WORK PLAN FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY

Kimberly-Clark Worldwide Site Upland Area
Everett, Washington

Prepared for: Kimberly-Clark Worldwide, Inc.

Project No. 110207-004-01 • November 22, 2013 Final

Aspect CONSULTING

earth + water

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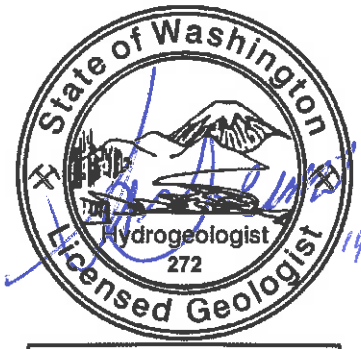

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Contents

List of Tables

List of Figures

List of Appendices

Acronyms

ADC	American Distributing Company
Agreed Order	Agreed Order No. DE 9476
ARA	archaeological resources assessment
ARAR	applicable or relevant and appropriate requirement
Aspect	Aspect Consulting, LLC
AST	above-ground storage tank
ASTM	American Society for Testing and Materials
BEK	BEK McDonnell Engineering
bgs	below ground surface
BNSF	BNSF Railway, Inc.
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Cleanup Action Plan
CFR	Code of Federal Regulations
CLARC	Cleanup Level and Risk Calculation
CLP	Contract Laboratory Program
COC	chain of custody
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSO	combined sewer outfall
CWRP	Central Waterfront Redevelopment Plan
DAHP	Department of Archaeology and Historic Preservation
DCA	disproportionate cost analysis
DQO	data quality objectives
Ecology	Washington State Department of Ecology
EDB	ethylene dibromide
EDC	1,2-dichloroethane
EDD	electronic data deliverable
EDL	estimated detection limit
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
ESA	Environmental Site Assessment

E1UB	estuarine subtidal unconsolidated bottom (habitat)
FBI	Friedman and Bruya, Inc.
FS	Feasibility Study
FSP	Field Sampling Plan
gpm	gallons per minute
GPS	global positioning system
HDPE	high density polyethylene
HREC	historical recognized environmental condition
HRGC	high resolution gas chromatography
HRMS	high resolution mass spectrometry
HSP	Health and Safety Plan
IA	interim action
ID	identification
IDW	investigation-derived waste
IHS	indicator hazardous substance
K-C	Kimberly-Clark Worldwide Inc.
lb	pound
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LLC	limited liability company
LG	licensed geologist
LHG	licensed hydrogeologist
LUST	leaking underground storage tank
MD	matrix spike duplicate
MDL	method detection limit
mg/kg	milligrams/kilograms
mg/L	milligrams per liter
MHHW	mean higher high water
MLLW	mean lower low water
MQI	measurement quality indicator
MS	matrix spike
MTCA	Model Toxics Control Act
NAPL	non-aqueous phase liquid

No.	number
NOEC	no observed effect concentration
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
NTU	nephelometric turbidity unit
ORP	oxidation-reduction potential
PAH	polycyclic aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene (perchloroethylene)
PE	registered professional engineer
PEG	Pacific Environmental Group
pH	negative log of the hydrogen ion concentration in solution
PID	photoionization detector
P.O.	post office
PQL	practical quantitation limit
PSAPCA	Puget Sound Air Pollution Control Agency
PSI	Puget Sound Initiative
PUD	Snohomish County Public Utility District
Pyron	Pyron Environmental, Inc.
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
%R	percent recovery
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
REC	recognized environmental condition
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RPD	relative percent difference
SAP	Sampling and Analysis Plan

SDG	sample delivery group
SEPA	State Environmental Protection Act
Site	K-C Worldwide Site
SOP	standard operating procedure
SPLP	synthetic precipitation leaching procedure
SSL	spent sulfite liquor
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWCA	SWCA/Northwest Archaeological Associates
SWPPP	Stormwater Pollution Prevention Plan
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TBT	tributyl tin
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TEE	terrestrial ecological evaluation
TEQ	toxic equivalent quotient/concentration
TPH	total petroleum hydrocarbons
TSDF	Treatment, Storage, Disposal Facility (RCRA)
TSS	total suspended solids
µg/L	micrograms per liter
U.S.	United States
µS/cm	microsiemens per centimeter
UST	underground storage tank
VI	vapor intrusion
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife

1 Introduction

This document presents a Work Plan to conduct a Remedial Investigation (RI) and Feasibility Study (FS) for the Upland Area of the Kimberly-Clark Worldwide Site (Site) located at 2600 Federal Avenue in Everett, Washington (Figure 1-1). The RI/FS Work Plan has been prepared to meet the requirements of Agreed Order No. DE 9476 (Agreed Order) between the Washington State Department of Ecology (Ecology) and Kimberly-Clark Worldwide, Inc. (K-C), executed on December 20, 2012. The purpose of the RI/FS is to evaluate the nature and extent of hazardous substances in soil and groundwater at the Upland Area and, using that information, develop and evaluate cleanup action alternatives for final cleanup.

The Site is generally located adjacent to the East Waterway on the west side of Marine View Drive between Everett Avenue and 21st Street. K-C is an owner of the Site, which includes the approximately 56 acres of the Upland area as well as 12 acres of adjacent tidelands. The Site is defined in the AO. It is defined as the extent of contamination caused by release of hazardous substances at the Site, and is not limited by property boundaries. This RI/FS Work Plan specifies regulatory action to be conducted for the Upland Area, as expressed in the Agreed Order, with the In-Water Area to be addressed under a separate Agreed Order.

The RI/FS will be conducted in accordance with RCW 70.105D.050(1) and the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC).

1.1 RI/FS Objectives

The Upland Area RI/FS is intended to provide sufficient data and evaluation to enable Ecology to select a cleanup action in accordance with MTCA. To that end, specific objectives of the Upland Area RI/FS are to:

- Obtain data of sufficient quality and quantity to describe the physical setting and physical properties of soil, groundwater, and soil vapor (air);
- Determine the nature and extent of contamination in soil, water, and, where applicable, soil vapor (air);
- Characterize the fate and transport of identified contaminants, including how contaminants migrate between media (e.g., soil leaching to groundwater, groundwater discharge to surface water, and volatilization from soil or groundwater to air);
- Use the information collected to evaluate potential risk to human health and the environment through complete exposure pathways under the planned future land use;
- Determine the need for cleanup actions in the Upland Area, and identify and evaluate the alternatives for doing so based on specific contaminants and environmental conditions, consistent with land use plans; and

- Report the methods and findings of the RI/FS to Ecology and the local community.

1.2 Project Management

The Upland Area RI/FS is being conducted by Aspect Consulting, LLC (Aspect) on behalf of K-C, in accordance with WAC 173-340-350. Ecology is providing regulatory oversight of the RI/FS activities in accordance with Agreed Order No. 9476. In accordance with the Agreed Order, the designated project coordinators for Ecology and K-C are listed below.

The project coordinator for Ecology is:

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The project coordinators for K-C are:

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Cindy Jernigan
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Global Sustainability
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Each project coordinator is responsible for overseeing the implementation of the Agreed Order.

K-C's consultant project team consists of representatives from Aspect and its subconsultants and subcontractors. Aspect's lead personnel and their roles for the RI/FS are as follows:

- Steve Germiat, LHG, is the project manager with final authority and responsibility for the consultant team's activities;
- Carla Brock, LG, is the RI task manager, responsible for directing the RI field program and managing and reporting the data; and
- Dave Heffner, PE, is the FS task manager, responsible for directing the FS.

Aspect will also use other geologists and engineers for completion of the RI and FS tasks.

Aspect's expected primary subconsultants for the RI/FS include:

- Pyron Environmental, providing assistance with Quality Assurance Project Plan (QAPP) preparation, analytical laboratory coordination, and data quality validation for newly collected data. EcoChem Inc. may also provide data validation services;
- David Evans and Associates, providing surveying and civil engineering services; and
- SWCA/Northwest Archaeological Associates (SWCA), providing historical research.

Aspect's expected primary subcontractors for the RI/FS include:

- Friedman and Bruya, Inc. and ALS Environmental (both are Ecology accredited environmental laboratories), providing analytical laboratory services; and
- Cascade Drilling or Holt Services, providing drilling and construction of soil borings, monitoring wells, and soil vapor probes.

1.3 Public Involvement

Ecology and K-C will promote public involvement throughout the RI/FS and cleanup stages for the Upland Area, as required by WAC 173-340-600. Public involvement may include, but not be limited to, preparation of fact sheets published for public information, establishing public comment periods to solicit public comment on key deliverables, status updates published in the Ecology Site Registry, mailings to addresses within the vicinity of the Site, and posting of public information at the Upland Area. The public involvement activities are described in greater detail within Ecology's Public Participation Plan for the Site, which is Exhibit E to the Agreed Order. The Agreed Order can be viewed on Ecology's website using the following weblink: https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=2569.

Note that all documents referenced throughout this report as being available on Ecology's website can be accessed using the weblink above.

1.4 Schedule and Reporting

Exhibit B to the Agreed Order establishes the general RI/FS schedule and reporting requirements, which are as follows:

- After submittal of this draft RI/FS Work Plan, Ecology has 30 days for review.
- The draft final RI/FS Work Plan, which will address comments from Ecology, is due 60 days after receipt of Ecology's comments, and Ecology will have 20 days for review.
- The final RI/FS Work Plan, which will address Ecology's further comments, will be submitted no later than 45 days after receipt of Ecology's comments.
- The Upland Area RI/FS field activities will begin within 30 days of submittal of the Final RI/FS Work Plan to Ecology.

- A Data Report Technical Memorandum, presenting results from the Upland Area RI data collection, will be provided to Ecology within 30 calendar days following receipt and validation of all RI/FS analytical data.
- The Interim Action Report will be provided to Ecology within 90 days of completing the Upland Area interim action (opportunistic cleanup completed with mill demolition). Additionally, quarterly update technical memoranda will be provided to Ecology during the interim action activities.
- The Upland Area Draft RI/FS Report will be provided to Ecology within 180 days following confirmation by the Ecology Project Manager that all data gaps have been addressed. Ecology will have a 30-day review period of the Draft RI/FS Report.
- The Upland Area Draft Final RI/FS Report will be submitted to Ecology within 90 calendar days following receipt of Ecology's comments on the Draft RI/FS Report. The public will then have 30 days to comment on the Draft Final RI/FS Report.
- The Upland Area Final RI/FS Report will be submitted to Ecology within 45 days following Ecology's completion of the responsiveness summary to public comment on the Draft Final RI/FS Report.
- The Draft Cleanup Action Plan (CAP) for the Site will be submitted to Ecology within 120 days after the Draft Final RI/FS Reports, for both the Upland Area and the in-water area, are published for public comment. Ecology will have a 30-day review period of the Draft CAP.
- The Draft Final CAP will be submitted to Ecology within 60 days following receipt of Ecology's comments on the Draft CAP.
- Analytical data used in the Upland Area RI/FS (including interim action) will be uploaded to Ecology's online Environmental Information Management (EIM) database within 60 days of data validation completion.

If further investigation is warranted to delineate the nature and extent of hazardous substances at the Upland Area sufficiently to develop and evaluate cleanup action alternatives, K-C will develop and submit a scope, schedule and submittal requirements for additional field activities to Ecology for review and approval.

1.5 Work Plan Organization

The remaining sections of this Work Plan are organized as follows:

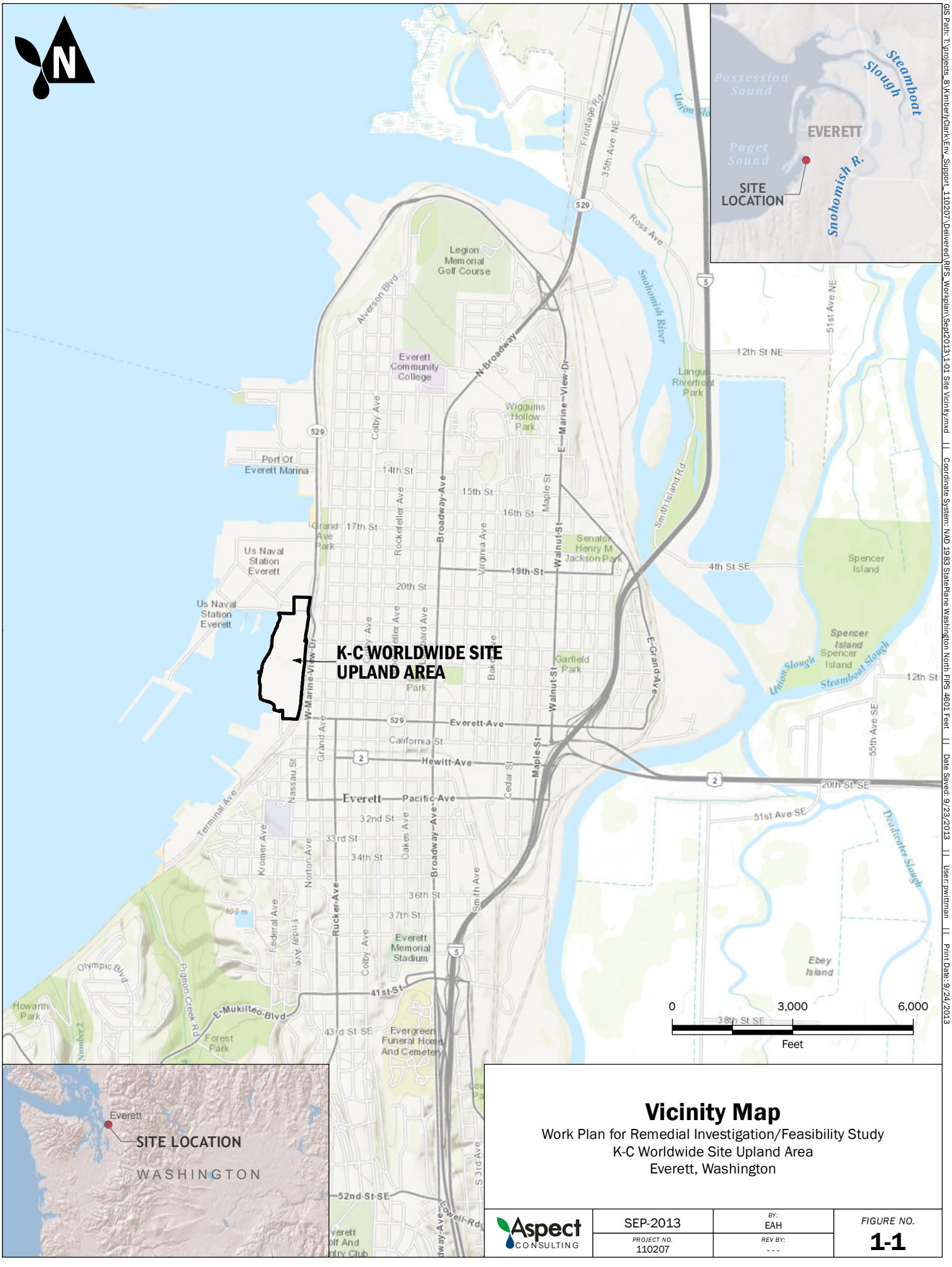
- **Section 2**—Site History and Setting describes the mill property location and zoning, operational history, and environmental setting, as obtained from readily available existing information.
- **Section 3**—Previous Independent Remedial Actions presents a summary of the previous investigations and independent cleanup actions conducted at the mill property, including the activities and results from K-C's independent Phase 2 Environmental Site Assessment (ESA) conducted in 2012.
- **Section 4**—Preliminary Conceptual Site Model identifies the preliminary indicator hazardous substances (IHS) for the Upland Area, potential sources of

those hazardous substances and the potential migration pathways and environmental media where they are suspected or confirmed to be found, and the potential receptors and exposure pathways.

- **Section 5**—Preliminary Screening Levels describes the derivation of numerical screening levels for soil and groundwater that are proposed for evaluation of the environmental data collected during the RI.
- **Section 6**—Data Gaps and Remedial Investigation Approach summarizes data gaps in the prior environmental investigation/cleanup information and other historical information, and proposes data collection methods to address the identified data gaps in the RI.
- **Section 7**—Feasibility Study Approach describes how cleanup action alternatives will be developed and evaluated and how a cleanup alternative will be selected.
- **Section 8**—References lists documents used or referenced in this Work Plan.

Appendices to the Work Plan include:

- **Appendix A—Sampling and Analysis Plan (SAP)** includes a Field Sampling Plan (FSP) providing the details regarding sample collection and handling for soil and groundwater samples collected during the proposed data collection, and a Quality Assurance Project Plan (QAPP) providing analytical laboratory requirements for quality assurance/quality control (QA/QC) procedures related to execution of the proposed data collection.
- **Appendix B—Archaeological Resources Assessment and Cultural Resources Monitoring and Discovery Plan**, both prepared by SWCA. The Archaeological Resource Assessment (ARA) provides a robust history of predevelopment and industrial activities in the Upland Area and surrounding area. This version, suitable for public distribution, has been redacted to remove potentially sensitive archaeological information, as required by law. The Monitoring and Discovery Plan provides protocols for monitoring for archaeological objects and, if such objects are suspected, protocols for stopping work and communicating with stakeholders.
- **Appendix C—Summary of Hazardous Waste Management** includes a summary of the mill hazardous waste management at the pulp and paper mill, including annotated copies of historical maps depicting locations of hazardous substance use and storage within the mill.
- **Appendix D—Site-Specific Health and Safety Plan** is a site-specific Health and Safety Plan (HSP), in accordance with WAC 173-340-810, to be used by Aspect employees during execution of the proposed RI field activities.



Vicinity Map

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	SEP-2013	BY: EAH	FIGURE NO. 1-1
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\Kimberly-Clark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\1-01 Site Vicinity.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 9/23/2013 || User: pwittman || Print Date: 9/24/2013

2 Site History, Setting, and Land Use

This section presents an overview of the Upland Area location, history, cultural resources, and environmental setting.

