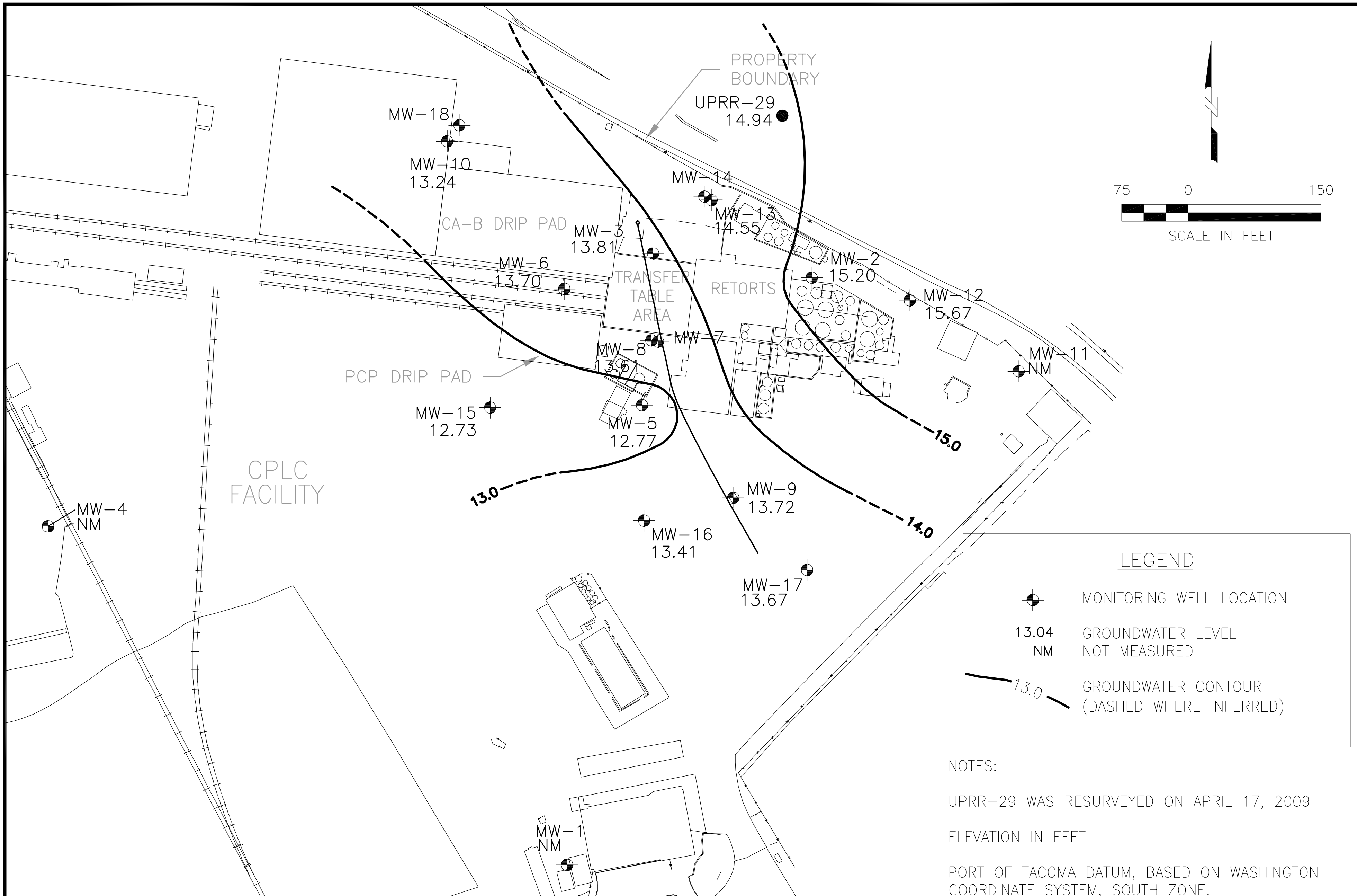
04530-015-300

GROUNDWATER LEVELS
JANUARY 2009

DATE: 04/16/09 | DRWN: E.M./SEA

FIGURE 11

File: M:\Cascade Lumber\Annual GW Report\2010\shallow_gw_level.dwg Layout: FIGURE 11 User: MarshallE Plotted: Mar 25, 2010 - 9:55am Xref's:



NOTES:

UPRR-29 WAS RESURVEYED ON APRIL 17, 2009

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

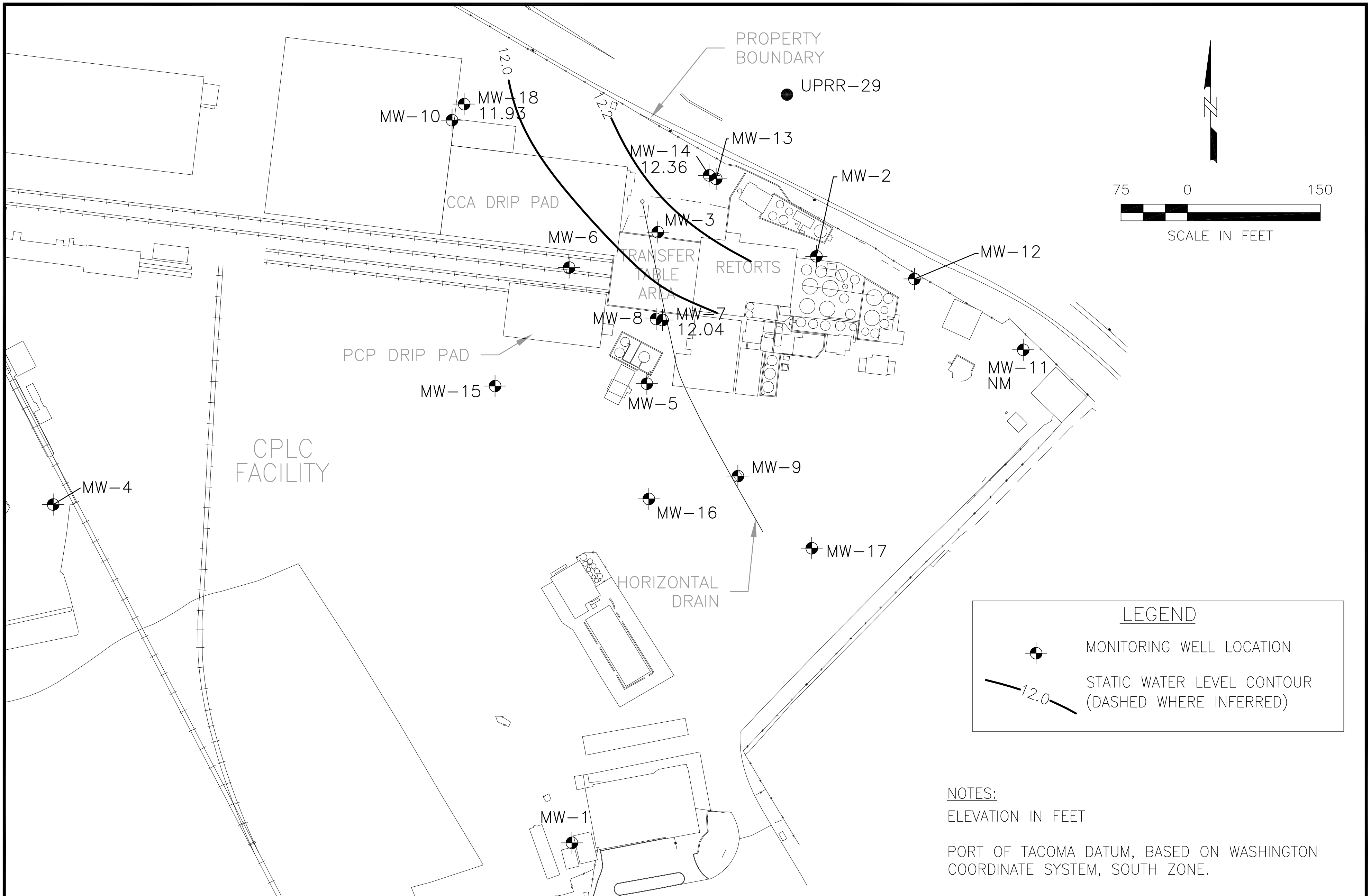
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON
60137021-0300

GROUNDWATER LEVELS
JANUARY 2010

DATE: 03/25/10 DRWN: E.M./SEA

FIGURE 11

File: P:\CADD\Cascade Lumber\16832S033.dwg Layout: Layout1 User: oliveriam Plotted: Mar 09, 2011 - 12:37pm Xref's:



RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

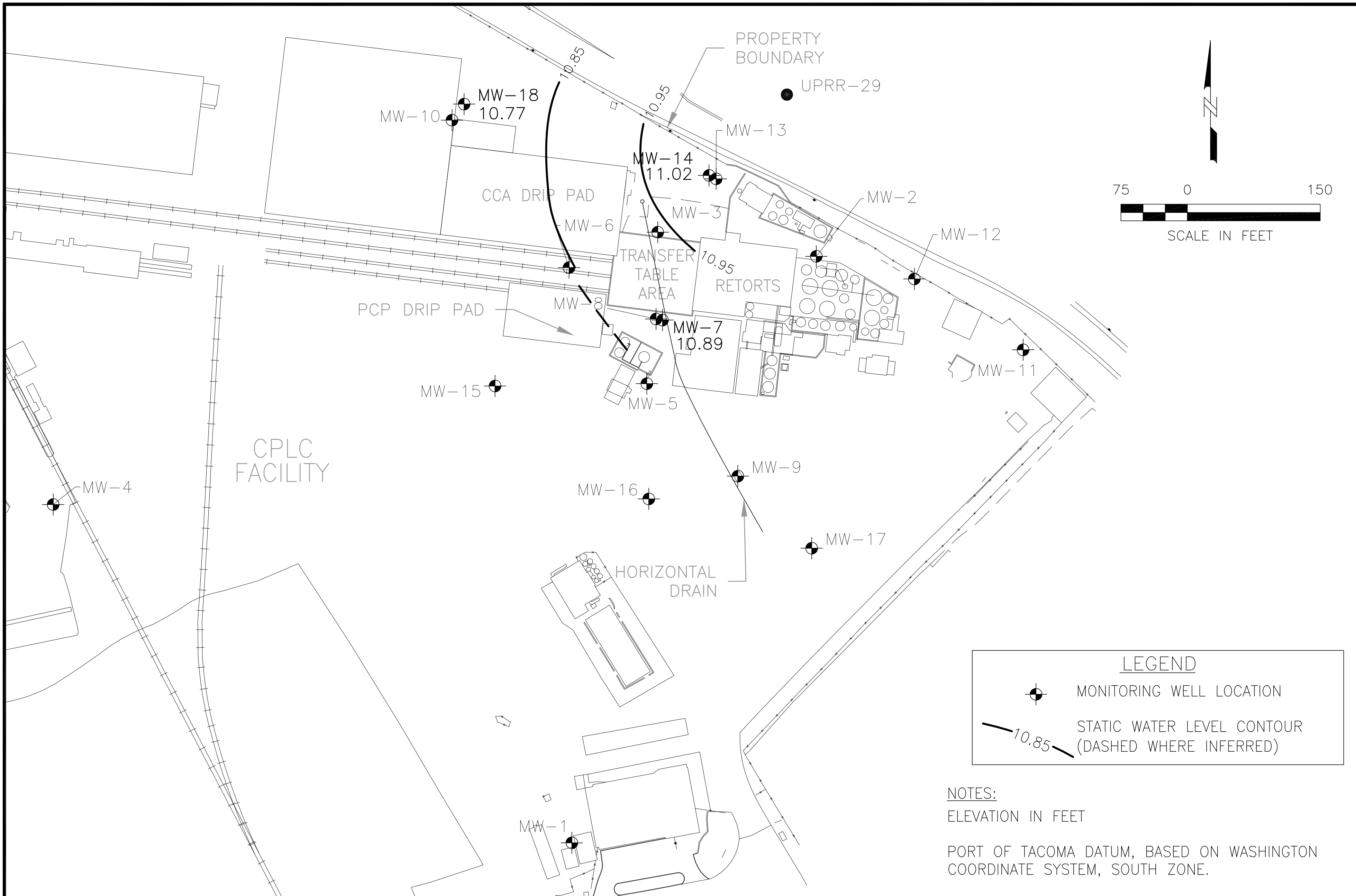
CPLU1-16832-500

DATE: 04/11/05 | DRWN: A.S./SEA

POTENTIOMETRIC SURFACE MAP
DEEPER AQUIFER
FEBRUARY 4, 2004

FIGURE 3-8

File: P:\CADD\Cascade Lumber\16832S024.dwg Layout: Layout1 User: oliveriam Plotted: Mar 09, 2011 - 12:39pm Xref's:



NOTES:
ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

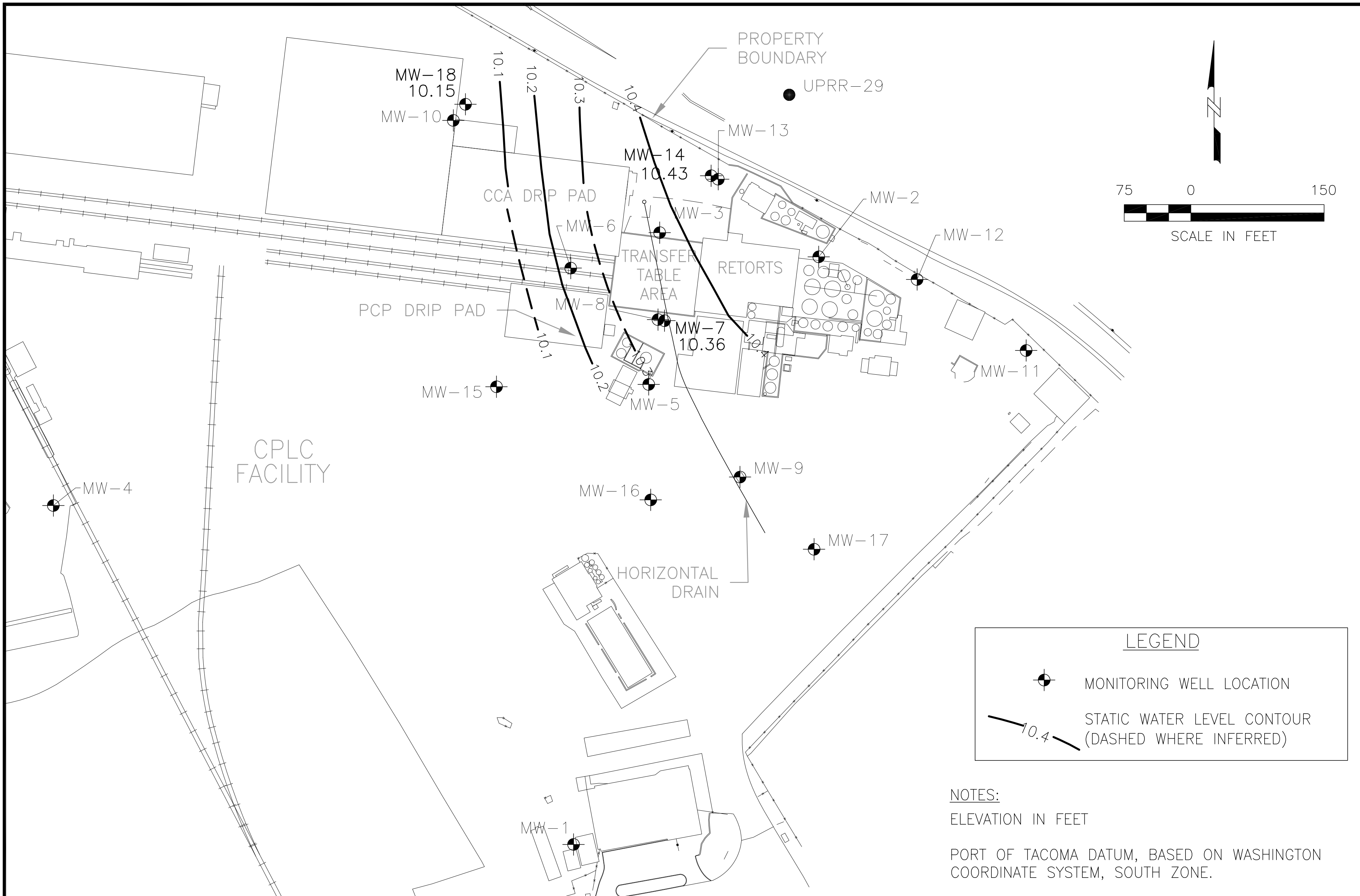
RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON
CPLU1-16832-500

POTENTIOMETRIC SURFACE MAP
DEEPER AQUIFER
MAY 26, 2004

DATE: 04/11/05 | DRWN: A.S./SEA

FIGURE 3-9



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

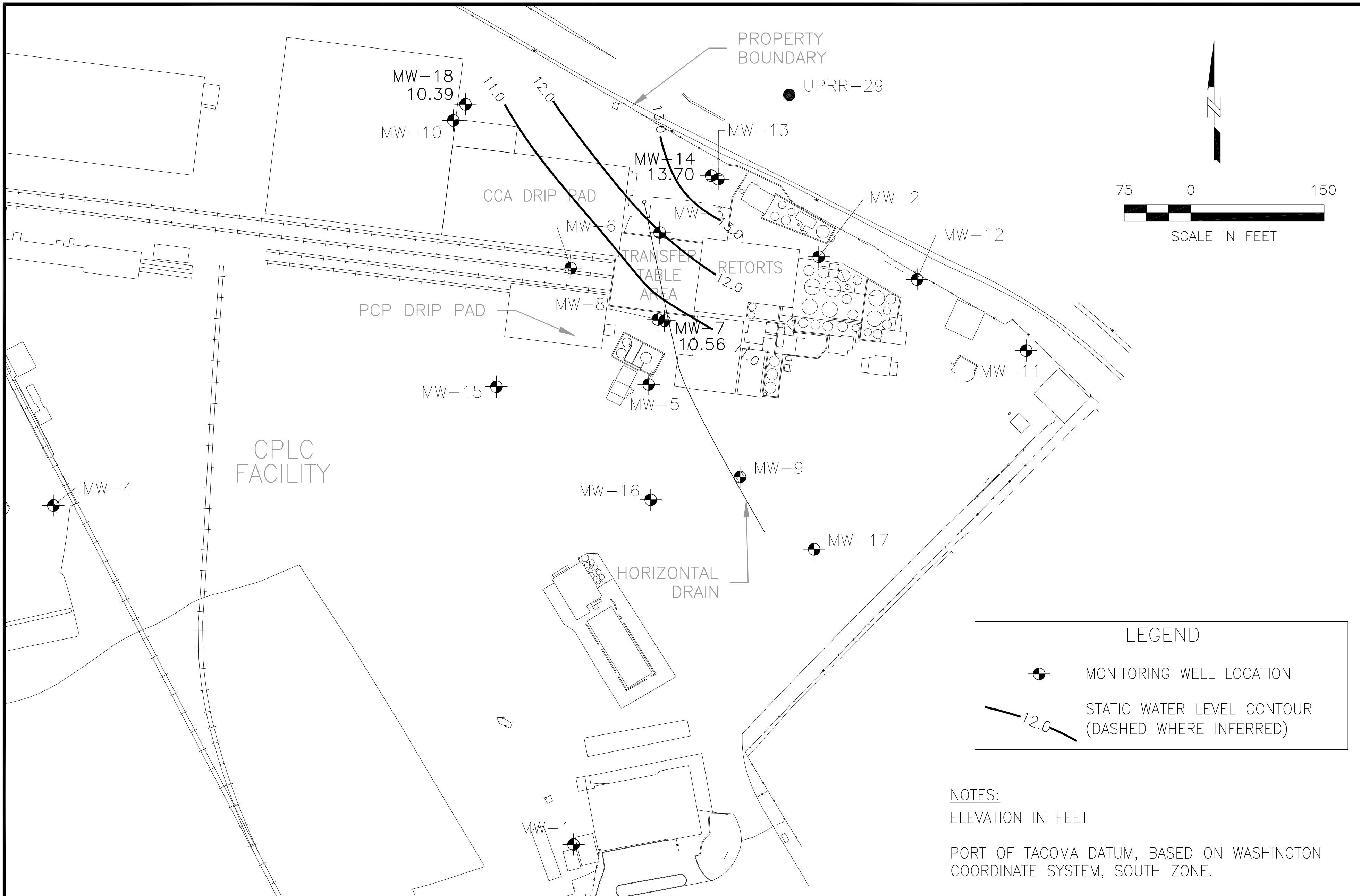
CPLU1-16832-500

DATE: 05/03/05 | DRWN: A.S./SEA

POTENTIOMETRIC SURFACE MAP
DEEPER AQUIFER
SEPTEMBER 7, 2004

FIGURE 3-10

File: P:\CADD\Cascade Lumber\16832S026.dwg Layout: Layout1 User: oliveriam Plotted: Mar 09, 2011 - 12:41pm Xref's:



LEGEND

MONITORING WELL LOCATION

12.0 STATIC WATER LEVEL CONTOUR (DASHED WHERE INFERRED)

NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

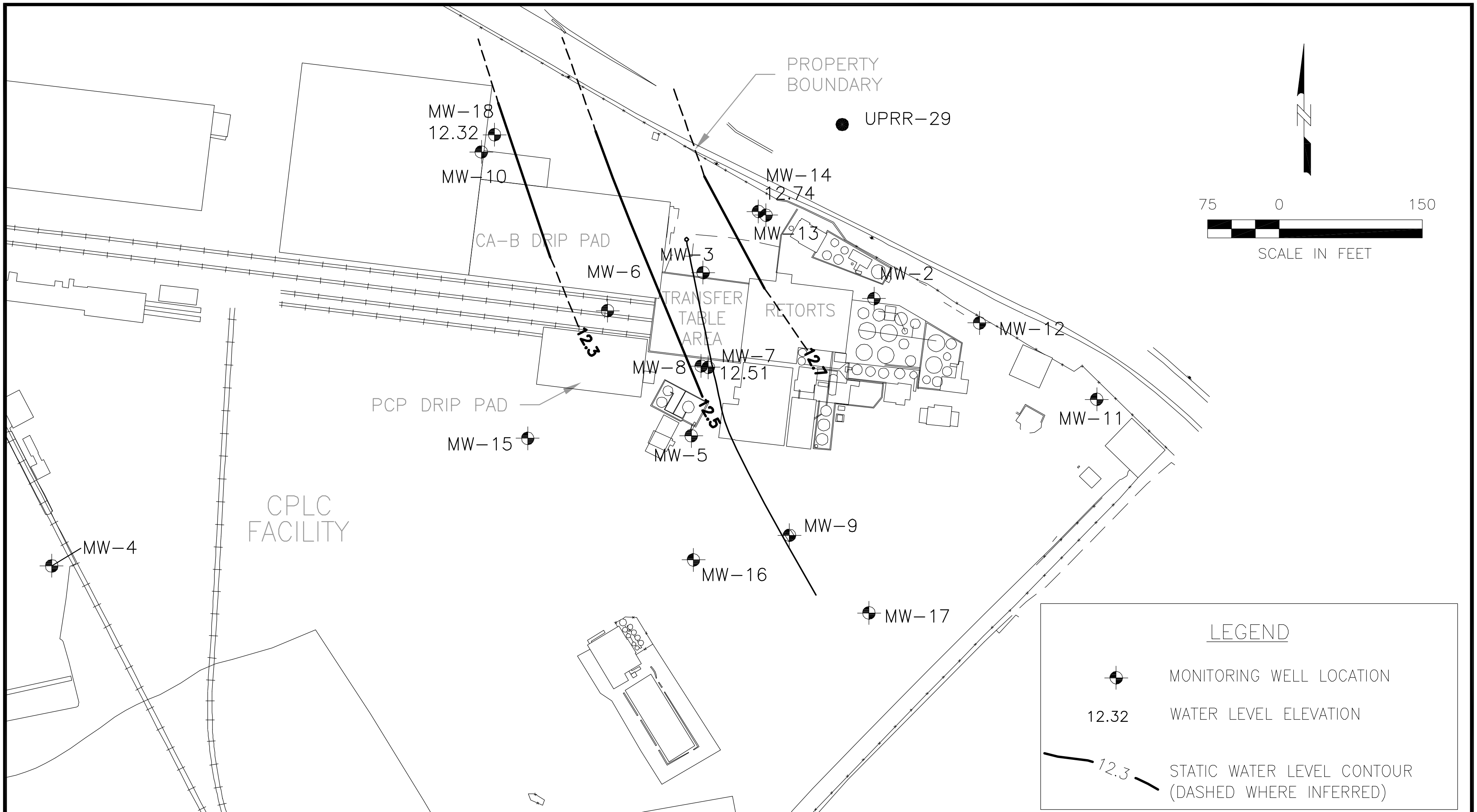
CPLU1-16832-500

DATE: 04/11/05 | DRWN: A.S./SEA

POTENTIOMETRIC SURFACE MAP
DEEPER AQUIFER
NOVEMBER 30, 2004

FIGURE 3-11

File: M:\Cascade Lumber\Annual GW Report\2010\potentio_deep_1-10.dwg Layout: FIGURE 12 User: MarshallE Plotted: Mar 25, 2010 - 10:12am Xref's:



