



**Closure Plan  
Boomsnub/Airco Superfund Site  
Hazel Dell, Washington**

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## LIST OF ACRONYMS AND ABBREVIATIONS

bgs	Below ground surface
BOC	The BOC Group, Inc.
Boomsnub	Boomsnub Corporation
CDF	Controlled density fill
COC	Constituent of concern
CPU	Clark Public Utilities
CSM	Conceptual site model
CV	Control vault
EA	EA Engineering, Science, and Technology, Inc., PBC
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
ft	Foot (feet)
GAC	Granular activated carbon
HDPE	High-density polyethylene
IWS	In-well stripping
IX	Ion exchange
Linde	Linde LLC
µg/L	Microgram(s) per liter
MCL	Maximum contaminant level
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
O&M	Operations and maintenance
OU	Operational Unit
PBC	Public Benefit Corporation\
PID	Photoionization detector
PQL	Practical quantitation limit
PVC	Polyvinyl chloride
RAO	Remedial Action Objective
RI	Remedial Investigation
RL	Reporting limit
ROD	Record of Decision

Site	Boomsnub/Airco Superfund Site
SOW	Statement of Work
SVE	Soil vapor extraction
TCE	Trichloroethene
TVH	Total volatile hydrocarbons
URSG	URS Greiner
VOC	Volatile organic compound
WAC	Washington Administrative Code

## 1. INTRODUCTION

This Closure Plan (Revision 2) was prepared in accordance with the Statement of Work (SOW) for the Consent Decree between The BOC Group, Inc. (BOC) and the U.S. Environmental Protection Agency (EPA) for the Boomsnub/Airco Superfund Site (Site) to support Site closure activities (Docket Number CV07-5163 FDB, entered by the court on 29 June 2007). Linde LLC (Linde) is the successor to BOC, and is now responsible for implementing the SOW.

A draft Closure Plan (Revision 0) was submitted to EPA in September 2007. At EPA's request, the Closure Plan was revised to incorporate a new method of data evaluation to determine when the Site was ready for closure, and an updated Closure Plan (Revision 1) was submitted to EPA in February 2009. This Closure Plan (Revision 2) was updated to reflect current Site conditions and to incorporate recent EPA guidance. Comments on the 2009 Closure Plan, received 31 August 2016, December 22, 2016, and January 23, 2018 have also been incorporated herein.

The objectives of this Closure Plan are to:

- Update the Site conceptual model.
- Present the procedures that will be used to demonstrate that Site remediation is complete, including a statistical process to confirm that remedial activities have met the remedial action objectives (RAOs) for the Site.
- Describe the process for decommissioning and demolition/removal of the extraction, treatment, and monitoring systems.

Site contamination originated from the adjacent BOC/Linde (formerly Airco) and Boomsnub Corporation (Boomsnub) facilities. The primary Site contaminants are hexavalent chromium and volatile organic compounds (VOCs), from the Boomsnub and former Airco facilities, respectively. Under the terms of the Consent Decree, Linde will be responsible for all remediation activities associated with the VOC source area, as well as groundwater remediation, until such time as cleanup levels for VOCs are achieved across the Site. If chromium concentrations in the groundwater exceed cleanup levels at the time VOCs achieve cleanup levels, responsibility for operation and maintenance of the groundwater treatment system will revert to the EPA. Linde retains responsibility for decommissioning of the groundwater extraction and treatment system at the time it is no longer required. Linde is also responsible for removal of a limited volume of chromium-contaminated soil underlying buildings on the Boomsnub property, once the buildings are demolished.

The Closure Plan has been divided into 3 sections:

**Section 1** provides general information related to the Site including the Site history, the RAOs and remedial actions to date, and the conceptual site model (CSM).

**Section 2** describes procedures for determining when groundwater at the Site has reached cleanup levels and the Site can be closed.

**Section 3** presents the general guidelines for decommissioning/demolition of the groundwater monitoring, extraction, and treatment systems. Detailed plans and/or specifications for decommissioning or demolition will be prepared at a later date, closer to the time the work will be performed. This plan also addresses the removal and disposal of chromium-contaminated soil remaining under the ion exchange (IX) treatment building and air stripper secondary containment pad on Boomsnub property.

## 1.1 SITE BACKGROUND

The Site is located in Hazel Dell, Washington, just north of the city limits of Vancouver, Washington and includes the former Boomsnub chrome plating facility and the active Linde (formerly BOC and Airco) facility. A Site location map is presented as Figure 1.

The Site is divided into three Operable Units (OUs) to manage cleanup activities (see Figure 2):

- Boomsnub Soil (OU-1)
- BOC Soil (OU-2)
- Sitewide Groundwater (OU-3).

In 1987, the Washington State Department of Ecology (Ecology) determined that a plume of chromium-contaminated groundwater was emanating from the Boomsnub facility. While cleanup activities were being conducted by Ecology at the Boomsnub facility, VOCs were detected in groundwater samples and were suspected of coming from the BOC property across the street. BOC began investigating the nature and extent of VOCs in 1991. In June 1994, the EPA took over the role of lead regulatory agency from Ecology and in April 1995, the Site was placed on the National Priorities List. Ultimately, chromium and VOCs in groundwater, emanating from two separate release points, were found to extend approximately 4,400 feet (ft) downgradient in a west-northwest direction.

A Record of Decision (ROD) was issued in February 2000 describing the remedies for OU-1 and OU-3 (EPA 2000). Instead of issuing a ROD for OU-2, an Action Memorandum was issued by EPA in September 2001 for a removal action at OU-2 (EPA 2001). The remedies are described in Section 1.3 of this document.

On 1 April 2002, interim responsibility for conducting the remedial action using the OU-3 groundwater extraction and treatment system was transferred from EPA to BOC with an Administrative Order on Consent, Docket Number CERCLA-10-2001-0114. Responsibilities include treatment system operation and maintenance, as well assessing progress toward meeting the RAOs. The Site is currently being operated by Linde under the Consent Decree (EPA 2007). EA Engineering, Science, and Technology, Inc., PBC (EA) is currently performing O&M on the Site for Linde.

## **1.2 REMEDIAL ACTION OBJECTIVES**

### **1.2.1 OU-1 Boomsnub Soil**

The ROD (EPA 2000) identified the following RAOs for OU-1, Boomsnub Soil:

- Prevent hexavalent chromium in soil from serving as an uncontrolled, ongoing source of contamination to the downgradient groundwater plume.
- Prevent future workers from being exposed to lead and chromium in soils above industrial standards.

According to the ROD, existing monitoring wells near the Boomsnub property are to be used to evaluate the effectiveness of the selected soil remedy in achieving the first OU-1 RAO.

### **1.2.2 OU-2 BOC Soil**

The OU-2 Action Memorandum (EPA 2001) established the following RAOs for OU-2:

- Remove VOCs from the vadose zone that may be acting as the source to groundwater.
- Remove VOCs from groundwater on the western portion of the BOC property.
- Halt off-property migration of VOCs in groundwater.

The primary constituents of concern (COCs) for the Site are trichloroethene (TCE) (OU-2/OU-3) and hexavalent chromium (OU-1/OU-3). The remediation goals for the Site include the reduction of total chromium (used as a substitute indicator for hexavalent chromium) in groundwater to 80 micrograms per liter ( $\mu\text{g/L}$ ) and the reduction of TCE to 5  $\mu\text{g/L}$ .

### **1.2.3 OU-3 Sitewide Groundwater**

The ROD (EPA 2000) identified continued groundwater extraction and treatment until groundwater cleanup levels are achieved throughout the groundwater plume as the remedy for OU-3 and established the following RAOs for OU-3 groundwater remediation:

- Prevent further impacts to the alluvial aquifer.
- Restore impacted groundwater to drinking water standards (Maximum Contaminant Levels [MCLs] or Washington State Model Toxics Control Act [MTCA] Method B standards).
- Prevent ingestion of contaminated groundwater above federal and state drinking water standards.
- Prevent impacts to the Upper Troutdale aquifer and the public drinking water supply by reducing contamination in the alluvial aquifer.

According to the ROD, the area of attainment for the groundwater COCs at the Site is the entire groundwater plume in the alluvial aquifer. The area of attainment in the Upper Troutdale aquifer is the area defined by the existing monitoring wells, including currently impacted wells AMW-24 and MW-33, and other wells screened within the Upper Troutdale aquifer at the Site.

Cleanup levels for COCs, as established in the ROD, are presented in the following table.

**Groundwater Cleanup Levels**

Constituents of Concern	CAS Number	Basis	Practical <sup>(a)</sup> Quantitation Limit (µg/L)	Cleanup <sup>(b)</sup> Level (µg/L)
Hexavalent chromium	18540-29-9	MTCA B	5	80
Chromium (total)	7440-47-3	MCL	5	100
Bromodichloromethane	75-27-4	MTCA B	1	1
Carbon tetrachloride	56-23-5	MTCA B	1	1
Dibromochloromethane	124-48-1	MTCA B	1	1
1,2-Dichloroethane	107-06-2	MCL	1	5
1,1-Dichloroethene	75-35-4	MTCA B	1	1
Tetrachloroethene	127-18-4	MCL	1	5
1,1,1-Trichloroethane	71-55-6	MCL	1	200
Trichloroethene	79-01-6	MCL	1	5
NOTES: CAS = Chemical Abstract Service µg/L = Micrograms per liter MTCA = Washington State Model Toxics Control Act MCL = Maximum Contaminant Level (a) Ecology Implementation Memo No. 3 dated 24 November 1993 (Ecology 1993). (b) Cleanup level established as the higher of the regulatory level or the practical quantitation limit; see Washington Administrative Code 173-340-700(6) and Ecology Implementation Memo No. 3 dated 24 November 1993.				

## 1.3 REMEDIAL ACTIONS

### 1.3.1 OU-1 Boomsnub Soil

The chromium source area (OU-1) is located on the Boomsnub property. A soil removal action was conducted by EPA in 1994, removing soil from a 70-foot diameter area to a depth of 28 ft. According to the ROD, the majority of the chromium contaminated soil was removed during this action, however post-removal sampling indicated chromium contaminated soil remains on the Site at levels exceeding the cleanup level (EPA 2000).

In October 2002, URS-Greiner (URSG), working under contract with EPA and in cooperation with representatives from the EPA Environmental Services Assistance Team, conducted additional soil characterization activities on the Boomsnub property around the groundwater extraction and treatment system building. The purpose of the work was to identify areas in the

shallow soils (15 ft or less deep) with concentrations of chromium above the cleanup levels specified in the ROD. The results of the soil characterization activities were presented in the *Soil Characterization: Groundwater Treatment System Compound* report, finalized in April 2003 (URSG 2003).

The ROD identified excavation of soil less than 15 ft deep with chromium concentrations above 400 milligrams per kilogram (mg/kg) as the remedy for OU-1. Additional chromium contaminated soil will be removed as described in the Consent Decree and in Section 3.6 of this plan.

### **1.3.2 OU-2 BOC Soil**

The VOC source area (OU-2) is located on the BOC/Linde property. In September 2003, Linde began construction of the Non-Time Critical Removal Action at their facility to address the VOC source area (OU-2). The selected remedial action was a combination of in-well stripping (IWS) and soil vapor extraction (SVE) systems to remove VOCs from both the groundwater and soil. The systems became operational in February 2004. The SVE system was operated to treat the vadose zone soil in OU-2. The SVE system was shut down following completion of rebound testing and EPA approval, as documented in a letter dated 4 March 2008 (EA 2008b). The IWS system was operated to treat groundwater in OU-2, until it was turned off with EPA approval in August 2013 (EPA 2013a). The systems were successful in reducing TCE mass in groundwater by more than 97% before asymptotic removal rates were reached and the systems were shut off; however, groundwater concentrations of COCs remained above the cleanup levels.

The OU-2 treatment system consisted of 21 wells (9 IWS wells, 5 duplex SVE wells, and 2 piezometers) and associated piping (Figure 3). Although it is no longer operational, the OU-2 treatment and monitoring equipment remains on the Linde property. The treatment equipment is housed in self-contained equipment trailers and included three trains (2 IWS and 1 SVE) incorporating moisture separators, blowers, and granular activated carbon (GAC) treatment for air discharge.

### **1.3.3 OU-3 Sitewide Groundwater**

A groundwater extraction network is used to capture the contaminated groundwater in OU-3, and pump it to a central treatment facility located on the Boomsnub property. The system was originally constructed and operated by Boomsnub in 1990 and has been expanded and upgraded several times by Ecology, EPA, and BOC/Linde. It was initially estimated that the groundwater treatment remedy would require up to 30 years for completion, during which time the system's performance would be monitored and optimized on a regular basis and adjusted as needed based on the performance data collected during operation. Remediation progress at the Site appears to be on or ahead of schedule.

The groundwater extraction and treatment system for OU-3 consists of the following components:

- An extraction system, which at the maximum extent consisted of 24 extraction wells pumping approximately 160 gallons per minute of groundwater through approximately 10,000 ft of double-walled force main to a central treatment system on Boomsnub property. Currently, 11 extraction wells are in operation, pumping approximately 125 gallons per minute of groundwater.
- A central treatment system used to treat the extracted groundwater. Chromium is removed using an IX system; VOCs are removed using air stripping with GAC treatment of the off-gas.
- An infiltration gallery on the Linde property which is used for treated water disposal; the water is discharged via a force main from the treatment system to the infiltration gallery.

An extensive groundwater monitoring network has been established for the Site. The majority of monitoring wells at the Site are located in the alluvial aquifer. In addition, a number of wells screened in the Upper Troutdale aquifer have been sampled in relation to the Site, including monitoring wells, production wells, and private wells. For ease of discussion, Site extraction and monitoring wells were divided into several “well groupings” across the Site. Alluvial aquifer wells were divided into the following groupings: Upgradient, TCE Source, Proximal, Intermediate, Church of God, and Toe of Plume. Troutdale aquifer wells are treated as a separate well grouping. The locations of Site extraction and monitoring wells, along with the well groupings, are shown on Figure 4.

The groundwater extraction system has been evaluated periodically to allow optimization of the extraction well pumping rates. Results of these evaluations have been presented in several Technical Memoranda (EA 2004c, EA 2008a, EA 2013). The overall goal of the initial capture zone assessment (EA 2004c) was to evaluate the effectiveness of the remedial system at the Site using a systematic approach drawing from multiple lines of evidence. The six-step process used was as outlined by the EPA in the document titled A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems (EPA 2008a).

The six steps used to complete the initial capture zone assessment were as follows:

- Step 1 – Review site data, site conceptual model and remedy objectives
- Step 2 – Define site-specific target capture zones
- Step 3 – Interpret water levels using potentiometric surface maps
- Step 4 – Perform particle tracking using groundwater flow model
- Step 5 – Evaluate concentration trends
- Step 6 – Interpret actual capture zones based on Steps 1 to 5, compare to target capture zones, assess uncertainties and data gaps.

During the initial assessment (EA 2004c), it was concluded that the Site groundwater flow model effectively simulates water elevation data measured at the site. Therefore, future capture analyses focused on use of the model to simulate water elevations and thus assess capture effectiveness.

Subsequent Technical Memoranda (EA 2008a, EA 2013) provided evaluations of plume capture at the then-current leading edge of the plume, using modified pumping rates. These evaluations focused on the use of particle tracking, using the Site groundwater flow model, to simulate and illustrate the effective capture zones of extraction wells at the Site. The target capture zone for these evaluations was determined based on the most recent water quality data, including the extent of TCE and chromium concentrations in groundwater exceeding the Site cleanup levels. Similar evaluations will be performed in the future, as needed, to optimize pumping rates and contaminant capture as the plume continues to shrink.

In 2006, an *in situ* treatment program was performed to treat an area of recalcitrant chromium and VOC contamination near the original toe of the groundwater contaminant plumes, in the area of wells MW-41 and AMW-63. The localized area of contamination appeared to be the result of continued desorption of TCE and chromium from lower permeability material at the bottom of the alluvial aquifer. These areas of lower permeability are not effectively treated by groundwater pumping, thus a study was conducted to evaluate the potential use of *in situ* treatment by reductive dechlorination for areas of residual contamination within the groundwater plume. This effort is referred to as the Toe-of-Plume Pilot Study and included the injection of EHC-M<sup>TM</sup>, a combination of controlled-release carbon and zero valent iron particles which stimulates reductive dechlorination of TCE and chemical reduction/precipitation of chromium (EA 2007a). Chromium and TCE concentrations in the pilot study monitoring wells have remained below the cleanup level since that time, indicating that the treatment was and remains effective.

In 2008, an investigation identified another plume of VOC contamination in groundwater north of the OU-3 plume, in the area around well AMW-18 (EA 2008c). This offsite plume is referred to as the Northern Plume. In May 2011, EPA and Linde performed a joint investigation of the Northern Plume area to get a better understanding of the source, extent, and concentrations of VOCs in the plume (EA 2011). A new monitoring well (AMW-64) was installed in February 2012, at the request of the EPA, to monitor the Northern Plume northwest of well AMW-18 (EA 2012). The Northern Plume continues to be monitored, along with the OU-3 plume, to evaluate potential impacts to the Site and treatment system. The source of this plume appears to be the former Permalume Plastics Site. EPA does not attribute this contamination to activities on the Boomsnub or Linde properties. EPA has agreed to reimburse Linde for costs incurred monitoring the offsite Northern Plume (EPA 2016).