Note that the Upland Area has a century-long industrial history, and its most recent facility, K-C's pulp and paper mill, has demolished with the exception of the distribution warehouse and secondary wastewater treatment area. Consequently, all facilities (excluding the aforementioned warehouse and wastewater areas) and operational areas of the Upland Area are now historical, and can be referred to as "former"; however, for brevity throughout the RI/FS Work Plan and subsequent RI and FS documents, the adjective "former" is omitted when referring to the historical facilities and operations.

2.1 Site Location

The Upland Area is located in an industrial-port area on the west side of downtown Everett, Washington (Figure 1-1). It consists of 14 contiguous tax parcels totaling approximately 72 acres of land (Figure 2-1). One parcel, 00597761800102, is reportedly owned by Chevron USA, Inc. The Site is defined as described above in Section 1, but the Upland Area is located adjacent to the East Waterway which is a dredged waterway within the larger Port Gardner Bay, approximately 2.3 miles south of the mouth of the Snohomish River (Figure 1-1). The East Waterway contains a federal navigation channel maintained by the United States (U.S.) Army Corps of Engineers.

The Upland Area's eastern boundary is formed by the BNSF Railway Inc. (BNSF) railroad tracks and West Marine View Drive beyond (Figure 2-1). The western boundary of the Upland Area is the East Waterway shoreline, defined as mean higher high water (MHHW). The U.S. Naval Station Everett is located adjacent to the north. Adjacent to the south are multiple industrial properties owned by BNSF, the American Distributing Company (ADC), ExxonMobil Corporation, the Ronan C. Bonnie Trustee, and the Port of Everett. Road access to the property is gained via the north gate, on West Marine View Drive, in the northeast portion of the property.

David Evans and Associates' recent survey of K-C's southwestern property boundary in accordance with the legal description confirms that the southwestern boundary of parcel 29051900300100 has been incorrectly located in Snohomish County's online parcel database. Consequently, the boundary has been incorrectly depicted in Aspect's reports to date for the Upland Area, which relied on the County's database for parcel boundaries. The correct parcel boundary is coincident with the fence line in that area. The area immediately south of the fence line, which the County database indicates is K-C property, is in fact Port of Everett property and is currently occupied by their tenant Dunlap Towing. The parcel boundary, and thus the boundary of the Upland Area, has been corrected on figures in this Work Plan.

2.2 Site History

A detailed cultural and industrial history of the Upland Area and surrounding area is provided in the *Draft Archaeological Resources Assessment for the Kimberly-Clark Worldwide Site Upland Area, Everett, Snohomish County, Washington* prepared by SWCA, and can be referenced in conjunction with this Work Plan. The purpose of the archaeological resources assessment (ARA), included in Appendix B to this Work Plan, was to assess the probability of encountering archaeological deposits or objects during cleanup excavation within the Upland Area. The ARA includes background information regarding the setting of the Upland and In-Water Areas of the Site, thorough discussion of the area's industrial history, expectations for buried cultural resources based on previous investigations in the vicinity, and a probability map showing interpreted areas of the Upland Area with potential to harbor significant archaeological materials based on interpreted pre-development water depth/landforms. The ARA identifies no recorded cultural resource sites within the Upland Area.

The following subsections present an overview of the development history of the Upland Area, as well as specific information regarding historical mill operations, facilities, and features of the Upland Area.

2.2.1 Development History

This subsection presents an overview of the development history of the Upland Area. The area comprising the Upland Area was developed as early as the late 1800s. Historical Sanborn Fire Insurance Maps for the Everett area were published for years 1902, 1914, 1950, and 1957. Copies of the Sanborn maps are included in the ARA (SWCA, 2013a; see Appendix B to this Work Plan). The following early development history is summarized from the ARA.

The Parminter-Robinson lumber mill was the first documented mill within the Upland Area, operating on its northern portion as early as 1892. With development of the larger Clark-Nickerson Lumber Company mill by 1901, Robinson's sash and door plant operations moved onto a parcel immediately to the north. By 1901, Everett housed 9 sawmills and 13 shingle mills; by 1910, there were 11 sawmills and 16 shingle mills. The Clark-Nickerson Lumber Company mill was initially about 46 acres in extent, and built primarily on an overwater wharf structure. The mill subsequently dredged about 50,000 yards of sediment to create a channel around its wharf. Beginning in 1901, the mill began filling the tidelands around its mill using wood waste materials from the sawmill. By 1901, the Everett Flour Mill Company filled a 50- by 225-foot area of tidelands on which to construct its flour mill south of the Clark-Nickerson Lumber Company mill. The flour mill structures were dismantled and moved to a new location in 1926. A ship building company (Norway-Pacific Construction and Dry Dock Company) built a shipyard facility south of the Everett Flour Mill Company's mill by 1918, between the Everett Avenue and 25th Avenue. Shortly following the end of World War I, the plant shut down and was dismantled by 1925.

The 1902 Sanborn map depicts that the shoreline of the Site was initially several hundred feet farther east of its current position. In addition, the northern portion of the Upland Area was occupied by the Clark-Nickerson Lumber Company, and the Everett Flour Mill Company occupied a smaller area near the center of the Site. Areas south of the Everett

Flour Mill Company were historically occupied by residential structures ("squatters' shacks"). Additional details regarding these facilities are provided in the ARA.

The 1914 Sanborn map depicts minor changes in the position of the shoreline. Additional development of both the Clark-Nickerson Lumber Company and the Everett Flour Mill Company, and removal of the majority of the residential structures on the southern portion of the Site are also depicted. Reportedly, in 1915, the City of Everett passed an ordinance granting Standard Oil Company (now Chevron) permission to construct a fuel storage tank farm on the south end of the Upland Area; that facility is not apparent on the 1914 Sanborn map, and the date of its construction is uncertain, but a 1930 Great Northern Railway Map shows the Standard Oil oil tanks present at that time (AMEC, 2010).

The 1950 Sanborn map depicts significant development across the Upland Area. The name of the Clark-Nickerson Lumber Company facility had been changed to North Star Lumber Company and included minor developmental changes. The Everett Flour Mill Company facility was no longer depicted on the 1950 map, but the area proximate to the central portion of the Site included significant development and was identified as Soundview Pulp Company. The Associated Oil Company facility was also depicted on the 1950 map and included three ASTs with unlabeled capacities located in the asphalt paved area on the north side of K-C's warehouse building at the south end of the Upland Area. The position of the shoreline, in areas identified as Soundview Pulp Company, was also significantly different than on the 1914 map. Areas where development of the Soundview Pulp Company had occurred were assumed filled prior to development of that facility; however, no additional information regarding the areas that were filled or the source of the fill used at the Upland Area has been identified.

The Puget Sound Pulp and Timber Company was formed in 1929 and operated the pulp mill at the Site until 1932 when the Soundview Pulp Company assumed ownership. The Soundview Pulp Company continued operations at the Site and was reportedly the largest single sulfite pulp producing plant in the world when it merged with Scott Paper Company in 1951. Following the merger, construction of the paper mill adjacent to the pulp mill at the Site began and was completed in 1954. The wastewater treatment facility, with two primary clarifiers and an interceptor sewer system, was subsequently constructed at the Site by Scott Paper Company in 1964. The mill facility also originally contained a log pond that was used for temporary storage of logs that were rafted to the mill and chipped on site for use in the pulp operations. The log pond was reportedly filled sometime between 1979 and 1981 and was then used to store wood chips for use in pulp and paper operations. Scott Paper Company continued pulp and paper operations at the Site through 1995 when it merged with K-C Corporation.

2.2.2 Operational History of Pulp and Paper Mill

This subsection presents specific information regarding historical pulp and paper mill operations on the Upland Area. The information presented in this subsection was compiled from the ARA and the *Phase I Environmental Site Assessment, Everett Pulp and Paper Mill, Everett, Washington*, dated April 2011 (AECOM, 2011). AECOM (2011) developed the historical summary from interviews, and a review of historical aerial photographs, city directories, topographic maps, records review, and information obtained from K-C and the City of Everett.

In addition, Exhibit A to the Agreed Order includes a series of historical aerial photographs for the Upland Area (1947, 1952, 1966, 1979, 1985, 1992, and 2006), annotated by Ecology to call out operational features of the pulp and paper mill.

Since the mid-1920s, the primary historical operations within the Upland Area included a sulfite pulp and paper mill, which produced bleached sulfite pulp and various tissue products. Mill operations have historically included four operational areas identified as tissue manufacturing/wastewater treatment, biomass receiving/distribution, pulp storage/bag house, and pulp processing warehouse.

The pulp mill began operations in the early 1930s and included five digesters and two pulp drying machines. Four Scott Paper Company machines were added to the facility between 1953 and 1955. The parking lots were constructed adjacent to the mill on the east side of West Marine View Drive.

The southern portion of the Upland Area was partially developed by 1930, including two tank farms and smaller facilities with associated railroad spurs owned by Tidewater/Associated Oil Company (predecessor to Texaco) and by Standard Oil/Chevron. The Bunker C fuel oil AST farm and property were purchased from Tidewater/Associated Oil in 1957, and other property was purchased from Standard/Chevron in 1967. The current distribution/warehouse facility located on the south end of the site was constructed in 1959. According to the Snohomish County parcel database, Chevron still owns one parcel beneath the warehouse.

Wood chipping and log rafting operations were discontinued at the mill in 1970, according to a 1994 Scott Paper Company letter to CH2M Hill. In 1974, the mill constructed a sulfite recovery boiler (Boiler No. 10) to recover spent liquor from operations and to combust it for steam generation and the conversion of sulfur dioxide, which was reused in the process. The log pond was filled by the early 1980s.

In 1995, five Dutch Oven wood-fired boilers were replaced with a new boiler (Boiler No. 14), which is owned by the Snohomish County Public Utility District (PUD). Also in 1995, the Snohomish County PUD built the biomass fuel shipping pier and related conveyors, which it owns and which was used by the K-C mill as well. In the mid-1990s, Scott Paper Company, working with the U.S. Navy, razed the Naval Reserve Center (formerly located just south of the Everett mill's secondary clarifiers), which consisted of the following: offices, garage, boiler room, flammable storage shed, diesel AST, gasoline UST, machine/wood shop, classroom, and a gun range. The area is currently paved for semi-truck parking. By 1997, the Bunker C fuel oil AST farm located just north of the distribution/warehouse building was removed.

The Human Resources/Safety/Medical Building was razed in late 2009. All mill operations were permanently ceased in April 2012. Demolition of the K-C mill started in summer 2012 and was completed in July 2013.

Mill Wastewater Discharges

Until 1951, waste water from the K-C mill, consisting of concentrated sulfite waste liquor (SWL), waste bleach water, and pulp fiber wash water, was discharged untreated to the East Waterway through up to seven outfalls located adjacent to the facility (outfall locations are show in Exhibit A of the Order). In 1951, the mill constructed a deep water

outfall (Outfall SW001), in conjunction with the Weyerhaeuser mill located south of the K-C mill. The newly constructed Outfall SW001 discharged concentrated SWL from the K-C mill and Weyerhaeuser Mill A to the deep waters of Port Gardner Bay.

In 1963, the K-C mill's sanitary sewers were separated from the mill's process effluents and connected to the City of Everett's system. In July 1965, the mill put into operation waste sedimentation facilities with two primary clarifiers and an interceptor sewer system. An industrial wastewater treatment plant was constructed at the K-C mill in 1979 and put on-line in January 1980. The plant included two secondary clarifiers and secondary aeration basins, from which treated mill waste water was discharged to the East Waterway through two outfalls located adjacent to the facility (Outfalls 003 and 008) and via the deep water Outfall SW001 shared with Weyerhaeuser.

In 2004, K-C constructed a deep water outfall (Outfall 100) to replace deep water Outfall 001, which was plugged and demolished in the nearshore area. Outfall 100 became fully operational in 2005. Under its National Pollutant Discharge Elimination System (NPDES) permit, K-C was authorized to discharge treated process wastewater, storm water, and non-contact cooling water from deep water Outfall 100. Regional municipal wastewater from the Cities of Everett and Marysville was and continues to be discharged through Outfall 100 also. K-C was also authorized to discharge treated process wastewater, storm water, and non-contact cooling water from Outfalls 003 and 008 in emergencies and shutdowns.

Mill Hazardous Waste Management

The pulp and paper mill was a large quantity generator of hazardous waste (RCRA ID number WAD009250820) from the early 1980s until its closure in 2012. The mill was never a hazardous waste Treatment, Storage, and Disposal Facility (TSDF) under RCRA. The mill's 90-day Hazardous Waste Accumulation Unit (HWAU, aka "haz waste cage") was a secure storage unit in which hazardous and non-hazardous waste materials generated at the mill were temporarily stored prior to proper off-site disposal. Prior to closure, K-C accumulated waste materials within the accumulation unit for periods less than 90 days, and handled and disposed of the wastes in accordance with applicable requirements of the state Dangerous Waste Regulations (Chapter 173-303 WAC). One of the final steps in mill demolition was to conduct clean closure of the HWAU, as described in the RCRA Closure Report for the mill (Aspect, 2013b).

In addition to describing closure of the HWAU, Appendix A to the RCRA Closure Report summarizes the mill's historical hazardous waste management, as well as Ecology's dangerous waste inspection during the mill closure activities, which concluded that waste management activities were being conducted in conformance with state Dangerous Waste Regulations requirements. That appendix also includes maps depicting locations of hazardous substance use/storage dating back to the early 1980s. That historical information has been incorporated into this Work Plan. Specifically, Figure 2-2 of this Work Plan depicts historical features of the pulp and paper mill, including labeling of the mill buildings and depicting locations where hazardous substances were used and/or stored within the mill, as identified from the historical maps. For ease of reference, Appendix C of this RI/FS Work Plan repeats the summary of the mill hazardous waste management including annotated copies of the historical maps.

2.3 Cultural Resources

Ecology is working with landowners/stakeholders including local Native American Tribes to clean up contaminated sites and sediments in the vicinity of the Port Gardner Bay area and the Snohomish River Estuary. Port Gardner Bay is identified as a high-priority, "early-action", cleanup area under the Puget Sound Initiative (PSI). The Site has been identified as a cleanup site under the PSI. Local Tribes that have been actively engaged by Ecology under the PSI at Port Gardner include the Tulalip, Suquamish, Swinomish, and Lummi. Ecology has worked with a tribal liaison to assist in developing contacts and early engagement with cultural and natural resource departments within each of the aforementioned Tribes. Engagement with the Tribes has consisted of meetings to discuss PSI cleanup sites and cultural resources, providing the Tribes with draft work products for early input, and providing them with updates containing the current status of each PSI site, near-term work products for tribal review, project schedules, and a summary of tribal engagement for the Port Gardner PSI sites.

Based on Ecology's discussion with the Tribes and information provided in a 1973 Historical Survey of Everett (Dilgard and Riddle, 1973), people have inhabited the Port Gardner Bay area for thousands of years. For centuries, the northwest point of the peninsula (i.e., Preston Point) was the site of Hebolb, the principal village of the Snohomish Tribe. The village's location near the mouth of the Snohomish River and next to Port Gardner Bay provided both abundant food and transportation. Native Tribes used the Everett shoreline in part for subsistence activities such as shellfish collection, hunting, plant gathering, and fishing. According to local Tribes, native long houses were located up and down the Everett waterfront. Local Tribes have communicated to Ecology that the Everett waterfront is a culturally sensitive area. With that in mind, the procedures to be used in the event archaeological resources are encountered during Site activities are presented below.

As described above, SWCA prepared an ARA that provides additional details regarding cultural resources in the Upland Area vicinity (SWCA, 2013a), as well an Inadvertent Discovery Plan in support of the Upland Area interim action (SWCA, 2013b). That information will also be applied to the RI/FS work. Appendix B includes the ARA and Inadvertent Discovery Plan.

Subsurface explorations completed during the RI/FS will be observed and logged by a geologist, with attention paid to looking for evidence of non-soil materials. If a potential archaeological object is discovered during investigation activities, work will be stopped immediately, and an archaeological professional will mobilize to the location to observe and assess the materials encountered. If the archaeologist concludes that the finding is not archaeological, the events of the archaeological investigation will be documented and work may proceed. If the archaeologist concludes that the find is archaeological and recommends it as not significant, the archaeologist will record the archaeological object or deposit, document the events of investigation, and will contact the Department of Archaeology and Historic Preservation (DAHP) and the tribes to get concurrence.

If the archaeologist confirms that an archaeological object has been encountered, work will remain stopped and Ecology, DAHP, the City of Everett Planning and Community Development Department, and the Tulalip and Suquamish Tribes Cultural Resources

Departments will be notified in a timely manner (current day if possible) and no later than the close of the next business day (see contact list in the table below). An archeologist will be retained for an onsite inspection and the parties mentioned above will also be invited to participate. The archaeologist will document the discovery and provide a professionally documented site form and report to the above-listed parties. In the event of any discovery of human remains, work will be immediately halted in the discovery area, the remains will be covered and secured against further disturbance, and the Everett Police Department and Snohomish County Medical Examiner will be immediately contacted, along with the DAHP Physical Anthropologist and authorized Tribal representatives. The archaeologist will prepare a treatment plan in consultation with the above-listed parties consistent with RCW 27.44 and RCW 27.53, and implement it in accordance with Chapter 25-48 WAC. Appendix B includes the Cultural Resources Monitoring and Inadvertent Discovery Plan, prepared by SWCA, which details the communications protocols, and the list of contacts, if archaeological objects are encountered.

2.4 Environmental Setting

This section describes the environmental setting of the Upland Area, based on prior assessments.

2.4.1 Topography

The local topography surrounding the property slopes westward toward the Waterway. Property ground surface elevations (above mean lower low water; MLLW) range from approximately 16 feet along the eastern boundary to approximately 5 feet on the western boundary.

2.4.2 Geology and Hydrogeology

A wedge of fill, generally thickening from east to west, comprises the shallow subsurface soils across the Upland Area. Beginning in the late 1800s, the fill was placed on the East Waterway tidal flats to create new upland, as described in Section 2.2. Within the west-center portion of the Upland Area, a log pond was filled in stages between the mid-1950s and early 1980s to create upland for wood chip and hog fuel storage. Based on extensive subsurface drilling during the Phase 2 ESA, the fill has variable composition, predominantly including sand and silty sand with shell fragments (probable dredge fill), and localized occurrences of gravel, debris, and wood chips/sawdust. The Phase 2 ESA final report can be viewed on Ecology's website using the weblink referenced in Section 1.3.