VERTICAL DATUM:

P.O.T. CIRCA 1995
SUBTRACT 7.22 TO GET TO CITY OF TACOMA MSL
BM – MONUMENT AT INTERSECTION OF MILWAUKEE AND LINCOLN
RCA 95 SURVEY: 18.49
CITY OF TACOMA: 11.27 MSL

AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

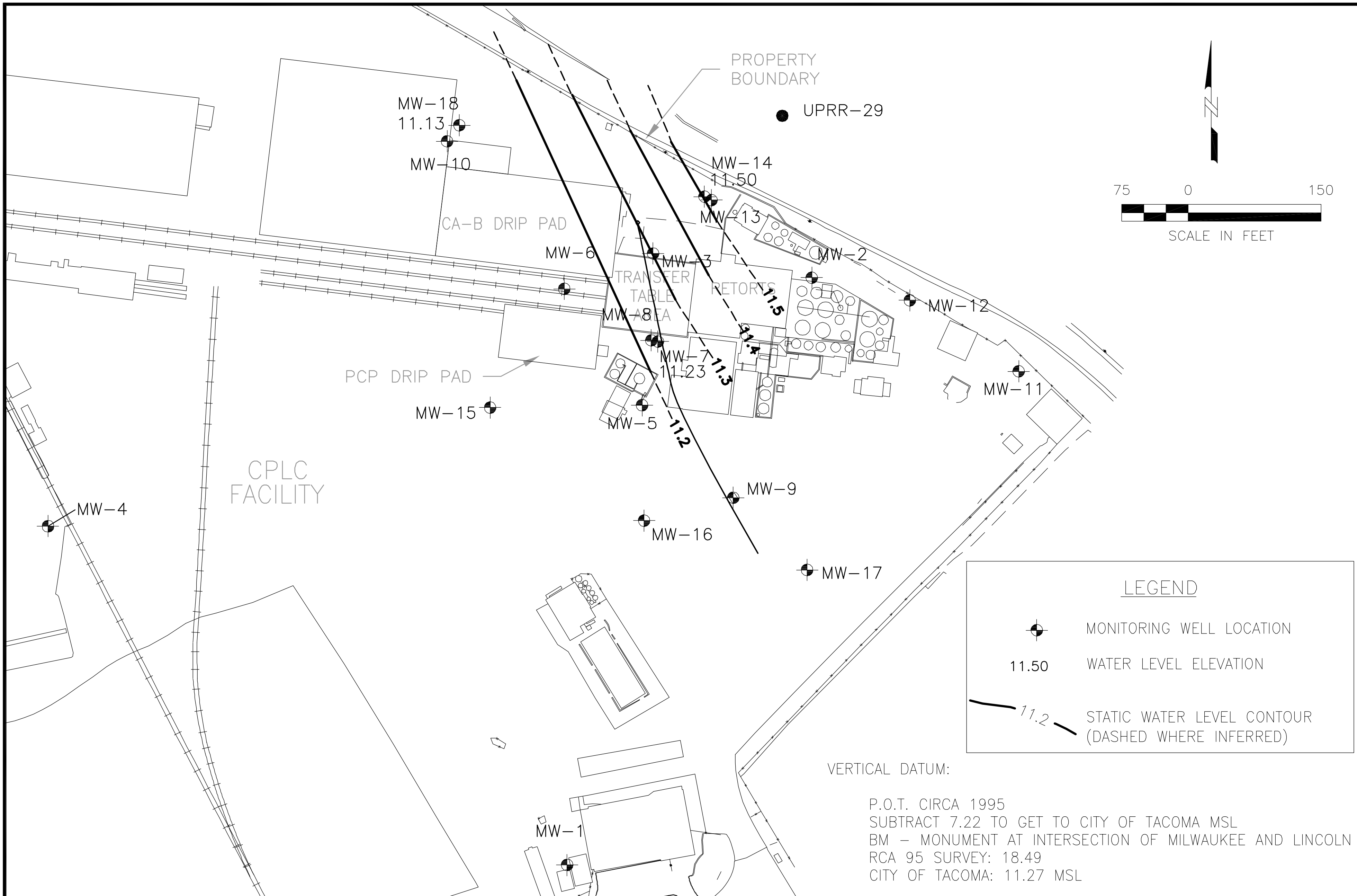
60137201-0300

POTENTIOMETRIC SURFACE MAP
DEEP AQUIFER
JANUARY 2010

DATE: 03/25/10 | DRWN: E.M./SEA

FIGURE 12

File: P:\CADD\Cascade Lumber\potentio_deep_1-09.dwg Layout: FIGURE 12 User: MarshallE Plotted: Mar 24, 2009 - 11:02am Xref's:



AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

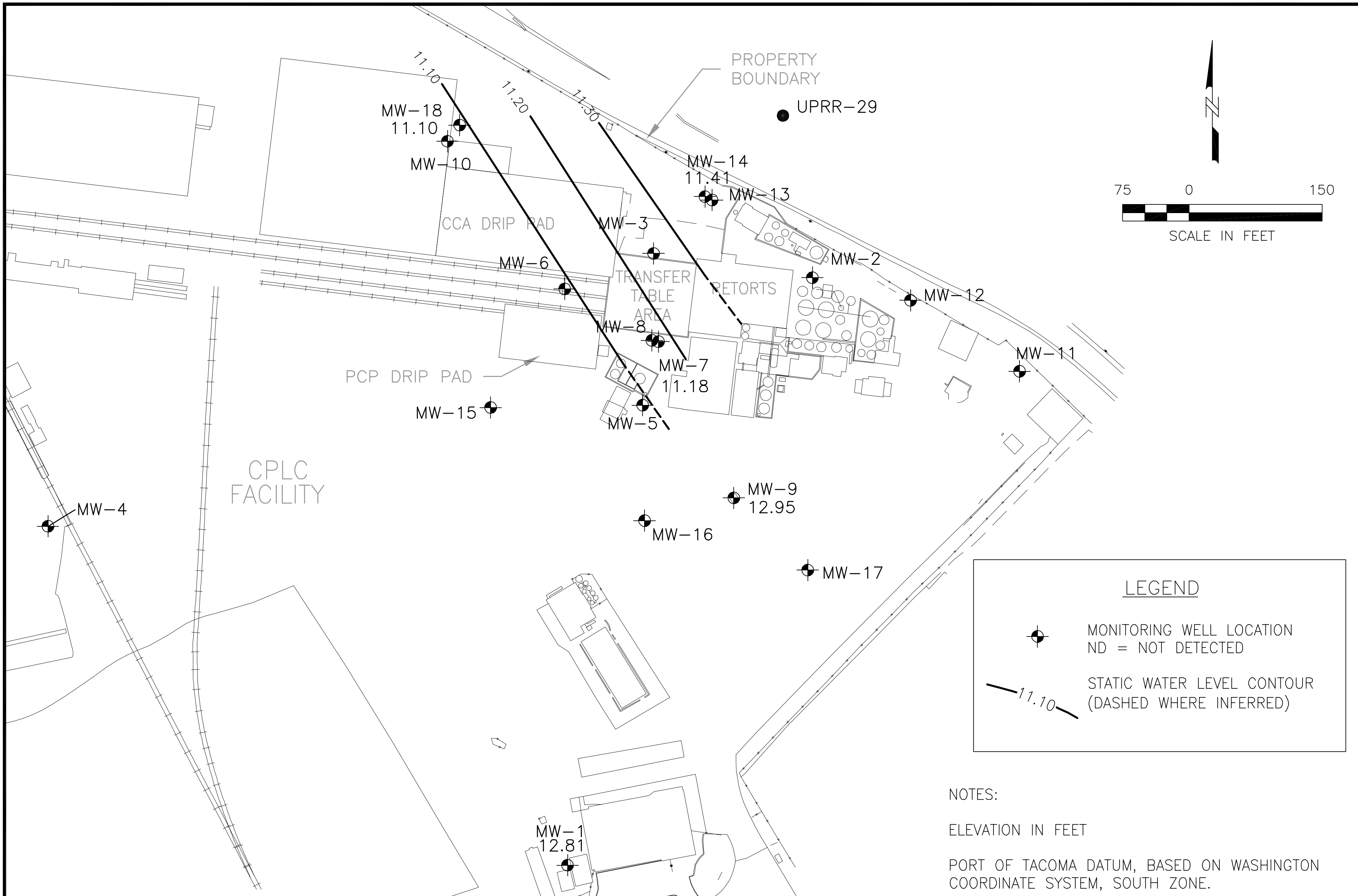
04530-015-0300

DATE: 03/19/09 DRWN: E.M./SEA

POTENTIOMETRIC SURFACE MAP
DEEP AQUIFER
JANUARY 2009

FIGURE 12

File: L:\Cascade Lumber\04530-015-S003.dwg Layout: FIG 12 User: emarshall Plotted: Mar 10, 2008 - 2:34pm Xref's:



LEGEND

MONITORING WELL LOCATION
ND = NOT DETECTED

11.10 STATIC WATER LEVEL CONTOUR (DASHED WHERE INFERRED)

NOTES:

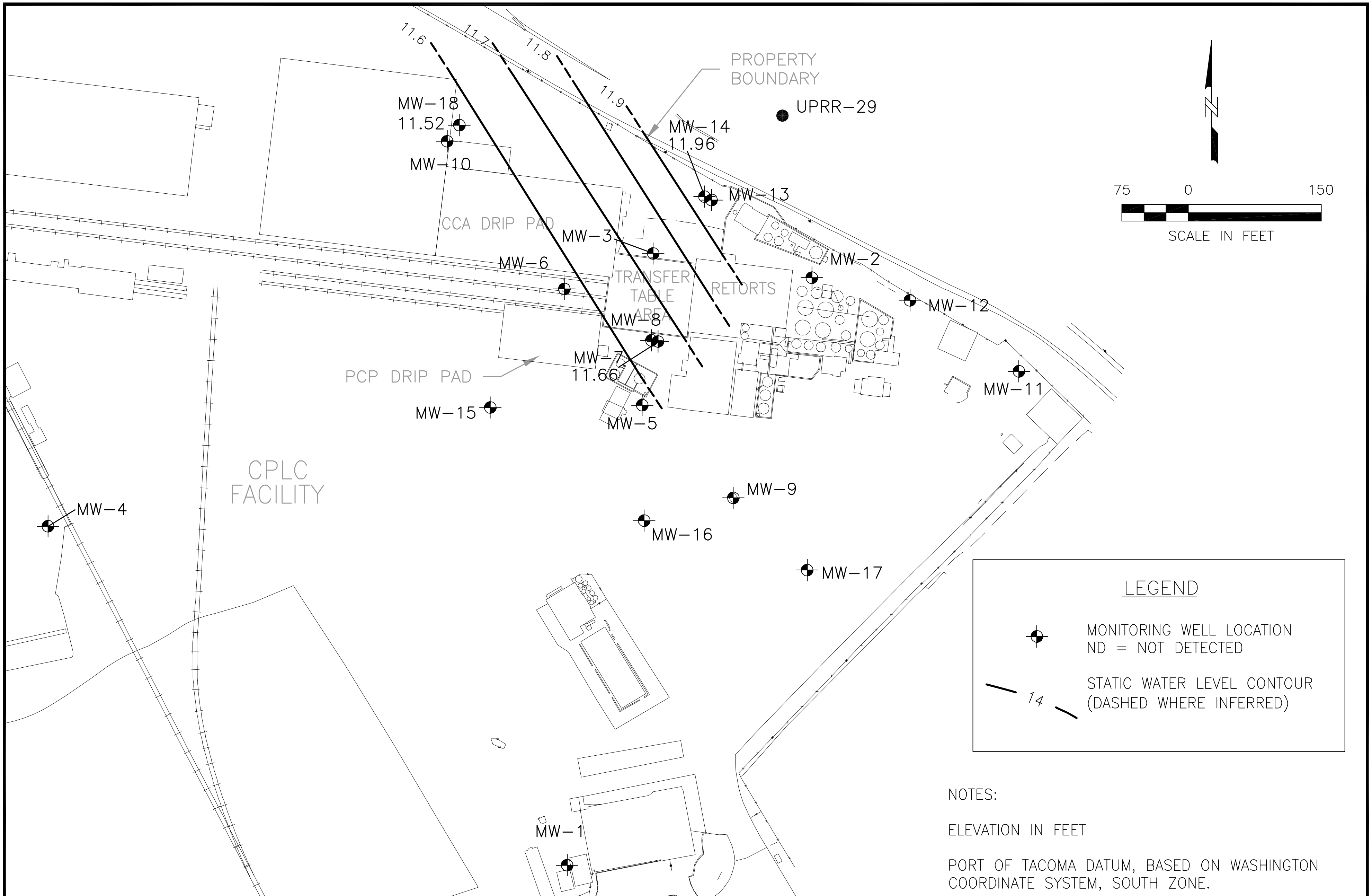
ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

ENSR | AECOM

CASCADE POLE AND LUMBER COMPANY TACOMA, WASHINGTON 04530-015-300	**POTENTIOMETRIC SURFACE DEEP AQUIFER JANUARY 2008**
DATE: 03/10/08 DRWN: E.M./SEA	**FIGURE 12**

File: H:\16832\16832S111.dwg Layout: FIG User: emarshall Plotted: May 03, 2007 - 8:58am Xref's:



NOTES:

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

ENSR | AECOM

Merged with ENSR in 2007

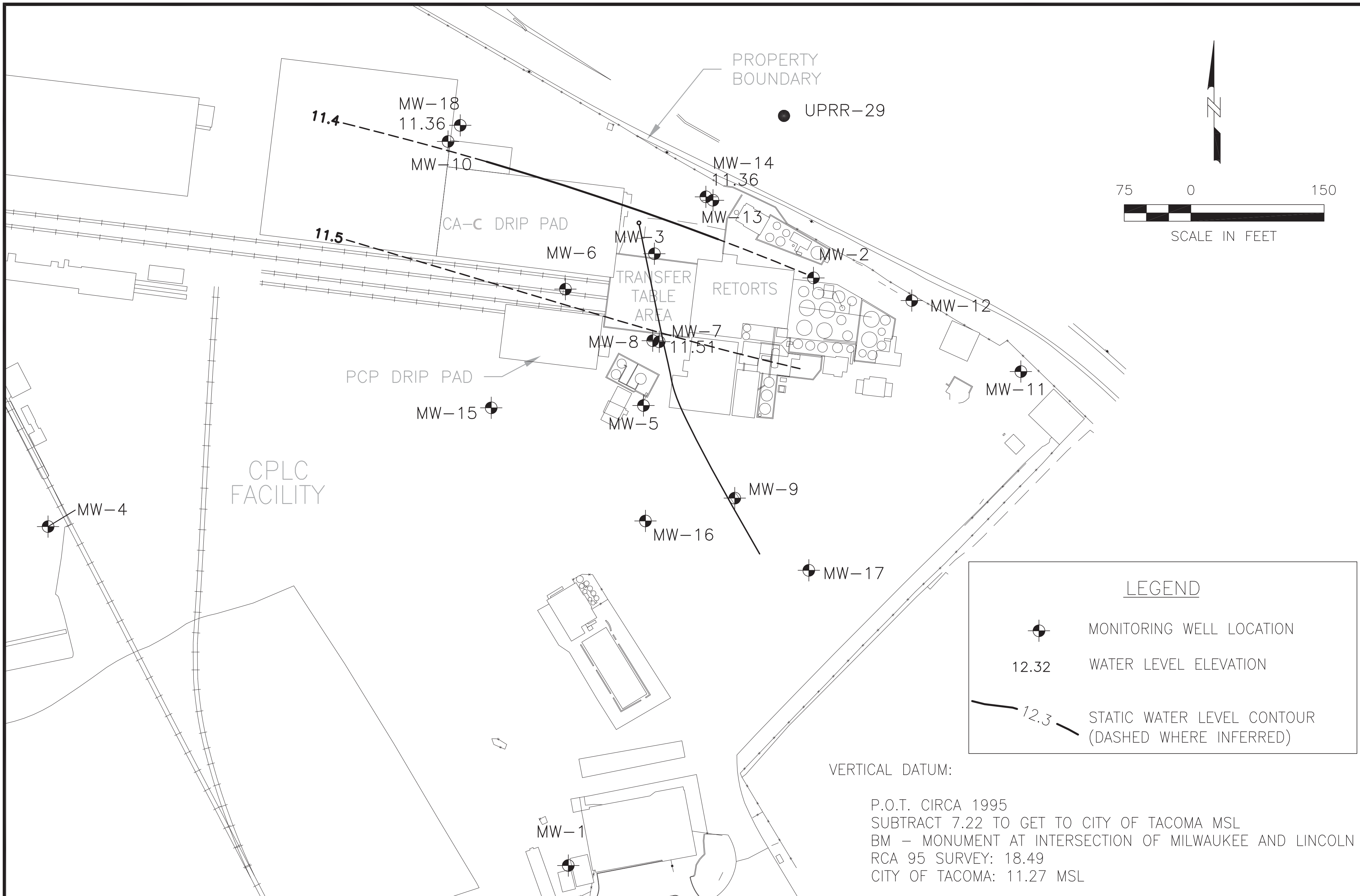
RETEC

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

CPLC1-16832-500

POTENTIOMETRIC SURFACE
DEEP AQUIFER
FEBRUARY 2007

DATE: 05/03/07	DRWN: E.M./SEA			**FIGURE 12**



AECOM

CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

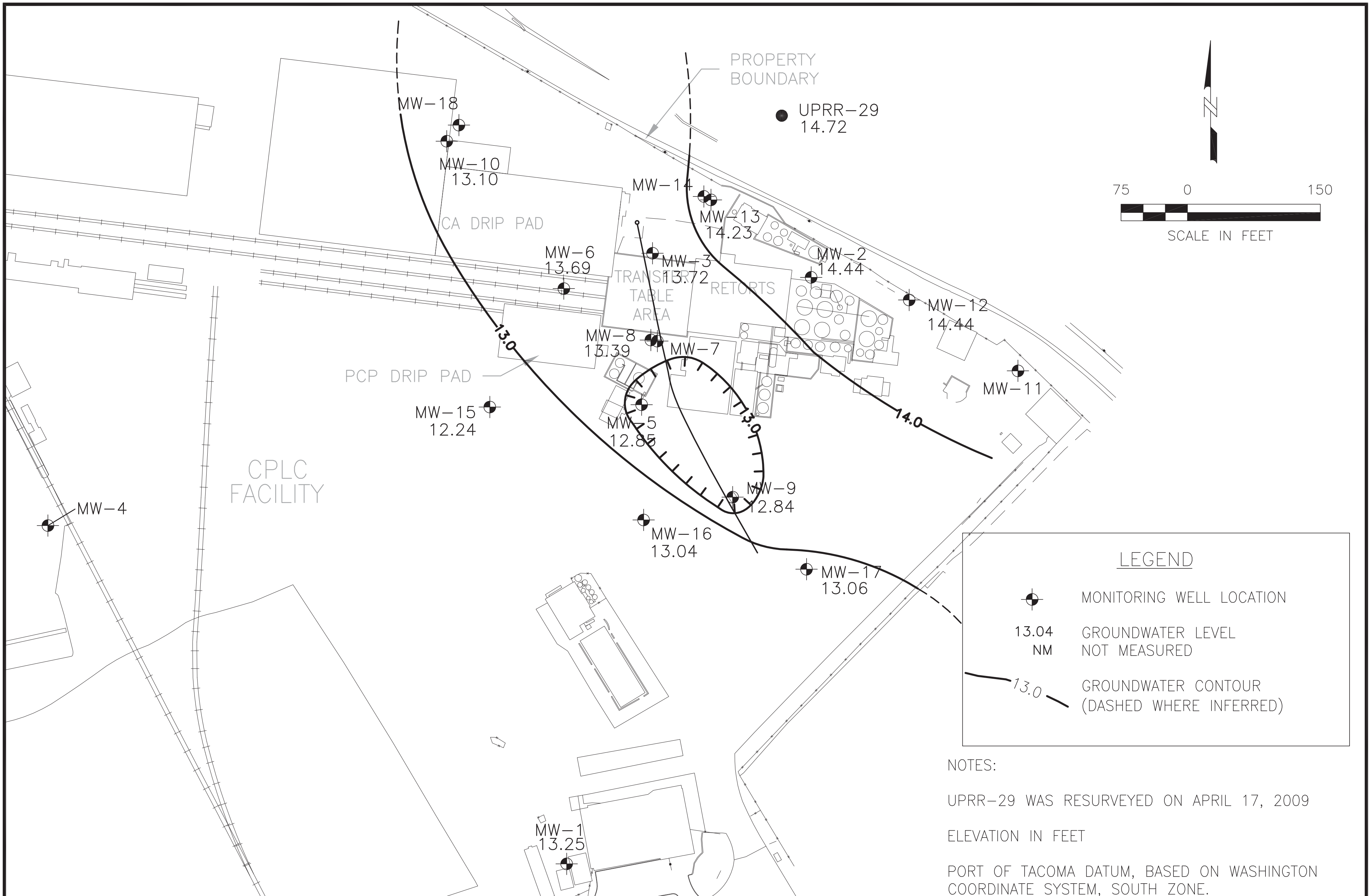
60137201-0300

DATE: 03/21/12 DRWN: M.O./SEA

POTENTIOMETRIC SURFACE MAP
DEEP AQUIFER
FEBRUARY 2012

FIGURE 3-4

File: G:\PROJECTS\CADD\Cascade Lumber\Annual GW Report\2012\shallow_gw_level.dwg Layout: FIGURE 11 User: oliveriam Plotted: Mar 21, 2012 - 4:38pm Xref's:



NOTES:

UPRR-29 WAS RESURVEYED ON APRIL 17, 2009

ELEVATION IN FEET

PORT OF TACOMA DATUM, BASED ON WASHINGTON COORDINATE SYSTEM, SOUTH ZONE.