In September 2015, EPA issued an Explanation of Significant Differences (ESD) which added *in situ* treatment as a remedy for groundwater and soil to supplement the groundwater extraction and treatment system, where needed to accelerate or improve remediation (EPA 2015).

Groundwater monitoring data are incorporated into a Site database. The groundwater monitoring program is detailed in the Long-Term Monitoring Plan (EA 2007b). Updates to the monitoring program are provided in the Annual Status Reports, the most recent of which was prepared for 2016 (EA 2017).

Figures 5 and 6 show the changing footprint of the chromium and TCE plumes since 1995. These figures illustrate that groundwater remedial actions have been effective in mass removal

and in reducing the footprints of both the chromium and TCE plumes. Based on the reduction in size of the contaminant plumes, only 11 of the original 24 extraction wells remain in use.

## **1.4 CONCEPTUAL SITE MODEL**

The CSM is a mental construct of the means by which contaminants were introduced into the environment and the fate and movements of the contaminants in liquid, dissolved, vapor, or solid phases from the release to points at which the contaminants are extracted and/or treated, or at which people or ecological receptors can be exposed to them. CSM information for the Site has been presented in previous documents, including:

- ROD, Boomsnub/Airco Superfund Site (EPA 2000)
- Remedial Investigation (RI) Report, Boomsnub/Airco Superfund Site (ICF Kaiser 1998)
- Site Evaluation Work Plan, BOC Gases (EA 1997).

The initial Site CSM, as presented in the ICF Kaiser RI Report in 1998, is presented as Figure 7. This CSM took into account the following factors: primary sources, primary release mechanisms, secondary sources, secondary release mechanisms, transport pathways, exposure routes, and potential receptors. Figure 8 shows an updated pathway network receptor diagram, based on current conditions (updated CSM). The following sections describe the current Site CSM and changes to the CSM that have occurred since 1998.

The CSM is periodically updated as new information or insights become available. This can include testing for the presence of potential contaminants which had not been previously considered. EPA has recently identified former chrome-plating facilities to be potential sources of Perfluorinated Chemicals (PFCs). Upon final approval of this Closure Plan, in order to test for the presence/absence of PFCs, a sampling and analysis plan for EPA review and approval will be prepared in early 2018 to include sampling of the groundwater treatment plant inflow and outflow, and monitoring wells located down gradient of the percolation pond. If PFCs are not present, then no CSM update to account for their fate and transport would be necessary. If present, then further investigation to update that aspect of the CSM might be needed.

### **1.4.1 Site Geology/Hydrogeology**

A brief overview of the Site geology and hydrogeology is presented in this section. Additional information is available in the following reports:

- Additional Hydrogeologic Investigation (EA 2005)
- Groundwater Modeling Summary Report (EA 2004a)
- RI Report (ICF Kaiser 1998).

Geologic units of concern at the Site include the alluvial aquifer, the aquitard, and the Upper Troutdale aquifer. The Upper Troutdale aquifer is part of the Upper Troutdale Formation.

### ***1.4.1.1 Topography***

The Site lies in the broad historic flood plain of the Columbia River, which is located approximately two miles south of the Site. Ground elevations at the Site range from approximately 250 to 290 ft above mean sea level. There are no surface water features close enough to the Site to be impacted by Site contaminants (EPA 2000). The Burnt Bridge/Salmon Creek drainage divide runs northeast across the Site, approximately 0.5 miles west of the BOC property. Surface water to the north and west of the divide flows toward Salmon Creek while water to the south and east of the divide flows toward Burnt Bridge Creek via Cold Canyon. Both the Linde and Boomsnub properties are located to the east of this surface water divide.

### ***1.4.1.2 Alluvial Aquifer***

The alluvial aquifer is unconfined and receives recharge via precipitation on the ground surface. The water table in the alluvial aquifer in the Site area generally ranges from about 10 to 30 ft below ground surface (bgs). The groundwater flow direction in this unit is well established, with groundwater moving to the west-northwest. No significant surface water bodies are present that affect groundwater flow patterns within the plume area. However, the existing groundwater extraction well network has created localized areas of drawdown which locally disrupt the overall groundwater flow pattern.

The alluvial aquifer is composed of fine to medium sand with varying amounts of silt, of fluvial and alluvial origins. This unit ranges in thickness from about 60 to 140 ft in the Site area. A general thickening of the alluvial aquifer occurs to the west of the Boomsnub property, in a band trending generally northeast-southwest in the area of NE St. Johns Road. This is commonly referred to as the “trough” area.

Although vertical heterogeneity within this aquifer has been noted, the trends are similar throughout the Site area (ICF Kaiser 1999). The alluvial aquifer generally becomes siltier with depth. The base of the alluvial aquifer typically consists of 10 to 20 ft of silt or silty sand that grades into the silty clay aquitard. Measured hydraulic conductivity for the alluvial aquifer ranges from 10 to 130 feet per day (ICF Kaiser 1998), with the lowest values noted in the deep silty portion of the aquifer.

The vertical hydraulic gradient varies at the Site due to the groundwater pumping. Water levels in alluvial aquifer well clusters tend to be similar at the different depths, except near active extraction wells where groundwater withdrawals impact the flow patterns. However, there is a significant downward hydraulic gradient from the alluvial aquifer to the semi-confined Upper Troutdale aquifer. The vertical hydraulic gradient between nearby alluvial and Upper Troutdale aquifer wells was calculated by using the difference in water levels (hydraulic head) divided by the difference in vertical distance between well screens. This was evaluated in several areas across the Site (where nearby non-pumping wells were available in both aquifers) using data from Spring and Fall 2015. The vertical hydraulic gradient between the two aquifers ranged from approximately 0.6 to 0.9 downward.

Based on recent alluvial aquifer water level measurements, the horizontal hydraulic gradient across the Linde property is approximately 0.008; this area is impacted by recharge from the infiltration gallery (EA 2015, EA 2016). Downgradient, within the plume area, (using an average from just west of the Linde property to the original toe of plume area) the gradient is approximately 0.004 (EA 2015, EA 2016).

The alluvial aquifer is a major water-bearing unit and contains the majority of the groundwater impacted by TCE and chromium. The contaminant plumes tend to migrate downward in the aquifer with increasing distance from the source areas. In downgradient portions of the Site, the highest TCE concentrations tend to occur near the base of the alluvial aquifer, at slightly greater depths than the highest chromium concentrations. All of the Site extraction wells and most of the Site monitoring wells are completed within the alluvial aquifer. There are no known drinking water supply wells located within the impacted Site area.

#### ***1.4.1.3 Aquitard***

The aquitard unit is comprised of a medium gray, silty clay to clay and is a major barrier to vertical groundwater flow between the overlying alluvial aquifer and the underlying Upper Troutdale Formation. The aquitard unit has a low hydraulic conductivity and conducts an insignificant amount of horizontal groundwater flow. Primarily, groundwater moves vertically through this unit; however, movement is very slow due to the low hydraulic conductivity.

The thickness of the aquitard varies across the Site from about 10 to 30 ft; however, in some areas, including portions of the trough area, this unit thins to less than 10 ft. The top and bottom elevations of the aquitard are variable, and highs and depressions in the top surface have been noted (ICF Kaiser 1999). Due to the low permeability of this unit, limited monitoring well data have been collected on chemical concentrations, although samples of this unit have been collected to assess hydraulic properties. Laboratory measurements of the vertical hydraulic conductivity of the aquitard range from  $5.7 \times 10^{-2}$  to  $5.8 \times 10^{-4}$  ft/day (ICF Kaiser 1998).

TCE has been detected at relatively low concentrations in several Upper Troutdale aquifer wells. The presence of VOC compounds in the Upper Troutdale aquifer is the result of either a natural or artificial breach in the aquitard or migration through the aquitard (EPA 2002).

#### ***1.4.1.4 Upper Troutdale Aquifer***

The Upper Troutdale aquifer occurs within the Upper Troutdale Formation, below the aquitard and below a less permeable, siltier portion of the Upper Troutdale Formation. The Upper Troutdale aquifer consists of gravel and cobbles in a sandy matrix with variable amounts of silt. Highly permeable zones in this unit are composed of gravel and cobbles that may be in layers from 20 to 40 ft in thickness. These permeable zones comprise the primary drinking water aquifer for the area. Groundwater flow in this aquifer is generally to the west-southwest. This unit is confined due to the presence of the overlying aquitard.

Estimated hydraulic conductivity values for the Upper Troutdale aquifer range from 258 to 2,851 feet per day (ICF Kaiser 1999; Fetter 1994). Based on recent water level measurements, in the Upper Troutdale aquifer the average horizontal gradient across the Site area is approximately 0.006-0.007 (EA 2015, EA 2016).

Upper Troutdale aquifer monitoring in the Site area has included sampling of 10 monitoring wells, one production well at the Linde facility, and limited private well sampling. Note that, for ease of discussion, wells used to monitor the Upper Troutdale aquifer at the Site are generally referred to as “Troutdale aquifer” wells. Based on data from these wells, the upper portion of the Upper Troutdale aquifer is not significantly impacted by the Site; however, TCE has been detected at concentrations slightly above the 5 µg/L cleanup level in two monitoring wells (AMW-24 and MW-33) and one private well (Bennett well). Note that the Bennett well is not used for potable purposes; potable water for this property is supplied by Clark Public Utilities. While chromium has been detected in some Upper Troutdale aquifer monitoring wells, the concentrations have been well below the cleanup level. The water quality of the Upper Troutdale aquifer is of major concern due to the public water supply wells that pump groundwater from this unit. The nearest supply well is located approximately 1 mile west of the source areas for the alluvial aquifer plumes.

#### **1.4.2 Contaminant Source and Source Control**

The primary concern at this Site is chromium and TCE migrating from the soil OUs to groundwater. A secondary concern was surface exposure to contaminants at the soil OUs.

The chromium source area is located on Boomsnub property and the VOC source area is located on Linde property. Primary contaminant sources included tanks, containment vaults, and drywells. The primary sources have been removed and cleaned up on both properties; therefore, the primary sources, as well as the related primary release mechanisms (spills and leaks), were deleted from the updated CSM.

On the Linde property, the IWS/SVE (OU-2) remedial activities have removed most of the VOC contamination in the source area. However, based on continuing fluctuations in TCE concentrations in groundwater, including frequent TCE increases when the water table is higher, residual subsurface soil contamination likely occurs at depths near the water table in the OU-2 area.

On the Boomsnub property, soils with chromium concentrations exceeding 400 mg/kg have been removed in the upper 15 ft of the Site, except under the air stripper secondary containment pad and the IX building. The contaminants in these areas are currently covered and will be removed when the structures are removed during Site decommissioning; therefore, they have been deleted as sources. However, higher concentrations of chromium remain in the soil at depths greater than 15 ft bgs. Therefore, soil is retained as a source for chromium contamination in soils below 15 ft bgs at Boomsnub. In accordance with the Consent Decree (EPA 2007), any chromium contaminated soil remaining below 15 ft bgs is not the responsibility of Linde and will not be removed as part of this Closure Plan.

### 1.4.3 Contaminant Distribution, Transport, and Fate

Stormwater runoff, infiltration/leaching, and dust and/or volatilization were initially identified as secondary release mechanisms due to soil contamination at the Site. Stormwater runoff and dust/volatilization no longer apply because surface and shallow soil contamination (TCE and chromium) have been removed. Because remaining chromium contamination in soil under Site structures is covered and will be removed during Site decommissioning, these secondary release mechanisms are considered to no longer apply to those areas. However, infiltration/leaching remains as a release mechanism for chromium due to the continued presence of contaminated soil below 15 ft bgs at OU-1, and for TCE due to possible residual TCE contamination in subsurface soil at OU-2.

Surface water, wind, and groundwater were identified as transport pathways at the Site. However, surface water and wind no longer apply since surface soil contamination in both source areas either has been removed or is covered. Groundwater contamination remains at the Boomsnub and Linde properties and downgradient; therefore, groundwater remains as a transport pathway for both locations.

While vapor intrusion is considered a potential transport pathway, it is not included due to the lack of receptors. In the OU-2 area, VOC contamination occurs near the water table; however, there are no occupied buildings overlying the impacted area. Downgradient of OU-2, the VOC contamination occurs at depth in groundwater, with overlying unimpacted groundwater (Figure 12). According to recent EPA guidance on vapor intrusion assessment, "...the presence of a lens of clean water as little as a foot in thickness overlying a plume may be sufficient to impede vapor flux to the vadose zone" (EPA 2015). Throughout most of the existing VOC plume (outside of the OU-2 area), a significant thickness of "clean" water overlies the VOC impacted groundwater; therefore, vapor intrusion is not considered a complete pathway. In downgradient portions of the Site, 50 feet or more of "clean" groundwater may occur above groundwater with concentrations exceeding the Site cleanup levels, as indicated by previous sampling of shallower wells and direct push samplers.

Periodic monitoring of vapor concentrations in vaults and well headspace has been conducted, and has provided further evidence regarding the lack of a vapor intrusion pathway. Air quality monitoring of extraction well containment vaults was completed during the Spring 2001 sampling event. Results of that monitoring indicated that containment vault entry for sampling and maintenance purposes did not expose field personnel to unsafe conditions or hazardous atmospheres (EA 2004b). In 2009, a photoionization detector (PID) was used during well sampling to monitor total volatile hydrocarbons (TVH). Measurements were obtained from the headspace of 90 wells and vaults and from the breathing zone at each location sampled during the October 2009 event. The PID provides a rapid readout of the TVH concentration in parts per million (ppm). Where headspace PID readings were observed, the concentrations dropped to 0.0 ppm in less than 10 seconds, with the exception of MW-6A. The highest reading obtained at each location was recorded. In the vault for extraction well MW-6A, a measurement of 16.3 ppm was obtained. The reading declined to 0.0 ppm within 30 seconds. Readings above 0.0 ppm were

detected in six other Site wells or vaults at concentrations up to 0.6 ppm. It should be noted that with the Photovac 2020 model used, humidity may produce a positive response in the absence of contamination; some of the low-level headspace detections may have been due to the humidity of the stagnant air. No detectable TVH concentrations were reported within the breathing zone at any location sampled (EA 2009)

The plumes of contaminated groundwater at concentrations exceeding the cleanup levels for chromium and TCE initially impacted an area approximately 4,400 ft long and 900 ft wide (EPA 2000). Figures 9 and 10 show map and cross section views of the Site, including the approximate extent of the chromium and TCE plumes, during 1998, as depicted in the ROD (EPA 2000).

After more than 15 years of extracting and treating impacted groundwater, the downgradient TCE contaminant plume has been reduced to an area approximately 2,500 ft long and 350 ft wide, and the downgradient chromium contaminant plume has been reduced to only about 700 ft long and 75 ft wide. Figures 11 and 12 show map and cross section views of the Site, including the approximate extent of the chromium and TCE plumes, during early 2016. The removal of the majority of the contaminant source materials has resulted in a separation of the area of contaminated groundwater underlying the source areas and the downgradient contaminant plumes. The majority of the remaining TCE contaminant mass in groundwater occurs near the base of the alluvial aquifer in the trough area (see Figure 12). The need for *in situ* treatments is anticipated in this area to reduce TCE concentrations in groundwater to the cleanup level within a reasonable timeframe.

While several VOCs in addition to TCE have been detected in groundwater at concentrations exceeding the Site cleanup levels, this has occurred in wells where TCE also exceeds the cleanup level. Therefore, once TCE concentrations are at or below the cleanup level, other VOCs are not expected to occur at concentrations of concern.

The presence of the offsite Northern Plume may complicate remediation of the Site. At this time, the Northern Plume appears to have merged with the OU-3 plume along a portion of the northern OU-3 boundary; specifically, in the well MW-38 area. To date, TCE concentrations in Site extraction wells have not noticeably increased, indicating that the Northern Plume does not appear to be impacting these wells yet. The migration of the Northern Plume and potential impacts on Site remediation are being closely monitored. EPA and Linde have entered into an agreement regarding reimbursement for costs incurred by Linde for monitoring the Northern Plume since Linde is not considered responsible for the Northern Plume contamination.

In the three Troutdale wells that have been impacted by TCE (AMW-24, MW-33, and Bennett), TCE concentrations appear to be slowly decreasing. Although TCE concentrations fluctuated in earlier years, TCE concentrations have been on a decreasing trend in wells AMW-24 and MW-33 since 2007 and 2010, respectively. In the Bennett well, TCE concentrations have been below the cleanup level since 2016.

#### 1.4.4 Receptors

The potential for human (workers and residents) and ecological (terrestrial) receptors was initially identified at the Site. Inhalation, ingestion, and dermal contact (via soil and groundwater) were identified as exposure routes. Because shallow contaminated soil (up to 15 ft bgs) has been removed from both source areas or covered, human and ecological receptors are not currently exposed to contaminants originating from soil and inhalation, ingestion, and dermal contact via soil are no longer considered exposure routes. Note that humans (workers) will be exposed to chromium contaminated soil during Site decommissioning (see Section 3.6).

Groundwater contamination remains at the Site. Humans (workers and residents) remain as potential receptors for groundwater contamination via ingestion, inhalation, and dermal contact. However, the likelihood of contact is limited by the following:

- Potential exposures for workers are expected to be low since the water table occurs at depths of more than 10 ft throughout most of the Site area.
- The alluvial aquifer in the Site area is not used for potable purposes. Therefore, the potential exposure for residents via the alluvial aquifer is low.