A shallow unconfined (water table) water-bearing zone occurs within the fill, overlying the underlying siltier native tidal flat deposits. The water table within the fill is relatively shallow, generally ranging in depth from 1 to 4 feet below grade in the Upland Area's eastern areas to 6 to 12 feet below grade in its western areas. Consequently, groundwater generally flows toward the west across the Upland Area, with discharge to the East Waterway; however, depending on the alignment of the shoreline, groundwater flow directions locally may range from northwesterly to southwesterly. For example, in the south end of the Site, groundwater locally flows to the southwest toward the off-loading dock slip.

Groundwater in the fill is hydraulically connected to the East Waterway, and tidally-induced water table fluctuations near the East Waterway range between about 2 and 7 feet depending on the location, based on data from the 72-hour tidal study data presented in the independent Phase 2 ESA. During that study, during which East Waterway tidal fluctuations greater than 15 feet occurred, wells located within about 100 feet of the shoreline showed significant tidal response, with tidal efficiencies[1] ranging from 0.06 to 0.43, and tidal lag times[2] ranging from 0.6 to 2.5 hours. Wells located 200 feet or more from the shoreline did not show a significant tidal response (Aspect, 2013).

While nearshore groundwater flow directions reverse diurnally with the tide, the tidally-averaged groundwater flow directions within the Upland Area are toward the west with the expected net discharge to the East Waterway. Maps illustrating groundwater elevation contours, and interpreted groundwater flow directions, during low tide and high tide conditions (measurements in July and September 2012), and the tidally-averaged condition based on the tidal study data are presented in the Phase 2 ESA (Aspect, 2013; Figures 4-1 to 4-6).

2.4.3 Climate

The climate of the Everett area is maritime, characterized by cool summers and mild winters influenced by ocean air. The average annual minimum temperature is 42.6 degrees Fahrenheit and the average maximum temperature is 59.1 degrees Fahrenheit (Western Regional Climate Center, 2012). The average annual precipitation in Everett is 36.7 inches, with greater than 4 inches of precipitation per month from November through January.

2.4.4 Ecological Setting

The information regarding the Upland Area's ecological setting presented in this section was obtained from the *Habitat Assessment for the Kimberly-Clark Everett Mill Site Demolition Project*, which was prepared prior to mill demolition (Anchor QEA, 2012).

The western boundary of the Upland Area is adjacent to the marine environment of the East Waterway in Port Gardner Bay of Possession Sound, which is mapped by the U.S. Fish and Wildlife Service as E1UB (Estuarine Subtidal Unconsolidated Bottom) habitat. The Upland Area shoreline is a bulkhead comprised mostly of riprap and large rock material, with some wood bulkhead located on the north end. Wetlands, streams, or drainage channels are not present within the Upland Area.

Upland vegetation is limited to a narrow strip of managed grass and ornamental trees and shrubs associated with a walking trail inland of the bulkhead shoreline. Plant species include western red cedar, western azalea, nootka rose, and the nonnative species Himalayan blackberry, and butterflybush. Wildlife species include bird species common in urban areas of Snohomish County: crows, house sparrows, black-capped chickadees, terns, and gulls species. No amphibian, reptile, or mammal species, tracks, or signs were observed in a Site reconnaissance by Anchor QEA.

The adjacent East Waterway offshore of the Upland Area is identified as Dungeness crab priority habitat. Areas in Port Gardner Bay are also identified by the City of Everett and

[1] Ratio of the groundwater elevation change to corresponding tide elevation change.
[2] Time difference between tide elevation peak and corresponding groundwater elevation peak.

the Washington Department of Fish and Wildlife (WDFW) as haul-out areas for California sea lions and harbor seals, regular large concentrations of waterfowl, and intertidal hardshell clam areas. Harbor seals are also commonly observed on log booms located near the shoreline of the Upland Area.

No ESA-listed animal species are known to occur within the Upland Area. The five Endangered Species Act-listed terrestrial species within Snohomish County (Canada lynx, gray wolf, grizzly bear, marbled murrelet, and northern spotted owl) are all associated with habitat that includes large undeveloped areas, which do not occur on or near the Upland Area. Based on the Washington Nature Mapping Program, potential habitat for these five species, and critical habitat for the northern spotted owl and marbled murrelet, is not present within 20 miles of the Upland Area.

Many of these twelve ESA-listed aquatic species identified in Snohomish County[3] are known to occur in Possession Sound. However, only a few of the twelve species are likely to occur within the narrow and relatively shallow water of the East Waterway. The marine mammal and sea turtle species (humpback whale, killer whale, Steller sea lion; and leatherback sea turtle, respectively) typically occur in the deep-water habitat of Puget Sound and could occur in Possession Sound offshore of the Upland Area but are very unlikely to occur in the East Waterway adjacent to it. Chinook salmon, steelhead, and bull trout occur in Possession Sound and are likely to migrate near the East Waterway shoreline. The fish species bocaccio, canary rockfish, green sturgeon, Pacific eulachon, and yelloweye rockfish are associated with deep-water habitats of Puget Sound and typically breed and forage near the ocean floor. Adults of these species are very unlikely in the marine environment of the East Waterway. Juveniles of these species do migrate in nearshore habitats and could occur in the adjacent offshore habitat.

Overall, the Upland Area is completely developed with vegetation limited to a narrow patch of landscaped trees, shrubs, and managed grass along a shoreline walking trail. The limited vegetation represents low-quality wildlife habitat. Wildlife use of the terrestrial habitat is likely dominated by disturbance-tolerant species typical of urban areas. The adjacent marine habitat provides foraging habitat for waterfowl and other birds and aquatic species typically found in the marine environment of Puget Sound. Habitat surrounding the Upland Area includes fragmented and disturbed areas associated with industrial development.

At the time of this Work Plan, the envisioned redevelopment plan for the Upland Area (see Section 2.5) is expected to qualify for an exclusion from conducting a terrestrial ecological evaluation (TEE) in accordance with WAC 173-340-7491(1)(b); however, that determination has not been made by Ecology. Therefore, for purposes of the RI/FS Work Plan, MTCA soil screening levels based on terrestrial receptors are incorporated into the preliminary soil screening levels for the RI (Section 5). As the redevelopment plan for the Upland Area becomes better defined, the RI will evaluate whether the Upland Area qualifies for an exclusion from conducting a TEE in accordance with WAC 173-340-7491(1)(b).

[3] Chinook Salmon, Puget Sound Steelhead, Bocaccio, Canary Rockfish, Green Sturgeon, Pacific Eulachon, Yellow Rockfish, Bull Trout, Orca, Leatherback Sea Turtle, Humpback Whale, and Stellar Sea Lion.

2.5 Current and Future Land Use

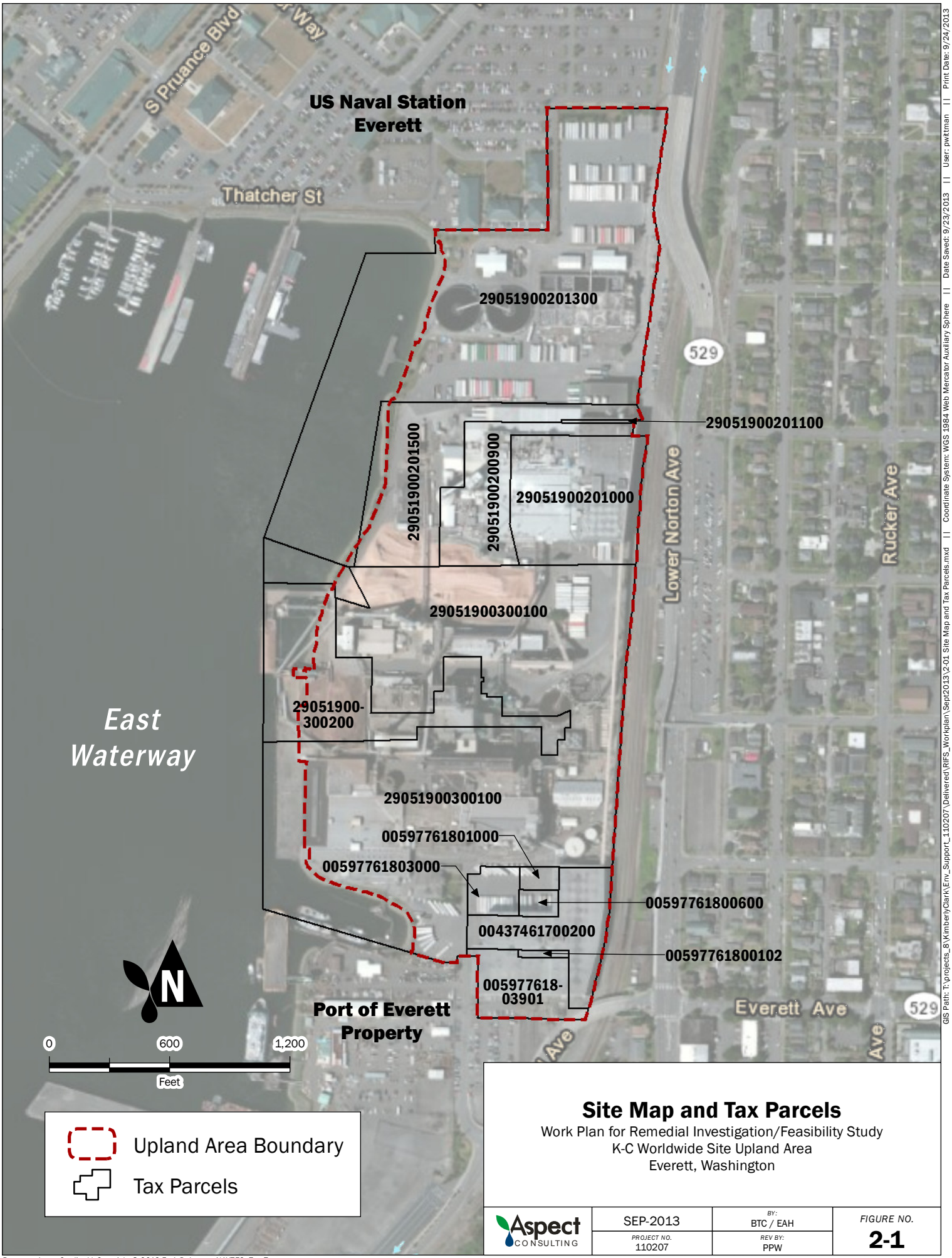
The Upland Area is located within a long-term industrial area and it has historically been zoned Industrial, M-2 Heavy Manufacturing. In January 2013, after the City of Everett completed its Central Waterfront Planning, the City reaffirmed the Upland Area's industrial zoning. In January, the City adopted a new land use plan, the Central Waterfront Redevelopment Plan ("CWRP"), as a Subarea Plan of the Everett Comprehensive Plan. The CWRP imposes a modified M-2 zoning on the Central Waterfront Planning Area, which includes the Upland Area property. The City approved alternative under the CWRP along with a description of the modified M-2 zoning is provided below.

Approved Alternative to the CWRP—The approved alternative allows for water-dependent uses within the shoreline jurisdiction (i.e., minimum of 200 feet from the Ordinary High Water Mark), and a mix of water-dependent uses and non-water-dependent industrial uses outside of the shoreline jurisdiction. Public access is strongly encouraged on-site where not in conflict with water-dependent uses, and required on-site for nonwater-dependent uses in shoreline jurisdiction.

Modified M-2 Zoning – A wide variety of manufacturing uses are permitted under the modified M-2 zoning as well as business parks, and commercial uses serving other area businesses. Some of the permissible uses under the modified M-2 zoning are not compatible with Ecology's characteristics for an industrially zoned property. One of the characteristics for an industrial zoned property is that access is generally not allowed by the general public, or is highly limited and controlled (see WAC 173-340-745). Some of the permissible uses that are not traditional industrial under the modified M-2 zoning include light business/commercial uses such as shopping and a farmers market, entertainment uses, different types of lodging, schools, and special uses such as a church or daycare.

As of late September 2013, K-C has the property under contract for sale to a maritime ship-building company, with a planned water-dependent industrial redevelopment consistent with City zoning. The potential future buyer is currently conducting their due diligence for the property transaction. K-C will maintain responsibility and liability for cleanup of the Upland Area after sale of the property.

As mentioned above, the potential buyer plans to use the entire property as an industrial shipyard. In addition, no public access is anticipated. This type of use meets Ecology's characteristics for an industrial property as specified in WAC 173-340-745(1)(a)(i). The use of industrial cleanup levels at this time is deemed appropriate based on the planned industrial future use identified by the prospective buyer.

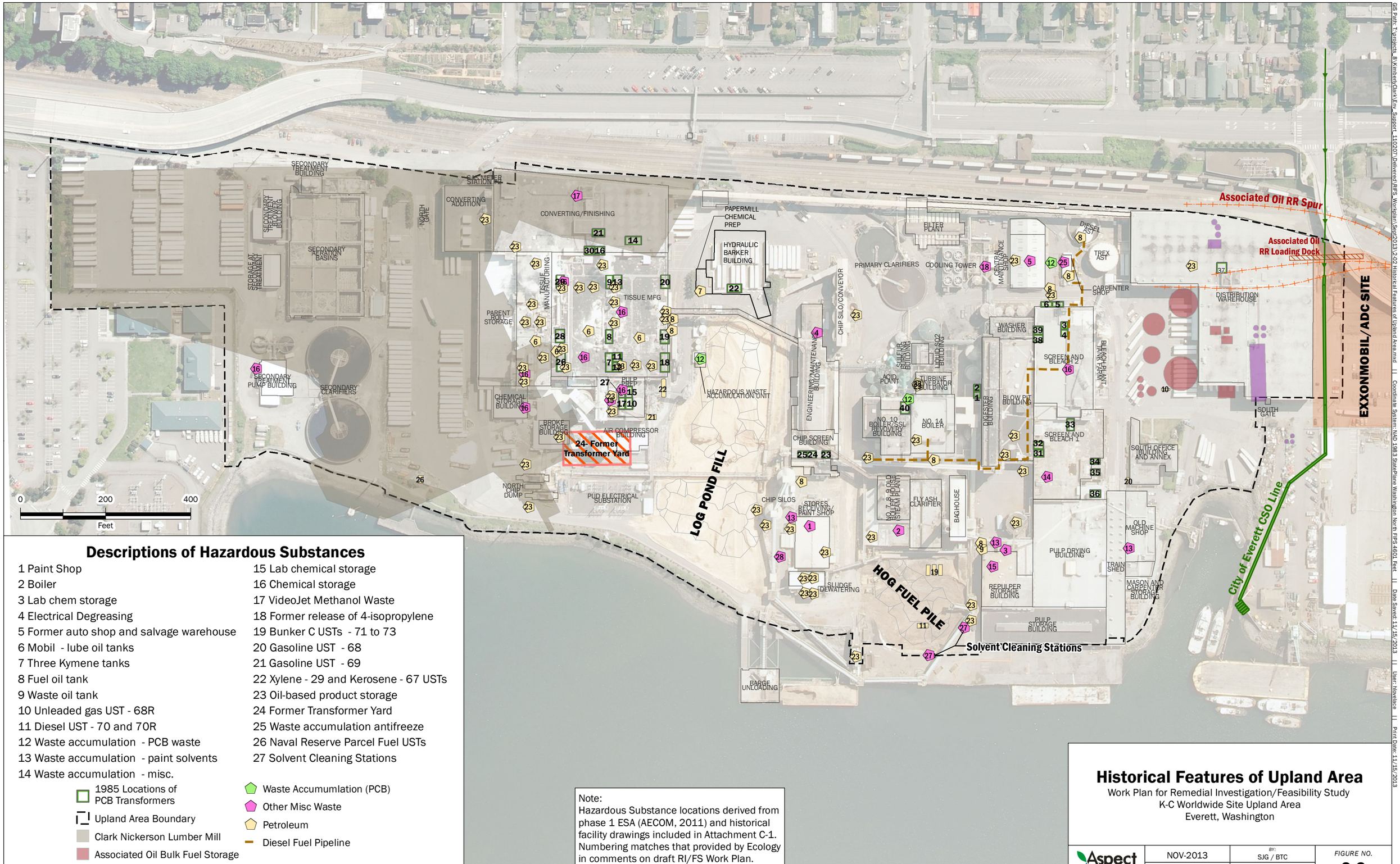


Site Map and Tax Parcels

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	SEP-2013	BY: BTC / EAH	FIGURE NO. 2-1
	PROJECT NO. 110207	REV BY: PPW	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\2-01 Site Map and Tax Parcels.mxd || Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere || Date Saved: 9/23/2013 || User: pwittman || Print Date: 9/24/2013



Descriptions of Hazardous Substances

1 Paint Shop
2 Boiler
3 Lab chem storage
4 Electrical Degreasing
5 Former auto shop and salvage warehouse
6 Mobil - lube oil tanks
7 Three Kymene tanks
8 Fuel oil tank
9 Waste oil tank
10 Unleaded gas UST - 68R
11 Diesel UST - 70 and 70R
12 Waste accumulation - PCB waste
13 Waste accumulation - paint solvents
14 Waste accumulation - misc.
15 Lab chemical storage
16 Chemical storage
17 VideoJet Methanol Waste
18 Former release of 4-isopropylene
19 Bunker C USTs - 71 to 73
20 Gasoline UST - 68
21 Gasoline UST - 69
22 Xylene - 29 and Kerosene - 67 USTs
23 Oil-based product storage
24 Former Transformer Yard
25 Waste accumulation antifreeze
26 Naval Reserve Parcel Fuel USTs
27 Solvent Cleaning Stations

1985 Locations of PCB Transformers
Upland Area Boundary
Clark Nickerson Lumber Mill
Associated Oil Bulk Fuel Storage
Standard Oil Bulk Fuel Storage
Waste Accumumlation (PCB)
Other Misc Waste
Petroleum
Diesel Fuel Pipeline

Note:
Hazardous Substance locations derived from phase 1 ESA (AECOM, 2011) and historical facility drawings included in Attachment C-1. Numbering matches that provided by Ecology in comments on draft RI/FS Work Plan.