AECOM

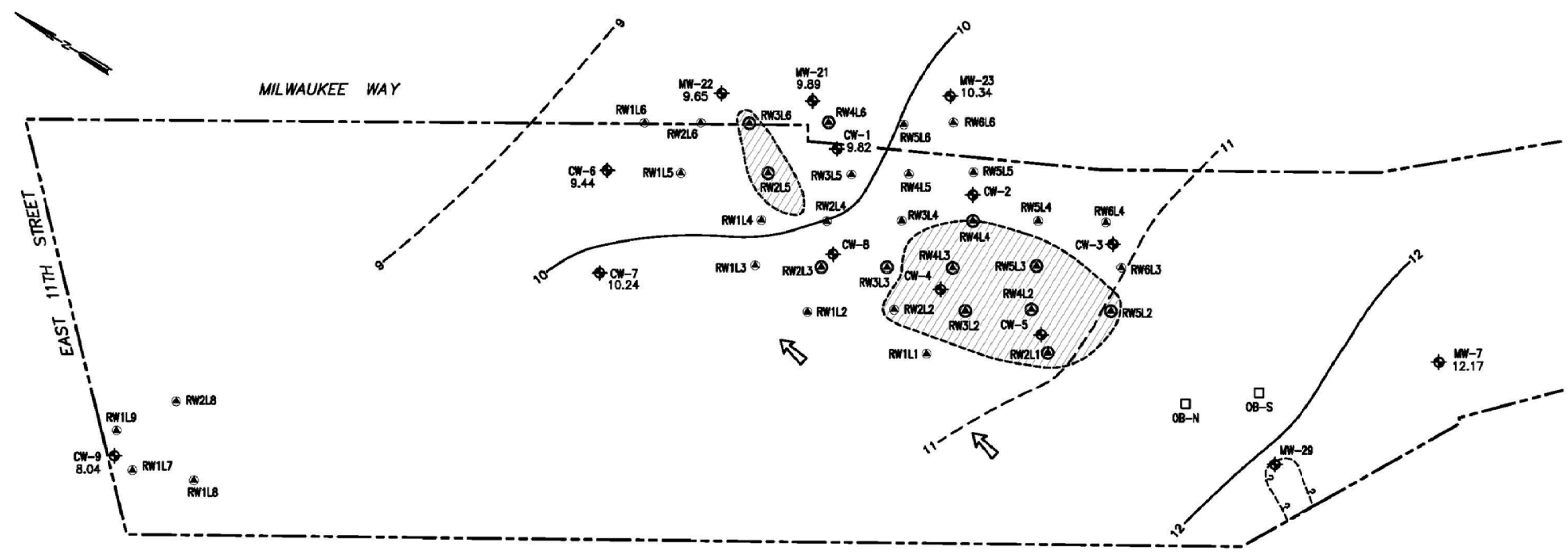
CASCADE POLE AND LUMBER COMPANY
TACOMA, WASHINGTON

60137021-0300

DATE: 03/21/12 | DRWN: M.O./SEA

GROUNDWTER ELEVATION CONTOUR MAP
SHALLOW AQUIFER
FEBRUARY 2012

FIGURE 3-1



LEGEND:

9.65 Groundwater Elevation (Feet Above MSL)

—12— Inferred Groundwater Elevation Contour (feet)

General Groundwater Flow Direction

Current Free Product Plume (Dashed Where Inferred) As of October, 2004

MW-21 Compliance Monitoring Well Location

RW2L8 Groundwater Recovery Well with No Above Ground Stickup

RW2L8 Groundwater Recovery Well with Above Ground Stickup

OB-1 Reinfiltration Trench Piezometer Location

Approximate Property Boundary

NOTES:

1. Product was present in CW-4 and CW-5 but could not be measured due to high viscosity.
2. Water elevations measured with the groundwater extraction system operating.

SCALE 0 200 400 FEET

SOURCE: DOWL ENGINEERS, A DIVISION OF DOWL, INC.

DRAWN BY	CHECKED BY	APPROVED BY	OFFICE	DRAWING NUMBER
MPortacio 3/05			BOTHELL	111487.01

XREF Files: IMAGE Files:
File: N:\Project\final\PortofTacoma\111487\Drawings\BT-GWCMAP-2-05-F1.dwg user: maria.portacio March 8, 2005

Shaw® Shaw Environmental, Inc.
19909 120th Avenue N.E., Suite 101
Bothell, Washington 98011
Phone (425) 485-5000
Fax. (425) 486-9766

GROUNDWATER ELEVATION CONTOUR MAP - FEBRUARY 2005

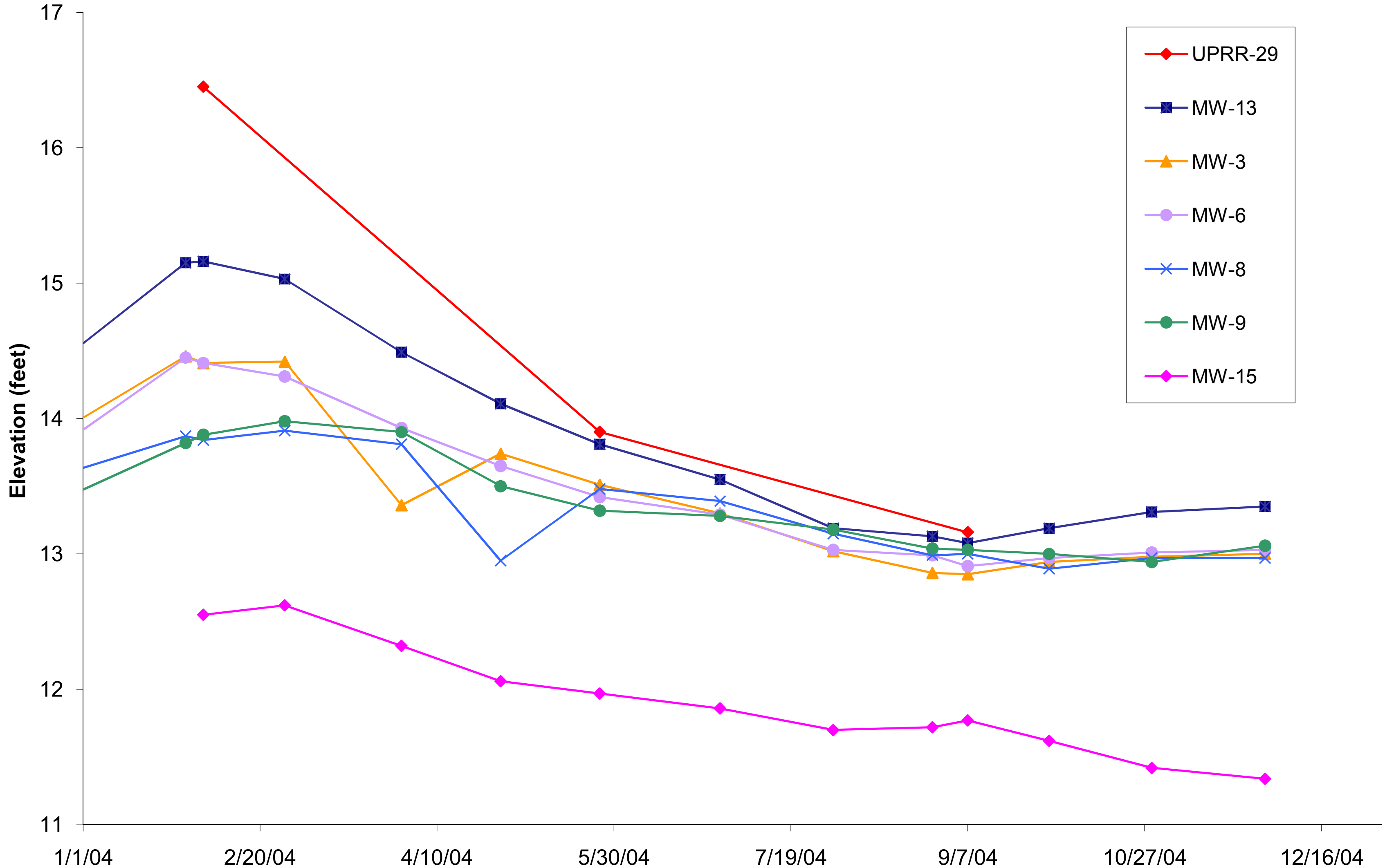
PORT OF TACOMA
FORMER MILWAUKEE RAILYARD SITE
TACOMA, WASHINGTON

File: P:\CADD\Cascade Lumber\16832S051.dwg Layout: FIGURE 3-6 User: oliveriam Plotted: Mar 09, 2011 - 12:36pm Xref's:

RETEC

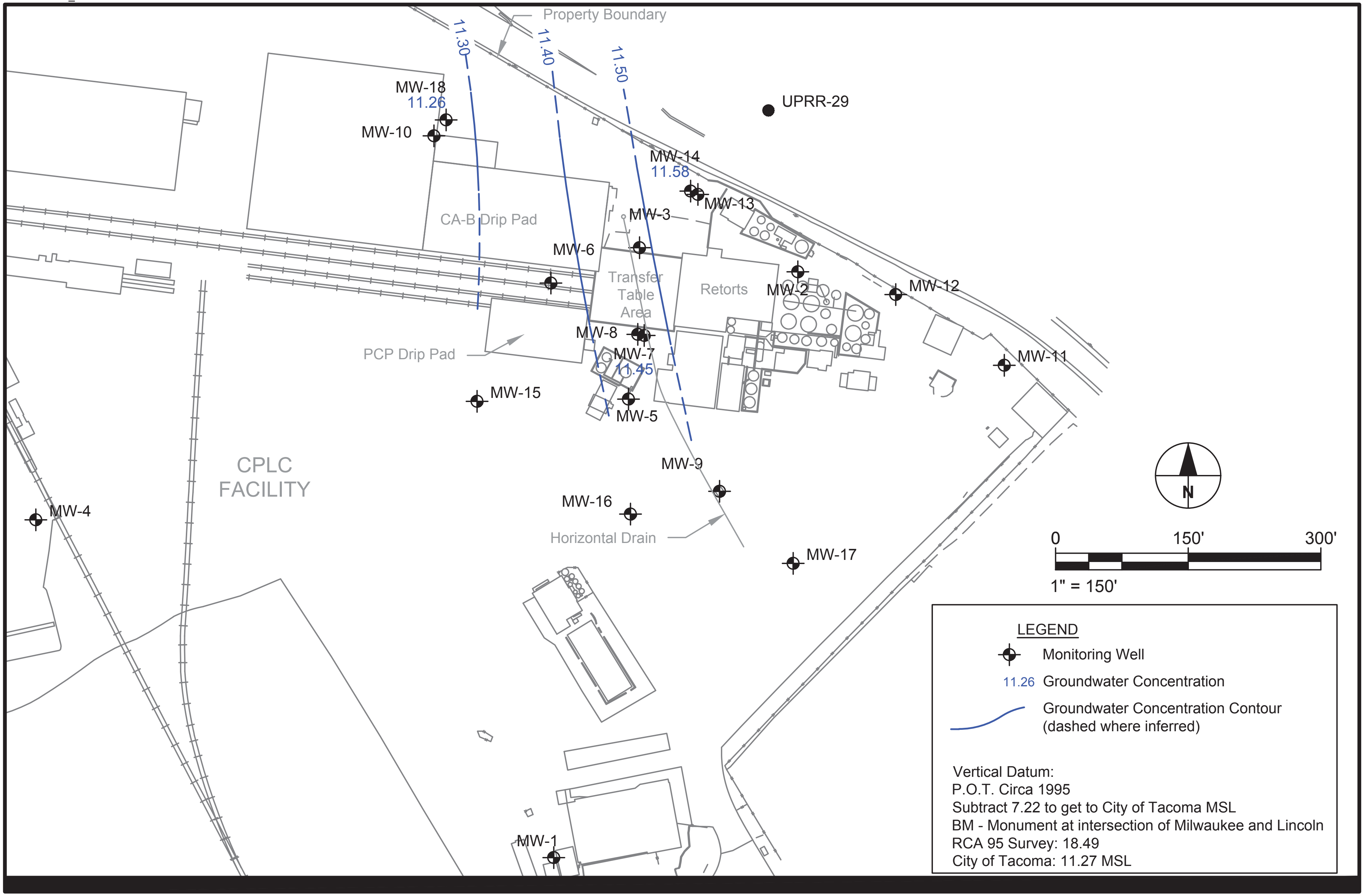
CASCADE POLE AND LUMBER COMPANY TACOMA, WASHINGTON CPLU1-16832-500	**GROUNDWATER LEVATION CONTOUR MAP** **UPRR SITE** **FEBRUARY 2005**
DATE: 04/18/05 DRWN: A.S./SEA	**FIGURE 3-2**

Figure 3-3 Groundwater Elevation Hydrograph



Last saved by: MARSHALLE(2013-04-26) Last Plotted: 2013-04-26
Filename: Z:_SEATTLE WORK\CPLC\2013 ANNUAL GW REPORT\60220510-FIG-B-SHALGW.DWG

Project Management Initials: Designer: EM/ftc Checked:RK/sea Approved:_____ ANSI A 8.5" x 11"



Cascade Pole and Lumber Company
2013 Annual Groundwater Report
Tacoma, Washington
Project No.: 60220510 Date: 2013-04-26

Potentiometric Surface Map
in Deep Aquifer
February 2013

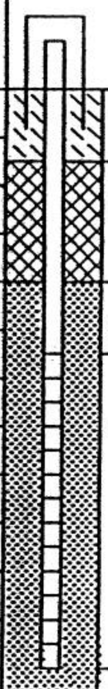
AECOM

Figure 3-4

APPENDIX B

WELL LOGS

REMEDIATION TECHNOLOGIES INC (RETEC)	**MONITORING WELL LOG**	**WELL NUMBER:** MW-4 **SHEET** 1 **OF** 1
PROJECT NAME/NUMBER: 30-499-310		**DRILLING CO:** Soil Sampling Service
LOCATION: North of the bark chipper		**DRILLER:** M. Marquardi
SCHEDULE	**WATER LEVEL**	**RIG TYPE:** B-61
INITIATED: 1/23/91 0930 **COMPLETED:** 1/23/91 1040	**DEPTH:** 6.35 **DATE:** 1/23/91 1143	**METHOD:** HSA
BORING DEPTH: 12.5'	**BORING DIAMETER:** 7.25"	**LOGGED BY:** L. Baker



DEPTH IN FEET	WELL CONSTRUCTION		SOIL DESCRIPTION	TYPE	DEPTH	BLOWS	% RECOV	PID ppm
0	Cement 1.5' Benton. chips 4'	GM	SAND (top 2"): very dark gray (2.5YN/3), medium sand, some silt, trace clay, wet. GRAVEL AND WOOD DEBRIS (2"): olive brown(2.5Y4/4), moist, no odor, PID run on primarily this material. SANDY GRAVEL (6"): light olive brown(2.5Y5/4), damp, no odor.	S S	A A X	20 50 4 7 9 9	50 100	2.7 1.6
5	2".01PVC screen @6' Sand 10-20	SM & ML	SILTY SAND(12"): olive yellow (2.5Y6/6) grades downward to olive (5Y5/4). SILT(6"):black(N2/0), organic rich silt, some clay, wood chips, damp to moist, sand at very tip of core, sampled.	S	A X	4 7 9	100	5.2
		SM	SILTY SAND: black (N2/0) with thin olive yellow silty clay-.1-.5" layers, fine to medium sand, trace clay, moderate sorting with variable amounts of silt and clay 5-35%, wet, sewage odor, saturated	S	X	5 7 6	100	4.5
10		SM	SAND: black (N2/0), very fine to medium, medium sorting, saturated, mild sewage-like odor.	S	X	1 2 2	100	6.0 *
	12' TD	SM & ML	SAND (4"): black (N2/0), very fine to medium, medium sorting, saturated, no odor. SILTY CLAY TO CLAYEY SILT: laminated black(N2/0) and grayish brown (2.5Y5/2), wet no odor, soft, root traces.					
15								
20			NOTE: PID for empty plastic bag is 2.1 ppm. Sand immediately above clay is 9 pmm peak. Getting PID readings but no product odor.					
25								

REMARKS:
S - Split spoon sample
X - Sample depth
* - Second test is 5.4 ppm
A - Sample sent to laboratory for analysis

Boring/Well Log

RETEC

Well #: MW-15

Project: **Cascade Pole**	Monument: **Heavy duty flush mount**	Stick Up:
Project #: **CPLU1-16832**	Northing: Easting:	Ground Elevation:
Location:	Drill Rig Type: **B-59 Foremost**	MP Elevation:
Client: **McFarland Cascade**	Method: **Hollow stem auger**	Total Depth: **19.5'**
Start Date & Time: **12/15/03 1215**	Casing ID: **8"**	Filter Pack: **5-12' 10/20 silica sand**
Finish Date & Time: **12/15/03 1430**	Boring ID: **4"**	Seal: **1.5-5' 3/8" benonite chips**
Contractor: **Holt Drilling**	Bit Type:	Grout:
Operator: **Michael Reynolds**	Logged By: **N. Bacher**	Screen: **6-11' 0.010-slot Sch. 40 PVC**

Sample Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: **USCS**)	Elevation (ft.)	Comments
GS	0-0.5	100		1.6			0	(0-0.5') ASPHALT.	0	
								(0.5-1') SLIGHTLY GRAVELLY SAND. Slightly moist, dense, dark gray, some wood fragments. Gravel up to 1/4". No OVC.		
SS	2.5-4	100	7/8/15	1.6				(1-2.5') Same as above. Logged cuttings.		
								(2.5-3.8') MEDIUM SAND. Slightly moist, medium dense, black, trace silt. No OVC.		
SS	5-6.5	75	5/5/6	0			5	(3.8-4.0') SLIGHTLY GRAVELLY SAND. Slightly moist, medium dense, black. Gravel is up to 1/4" and rounded. No OVC.	-5	
								(5-6.5') VERY SILTY FINE SAND. Moist, medium dense, brownish gray. No OVC.		
SS	7.5-9	35	4/3/3	0				(7.5-9') SILTY SAND. Wet, medium dense, dark brown, trace gravel, some wood. Slight odor, no visual contamination. Drilled through a brick at 8.5-9'.		
SS	10-11.5	5	1/1/0	NM			10	(10-11.5') WOOD. Wet, soft, black, sandy. Slight organic odor, no visual contamination. Poor recovery.	-10	
SS	11.5-13	5	0/0/0	0				(11.5-13') Same as above. Poor recovery.		
SS	13-14.5	5	3/2/1	NM				(13-14.5') Wood chunk stuck in shoe. No recovery.		
SS	15-16.5	0	3/1/1	NM			15	(15-16.5') Wood chunk stuck in shoe. No recovery. Slight organic odor on wood, no visual contamination.	-15	

Remarks and Datum Used: Slight methane odor in hole during backfill.
No blacklight response on any sample.

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)

Boring/Well Log

Well #: MW-15

Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description (Classification Scheme: USCS)	Elevation (ft.)	Comments
	18-19.5	0	0/0/0	NM				(18-19.5) CLAYEY SILT TO SILTY CLAY. Wet, soft, gray, some wood fragments. No OVC. Logged what was on the core catcher only. Poor recovery.		

Remarks and Datum Used:

Slight methane odor in hole during backfill.

No blacklight response on any sample.

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Sample Type

N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)

RETEC

Boring/Well Log

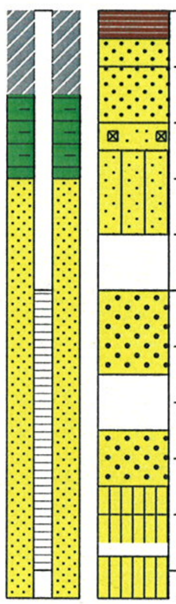
Well #: MW-16
Sheet 1 of 1

Project: **Cascade Pole**	Monument: **Heavy duty flush mount**	Stick Up:
Project #: **CPLU1-16832**	Northing: Easting:	Ground Elevation:
Location:	Drill Rig Type: **B-59 Foremost**	MP Elevation:
Client: **McFarland Cascade**	Method: **Hollow stem auger**	Total Depth: **10.5'**
Start Date & Time: **12/15/03 1500**	Casing ID: **8"**	Filter Pack: **3-10.5' 10/20 silica sand**
Finish Date & Time: **12/15/03 1700**	Boring ID: **4"**	Seal: **1.5-3' 3/8" bentonite chips**
Contractor: **Holt Drilling**	Bit Type:	Grout:
Operator: **Michael Reynolds**	Logged By: **N. Bacher**	Screen: **5-10' 0.010-slot Sch. 40 PVC**

Sample

Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)
GS	0-0.5	100		1.6
SS	2.5-4	50	4/5/5	1.6
SS	5-6.5	50	3/5/4	3.2
SS	7.5-9	100	1/18"	1.6
SS	9-10.5	80	NA	1.6

Well Completion Log / Graphic



Depth (ft.): 0, 5, 10

Soil and Rock Description

Classification Scheme: **USCS**

(0-0.5') ASPHALT.

(0.5-1') SLIGHTLY GRAVELLY SAND. Moist to dry, dense, brownish black. Gravel up to 1/4". No OVC.

(1-2') Same as above but moist. Logged cuttings.

(2-2.5') GRAVEL. Minor sand, gravel is 1" and rounded. Logged cuttings.

(2.5-4') SILTY SAND. Moist, medium dense, gray, w/ 1/4" subrounded gravel. No OVC.

(5-6.5') SAND. Moist to wet, medium dense, black, w/ some wood fragments. Slight to moderate odor, no visual contamination.

(7.5-8.5') Same as above but no wood or no OVC.

(8.5-9') SILTY CLAY. Moist to wet, medium soft, gray, w/ organics (reeds, grasses). No OVC.

(9-9.5') Same as above.

(9.5-9.75') WOOD wet, fibrous. No OVC.

(9.75-10.5') SILTY CLAY. Moist to wet, medium soft, gray, w/ organics (reeds, grasses). No OVC.

Elevation (ft.): 0, -5, -10

Comments

Remarks and Datum Used:

Moderate methane odor in hole.

No blacklight response on any sample.

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Sample Type

N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)

RETEC — Boring/Well Log

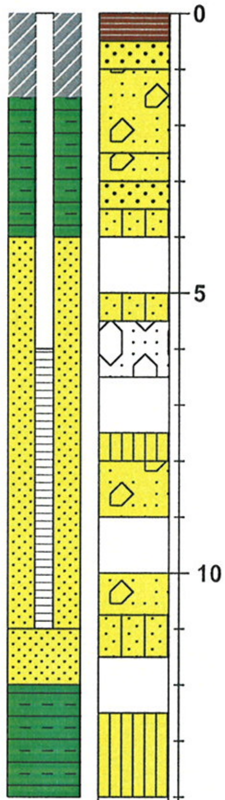
Well #: MW-17
Sheet 1 of 2

Project: **Cascade Pole**	Monument: **Heavy duty flush mount**	Stick Up:
Project #: **CPLU1-16832**	Northing: Easting:	Ground Elevation:
Location:	Drill Rig Type: **B-59 Foremost**	MP Elevation:
Client: **McFarland Cascade**	Method: **Hollow stem auger**	Total Depth: **19.5 ft**
Start Date & Time: **12/15/03 0845**	Casing ID: **8"**	Filter Pack: **4-14' 10/20 silica sand**
Finish Date & Time: **12/15/03 1115**	Boring ID: **4"**	Seal: **1.5-4' 3/8" bentonite chips**
Contractor: **Holt Drilling**	Bit Type:	Grout:
Operator: **Michael Reynolds**	Logged By: **N. Bacher**	Screen: **6-11' 0.010-slot Sch. 40 PVC**

Sample

Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)
GS				1.6
SS	2.5-4	80	21/37/24	1.6
SS	5-6.5	60	5/7/8	1.6
SS	7.5-9	100	9/10/7	1.6
SS	10-11.5	50	1/2/1	0
SS	12.5-14	100	1/18"	1.6

Well Completion Log | Graphic | Depth (ft.)



Soil and Rock Description

Classification Scheme: **USCS**

- (0-0.5') ASPHALT.
- (0.5-1') GRAVELLY SAND. Moist, dense, blackish brown. Gravel up to 1/2" and rounded. No OVC.
- (1-2.5') Grading to SANDY GRAVEL. Logged cuttings only.
- (2.5-3') SANDY GRAVEL. Moist, dense, greyish black, trace silt. Wood chunks. No OVC.
- (3-3.5') SLIGHTLY GRAVELLY SAND. Dry to moist, medium dense, light brown. No OVC.
- (3.5-4') SILTY SAND. Moist, medium dense, gray brown. No OVC.
- (5-5.5') SLIGHTY SILTY SAND. Moist, medium dense, black. No OVC.
- (5.5-6.5') Hammered through red bricks.
- (7.5-8') CLAYEY SILT. Moist to wet, medium dense, gray, minor sand. No OVC.
- (8-9') SANDY GRAVEL. Moist, fairly loose, light brown. Gravel up to 1/2" and subrounded. No OVC.
- (10-10.75') Same as above.
- (10.75-11.5') SILTY SAND. Wet, medium soft, gray, minor gravel. No OVC.
- (12.5-14') SILTY CLAY. Moist, medium soft, gray. Abundant plant fragments (grasses, reeds). Slight organic (rotten) odor. No OVC.

Elevation (ft.): 0, -5, -10, -15

Comments:

Remarks and Datum Used: PID calibrated to 98.9 ppm at 1030

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Sample Type

N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)

RETEC

Boring/Well Log

Sample					Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description Classification Scheme: **USCS**	Elevation (ft.)	Comments
Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)						

Remarks and Datum Used:	PID calibrated to 98.9 ppm at 1030

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater		
Date	Time	Depth (ft.)