The Upper Troutdale aquifer within the Site area is not currently used for potable water. However, the Upper Troutdale aquifer is used for potable water downgradient of the Site. Therefore, residents remain as potential receptors via the Upper Troutdale aquifer.

Institutional Controls required under the ROD (EPA 2000) to prevent the ingestion of groundwater include public notice and long-term compliance monitoring for contaminated ground water, and Site access restrictions for the Boomsnub property for the duration of the pump and treat system's operation.

## 2. SITE CLOSURE MONITORING AND EVALUATION

Site closure will occur when RAOs are met, which will be confirmed when the concentrations of all Site COCs in groundwater monitoring and extraction wells have reached the Site-specific cleanup levels, as defined in the ROD and presented in Section 1.2. Note that an exception to this occurs in the case where VOCs in groundwater meet cleanup levels but chromium does not. Per the Site Consent Decree (EPA 2007), Linde is responsible for groundwater remediation until such time as cleanup levels for VOCs are achieved across the Site. If chromium concentrations in the groundwater exceed cleanup levels at the time VOCs achieve cleanup levels, responsibility for operation and maintenance of the groundwater treatment system will revert to the EPA. EPA is responsible for removal of any remaining chromium in groundwater at that point.

The following EPA guidance documents were used to develop the procedures in this Closure Plan that will be used to determine when the groundwater cleanup levels have been achieved.

- *Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Actions at a Groundwater Monitoring Well* (EPA 2014)
- *Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions* (EPA 2013b)

Site closure will occur in two phases: (1) remediation monitoring will continue to be performed to determine when remediation is complete; (2) attainment monitoring will be performed to confirm COC concentrations are expected to remain below the cleanup levels in the future. The Site will be closed once all impacted wells have reached attainment for all COCs.

Table 1 lists the wells which will be included in Site closure monitoring. This includes all wells at the Site with the following exceptions:

- Wells which have never had concentrations of Site COCs greater than the cleanup levels.
- Abandoned wells.
- In-well stripping wells used only for remediation, and screened inappropriately to monitor the plume.
- Private wells and wells installed for other purposes that have never been included in the monitoring program.
- Wells impacted by the Northern Plume (now or in the future) will not be considered part of OU-3 and will not be required to reach attainment before Site closure. These wells may be retained by EPA for future monitoring of the Northern Plume after closure of OU-3.

The excluded wells are listed in Table 2; justification for each exclusion is provided in the table.

## 2.1 REMEDIATION MONITORING

According to EPA guidance (EPA 2014), “*the remediation monitoring phase refers to the phase of the remedy where either active or passive remedial activities are implemented to reach groundwater cleanup levels*”. Once the cleanup levels have been met, decisions can be made regarding shutting off pumps in nearby extraction wells, in preparation for attainment monitoring.

EPA guidance (EPA 2014) recommends that a minimum of four data points be used to identify completion of the remediation monitoring phase (i.e. groundwater concentrations below cleanup levels during pumping conditions). Additional data may be required in some cases, if statistical analysis is required. At this Site, the last four data points will be reviewed to determine if a non-statistical or statistical approach to the data is required.

Statistical analysis will not be required if groundwater COC concentrations are all “non-detect” (i.e., the Practical Quantitation Limit or Reporting Limit is below the cleanup level).

If the results are a combination of “non-detect” and below the cleanup level for all detected COCs, a statistical analysis is not needed to accurately conclude that the COC cleanup levels have been reached.

In cases where COC concentrations in a particular groundwater monitoring well are present at detectable levels both above and below the cleanup level in the four remediation monitoring data points, a statistical analysis of the four data points will be used to conclude whether the groundwater has reached the remediation goals for Site COCs in that monitoring well. In accordance with the guidance, the statistical evaluation will be conducted using the mean test for data sets without a trend, or the trend test for data sets with a trend, to determine the upper 95% UCL. If the selected statistical method demonstrates that the 95% UCL value is at or below the cleanup level for the COC, then the remediation monitoring phase will be considered complete. For data sets with a 95% UCL that exceeds the cleanup level, additional analyses (e.g., trend forecasting) will be conducted to determine if future attainment of the cleanup level is likely, and if so, to provide an estimate of the number of additional samples necessary to demonstrate attainment.

Attainment monitoring will not begin until the remediation phase is complete and the extraction well(s) in the vicinity of the monitoring well have been shut down, allowing groundwater to return to steady state conditions. We estimate steady state will be achieved approximately one month after nearby extraction wells have been shut off.

For this Site, groundwater monitoring has been ongoing for more than 20 years. In many wells, concentrations of all COCs have been below the cleanup levels for many sampling events. Table 1 indicates the current status of all wells in the closure monitoring program, including the following: whether the remediation phase of monitoring is complete in each well for VOCs and/or chromium, whether the well is at post-remediation steady state (no longer impacted by

treatment system operations), and whether the well meets the criteria for the start of attainment monitoring for VOCs and/or chromium. The last four data points for each COC in each well were used for this evaluation. Supporting data used for this evaluation are included in the 2016 Annual Report (EA 2017).

### **2.1.1 Additional Remedial Action**

In areas of the site where continued groundwater pumping is no longer effective in reducing contaminant concentrations, such that meeting the RAOs might take considerably longer than had been anticipated additional remedial action may be implemented, as allowed by the 2015 ESD. It is anticipated that *in situ* treatment will be required in the area around MW-18E, and also to address residual contaminant concentrations within OU-2. Additional areas may be identified as the plume continues to shrink, and residual pockets of contamination remain. When areas requiring additional treatment are identified, either during the remedial or attainment monitoring phases, the EPA will be notified and a work plan will be prepared for EPA approval prior to implementing additional actions.

In areas where *in situ* treatment is used to treat recalcitrant contaminants, nearby extraction wells will need to be turned off to avoid drawing in groundwater containing injected amendments and fouling the groundwater treatment system. In such a case, where contaminant capture is no longer maintained by extraction well pumping, potential contaminant migration will continue to be monitored by sampling of downgradient wells.

## **2.2 ATTAINMENT MONITORING**

The attainment monitoring phase is intended to confirm that COC concentrations will remain at or below the cleanup level in the future. Therefore, the data set used to determine completion of attainment monitoring will be limited to information collected after it has been demonstrated that groundwater in the well has reached post-remediation, steady-state, conditions. Well attainment will be assessed after nearby extraction wells have been off at least one month, or groundwater conditions indicate that steady-state conditions have been reached. The attainment monitoring phase evaluation will be conducted separately for each COC at each well. Existing data may be used to assess attainment.

If rebound of contaminant concentrations occurs following shut down of extraction wells, recommendations regarding restart of the extraction system or *in situ* treatment of areas of residual contamination will be made and presented to EPA. *In situ* treatment will be conducted as necessary and where practical to bring wells to completion of remediation and will be conducted in accordance with the approved ESD (EPA 2015) for the Site. If rebound occurs during attainment monitoring, the well will return to the “remediation monitoring” phase. Cleanup attainment will be measured using eight data points, in accordance with EPA guidance (EPA 2014). For this Site, attainment monitoring will typically occur over 3 years, with quarterly samples being collected the first year, followed by semiannual sampling for two years. For wells currently not impacted by groundwater extraction and at steady state, existing data may be used for this evaluation.

Attainment monitoring will be complete when contaminant-specific data provide evidence indicating that (1) the cleanup level for each COC for which Linde is responsible has been met and (2) the groundwater will continue to meet the contaminant cleanup level for each COC in the future.

### **2.2.1 Evaluation of Whether the Cleanup Level Has Been Met**

Once the eight attainment monitoring data points are available, an attainment evaluation will be conducted. Data for each COC at each well will be evaluated. Statistical analysis will not be required if groundwater COC concentrations are all “non-detect” (i.e., the Practical Quantitation Limit or Reporting Limit is below the cleanup level). If the results are a combination of “non-detect” and below the cleanup level for all detected COCs, a statistical analysis will not be needed to accurately conclude that the COC cleanup levels have been reached.

In cases where COC concentrations in groundwater are present at detectable levels both above and below the cleanup level, a statistical analysis on the well data set will be used to conclude whether the groundwater has reached the cleanup levels for Site COCs in that well. In accordance with the guidance, the statistical analysis will use the mean or trend test to determine the upper 95% UCL. If the selected statistical method demonstrates that the UCL values are at or below the cleanup levels for the COCs, then the first phase of attainment monitoring is considered complete.

If the data analysis demonstrates that the UCL value is above the COC cleanup level, it is appropriate to conclude that the COC cleanup level has not been met. In this case, additional monitoring will be performed and the need for additional remediation will be evaluated.

### **2.2.2 Evaluation of Whether Groundwater Will Continue to Meet Cleanup Levels**

For COCs demonstrated to have attained the cleanup levels, a trend analysis may be used to determine whether the groundwater will continue to meet the contaminant cleanup level in the future. The groundwater monitoring data should follow a normal distribution to employ trend statistics. If the data are not normally distributed, use of a data transformation tool may be appropriate to allow for the use of normal trend statistics. However, in some instances, it may be appropriate to use only nonparametric trend statistics. If the data are not normally distributed, the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities* (EPA 2009) will be used for data transformation tools.

If the trend line does not have a statistically significant positive slope (i.e., increasing trend), it will be concluded that the contaminant concentrations for that COC in groundwater will remain at or below the cleanup level.

If the trend line has a statistically significant positive slope (the concentration trend is increasing), the attainment monitoring phase will not be complete and additional investigation will be required to determine the cause of increasing groundwater concentrations.

If both the UCL value is at or below the COC cleanup level and the time-dependent trend line has a zero or statistically significant negative slope, it will be concluded that the attainment monitoring phase has been completed for the COC being evaluated.

Once attainment has been achieved in a well, no further monitoring of that well will be required.

Once all alluvial aquifer wells in the monitoring program have met attainment levels, there will no longer be a source of contaminants to underlying formations. If TCE concentrations in Troutdale aquifer wells have not met attainment levels by the time all alluvial aquifer wells have, groundwater monitoring of the Troutdale wells will continue.

### **2.3 REPORTING**

Table 1 will be updated annually based on updated evaluations of the data from wells that have not previously achieved attainment, and the results will be presented in the Annual Status Reports. In these evaluations, completion of the remediation and attainment monitoring phases will be evaluated separately for chromium and for VOCs in each well. Based on the results, recommendations will be made regarding continued sampling, the frequency of sampling, and shutting off pumping at selected extraction wells. The Annual Status Reports will include a list of wells that have reached attainment. Preparation of Annual Status Reports will be discontinued once Site wells have reached attainment for VOCs. A flow chart depicting the Annual Well review process is presented as Figure 13.

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### 3. DECOMMISSIONING AND DEMOLITION

This section presents the general guidelines for decommissioning and demolition of the monitoring, extraction, and treatment systems related to each operable unit. Detailed work plans and/or specifications for decommissioning and demolition procedures will be prepared closer to the time when the work is to be performed. Note that if chromium concentrations in the groundwater exceed cleanup levels at the time VOCs achieve cleanup levels, responsibility for operation and maintenance of the groundwater treatment system will revert to the EPA. Linde retains responsibility for decommissioning of the groundwater extraction and treatment system at the time it is no longer required. Linde is also responsible for removal of a limited volume of chromium-contaminated soil underlying buildings on the Boomsnub property, once the buildings are demolished. Guidelines are provided for the following:

- Communication Plan
- Well and pipeline decommissioning
- Structure and building demolition
- Chromium-contaminated soil removal
- Decommission both infiltration galleries
- Utility service discontinuation
- Waste disposal requirements
- Site restoration.

Decommissioning of the OU-2 SVE and IWS systems may begin when the systems or their components are no longer needed at the Site, and with EPA approval.

OU-3 pipeline and well decommissioning may begin at areas of the Site where attainment monitoring has indicated the Site has met the cleanup goals, and with EPA approval. The treatment system will be decommissioned only after all attainment monitoring is complete, or as approved by EPA.

Contaminated soil removal will take place in OU-1 following removal of the OU-3 groundwater treatment system and associated structures (see Section 3.6).

#### 3.1 COMMUNICATION PLAN

During Site decommissioning, Linde or their designated representative will be in communication with numerous regulatory agencies, governmental organizations, and private property owners. The following table lists the organizations or individuals and when contact is required for decommissioning activities.

<b>Organization</b>	<b>Communication Requirement</b>
Linde Facility	The operations manager will be notified whenever work is conducted on Linde property.
City of Vancouver - Public Works	City of Vancouver - Public Works will be notified when work will be performed in the vicinity of city water or sewer.
Clark County	Clark County will be notified when work will impact utilities (electric, water, sewer), and when work will be performed in county roadways or right-of-ways.  The County and their current Railroad Operator will be notified whenever work is conducted within the railroad right of way. Special training/safety requirements may apply.
Clark Public Utilities (CPU)	CPU will be notified whenever planned work will affect their wells.
Private property owners	Property owners affected by Site activities will be notified prior to any decommissioning work occurring on their property.
Southwest Clean Air Agency	Southwest Clean Air Agency will be notified regarding any processes that will generate air emissions.
EPA	EPA will be notified of all decommissioning activities in accordance with the Consent Decree.
Washington Department of Ecology (Ecology)	Ecology will be copied on correspondence and documents sent to EPA, as directed by EPA.

A current list of the organizations including current contact people, addresses, and phone numbers, is maintained by EA. Figure 14 shows the property boundaries within the Site, along with the parcel number, the owner name, and the Site wells within each parcel. Contact information may change throughout this project and will need to be updated periodically.

### 3.2 WELLS

Well locations are indicated on Figure 2. Because of the large number of wells in the OU-2 treatment area on the western side of the Linde property, wells in that area are shown on Figure 3. Wells will be decommissioned upon Site closure or upon EPA approval.

### 3.2.1 Wells to Remain

Although most Site wells will be decommissioned, some will remain. Some wells may be left intact for future use by the property owner; this may require a transfer of ownership of the well. Wells to remain include the following:

- Groundwater supply wells GWSW-1 and GWSW-2 will remain to provide cooling water for the BOC air separation plant.
- CPU wells will remain the property of CPU and will be left undisturbed. Well CPU-13, currently part of the groundwater extraction network, will be returned to a monitoring well and will be maintained by CPU.

The procedure for transferring well ownership will include final sampling of the well, removal of pumps or piping connected to the well, and submittal of written notification to the well owner.

Should chromium in groundwater remain after attainment for VOCs, EPA will assume all responsibility for wells needed for monitoring or remediating chromium.

### 3.2.2 Wells to be Decommissioned

To decommission extraction wells, the power will be turned off and lock out/tag out procedures will be employed prior to disconnecting electrical wiring from the submersible pumps.

To decommission monitoring wells with dedicated submersible pumps, the pump will be removed prior to well decommissioning and will be decontaminated following the procedures outlined in the project Quality Assurance and Sampling Plan (QASP; EA 2004b). Submersible pumps will remain the property of Linde.

Well decommissioning will be performed by a licensed well driller in accordance with Washington Administrative Code (WAC) 173-160-460. Site restoration will be performed, as necessary, as described in Section 3.10 of this plan. This may include the use of native soil or imported fill material to backfill to surrounding grade, particularly at locations where wells occur in vaults. Site restoration may also include patching of asphalt or concrete in paved areas. Decommissioning of vaults is further discussed in Section 3.4.

Traffic control plans and flaggers may be needed to decommission wells located in roads.

### 3.2.3 Record Keeping

As wells are closed and decommissioned, the following records will be maintained at the Site trailer and in project record files:

- Closure justification
- Well decommissioning forms

### 3.3 PIPELINES

The groundwater extraction system at the Site currently consists of approximately two miles of underground piping used to transport groundwater from 26 extraction wells to the treatment system (Figure 2). This piping varies in size from 1-inch to 4-inch high-density polyethylene (HDPE) or polyvinyl chloride (PVC) inner pipe with a PVC or HDPE secondary containment pipe. Underground piping also includes electrical conduit to each of the extraction well locations. Above ground piping is present at the groundwater treatment system location on Boomsnub property, and also in the IWS system area on Linde property. Decommissioning of both above ground and underground piping associated with these existing treatment systems is addressed in this section.

There are 19 control vaults located along the groundwater extraction pipeline. Some vaults contain extraction wellheads, while others contain the pipeline and electrical controls.

Pipelines and vaults will be decommissioned upon Site closure or upon EPA approval. Power to vaults and extraction wells will be turned off and lock out/tag out procedures will be employed prior to decommissioning.

#### 3.3.1 Above Ground Piping

Above ground and exposed piping will be decommissioned using the following procedures:

- 1) The piping will be disassembled.
- 2) Piping will be triple rinsed and cut into small pieces.
- 3) Materials will be disposed of as described in Section 3.9.

#### 3.3.2 Underground Piping

Underground piping will be decommissioned using the following procedures:

- 1) Underground conduit will be left in place unless otherwise requested by the property owner. After power has been shut off and connections from motor starters to pumps have been severed, conduit will be abandoned by pulling the electrical wire from the conduit, if feasible.
- 2) Connections from the pipeline to vaults will be severed.
- 3) Underground pipe will be abandoned by pumping full with bentonite, cement grout, or neat cement to prevent the possibility of future use. Pipeline sections which were installed by jack and bore (between control vault [CV]-2 and CV-3, and between CV-6 and CV-7) will be filled with cementaceous grout.
- 4) Buried pipe will not be sampled.