Historical Features of Upland Area

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	NOV-2013	BY: SJG / BTC	FIGURE NO. 2-2
	PROJECT NO. 110207	REV BY: HRL	

GIS Path: T:\projects_8\Kimberly\Clark\Env_Support_110207\Deliverech\RIFS_Workplan\Sept2013\2-02 Historical Features of Upland Area.mxd | | Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet | | Date Saved: 11/25/2013 | | User: hlovelace | | Print Date: 11/25/2013

3 Previous Independent Remedial Actions

This section summarizes previous remedial actions, including environmental investigations and independent cleanups, conducted at the Upland Area. The summary is based on reports provided by K-C supplemented by information summarized in the Phase 1 ESA for the property (AECOM, 2011) where the original documents were not available. The Phase 1 ESA final report can be viewed on Ecology's website using the weblink referenced in Section 1.3. The underground storage tank (UST) investigations described below are associated with Ecology UST ID 5351 and release ID 1624.

For reference, Figure 2-2 depicts historical site features including labeling of the pulp and paper mill buildings, and locations of hazardous substance use/storage within the mill based on historical maps. Attachment C-1 to Appendix C includes annotated copies of historical maps that were sources for the hazardous substance locations depicted on Figure 2-2.

3.1 Remedial Actions during Mill Operations

This subsection summarizes the various independent investigations and cleanups conducted between 1989 and 2011, while the pulp and paper mill was operational.

3.1.1 Removal of Gasoline UST No. 69

UST No. 69, originally installed in around 1966, was formerly located between Buildings 29 and 37 (Figure 3-1). This UST is part of Historical Recognized Environmental Condition (HREC) 1 as identified in the Phase 1 ESA (refer to Section 3.1.14). During removal of this 260-gallon leaded gasoline in 1989, six soil samples and one groundwater sample were collected for chemical analysis. Ethylbenzene was detected in one soil sample and xylenes were detected in four soil samples, all at concentrations less than MTCA Method A soil cleanup levels for unrestricted use. Concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) were not detected in the groundwater sample (Scott Paper, 1989). Scott Paper Company reported the findings to Ecology (AECOM, 2011).

3.1.2 Heavy Duty Shop Soil Removal

In 1990, oily water from the Heavy Duty Shop sump was reportedly diverted to the hog fuel pile area north of the Shop. The Heavy Duty Shop Sump is identified as REC 3 on Figure 3-1. A test pit to 6-foot depth in the release area encountered "oil-saturated wood chips and soil" to a depth of 3 feet. Total petroleum hydrocarbons (TPH) were detected at a concentration of 2,200 mg/kg in a sample of the oily soil. TPH was not detected in two soil samples collected below the oily soil layer.

In 1991, an estimated 40 to 50 cubic yards of visibly stained soil was removed from the release area. The memorandum describing the soil removal (EcoChem, 1991) was submitted to Ecology. No verification of groundwater quality data were collected as part of the cleanup.

3.1.3 Removal and Investigation of Five USTs

Five USTs at the mill property were permanently decommissioned by removal in November and December 1989 (Landau, 1991). The USTs below are part of HREC 1 and are depicted on Figure 3-1. The capacity and contents of the USTs reportedly included the following:

- One 250-gallon unleaded gasoline UST (Tank No. 68);
- One 1,000-gallon diesel fuel UST (Tank No. 70); and
- Three 12,000-gallon Bunker C fuel oil USTs (Tanks No. 71, 72, and 73).

As part of the UST decommissioning activities, soil and groundwater samples were collected and submitted for laboratory analysis. The laboratory analytical results indicated that releases of petroleum hydrocarbons had occurred at each of the UST locations. Based on the data, contaminated soil was excavated from each UST pit location.

Following removal of the five USTs, Landau conducted a subsurface investigation in November and December 1990, to further assess soil and groundwater quality in the vicinity of the USTs. The investigation consisted of advancing seven soil borings, three around UST No. 68 and four around UST No. 70; collecting soil samples for laboratory analysis; completing the seven borings as groundwater monitoring wells; and conducting a groundwater sampling event. Figure 3-1 depicts the approximate locations of the monitoring wells in the two areas.

Applying the screening levels in Section 5, the results of the subsurface investigation were as follows:

- Groundwater flow is toward the shoreline in both areas: southwesterly near UST No. 68, and westerly near UST No. 70. The water table in the UST No. 70 area fluctuated up to 2 feet in response to tidal fluctuations measured during the Phase 2 ESA 72-hour tidal study, while the water table in the UST No. 68 area fluctuated less than 0.3 feet; however, tidal influences do not significantly affect groundwater flow directions in these areas.
- Concentrations of TPH as gasoline (gasoline-range TPH) were detected at concentrations up to 670 mg/kg in soil samples within the footprint of UST No. 68, but the volatile organic compounds (VOCs) benzene, toluene, ethylbenzene, and xylenes (BTEX) were not detected in soil.
- Gasoline-range TPH, benzene, toluene, and xylenes were detected in groundwater samples collected from the three groundwater monitoring wells installed at and generally downgradient of UST No. 68. The detected groundwater BTEX concentrations in the three wells were less than groundwater screening levels for protection of the East Waterway marine environment. Comparison of groundwater concentrations relative to screening levels based on vapor intrusion (VI) is as follows:
  - At the well within the footprint of UST No. 68, detected BTEX concentrations were less than groundwater screening levels based on VI for unrestricted use.

  - Approximately 30 feet to the southwest of UST No. 68, the 1,700 µg/L xylenes concentration detected was greater than the VI-based groundwater screening levels for unrestricted and industrial land uses.
  - Approximately 85 feet south-southwest of UST No. 68, the 7.2 µg/L benzene concentration detected was greater than the VI-based groundwater screening level for unrestricted land use but less than that for industrial land use.
- Concentrations of diesel-range TPH or Bunker C fuel oil were detected in soil samples collected proximate to UST No. 70 at concentrations less than the 2,000 mg/kg soil screening level for unrestricted and industrial land uses, based on potential for accumulation of non-aqueous phase liquid (NAPL; i.e., "free product").
- Diesel-range and/or Bunker C TPH was detected in groundwater samples from the well located south of UST No. 70 (4,400 µg/L), and from the well located west of it (greater than 20,000 µg/L), which exceed a 500 µg/L MTCA Method A groundwater cleanup level that is applied for surface water protection (WAC 173-340-730(3)(b)(iii)(C)). TPH was not detected in groundwater samples from wells located east and north, respectively, of the tank.
- One inch of floating Bunker C product was detected in the recovery sump installed in the tank pit of USTs 71, 72, and 73. No explorations were conducted around these USTs.

Landau recommended that additional groundwater monitoring be conducted to further assess groundwater quality proximate to each of the tanks. Soil or groundwater samples collected during the investigation were not analyzed for polycyclic aromatic hydrocarbons (PAHs).

3.1.4 Investigation in Vicinity of Old Paint Shop

In June 1994, a strong solvent odor and a thin floating layer of a viscous, brown-black substance were observed within a localized length of utility trench excavated proximate to the Central Maintenance Shop (salvage warehouse). The location is reportedly near a historical paint shop that operated until the early 1970s. This area is identified as HREC 5 on Figure 3-1. A grab sample of water within the trench was collected for chemical analysis of gasoline-, diesel-, and oil-range TPH, VOCs, and PCBs. One VOC, p-isopropyltoluene (i.e., 4-isopropyltoluene or p-cymene), was detected in the water sample at a concentration of 11,000 µg/L, along with 380 µg/L gasoline-range TPH. Landau interpreted the p-isopropyltoluene to be a component of turpentine solvent used in the historical paint shop (Landau, 1994b). There are no marine-based or VI-based groundwater screening levels for 4-isopropyltoluene. However, isopropylbenzene (cumene) has been used a surrogate compound for p-isopropyltoluene, based on similar chemical structure, in regulatory programs outside Washington State (Fehling et al, 2011); cumene has a VI-based groundwater screening level of 720 µg/L and no marine-based groundwater screening level.

Subsequently, Landau conducted an investigation in August 1994 to assess soil and groundwater quality in the vicinity of the solvent occurrence. The subsurface investigation consisted of advancing seven soil borings and collecting soil samples and

reconnaissance groundwater samples[4] for laboratory analysis of gasoline-range TPH/BTEX and diesel-range TPH. In addition, the groundwater sample from the boring located west (downgradient) of the solvent occurrence was analyzed for the full suite of VOCs. The approximate locations of the solvent occurrence and associated borings are depicted on Figure 3-1.

The soil samples and the reconnaissance groundwater samples from the seven borings did not contain detectable concentrations of gasoline-range TPH or BTEX. Additionally, no VOCs were detected in the downgradient groundwater sample. The only detectable soil TPH in the eleven soil samples collected was diesel-range TPH - less than 140 mg/kg, well below the 2,000 mg/kg soil screening level - in the boring located southwest of the observed release.

The 1994 investigation results indicate a highly localized historical release of paint thinner, with no evidence for migration of contaminated groundwater at that time. The Work Plan for independent Phase 2 ESA identified no data gaps warranting further exploration for this area (Aspect, 2012a).

3.1.5 UST No. 29 Xylene Release and Independent Cleanup

A release of xylene to soil and groundwater was identified during removal of USTs No. 29 and 67 in 1989 (Landau, 1989). This area is identified as being part of HREC 1 on Figure 3-1. The USTs were positioned end-to-end and were located immediately west of the Paper Machine Building. UST No. 29 was a 12,500-gallon single-walled UST used to store xylene, which was used as a solvent for cleaning certain machinery in the paper mill. UST No. 67 was a 12,500-gallon single-walled UST used to store kerosene. Figure 3-1 depicts the locations of the tanks and their excavation outline, as reported in Landau (1989).

The xylene release was first identified by solvent odors observed during the initial excavation conducted on November 7, 1989. USTs No. 29 and 67 were subsequently removed on November 8, 1989, and excavated soil was stockpiled on site. No release of kerosene was observed during decommissioning of UST 67; however, the xylene release from UST No. 29 was apparent in the UST No. 67 excavation location. During the 1989 UST decommissioning, removal of contaminated soil on the excavation's north wall was restricted by the tank pad and secondary containment wall for the Pulp Chests located immediately north of the USTs, and currently in place.

During the 1989 tank removal activities, a process water drain line was broken and approximately 15,000-gallons of wastewater from the No. 1 and No. 2 paper machines filled the excavation. An oily sheen was observed on the water surface within the excavation. Water sample TS-29 was collected from the excavation for laboratory analysis, and absorbent pads were applied to limit oil material from entering the broken water line. The water line was subsequently repaired on November 9, 1989. After notifying Ecology, approximately 15,000 gallons of water were pumped from the excavation into a Baker tank for temporary storage, and subsequent treatment, on site.

[4] Grab groundwater samples collected from the soil borings during drilling; no monitoring well was installed.

Water sample TS-29, collected from the excavation, was submitted for laboratory analysis of TPH (U.S. Environmental Protection Agency [EPA] Method 418.1) and VOCs (EPA Method 8240). A TPH concentration of 310,000 µg/L was detected in the water sample by the 418.1 method, which is not specific to petroleum fraction. Subsequent analysis of water sample TS-29 by Modified EPA Method 8015 detected a concentration of 1,900,000 µg/L gasoline-range hydrocarbons, while kerosene was not detected. Total xylenes, ethylbenzene, and toluene were also detected in excavation water sample TS-29 at concentrations of 770,000 µg/L, 160,000 µg/L, and 4,800, µg/L, respectively. Benzene was not detected. Ethylbenzene and toluene are reportedly impurities in technical grade xylene (Landau, 1989).

In addition, Landau collected a sample of water stored in the Baker tank (BT-1) for analysis of BTEX. Detected concentrations in water sample BT-1 were 120,000 µg/L total xylenes, 20,000 µg/L ethylbenzene, and 2,100 µg/l toluene; benzene was not detected.

Following testing to confirm that the mill's wastewater treatment system could adequately treat the contaminated water, and after receiving verbal approval from Ecology, the Baker tank water was discharged to the mill's secondary wastewater treatment plant at a maximum feed rate of 15 gallons per minutes (gpm) for treatment (Scott Paper, 1990).

Within the final limits of the UST No. 29/67 excavation, four discrete soil samples were collected from each of the excavation sidewalls at a depth of approximately 4 feet below ground surface (bgs). A composite soil sample was also collected from the stockpile of excavated soil. The five soil samples were submitted for laboratory analysis of TPH by EPA Method 418.1, and BTEX.

As observed with the water data, the soil analytical data showed highest concentrations of xylenes with lower concentrations of ethylbenzene and much lower concentrations of toluene. In the four excavation sidewall soil samples, the lowest concentrations were detected in the eastern sidewall (0.75 mg/kg xylenes, 0.048 mg/kg ethylbenzene; and non-detect TPH, benzene, and toluene), and the highest concentrations were detected in the northern sidewall (37,000 mg/kg xylenes; 6,600 mg/kg ethylbenzene; 5,700 mg/kg TPH; and non-detect benzene and toluene). The sample of stockpiled soil contained 2,800 mg/kg xylenes, 590 mg/kg ethylbenzene, and no detectable benzene or toluene. The UST No. 29 excavation was backfilled with the stockpiled soil removed from the UST excavation (Landau, 1989).

Landau then installed a test soil vapor extraction (SVE) system on top of the impacted backfill soil to passively remove vapors and for potential use as an active vacuum extraction system. The SVE piping was encased in an approximately 2-foot layer of pea gravel placed on top of the soil backfill, which was covered with a high density polyethylene (HDPE) liner and resurfaced with asphalt. Scott Paper Company informed Ecology of the SVE system operation plans (Scott Paper, 1991).

Landau initiated startup of the SVE system with two 4-hour tests conducted on November 22 and December 2, 1991. The primary purpose of the tests was to measure the expected mass discharge rate of xylenes from the SVE system to assess compliance with a 15-pound-per-day (lb/day) rate dictated by the Puget Sound Air Pollution Control

Agency (PSAPCA). Based on the tests, Landau calculated an expected mass flow rate of 1.3 lb/day from the SVE system. Following review of those results, Landau initiated continuous operation of the SVE system on January 10, 1992, and recommended that operation of the SVE system continue until the mass discharge flow rate fell below 0.1 lb/day (Landau, 1992).

The SVE system operated on a near-continuous basis from startup in November 1991 through January 1993. From January 1993 through mid-1994, the SVE system was periodically shut down for 1- to 3-month periods and then restarted to operate on a pulsing basis. In mid-1994, laboratory analytical results indicated that the mass flow rate generated from the SVE system no longer warranted continued operation, and Landau initiated a compliance monitoring investigation of the tank area to assess whether the cleanup action had attained applicable cleanup standards.

The June 1994 compliance monitoring investigation consisted of (Landau, 1994a) the following:

- Advancing nine direct-push soil borings to a depth of approximately 9 feet bgs in areas adjacent to and within 100 feet west (downgradient) of the UST No. 29/67 excavation;
- Collecting and analyzing for BTEX six soil samples from five borings located around and downgradient of the excavation;
- Collecting and analyzing for BTEX grab groundwater samples from five downgradient borings; and
- Collecting and submitting vapor samples from the SVE system for laboratory analysis of BTEX.

In soil borings located immediately north of the excavation, detected concentrations of total xylenes ranged from 123 mg/kg in the vadose zone to 2,990 mg/kg in the saturated zone. In 1989, prior to operation of the SVE system, xylenes had been detected at 26,000 mg/kg in soil sample collected from the north excavation sidewall, and located adjacent to the 123 mg/kg sample, suggesting a substantial concentration decline in vadose zone soil at the excavation location. Within 10 feet west of the excavation, detected soil xylenes concentrations declined to less than 7 mg/kg. Xylenes were not detected in the soil sample collected approximately 50 feet west of the excavations.

Concentrations of total xylenes detected in the grab groundwater samples declined with increasing downgradient distance. Xylenes were detected at a concentration of 30,560 µg/L in the groundwater sample collected about 35 feet west of the excavation's western end. Approximately 60 feet west of the excavation, the detected groundwater xylenes concentration was 315 µg/L. In borings positioned 25 to 30 feet north and south of that location, xylenes were detected in groundwater at 5.1 µg/L and 1.5 µg/L, respectively. Approximately 90 feet west of the excavations, xylenes were not detected in the groundwater sample collected. Ethylbenzene concentrations in the groundwater samples were lower than detected xylenes concentrations. Low-level concentrations of benzene and/or toluene were also detected in the groundwater samples collected.

Based on the collective data collected during the 1989 UST removal and in 1994, Landau (1994a) concluded the following:

- In 2.5 years of operation, the SVE system had been effective in reducing xylene concentrations in soil located above the water table in the excavation area.
- Further operation of the SVE system was not warranted since vapor-phase VOC concentrations generated by the system were no longer detectable.
- Residual xylene-contaminated soil may be concentrated on the north side of the tank excavation area, beneath the adjacent tank pad.
- The downgradient extent of xylene and ethylbenzene in groundwater was defined within approximately 100 feet of the excavation area, and the contamination was not impacting downgradient receptors. Additional groundwater monitoring would be required to demonstrate conclusively that natural attenuation of residual xylene is occurring.
- More aggressive remedial measures for the xylene release would require removal of operating infrastructure, the cost of which was not warranted because the plume was contained and appeared to be attenuating naturally.

Scott Paper Company submitted to Ecology the Landau reports regarding the UST No. 29 release identification and independent cleanup activities. In August 1994, Scott notified Ecology of plans to shut down the SVE system and requested Ecology authorization to do so (Scott Paper, 1994). Ecology responded that the cleanup was an independent action taken by Scott Paper and thus made no determination on sufficiency of the cleanup (Ecology, 1994). In 2002, Ecology listed the Facilities Leaking Underground Storage Tank (LUST) ID No. 1627 as inactive.