RETEC Boring/Well Log

Well #: MW-18
Sheet 1 of 2

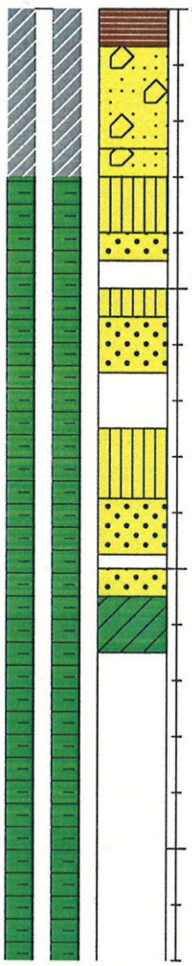
Project: **Cascade Pole**	Monument: **Heavy duty flush mount**	Stick Up:
Project #: **CPLU1-16832**	Northing: Easting:	Ground Elevation:
Location:	Drill Rig Type: **B-59 Foremost**	MP Elevation:
Client: **McFarland Cascade**	Method: **Hollow stem auger**	Total Depth: **29 ft**
Start Date & Time: **12/16/03 0855**	Casing ID: **8 (10)**	Filter Pack: **21-29' 10/20 silica sand**
Finish Date & Time: **12/16/03 1500**	Boring ID: **4 (6)**	Seal: **3-21' 3/8" bentonite chips**
Contractor: **Holt Drilling**	Bit Type:	Grout:
Operator: **Michael Reynolds**	Logged By: **N. Bacher**	Screen: **22-27' 0.010-slot Sch.40 PVC**

Soil and Rock Description

Classification Scheme: **USCS**

Type & #	Depth Range	% Rec	Blows per 6"	PID (ppm)
SS	2.5-4	100	2/5/9	1.6
SS	5-6.5	70	2/2/8	1.6
SS	7.5-9	60	1/1/1	1.6
SS	10-11.5	100	1/18"	1.6
SS	12.5-14	10	2/4/5	3.2
SS	15-16.5	0	3/5/4	NM

Well Completion Log / Graphic / Depth (ft.)



(0-0.67') ASPHALT.

(0.67-2.5') SANDY GRAVEL (GW). moist, loose to medium dense, black gray. No OVC. Logged cuttings.

(2.5-3') Same as above.

(3-4') SILT WITH TRACE CLAY (ML). moist to dry, stiff, gray, some oxidation mottling. No OVC.

(4-4.5) MEDIUM TO FINE SAND (SP). moist, medium dense, blackish brown. No OVC.

(5-5.5') SLOUGH (ML). Gray silt from above sloughed in hole.

(5.5-6.5') MEDIUM SAND (SP). moist, medium dense, blackish brown. No OVC.

(7.5-8.75') SLOUGH (ML). Gray silt from above slough in hole.

(8.75-9.75') MEDIUM SAND (SP). moist, medium dense, blackish brown. No OVC

(10-10.5') Same as above.

(10.5-11.5') SILTY CLAY (CL). moist to wet, medium stiff, gray. Black organic fibers, slight organic odor. No OVC.

(12.5-14') SHREDDED WOOD (WOOD). Poor recovery. Wet, some gray silty clay, slight odor. No OVC. Wood stuck in shoe.

(15-16.5') NO RECOVERY. Spoon full of gray water.

Elevation (ft.): 0, -5, -10, -15

Comments:

Remarks and Datum Used: Telescoped from 10" to 8" augers at 11'.

The RETEC Group, Inc.
1011 SW Klickitat Way, Suite 207
Seattle, WA 98134-1162
Phone: (206) 624-9349
Fax: (206) 624-2839

Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

Groundwater

Date	Time	Depth (ft.)

RETEC

Boring/Well Log

Soil and Rock Description
Classification Scheme: **USCS**

Sample: Type & #	Sample: Depth Range	Sample: % Rec	Sample: Blows per 6"	Sample: PID (ppm)	Well Completion Log	Graphic	Depth (ft.)	Soil and Rock Description	Elevation (ft.)	Comments
SS	17.5-19	0	1/18"	NM				(17.5-19') NO RECOVERY. Spoon full of gray water.		
SS	20-21.5	50	1/1/1	1.6			20	(20-21.5') MEDIUM SAND WITH MINOR SILT (SP). wet, loose to medium dense, gray, trace wood shreds. No OVC.	-20	
SS	22.5-24	100	2/4/7	0				(22.5-24') MEDIUM SAND WITH MINOR TO TRACE SILT (SP). wet, medium dense, blackish gray, red brick fragments (<1mm) in matrix. No OVC.		
SS	25-26.5	100	6/6/6	1.6			25	(25-26.5') Same as above.	-25	
SS	27.5-29	60	1/18"	0				(27.5-29') Same as above but very wet. Trace clayey silt on shoe. No OVC.		

Remarks and Datum Used: Telescoped from 10" to 8" augers at 11'.

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Phone: (206) 624-9349
Fax: (206) 624-2839

Sample Type
N = SPT
DP = Direct Push
SS = Split Spoon
C = Core

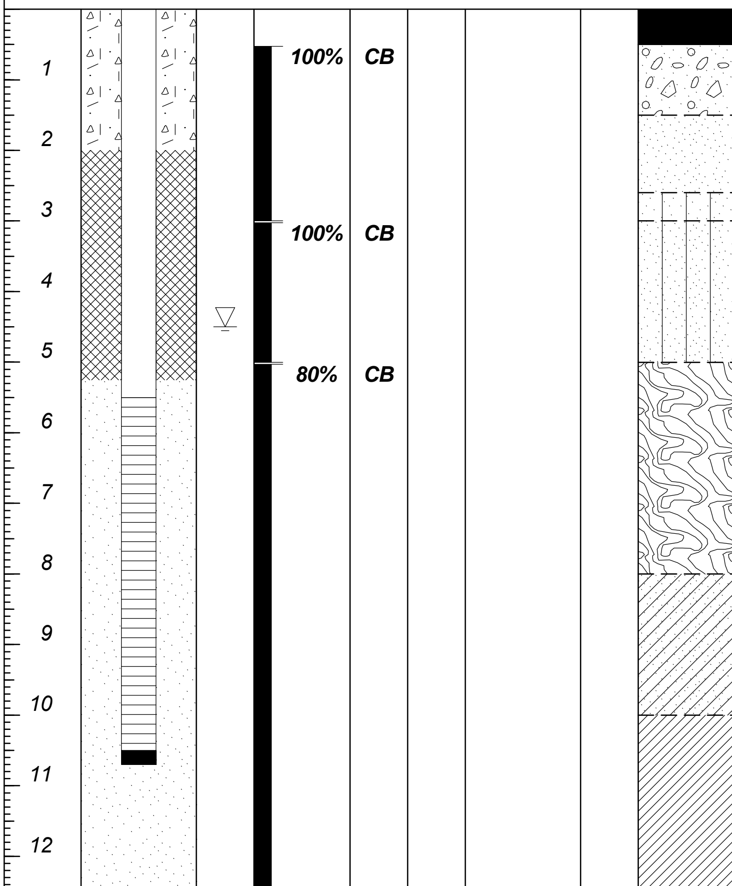
Groundwater: Date	Time	Depth (ft.)

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0999.01.02	**MW-19**	**1 of 1**

Project Name	**McFarland Cascade Pole & Lumber**	TOC Elevation (feet)	
Project Location	**1640 East Marc Street, Tacoma, WA**	Surface Elevation (feet)	
Start/End Date	**2/16/2015 to 2/16/2015**	Northing	
Driller/Equipment	**Cascade Drilling LLP/Sonicore 50K**	Easting	
Geologist/Engineer	**Heather Good**	Hole Depth	**12.5-feet**
Sample Method		Outer Hole Diam	**8-inch**



Depth (feet, BGS)	Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Soil Description
0–0.5							0.0 to 0.5 feet: ASPHALT.
0.5–1.5		**100%**	**CB**				0.5 to 1.5 feet: SANDY GRAVEL (GW); dark brown to light bluish gray; 5% fines; 35% sand, fine to coarse; 60% gravel; fine to coarse, subrounded; few cobbles; moist.
1.5–2.6							1.5 to 2.6 feet: SAND (SP); dark brown; 5% fines; 90% sand, fine, very loose; 5% gravel, fine, subrounded; moist.
2.6–3.0		**100%**	**CB**				2.6 to 3.0 feet: SANDY SILT (MLS); bluish-gray; 75% fines, stiff, nonplastic; 20% sand, fine to coarse; 5% gravel, fine to medium, subrounded; trace greenish-brown mottles; moist.
3.0–5.0							3.0 to 5.0 feet: SILTY SAND with GRAVEL (SM); dark brown; 15% fines, soft, nonplastic; 70% sand, fine to coarse, loose; 15% gravel, fine to medium, subrounded; few rootlets and cobbles, wood, glass, tile and brick fragments; moist to wet at 4.5 feet.
5.0–8.0		**80%**	**CB**				5.0 to 8.0 feet: WOOD (WOODY DEBRIS); dark brown; 80% wood fragments; 15% sand, fine; 5% gravel, fine to medium, subrounded; hydrocarbon-like odor; moist.
8.0–10.0							8.0 to 10.0 feet: SILTY CLAYEY SAND (SC); dark gray; 85% fines; nonplastic, very soft; 15% sand, fine; abundant wood at 8.0 to 8.5 feet, few gravel, subrounded; hydrocarbon-like odor; wet.
10.0–12.5							10.0 to 12.5 feet: SILTY CLAY (CL); dark gray to black; 90% fines, high plasticity, very soft; 10% sand, fine; few rootlets; hydrocarbon-like odor; dark gray to black laminations; wet.

Total Depth = 12.5 feet below ground surface.

Boring Completion Details:
0.0 to 5.0 feet: 8-inch boring.
5.0-12.5 feet: 4.5 inch boring.
0.0 to 2.0 feet: concrete.
2.0 to 5.0 feet: bentonite chips hydrated with potable water.
5.25 to 12.5 feet: 10X20 silica sand.

Monitoring Well Completion Details
Stick-up completion.
+3.0 to 5.5 feet: 2-inch, schedule 40, polyvinyl chloride, riser pipe.
5.5 to 10.5 feet: 2-inch, schedule 40, polyvinyl chloride, 0.010-inch machine slot, well screen.
10.5 to 10.7 feet: 2-inch, schedule 40, polyvinyl chloride pipe end cap.

NOTES: CB = Core barrel.
Hole Diameter: 8" to 5', 4.5" to 12.5'

▽ **Based on soil observation.**

Maul Foster & Alongi, Inc.	Geologic Borehole Log/Well Construction		
	Project Number	Well Number	Sheet
	0999.01.02	**MW-20**	**1 of 1**

Project Name	**McFarland Cascade Pole & Lumber**	TOC Elevation (feet)	
Project Location	**1640 East Marc Street, Tacoma, WA**	Surface Elevation (feet)	
Start/End Date	**2/16/2015 to 2/16/2015**	Northing	
Driller/Equipment	**Cascade Drilling LLP/Sonicore 50K**	Easting	
Geologist/Engineer	**Heather Good**	Hole Depth	**12.5-feet**
Sample Method		Outer Hole Diam	**8-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
0–0.5									0.0 to 0.5 feet: ASPHALT.
1			100	CB					0.5 to 2.5 feet: SANDY GRAVEL (GW); dark grayish brown; 5% fines, 35% sand, fine to coarse; 60% sand, fine to medium, subrounded; few cobbles; moist.
3			90	CB					2.5 to 5.0 feet: SAND (SW); dark gray; 5% fines; 90% sand, fine, very loose; 5% gravel, fine, subrounded; moist.
5			90	CB					5.0 to 8.0 feet: SAND (SP); dark gray; 5% fines; 95% sand, fine, very loose; moist to wet at 7.0 feet.
7	▽								
8									8.0 to 9.0 feet: CLAYEY SILT (ML); dark gray; 95% fines, soft, low plasticity; 5% sand, fine; few rootlets; wet.
9									9.0 to 12.5 feet: SILTY CLAY (CH); black to dark grayish brown; 100% fines, very soft, high plasticity; abundant organics, including rootlets and plant fragments; laminated black to dark grayish brown; wet.

Total Depth = 12.5 feet below ground surface.

Boring Completion Details:
0.0 to 5.0 feet: 8-inch boring.
5.0-12.5 feet: 4.5 inch boring.
0.0 to 2.0 feet: concrete.
2.0 to 5.25 feet: bentonite chips hydrated with potable water.
5.25 to 12.5 feet: 10X20 silica sand.

Monitoring Well Completion Details
Stick-up completion, step-down well install.
+3.0 to 5.5 feet: 2-inch, schedule 40, polyvinyl chloride, riser pipe.
5.5 to 10.5 feet: 2-inch, schedule 40, polyvinyl chloride, 0.010-inch machine slot, well screen.
10.5 to 10.7 feet: 2-inch, schedule 40, polyvinyl chloride pipe end cap.

NOTES: CB = Core barrel.
Hole Diameter: 8" to 5', 4.5" to 12.5'

▽ **Based on soil observation.**

APPENDIX C

SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN

MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

Prepared for

MCFARLAND CASCADE HOLDINGS, INC.

A STELLA-JONES COMPANY

TYEE MANAGEMENT COMPANY, LLC

January 12, 2016
Project No. 0999.01.01

Prepared by
Maul Foster & Alongi, Inc.
1329 N State Street, Suite 301, Bellingham WA 98225

MAUL
FOSTER
ALONGI

SAMPLING AND ANALYSIS PLAN

MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE

TACOMA, WASHINGTON

The material and data in this plan were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

Carolyn Wise, GIT
Staff Geologist

Heather R. Good, LHG
Project Hydrogeologist

CONTENTS

FOLLOWING PLAN:

TABLE

GROUNDWATER SAMPLE HANDLING SUMMARY

ACRONYMS AND ABBREVIATIONS

CMP	groundwater compliance monitoring plan
COC	chain of custody
cPAH	carcinogenic polycyclic aromatic hydrocarbon
Ecology	Washington State Department of Ecology
FSDS	field sampling data sheet
IDW	investigation-derived waste
IHS	indicator hazardous substance
LCS	laboratory control sample
LDS	laboratory duplicate sample
MCHI	McFarland Cascade Holdings, Inc.
MCPLC	McFarland Cascade Pole and Lumber Company
MFA	Maul Foster & Alongi, Inc.
MS/MSD	matrix spike and matrix spike duplicate
PCP	pentachlorophenol
Property	Property, owned by Tyee, on which MCPLC conducts its operations
QA	quality assurance
QC	quality control
SAP	sampling and analysis plan
SIM	selective ion monitoring
Site	McFarland Cascade Pole and Lumber Company site
Tyee	Tyee Management Company, LLC
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

1 INTRODUCTION

Maul Foster and Alongi, Inc. (MFA) has prepared this sampling and analysis plan (SAP), including quality assurance project plan elements, consistent with the requirements of Washington Administrative Code (WAC) 173-340-820, on behalf of McFarland Cascade Holdings, Inc. (MCHI) and Tyee Management Company, LLC (Tyee) for the McFarland Cascade Pole and Lumber Company (MCPLC) site (Site) in Tacoma, Washington, to guide the collection of groundwater samples during groundwater compliance monitoring events. For purposes of this plan, "Property" (unless otherwise specified) refers to the property on which MCPLC conducts its operations, which is owned by Tyee and is leased to MCHI. The Site includes the Property and a limited portion of the adjacent former Union Pacific Railroad Milwaukee Railyard property to the northeast that is currently owned by the Port of Tacoma (see Figure 2 of the groundwater compliance monitoring plan [CMP]) (MFA, 2016a). The Site has been an active wood-treating facility since 1974; previous operations at the Site included a lumber mill and a landscape bark operation.

This SAP has been prepared consistent with the requirements of the Washington State Department of Ecology's (Ecology) Guidance on Sampling and Data Analysis Methods (Ecology, 1995), Guidance for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology, 2004), and the 1993 Model Toxics Control Act (WAC Chapter 173-340).

1.1 Investigation Objectives

The primary objective of this SAP is to establish procedures for the collection of data of sufficient quality to evaluate the nature and extent of impacted groundwater at the Site. The CMP references the relevant procedures and protocols from this SAP and the locations, frequency, and types of field or laboratory analyses that will be conducted. This SAP is meant to ensure that reliable data are obtained in support of remedial actions at the Site if such actions are necessary for the protection of human health and the environment. It provides a consistent set of procedures that will be used throughout the various work phases identified in the CMP (MFA, 2016a).

If a phase of work or an otherwise unforeseen change in methodology requires modification to this SAP, an addendum may be prepared that describes the specific revision(s) or the alternative procedures. Procedures are provided that will be used to direct the investigation process so that the following conditions are met:

- Data collected are of high quality, representative, and verifiable.
- Use of resources is cost effective.
- Data can be used by the Property owner and operator and by Ecology to support compliance monitoring for the selected Site remedy.

This SAP provides guidance on procedures for groundwater sampling, monitoring well installation and decommissioning, and management of investigation-derived waste (IDW). It also includes procedures for collecting, analyzing, evaluating, and reporting useful data. The document includes quality assurance (QA) procedures for field activities, sampling QA and quality control (QC) procedures, and data validation. The goal of the procedures outlined in this SAP is to obtain reliable data about physical, environmental, and chemical conditions at the Site in order to support the goals and objectives of the CMP.

2 ACCESS AND SITE PREPARATION

2.1 Access

MFA personnel will be on the Site during compliance monitoring activities. Access to the Site is allowed at all reasonable times for the purpose of performing work. Work activities resulting in loud noises will generally be confined to the hours between 7 a.m. and 7 p.m. MFA will notify MCHI before beginning work at the Site.

2.2 Site Preparation

Before any subsurface field activities (e.g., monitoring well installation) begin at the Site, public and private utility-locating services will be used to check for underground utilities and pipelines near each proposed well or boring location. MFA will coordinate fieldwork with MCPLC to define the locations of possible on-site utilities, piping, and other subsurface obstructions. Ecology will be notified a minimum of 48 hours before activities begin at the Site.

3 GROUNDWATER ASSESSMENT

Existing monitoring well locations are shown on Figure 4 of the CMP (MFA, 2016a). Any additional wells to be installed at the Site will be installed using a direct-push drill rig (i.e., Geoprobe™) in accordance with the installation details described below, and subsurface soil will be logged during well installation. In the event that refusal is met before the desired well installation depth is reached (i.e., significant debris, cobbles, or bedrock are encountered), a different type of drilling technology may be considered.

3.1 Monitoring Well Installation

Monitoring wells will be constructed according to the Washington well construction standards (Chapter 173-160 WAC) and as described below.

- Monitoring wells will be constructed with 2-inch-diameter polyvinyl chloride or stainless steel riser pipe and screened sections consisting of 0.010-inch machine slots. The monitoring wells may be constructed with prepacked well screen with 10 x 20 washed silica sand or by placing materials downhole, following the WAC regulation listed above.
- Additional filter pack may be placed around the prepacked screen (if used). The additional filter pack will consist of graded 10 x 20 washed silica sand and will extend a maximum of 1 foot below the bottom of the screen and 3 feet above the top of the screen. A weighted line will be used to monitor the level of the filter pack during installation. The filter pack may be surged during installation.
- Bentonite grout or hydrated chips (e.g., 0.75-inch minus) will be used to seal the annulus above the filter pack. Potable water will be used. A weighted line will be used to measure the top of the bentonite chips as they are poured into place.
- At least 24 hours after installation of a well, the well will be developed by surging, bailing, or pumping to remove sediment that may have accumulated during installation and to improve the hydraulic connection with the water-bearing zone.
- Water quality field parameters such as specific conductance, pH, temperature, and turbidity will be measured during well development as deemed appropriate. The wells will be developed until the turbidity measurements are 10 nephelometric turbidity units or less, or until there is no noticeable decrease in turbidity. To the extent practical, water quality field parameters will be considered stable when the specific conductance is within 10 percent of the previous reading, pH is within 0.1 standard unit of the previous reading, and temperature is within 0.1 degree Celsius of the previous reading.

3.2 Soil Logging

During well installation, a log of the soil will be prepared by a geologist or hydrogeologist licensed by the State of Washington or a person working under the direct supervision of a geologist or hydrogeologist licensed by the State of Washington. Site characterization is complete and soil samples will not be collected for chemical analysis. Soil logs will include information such as the project name and location, the name of the drilling contractor, the drilling method, the sampling method, sample depths, blow counts (if applicable), a description of soil encountered, and screened intervals. Soils will be described using American Society for Testing and Materials designation D2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedures). The information will be recorded on an MFA boring log form, as shown in Appendix A, or in the field notes.

3.3 Groundwater Elevations

Water level measurements to the nearest 0.01 foot will be taken, using an electronic water level indicator. If the total well or boring depth is not known, the total depth will also be measured. The depth to water will be measured from the designated measuring point (typically the top of the casing, which is typically a polyvinyl chloride riser pipe) The measuring point will be marked so that readings are measured from the same reference point each time, and the measuring point elevation will be surveyed. During monitoring events, the well condition (including the condition of the lock, monument integrity, and legibility of well labels) will be recorded for each location. The water level indicator will be decontaminated between wells in accordance with the procedures outlined in Section 3.6.

3.4 Monitoring Well Decommissioning

Wells to be decommissioned (see the CMP, MFA, 2016a) will be decommissioned with bentonite chips or with bentonite grout in accordance with the WAC for Minimum Standards for Construction and Maintenance of Wells (WAC 173-160, 1998).

3.5 Surveying

The installation locations for proposed wells and other features of interest will be surveyed using a global positioning unit (e.g., Trimble™) capable of submeter accuracy. The location and measuring point elevation for newly installed monitoring wells will be surveyed by a licensed surveyor.

3.6 Equipment Cleaning and Decontamination

3.6.1 Drilling Equipment

The working area of the drill rig and downhole drilling equipment will be steam-cleaned or pressure-washed after arrival on the Property and after use in each borehole or monitoring well. Decontamination fluids will be transferred to drums approved by the Washington State Department of Transportation (WSDOT), and will be managed according to the procedures outlined in Section 3.7.

3.6.2 Sampling Equipment

Nondisposable sampling equipment and reusable materials that contact the soil or water will be decontaminated on site and before and after each sample and sampling location. Decontamination will consist of the following:

- Tap-water rinse (may consist of an equivalent high-pressure or hot-water rinse). Visible soil to be removed by scrubbing.
- Nonphosphate detergent wash, consisting of a dilute mixture of Liqui-Nox® (or equivalent) and tap water.
- Distilled-water rinse.
- Methanol solution rinse (1:1 solution of methanol with distilled water).
- Distilled-water rinse.

Decontamination fluids will be transferred to drums for management.

3.7 Management of Investigation-Derived Waste

IDW may include items such as soil cuttings, purged groundwater, decontamination fluids, sampling debris, and personal protective equipment. The IDW will be segregated into solids, liquids, and sampling debris (e.g., personal protective equipment, tubing, bailers). IDW will be stored in a designated area on the Site in WSDOT-approved drums.

Drums will be labeled with their contents, the approximate volume of material, the date of collection, and the origin of the material. The drums will be sealed, secured, and transferred to a designated area on the Site, pending characterization. Analytical data from groundwater sampling activities previously described may be used to characterize the soil cuttings, drilling fluids, purge water, and decontamination fluids generated during drilling and monitoring well sampling.

4 GROUNDWATER SAMPLING

Groundwater samples will be collected from monitoring wells and the horizontal recovery well following the procedures outlined below. Groundwater samples that will be analyzed for dissolved metals will be field-filtered (see Section 5).

4.1 Monitoring Well Groundwater Sampling

If a peristaltic pump is used, standard low-flow sampling techniques will be used to collect groundwater samples from monitoring wells. If possible, groundwater samples should be collected from the middle of the screened interval or, if the water level is below the top of the screen, from the middle of the water column. New, disposable tubing will be used at each monitoring location.

Before collection of groundwater samples, the water level will be measured and the well will be purged. If a peristaltic pump is used, the well should be purged at a low flow rate (e.g., 0.1 to 0.5 liter per minute). A minimum of one well volume will be purged before sample collection or until selected water quality field parameters (e.g., temperature, specific conductance, pH, turbidity) have stabilized. If the well goes dry during purging, a sample can be collected once the well recharges enough water. During purging, the flow rates, water levels, and water quality parameters will be recorded on an appropriate field form or in the field notes. Groundwater will be transferred directly into laboratory-supplied containers specific to the analysis required.