### 3.4 VAULTS

Vaults will be decommissioned using the following procedures:

- 1) Electrical wiring within vaults or at the extraction wellheads will be disconnected following the shut-off of power and use of lock out/tag out procedures.
- 2) Valves and other pipe fittings will be removed from the vaults and will be triple-rinsed prior to disposal; these materials will be disposed of per Section 3.9.
- 3) Submersible pumps and variable speed controllers will be decontaminated according to procedures outlined in the project QASP (EA 2004b), and transferred into the custody of Linde.
- 4) Subsurface vault openings will either be sealed with grout or the vault will be removed from the ground.
- 5) Vaults removed from the ground will be rinsed, crushed and recycled offsite.
- 6) The vault area will be restored to match surrounding conditions, as described in Section 3.10.

Traffic control plans and flaggers may be needed to perform work on control vaults along NE 78th Street.

### 3.5 STRUCTURES/BUILDINGS

Support facilities for the Site include an office trailer, maintenance building, the IX building, a shed which houses electrical controls for extraction wells (the sheep shed), and two OU-2 treatment system trailers.

As part of Site closure, structures associated with the Site will either be removed or transferred to other owners. For removal of the structures to occur, the following will need to be addressed for each structure:

- Discontinue utility service
- Disconnect piping
- Remove salvageable equipment and chemicals prior to demolition and disposal or transfer of ownership.

Decommissioning/demolition of the structures will take place upon Site closure or upon EPA approval. The OU-2 treatment system trailers may be decommissioned once treatment in that area is complete. The IX building and sheep shed may be decommissioned once treatment is

complete in OU-3. The IX building must be demolished and removed before chromium-contaminated soil on the Boomsnub property can be excavated. The proposed disposition for each of these structures is described in this section.

### **3.5.1 Boomsnub Office Trailer**

The office trailer is located on Boomsnub property. The following activities are planned during Site decommissioning:

- Furniture, appliances, computers, sampling equipment and supplies, and chemicals stored in the trailer will be returned to their owner.
- The main valve for potable water will be shut off and the delivery line will be cut flush with ground level and capped.
- The connection to the sewer will be cut flush with the ground and capped.
- An electrician will disconnect the service from the trailer and power from the main breaker.
- Telecommunication providers will be contacted to discontinue applicable services and lines will then be severed and removed from the office trailer.

If the decision is made to demolish the trailer, light bulbs, ballasts, and temperature thermostats in the trailer will be removed prior to demolition.

### **3.5.2 Maintenance Building**

The maintenance building is located on Boomsnub property. It is proposed that this building be left intact. The following activities are planned during Site decommissioning:

- Existing utilities (electric) will be left connected and operational at this building.
- Equipment and supplies will be removed from the premises and returned to their owner.
- Equipment which has had contact with groundwater from the Site (valves or piping) will be decontaminated by triple rinsing and cut into small pieces. These materials will be disposed of as described in Section 3.9.
- The interior of the building will be cleaned to remove any potential contamination. Cleaning of the interior will be performed by pressure washing, priming, and painting.

### 3.5.3 IX Building

The IX Building is located on Boomsnub property. This building will be demolished during Site decommissioning. The following activities are planned for this building:

- An electrician will disconnect the main power to the building.
- All equipment will be removed from the building.
- IX canisters will be emptied of used resin media, triple rinsed, and sold for reuse.
- Treatment system piping within the IX building will be addressed as described in Section 3.3.
- Demolition of the IX building will be performed by a private contractor, with supervision and documentation provided by EA personnel.
- The IX building, once demolished, will be disposed of as described in Section 3.9.

### 3.5.4 Sheep Shed

The sheep shed is located next to well MW-22D and vault CV-12 (Figure 2). This building is the power and control center for extraction wells in its vicinity. The sheep shed will be demolished during Site decommissioning. The following activities are planned for this building:

- An electrician will disconnect the electrical service.
- Electrical motor starters, controllers, and conduits entering and exiting the shed will be removed. Electrical wire will be removed from the conduits where feasible.
- Demolition of the building will be performed by a private contractor, with supervision and documentation provided by EA personnel.
- The building, once demolished, will be disposed as described in Section 3.9.

### 3.5.5 OU-2 Treatment System Trailers

The OU-2 treatment system trailers are located on Linde property. These two Wells Cargo utility trailers house the IWS and SVE systems. The trailers and all contents are owned by Linde. The following activities are planned during Site decommissioning:

- An electrician will disconnect the power and all associated conduit connected to the treatment trailers.

- Treatment system piping will be disconnected from the equipment trailers and cut off at or below ground level.
- Aboveground sections of piping that have had contact with groundwater from the Site will be handled as described in Section 3.3. These materials will be disposed of as described in Section 3.9.
- Underground piping will be disconnected at the wellhead and pumped full with grout, as described in Section 3.3.

### **3.6 CHROMIUM-CONTAMINATED SOILS AT BOOMSNUB**

Chromium-contaminated soils remain beneath the air stripper secondary containment pad and the IX building on the Boomsnub property (OU-1). Once the treatment system is removed from the Site, the asphalt pad and IX building will be removed. As presented in the Consent Decree, approximately 500 cubic yards of subsurface soil under the building and paved areas will be removed. The area for soil removal was identified in the 2003 Soil Characterization Study (URSG 2003). Soil to be removed is that within 15 ft of the ground surface and with chromium concentrations greater than 400 mg/kg. Clean fill material will be brought in to backfill the area. Any other soil with concentrations exceeding cleanup levels for chromium will be the responsibility of EPA.

Prior to performing this removal action, a Sampling and Analysis Plan will be prepared outlining the type and number of samples to be collected and analyzed, as well as health and safety guidelines to be followed as part of the removal action. At the completion of soil removal activities, Site restoration will be performed as described in Section 3.10.

### **3.7 INFILTRATION GALLERIES**

There are two infiltration galleries at the Site. One is located on the Boomsnub property and is currently only to be used in the event of an overflow of treatment system water. The second infiltration gallery is located on Linde property, upgradient of the TCE source area; this gallery was constructed for the sole purpose of re-infiltration of water treated by the Boomsnub groundwater treatment system. The infiltration galleries will be decommissioned upon Site closure. The infiltration gallery piping will be decommissioned in accordance with Underground Injection Control program requirements (WAC 173-218-120). Any piping in contact with the aquifer will be decommissioned by a licensed well driller, in accordance with WAC 173-160, Minimum Standards for Construction and Maintenance of Wells. Any infiltration structures within 3 ft of the land surface will be removed and up to 3 ft below the land surface will be backfilled with material that is uncontaminated, chemically and biologically inert, and that drains equal to or more slowly than the native material surrounding the well. The remaining 3 ft directly below the land surface will be filled with native soil or other structurally sound material common with current engineering practices. Any remaining piping more than 3 ft bgs, but not in contact with the aquifer, will be decommissioned by pumping full of grout (see Section 3.3).

### 3.7.1 Boomsnub Infiltration Gallery

The infiltration gallery on Boomsnub property consists of underground piping. Piping within the infiltration gallery will be decommissioned as described above. The Boomsnub infiltration gallery will be decommissioned before chromium-contaminated soil is removed from the property, since soil removal activities may impact the infiltration gallery area.

### 3.7.2 Linde Infiltration Gallery

The infiltration gallery on Linde property consists of underground piping. Also included in decommissioning of this structure are the piping, vaults, and inspection ports/manholes along the underground pipeline extending from Boomsnub to the infiltration gallery. Piping within the infiltration gallery will be decommissioned as described above. Other underground piping, including the pipeline to the infiltration gallery, will be decommissioned by pumping full with grout (see Section 3.3). Vaults and inspection ports/manholes will be removed from the ground, as described in Section 3.4, and the locations will be backfilled and compacted, as described in Section 3.10.

## 3.8 UTILITIES

Utilities at the Site include solid waste, telecommunications, electricity, water, and sewer. The following table provides the current utility name, contact information, and account number for each service. As applicable portions of the Site are closed, accounts will be closed or transferred as appropriate.

Utility Name	Type	Address/Phone
City of Vancouver	Water/ Sewer	PO Box 8875 Vancouver, WA 98666-8875 360-696-8152
Clark Public Utilities	Electricity	PO Box 8989 Vancouver, WA 98668 360-992-3000
Qwest	Phone	PO Box 12480 Seattle, WA 98111-4480 800-603-6000
T-Mobile	Cell	PO Box 660252 Dallas, TX 75266-0252 800-937-8997
Waste Connections	Municipal Solid Waste	9411 NE 94 <sup>th</sup> Ave, Vancouver, WA 98662 360-892-5370, or toll free 866-892-9269

### 3.9 WASTE DISPOSAL

Wastes to be generated during Site decommissioning include solid waste, soil, and water. Operational wastes (spent resin, spent carbon, and particulate filters) will be disposed of before decommissioning begins. These materials will be handled in accordance with the procedures described in the Site O&M Manual (EA 2007c). The following table provides a list of the expected types and estimated volumes of waste to be generated during decommissioning activities.

**Types/Volumes of Materials for Disposal**

Waste Type	Approximate Quantity	Source
Solid Waste:		
Piping	2,000 feet	Extraction network and treatment system
Demolition debris	300 tons	Site structures, equipment, and concrete from vaults
Soil	500 cubic yards	Boomsnub property chromium source area (OU-1)
Water	1,500 gallons	Decontamination of waste materials and equipment

#### 3.9.1 Solid Waste

Non-hazardous solid wastes will be disposed of at a Subtitle D landfill facility.

#### 3.9.2 Soil

Chromium-contaminated soil will be contained and sampled prior to offsite disposal. The disposal location will be determined based on the sample characterization results. Details of the sampling and waste handling procedures will be provided in the Sampling and Analysis Plan, described in Section 3.6.

#### 3.9.3 Water

Rinse/decontamination water will be contained in either 55-gallon drums or containment tanks on Boomsnub property. A sample of the decontamination water will be collected for waste characterization analysis prior to disposal. The disposal location will be determined based on the sample characterization results. Sediments from rinse/decontamination water will be sampled and handled as described in the project QASP (EA 2004b).

### 3.10 SITE RESTORATION

Following the removal of infrastructure and treatment system components, the Site will be restored to match surrounding conditions. Restoration will be needed following removal of extraction/control vaults, buildings, and wells. Expected restoration activities include the following:

- Holes left from removal of vaults or other equipment will be backfilled flush with the surrounding ground surface.
- Native soil, imported rock or controlled density fill (CDF) will be used to bring depressions up to surrounding grade. CDF will be used in roadway areas.
- Compaction will be performed commensurate with area needs. Grass or landscaped planter areas will receive standard compaction and high use areas will receive structural compaction.
- Disturbed paving (either asphalt or concrete) will be restored.
- Straw or equivalent will be spread where soils are denuded of vegetation to minimize the effects of erosion. Seeding/revegetation will be conducted, as appropriate, to return Site to pre-demolition conditions.
- Drainage paths will be created at the surface to avoid excess ponding of surface water.

### **3.11 REPORTING**

As specified in the Consent Decree (EPA 2007), within 90 days of reaching attainment for TCE, Linde will schedule and conduct a pre-certification inspection to be attended by Linde and EPA. Within 30 days of the pre-certification inspection, Linde will submit a written report requesting certification to EPA for approval. In the report, a registered professional engineer and the Linde Project Coordinator shall state that, to the best of their knowledge, the Remedial Action has been completed in full satisfaction of the requirements of the Consent Decree. The written report will include as-built drawings signed and stamped by a professional engineer.

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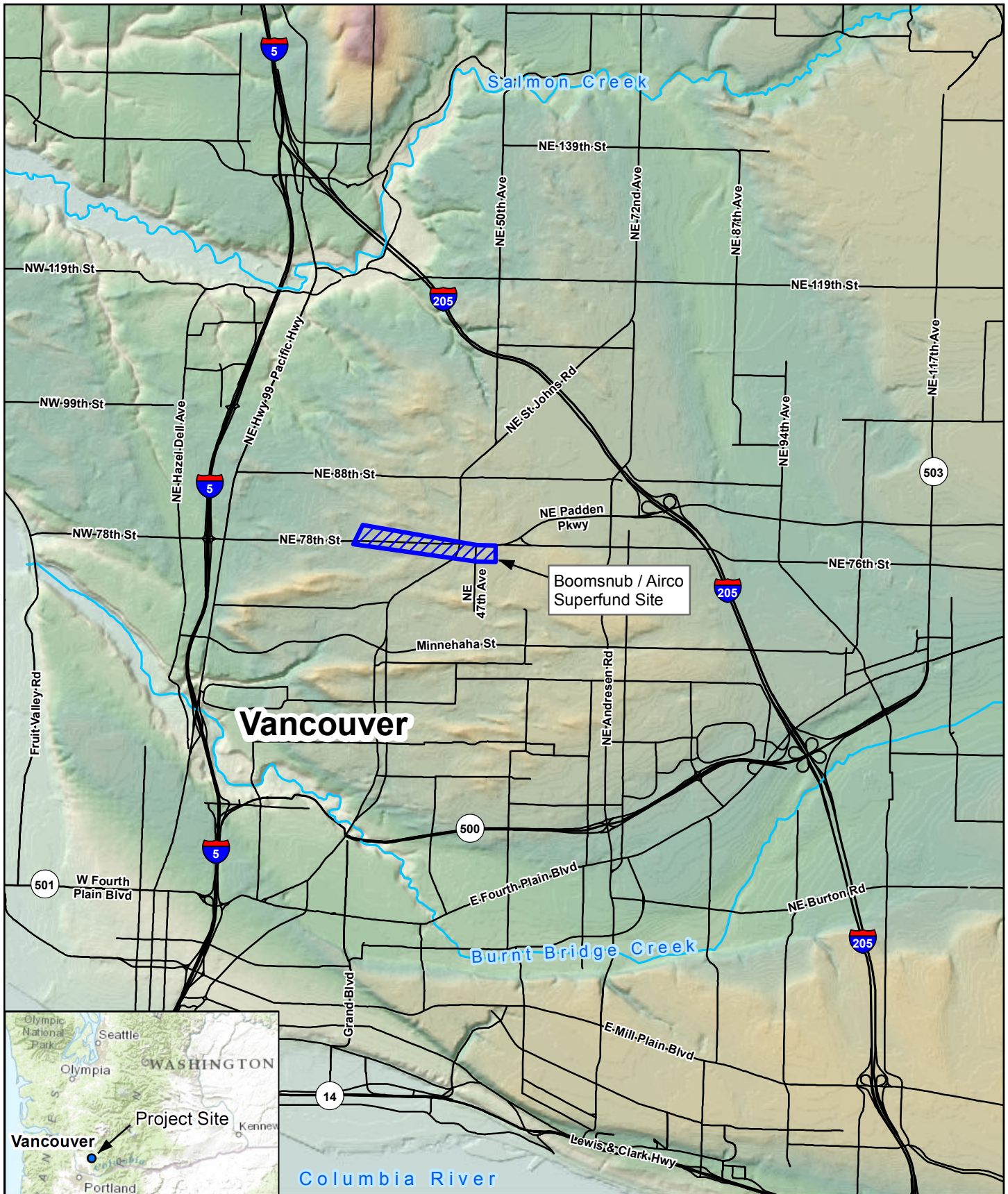
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## **FIGURES**

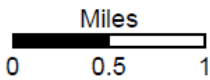
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Boomsnub / Airco Superfund Site