3.1.6 Independent Soil Cleanup in Bunker C Fuel Oil AST Area

Under the terms of Regulatory Order DE 93-AQI064 for Scott Paper's cogeneration boiler, the mill needed to convert from Bunker C fuel oil to diesel as a backup fuel source. At the time of the conversion in 1995, two ASTs remained in the Bunker C fuel oil AST farm on the north side of the distribution warehouse: one 1,596,000-gallon Bunker C fuel oil tank and one 211,000-gallon caustic soda tank (which historically also contained oil). These ASTs were identified as being part of REC 2 in AECOM's Phase 1 ESA (Figure 3-1). The tank farm area had an earthen surface enclosed by a tall concrete wall. Shallow soil samples collected at that time "show oil contamination next to the tank, which decreases rapidly when moving away from it" (Scott Paper, 1995a).

Prior to decommissioning and removal of the Bunker C fuel oil and caustic ASTs, surface soil from around the standing tanks was excavated and disposed of at Associated Sand and Gravel (now CEMEX), an off-site facility licensed for the handling of soil containing Bunker C fuel oil. Visual inspection indicated that the oil contamination had been removed, and none of the soil removed contained elevated pH (Scott Paper, 1995b). CH2M Hill reportedly was to collect soil samples following soil removal within the tank farm area, but a report of such activities has not been found. A 1997 letter to Ecology (K-C, 1997a), following removal of the ASTs, concluded, based on hydrocarbon fingerprinting soil sampling results, that the petroleum in the AST area is likely not the same material present at the ExxonMobil ADC site south of K-C's warehouse; the letter also indicates the intent to further characterize hydrocarbon contamination in the area.

3.1.7 U.S. Navy's Independent Cleanup of Naval Reserve Parcel

K-C engaged in a land exchange with the U.S. Navy in the mid-1990s. The land exchange deeded K-C land at the north end of the mill property to the U.S. Navy in exchange for a Naval Reserve property located between the paper mill and the new secondary treatment plant. According to Mr. Robert Waddle, formerly of K-C, the land deeded to K-C from the U.S. Navy in the property transaction included Tax Parcel No. 29051900201300 (Figure 2-1). As part of the exchange agreement, the U.S. Navy agreed to remediate contamination previously identified on that parcel (K-C, 1997b). This area is identified as HREC 2 on Figure 3-1.

Foster Wheeler (1998) documents the U.S. Navy's independent cleanup of the Naval Reserve Parcel as part of the land exchange. According to the report, the Naval Reserve Center was commissioned in 1949 and served as the administrative and operations center for local naval reserve activities. From 1947 to about 1981, naval vessels regularly docked at the Naval Reserve Center dock, which remains in place. The Naval Reserve Center included a combined garage/shop, boiler room, and diesel generator room (Building 1); and to the east, a Firing Range (Building 2). Two diesel USTs (5,000 gallon Tank 1 and 3,000 gallon Tank 2) were located immediately south of the boiler room and supplied fuel for the steam boiler and electrical generator.

The two diesel USTs were removed in July 1996. A hole was observed in Tank 1 during its removal. No visible flaws were documented for Tank 2 during its removal. Following removal of the USTs, Foster Wheeler collected confirmation soil samples from the excavation. Diesel-range TPH soil contamination was detected within the excavation around each of the tanks, with detected TPH concentrations up to 16,000 mg/kg.

Based on that first round of confirmation sampling, the excavation pits were over-excavated and sampled again. The excavation depth was approximately 12 feet, extending below the water table. In addition to the tank pits, an exploratory test pit was excavated and sampled approximately 5 feet south of the southern excavation limit. The inferred location of the final excavation limit, based on unscaled maps in the report, is shown on Figure 3-1. The petroleum-contaminated soil was removed for off-site thermal desorption.

Following over-excavation, a second round of excavation verification soil samples indicated residual diesel contamination present on the excavation bottom and south of the excavation. Diesel-range TPH was detected at 42,000 mg/kg in the sample of soil from the bottom of the excavation near its center. TPH was not detected in samples collected on the south, north, and west sidewalls, respectively, of the excavation. The soil sample collected on the east sidewall contained 260 mg/kg diesel-range TPH.

Three soil samples were collected from different depths in the exploratory test pit just south of the excavation. Detected diesel-range TPH was not detected in the 5-foot sample, but was detected at concentrations of 53,000 mg/kg and 7,000 mg/kg in the 7.5-foot and 9-foot soil samples, respectively.

According to the report, "groundwater and pilings driven randomly spaced at about 8-feet bgs impeded further excavation; therefore, soil excavation was suspended and the pits backfilled with pea gravel to approximately 1 foot above groundwater. The remaining excavations were filled to grade with clean backfill material."

The report also states that additional TPH-contaminated soil identified beneath the boiler room was removed, but does not provide location information or verification soil sample data for the excavation. Likewise, the report states that 15 cubic yards of lead-contaminated soil was removed from beneath the Firing Range building, but does not provide location information or verification soil sample data for the excavation.

In August 1997 through October 1998, following demolition of the facility structures, Foster Wheeler conducted characterization soil sampling and analysis from the USTs area, adjacent bilge water tank location and flammable material storage shed, and the Firing Range area. Twenty-four drilled soil borings were advanced to depths of approximately 10 feet in the Building 1 area to characterize soil quality around the USTs, bilge water tank location, and flammable material storage shed. Four additional hand-augered borings were also sampled to depths of 1.25 feet around the flammable material storage shed. Twenty-one hand-augered borings were sampled to depths of 3 feet at the Firing Range. The first 14 borings were sampled in September 1997, and the last seven in October 1997; the report presents locations only for the first 14 borings.

Following soil removal and site restoration, two monitoring wells were installed in the most contaminated areas to monitor groundwater quality as a reflection of the soil removal effectiveness. The wells were identified as North Well and South Well, but the report does not present locations for them. The January 1998 groundwater samples collected from the two wells contained no detectable TPH or BTEX, and concentrations of the PAHs acenaphthene, fluorene, and naphthalene (up to 4 µg/L) were less than respective groundwater screening levels. Based on the June 21, 1999, report transmittal letter from the U.S. Navy to K-C, the wells were decommissioned.

3.1.8 Investigation of Bulk Fuel Facilities

On behalf of K-C, Chevron, Texaco, and BNSF, Pacific Environmental Group (PEG) conducted a subsurface investigation to assess petroleum contamination previously encountered adjacent to the City of Everett Combined Sewer Outfall (CSO) line which runs east-west immediately south of the K-C shipping warehouse in the southeast corner of the mill property, within the Everett Avenue easement (see REC 1 on Figure 3-1). In 1995, petroleum product had been observed discharging from the CSO line into the East Waterway. Investigation determined that petroleum product was entering a segment of the CSO line that was constructed of clay tiles which had settled and cracked. In summer 1996, portions of the CSO line were replaced, and the remaining portions of it were slip-lined. Reportedly, 1,450,800 gallons of water and 23,050 gallons of petroleum product were removed by dewatering conducted during the construction (AMEC, 2010).

The purpose of the PEG (1998) investigation was to evaluate soil and groundwater quality in the vicinity of petroleum bulk facilities located north of the CSO (Standard Oil and Tidewater/Associated Oil Company facilities on K-C property) and south of it (on ExxonMobil/American Distributing Company [ADC] site) to assess whether the historical facilities contributed to petroleum contamination documented at the CSO line. In the Phase 1 ESA for the mill property (AECOM, 2011), the facilities on the K-C property constituted Recognized Environmental Condition (REC) 2, whereas the facilities on the ExxonMobil/ADC Site constituted REC 1.

The investigation consisted of advancing 17 soil borings; collecting and analyzing soil samples from three borings based on field screening; collecting and analyzing reconnaissance groundwater samples from 14 borings; completing two borings as groundwater monitoring wells inside of the K-C warehouse; and collecting groundwater samples from the wells. The approximate locations of the borings and monitoring wells are depicted on Figure 3-1.

Concentrations of TPH and BTEX detected in the three soil samples were well less than unrestricted soil screening levels (TPH less than 150 mg/kg, and negligible BTEX). The highest groundwater concentrations of diesel-range plus oil-range TPH (91,000 to 100,000 µg/L) were detected in groundwater samples collected from two locations adjacent to the CSO line. Those two groundwater samples also contained gasoline-range TPH (327 µg/L and 736 µg/L, respectively), but BTEX concentrations were less than groundwater screening levels for marine protection and VI protection.

Much lower groundwater TPH concentrations (non-detect to 430 µg/L) were detected at the two wells located within the footprint of the K-C warehouse. These low, dissolved-phase groundwater concentrations are not indicative of free-phase petroleum in the vicinity. As such, the data indicated that the source of TPH encountered along the CSO line did not migrate from beneath the K-C warehouse to the north.

TPH concentrations exceeding respective screening levels were detected in selected wells located in the area of the Associated Oil Company fuel facilities, and to the west along a Bunker C fuel oil pipeline that reportedly ran from the slip shoreline to the tank farm. No PAH analyses were conducted in the investigation.

The cover letter transmitting the PEG (1998) report to Ecology states, “Based on the results of this investigation, we believe it is impossible to conclude that the free product found in the CSO Line is the result of operations at the Chevron and Tidewater properties, now owned by Kimberly-Clark. Additionally, fuel fingerprinting analysis, conducted during the CSO Line repairs, showed a strong correlation between the fuel oil from the CSO Line and the free product recovered from wells at the Mobil/American Distributing site. Based on these results, we believe there is no reason to maintain any link between the bulk plants and the Mobil/American Distributing/CSO problem” (Texaco, 1998).

3.1.9 PCB Decontamination of Substations

K-C removed polychlorinated biphenyl (PCB)-containing equipment from the mill between 1995 and 2004 (AECOM, 2011). After cleaning concrete pads beneath electrical transformers 5 and 6 within Screen/Bleach Unit 2, the concrete was found to contain residual PCB concentrations greater than the EPA cleanup level based on wipe sampling. The concrete was removed, and soils beneath them sampled for PCBs. PCB concentrations in the subgrade soils contained 1.4 and 3.4 mg/kg, greater than the 1 mg/kg unrestricted soil screening level and less than the 10 mg/kg industrial soil screening level.

Appendix C provides a discussion of PCB management at the mill since the 1980s, including agency inspections, based on available information. Attachment C-1 to Appendix C includes a 1985 facility drawing depicting locations of 47 transformers, 40 of which were PCB-containing, within the mill. PCB-containing transformer locations are depicted on Figure 2-2.

3.1.10 Removal of UST No. 68R

In November 1999, BEK McDonnell Engineering (BEK) conducted a site assessment during the permanent decommissioning by excavation and removal of a 500-gallon unleaded gasoline UST and associated dispensing pump located northwest of the K-C warehouse. UST 68R was identified as part of HREC 1 in AECOM's Phase 1 ESA (Figure 3-1). BEK's site assessment consisted of collecting and analyzing three soil samples from the final limits of the UST excavation, one sample from under the pump island, and completing Ecology's site assessment checklist.

BEK reported that the removed UST was in very good condition, with no visual evidence of corrosion or holes. BEK reported that groundwater was not observed in the tank pit prior to removal of the tank; however, a slight gasoline sheen was observed on pea gravel at the base of the tank pit. A pressurized water line was present within the tank pit and was supported beneath by gravel fill. To avoid disturbance of the water line, the fill was not removed; therefore, soil sampling beneath it was not conducted.

Gasoline-range TPH and BTEX were not detected in the four soil samples collected from the tank pit. Based on the results of the site assessment, BEK concluded that contamination was not present in the tank pit or adjacent pump island area. Although the base of the tank pit was reportedly above the water table, gasoline sheen was reportedly observed at the pit base, but there were no data to verify whether groundwater had been impacted.

3.1.11 Bunker C Fuel Oil Soil Removal, Bleach Unit 2

During the 1999 construction of Screen/Bleach Unit 2 and associated relocation of a water line at the northeast corner of Screen/Bleach Unit 1, soil contaminated with Bunker C fuel oil was reportedly encountered (HREC 3 on Figure 3-1). The inferred source was an abandoned fuel pipeline between the fuel tank farm on the south and the boiler house on the north. An estimated 15 cubic yards of contaminated soil was removed and disposed of during the 1999 construction project. No sampling was conducted within the excavation following soil removal (K-C, 1999).

3.1.12 Latex Spill Investigation

Aspect (2009) conducted an investigation to evaluate a release of latex product (AIRFLEX® EN1165) that occurred proximate to the southwest corner of the tissue mill between September and November 2008 (see REC 6 on Figure 3-1). The latex product contained less than 1% vinyl acetate and less than 0.1% acetaldehyde, 1,4-dioxane, ethylene oxide, and formaldehyde. K-C used the latex in manufacture of household paper towels and unloaded it from tank cars at the terminus of a rail spur that runs along the loading dock.

K-C discovered the spill when latex was observed seeping out of the ground next to the loading dock during pumping operations. The spill occurred from subsurface piping,

which may have been damaged when a tank car derailed at the spur terminus in September 2008. Upon discovery of the spill, the subsurface pipeline was immediately taken out of service and replaced with a temporary above-grade pipeline. Based on unloading records, K-C estimated that up to 250,000 pounds (roughly 28,000 gallons) of product were spilled.

After learning of the release, K-C notified Ecology regarding the spill and conducted an investigation into the chemical properties of the latex product to determine its hazard potential. Using data supplied by the vendor, and confirmatory laboratory analysis of the as-delivered product for formaldehyde content, K-C determined that the spill did not constitute a reportable quantity under 40 CFR 302 and 40 CFR 355. Between February and April 2009, K-C removed approximately 15,500 gallons of the spilled product from beneath the mill using vacuum extraction (vactor truck). During the final removal effort, the flow of product from beneath the tissue mill building dissipated to a trickle.

Based on an evaluation of the collective information, Aspect (2009) concluded that the residual latex product poses negligible environmental concern and no adverse threat to industrial workers at the mill property, and that it would be impracticable to attempt removal actions more aggressive than ongoing vactor truck recovery of visible product.

3.1.13 Characterization of Soil Removed from Sand Filter 1 Foundation (Old Boiler House)

In 2011, CRETE Consulting conducted sampling and analysis of stockpiled soil to profile it for off-site disposal. The soil had been excavated from within the 7, 8, & 9 Old Boiler House Building (Steam Plant), adjacent to Dutch Ovens 1 through 5, to allow construction of the foundation for new Sand Filter 1 (REC 5 on Figure 3-1).

A composite sample of the stockpiled soil was collected for analysis of gasoline-, diesel- and oil-range TPH, Resource Conservation and Recovery Act (RCRA) 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver), and lead (by the toxicity characteristic leaching procedure [TCLP]). In addition, a discrete soil sample was collected for VOC analysis, and a discrete sample of soil suspected of containing spent sulfite liquor (SSL) was analyzed for RCRA 8 metals.

Concentrations of arsenic (35.4 mg/kg) and cadmium (5.2 mg/kg) in the composite soil sample exceeded the respective soil screening levels for unrestricted site use. The sample containing suspect SSL had no detected concentrations greater than unrestricted soil screening levels, and VOCs were not detected in the discrete sample. The 57 tons of stockpiled soil was properly disposed of at Roosevelt Regional Landfill (CRETE, 2011).

3.1.14 Phase 1 ESA

In April 2011, AECOM conducted a Phase 1 ESA for the mill property, in accordance with American Society for Testing Materials (ASTM) Standard E1527-05 (AECOM, 2011). Based on the results of the Phase 1 ESA, AECOM identified the following seven recognized environmental conditions (RECs) at the mill property (Figure 3-1):

- **REC 1: ExxonMobil/ADC Site**, a portion of which is on K-C's property (Everett Avenue easement). Prior independent remedial actions for this area are described in Section 3.1.8;

- **REC 2**: **Oil House and Gasoline/Bunker C Fuel Oil ASTs**. Prior independent remedial actions for this area are described in Sections 3.1.6 and 3.1.8;
- **REC 3: Heavy Duty Shop Sump**. Prior independent remedial actions for this area are described in Section 3.1.2;
- **REC 4: Rail Car Dumper Hydraulic System Building**. Aspect is aware of no prior investigation activities for this area;
- **REC 5: Dutch Ovens 1 through 5**. Prior independent remedial actions for this area are described in Section 3.1.13;
- **REC 6: Latex Spill Area**. Prior independent remedial actions for this area are described in Section 3.1.12; and
- **REC 7: East Waterway**. The East Waterway, which includes the In-Water Area of the Site, is outside of the Upland Area addressed in this RI/FS. The East Waterway will be addressed in its own RI/FS under a separate Agreed Order with Ecology.

The Phase 1 ESA also identified six historical RECs (HRECs), which "in the past would have been considered a REC but may or may not be considered a REC currently." The six identified HRECs are as follows (Figure 3-1):

- **HREC 1: UST Removals (UST Numbers 29, 67, 68, 68R, 69, 70, 70R, 71, 72, and 73)**. The ten USTs were removed and reported, including any detected releases, to Ecology. Ecology inactivated the LUST ID number for the mill property in 2002. There are reportedly no active USTs currently on the mill property (AECOM, 2011). Prior independent remedial action activities for these USTs are described in Sections 3.1.1, 3.1.3, 3.1.5, and 3.1.10. UST No. 70R was reportedly a 2,000-gallon diesel UST installed in 1989 (double-walled tank, cathodic protection, overflow sensor) in the same location as UST No. 70; it was decommissioned by removal in 1995 (AECOM, 2011). Aspect is aware of no sampling conducted during the decommissioning of UST No. 70R;
- **HREC 2: Naval Reserve Property**. Prior independent remedial actions for this area are described in Section 3.1.7;
- **HREC 3: Bleach Unit 2 (area of Bunker C fuel oil soil removal)**. Prior independent remedial actions for this area are described in Section 3.1.11;
- **HREC 4: PCB Transformer**. Prior independent remedial actions for this area are described in Section 3.1.9;
- **HREC 5: Paint Shop**. Prior independent remedial actions for this area are described in Section 3.1.4; and
- **HREC 6: Rail Car Dumper Containment Vault Valve**. This area was defined based on a valve failure which allowed release of 2 gallons of hydraulic fluid to the East Waterway in 1995. The spill was contained, cleaned up, inspected by Ecology, and the matter closed (ERNS No. 547098). Aspect is aware of no prior investigation activities for this area.