4.2 Horizontal Recovery Well Groundwater Sampling

Groundwater samples will be collected from the horizontal recovery well at the point where the drain discharges into the recovery sump, which is accessible from a manhole located north of monitoring well MW-3 (see Appendix B-1 of the site management plan [MFA, 2016b]). Samples will be collected directly into laboratory-supplied containers specific to the analysis required.

A water level and water quality parameter measurements will not be collected and the well will not be purged prior to sample collection. However, if the recovery sump and pump have been inactive (i.e., operation of the horizontal recovery well was terminated in accordance with the CMP), then a minimum of one well volume will be purged prior to sample collection.

4.3 Nomenclature

Groundwater samples will be labeled with a prefix to describe the sampling location identification number, a "GW" to indicate a groundwater sample matrix, and the date of collection. For example, a groundwater sample collected from a monitoring well at location MW4 and on January 1, 2015 will have the sample nomenclature of MW4-GW-010115.

Duplicate groundwater samples will replace the location number with "DUP," and the sample will have the same sample time as the primary sample. To avoid confusion, avoid collecting more than one duplicate sample during the same date and time. A duplicate sample of the abovementioned sample would appear as MWDUP-GW-010115.

Relevant sample information will be documented on the exploratory boring log (see Appendix A) or a field sampling data sheet (FSDS) (see Appendix B); documentation may include items such as the screened interval or open space, equipment used, water quality field parameters, and the amount of water purged before sampling. The screened interval or open borehole will be recorded on the boring log.

5 ANALYTICAL METHODS

5.1 Chemicals of Interest

The following chemicals have been identified as indicator hazardous substances (IHSs) for Site groundwater:

- Metals: arsenic, chromium, and copper
- Volatile organic compounds: benzene, ethylbenzene, and xylenes
- Pentachlorophenol (PCP)
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)

Analytical methods and sample handling procedures for these IHSs are included in the attached table.

5.2 Laboratory Test Methods and Reporting Limits

5.2.1 Groundwater

In accordance with the QA/QC requirements set forth in this SAP, a Washington State-accredited laboratory may perform the following analyses. Laboratory methods are summarized below and in the attached table:

- Dissolved arsenic and copper by U.S. Environmental Protection Agency (USEPA) Method SW6020 or 200.8
- Total hexavalent chromium by USEPA Method SM3500CR-B or 7196A
- Benzene, ethylbenzene, and xylenes by USEPA Method SW8260 or SW8021
- cPAHs by USEPA Method SW8270-selective ion monitoring (SIM)
- PCP by USEPA SW8270-SIM

5.3 QA/QC Samples Generated in Field

To ensure that field samples and quantitative field measurements are representative of the media collected and conditions being measured, sample collection and measurement methods will follow procedures documented in Section 4.1. QC samples collected in the field include field equipment rinsate blanks, trip blanks, and field duplicates. Field QC samples will be identified on the FSDSs. Field and trip blank results may indicate possible contamination introduced by field or laboratory procedures; field duplicates indicate precision in both field and laboratory procedures.

5.4 Laboratory Operations

In the laboratory, QC samples may include matrix spike and matrix spike duplicate (MS/MSD) samples, laboratory control samples (LCSs), surrogate spike samples, and method blanks, as well as other QC samples and procedures as required by the individual methods.

5.5 Sample Containers, Preservation, and Handling

5.5.1 Preservation

Water samples will be collected in laboratory-supplied containers, as generally specified, as summarized in the table. Samples to be analyzed for dissolved metals will be field-filtered.

The groundwater samples will be stored in iced coolers at approximately 4 degrees Celsius.

5.5.2 Sample Packaging and Shipping

Groundwater samples will be stored in shipping containers with ice or a refrigerator designated for samples and transported to the analytical laboratory.

5.6 Sample Custody

Sample custody will be tracked from point of origin through analysis and disposal, using a chain-of-custody (COC) form, which will be filled out with the appropriate sample and analytical information after samples are collected.

The following items will be recorded on the COC form:

- Project name
- Project number
- MFA project manager
- Sampler name(s)
- Sample number, date and time collected, media, number of bottles submitted
- Requested analyses for each sample
- Type of data package required
- Turnaround requirements
- Signature, printed name, and organization name of persons having custody of samples, and date and time of transfer
- Additional instructions or considerations that would affect analysis (nonaqueous layers, archiving, etc.)

Persons in possession of the samples will be required to sign and date the COC form whenever samples are transferred between individuals or organizations. The COC will be included in the shipping containers. The laboratory will implement its in-house custody procedures, which begin when sample custody is transferred to laboratory personnel.

If samples are shipped via air or ground transportation (by a third party), the following custody procedures will be followed. The COC will be signed and custody will be relinquished to the carrier. The signed COC(s) will be packed in shipping containers with the samples, and a custody seal will be placed on the container. The shipping documentation will be used by the carrier to document custody of the package while it is in transit to the laboratory.

At the analytical laboratory, a designated sample custodian will accept custody of the samples and will verify that the COC form matches the samples received. The shipping container or set of containers is given a laboratory identification number, and each sample is assigned a unique sequential identification number.

5.7 Instrumentation

5.7.1 Field Instrumentation

Field instruments will be used during the investigations. The following field equipment may require calibration before use and periodically during sampling activities:

- pH meter
- Conductivity meter
- Dissolved-oxygen meter
- Oxygen/reduction potential meter
- Turbidity meter
- Thermometer
- Photoionization detector
- Electronic water-level probe

Field-instrument calibration and preventive maintenance will follow the manufacturers' guidelines, and deviations from the established guidelines will be documented.

5.7.1.1 Field Calibration

Generally, field instruments should be calibrated daily before work begins. Field personnel may decide to calibrate more than once a day if inconsistent or unusual readings occur, or if conditions warrant more frequent calibration. Calibration activities should be recorded in logbooks or field notebooks. To ensure that field instruments are properly calibrated and remain operable, the following procedures will be used, at a minimum:

- Operation, maintenance, and calibration will be performed in accordance with the instrument manufacturers' specifications.

- Standards used to calibrate field instruments will meet the minimum requirements for source and purity recommended in the equipment operation manual. Standards will be checked for expiration dates that may be printed on the bottle. Standards that have expired should not be used.

- Acceptable criteria for calibration will be based on the limits set in the operations manual.

- Users of the equipment should be trained in the proper calibration and operation of the instrument.

- Operation and maintenance manuals for each field instrument should be available to persons using the equipment.

- Field instruments will be inspected before they are taken to the Site.
- Field instruments will be calibrated at the start of each workday. Meters will be recalibrated, as necessary, during the work period.
- Calibration procedures (including items such as time, standards used, and calibration results) should be recorded in a field notebook. The information should be available if problems are encountered.

5.7.1.2 Preventive Maintenance

Preventive maintenance of field instruments and equipment will follow the operations manuals. A schedule of preventive-maintenance activities should be followed to minimize downtime and ensure the accuracy of measurement systems. Maintenance will be documented in the field notebook.

5.7.2 Laboratory Instrumentation

Specific laboratory instrument calibration procedures, frequency of calibration, and preparation of calibration standards will be according to the method requirements as developed by the USEPA, following procedures presented in SW-846 (USEPA, 1986).

5.7.2.1 Laboratory Calibration and Preventive Maintenance

The laboratory calibration ranges specified in SW-846 (USEPA, 1986) will be followed.

Preventive maintenance of laboratory equipment will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments and inspection and monitoring of carrier gases, solvents, and glassware used in analyses. The preventive-maintenance approach for specific equipment should follow the manufacturers' specifications, good laboratory practices, and industry standard techniques.

Precision and accuracy data will be examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance should be performed when an instrument begins to change, as indicated by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet any of the QC criteria.

5.8 Laboratory QA/QC Samples

The laboratory QC samples will be used to assess the accuracy and precision of the laboratory analysis. Each category of laboratory QA/QC will be performed by the laboratory as required by method-specific guidelines. The acceptance criteria presented in the guidelines will be adhered to, and samples that do not meet the criteria will be reanalyzed or qualified, as appropriate.

5.8.1 Calibration Verification

Instruments will initially be calibrated at the start of the project or sample run, as required, and when any ongoing calibration does not meet control criteria. The number of points used in the initial calibration is defined in the analytical method. Calibration will be continued as specified in the analytical method to track instrument performance. If a continuing calibration does not meet control limits, analysis of project samples will be suspended until the source of the control failure is either eliminated or reduced to within control specifications.

5.8.2 Matrix Spike/Matrix Spike Duplicate

MS samples are analyzed to assess the matrix effects on the accuracy of analytical measurements. MS/MSD samples will be prepared by spiking investigative samples with known amounts of analytes before extraction and preparation and analysis. The recoveries for the MS/MSD samples will be used to assess the accuracy and precision in the analytical method by measuring how well the analytical method recovers the target compounds in the investigative matrices. For each matrix type, at least one set of MS/MSD samples will be analyzed for each batch of samples (consisting of 20 or fewer samples) received.

5.8.3 Method Blanks

Method blanks are prepared using analyte-free (reagent) water and are processed with the same methodology (e.g., extraction, digestion) as the associated investigative samples. Method blanks are used to document contamination resulting in the laboratory from the analytical process. A method blank shall be prepared and analyzed in every analytical batch. The method blank results are used to verify that reagents and preparation do not impart unacceptable bias to the investigative sample results. The presence of analytes in the method blank sample will be evaluated against method-specific thresholds. If analytes are present in the method blank above the method-specific threshold, corrective action will be taken to eliminate the source of contamination before proceeding with analysis. Investigative samples of an analytical batch associated with method blank results outside acceptance limits will be appropriately qualified by the data validation contractor.

5.8.4 Laboratory Control Samples

LCSs are prepared by spiking laboratory-certified, reagent-grade water with the analytes of interest or a certified reference material that has been prepared and analyzed. The result for percent recovery of the LCS is a data quality indicator of the accuracy of the analytical method and laboratory performance.

5.8.5 Laboratory Duplicate Samples

Laboratory duplicate samples (LDSs) are prepared by the laboratory by splitting an investigative sample into two separate aliquots and performing separate sample preparation and analysis on each aliquot. The results for relative percent difference of the primary investigative sample and the respective LDSs are used to measure precision in the analytical method and laboratory performance. For nonaqueous matrices, sample heterogeneity may affect the measured precision for the LDSs.

5.9 Field QC

The following samples will be prepared by the sampling personnel in the field and submitted to the laboratory:

- **Equipment Rinsate Blanks—**To ensure that decontamination procedures are sufficient, an equipment rinsate blank will be collected when nondedicated, nondisposable equipment is used. At least one equipment rinsate blank will be collected for every 20 samples collected. If more than 20 samples are collected with the same equipment, or if high concentrations of contaminants are encountered, additional equipment rinsate blanks may be collected. Equipment rinsate blanks will be collected by passing laboratory deionized/distilled water through or over nondisposable sampling equipment.
- **Trip Blanks—**A trip blank monitors the potential for sample contamination during sample collection and transport. A trip blank consists of reagent-grade water in a new sample container, which is prepared at the same time as the sample containers. The trip blank will accompany the samples throughout collection, shipment, and storage. At least one trip blank should be included with each cooler in which samples for volatile organic compound analyses are stored.
- **Field Duplicates—**Field duplicates are collected to measure sampling and laboratory precision. At least one duplicate sample will be collected for every 20 samples.

5.10 Data Reduction, Validation, and Reporting

The analytical laboratory will submit analytical data packages that include laboratory QA/QC results to permit independent and conclusive determination of data quality. Data quality will be determined by MFA, using the data evaluation procedures described in this section. The results of the MFA evaluation will be used to determine if the project data quality objectives are being met.

5.10.1 Field Data Reduction

Daily internal QC checks will be performed for field activities. Checks will consist of reviewing field notes and field activity memoranda to confirm that the specified measurements, calibrations, and procedures are being followed. The need for corrective action will be assessed on an ongoing basis, in consultation with the project manager.

5.10.2 Laboratory Evaluation

Initial data reduction, evaluation, and reporting at the analytical laboratory will be carried out as described in USEPA SW-846 manuals for analyses (USEPA, 1986), as appropriate. Additional laboratory data qualifiers may be defined and reported to further explain the laboratory's QC concerns about a particular sample result. Additional data qualifiers will be defined in the laboratory's case narrative reports.

5.10.3 Data Deliverables

Laboratory data deliverables are listed below. Electronic deliverables will contain the same data that are presented in the hard-copy report.

- Transmittal cover letter
- Case narrative
- Analytical results
- COC
- Surrogate recoveries
- Method blank results
- MS/MSD results
- Laboratory duplicate results

5.10.4 MFA Evaluation

5.10.4.1 Data QA/QC Review

MFA will evaluate the laboratory data for precision, completeness, accuracy, and compliance with the analytical method. MFA will review data according to applicable sections of USEPA organics and inorganic procedures (USEPA, 2008, 2010), as well as appropriate laboratory method-specific guidelines (USEPA, 1986).

Data qualifiers, as defined by the USEPA, are used to classify sample data according to their conformance to QC requirements. Common qualifiers are listed below:

- J—Estimate, qualitatively correct but quantitatively suspect.
- R—Reject, data not suitable for any purpose.
- U—Not detected at a specified reporting limit.

Poor surrogate recovery, blank contamination, or calibration problems, among other things, can require qualification of the sample data. When sample data are qualified, the reasons for the qualification should be stated in the data evaluation report.

QC criteria not defined in the guidelines for evaluating analytical data are adopted, where appropriate, from the analytical method.

The following information will be reviewed during data evaluation, as applicable:

- Sampling locations and blind sample numbers
- Sampling dates

- Requested analysis
- COC documentation
- Sample preservation
- Holding times
- Method blanks
- Surrogate recoveries
- MS/MSD results
- Laboratory duplicates (if analyzed)
- Field duplicates
- Field blanks
- LCSs
- Method reporting limits above requested levels
- Additional comments or difficulties reported by the laboratory
- Overall assessment

The results of the data evaluation review will be summarized for each data package. Data qualifiers will be assigned to sample results on the basis of USEPA guidelines, as applicable.

5.10.4.2 Data Management and Reduction

MFA uses a database (e.g., EQuIS™) to manage laboratory data. The laboratory will provide the analytical results in electronic, EQuIS-compatible format. Following data evaluation, data qualifiers will be entered into the database.

Data may be reduced to summarize particular data sets and to aid interpretation of the results. Statistical analyses may also be applied to results. Data reduction QC checks will be performed on hand-entered data, calculations, and data graphically displayed. Data may be further reduced and managed using one or more of the following computer software applications:

- Microsoft Excel® (spreadsheet)
- EQuIS™ (database)
- Microsoft Access® (database)
- AutoCad and/or Arc GIS (graphics)
- USEPA ProUCL (statistical software)

6 REPORTING

After the data are received, MFA will generate a data report, which will summarize and screen the data against the applicable criteria.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

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TABLE

Table
Groundwater Sample Handling Summary
McFarland Cascade Pole and Lumber Company Site
Tacoma, Washington

Analyte	Method	Suggested Volume	Container	Number of Containers	Preservative	Storage Temperature	Holding Time from Collection
Dissolved Arsenic and Copper	USEPA SW6020 or 200.8	500 milliliter	Polyethylene	1	Field-filter and HNO_3 pH < 2	4 degrees C	six months
Total Hexavalent Chromium	USEPA SM3500CR-B or 7196A	500 milliliter	High-Density Polyethylene	1	none	4 degrees C	24 hours
cPAHs	USEPA Method SW8270-SIM	1 liter	Amber Glass	2	none	4 degrees C	seven days
PCP	USEPA Method SW8270-SIM	500 milliliter	Amber Glass	2	none	4 degrees C	seven days
BEX	USEPA Method SW8260 or SW8021	40 milliliter	VOA	3	HCL pH <2	4 degrees C	14 days

NOTES:

BEX = benzene, ethylbenzene, and xylenes.

C = Celsius.

cPAH = polycyclic aromatic hydrocarbon.

HCL = hydrochloric acid.

HNO_3 = nitric acid.

NaOH = sodium hydroxide.

PCP = pentachlorophenol.

SIM = selective ion monitoring.

SM = standard method.

SW = solid waste.

USEPA = U.S. Environmental Protection Agency.

VOA = volatile organic analysis vial.

APPENDIX A

BORING LOG FORM

MAUL FOSTER ALONGI

Boring/Well No.:

Site:

Location:

Project #:

Boring Log Form

Drill Rig		MFA Staff:		Hole Dia:		Total Depth:	
Drilling Co.:			Water Level:		WLE Note:		
Start Date:		End Date:	Water Level:		WLE Note:		

Completion		Sample				Lithology							
		Top:		Time:	Depth:	Soil Type:				Color:			
		Length:				Top:		Fines:				Moisture:	
		Type:		Sample ID		Bottom:		Sand:				PID:	
		% Recov:				Soil Class:		Gravel:				Line Type:	
						Trace:				Impacts:			
						Notes:							
		Top:		Time:	Depth:	Soil Type:				Color:			
		Length:				Top:		Fines:				Moisture:	
		Type:		Sample ID		Bottom:		Sand:				PID:	
		% Recov:				Soil Class:		Gravel:				Line Type:	
						Trace:				Impacts:			
						Notes:							
		Top:		Time:	Depth:	Soil Type:				Color:			
		Length:				Top:		Fines:				Moisture:	
		Type:		Sample ID		Bottom:		Sand:				PID:	
		% Recov:				Soil Class:		Gravel:				Line Type:	
						Trace:				Impacts:			
						Notes:							
		Top:		Time:	Depth:	Soil Type:				Color:			
		Length:				Top:		Fines:				Moisture:	
		Type:		Sample ID		Bottom:		Sand:				PID:	
		% Recov:				Soil Class:		Gravel:				Line Type:	
						Trace:				Impacts:			
						Notes:							
		Top:		Time:	Depth:	Soil Type:				Color:			
		Length:				Top:		Fines:				Moisture:	
		Type:		Sample ID		Bottom:		Sand:				PID:	
		% Recov:				Soil Class:		Gravel:				Line Type:	
						Trace:				Impacts:			
						Notes:							
		Top:		Time:	Depth:	Soil Type:				Color:			
		Length:				Top:		Fines:				Moisture:	
		Type:		Sample ID		Bottom:		Sand:				PID:	
		% Recov:				Soil Class:		Gravel:				Line Type:	
						Trace:				Impacts:			
						Notes:							
		Top:		Time:	Depth:	Soil Type:				Color:			
		Length:				Top:		Fines:				Moisture:	
		Type:		Sample ID		Bottom:		Sand:				PID:	
		% Recov:				Soil Class:		Gravel:				Line Type:	
						Trace:				Impacts:			
						Notes:							
Borehole Notes:													

APPENDIX B

FIELD SAMPLING DATA SHEET FORM

Maul Foster & Alongi, Inc.
7223 NE Hazel Dell Avenue, Suite B, Vancouver, WA 98665 (360) 694-2691 Fax. (360) 906-1958

Soil Field Sampling Data Sheet

Client Name		**Sample Location**	
Project Number		**Sampler**	
Project Name		**Sampling Date**	
Sampling Event		**Sample Name**	
Sub Area		**Sample Depth**	
FSDS QA:			

Easting		**Northing**		**TOC**	

Sample Information

Sampling Method	Sample Type	Sample Category	PID/FID	Sampling Time	Container Code	#
(1) Backhoe	Liquid	Composite			2 oz. soil	
					4 oz. soil	
					8 oz. soil	
					Other	
					Total Containers	0

Sample Description:

General Sampling Comments

Sampling Method Code:

(1) Backhoe, (2) Hand Auger, (3) Drill Bit Cutting Head, (4) Geoprobe, (5) Split Spoon, (6) Shelbey Tube, (7) Grab, (8) Other (Specify)

Signature ______________________________

Maul Foster & Alongi, Inc.

7223 NE Hazel Dell Avenue, Suite B, Vancouver, WA 98665 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name		Sample Location	
Project #		Sampler	
Project Name		Sampling Date	
Sampling Event		Sample Name	
Sub Area		Sample Depth	
FSDS QA:		Easting		Northing		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
	Groundwater		VOA-Glass		
			Amber Glass		
			White Poly		
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly		
			Total Bottles	0	

General Sampling Comments

Signature ______________________________

FINAL SITE MANAGEMENT PLAN

MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

Prepared for

MCFARLAND CASCADE HOLDINGS, INC.

A STELLA-JONES COMPANY

TYEE MANAGEMENT COMPANY, LLC

January 12, 2016

Project No. 0999.01.01

MAUL FOSTER ALONGI

Prepared by

Maul Foster & Alongi, Inc.

1329 North State Street, Suite 301

Bellingham, WA 98225

FINAL SITE MANAGEMENT PLAN
MCFARLAND CASCADE POLE AND LUMBER COMPANY SITE
TACOMA, WASHINGTON

The material and data in this plan were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

JUSTIN LEE CLARY
STATE OF WASHINGTON
37246
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES: 2/8/2016

Justin L. Clary, PE
Principal Engineer

Heather Good, LHG
Project Hydrogeologist

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ACRONYMS AND ABBREVIATIONS

AECOM	AECOM Environment
AO	Agreed Order
BTEX	benzene, toluene, ethylbenzene, and xylenes
CA-C	copper azole type C
CAP	Cleanup Action Plan
CCA	copper-chromated arsenic
CFR	Code of Federal Regulations
CMP	Groundwater Compliance Monitoring Plan
COI	chemical of interest
COPC	chemical of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPLC	Cascade Pole and Lumber Company
CPOC	conditional point of compliance
CrVI	hexavalent chromium
CUL	cleanup level
Ecology	Washington State Department of Ecology
gpm	gallons per minute
GPS	global positioning system
HAZWOPER	Hazardous Waste Operations and Emergency Response
IHS	indicator hazardous substance
MCHI	McFarland Cascade Holdings, Inc.
MCPLC	McFarland Cascade Pole and Lumber Company
MFA	Maul Foster & Alongi, Inc.
MKA	MKAssociates, Inc. (land surveyor)
MTCA	Model Toxics Control Act
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Act
PCP	pentachlorophenol
the Port	Port of Tacoma
Property	property on which MCPLC conducts its operations that is owned by Tyee Management Company, LLC
QA	quality assurance
QC	quality control
recovery system	the horizontal recovery well and the associated components
Restricted Area	portion of the Site where soil management restrictions apply
RI/FS	Remedial Investigation and Feasibility Study
Site	anywhere that contamination from MCPLC's historical operations has come to lie, irrespective of property ownership
SMP	site management plan

Tyee	Tyee Management Company, LLC
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code

1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA) has prepared this site management plan (SMP) on behalf of McFarland Cascade Holdings, Inc. (MCHI) and Tyee Management Company, LLC (Tyee) for the McFarland Cascade Pole and Lumber Company (MCPLC) facility in Tacoma, Washington (see Figure 1). For purposes of this plan, Property (unless otherwise specified) refers to the property on which MCPLC conducts its operations, which is owned by Tyee and is leased to MCHI. Site refers to anywhere that contamination from MCPLC's historical operations has come to lie, irrespective of property ownership. The Site includes the Property and a limited portion of the adjacent former Union Pacific Railroad Milwaukee Railyard property to the northeast that is currently owned by the Port of Tacoma (the Port) (see Figure 2). The Maersk Pacific and Horizon Lines storage and shipping yards currently conduct operations on the Port property. This document has been prepared pursuant to Agreed Order (AO) No. 92HS-S146 and in accordance with the requirements of Washington Administrative Code (WAC) 173-340-440 and related provisions of the Washington State Model Toxics Control Act (MTCA) (WAC 173-340-350).

1.1 Purpose of Site Management Plan

The purpose of this SMP is to provide guidance for future site activities during which contact with contaminated media that have been left in place following past remedial actions may occur and also to provide guidance for monitoring and maintenance associated with the protective remedial action measures that remain in place. This SMP also provides guidelines for assessing soil and groundwater contamination that may be encountered during future construction at the Site, and outlines precautions and procedures necessary for the protection of human health and the environment. This SMP identifies indicator hazardous substances (IHSs); excavation protocols; soil handling procedures; waste characterization and disposal; groundwater management requirements; erosion and dust control; and stormwater protection measures.

The area of the Property where residual soil contamination remains in place is referred to as the Restricted Area. The selected remedy for the Site includes a protective cap that covers contaminated soil in the Restricted Area. Any activity in the Restricted Area that will compromise the integrity of the protective cap is prohibited, except in compliance with this SMP or other prior written approval by the Washington State Department of Ecology (Ecology). The site management guidelines and procedures outlined in this SMP are to be implemented during activities that involve contact with or extraction of groundwater, breaching of the protective cap, and/or disturbances to potentially contaminated soil underlying the cap.