Vancouver

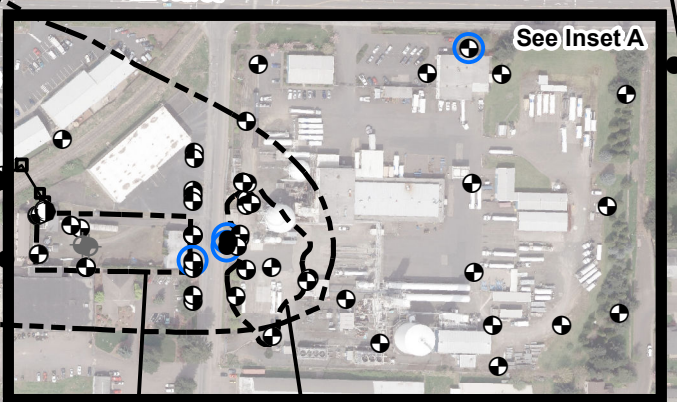
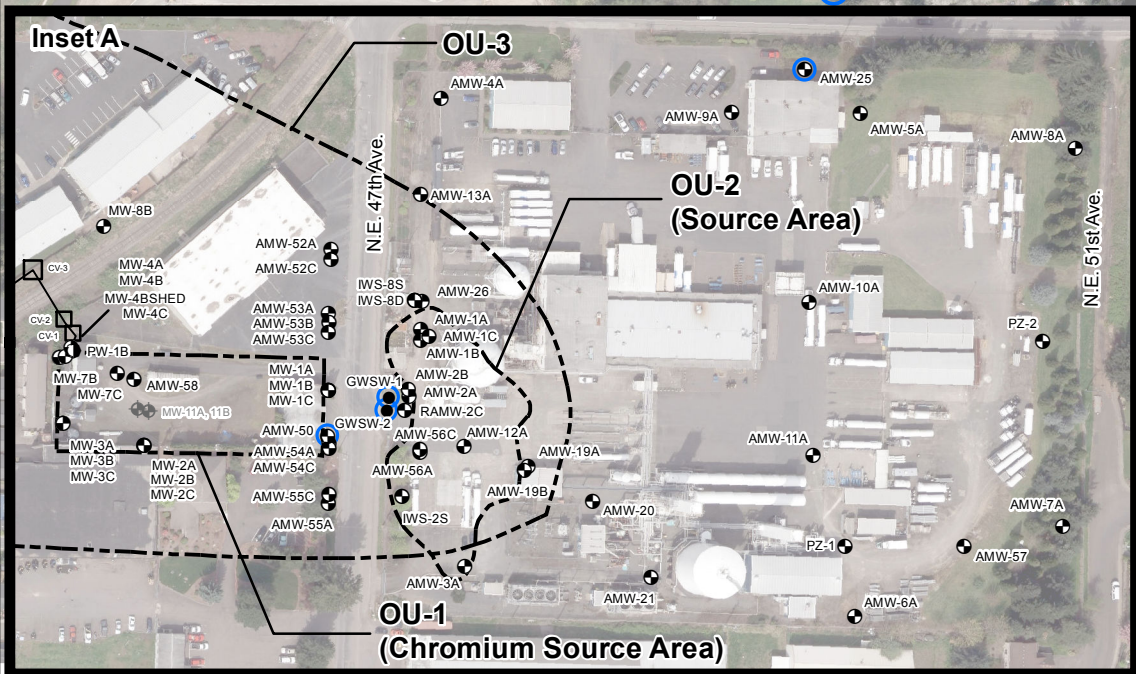
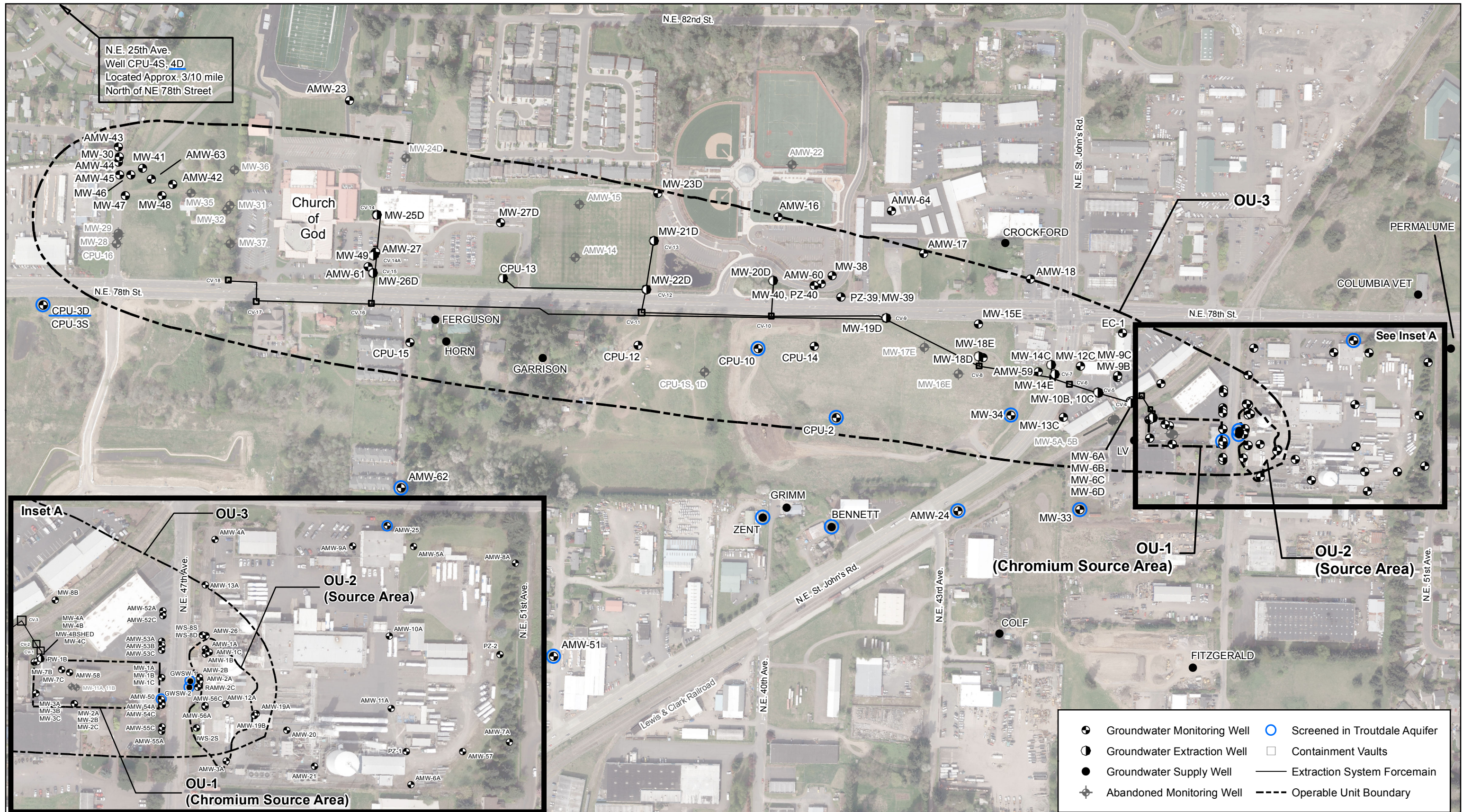
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 2200 Sixth Avenue, Suite 707  
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 Phone: (206) 452-5350  
 Fax: (206) 443-7646



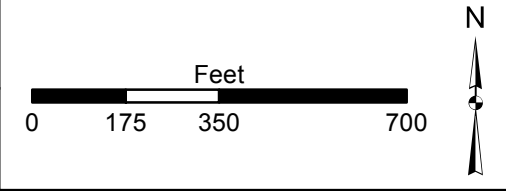
BOOMSNUB / AIRCO SUPERFUND SITE  
 HAZEL DELL, WASHINGTON

FIGURE 1  
 SITE LOCATION MAP

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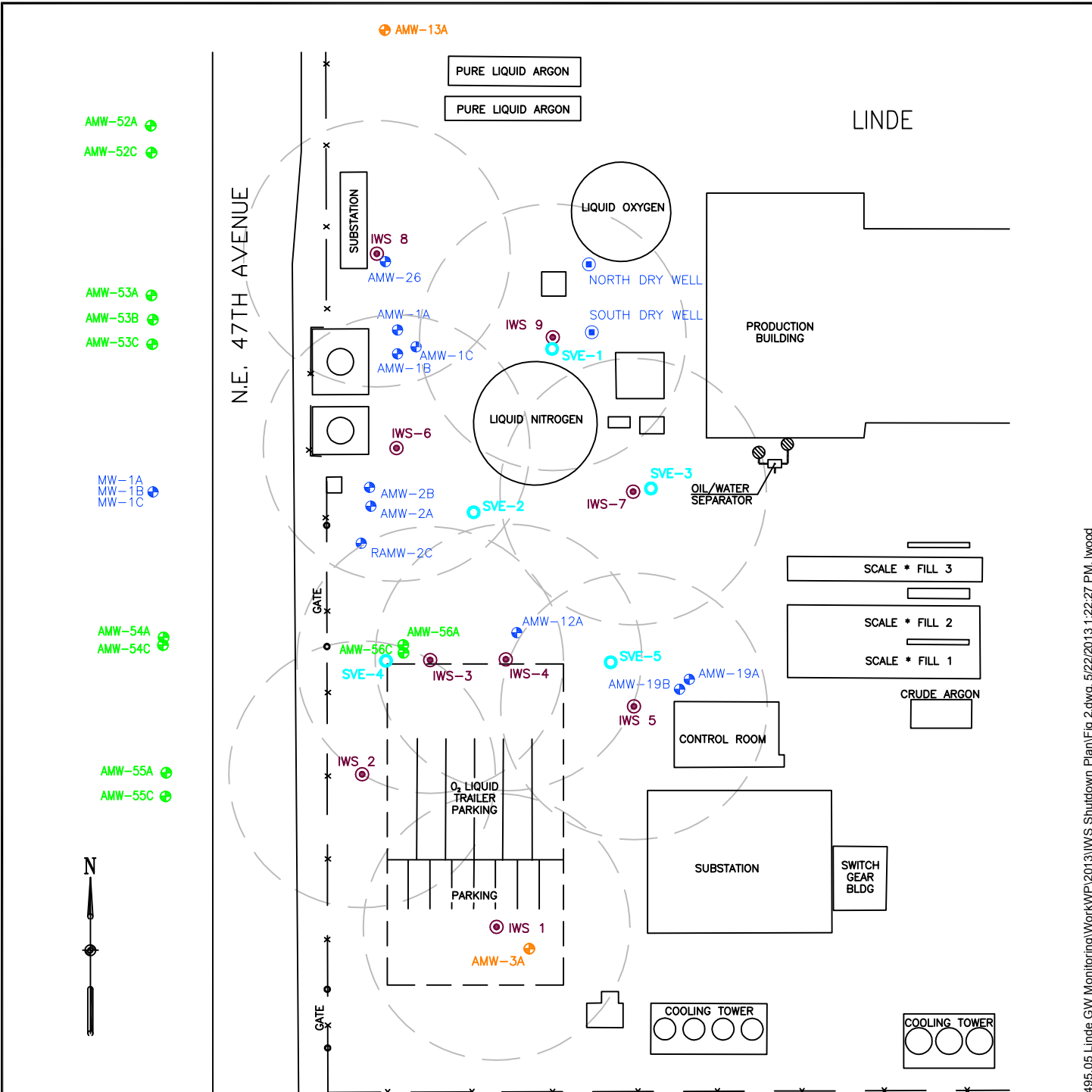
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 Seattle, WA 98121  
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**BOOMSNUB / AIRCO SUPERFUND SITE  
 HAZEL DELL, WASHINGTON**

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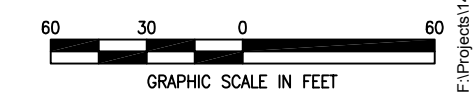
**FIGURE 2  
 OPERABLE UNITS SITE MAP**



**LEGEND**

- DRY WELL
- AMW-3A SOURCE AREA MONITORING WELL
- AMW-55C DOWNGRAIDENT MONITORING WELL
- IWS IN WELL STRIPPING WELL
- SVE-5 SOIL VAPOR EXTRACTION WELL
- AMW-55C SIDEGRAIDENT MONITORING WELL
- IN WELL STRIPPING WELL WITH ESTIMATED 55 FEET IN WELL STRIPPING RADIUS OF INFLUENCE

A - SCREENED AT WATER TABLE ~ 25' TO 35' BGS  
 B - SCREENED AT MIDAQUIFER ~ 45' TO 55' BGS  
 C - SCREENED AT BASE OF AQUIFER ~ 60' TO 70' BGS



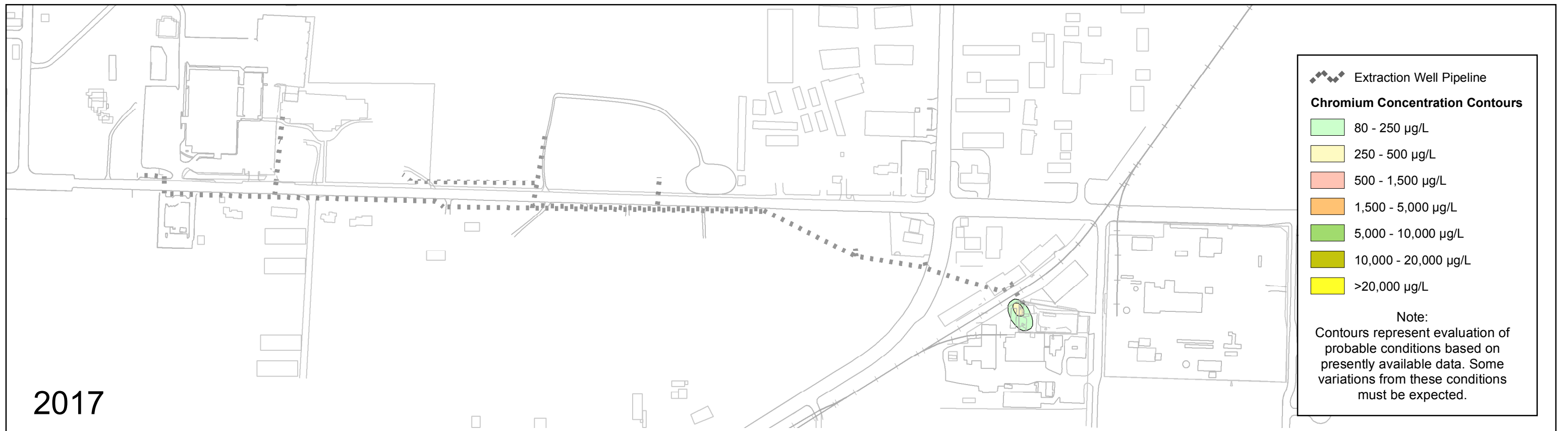
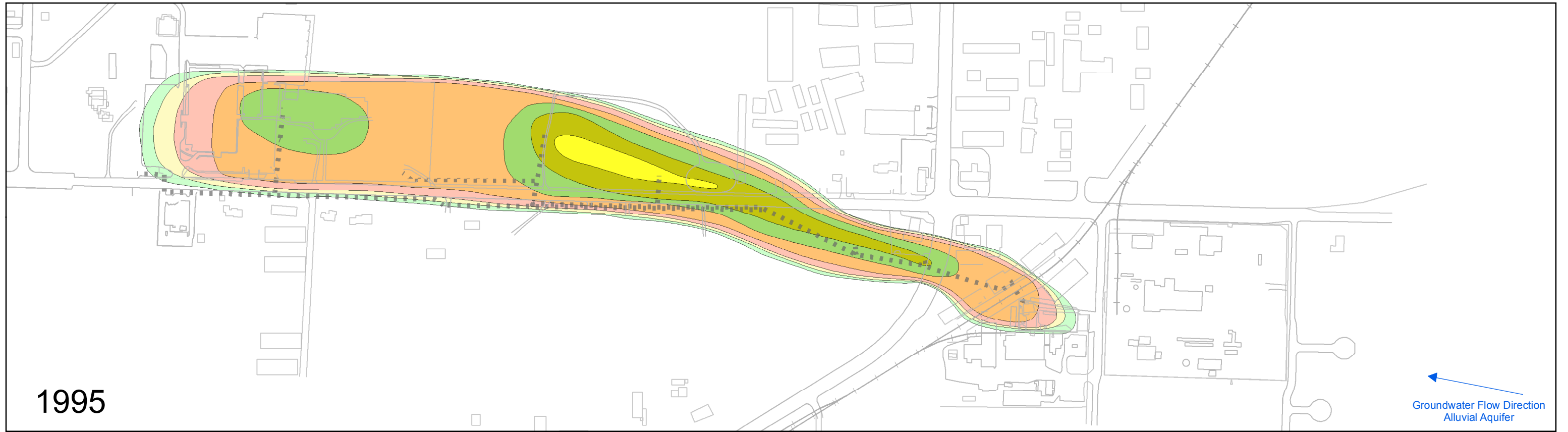
BOOMSNUB/AIRCO SUPERFUND SITE  
HAZEL DELL, WASHINGTON