3.2 Independent Phase 2 ESA

Aspect (2013) performed an independent Phase 2 ESA in 2012 to address data gaps identified from the prior environmental investigations summarized in Section 3.1, including the RECs/HRECs identified in AECOM's (2011) Phase 1 ESA. K-C completed the Phase 2 ESA as an independent remedial action prior to execution of the Agreed Order; however, it was conducted with informal consultation from Ecology, and it was intended to meet the requirements for substantial equivalence under WAC 173-340-515 involving independent remedial actions. Samples were taken and laboratory analyses were conducted consistent with MTCA requirements. The independent Phase 2 ESA supported, and did not foreclose, selection of a cleanup action consistent with MTCA requirements. The Phase 2 ESA was conducted as a phased investigation program in three rounds (February, May–July, and August–September of 2012). The Phase 2 ESA final report can be viewed on Ecology's website using the weblink referenced in Section 1.3.

In February 2012, Aspect conducted Round 1 of the Phase 2 ESA to initiate the evaluation of environmental conditions in three areas of the Upland Area. A Work Plan for the independent Phase 2 ESA was subsequently prepared (Aspect, 2012a). The objectives of the Work Plan were to:

- Synthesize the prior environmental investigation and cleanup information for the Upland Area (including the Round 1 data);
- Identify data gaps in the prior environmental investigation/cleanup information and other historical information; and
- Define an environmental assessment scope of work to address the identified data gaps.

K-C submitted a draft Work Plan to Ecology for review and comment. Ecology provided expedited review and written comments on the draft Work Plan (Ecology, 2012a). Many but not all of the comments were incorporated, and a final Work Plan was prepared (Aspect, 2012a). The assessment scope of work included in the Work Plan constituted Round 2 of the independent Phase 2 ESA. The Work Plan acknowledged that, following completion of the assessment scope of work it defined, an additional round of data collection may be warranted to further define the contaminant nature and extent in the Upland Area.

Based on findings from Rounds 1 and 2, an Addendum to the Phase 2 ESA Work Plan (Aspect, 2012b) was prepared, which outlined the rationale and scope of work for an additional round (Round 3) of assessment. The Round 2 data and proposed Round 3 scope of work were discussed with Ecology at that time.

In total, the Phase 2 ESA included completion of 106 soil borings, 49 of which were constructed as groundwater monitoring wells, completion of about 1,200 chemical analyses of soil and 570 chemical analyses of groundwater, and collection of site-wide hydrogeologic information including completion of a tidal study. The soil data collected were compared against soil screening levels for both industrial and unrestricted land uses. The results of the Phase 2 ESA are presented in the *Data Report for Phase 2 Environmental Site Assessment* (Aspect, 2013). The scope and results of the Phase 2 ESA are summarized very briefly below.

- Investigated the presence of petroleum hydrocarbons in soil and groundwater within the Standard Oil bulk fuel facilities located beneath and west of the distribution warehouse. Documented petroleum concentrations in soil greater than screening levels at several of the locations, and petroleum groundwater concentrations less than screening levels at all locations.
- Investigated the extent of petroleum hydrocarbons in soil and groundwater within the Associated Oil ASTs area (REC 2, immediately north of distribution warehouse). K-C recommends that an interim action soil removal be conducted in this area.
- Installed one boring to investigate potential impacts to soil and groundwater in the Heavy Duty Shop Sump area (REC 3), where previous soil excavation was conducted to address a discharge of oily water from the sump. The investigation did not identify petroleum impacts to soil or groundwater.
- Identified elevated concentrations of metals (arsenic, copper, lead, mercury, nickel, zinc) in groundwater downgradient of the Old Boiler/Dutch Ovens (REC 5), and investigated for a potential source of metals in upgradient soils. Metals were not detected at concentrations greater than the screening levels in soil and the source of metals to groundwater at this location was not identified.
- Investigated the extent of xylenes in soil and groundwater, associated with a release from xylene UST 29 (HREC 1), and a co-located release of latex product (REC 6). K-C recommends that an interim action soil removal be conducted in this area.
- Investigated soil and groundwater quality in the areas of USTs (No. 68, 68R, 69, 70/70R, 71/72/73; HREC 1), removed in the 1980s to1990s, to document current conditions where petroleum releases were previously reported to have occurred. Interim action removal of petroleum-impacted soil from the area of USTs No. 70/70R and 71/72/73 is recommended.
- Investigated the nature and extent of TPH in soil and groundwater in the vicinity of the USTs along with metals in shallow soil in the Firing Range area of the Naval Reserve Parcel (HREC 2).
- Investigated the quality of fill in the Log Pond Area and groundwater quality at the shoreline immediately downgradient of the Log Pond fill. Hazardous substances were not detected in soil exceeding unrestricted screening levels, and only low-level metals (arsenic, copper, and nickel) and ammonia were detected in groundwater greater than screening levels.
- Investigated potential impacts to soil and groundwater associated with the Acid Plant; the results indicated near-neutral pH of both soil and groundwater and no other indication of an acidic release.
- Investigated soil and groundwater quality at the Central Maintenance Shop, aka the Salvage Warehouse which, according to the 1994 facility drawing, included a PCB waste accumulation area on its south side. This structure is also labeled as the Auto Shop on the 1996 facility drawing (see Attachment C-1 to Appendix C). The investigation identified total PCBs in shallow soil beneath the building at concentrations greater than the unrestricted screening level and less than the industrial soil screening level, and groundwater petroleum and PAH

concentrations (suggestive of creosote) greater than respective groundwater screening levels. PCBs were not detected in either soil sample collected from the General Fill boring installed on the south side of the Shop, where PCB wastes were reportedly accumulated.

- Investigated soil and groundwater quality at the Old Machine Shop. The investigation identified total PCBs and lead in shallow soil beneath the building at concentrations greater than unrestricted screening levels and less than industrial soil screening levels, and dissolved nickel and ammonia concentrations greater than respective groundwater screening levels. In addition, copper was detected at 265 mg/kg in one soil sample, above a preliminary unrestricted soil screening level based on leachability to groundwater (defaults to 36 mg/kg natural background soil concentration); however, groundwater copper concentrations in the Old Machine Shop monitoring well were below the conservative groundwater screening level.
- Investigated soil and groundwater quality in the Boiler/Baghouse Area. Metals (arsenic, copper, lead, mercury, zinc), diesel-/oil-range petroleum, naphthalene, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and dioxins/furans were detected in one or more soil samples at concentrations greater than respective unrestricted screening levels; lead concentrations also exceeded the industrial soil screening level. The groundwater sample from well Boiler-MW-1 contained only a marginal exceedance for total cPAHs, as well as dissolved copper concentrations greater than its screening level. The high concentrations of Bunker C fuel oil in soil of this area are interpreted to be associated with the adjacent Bunker C fuel oil USTs No. 71/72/73, possibly indicating a subsurface pipeline from the USTs to the boiler. The oil-contaminated soil is recommended for removal in conjunction with the USTs No. 71/72/73 interim action; a subsurface fuel pipeline(s), if present, will be removed in the interim action also. Removal of metals-contaminated soil in this area is also recommended as an interim action.
- Investigated soil and groundwater quality at the Hazardous Waste Cage located on the north side of the Log Pond fill. The investigation identified lead in one soil sample greater than the unrestricted soil screening level and less than the industrial screening level; detected arsenic and total cPAH concentrations in soil also exceeded respective unrestricted soil screening levels. Soil concentrations of copper, nickel, and zinc also exceeded respective unrestricted soil screening levels based on groundwater protection – screening levels which are equal to natural background concentrations and thus very conservative. Concentrations of dissolved arsenic, copper, and nickel were detected in groundwater at concentrations greater than respective groundwater screening levels.
- Investigated soil and groundwater quality at the Diesel AST Area (Figure 3-1), which includes the AST (within secondary containment structure) and associated diesel pump station that began operation in the mid-1990s. The investigation identified oil-range petroleum in surficial soil west of the Diesel AST, which does not appear related to it. The groundwater sample at that location had no exceedances. Detected concentrations of petroleum in soil from borings next to the AST and diesel pump house were less than screening levels, while total cPAHs and naphthalene were greater than unrestricted screening levels in one or

more soil samples. The groundwater sample from that location contained no exceedances for petroleum or naphthalene, and a marginal exceedance for total cPAHs.

- Investigated potential impacts to soil and groundwater associated with the Hydraulic Barker Building. The results identified concentrations of oil-range petroleum hydrocarbons and cPAHs in soil exceeding unrestricted soil screening levels. Soil concentrations of copper, mercury, and zinc also exceeded respective unrestricted soil screening levels based on groundwater protection, but detected groundwater concentrations were less than respective groundwater screening levels.
- Conducted Upland Area-wide sampling and analysis of the fill soil at 15 accessible locations outside of distinct operational areas ("General Fill"). The results detected diesel-/oil-range petroleum hydrocarbons, cPAHs, lead, and/or dioxins/furans greater than the screening levels at one or more of 15 locations. Follow up assessment included the following:
    - Additional investigation was conducted to further delineate the petroleum exceedance detected in saturated soil at the GF-B-9 location. Petroleum exceedances were not detected in immediately downgradient groundwater, but the lateral extent of soil petroleum exceedances was not defined. The distribution of PAHs in the 10- to 11-foot soil sample from GF9-MW-1 suggests a creosote-like source.
    - Additional investigation was conducted to further delineate the shallow soil lead concentration (659 mg/kg) exceeding the unrestricted screening level at the GF-B-11 location, which is recommended for interim action removal. The soil lead at this location will designate as characteristic hazardous waste (TCLP lead greater than 5 mg/L) once it is excavated, and will require stabilization treatment to reduce TCLP leachability prior to land disposal.
    - Oil-range TPH detected in shallow soil at the GF-B-14 location is attributed to adjacent contamination from the Associated Oil Company ASTs area, and is recommended for removal as part of the interim action for that area.
- Evaluated groundwater quality in monitoring wells located on the upgradient (east) side of the Upland Area and along the shoreline downgradient (west) of it (most wells were sampled twice; some shoreline wells had one sample and some had three samples). It's noted that the majority of wells were sampled only during the dry season between June and September 2012 (only six of the wells had both wet and dry season sampling). Metals (arsenic, copper, nickel and/or zinc) and ammonia were the only constituents detected exceeding respective screening levels in groundwater collected from the 15 shoreline wells. Arsenic, copper, nickel, and ammonia exceedances were commonly detected in groundwater across the Upland Area, and may be influenced by geochemically reducing conditions in the organic-rich fill from which the uplands were created. The detected total ammonia groundwater concentrations in two shoreline wells – MW-06 and NRP-MW-03 – exceeded a 10 mg/L no observable effects level, but

none of the detected concentrations exceeded a 20 mg/L minor effects level (biological effects levels from Kendall and Barton, 2004). Detected metals were less than screening levels in groundwater from the two upgradient wells.

The data gaps to be addressed in the Upland Area RI have been defined primarily based on the findings of the independent Phase 2 ESA, as described in more detail in Section 6.

3.3 Interim Action

In accordance with the Agreed Order, an interim action is being conducted following mill demolition activities. The Interim Action Plan (Aspect, 2012c), which is included as Exhibit C of the Agreed Order, presents the general interim action approach.

The interim action (i.e., opportunistic cleanup) will involve excavation and proper off-site disposal of known areas of contaminated soil, with concurrent dewatering to facilitate soil removal and handling. As such, the interim action will involve permanent removal of contaminated soil and/or groundwater, to the maximum extent practicable, to meet interim action soil cleanup levels that have been agreed upon with Ecology. In the Interim Action Plan, the interim action soil cleanup levels were established to apply if an unrestricted land use is selected. However, the Interim Action Plan states that, if, during the course of the interim action, it becomes known that the Upland Area will remain in industrial land use (consistent with WAC 173-340-200 [definitions] and -745), interim action soil cleanup levels for an industrial land use can be applied, subject to prior discussion with and approval by Ecology.

The interim action will not conflict with or eliminate reasonable alternatives for the final Upland Area cleanup action in accordance with WAC 173-340-430(3)(b).

The following interim action areas, depicted on Figure 3-1, have been tentatively identified based on the results of the Phase 2 ESA, previous investigations, or observations from demolition:

- TPH-contaminated soil at the Associated Oil Company ASTs area, north of, but not beneath, the distribution warehouse;
- Metals-contaminated soil at the Boiler/Baghouse area;
- Lead-contaminated soil (hazardous waste) at the GF11 area;
- TPH-contaminated soil at the USTs No. 71/72/73 area;
- TPH-contaminated soil at the UST No. 70 area;
- TPH-contaminated soil, if present, at the Heavy Duty Shop Sump;
- TPH-contaminated soil, if present, at the Rail Car Dumper Building;
- Xylene-contaminated soil containing latex at the UST No. 29/Latex Spill area; TPH-contaminated soil at the Naval Reserve Parcel UST area; and
- TPH-contaminated materials (apparent gear oil) observed in a small sump within the area adjacent to the Hydraulic Barker Building.

The primary contaminants targeted for removal within each interim action area are identified above. Potential contamination associated with other chemical groups will also be investigated and addressed under the interim actions based on discussions and agreements made with Ecology.

In late February 2013, apparent SSL was discovered within the foundation of the Digester Building during demolition. The liquor appeared to be fully contained within concrete cells[5] comprising the foundation. Three samples of the liquor were collected and analyzed immediately upon discovery. Sampling results confirmed alkaline pH (8.9 to 10.4) and concentrations in one or more samples exceeding groundwater screening levels for total metals (arsenic up to 13 µg/L, copper up to 110 µg/L, lead up to 760 µg/L, mercury up to 1.6 µg/L, nickel up to 23 µg/L, and zinc up to 1,100 µg/L), bis(2-ethylhexyl)phthalate (up to 15 µg/L), and petroleum (830 µg/L diesel- plus oil-range). All detected concentrations were well below effluent criteria for discharge to sanitary sewer under K-C's existing Discharge Authorization. The liquor was subsequently removed by vactor truck, transported to K-C's wastewater treatment system, and discharged to the sanitary sewer for conveyance to the City of Everett's wastewater treatment plant.

The planned interim action soil removals will be conducted in compliance with the Interim Action Work Plan included as part of the Agreed Order and will include the elements listed below. These elements are more fully described in the Interim Action Work Plan. The Agreed Order can be viewed on Ecology's website using the weblink referenced in Section 1.3.

- Soil excavation with segregation of contaminated soil versus uncontaminated soil (termed "overburden") based on field screening and prior data, and further segregation of overburden based on geotechnical suitability for use as excavation backfill;
- Temporary stockpiling and sampling and analysis of overburden to verify compliance with interim action cleanup levels and for waste disposal characterization;
- Application of temporary erosion and sediment control and dust control best management practices for the interim action areas, in accordance with the existing *Stormwater Pollution Prevention Plan for Kimberly Clark Everett Pulp and Paper Mill Demolition and Remediation*, prepared by David Evans and Associates (SWPPP; as modified September 2012);
- Excavation dewatering to facilitate soil removal and handling, and on-site pre-treatment of the dewatering water by sedimentation and activated carbon, before its discharge to sanitary sewer under a Discharge Authorization;
- Transportation of contaminated soil off-site for disposal at appropriately permitted facilities, including treatment at the landfill when required to meet land disposal restriction treatment standards;
- Backfill and compaction of the cleanup excavations to match the surrounding surface grade, using a combination of geotechnically suitable overburden, crushed concrete from mill demolition, and imported granular soil, all of which will be chemically tested in accordance with the methods provided in the Interim Action Work Plan to verify compliance with interim action cleanup levels;
- Compliance monitoring consisting of:

[5] Drawings of the foundation confirm concrete walls and bottoms to the cells, and fluid levels in some cells were well above the water table depth, indicating they are largely water-tight.

- Protection monitoring to confirm that human health and the environment are adequately protected during implementation of the interim action. This includes air monitoring in the work zones, and visual monitoring of fugitive dust, and, if dust is leaving site, air monitoring at the property perimeter;
- Performance monitoring for all contaminants that exceed interim action soil cleanup levels and for other contaminants through soil sampling and analysis of excavation sidewalls and bottoms. This is being done to confirm attainment of interim action soil cleanup levels and provide supplemental information for the RI/FS; and

- Initiation of confirmation groundwater monitoring (quarterly) using existing and/or newly installed monitoring wells located downgradient of cleanup excavations, to begin data collection confirming long-term effectiveness of the interim action for source control.

3.3.1 Interim Action Reporting

Within 90 days of completing the interim action cleanup in coordination with mill demolition, an Interim Action Report, describing the methods and outcome of the interim cleanup activities, will be prepared and submitted to Ecology in accordance with the Agreed Order and the Interim Action Plan. The interim actions will also be incorporated into the Upland Area RI/FS report and the draft Cleanup Action Plan (CAP) for the Site.

3.4 Hazardous Waste Accumulation Unit Closure

In association with mill demolition, Aspect oversaw and documented RCRA clean closure of the mill's Hazardous Waste Accumulation Unit ("haz waste cage"), in accordance with the state Dangerous Waste Regulations (WAC 173-303-610) and Ecology implementation guidance for clean closure (Ecology, 2005). The structure, depicted on Figure 6-4, served as a 90-day hazardous waste accumulation unit at a generator site and is not a RCRA Treatment, Storage, and Disposal Facility (TSDF). The accumulation unit is therefore exempt from requirements in WAC 173-303-610 (closure and post-closure) and 173-303-620 (financial assurances), except for WAC 173-303-610(2) and 173-303-610(5).

WAC 173-303-610 (2) states that the owner/operator must close the area in a manner that:

- Minimizes the need for further maintenance;
- Controls, minimizes or eliminates the potential for impact from the waste activities conducted in the area;
- Returns the land to the appearance and use of the surrounding land areas; and
- Removes soil contaminated by waste releases as needed to achieve MTCA unrestricted soil cleanup levels.