1.2 Site Description

The Site is located on the Tacoma tide flats and includes the Property located at 1640 East Marc Street and a portion of the adjacent Port property located at 1119 Milwaukee Way, in Tacoma, Washington (Figures 1 and 2). The 43-acre Property is approximately 200 feet east of the Puyallup

River and 1,000 feet south of the Milwaukee Waterway. The Property is surrounded by industrial facilities, including Maersk Pacific and Horizon Lines storage and shipping yards to the northwest; the former Union Pacific Railroad Milwaukee Railyard to the northeast; Pallet Services (a pallet manufacturing and storage facility) to the east; and Fred Tebb and Sons (a lumber mill) and Recovery One (a demolition waste transfer and processing facility) to the south. The Site includes a small area on the former Union Pacific Milwaukee Railyard property (currently owned by the Port). The Milwaukee Railyard is no longer active and the Port has completed remedial actions to address free-phase diesel fuel and areas of related contamination. A restrictive covenant is in place on the Port property, and groundwater monitoring and cap maintenance activities are ongoing. The Port has also redeveloped its property to allow for the expansion of the Maersk Pacific Terminal.

1.3 Site History and Operations

The MCPLC facility is used for the manufacturing and processing of treated-wood products. Figure 2 shows the current layout of the facility. Activities at the facility have included debarking, sizing and framing, incising, staining, pressure- and non-pressure-treating, and distributing finished products to customers. Treated-wood products manufactured at the MCPLC facility include utility poles and dimensional lumber used for decking, fencing, and similar products.

The facility and the Property were originally owned and operated by Cascade Pole and Lumber Company (CPLC). CPLC began leasing the facility, the Property, and equipment to MCPLC in January 2004. CPLC and MCPLC are owned by the same parent company, MCHI. In 2012, Stella-Jones Corporation acquired MCHI. As part of that transaction, CPLC transferred ownership of the property to Tyee, which continues to lease the Property to MCHI.

CPLC purchased the Property in stages from the late 1960s through the early 1970s and began developing it for use as a wood-treating facility in 1972; wood-treating operations have been conducted on the Property since 1974. Before 1974, the northwest portion of the Property was used for a lumber mill and landscape bark operation. The rest of the Property was filled in the early 1970s by the Port. The fill consisted of dredged material and possibly other materials.

Wood-treating activities, including storage and application of wood preservatives, are conducted on the eastern portion of the Property in an area referred to as the "treating area." The drip pads, a transfer table, retorts, and a pentachlorophenol (PCP) thermal butt vat (see Figure 2) comprise the treating area. The facility layout shown in Figure 2 has been in use since the late 1990s. The facility layout prior to the late 1990s is discussed in the Remedial Investigation and Feasibility Study (RI/FS) (MFA and AECOM, 2014) and the Cleanup Action Plan (CAP) (Ecology, 2016).

Both pressure and non-pressure (i.e., thermal) processes are used at the facility. The wood-treating chemicals primarily used in these processes have been PCP, copper-chromated arsenic (CCA), copper azole type C (CA-C), and creosote. From 1978 to 1987, CPLC used Chemonite® ammoniacal copper zinc arsenate at the facility. As of December 2004, creosote use was discontinued at the facility. MCPLC continues to use PCP to treat utility poles, but CCA use was discontinued for lumber products in December 2003, and for all products, including those for industrial use, in 2011.

CPLC and MCPLC records indicate that four known spills have occurred at the Property; one of these spills migrated onto the adjacent Port property. Cleanup actions were implemented to address these spills and each was reported to Ecology:

- In August 1985, an overflow of process water from the cooling tower resulted in a release of approximately 100 gallons of water. Cleanup actions were implemented and efforts were made to eliminate the possibility of future spills.
- In March 1986, a cooling tower overflow resulted in the spill of approximately 100 gallons of process water. Cleanup actions were implemented and the system was redesigned to prevent any chance of recurrence.
- In May 1986, a storage tank overflow resulted in the spill of approximately 260 gallons of CCA. Cleanup actions and procedures were implemented to prevent any chance of recurrence.
- In May 2014, a wood-treatment-process work tank release resulted in the spill of approximately 300 gallons of CA-C. The spill migrated into a dry roadside ditch on the adjacent Port property. A project-specific cleanup goal of 146 milligrams per kilogram for copper in soil was developed in coordination with Ecology and the Tacoma-Pierce County Health Department. All soil with copper concentrations above the project-specific cleanup goal was excavated from the ditch (approximately 40 cubic yards [48.29 tons] in total). Ecology approved the spill response and cleanup and indicated that no further action associated with this spill was needed.

No other spills or releases have been reported at the MCPLC facility.

The MCPLC facility is a hazardous-waste generator (ID No. WAD 008 958 357). The facility discharges treated stormwater under a National Pollutant Discharge Elimination System (NPDES) permit (No. WA003795-3). MCPLC's current NPDES permit became effective on September 1, 2014 and has an expiration date of August 13, 2019. MCPLC is also registered with the Puget Sound Clean Air Agency (Registration No. 10398).

Chemicals used in the wood-treating process and their associated compounds and breakdown products, including the following, were identified as chemicals of interest (COIs) for the Site:

- Total and dissolved arsenic, copper, and chromium (including both trivalent chromium and hexavalent chromium [CrVI])
- Polycyclic aromatic hydrocarbons
- PCP
- Semivolatile organic compounds

In addition, the following COIs were identified in association with the PCP carrier oil formerly in use at the Site:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX)

- Total petroleum hydrocarbon–gasoline-range organics

The carrier oil in use since 2008 and currently in use at the facility is a 30 percent biodiesel and 70 percent recycled lubrication oil mixture that does not contain BTEX.

Samples of environmental media from the Site were analyzed for these COIs and detected chemicals were retained for consideration as IHSs.

CPLC entered into an AO with Ecology on June 7, 1993, for completion of a RI/FS and interim actions. Interim actions completed before execution of the AO were incorporated into the AO along with additional planned interim actions, including groundwater interim actions. Soil and groundwater investigations completed in association with the interim actions fulfilled the data collection requirements for the RI/FS. Site investigation details are discussed in the RI/FS (MFA and AECOM Environment [AECOM], 2014) and CAP (Ecology, 2016).

1.4 Remedial Action Description

Since the early 1990s, CPLC has conducted numerous upgrades (interim actions) at the facility. The interim actions were completed under the existing AO, with consent and approval by Ecology, and are part of the selected remedy for the Site. These actions consisted of:

- **Protective Cap—**Areas of the Property where arsenic concentrations in soil are known to exceed its cleanup level (CUL) are referred to in this plan as the Restricted Area and are designated on Figure 3. Currently, arsenic-contaminated soil in the Restricted Area is covered with asphalt pavement, concrete, buildings, or other constructed features (including the drip pad and transfer table containment slab described below), which function as a protective cap (Figure 3). The protective cap will be maintained in the Restricted Area as a component of the Site remedy. The protective cap in the Restricted Area is equipped with catch basins and piping to collect stormwater and direct it to on-site filtration/treatment systems. The stormwater is discharged under the site-specific NPDES permit.

- **Drip Pad Construction—**Included excavation and disposal of impacted soils, as well as installation of a steel-reinforced-concrete drip pad and underlying leak-detection system, which caps existing soil contamination and will prevent future contamination of soil.

- **Installation and Operation of the Horizontal Recovery Well—**Provides both hydraulic containment and removal of groundwater impacts from beneath the transfer table pit and the adjacent treatment area. Extracted water is reused in facility operations. The horizontal recovery well recovers groundwater from the shallow aquifer (see Section 2.2.2), which reduces the migration of chemically impacted shallow groundwater from the transfer table pit and treating area and reduces the mass of contaminants in shallow groundwater.

- **Transfer Table Pit Upgrade—**Included removal and off-site disposal of 860 tons of impacted soil, construction of a concrete containment slab that caps underlying contaminated soil, and construction of a drainage system emergency shutoff valve to prevent potential releases. These activities removed previous soil contamination and will prevent future contamination of soil.

Further information associated with each interim remedial action is provided in the RI/FS (MFA and AECOM, 2014).

In addition to the interim actions listed above, the selected remedial action includes monitored natural attenuation and compliance monitoring to address groundwater impacts at the Site. Groundwater compliance monitoring is discussed in the Groundwater Compliance Monitoring Plan (CMP) (MFA, 2016), which is provided as an attachment to the CAP (Ecology, 2016). Compliance with CULs at the downgradient conditional point of compliance (CPOC) is assessed through compliance monitoring of sentry wells.

The selected remedial action also includes the following institutional controls: (1) continued maintenance of the protective cap in the Restricted Area; (2) requirements for management of soil excavated from the Restricted Area; (3) prohibition on groundwater use throughout the Site; and (4) operation and maintenance of the horizontal recovery well in the Restricted Area. These institutional controls will be documented and enforced through a restrictive covenant placed on the Property and the existing restrictive covenant on the Port property prohibiting groundwater use.

2 NATURE AND EXTENT OF RESIDUAL CONTAMINATION

2.1 Residual Contamination

The Site includes residual soil contamination in the Restricted Area beneath the protective cap (i.e., existing paving, the drip pad, the transfer table pit containment slab, and facility buildings) (see Figure 3) and residual wood-treating chemicals in groundwater on the Property and a portion of the Port property, as defined by the Site boundary shown in Figures 1 through 4. IHS exceedances in groundwater are shown in Figure 4.

Through development of the RI/FS (MFA and AECOM, 2014), data were screened for determination of Site IHSs specific to soil and groundwater. COIs were identified based on historical and current operations, as discussed above, and those COIs that were detected in soil or groundwater during prior environmental investigations were retained as chemicals of potential concern (COPCs). A list of the site COPCs detected in soil is provided in Table 1. Soil- and groundwater-specific IHSs were then defined through screening the maximum detected concentration of COPCs against site-specific CULs, which had been developed using applicable state and federal standards.

The sole IHS identified for site soils is arsenic.

IHSs identified for site groundwater are:

- Metals: arsenic, CrVI, and copper
- PCP
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)
- Volatile organic compounds: benzene, ethylbenzene, and xylenes

The selected remedy for the Site addresses these IHSs.

2.2 Distribution of Indicator Hazardous Substances

IHSs are assumed to be present in soil in the Restricted Area, as shown in Figure 3, and in groundwater throughout the Site. A summary table from the CAP showing the final CULs for the Site is provided as Table 2.

Although a number of the soil COPCs are not considered IHSs, based on historical operations and the potential for future contamination, the complete list of soil COPCs has been provided in this SMP to allow workers involved with future site work in which contact with contaminated soil may occur to be aware of all site COPCs (see Table 1). The site-specific CUL for arsenic in soil is based on MTCA Method C for direct contact (see Table 2). For reference, MTCA Method C for direct contact CULs are also provided for the soil COPCs in Table 1.

2.2.1 Soil

During previous investigations, the arsenic CUL was exceeded in several sample locations across the Property, all of which are in the Restricted Area and were paved during interim action implementation or are covered by existing infrastructure (e.g., buildings, drip pads, transfer table) (see Figure 3). As part of the RI/FS, soil samples were collected from areas of the Property proposed for paving. Soil from one of these paving areas (Paving Area 1) was consolidated in an area on the eastern end of the Property, under an agreement with the U.S. Environmental Protection Agency (USEPA), and then paved (see Section 4.1 of the RI/FS and Figure 3). Because an arsenic CUL exceedance was detected in Paving Area 1, this area of soil is included in the soil Restricted Area and is covered by the protective cap (see Figure 3).

The potential exists for site COPCs to be present in soil at concentrations above MTCA Method C for direct-contact CULs in portions of the treating area where soil characterization has not been completed because of sampling access constraints or where potential soil impacts were not addressed by earlier interim actions. The portions of the treating area with potential COPC impacts in soil include the drip pads, transfer table, retorts, control room, tank farm, and PCP thermal butt vat (see Figure 2). The treating area is included in the soil Restricted Area as shown in Figure 3.

2.2.2 Groundwater

The depth to groundwater beneath the Site ranges from 3 to 10 feet below ground surface. Shallow groundwater is present in an unconfined aquifer consisting of approximately 6 to 10 feet of fine to medium sand with some sandy silt intervals. An aquitard underlies the shallow aquifer and consists of an approximately 6- to 7-foot-thick layer of silty clay to clayey silt. A semi-confined, deep aquifer consisting of a 6- to 10-foot-thick layer of very fine to medium sand with a trace of silt underlies the aquitard. A second aquitard underlies the deep aquifer and consists of a 3-foot-thick layer of sandy to clayey silt.

2.2.2.1 Shallow Groundwater

IHS concentrations detected in shallow groundwater from 2004 to 2013, during the RI/FS (MFA and AECOM, 2014), and from 2004 to 2015, following a February 2015 groundwater monitoring event (MFA, 2015), were compared to CULs. The four most recent data points, from groundwater monitoring events conducted between 2004 and 2015, were evaluated for each IHS to determine the most recent trend of groundwater exceedances at the Site. Figure 4 shows IHSs that were detected at concentrations above their respective CULs, based on the most recent data. CUL exceedances were detected in all shallow wells sampled, with the exception of monitoring well MW-1, which is located near the southern boundary of the Property, and sentry well MW-20 (see Figure 4). Arsenic exceeds its CUL in all but one of the shallow groundwater monitoring wells with CUL exceedances. Other IHS exceedances, including copper, PCP, and cPAHs, were detected in fewer locations. Arsenic in shallow sentry wells MW-4 and MW-19, and copper in shallow sentry well MW-19, exceeded their CULs. Arsenic and PCP were detected above their CULs in samples collected from the horizontal recovery well (HW-01).

Shallow groundwater quality data collected from monitoring well UPRR-MW-29 indicate that wood-treating-related chemical impacts are present on the Port property. Since 2004, copper, arsenic, PCP, and cPAHs have been detected at least once above Site CULs in this well (see Figure 4) and may have originated in the treating area of the MCPLC facility (USPCI, 1993). As a result, the Site boundary extends onto this potentially affected portion of the Port property. The Site boundary is located on the Port property at the zero concentration arsenic contour line in groundwater shown in Figure 32 of the Hydrogeologic Characterization Report (USPCI, 1993). The zero concentration contours for the other wood-treating-related chemicals detected in groundwater on the Port property are contained within this zero concentration contour for arsenic.

In general, IHS concentrations in shallow groundwater under the Property show stable or decreasing trends, and IHS impacts appear to be limited to the treating area, with the exception of arsenic at MW-4 and arsenic and copper at MW-19. However, conservative attenuation modeling demonstrated that the arsenic concentration detected at MW-4, and the copper and arsenic concentrations at MW-19, will naturally attenuate to below their CULs before reaching the CPOC at the downgradient Property boundary (i.e., the Property boundary along Dike Road parallel to the Puyallup River) (MFA, 2015; MFA and AECOM, 2014).

2.2.2.2 Deep Groundwater

There are three existing deep groundwater monitoring wells on the Property: one well upgradient of the treating area (MW-14) and two wells directly downgradient of the treating area (MW-7 and MW-18; see Figure 2). Deep groundwater monitoring data from 2004 to 2013 were evaluated in the RI/FS for CUL exceedances.

The following IHSs are not monitored in the deep aquifer wells: benzene, ethylbenzene, xylenes, and CrVI (MFA and AECOM, 2014). No exceedances of these IHSs were observed in the shallow aquifer (MFA, 2015; MFA and AECOM, 2014; also see Figure 4). Total chromium was monitored in the deep aquifer wells from 2004 to 2013, and the only total chromium concentration above the CrVI CUL in a deep well was detected in the upgradient deep well (MW-14) (MFA and AECOM, 2014).

IHS concentrations are significantly lower in the deeper aquifer. The only IHSs that have exceeded a CUL in deep groundwater since 2004 are arsenic, copper, cPAHs, and PCP. Concentrations of all IHSs show declining trends in deep groundwater, and CUL exceedances have not been detected in the downgradient deep groundwater wells (MW-7 and MW-18) since 2007 (MFA and AECOM, 2014). During the last four monitoring events, only arsenic and copper exceeded their CULs in the upgradient deep groundwater well (MW-14) (see Figure 4). This observation indicates that CULs are currently being met in the existing downgradient deep groundwater wells and suggests that CULs will continue to be met in the future.

No deep wells are located on the Port property, but given the low concentrations detected in deep groundwater on the Property and the lower concentrations of IHSs detected in the shallow groundwater on the Port property, deep groundwater on the Port property is not believed to be impacted by IHSs at levels that could pose a concern to human health or the environment.

3 PROTECTIVE CAP

The CAP requires maintaining a physical barrier that protects human health and the environment from IHSs identified in the Site soil (Ecology, 2016). A protective cap is required for the Restricted Area as shown on Figure 3. The protective cap is integrated with ongoing operations and includes the following cap types:

- Asphalt pavement cap
- Concrete cap
- Building cap

Table 3 summarizes each cap type, and the following subsections describe each of the cap components, including minimum design standards that would be applicable should any of the protective caps be removed or altered as a result of future development or maintenance activities. The Property owner may also use other capping materials at its discretion, provided the new material has hydraulic and structural properties similar to those listed below. If the Property owner proposes a new capping material that does not have hydraulic and structural properties similar to those listed below, Ecology must be notified at least 30 days prior to the action.

3.1 Asphalt Pavement Cap Description

The pavement cap consists of a 4- to 6-inch-thick layer of asphalt. The asphalt layer was constructed on an approximately 4-inch-thick layer of clean, compacted structural fill. The pavement was placed in a minimum of two lifts.

3.2 Drip Pad Concrete Cap Description

Two existing drip pads, located to the west of the transfer table area, effectively prevent exposure to underlying contaminated soils by creating a physical barrier and are included as part of the protective cap. The drip pads were constructed in 1993 in accordance with 40 Code of Federal Regulations (CFR) § 265, Subpart W. Construction of the drip pads also included removal and off-site disposal of contaminated soil. The pads are constructed of steel-reinforced concrete, and include an underlying leak-detection system above a high-density polyethylene sub-liner. Since their construction, the drip pad concrete surfaces have been maintained with penetrating and topcoat epoxies.

The drip pads will be inspected and maintained in accordance with Subpart W requirements, as discussed in Sections 8.1.2 and 8.3.2. Subpart W requires inspection of the integrity of the drip pad surface—the portion of the drip pad that serves as a protective cap; therefore, Subpart W inspections will ensure performance of the drip pad as a protective cap, as required under this SMP. Subpart W also requires inspection of other drip pad components that are not considered part of the protective cap (e.g., the leak-detection system topcoat epoxy, run-on and runoff controls). Inspection and maintenance of those components are not required under this SMP.

3.3 Transfer Table Concrete Cap Description

The transfer table pit was upgraded in 1999 and is described in greater detail in the Transfer Table Upgrade Completion Report (RETEC, 2000). The containment pad is constructed of 7-inch-thick, steel-reinforced concrete overlying a 12-inch-thick compacted base course layer.

3.4 Building Cap Description

Existing facility buildings effectively prevent exposure to underlying contaminated soils. Existing buildings are constructed with steel-reinforced concrete stem-walls and footings, or slab-on-grade or pier footing foundations. The interior areas of all buildings have finished floors constructed of concrete, asphalt, or wood.

4 SOIL MANAGEMENT PROCEDURES

This section describes protocols for managing potentially contaminated soils resulting from excavations, building construction or demolition, and other soil-disturbing activities in the Restricted

Area as shown in Figure 3 and discussed in Section 1.2. All activities that disturb soil beneath the protective cap in the Restricted Area must be conducted or overseen by workers who have appropriate hazardous site operations training (see Section 6.1). For all projects in the Restricted Area that will disturb soils (e.g., general earthwork or utility construction or repair), detailed records will be maintained at the facility of related activities and cap repair or replacement confirmation and specifications.

4.1 Protective Cap

Depending on the type of project, construction activities may be limited to disturbance of the protective cap zone without disturbance of the soil beneath the cap. Protective cap disturbances (i.e., above the bottom of the asphalt pavement layer, concrete pad, or building foundation) do not require any special handling or health and safety requirements (outside the standard construction health and safety protocol). If the protective cap is disturbed in the Restricted Area, repair will be required. Additional detail regarding cap construction requirements is provided in Section 3.

4.2 Potentially Contaminated Soil

All soil excavated from the Restricted Area shall be managed according to this plan or other prior written approval by Ecology. If activities require excavation in the Restricted Area below the cap (e.g., the cap is fully penetrated and underlying soils are contacted), then the protocol presented in this section will be followed. Worker safety requirements pertaining to handling of contaminated soil are provided in Section 6.1.

Further description of cap repair for each type of capping material is provided in Section 3. If activities in the Restricted Area are expected to result in handling of contaminated soils by a method that is inconsistent with this plan or using a cap material different from that previously approved, Ecology must be notified at least 30 days prior to the action.

4.2.1 Excavation and Handling

Soil excavated from the Restricted Area will be assumed to be contaminated unless analytical testing conducted in accordance with this SMP demonstrates otherwise and is approved by Ecology. However, analytical testing of soil excavated from the Restricted Area is not required unless approval is being sought to place the soil on a portion of the Property outside the Restricted Area or unless the soil will be disposed of off site, as discussed below.

Solid waste is defined in 40 CFR 261 and Chapter 173-303 WAC as any "discarded material" that is abandoned, recycled, or considered inherently waste-like. Disposal is defined in Chapter 173-303 as the discharging, discarding or abandoning of dangerous (hazardous) wastes into or on any land, air, or, water. To be a hazardous waste, a waste must first be designated as a solid waste. USEPA has made a distinction between material that may be designated as a solid waste and environmental media (i.e., soil, water, or air). USEPA has determined that in place environmental media does not meet the definition of a waste.

Further, the USEPA in its Area of Contamination policy has recognized that movement of contaminated soil within an area of contamination does not constitute a new act of treatment, storage, or disposal for purposes of RCRA (USEPA, 1996).

Temporary stockpiles of contaminated soil in the Restricted Area will be managed in accordance with the procedures outlined in Section 4.2.2. The following is a summary of the stockpile management options and associated testing, notification, and approval requirements for each:

- **Re-placement in the original excavation**—Ecology notification and preapproval and analytical testing are not required before the material is placed back in the original excavation in the Restricted Area, as described in Section 4.2.3.
- **Placement in a new location in the Restricted Area**—Analytical testing is not required, but Ecology notification and preapproval are required before the material is placed in a new location, outside the original excavation but within the Restricted Area boundary, as discussed in Section 4.2.4.
- **Placement on the Property outside the Restricted Area**—Following analytical testing consistent with this SMP and with Ecology's prior approval, soil excavated from the Restricted Area may be placed on the Property outside the Restricted Area, as described in Section 4.2.4.
- **Off-site disposal**—Contaminated material to be disposed of off site will be subject to Resource Conservation and Recovery Act testing and disposal requirements, as described in Section 4.2.5.

If excavated soil is not returned to the original excavation, the excavation will be backfilled with clean material (soil or other media). Contaminated soil excavated from beneath the cap will be segregated from any imported, clean backfill to avoid contamination of the backfill material. Excavation will be completed in a manner that minimizes dust generation and incorporates appropriate erosion-control procedures that prevent stormwater from contacting soil in the open excavation or from migrating onto the protective cap or off site.

4.2.2 Stockpiling

Temporary soil stockpiles will be managed consistent with this SMP, best management practices, and regulatory requirements. Stockpiled soil will be handled in a manner that minimizes erosion, contact with stormwater runoff, dust generation, and worker or public contact, unless the soil is loaded directly into trucks for immediate off-site disposal. Stockpiles will either be placed on an impermeable liner (e.g., impervious plastic sheeting with a minimum 10-mil thickness) or stored in Washington State Department of Transportation-approved containers. If the stockpile is placed on an impermeable liner, the existing ground surface will be cleared of debris and any objects that have the potential to puncture the liner. A berm constructed of clean soil, compost socks, or equivalent material approved by the project engineer will be installed along the perimeter of the stockpile. The bottom liner must extend up and over the perimeter berm. The cover will be secured with sandbags or other appropriate restraint. The stockpile will be covered with plastic sheeting or equivalent material and secured by sandbags at the end of each workday to prevent erosion, dust generation, and direct contact by humans. The sheeting that covers the stockpile must be regularly inspected to ensure that it remains functional and protective of human health and the environment.