FIGURE 3  
OU2 TREATMENT SYSTEM AND MONITORING WELLS

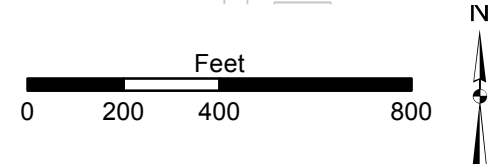


NOTE: WELL LOCATIONS ARE APPROXIMATE





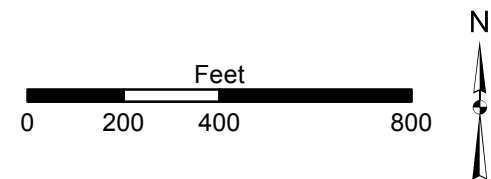
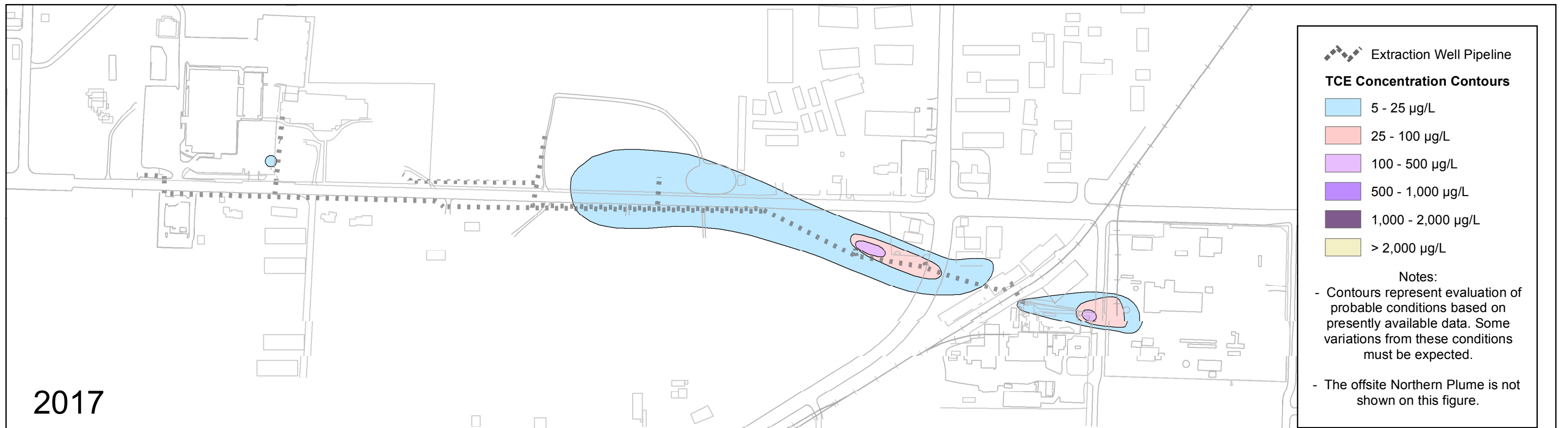
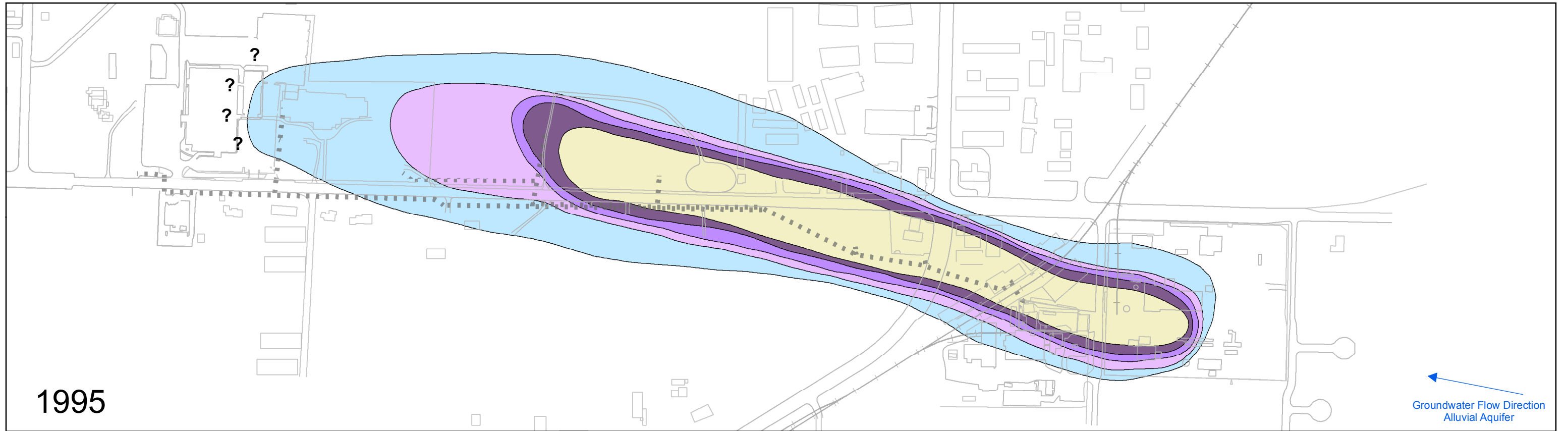
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FIGURE 5  
 CHROMIUM PLUME COMPARISON  
 1995 VS. 2017



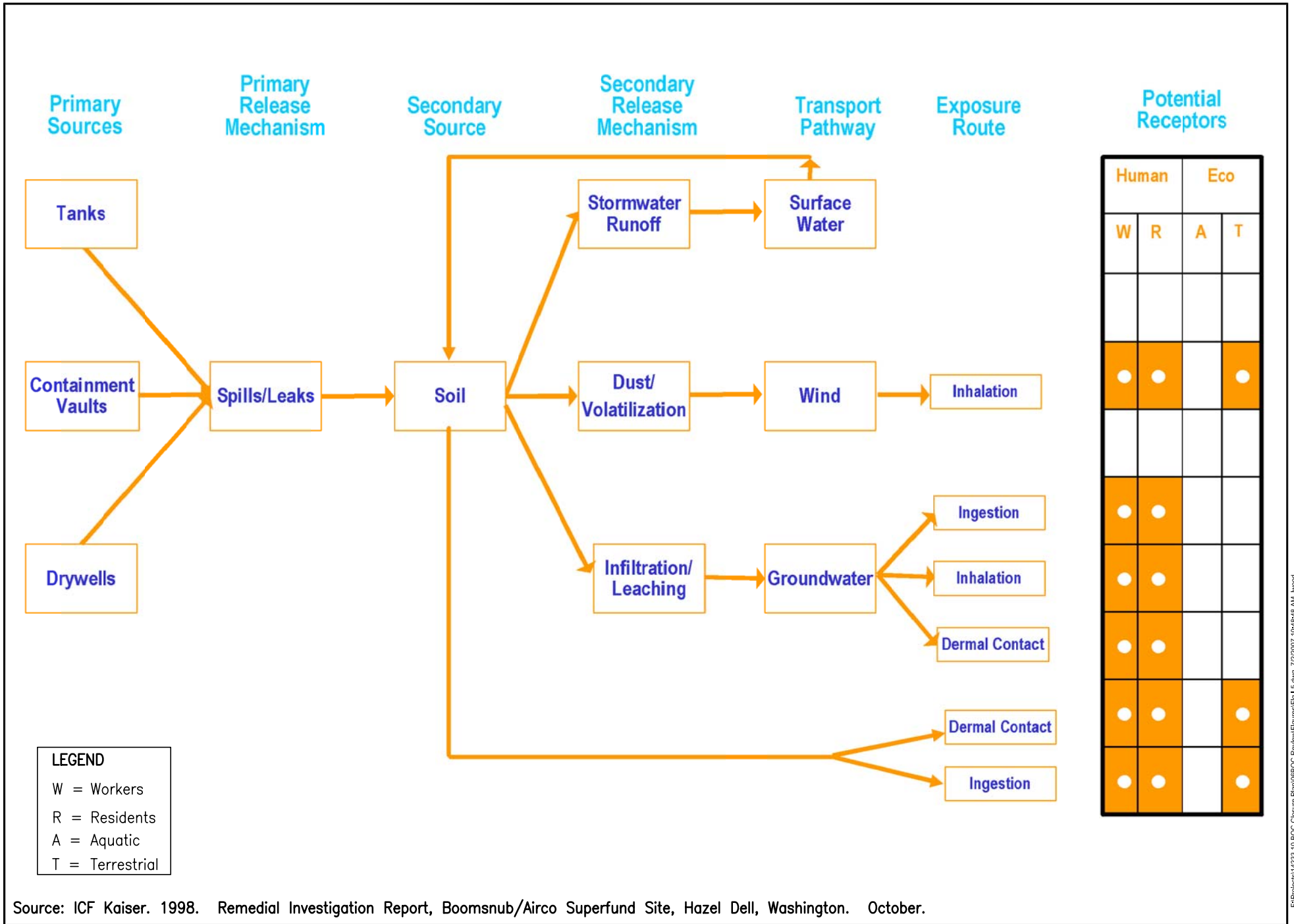


FIGURE 7. INITIAL CONCEPTUAL SITE MODEL



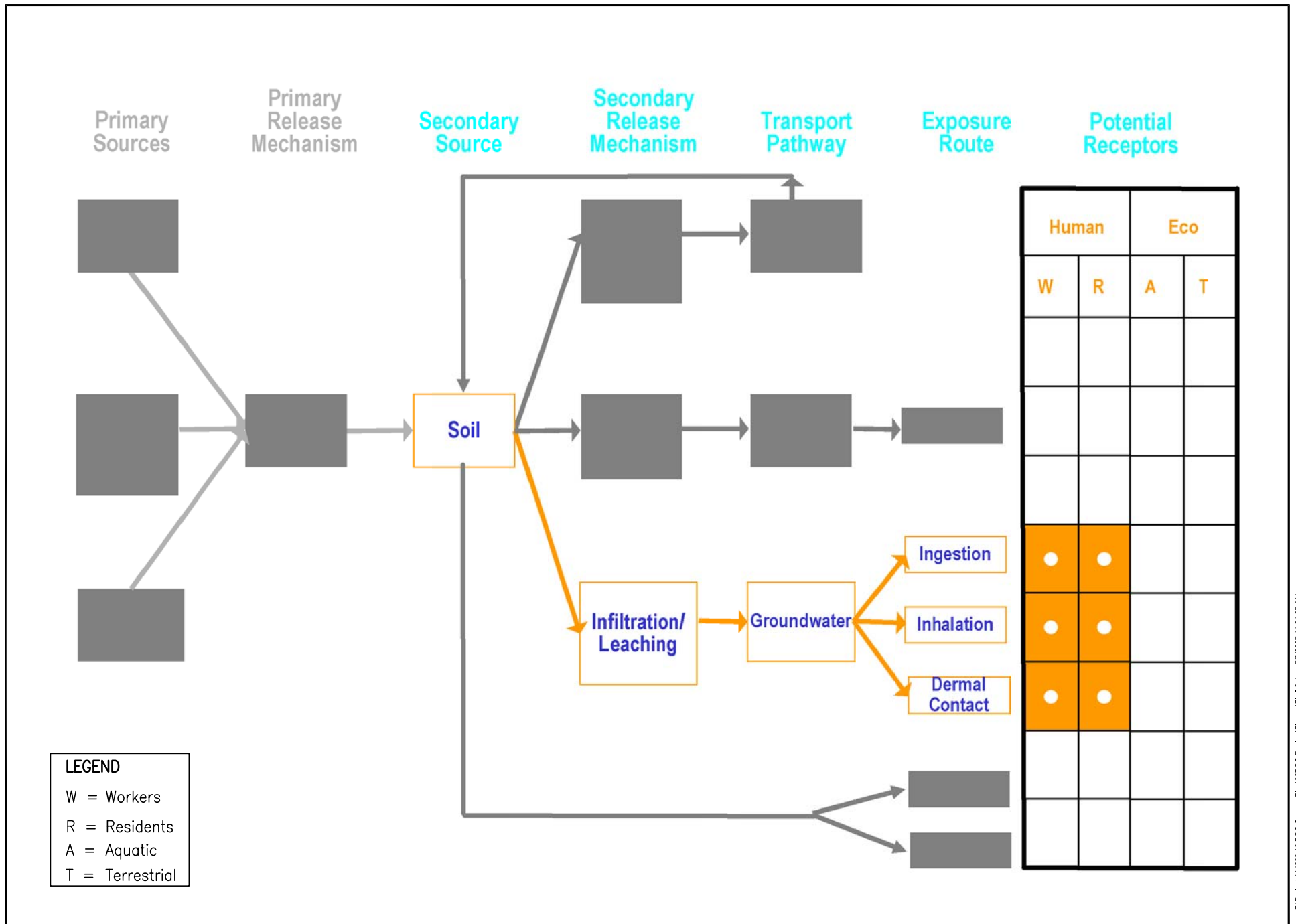
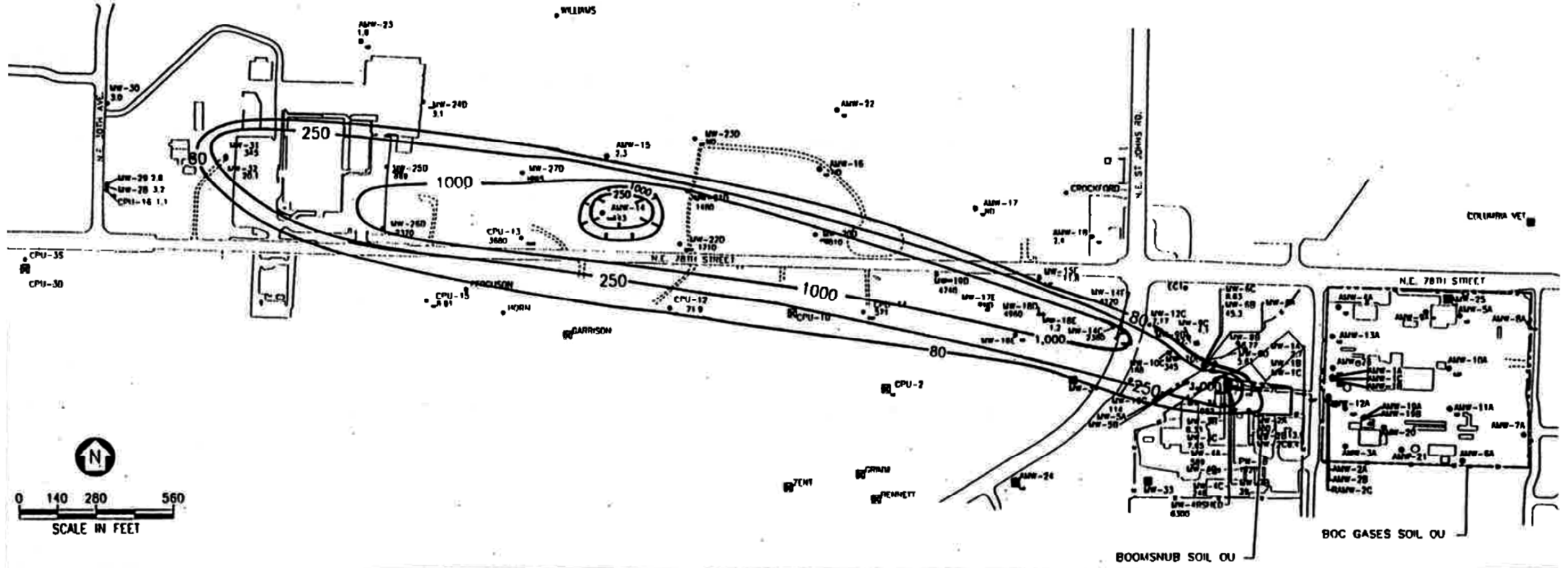
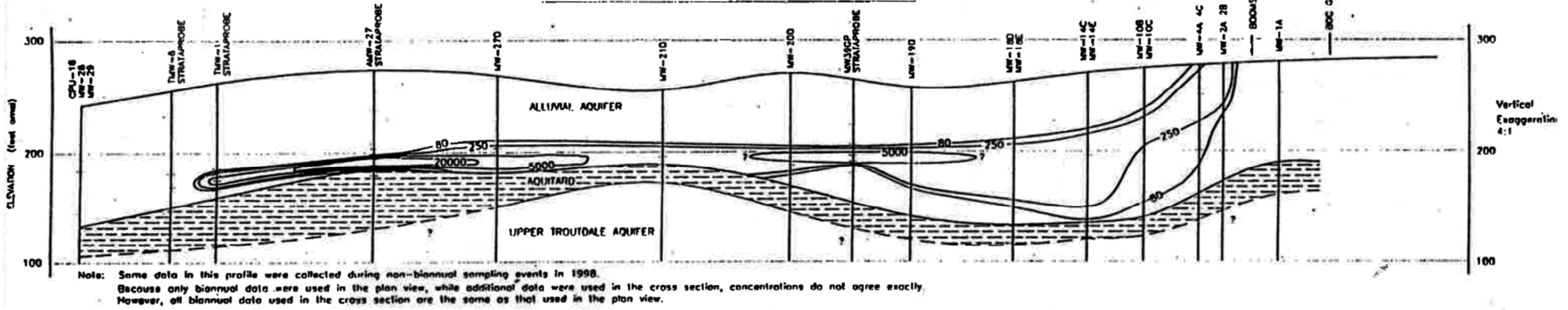