WAC 173-303-610 (5) states the following:

- Disposal or decontamination of equipment, structures and soils. During the partial and final closure periods, all contaminated equipment, structures and soils must

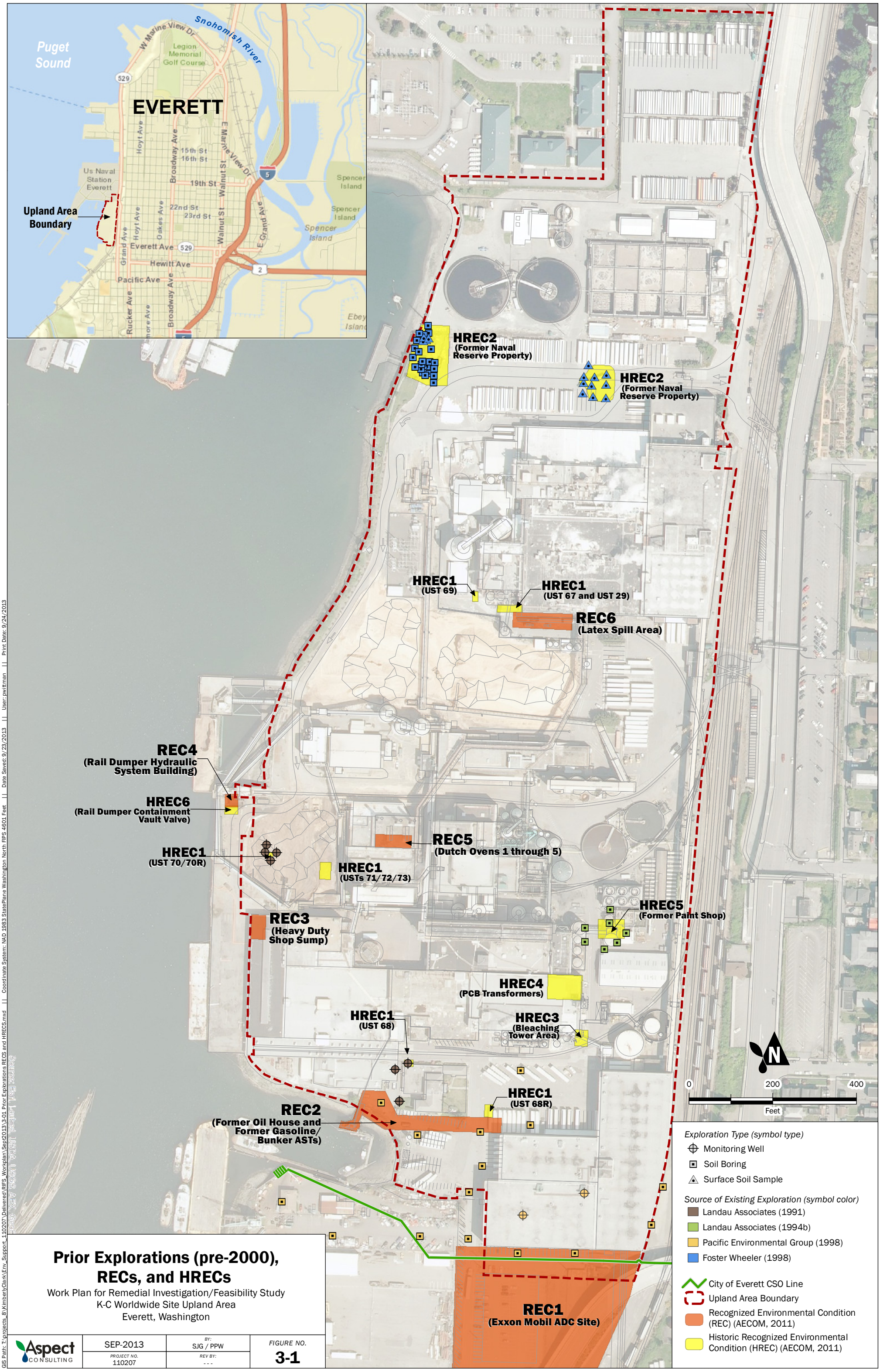
> be properly disposed of or decontaminated unless otherwise specified in WAC 173-303-640(8), 173-303-650(6), 173- 303-655(8), 173-303-660(9), 173-303-665(6), or under the authority of WAC 173-303-680 (2) and (4). By removing any dangerous wastes or dangerous constituents during partial and final closure, the owner or operator may become a generator of dangerous waste and must handle that waste in accordance with all applicable requirements of WAC 173-303-170 through 173-303-230.

Following the demolition contractor's final removal of waste materials from the accumulation unit, but prior to its demolition, Aspect conducted a visual inspection of the unit to document cracks in the structure and observe for evidence of a release from it. Aspect documented the inspection with a field report and photographs, including documenting the building corner locations (coordinates) using a global positioning system (GPS) instrument. Following the visual inspection, Aspect collected four fully penetrating core samples of the concrete floor slab for analysis of gasoline-, diesel-, and oil-range TPH, RCRA 8 metals, semivolatile organic compounds (SVOCs), VOCs, and PCBs. Detected concentrations in the concrete were less than respective soil screening levels for unrestricted use. The structure's concrete demolition debris was disposed of at CEMEX's landfill in Everett.

Following removal of the structure, Aspect collected soil samples at four hand-augered locations within the footprint of the former structure. At each of the four locations, soil samples were collected from depths of approximately 0 to 1 and 2 to 3 feet below grade for analysis of gasoline-, diesel-, and oil-range TPH, RCRA 8 metals, SVOCs, VOCs, and PCBs. Soil concentrations were less than respective unrestricted soil screening levels. The soil analytical data from the closure are validated and will be incorporated into the RI/FS.

Following the mill closure and demolition and soil testing of the accumulation unit, Aspect prepared a RCRA Closure Report for the mill (Aspect, 2013b). Appendix A to the RCRA Closure Report documents the waste management history of the mill, and includes historical maps showing locations of hazardous substance storage and use at the mill. The Report also describes the disposal of remaining chemical inventory during the mill closure/demolition, as well as the pre-demolition inspection, analytical testing of the accumulation unit structure and its demolition and proper disposition, and analytical testing of the underlying soil. Finally, the RCRA Closure Report summarizes Ecology's hazardous waste inspection conducted during the mill closure/demolition process (November 2012), during which Ecology concluded that the waste management activities were being conducted in accordance with the requirements of Chapter 173-303 WAC. For ease of reference, that information is repeated in Appendix C to this RI/FS Work Plan.

Based on the closure work completed and Ecology's November 2012 inspection, Aspect concludes that the RCRA closure activities for the mill achieved compliance with Chapter 173-303 WAC requirements for clean closure (Aspect, 2013b). A draft RCRA Closure Report was submitted to Ecology's Industrial Section and Toxics Cleanup Program for review and comment. Ecology approved the Closure Report on November 12, 2013 (Robert Carruthers, Ecology, email communication to Steve Germiat, Aspect, November 12, 2013).



Prior Explorations (pre-2000), RECs, and HRECs

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	SEP-2013	BY: SJG / PPW	FIGURE NO. 3-1
	PROJECT NO. 110207	REV BY: ---	

Source: Esri, Digital Globe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\3-01 Prior Explorations RECS and HRECS.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 9/23/2013 || User: pwittman || Print Date: 9/24/2013

Phase 2 ESA Explorations and Planned Interim Action Cleanup Areas

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	SEP-2013	BY: SJG / PPW	FIGURE NO. 3-2
	PROJECT NO. 110207	REV BY: EAH	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\3-02 Phase 2 ESA Explorations and Planned IA Cleanup Areas.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 9/25/2013 || User: pwittman || Print Date: 9/25/2013

4 Preliminary Conceptual Site Model

The preliminary conceptual site model identifies the preliminary indicator hazardous substances (IHS) identified for the Upland Area, potential sources of those hazardous substances and the potential migration pathways and environmental media where they are suspected or confirmed to be found, and the receptors and exposure pathways.

4.1 Preliminary Indicator Hazardous Substances

The Phase 2 ESA Data Report (Aspect, 2013a) provides a statistical analysis for soil and groundwater analytical results from the Phase 2 ESA, including total number of analyses and frequencies of detection and exceedances of screening levels applied in the Phase 2 ESA for each constituent in soil and groundwater. Tables 4-1 and 4-2 in this RI/FS Work Plan statistically summarize the Phase 2 ESA soil and groundwater data, respectively, relative to screening levels proposed for the RI/FS. For the purposes of the Work Plan, the soil data are compared against preliminary screening levels for human direct contact, protection of terrestrial ecological species, and protection of groundwater based on both saturated and unsaturated soils[6]; further differentiation and evaluation of saturated and unsaturated soil concentrations will be conducted during the RI.

Using that data, preliminary IHS for the Upland Area are identified, in accordance with WAC 173-340-703, to be protective of the planned future industrial land use. To provide context, the IHS are subdivided into primary and secondary IHS. Primary IHS are those that have been detected broadly across the Upland Area at concentrations above screening levels, indicating widespread sources across the Upland Area. Secondary IHS are those that have been detected above screening levels in discrete localized areas, potentially attributable to specific source locations. Constituents that exceed only soil screening levels based on leaching to groundwater, but without corresponding groundwater exceedances, are not identified as IHS at this time but may be in the future pending additional groundwater characterization conducted as part of the RI. TEE screening levels are also considered in defining IHS, although the future land use may qualify for an exclusion from conducting a TEE. Note that the Upland Area has not been fully characterized to date; therefore, the IHS may be revised in the RI based on additional data collected.

The preliminary primary IHS include the following:

- Petroleum hydrocarbons in the diesel- and oil-ranges and gasoline-range;
- Total cPAHs
- The metals arsenic, copper, lead, and nickel; and
- Ammonia in groundwater.

The preliminary secondary IHS include the following:

[6] Different values based on soil leachability to groundwater (refer to Section 5.2).

- Dioxins/Furans in the Boiler/Baghouse Area (IHS only for terrestrial ecological receptors);
- The metals chromium, mercury, and zinc at one or more soil or groundwater locations; and
- Xylene in the area of the xylene UST.

4.2 Sources of Contamination

The primary potential contaminant sources for the Upland Area include the following:

- **Sawmill and Lumber Storage.** As discussed in Section 2.2, the Parminter-Robinson mill and then the Clark-Nickerson Lumber Company mill operated on the northern portion of the Upland Area from roughly 1892 to 1934. These activities and the residual waste products resulting from these activities may have released petroleum hydrocarbons, PAHs, and/or heavy metals to Upland Area soil and/or groundwater. Additionally, the documented presence of a "Refuse Burner" in the Clark-Nickerson Lumber Company mill may indicate the burning of salt-laden wood which could be a source of dioxins/furans.
- **Pulp and Paper Mill Activities.** The Upland Area included operation of the pulp and paper mill between about 1931 and 2012. These activities included the storage and use of raw materials, handling and storage of residual waste products, burning of petroleum, wood fuels, and mill waste materials in the boilers for energy production[7], and a variety of maintenance and other industrial processes conducted in support of the pulp and paper mill operations. The mill was a large quantity generator (LQG) of hazardous waste under RCRA. As described in Section 3.4, the mill was not a RCRA TSDF, but there were temporary hazardous substance accumulation areas at locations within the mill – most recently the hazardous waste accumulation unit (refer also to discussion of mill hazardous waste management in Appendix C). The mill contained numerous electrical transformers, many of which contained PCBs historically, and the mill temporarily accumulated PCB wastes pending off-site disposal. The mill activities may have resulted in releases of petroleum hydrocarbons, dioxins/furans, PAHs and other SVOCs, VOCs, PCBs, and heavy metals to the Upland Area soil and/or groundwater.
- **Petroleum and Xylene Storage and Use.** The Standard Oil Company and Associated Oil Company operated bulk petroleum fuel storage facilities in the southern portion of the Upland Area from as early as the mid-1910s until the 1950s. The mill then used the Associated Oil storage facilities to store Bunker C oil until the mid-1990s, when the co-generation boiler was constructed; after that transition, K-C maintain diesel fuel in the Diesel AST northeast of the Warehouse as a backup fuel source for the boilers. Gasoline, diesel, and Bunker C fuels were also stored in USTs for use in the mill (USTs described in Section 3.1). In addition, the Navy operated diesel and gasoline USTs on the former Naval Reserve Parcel, which was transferred to K-C in the late 1990s. Xylene, used a solvent in the paper mill, was stored in an UST adjacent to the paper mill

[7] Starting in the mid-1990s the cogeneration boiler (No. 14 Boiler) operated in cooperation with Snohomish County Public Utility District No. 1

building. Additionally, smaller quantities of various petroleum products (esp. hydraulic and lube oils) were stored and used in the mill machinery and maintenance shops located across the Upland Area. All known ASTs and USTs within the Upland Area have been removed. Releases of petroleum products, PAHs, VOCs, and lead from leaded gasoline may have occurred in these locations.

- **Imported Fill Material.** As discussed in Section 2.2, the majority of the Upland Area was filled in the late 1800s and early 1900s. Soil containing wood debris and demolition materials (i.e., brick, concrete) has been encountered within the fill during previous investigation activities. The source of Upland Area fill material is not well documented, with the exception of dredge spoils used to fill "low-lying areas" (SWCA, 2013). PSM International Inc. (1988) states that Scott Paper used sand, gravel, and cement deposits from holding ponds at the Centrecon concrete pole manufacturing plant (now Ameron) in Everett to fill low-lying areas on the mill site. In addition, because of the poor strength of the fill and underlying tideflat soil, most of the larger mill structures are presumed to have been supported by pilings or other robust foundations, including both creosote-treated wood pilings and concrete. For example, "several thousand piles" were reportedly driven for construction of the original mill wharf in 1929 (SWCA, 2013).
- **Adjacent Industrial Operations.** A release of petroleum has migrated into utility corridors on K-C's property south of the distribution warehouse from property(ies) to the south (ExxonMobil/ADC site). In addition, BNSF's railroad borders the Upland Area to the east, which may be a source of contaminants to soil and/or groundwater immediately upgradient of the Upland Area.

4.3 Contaminant Migration Pathways

The previous investigation confirms that soil and groundwater are media of concern for the Upland Area. Potential migration pathways for contaminants in Upland Area soil and groundwater include the following:

- Leaching of contaminants from soil to groundwater;
- Dissolution of contaminants from separate-phase petroleum product, if present, in groundwater;
- Migration of dissolved-phase contaminants in groundwater and ultimate discharge to marine sediment and surface water of the East Waterway;
- Transport of contaminants to soil and adjacent marine surface water and sediment via surface water runoff;
- Erosion of upland bank soil containing hazardous substances along the shoreline in areas that are not armored or where the armoring has failed;
- Transport of contaminants in soil to outdoor air via wind or fugitive dust; and
- Vapor-phase transport of volatile contaminants from vadose zone soil or shallow groundwater to soil gas and then to outdoor air or indoor air within future occupied structures.

A number of physical, chemical, and biological processes affect transport and fate of organic and inorganic contaminants. Of particular importance for the Upland Area, tidal fluctuations induce twice-daily reversals in nearshore groundwater flow directions. This increases groundwater flow path length and hydrodynamic dispersion, and circulates seawater into the subsurface, creating a physically and chemically dynamic nearshore groundwater environment.

4.4 Receptors and Exposure Pathways

An exposure pathway describes the mechanisms by which human or ecological exposure to contaminants can occur assuming no remedial action or protective control is in place. An exposure pathway is considered complete if a human or ecological receptor can be exposed to a contaminant via that pathway. Potential pathways for receptors to be exposed to contaminants in Upland Area soil and groundwater are outlined below.

4.4.1 Soil

Current and future potentially complete exposure pathways for soil under the planned future industrial site use are identified below:

- Incidental ingestion and dermal contact with constituents in Site soil;
- Exposure through inhalation of soil contaminants (as particulates) that have migrated to air as windblown or fugitive dust;
- Exposure through inhalation of soil contaminants (as soil vapor) that have migrated to indoor and/or outdoor air; and
- Terrestrial wildlife contacting contaminated soils.

In addition to these pathways, contaminants in soil can leach to groundwater, acting as a secondary source as described in Section 4.3.

4.4.2 Groundwater

As discussed in Section 5.1, Upland Area groundwater is not used for drinking water and is not a practicable future source of drinking water due to its proximity to marine surface water and the availability of the City of Everett water supply. Therefore, potable use of groundwater is not considered a potentially complete exposure pathway.

Current and future potentially complete exposure pathways for groundwater include the following:

- Construction or utility workers contacting contaminated groundwater during excavation or other construction-related activities;
- Industrial workers (including construction worker) inhalation of indoor or outdoor air contaminated by vapor intrusion of volatile contaminants in shallow groundwater;
- Marine ecological receptors direct exposure to groundwater contaminants discharged to the sediment bioactive zone or surface water; and
- Higher-trophic-level marine organisms or humans consuming marine ecological receptors contaminated by groundwater discharges to the sediment bioactive zone or surface water.