Stockpiles to be disposed of off site will be characterized as described in Section 4.2.5 before removal. After stockpile removal, the area beneath the separation material will be inspected, and any remaining stockpile soil will be scraped, swept, or otherwise removed and properly disposed of.

4.2.3 Replacement in Original Excavation Location

Analytical testing and Ecology notification and approval are not required if soil excavated from the Restricted Area is intended to be returned to the original excavation. Prior to re-placement in the original excavation, the soil will be managed in temporary stockpiles in the Restricted Area in accordance with the stockpile management practices described in the previous section.

4.2.4 New Placement Location

All soil originating from the Restricted Area will be assumed to contain contaminants above CULs until sampling and analysis, described below, demonstrate otherwise. Soil excavated from the Restricted Area that is not returned to the original excavation may be placed in a new location in the Restricted Area, with Ecology's approval.

Instances that may potentially warrant a new placement location include large excavations for subgrade footings or utility trenches. Soil testing is not required to place soil in a new location in the Restricted Area. Any placement of soil in the Restricted Area must be capped consistent with the approved cap construction requirements outlined in Section 3. Ecology will be notified and approval requested at least 30 days prior to placement. The new placement location will be documented as described in Section 7 of this SMP.

Soil may be placed in a new location within the Property boundaries but outside the Restricted Area only if approved in advance by Ecology. As a condition of approval, Ecology will require sampling and analysis of the excavated soil and will base its decision on the analytical results. Depending on the analytical results, Ecology may require that the new placement area be capped consistent with the approved cap construction requirements outlined in Section 3. If capping is required for the new placement area, this plan will be amended to include the new area in the Restricted Area. Soil may be temporarily stored in stockpiles in the Restricted Area prior to placement in the new location according to the stockpiling procedures set forth in the previous section.

4.2.5 Off-site Disposal

Soil with contaminant concentrations above CULs may be reused on the Site if re-placed in the original excavation location (see Section 4.2.3) or if Ecology approves placement in a new location (see Section 4.2.4). However, if soil with contaminant concentrations above CULs will not be reused on the Site, as described above, then it must be disposed of appropriately at a licensed Treatment, Storage and/or Disposal Facility.

Soil removed from the Restricted Area may contain levels of IHS (arsenic), and soil removed from the treating area may have levels of COPCs (see Table 1), that are regulated under MTCA or as Dangerous Waste. The soil must be adequately characterized for disposal before its removal from the Property to ensure compliance with federal and state waste-management regulations. Excavated soil will be stockpiled methodically in order to facilitate the sampling method and organization. Composite sampling will be conducted to best characterize each stockpile in order to complete a waste profile for the disposal facility. Waste characterization samples will be obtained directly from the excavated soil stockpiles. As a general guideline, a sampling frequency of approximately one composite sample per 100 cubic yards of soil may be collected. The analytical methods used for waste characterization will be developed in coordination with the waste disposal facility to ensure that they meet the facility's criteria.

Composite samples will be collected from each stockpile section that is to be disposed of off site. In order to develop a representative sample of each delineated section, discrete samples of equal size will be collected from the stockpile section at a frequency to be determined by the project engineer and in accordance with the requirements of the disposal facility. These discrete samples will be compiled into a composite sample. As a general guideline, five-point composite samples may be obtained from each 100-cubic-yard stockpile section that is to be disposed of off site. A standard stainless-steel hand auger may be used to collect the samples from various depths within the stockpile. The sampler will avoid collecting samples from the stockpile surface. The stockpile section will be divided into subsections and one sample collected from each subsection and from the center of the section. As a general guideline, each 100-cubic-yard stockpile may be divided into four quadrants, with one subsample collected from each quadrant and a fifth subsample collected from the center of the 100-cubic-yard section. One subsection sample will be collected from each of the following depths: a shallow depth, a mid-depth, and the bottom of the stockpile; and two samples will be collected from randomly selected depths.

Samples will be composited using a stainless-steel bowl with a stainless-steel spoon. Rocks and other debris will be removed from the sample. Part of the composited sample will be placed in the laboratory-provided containers and sealed. The sampling equipment will be decontaminated after each composite sample is collected. The samples will be placed on ice in a shipping container with chain-of-custody paperwork and transported to an accredited laboratory for analysis.

Obtaining samples in this manner is intended to generate data that are representative of the contaminants in that particular section of the stockpile, and accounts for the variability of the soil generated from different excavation locations. The soil in each stockpile is expected to be homogenized through the on-site handling procedures of excavation, placement in a dump truck, and dumping into a pile. Composite sampling, combined with the on-site homogenization, should result in a sample that is representative of the pile. Variability of the soil from different excavations will be addressed by collecting one composite sample per every 100 cubic yards of soil. Laboratory quality assurance and quality control (QA/QC) data, along with sample results, will be validated before handling procedures are determined for any soil. To facilitate management of the soil in an effective timeframe, this review will be conducted as laboratory reports are received.

The data quality objectives for this sampling approach address precision, accuracy, representativeness, comparability, and completeness:

- The term “precision” refers to the ability of an analytical method or instrument to reproduce a measurement. Review of laboratory-generated QA/QC documentation will allow assessment of laboratory precision.
- Accuracy is assessed by evaluating how close a measurement is to the true or expected value. Accuracy is evaluated by reviewing laboratory QC data, such as blank and spiked samples.
- Representativeness of the data is an indication of how well data represent an expected environmental condition. The compositing approach has been designed to obtain samples that are representative of the individual stockpile sections.
- Comparability, or the confidence in evaluating one data set in relation to another, will be established through the use of consistent field techniques, standard analytical methods, standard reporting formats, equipment calibration, and analysis of reference materials.
- The data will be assessed for completeness by summarizing the number of valid results versus the total number of samples collected. Because only valid laboratory results will be acceptable for disposal determination, the results will be 100 percent complete.

Analysis of soil to be disposed of off site must be conducted by an accredited laboratory for disposal characterization purposes specified by the licensed disposal facility.

5 GROUNDWATER MANAGEMENT PROCEDURES

Groundwater may be impacted with the IHSs for groundwater listed in Table 2.

Extraction (from the horizontal recovery well) and on-site reuse of groundwater will continue, as described in Section 1.4. Management of groundwater extracted from the horizontal recovery well will continue according to the following procedures, which are generally consistent with past practices (see Appendix A for detailed information on the horizontal recovery well system):

- Extracted groundwater is pumped into an immediate-transfer tank located in the treatment plant containment area.
- The transfer tank is equipped with an automatic pumping system that allows for immediate transfer of recovered groundwater into a preservative solution make-up water tank system.
- The transfer tank configuration prevents the inadvertent back flow of preservative solution make-up water into the subgrade pumping vault.
- Extracted groundwater may be temporarily stored in the transfer tank during temporary shutdowns of treatment operations (e.g., extended periods of freezing weather). Alternatively, the pumping system will be turned off to prevent the accumulation of groundwater in the transfer tank and/or the preservative solution make-up water tanks.

If groundwater extracted from the horizontal recovery well is no longer used in facility operations, the horizontal recovery well will continue to operate in accordance with the CMP (see Appendix A of the CAP; Ecology, 2016). Groundwater extracted from the horizontal recovery well that will not be used on site will be assumed to contain Dangerous Waste and will be managed and disposed of in compliance with the Dangerous Waste requirements, until sampling and analysis demonstrate that it does not contain Dangerous Waste.

Because groundwater under the Site is present at shallow depths, it is possible that groundwater may be generated during on-site work (e.g., dewatering of excavations). Any groundwater generated during construction will be reused on site consistent with the reuse of groundwater from the horizontal recovery well extraction system, if determined to be feasible.

Construction-related groundwater or extracted groundwater that cannot be reused on site must be appropriately disposed of off site. Groundwater will be placed in containers or tanks for temporary storage. Once containers are full, or groundwater discharge activities are complete, water samples will be collected and analyzed by an accredited laboratory as specified by the licensed disposal facility. Construction-related or extracted water will not be stored for more than 90 days unless testing shows that it is not a Dangerous Waste.

6 SITE CONTROLS

The following controls are required in order to protect the environment and reduce potential exposure of site workers to any potentially contaminated material that remains at the Site.

6.1 Worker Health and Safety

All future activities that penetrate the cap in the Restricted Area or that have the potential to expose workers to shallow groundwater within the Site boundary are to be conducted according to WAC 173-340-810; the Occupational Safety and Health Act (OSHA) of 1970 (29 U.S. Code Sec. 651 et seq.); the Washington Industrial Safety and Health Act (Chapter 49.17 Revised Code of Washington); and relevant regulations. Special worker qualifications and training apply to:

- Soil-disturbing activities that penetrate the cap in the Restricted Area
- Activities that may encounter groundwater throughout the Site (e.g., excavations that extend below the top of the water table or that generate groundwater by dewatering)

Shallow groundwater typically is present between 3 and 10 feet below ground surface. Under this SMP, no special worker qualifications or training are required for activities that do not penetrate the protective cap and that do not expose workers to shallow groundwater.

The contractor will be required, before beginning work, to prepare a health and safety plan, which is to be available for review by Ecology upon request. The health and safety plan will include the following:

- Current standard Hazardous Waste Operations and Emergency Response (HAZWOPER) certification for workers disturbing impacted soil in the area underlying the protective cap
- IHSs and site background
- Personal protective equipment
- Personal hygiene and decontamination protocols
- Medical surveillance
- Hazard communication and site control
- Recordkeeping and reporting

6.1.1 Qualified Personnel

The contractor will complete construction work in compliance with OSHA regulations (29 CFR § 1910.120 and § 1926.65); workers in any portion of the Restricted Area (Figure 3) where the cap is penetrated and not yet repaired and any workers who will come in contact with potentially contaminated soil from beneath the protective cap area must be "qualified personnel." The qualified personnel must have current standard HAZWOPER training, if required. Managers and supervisors directly overseeing the working crew must have received additional specialized training in hazardous-waste-management supervision.

6.2 Access Restriction

In the event of construction in the Restricted Area with the potential to generate contaminated soil, fencing will be maintained in order to restrict access of personnel who are not HAZWOPER certified to areas that are no longer contained by a cap (i.e., "controlled areas"). Signage will be posted on the fencing separating the personnel who are not HAZWOPER certified from the controlled areas.

6.3 Decontamination Procedures

Soil will be removed from equipment before the equipment leaves the controlled area. Soil must be removed from vehicle tires that contact contaminated soil by brushing, wheel wash, or another method that is appropriate to the work being performed before the vehicle leaves the controlled area to prevent tracking of potentially contaminated soil to clean portions of the Site or off site. Decontamination will be conducted in a manner that prevents contamination of the protective cap.

Decontamination will be managed so that washwater does not migrate from the decontamination area.

Equipment and personnel decontamination procedures will be defined in the activity-specific health and safety plan.

6.4 Groundwater Use Restrictions

As a requirement of the restrictive covenant for the Property and the preexisting restrictive covenant for the Port property, groundwater for domestic use will not be extracted from the Site by wells or by other means. This restriction does not apply to groundwater that is extracted for the purpose of dewatering for temporary construction activities, development, or the installation of sewer or utilities. Groundwater management is discussed in Section 5.

7 NOTIFICATION AND REPORTING

The contractor will maintain weekly reports of field activities during any active construction that disturbs soil or other cap material in the Restricted Area. The Property owner will prepare a project completion report to document the management of impacted soil for each project in which such work is conducted. The report will document the management techniques used, approximate volumes of materials handled, placement or disposal information, disposal manifests, and analytical data generated during management of the impacted material. These reports will be retained at the facility to be made available for inspection or at Ecology's request.

7.1 Notification

Ecology notification will be required for the following actions:

- If the Property owner proposes a new capping material that does not have hydraulic and structural properties similar to those listed in Section 3, Ecology must be notified at least 30 days prior to the action.
- Soil excavated from the Restricted Area that is not returned to the original excavation may be placed in a new location within the Property boundaries with prior Ecology approval. Ecology approval will be requested at least 30 days before soil placement, and the new placement location will be documented as described below.
- If Ecology approves the placement of soil excavated from the Restricted Area to a new location within the Property boundaries but outside the Restricted Area, the new placement location, and details of the cap construction (if required), will be documented as described below. If a cap is required, this SMP will also be amended to include the new area in the Restricted Area.
- If activities in the Restricted Area are expected to result in handling of contaminated soils by a method that is inconsistent with this SMP or using a cap material different from that previously approved, Ecology must be notified at least 30 days prior to the action.

7.2 Recordkeeping

Each time the protective cap is penetrated, the Property owner will prepare a report documenting the activity that penetrated the cap. The report will include at least the following:

- Location and extent of the cap penetration. Location coordinates for each corner of the penetration perimeter will be collected using a global positioning system (GPS) unit and included in the report. These coordinates will also be recorded in a geographic information system database, which will be maintained in association with the Property records.
- Estimated volume of soil excavated.
- Disposition of the excavated soil.
  - If excavated soil is placed on the Property, the location of the area where it was placed (including location coordinates, as described above) will be recorded if the soil is disposed of in an area different from the excavation area.
  - If excavated soil is disposed of off site, documentation will include characterization of soil, waste profile for disposal, manifests or trip tickets, disposal certificates, and agreement with disposal facility.
- How the cap was repaired, including work orders, repair materials, construction details, and identity of contractor that made the repair.

Each report prepared under this section will be filed in the permanent records for the Property to be provided to future Property owners or to Ecology by request.

8 PROTECTIVE CAP MONITORING AND MAINTENANCE

The protective cap requires regular and routine inspection for evaluation and maintenance of its integrity. Monitoring and, if required, maintenance will be conducted annually, at a minimum. This frequency will provide an opportunity to correct small, localized failures before they become larger, more detrimental failures. In addition to annual inspection, an inspection will take place after a large natural disaster occurs in close proximity to the Property, or any other large-scale disturbance occurs near or at the Property. This section outlines the monitoring and inspection procedure for each of the protective capping materials.

The person conducting the monitoring will complete the monitoring worksheet provided as Appendix B. The worksheet will be filed in the permanent records for the Property to be provided to future Property owners or to Ecology upon request and will also be included in the groundwater monitoring reports that will be prepared in accordance with the schedule described in the CMP

(MFA, 2016). The main purpose of the monitoring event is to document current conditions of capping materials. The documentation will be used as a reference to evaluate the severity of cap degradation and to determine if corrective action is required.

8.1 Protective Cap Inspection

This section describes the minimum observation and monitoring requirements per inspection for each component of the overall protective cap in the Restricted Area.

8.1.1 Pavement Cap

The following defines the minimum observation and monitoring requirements per inspection for all pavement-related caps in the Restricted Area. As appropriate, recorded observations will be accompanied by documenting photographs:

- Overall cap condition
- Evidence of cracking, buckling, or subgrade shifting
- Observed alligatored areas (i.e., areas with numerous intersecting cracks that extend through the cross section of the cap)

8.1.2 Drip Pad Concrete Cap

Monitoring and maintenance of drip pads associated with wood-treating facilities, and associated reporting, are required to be completed in accordance with Subpart W (40 CFR § 265.443 and 265.444). While a drip pad is in operation, weekly inspections are required under Subpart W, which include inspection of the drip pad surface—the portion of the drip pad that serves as a protective cap. The physical presence of the drip pad structure ensures that the integrity of the protective cap is maintained. No other inspection or monitoring specific to this SMP is required. Inspections of other drip pad components (e.g., leak-detection system, epoxy coating) are also required under Subpart W, but are not required in association with this SMP.

8.1.3 Transfer Table Concrete Cap

The following defines the minimum observation and monitoring requirements per inspection for the transfer table concrete cap. As appropriate, recorded observations will be accompanied by documenting photographs:

- Overall cap condition
- Evidence of cracking, buckling, or subgrade shifting

8.1.4 Building Cap

The following defines the minimum observation and monitoring requirements per inspection for building caps. As appropriate, recorded observations will be accompanied by documenting photographs:

- Overall cap condition
- Visible cracks in the foundation

8.2 Corrective Action

If evidence of erosion or failure is observed in any of the abovementioned caps, the person conducting the inspection and reporting will consult with an engineer licensed in the state of Washington. The engineer will decide if additional analysis or observation is necessary to determine if the damage will reduce the effectiveness of the protective cap. Corrective action will be evaluated on a case-by-case basis according to the type and/or severity of damage and the urgency. The following will be conducted in order to document damage and to evaluate the need for corrective action:

1. Engineer's internal review of inspection reports and photographs
2. Site visit by the engineer to review damage
3. Additional measurement or analysis (survey, sample collection, or analysis)
4. Consultation with Ecology regarding the damage or deterioration and the engineering assessment
5. Proposal for repair prepared by the engineer (if determined necessary)
6. Contract with an appropriately certified and licensed contractor for completion of repair work (if needed)

8.3 Protective-Cap Maintenance

This section describes the minimum maintenance requirements for each component of the overall protective cap.

8.3.1 Pavement Cap

Pavement cap maintenance will be conducted if evidence of significant cracking or buckling (e.g., formation of potholes) is observed. Areas that show these failures will be maintained by the application of a corrective patch of asphalt or concrete, or the application of a sealer, as appropriate. Areas of failure that are entirely removed will be replaced to match existing thicknesses/materials. Specific to asphalt pavement, significant alligatored areas requiring removal will be replaced with asphalt 2.5 inches thick; insignificant alligatored areas may be repaired as cracks. If buckling results in cracking, the cracks will be repaired.

8.3.2 Drip Pad Concrete Cap

As discussed above, maintenance of drip pads associated with wood-treating facilities is required to be completed in accordance with Subpart W (40 CFR § 265.443). Subpart W requires that the physical integrity of the drip pads, as well as other components of the pads (e.g., leak-detection system, topcoat epoxy), be maintained in order to prevent leakage of hazardous substances to the subsurface. These Subpart W requirements will also ensure that the integrity of the drip pads as a protective cap will be maintained; therefore, compliance with Subpart W maintenance requirements is sufficient for the purposes of this SMP, and no other maintenance activities specific to this SMP are required.

8.3.3 Transfer Table Concrete Cap

The transfer pit concrete containment pad will be maintained as a protective cap for preventing exposure to potentially contaminated soil below. Maintenance of the transfer table concrete cap will be conducted if evidence of significant cracking is observed. Cracks will be repaired by the application of a corrective patch of concrete, or another material (as appropriate) that is compatible with the concrete, and will not be compromised by the potential presence of wood-treating chemicals that may be released from above.

8.3.4 Building Cap

Building foundations are not anticipated to require significant maintenance over the life of the building. Any maintenance will be completed in accordance with a licensed structural engineer's recommendations (building foundation).

9 HORIZONTAL RECOVERY WELL OPERATION AND MAINTENANCE

Detailed information on the design, construction, and development of the horizontal recovery well and the associated components (referred to collectively as the "recovery system") are provided in the Groundwater Interim Action Implementation Report (ThermoRetec, 1999). A map showing the locations of the recovery system components, a schematic profile drawing of the horizontal recovery well, a piping and instrumentation diagram, and an inspection form, all excerpted from the Groundwater Interim Action Implementation Report (ThermoRetec, 1999), are included as Appendix A. Inspections will be conducted on a monthly basis, using the inspection form provided in Appendix A. Inspection forms will be filed in the permanent records for the Property to be provided to future Property owners or to Ecology upon request, and will also be included in the groundwater monitoring reports that will be prepared in accordance with the schedule described in the CMP (MFA, 2016).

Operation of the horizontal recovery well is a required component of the groundwater treatment; therefore, it will continue to operate in accordance with the requirements outlined in the CMP (MFA, 2016); and it will be maintained until the criteria for decommissioning it have been met and Ecology approves decommissioning. In the event that groundwater extracted from the horizontal recovery well is no longer used in facility operations or the facility is shut down or closed, operation and maintenance of the horizontal recovery well will continue in accordance with the CMP (MFA, 2016). If shutdown of the horizontal recovery well is required for 30 consecutive days or more (e.g., for cleaning or repair) during any stage of the groundwater monitoring program when operation of the horizontal recovery well is required (see the CMP [MFA, 2016]), Ecology will be notified within 60 days of the first day of the 30-consecutive-day shutdown.

Discharge rates from the horizontal recovery well are generally higher following initial restarting of the system following a shutdown. As the aquifer is dewatered, discharge rates generally begin to decrease. Based on operations to date, recovery rates are generally approximately 4 gallons per minute (gpm) following an initial system restart and approximately 2 gpm once steady-state conditions are met. Discharge rates will be measured periodically in association with system operations to ensure that flows are optimized.

Recovery system equipment and piping will be inspected monthly, as described above, to ensure proper operation. However, it should be noted that the recovery system is located in an active part of the facility; therefore, any potential malfunctions that occurred between inspections likely would be detected immediately during standard plant operations. Visual inspections will include the wellhead vault and all equipment and piping. Leaks or malfunctioning equipment will be attended to promptly.

The horizontal recovery well may be redeveloped as needed to improve recovery and performance. Redevelopment may be performed in accordance with the procedures outlined in the Groundwater Interim Action Implementation Report (ThermoRetec, 1999) or using other industry standard well-development methods.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

REFERENCES

Ecology. 2016. Final cleanup action plan, Cascade Pole and Lumber Company, Tacoma, Washington. Washington State Department of Ecology, Toxics Cleanup Program, Southwest Regional Office, Lacey, Washington. January 12.

MFA. 2015. February 2015 groundwater monitoring report—Cascade Pole and Lumber Company, Tacoma facility. Prepared for McFarland Cascade Holdings, Inc., and Tyee Management Company, LLC. Maul Foster & Alongi, Inc., Bellingham, Washington. May 26.

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USEPA. 1996. Letter (re: use of the area of contamination [AOC] concept during RCRA cleanups), to RCRA Branch Chiefs and CERCLA Regional Managers, from M. Shapiro, S. Luftig, and J. Clifford, U.S. Environmental Protection Agency. March 13.

USPCI. 1993. Hydrogeologic characterization report—Union Pacific Railroad Parcel "A" Former Milwaukee Railyard, Tacoma, Washington. Vol. 1. USPCI Remedial Services, Boulder, Colorado. April.

TABLES

Table 1
Chemicals of Potential Concern in Soil
McFarland Cascade Holdings, Inc. and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Chemicals of Potential Concern in Soil	MTCA C Direct-Contact CUL (mg/kg)
Metals	
arsenic, inorganic*	88
CrIII	5,300,000
CrVI	11,000
copper	140,000
zinc	1,100,000
PAHs	
acenaphthene	210,000
acenaphthylene	NV
anthracene	1,100,000
benzo(g,h,i)perylene	NV
benzo(a)anthracene	180
benzo(b)fluoranthene	180
benzo(k)fluoranthene	1,800
chrysene	18,000
cPAH TEQ (benzo[a]pyrene)	18
dibenzo(a,h)anthracene	18
fluoranthene	140,000
fluorene	140,000
indeno(1,2,3-cd)pyrene	180
methyl naphthalene;2-	14,000
naphthalene	70,000
phenanthrene	NV
pyrene	110,000
SVOCs	
4-chloro-3-methylphenol	NV
benzoic acid	14,000,000
cresol;o-	180,000
cresol;p-	18,000
dibenzofuran	3,500
pentachlorophenol	330

NOTES:
The soil chemicals of potential concern are chemicals of interest that have been detected in soil at the site.
cPAH TEQ = carcinogenic PAH toxic equivalency quotient.
CrIII = trivalent chromium.
CrVI = hexavalent chromium.
CUL = cleanup level.
mg/kg = milligrams per kilogram.
MTCA = Model Toxics Control Act.
NV = no value.
PAH = polycyclic aromatic hydrocarbon.
SVOC = semivolatile organic compound.
*Arsenic was selected as an indicator hazardous substance.