FIGURE 8. UPDATED CONCEPTUAL SITE MODEL



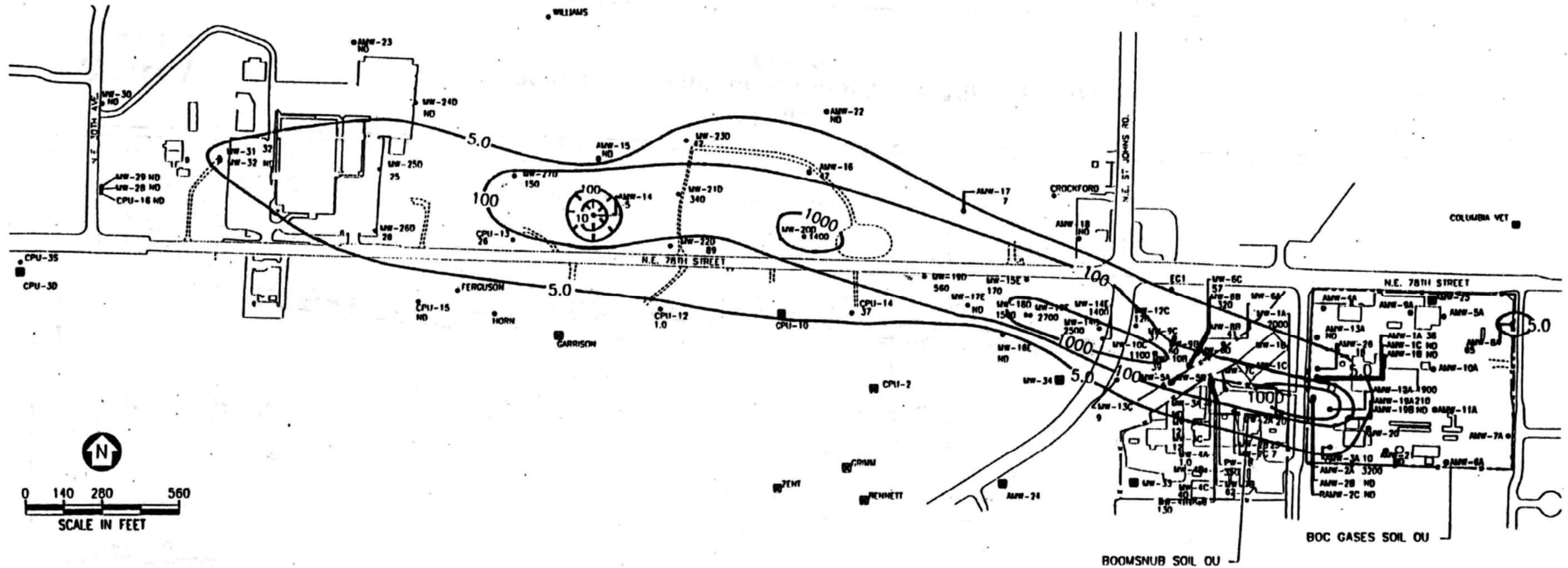


Chromium Concentrations in Profile

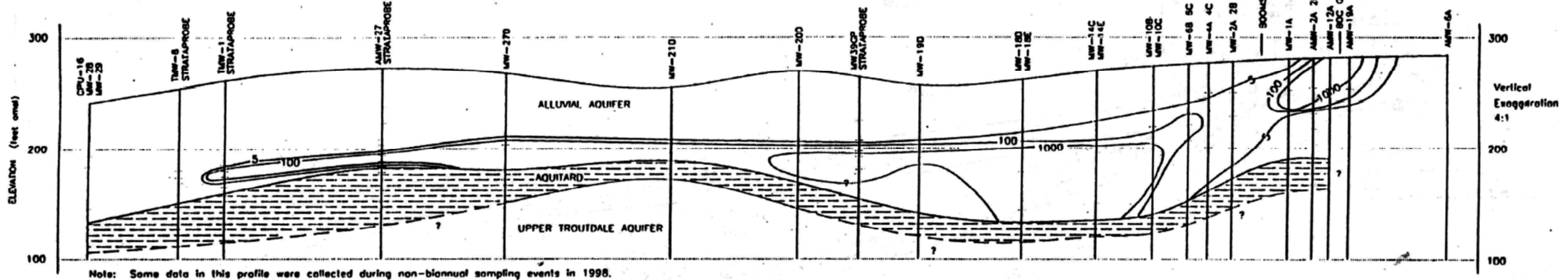


Source: Record of Decision, Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EPA Region 10. February 2000.

	PROJECT MGR:	DESIGNED BY:	DATE:	FILE:	BOOMSNUB/AIRCO SUPERFUND SITE HAZEL DELL, WASHINGTON	Figure 9 Chromium Concentrations, May 1998
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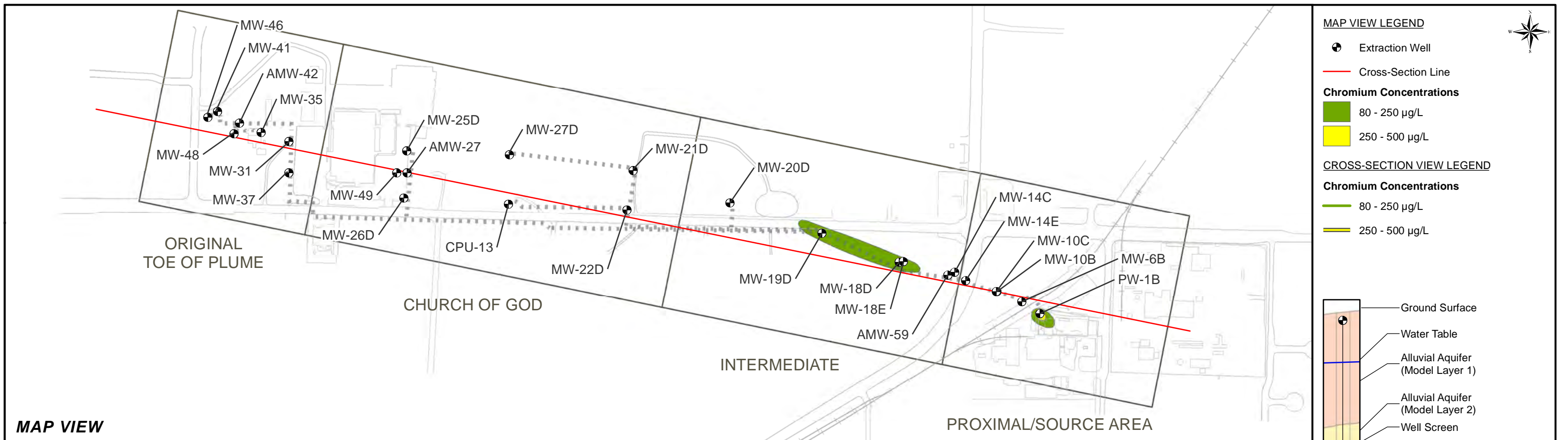


TCE Concentrations in Profile

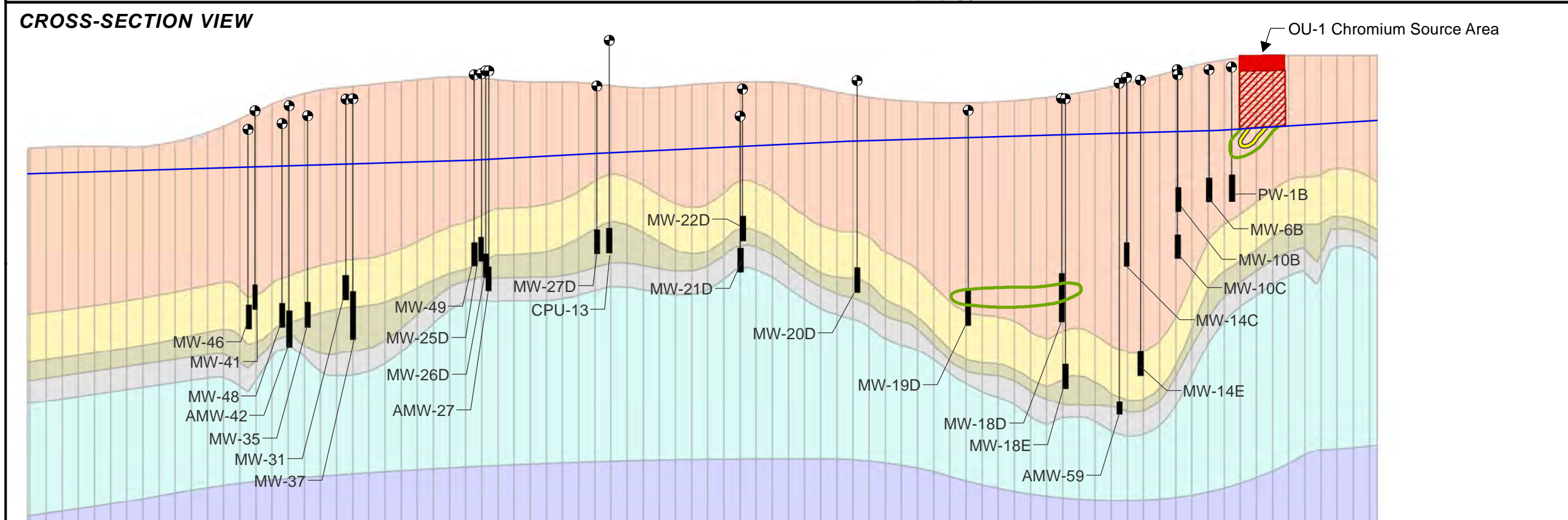


Source: Record of Decision, Boomsnub/Airco Superfund Site, Hazel Dell, Washington. EPA Region 10. February 2000.

	PROJECT MGR:	DESIGNED BY:	DATE:	FILE:	<b>BOOMSNUB/AIRCO SUPERFUND SITE HAZEL DELL, WASHINGTON</b>	<b>Figure 10 Trichloroethene Concentrations, May 1998</b>
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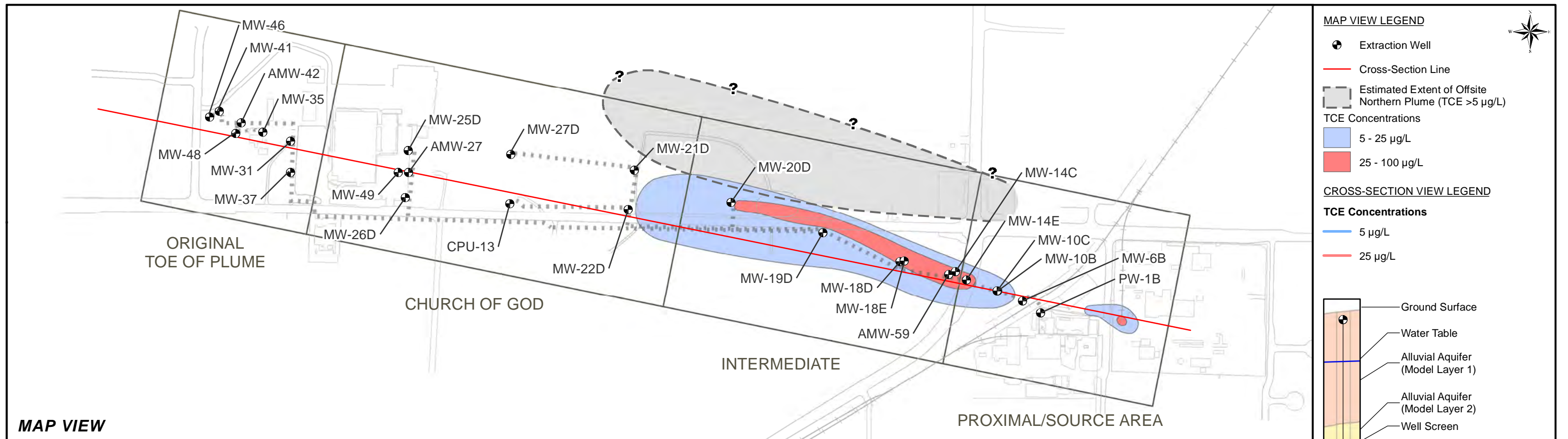
- MAP VIEW LEGEND**
- ⊕ Extraction Well
  - Cross-Section Line
- Chromium Concentrations**
- 80 - 250 µg/L
  - 250 - 500 µg/L
- CROSS-SECTION VIEW LEGEND**
- Chromium Concentrations**
- 80 - 250 µg/L
  - 250 - 500 µg/L



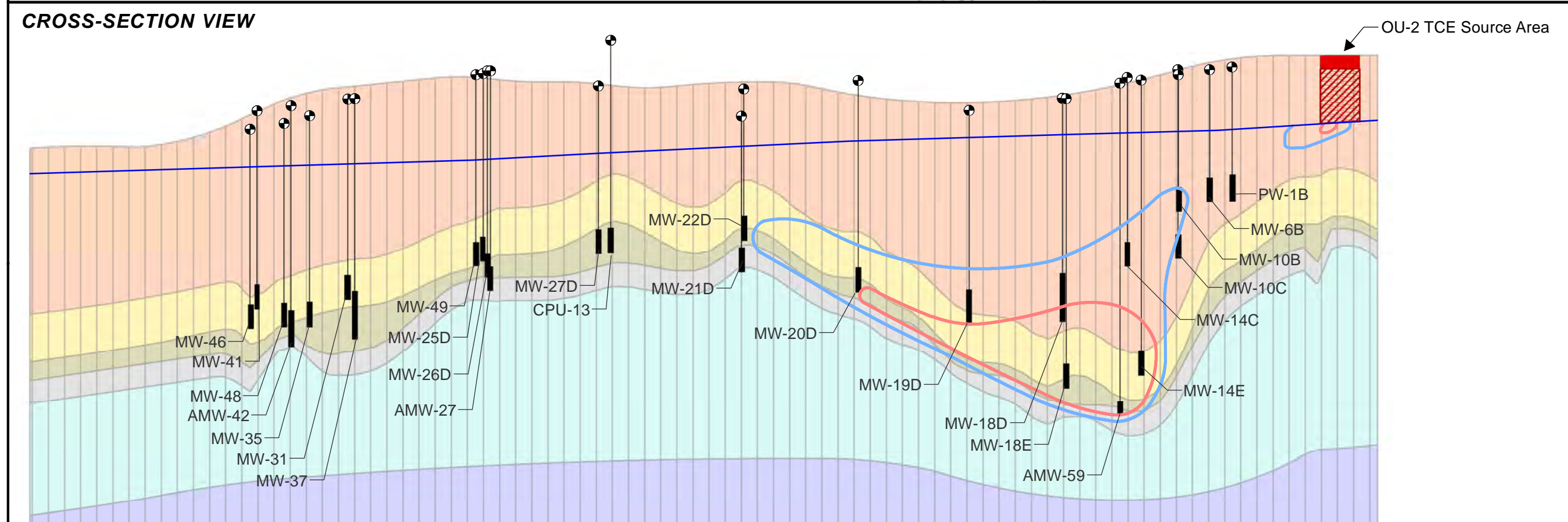
- Ground Surface
- Water Table
- Alluvial Aquifer (Model Layer 1)
- Alluvial Aquifer (Model Layer 2)
- Well Screen
- Silty Unit of Alluvial Aquifer (Model Layer 3)
- Aquitard (Model Layer 4)
- Cemented Troutdale (Model Layer 5)

- Notes:
- (1) Map view shows chromium concentrations as projected onto the horizontal plane.
  - (2) Cross-section view shows chromium concentrations and screen intervals as projected onto the vertical plane.
  - (3) The concentration contours are approximate.
  - (4) Stratigraphic units interpolated from site boring data. Cross-section view shown is for site groundwater model row 22, approximately the central axis of the plume.
  - (5) Extraction wells are shown.
  - (6) µg/L = Microgram(s) per liter

	PROJECT MGR:	DESIGNED BY:	DATE:	FILE:	<b>BOOMSNUB/AIRCO SUPERFUND SITE HAZEL DELL, WASHINGTON</b>	<b>Figure 11 Chromium Concentrations, April 2016</b>
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	CMB	JK	1524013	AS SHOWN		



MAP VIEW



CROSS-SECTION VIEW

**MAP VIEW LEGEND**

- Extraction Well
- Cross-Section Line
- ▭ Estimated Extent of Offsite Northern Plume (TCE >5 µg/L)

**TCE Concentrations**

- 5 - 25 µg/L
- 25 - 100 µg/L

**CROSS-SECTION VIEW LEGEND**

**TCE Concentrations**

- 5 µg/L
- 25 µg/L

Ground Surface

Water Table

Alluvial Aquifer (Model Layer 1)

Alluvial Aquifer (Model Layer 2)

Well Screen

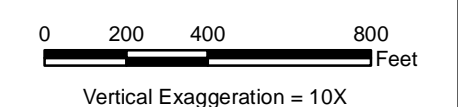
Silty Unit of Alluvial Aquifer (Model Layer 3)

Aquitard (Model Layer 4)

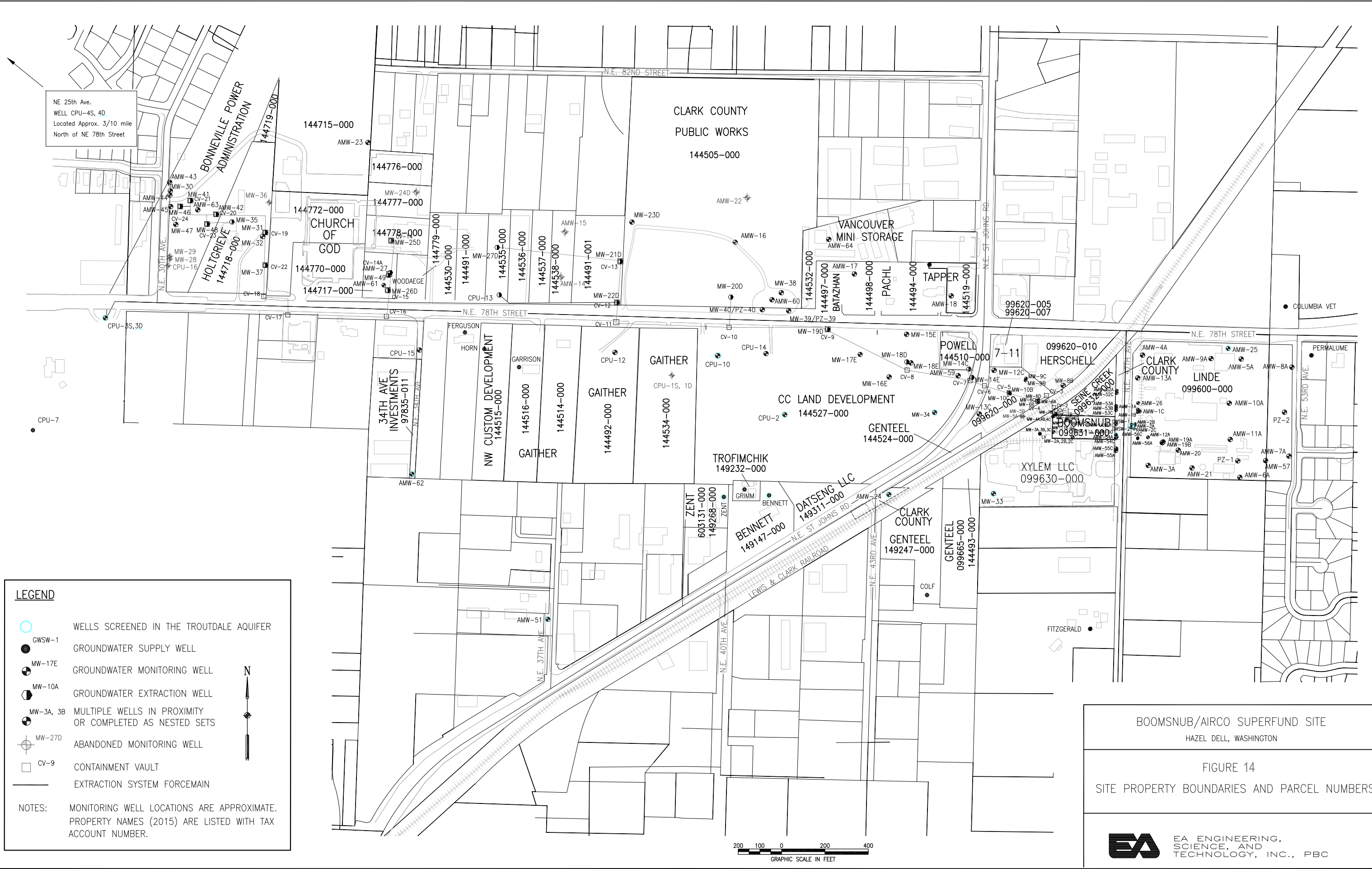
Cemented Troutdale (Model Layer 5)