Table 2
Final Cleanup Levels
McFarland Cascade Holdings, Inc. and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Indicator Hazardous Substance	Groundwater CUL (ug/L)	Groundwater CUL Basis	Soil CUL (mg/kg)	Soil CUL Basis
arsenic	5	MTCA A	88	MTCA C, CAR
benzene	51	SW, ARAR	--	--
CrVI	50	SW, ARAR	--	--
copper	2.4	SW, ARAR	--	--
cPAH TEQ (benzo[a]pyrene)	0.1	PQL	--	--
ethylbenzene	2100	SW, ARAR	--	--
pentachlorophenol	3	SW, ARAR	--	--
xylenes	1000	MTCA A	--	--

NOTES:

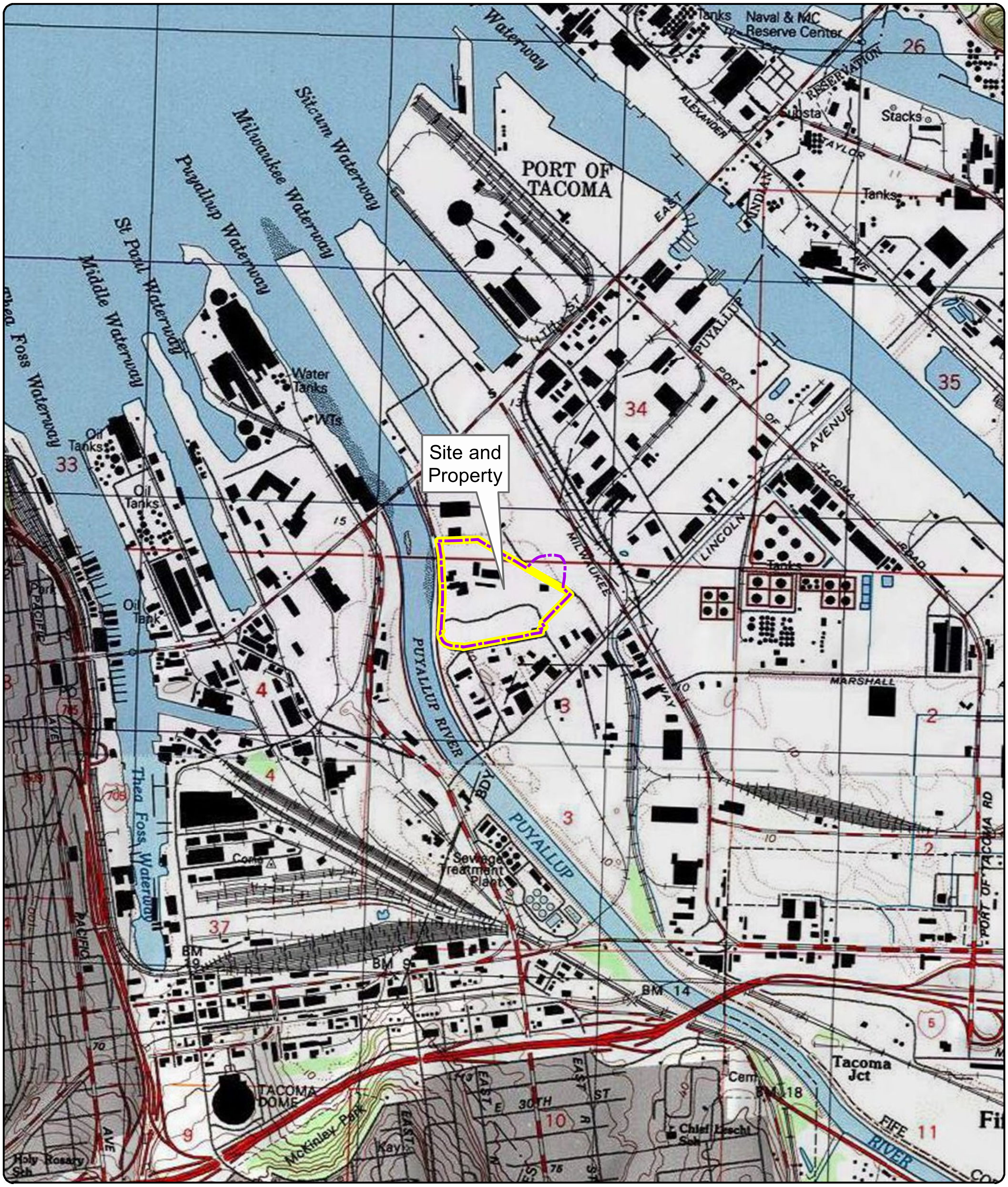
-- = not selected as an indicator hazardous substance for soil.
CrVI = hexavalent chromium.
CUL = cleanup level.
cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.
mg/kg = milligrams per kilogram.
MTCA A = Model Toxics Control Act, Method A table value for groundwater.
MTCA C, CAR = Model Toxics Control Act, Method C, carcinogen standard values.
ug/L = micrograms per liter.
PQL = practical quantitation limit.
SW, ARAR = surface water Applicable or Relevant and Appropriate Requirements.

Table 3
Capping Options
McFarland Cascade Holdings, Inc. and Tyee Management Company, LLC
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Type of Use	Typical Section
Asphalt Pavement	Low-permeability surface (minimum thickness 4 inches) with sub-base as necessary for construction
Drip Pad	Low-permeability surface (minimum thickness 4 inches) constructed of steel-reinforced concrete with sub-base as necessary for construction*
Transfer Table Pit Containment Slab	Low-permeability surface (minimum thickness 7 inches) constructed of steel-reinforced concrete with sub-base as necessary for construction
Building/structure	—Stem wall/footing steel-reinforced concrete foundation with sub-base as necessary for construction —Slab-on-grade steel-reinforced concrete (minimum thickness 3 inches) with sub-base as necessary for construction

*The drip pad minimum thickness is relative to the capping requirement and does not necessarily comply with the drip pad requirements put forth in 40 CFR 265, Subpart W.

FIGURES



Site Address: 1640 East Marc Street, Tacoma, Washington
Source: US Geological Survey (1990) 7.5-minute topographic quadrangle: Tacoma North
Section 3, Township 20 North, Range 3 East and
Section 34, Township 21 North, Range 3 East

Legend

Site Boundary

Property Boundary

Figure 1
Site Location

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

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Note: The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero arsenic concentration contour as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 1,000 2,000
Feet

Project: 9081.01.04-04 Produced By: jmiller Approved By: hhirsch Print Date: 9/17/2014

Figure 2
Site Features

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary
- Protective Cap (Currently Paved) and Soil Restricted Area

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. PCP = pentachlorophenol.
4. SWTS = stormwater treatment system.
5. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property, in the vicinity of monitoring well UPRR-MW-29, is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Project: 9081.01.04-00
Produced By: apadilla
Approved By: hhirsch
Print Date: 10/16/2014
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Figure 3
Soil Restricted Area and Protective Cap
McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

- Drip Pad Soil Sample Location
- Paving Area & Transfer Table Soil Sample Location
- Shallow Monitoring Well
- Deep Monitoring Well
- Arsenic CUL Exceedance (Soil)
- Railroad
- Site Boundary
- Property Boundary
- Protective Cap (Currently Paved) and Soil Restricted Area

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. CUL = cleanup level.
4. PCP = pentachlorophenol.
5. SWTS = stormwater treatment system.
6. Arsenic cleanup level = 88 mg/kg.
7. Arsenic data are included in the final Remedial Investigation and Feasibility Study (MFA and AECOM, 2014).
8. No arsenic exceedances were observed in soil samples collected from depths greater than 5 feet. The maximum depth sampled was 24 feet.
9. mg/kg = milligrams per kilogram (parts per million).
10. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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Project: 9081.01.04-00 Produced By: jmiller Approved By: hhirsch Print Date: 8/4/2015

Figure 4
Groundwater Exceedances 2004 to 2015

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

Exceedances

- Arsenic—5 ug/L CUL
- Copper—2.4 ug/L CUL
- PCP—3 ug/L CUL
- cPAH TEQ—0.1 ug/L CUL
- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Property Boundary

Notes:
1. This figure shows indicator hazardous substances for which the maximum detected concentration observed in groundwater was above CULs. Data from the four most recent monitoring events conducted between 2004 and 2015 for each well location were evaluated. During the 2004 to 2015 timeframe, monitoring wells MW-1, MW-19, and MW-20 were monitored only once, and MW-4 was monitored only twice.
2. Samples have not been collected from monitoring well location MW-11 since 2002.
3. Hexavalent chromium, benzene, ethylbenzene, and xylenes were below their respective cleanup levels during the four most recent monitoring events.
4. Total and dissolved metals were analyzed in some locations. When both were available, the greater of the two was used.
5. cPAH TEQ = carcinogenic polycyclic aromatic hydrocarbon toxic equivalency quotient.
6. CUL = cleanup level.
7. PCP = pentachlorophenol.
8. ug/L = micrograms per liter.
9. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 100 200
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI.

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Print Date: 11/4/2015
Approved By: hhirsch
Produced By: jmiller
Project: 9081.01.04-04

APPENDIX A

HORIZONTAL RECOVERY WELL DRAWINGS AND INSPECTION FORM

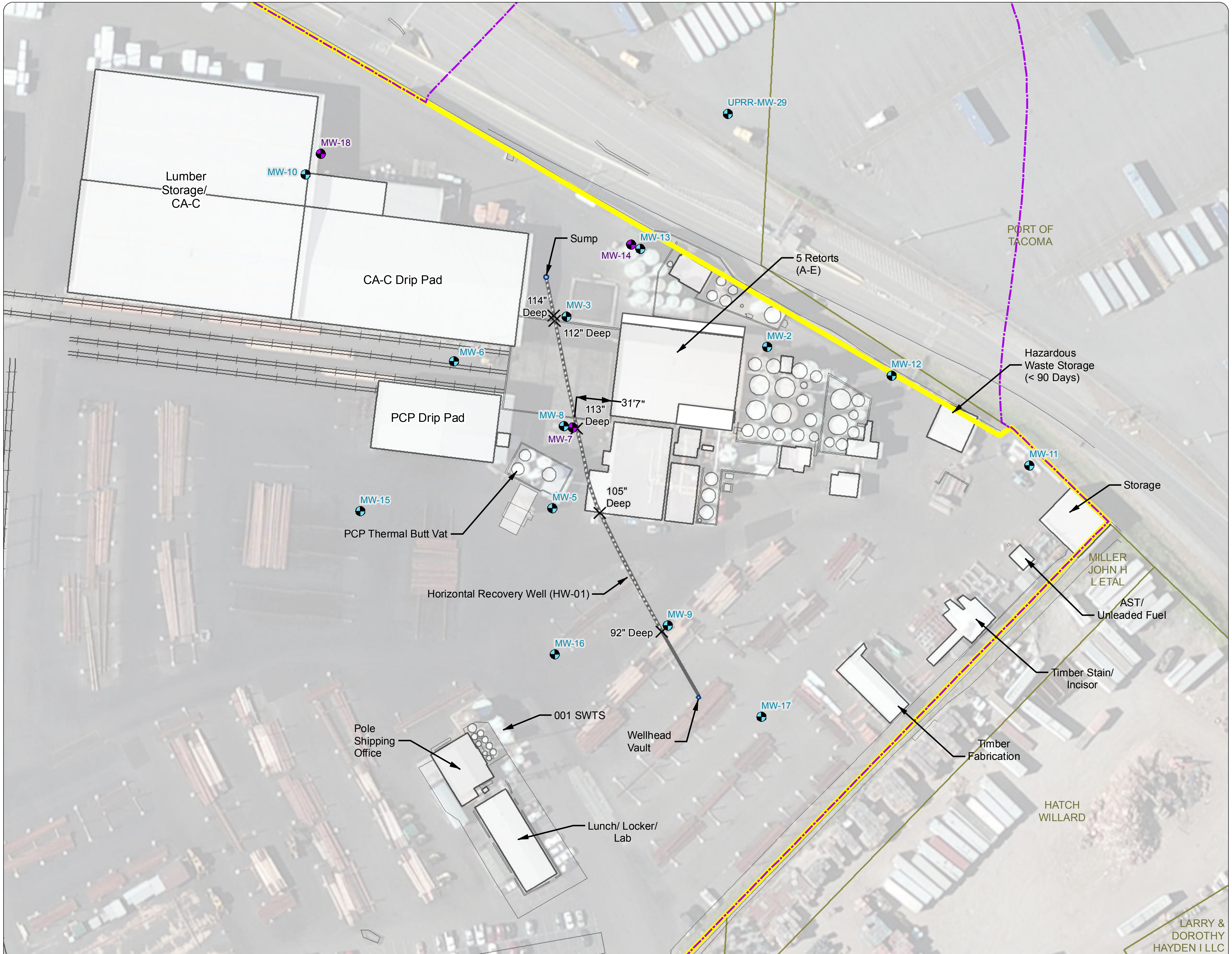

Figure A-1
Horizontal Recovery Well Location

McFarland Cascade Pole and Lumber Company
Tacoma, Washington

Legend

- Shallow Monitoring Well
- Deep Monitoring Well
- Railroad
- Site Boundary
- Pierce County Parcels
- Property Boundary

Horizontal Recovery Well

- Blank Casing
- Screened Casing

Notes:
1. AST = aboveground storage tank.
2. CA-C = copper azole - type C.
3. PCP = pentachlorophenol.
4. The portion of the Site Boundary that extends onto the adjacent Port of Tacoma property in the vicinity of monitoring well UPRR-MW-29 is consistent with the zero concentration contour for arsenic in groundwater as shown in the Hydrogeologic Characterization Report for the Union Pacific Railroad, Former Milwaukee Railyard site (USPCI, 1993).

0 50 100
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online; site layout and features obtained from AECOM Environment, RETEC, MKA and USPCI; county parcel boundaries (July 2014) obtained from Pierce County.

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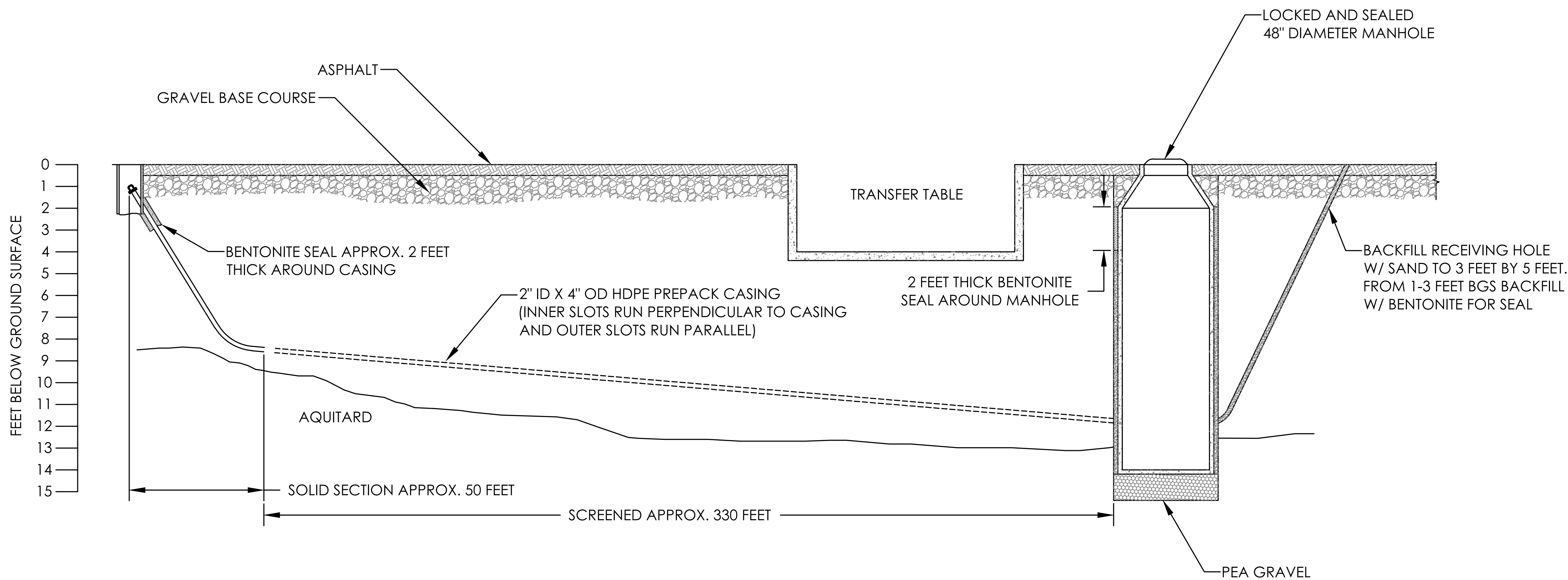
Print Date: 11/4/2015
Approved By: hhirsch
Produced By: jmiller
Project: 9081.01.04-00



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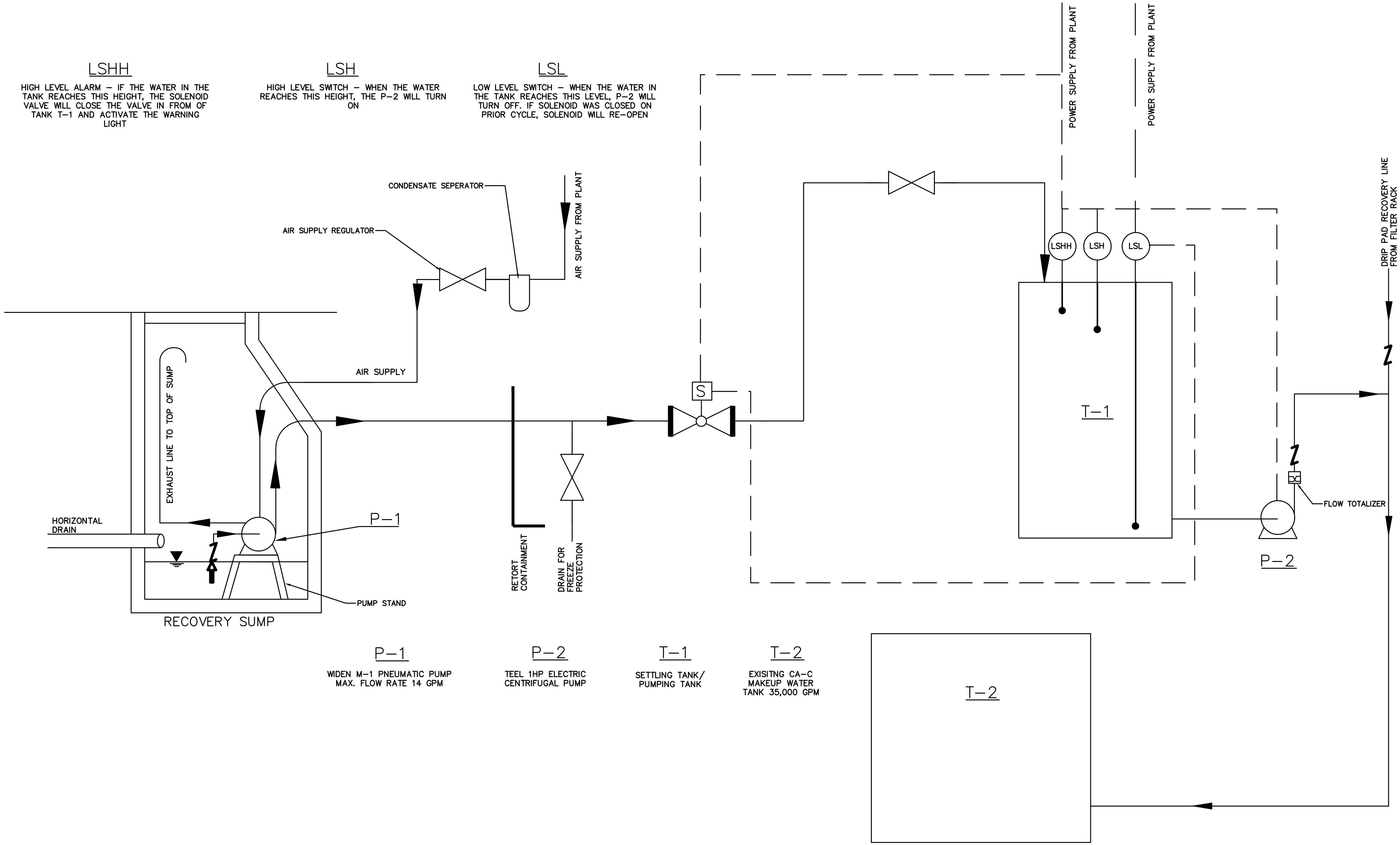
NOTES:
BGS = BELOW GROUND SURFACE
ID = INNER DIAMETER
OD = OUTER DIAMETER

DRAWING NOT TO SCALE

Figure A-2
Horizontal Recovery Well Profile
McFarland Cascade Pole & Lumber Co.
Tacoma, Washington



Filepath: G:\00_MFA Civil 3D\00_PROJECTS\0999.01 - Cascade Pole\EXHIBIT\Figure 2-4 Groundwater Collection System.dwg

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NOTES:
CA–C = Copper Azole–Type C
GPM = Gallons Per Minute
HP = Horsepower
Drawing not to scale

Figure A-3
Groundwater Collection System
McFarland Cascade Pole and Lumber Co.
Tacoma, Washington

Groundwater Recovery System Check Form
Cascade Pole and Lumber Company
Tacoma, Washington

Date: ____________________________ Time: ___________________

Checked By: ______________________ Weather: ________________

1) Discharge pump operating? YES ____________ NO ____________

2) Water level in tank _____________________ ft

3) Alarm light on? YES __________ NO ___________

4) Pipes leaking? YES __________ NO ___________

5) Discharge TOTALIZER reading ___________________ gallons

6) Describe any activities performed:

____

____

____

EMERGENCY SHUTDOWN PROCEDURES

Turn off WELL PUMP (air supply)
Turn off TRANSFER PUMP (at electrical panel)

System Administration and Responsible Individual:
Ted Smith (253) 597-3319

INSPECTION FREQUENCY

Inspections are to be conducted on a monthly basis.

RECORDING PROCEDURES

File this form in the permanent records for the Property to be provided to future Property owners or to Ecology by request and also include in the groundwater monitoring reports to be prepared in accordance with the schedule described in the Groundwater Compliance Monitoring Plan.

ECOLOGY NOTIFICATION OF SHUTDOWN

If the horizontal recovery well is non-operational for 30 days or more during periods when operation of the horizontal recovery well is a required component of the groundwater treatment (i.e., during the protection stage of monitoring; see the groundwater compliance monitoring plan [MFA, 2016]), Ecology must be notified within 30 days after the 30th consecutive day on which the well is not operated (i.e., within 60 days of the first day of the 30-consecutive-day shutdown).

APPENDIX B

SITE INSPECTION SUMMARY REPORT FORM

SITE INSPECTION SUMMARY REPORT - CAP VISUAL MONITORING
CASCADE POLE AND LUMBER COMPANY

Date:	
Weather:	
Precipitation (prior 24 hrs):	
Completed By:	

Photograph Requirements:

Overview photograph of each cap component to capture composite view of entire cap.

Any noted changes or damage to the cap.

General Observations:

General cap condition.

Stormwater flow characteristics (if monitoring conducted during wet weather).

Activity on the site.

Visible changes since previous inspection.

Standing water or areas of concentrated surface water flow.

Visible demarcation fabric.

Specific Observations: To be noted with photographs, measurements, and locations:

Pavement Cap:

- Settling or bulging indicating differential settlement or heaving.
- Cracking or buckling indicating lateral expansion or contraction.

Drip Pad Cap:

- Inspections to be completed separately and in accordance with 40 CFR 264/265.

Transfer Table Pit Cap:

- Settling or bulging indicating differential settlement or heaving.
- Cracking or buckling indicating lateral expansion or contraction.

Building Cap:

- Cracking of foundation.
- Penetration of vapor intrusion barrier (spread footing foundations).

Measurements:

Length and depth of any surface erosion or damage.

Estimated areal coverage of vegetation/landscaping material on soil cap.

Depth of soil cap at edges adjacent to pavement/building cap.

Recording:

This worksheet will be filed in the permanent records for the Property to be provided to future Property owners or to Ecology by request and will also be included in the groundwater monitoring reports that will be prepared in accordance with the schedule described in the Groundwater Compliance Monitoring Plan.

SITE INSPECTION SUMMARY REPORT - CAP VISUAL MONITORING
CASCADE POLE AND LUMBER COMPANY

Date:	
Weather:	
Precipitation (prior 24 hrs):	
Completed By:	

General Observations:

Specific Observations: To be noted with photographs, measurements, and locations:

Pavement Cap:

Drip Pad Cap:

Transfer Table Pit Cap:

Building Cap:

Measurements:

SITE INSPECTION SUMMARY REPORT - CAP VISUAL MONITORING
CASCADE POLE AND LUMBER COMPANY

Date:		
Location (Station or Coordinates)	**Observations**	**Photo Log**
Precipitation (prior 24 hrs):		