Notes:

- (1) Map view shows TCE concentrations as projected onto the horizontal plane.
- (2) Cross-section view shows TCE concentrations and screen intervals as projected onto the vertical plane.
- (3) The concentration contours are approximate.
- (4) Stratigraphic units interpolated from site boring data. Cross-section view shown is for site groundwater model row 22, approximately the central axis of the plume.
- (5) Extraction wells are shown.
- (6) µg/L = Microgram(s) per liter



	PROJECT MGR:	DESIGNED BY:	DATE:	FILE:	<b>BOOMSNUB/AIRCO SUPERFUND SITE HAZEL DELL, WASHINGTON</b>	<b>Figure 12 Trichloroethene Concentrations, April 2016</b>
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	CMB	JK	1524013	AS SHOWN		



NE 25th Ave.  
WELL CPU-4S, 4D  
Located Approx. 3/10 mile  
North of NE 78th Street

**LEGEND**

- WELLS SCREENED IN THE TROUTDALE AQUIFER
- GWSW-1 GROUNDWATER SUPPLY WELL
- MW-17E GROUNDWATER MONITORING WELL
- MW-10A GROUNDWATER EXTRACTION WELL
- MW-3A, 3B MULTIPLE WELLS IN PROXIMITY OR COMPLETED AS NESTED SETS
- ⊕ MW-27D ABANDONED MONITORING WELL
- CV-9 CONTAINMENT VAULT
- EXTRACTION SYSTEM FORCEMAIN

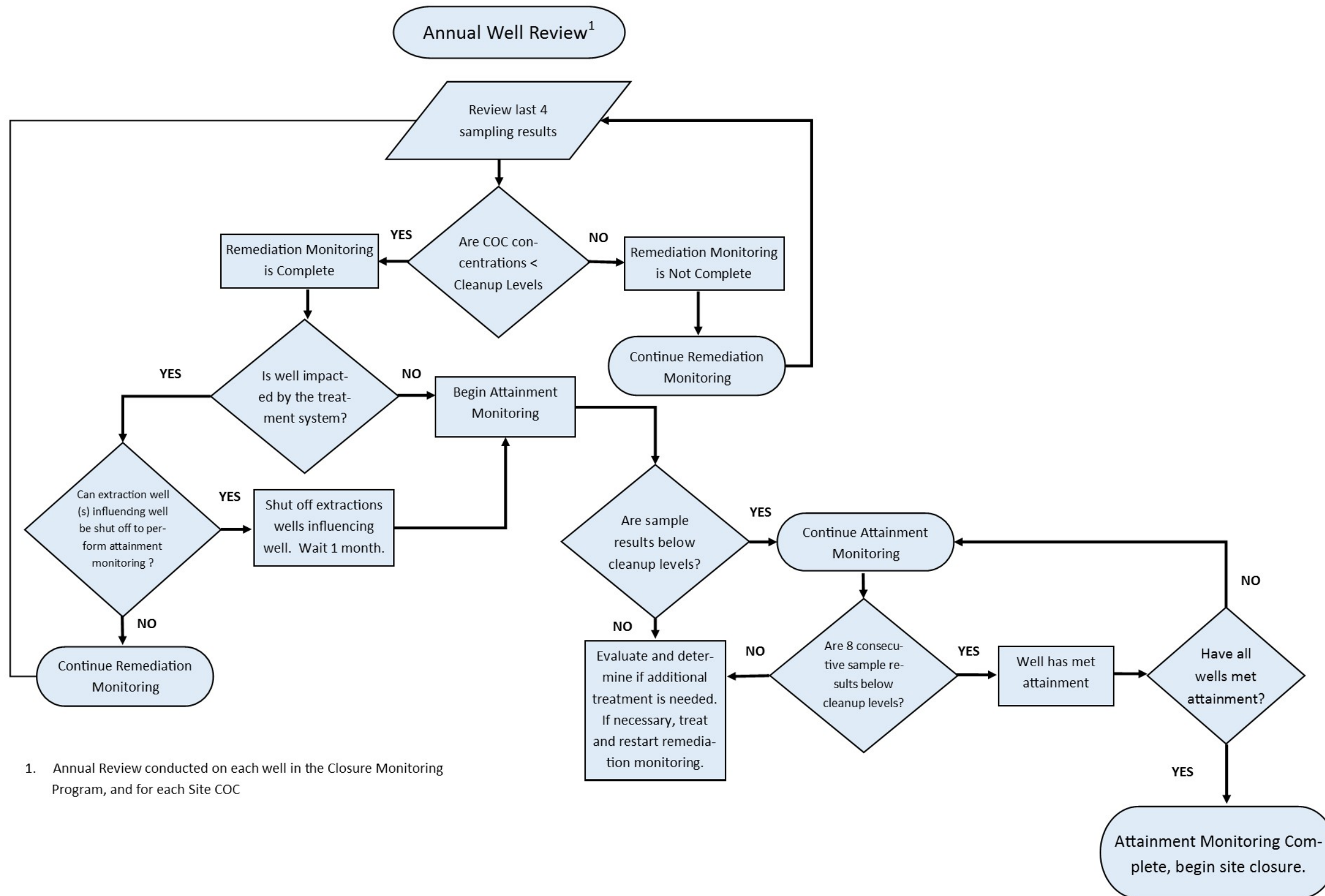
NOTES: MONITORING WELL LOCATIONS ARE APPROXIMATE. PROPERTY NAMES (2015) ARE LISTED WITH TAX ACCOUNT NUMBER.

BOOMSNUB/AIRCO SUPERFUND SITE  
HAZEL DELL, WASHINGTON

FIGURE 14  
SITE PROPERTY BOUNDARIES AND PARCEL NUMBERS

**EA** EA ENGINEERING,  
SCIENCE, AND  
TECHNOLOGY, INC., PBC





1. Annual Review conducted on each well in the Closure Monitoring Program, and for each Site COC

# **TABLES**

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**Table 1. Wells Included in the Closure Monitoring Program, Boomsnub/Airco Superfund Site**

Well Name	No longer Impacted by Treatment System/Under Steady State Conditions ? <sup>(1)</sup>	Remediation Phase Complete for VOCs?	Currently Ready for Attainment Monitoring of VOCs?	Remediation Phase Complete for Chromium?	Currently Ready for Attainment Monitoring of Chromium?
<b>Upgradient</b>					
AMW-8A	No	Yes	No	NA	NA
<b>TCE Source Area <sup>(2)</sup></b>					
AMW-1A	No	No	No	NA	NA
AMW-1B	No	Yes	No	NA	NA
AMW-1C	No	Yes	No	NA	NA
AMW-2A	No	No	No	NA	NA
AMW-2B	No	Yes	No	NA	NA
AMW-3A	Yes	No	No	NA	NA
AMW-4A	Yes	No	No	NA	NA
AMW-12A	No	No	No	NA	NA
AMW-13A	No	Yes	No	NA	NA
AMW-19A	No	Yes	No	NA	NA
AMW-26	No	Yes	No	NA	NA
AMW-52A	No	Yes	No	NA	NA
AMW-53A	No	No	No	NA	NA
AMW-54A	Yes	Yes	Yes	NA	NA
AMW-55A	Yes	Yes	Yes	NA	NA
AMW-56A	Yes	Yes	Yes	NA	NA
MW-1A	No	No	No	NA	NA
MW-1B	No	Yes	No	NA	NA
MW-1C	No	Yes	No	NA	NA
<b>Proximal</b>					
AMW-58	No	Yes	No	NA	NA
MW-2A	No	Yes	No	No	No
MW-2B	No	No	No	Yes	No
MW-2C	No	Yes	No	NA	NA
MW-3A	No	NA	NA	Yes	No
MW-3B	No	Yes	No	Yes	No
MW-3C	No	No	No	Yes	No
MW-4A	No	No	No	No	No
MW-4B	No	No	No	No	No
MW-4BSHED	No	No	No	No	No
MW-4C	No	No	No	No	No
MW-6A	No	Yes	No	No	No
MW-6B	No	Yes	No	Yes	No
MW-6C	No	No	No	Yes	No
MW-6D	No	No	No	Yes	No
MW-7B	No	No	No	Yes	No
MW-7C	No	Yes	No	Yes	No
MW-8B	No	No	No	Yes	No
MW-9B	No	No	No	Yes	No
MW-9C	No	No	No	NA	NA
MW-10B	No	No	No	Yes	No
MW-10C	No	Yes	No	Yes	No
MW-12C	No	No	No	Yes	No
MW-13C	No	No	No	Yes	No
PW-1B	No	Yes	No	Yes	No

Well Name	No longer Impacted by Treatment System/Under Steady State Conditions ? <sup>(1)</sup>	Remediation Phase Complete for VOCs?	Currently Ready for Attainment Monitoring of VOCs?	Remediation Phase Complete for Chromium?	Currently Ready for Attainment Monitoring of Chromium?
<b>Intermediate</b>					
AMW-59	No	No	No	NA	NA
AMW-60	No	No	No	NA	NA
CPU-14	No	No	No	Yes	No
MW-14C	No	No	No	Yes	No
MW-14E	No	No	No	Yes	No
MW-15E	No	Yes	No	Yes	No
MW-16E	No	No	No	Yes	No
MW-18D	No	No	No	No	No
MW-18E	No	No	No	Yes	No
MW-19D	No	No	No	No	No
MW-20D	No	No	No	Yes	No
MW-38	No	No	No	NA	NA
MW-40	No	Yes	No	No	No
PZ-39	No	No	No	No	No
<b>Church of God</b>					
AMW-27	Yes	Yes	Yes	Yes	Yes
AMW-61	Yes	No	No	No	No
CPU-12	No	No	No	Yes	No
CPU-13	Yes	Yes	Yes	Yes	Yes
CPU-15	Yes	NA	No	Yes	Yes
MW-21D	No	NA	NA	Yes	No
MW-22D	No	Yes	No	Yes	No
MW-25D	Yes	Yes	Yes	Yes	Yes
MW-26D	Yes	Yes	Yes	Yes	Yes
MW-27D	Yes	Yes	Yes	Yes	Yes
MW-49	Yes	Yes	Yes	Yes	Yes
<b>Toe of Plume</b>					
AMW-42	Yes	Yes	Yes	Yes	Yes
MW-41	Yes	Yes	Yes	Yes	Yes
MW-48	Yes	Yes	NO	NA	NA
<b>Troutdale</b>					
AMW-24	Yes	No	No	Yes	Yes
BENNETT	Yes	No	No	Yes	Yes
MW-33	Yes	No	No	Yes	Yes
Notes:					
(1) Implies the well is no longer influenced by nearby extraction wells or by discharge to the infiltration gallery, and that groundwater at the well has achieved post-remediation steady-state conditions.					
(2) Chromium is not a COC for TCE Source Area wells					
COC = Contaminant of Concern identified for the Site					
NA = Indicates COC has never been detected at concentrations exceeding the cleanup level					
VOC = Volatile organic compound					

**Table 2. Wells Excluded from the Closure Monitoring Program, Boomsnub/Airco Superfund Site**

Well Name	Justification	Well ID	Justification
RAMW-2C	COC never detected above CUL	IWS-1	Remediation Well
AMW-5A	COC never detected above CUL	IWS-1PZ	Remediation Well
AMW-6A*	COC never detected above CUL	IWS-2	Remediation Well
AMW-7A*	COC never detected above CUL	IWS-2PZ	Remediation Well
AMW-9A	COC never detected above CUL	IWS-3	Remediation Well
AMW-10A*	COC never detected above CUL	IWS-3PZ	Remediation Well
AMW-11A*	COC never detected above CUL	IWS-4	Remediation Well
AMW-14	Abandoned	IWS-4PZ	Remediation Well
AMW-15	Abandoned	IWS-5	Remediation Well
AMW-16	Impacted by Northern Plume	IWS-5PZ	Remediation Well
AMW-17	Impacted by Northern Plume	IWS-6	Remediation Well
AMW-18	Impacted by Northern Plume	IWS-6PZ	Remediation Well
AMW-19B	COC never detected above CUL	IWS-7	Remediation Well
AMW-20	COC never detected above CUL	IWS-7PZ	Remediation Well
AMW-21	COC never detected above CUL	IWS-8	Remediation Well
AMW-22	Abandoned	IWS-8PZ	Remediation Well
AMW-23	COC never detected above CUL	IWS-9	Remediation Well
AMW-25	COC never detected above CUL	IWS-9PZ	Remediation Well
AMW-43	COC never detected above CUL	LAVALLEY	Never in monitoring program
AMW-44	COC never detected above CUL	LV	Never in monitoring program
AMW-45	COC never detected above CUL	MILLER	Never in monitoring program
AMW-50	COC never detected above CUL	MW-1	Never in monitoring program (Clark County well)
AMW-51	COC never detected above CUL	MW-2	Never in monitoring program (Clark County well)
AMW-52C	COC never detected above CUL	MW-3	Never in monitoring program (Clark County well)
AMW-53B	COC never detected above CUL	MW-4	Never in monitoring program (Clark County well)
AMW-53C	COC never detected above CUL	MW-5	Never in monitoring program (Clark County well)
AMW-54C	COC never detected above CUL	MW-5A	Abandoned
AMW-55C	COC never detected above CUL	MW-5B	Abandoned
AMW-56C	COC never detected above CUL	MW-11A	Abandoned
AMW-57	COC never detected above CUL	MW-11B	Abandoned
AMW-62	COC never detected above CUL	MW-17E	COC never detected above CUL
AMW-63	COC never detected above CUL	MW-23D	Impacted by Northern Plume
AMW-64	Impacted by Northern Plume	MW-24D	Abandoned
COLF	Never in monitoring program	MW-28	Abandoned
COLUMBIA VE	Never in monitoring program	MW-29	Abandoned
CPU-1D	Abandoned	MW-30	COC never detected above CUL
CPU-1S	Abandoned	MW-31	Abandoned
CPU-2	COC never detected above CUL	MW-32	COC never detected above CUL
CPU-3D	COC never detected above CUL	MW-34	COC never detected above CUL
CPU-3S	COC never detected above CUL	MW-35	Abandoned
CPU-4D	Water levels only, never sampled	MW-36	Abandoned
CPU-4S	Water levels only, COC never detected above CUL	MW-37	COC never detected above CUL
CPU-10	COC never detected above CUL	MW-39	Never in monitoring program; pilot study well
CPU-16	Abandoned	MW-46	COC never detected above CUL
CROCKFORD	Never in monitoring program	MW-47	COC never detected above CUL
EC-1	COC never detected above CUL	PERMALUME	Never in monitoring program/abandoned
FERGUSON	Never in monitoring program	PZ-1	Water levels only, COC never detected above CUL
FITZGERALD	Never in monitoring program	PZ-2	Water levels only, COC never detected above CUL
GARRISON	Never in monitoring program	PZ-40	Water levels only, COC never detected above CUL
GRIMM	Never in monitoring program	SW-1	Abandoned
GWSW-1	Production well, COC never detected above CUL	WELCH	Never in monitoring program
GWSW-2	Production well, COC never detected above CUL	WILLIAMS	Never in monitoring program
HASTAY	Never in monitoring program	WOODAEGE	Never in monitoring program
HORN	Never in monitoring program	ZENT	Never in monitoring program
IWS-1	Remediation Well		

Notes:  
COC = Contaminant of Concern identified for the Site.  
CUL = Cleanup level identified in the Site Record of Decision.  
\* = Well sampled as part of the Linde infiltration gallery monitoring.