Table 4-1 - Statistical Summary of Soil Quality Data from Phase 2 ESA

K-C Worldwide Site Upland Area 110207

						Relative to Preliminary Industrial Soil Screening Levels					
						Saturated Soil			*Unsaturated Soil*		
Analyte	**Units**	**No. Analyses**	**No. Detects**	**Detection Frequency**	**Max Detection**	**Preliminary Screening Level**	**No. Exceedances of Screening Level**	**Exceedance Frequency**	**Preliminary Screening Level**	**No. Exceedances of Screening Level**	**Exceedance Frequency**
TPHs											
Gasoline Range Hydrocarbons	mg/kg	142	32	23%	9700	30	16	11%	30	16	11%
Diesel Range Hydrocarbons	mg/kg	228	68	30%	62000	2000	23	10%	2000	23	10%
Oil Range Hydrocarbons	mg/kg	228	49	21%	46000	2000	21	9%	2000	21	9%
Total TPHs	mg/kg	228	69	30%	108000	2,000	32	14%	2,000	32	14%
Metals											
Antimony	mg/kg	118	39	33%	71.9	1400	s	0%	1400		0%
Arsenic	mg/kg	136	135	99%	74.4	20	6	4%	20	6	4%
Beryllium	mg/kg	118		0%		7000		0%	7000		0%
Cadmium	mg/kg	125	3	2%	7.85	14		0%	14		0%
Chromium (Total)	mg/kg	125	125	100%	75.8	67	2	2%	67	2	2%
Copper	mg/kg	125	125	100%	367	36	32	26%	36	32	26%
Lead	mg/kg	149	149	100%	1870	81	24	16%	118	16	11%
Mercury	mg/kg	125	26	21%	1.8	5.5		0%	5.5		0%
Nickel	mg/kg	124	124	100%	78.7	48	4	3%	48	4	3%
Selenium	mg/kg	125	1	1%	1.84	1	1	1%	1	1	1%
Silver	mg/kg	125	1	1%	1.94	18000		0%	18000		0%
Thallium	mg/kg	118		0%				0%			0%
Zinc	mg/kg	125	125	100%	812	360	2	2%	360	2	2%
VOCs											
1,1,1,2-Tetrachloroethane	mg/kg	146		0%		5000		0%	5000		0%
1,1,1-Trichloroethane	mg/kg	146		0%		7000000		0%	7000000		0%
1,1,2,2-Tetrachloroethane	mg/kg	146		0%		660		0%	660		0%
1,1,2-Trichloroethane	mg/kg	146		0%		2300		0%	2300		0%
1,1-Dichloroethane	mg/kg	146		0%		700000		0%	700000		0%
1,1-Dichloroethene	mg/kg	146		0%		180000		0%	180000		0%
1,1-Dichloropropene	mg/kg	146		0%				0%			0%
1,2,3-Trichlorobenzene	mg/kg	146		0%				0%			0%
1,2,3-Trichloropropane	mg/kg	146		0%		4.4		0%	4.4		0%
1,2,4-Trichlorobenzene	mg/kg	121		0%		4500		0%	4500		0%
1,2,4-Trimethylbenzene	mg/kg	146	8	5%	9.3			0%			0%
1,2-Dibromo-3-chloropropane	mg/kg	146		0%		160		0%	160		0%
1,2-Dibromoethane (EDB)	mg/kg	147		0%		66		0%	66		0%
1,2-Dichlorobenzene	mg/kg	121	1	1%	0.4	320000		0%	320000		0%
1,2-Dichloroethane (EDC)	mg/kg	147		0%		1400		0%	1400		0%
1,2-Dichloropropane	mg/kg	146		0%				0%			0%
1,3,5-Trimethylbenzene	mg/kg	146	2	1%	5.1	35000		0%	35000		0%
1,3-Dichlorobenzene	mg/kg	121		0%				0%			0%
1,3-Dichloropropane	mg/kg	146		0%				0%			0%
1,4-Dichlorobenzene	mg/kg	121		0%				0%			0%
1,4-Dioxane	mg/kg	1		0%				0%			0%
2,2-Dichloropropane	mg/kg	146		0%				0%			0%
2-Butanone	mg/kg	146		0%		2100000		0%	2100000		0%
2-Chlorotoluene	mg/kg	146	2	1%	7.6	70000		0%	70000		0%
2-Hexanone	mg/kg	146		0%				0%			0%
4-Chlorotoluene	mg/kg	146	1	1%	0.11			0%			0%
4-Methyl-2-pentanone	mg/kg	146		0%		280000		0%	280000		0%
Acetone	mg/kg	146	1	1%	1.5	3200000		0%	3200000		0%
Benzene	mg/kg	183	2	1%	0.055	2400		0%	2400		0%
Bromobenzene	mg/kg	146		0%				0%			0%
Bromodichloromethane	mg/kg	146		0%		2100		0%	2100		0%
Bromoform	mg/kg	146		0%		17000		0%	17000		0%
Bromomethane	mg/kg	146		0%		4900		0%	4900		0%
Carbon tetrachloride	mg/kg	145		0%		1900		0%	1900		0%
Chlorobenzene	mg/kg	146		0%		70000		0%	70000		0%
Chloroethane	mg/kg	146		0%				0%			0%
Chloroform	mg/kg	146		0%		35000		0%	35000		0%
Chloromethane	mg/kg	146		0%				0%			0%
cis-1,2-Dichloroethene (DCE)	mg/kg	146		0%		7000		0%	7000		0%
cis-1,3-Dichloropropene	mg/kg	146		0%				0%			0%
Dibromochloromethane	mg/kg	146		0%		1600		0%	1600		0%
Dibromomethane	mg/kg	146		0%		35000		0%	35000		0%
Dichlorodifluoromethane	mg/kg	142		0%		700000		0%	700000		0%
Diisopropyl ether (DIPE)	mg/kg	1		0%				0%			0%
Ethanol	mg/kg	1		0%				0%			0%
Ethyl t-butyl ether (ETBE)	mg/kg	1		0%				0%			0%
Ethylbenzene	mg/kg	183	9	5%	630	350000		0%	350000		0%
Hexachlorobutadiene	mg/kg	146		0%		1700		0%	1700		0%
Isopropylbenzene	mg/kg	146	7	5%	9.6	350000		0%	350000		0%
Methyl tert-butyl ether (MTBE)	mg/kg	147		0%				0%			0%
Methylene chloride	mg/kg	146	1	1%	0.5	18000		0%	18000		0%
n-Propylbenzene	mg/kg	146	10	7%	7.6	350000		0%	350000		0%
p-Isopropyltoluene	mg/kg	146	9	6%	1.5			0%			0%
sec-Butylbenzene	mg/kg	146	12	8%	1.9			0%			0%
Styrene	mg/kg	146		0%		700000		0%	700000		0%
t-Amyl methyl ether (TAME)	mg/kg	1		0%				0%			0%
t-Butyl alcohol (TBA)	mg/kg	1		0%				0%			0%
tert-Butylbenzene	mg/kg	146	2	1%	0.37			0%			0%
Tetrachloroethene (PCE)	mg/kg	146		0%		240		0%	240		0%
Toluene	mg/kg	183	3	2%	1.6	280000		0%	280000		0%
trans-1,2-Dichloroethene	mg/kg	146		0%		70000		0%	70000		0%
trans-1,3-Dichloropropene	mg/kg	146		0%				0%			0%
Trichloroethene (TCE)	mg/kg	146		0%		1100		0%	1100		0%
Trichlorofluoromethane	mg/kg	146		0%		1100000		0%	1100000		0%
Vinyl acetate	mg/kg	1		0%		3500000		0%	3500000		0%
Vinyl chloride	mg/kg	146		0%		88		0%	88		0%
m,p-Xylenes	mg/kg	146	6	4%	1800			0%			0%
o-Xylene	mg/kg	146	5	3%	450	700000		0%	700000		0%
Total Xylenes	mg/kg	146	6	4%	2250			0%			0%

Table 4-1 - Statistical Summary of Soil Quality Data from Phase 2 ESA

K-C Worldwide Site Upland Area 110207

						Relative to Preliminary Industrial Soil Screening Levels					
						Saturated Soil			*Unsaturated Soil*		
Analyte	**Units**	**No. Analyses**	**No. Detects**	**Detection Frequency**	**Max Detection**	**Preliminary Screening Level**	**No. Exceedances of Screening Level**	**Exceedance Frequency**	**Preliminary Screening Level**	**No. Exceedances of Screening Level**	**Exceedance Frequency**
PAHs											
Acenaphthene	mg/kg	214	75	35%	72	210000		0%	210000		0%
Acenaphthylene	mg/kg	214	25	12%	3			0%			0%
Anthracene	mg/kg	214	64	30%	32	1100000		0%	1100000		0%
Benzo(g,h,i)perylene	mg/kg	214	110	51%	11			0%			0%
Fluoranthene	mg/kg	214	126	59%	76	140000		0%	140000		0%
Fluorene	mg/kg	214	68	32%	79	140000		0%	140000		0%
Phenanthrene	mg/kg	214	127	59%	300			0%			0%
Pyrene	mg/kg	214	139	65%	120	110000		0%	110000		0%
2-Methylnaphthalene	mg/kg	59	9	15%	300	14000		0%	14000		0%
Naphthalene	mg/kg	211	80	38%	79	70000		0%	70000		0%
Benz(a)anthracene	mg/kg	214	111	52%	32			0%			0%
Benzo(a)pyrene	mg/kg	214	108	50%	26			0%			0%
Benzo(b)fluoranthene	mg/kg	214	114	53%	18			0%			0%
Benzo(k)fluoranthene	mg/kg	214	59	28%	6			0%			0%
Chrysene	mg/kg	214	122	57%	70			0%			0%
Dibenzo(a,h)anthracene	mg/kg	214	29	14%	4.5			0%			0%
Indeno(1,2,3-cd)pyrene	mg/kg	214	95	44%	4.3			0%			0%
Total cPAHs TEQ	mg/kg	212	127	60%	32	0.4	28	13%	7.9	4	2%
Other Semivolatiles											
1,2,4-Trichlorobenzene	mg/kg	57		0%		4500		0%	4500		0%
1,2-Dichlorobenzene	mg/kg	57		0%		320000		0%	320000		0%
1,3-Dichlorobenzene	mg/kg	57		0%				0%			0%
1,4-Dichlorobenzene	mg/kg	57		0%				0%			0%
2,4,5-Trichlorophenol	mg/kg	59		0%		350000		0%	350000		0%
2,4,6-Trichlorophenol	mg/kg	59		0%		3500		0%	3500		0%
2,4-Dichlorophenol	mg/kg	59		0%		11000		0%	11000		0%
2,4-Dimethylphenol	mg/kg	59		0%		70000		0%	70000		0%
2,4-Dinitrophenol	mg/kg	59		0%		7000		0%	7000		0%
2-Chloronaphthalene	mg/kg	59		0%		280000		0%	280000		0%
2-Chlorophenol	mg/kg	59		0%		18000		0%	18000		0%
2-Methylphenol	mg/kg	59		0%		180000		0%	180000		0%
2-Nitroaniline	mg/kg	59		0%		35000		0%	35000		0%
2-Nitrophenol	mg/kg	59		0%				0%			0%
3 & 4 Methylphenol	mg/kg	59		0%				0%			0%
3-Nitroaniline	mg/kg	59		0%				0%			0%
4,6-Dinitro-2-methylphenol	mg/kg	59		0%				0%			0%
4-Bromophenyl phenyl ether	mg/kg	59		0%				0%			0%
4-Chloro-3-methylphenol	mg/kg	59		0%				0%			0%
4-Chloroaniline	mg/kg	59		0%		660		0%	660		0%
4-Chlorophenyl phenyl ether	mg/kg	59		0%				0%			0%
4-Nitroaniline	mg/kg	59		0%				0%			0%
4-Nitrophenol	mg/kg	59		0%				0%			0%
Benzoic acid	mg/kg	59		0%		14000000		0%	14000000		0%
Benzyl alcohol	mg/kg	59		0%		350000		0%	350000		0%
Benzyl butyl phthalate	mg/kg	59	2	3%	0.065	69000		0%	69000		0%
Bis(2-chloro-1-methylethyl) ether	mg/kg	59		0%		1900		0%	1900		0%
Bis(2-chloroethoxy)methane	mg/kg	59		0%				0%			0%
Bis(2-chloroethyl) ether	mg/kg	59		0%		120		0%	120		0%
Bis(2-ethylhexyl) phthalate	mg/kg	59	1	2%	1	9400		0%	9400		0%
Carbazole	mg/kg	59	5	8%	0.29			0%			0%
Dibenzofuran	mg/kg	59	7	12%	18	3500		0%	3500		0%
Diethyl phthalate	mg/kg	59		0%		2800000		0%	2800000		0%
Dimethyl phthalate	mg/kg	59	1	2%	0.033			0%			0%
Di-n-butyl phthalate	mg/kg	59	2	3%	0.042	350000		0%	350000		0%
Di-n-octyl phthalate	mg/kg	59		0%				0%			0%
Hexachlorobenzene	mg/kg	59		0%		17		0%	17		0%
Hexachlorobutadiene	mg/kg	59		0%		1700		0%	1700		0%
Hexachlorocyclopentadiene	mg/kg	59		0%		21000		0%	21000		0%
Hexachloroethane	mg/kg	59		0%		3500		0%	3500		0%
Isophorone	mg/kg	59		0%		140000		0%	140000		0%
Nitrobenzene	mg/kg	59		0%		7000		0%	7000		0%
N-Nitroso-di-n-propylamine	mg/kg	59		0%		19		0%	19		0%
N-Nitrosodiphenylamine	mg/kg	59		0%		27000		0%	27000		0%
Pentachlorophenol	mg/kg	59		0%		4.5		0%	4.5		0%
Phenol	mg/kg	59		0%		1100000		0%	1100000		0%
2,4-Dinitrotoluene	mg/kg	59		0%		7000		0%	7000		0%
2,6-Dinitrotoluene	mg/kg	59		0%		3500		0%	3500		0%
PCBs											
Aroclor 1016	mg/kg	63		0%				0%			0%
Aroclor 1221	mg/kg	63		0%				0%			0%
Aroclor 1232	mg/kg	63		0%				0%			0%
Aroclor 1242	mg/kg	63		0%				0%			0%
Aroclor 1248	mg/kg	63		0%				0%			0%
Aroclor 1254	mg/kg	63	7	11%	1.9			0%			0%
Aroclor 1260	mg/kg	63	6	10%	1			0%			0%
Total PCBs	mg/kg	63	9	14%	2.55	10		0%	10		0%
Dioxins/Furans											
2,3,7,8-TCDD	mg/kg	24	3	13%	0.0000022			0%			0%
1,2,3,7,8-PeCDD	mg/kg	24	6	25%	0.00000349			0%			0%
1,2,3,4,7,8-HxCDD	mg/kg	24	13	54%	0.0000138			0%			0%
1,2,3,6,7,8-HxCDD	mg/kg	24	16	67%	0.0000366			0%			0%
1,2,3,7,8,9-HxCDD	mg/kg	24	13	54%	0.0000306			0%			0%
1,2,3,4,6,7,8-HpCDD	mg/kg	24	23	96%	0.000395			0%			0%
OCDD	mg/kg	24	24	100%	0.00383			0%			0%
2,3,7,8-TCDF	mg/kg	24	10	42%	0.0000467			0%			0%
1,2,3,7,8-PeCDF	mg/kg	24	5	21%	5.7E-06			0%			0%
2,3,4,7,8-PeCDF	mg/kg	24	10	42%	8.3E-06			0%			0%
1,2,3,4,7,8-HxCDF	mg/kg	24	10	42%	1.5E-05			0%			0%
1,2,3,6,7,8-HxCDF	mg/kg	24	12	50%	7.1E-06			0%			0%
1,2,3,7,8,9-HxCDF	mg/kg	24	1	4%	2.8E-07			0%			0%
2,3,4,6,7,8-HxCDF	mg/kg	24	13	54%	5.9E-06			0%			0%
1,2,3,4,6,7,8-HpCDF	mg/kg	24	22	92%	1.0E-04			0%			0%
1,2,3,4,7,8,9-HpCDF	mg/kg	24	11	46%	4.1E-06			0%			0%
OCDF	mg/kg	24	19	79%	2.8E-04			0%			0%
Total 2,3,7,8 TCDD [TEQ]	mg/kg	24	24	100%	2.2E-05	6.3E-06	5	21%	6.3E-06	5	21%

Notes: (1) A blank indicates a value of zero, except for the screening level for which it indicates none available.
(2) All soil samples are screened against saturated and unsaturated criteria, regardless of depth

Table 4-2 - Statistical Summary of Groundwater Quality Data from Phase 2 ESA

KC Worldwide Site Upland Area

Analyte	Units	No. Analyses	No. Detects	Detection Frequency	Max Detection	Preliminary Groundwater Screening Level (Industrial Land Use)	Number of Exceedances of Groundwater Screening Level	Groundwater Screening Level Exceedance Frequency
TPHs								
Gasoline Range Hydrocarbons	ug/L	58	13	22%	24000	800	3	5%
Diesel Range Hydrocarbons	ug/L	57	17	30%	1200	500	5	9%
Oil Range Hydrocarbons	ug/L	57	2	4%	380	500		0%
Total TPHs	ug/L	57	17	30%	1580	500	7	12%
Dissolved Metals								
Antimony	ug/L	48	13	27%	3.96	640		0%
Arsenic	ug/L	50	39	78%	202	5	9	18%
Beryllium	ug/L	48		0%		270		0%
Cadmium	ug/L	50	14	28%	0.776	8.8		0%
Chromium (Total)	ug/L	50	36	72%	110	243000		0%
Copper	ug/L	50	33	66%	44.9	3.1	15	30%
Lead	ug/L	58	18	31%	37.3	8.1	4	7%
Mercury	ug/L	50	1	2%	0.12	0.025	1	2%
Nickel	ug/L	50	50	100%	308	8.2	9	18%
Selenium	ug/L	50	20	40%	25.6	71		0%
Silver	ug/L	50	8	16%	0.031	1.9		0%
Thallium	ug/L	48	1	2%	0.026	0.47		0%
Zinc	ug/L	50	44	88%	116	81	1	2%
Total Metals								
Antimony	ug/L	21	6	29%	9.02	640		0%
Arsenic	ug/L	21	11	52%	218	5	5	24%
Beryllium	ug/L	21		0%		270		0%
Cadmium	ug/L	21	5	24%	5.22	8.8		0%
Chromium (Total)	ug/L	21	14	67%	83.8	243000		0%
Copper	ug/L	21	10	48%	226	3.1	6	29%
Lead	ug/L	25	10	40%	234	8.1	4	16%
Mercury	ug/L	21	2	10%	0.57	0.025	2	10%
Nickel	ug/L	21	21	100%	39.3	8.2	5	24%
Selenium	ug/L	21	6	29%	17	71		0%
Silver	ug/L	21	3	14%	0.035	1.9		0%
Thallium	ug/L	21		0%		0.47		0%
Zinc	ug/L	21	20	95%	274	81	1	5%
VOCs								
1,1,1,2-Tetrachloroethane	ug/L	71		0%		1.7		0%
1,1,1-Trichloroethane	ug/L	71		0%		12000		0%
1,1,2,2-Tetrachloroethane	ug/L	71		0%		11		0%
1,1,2-Trichloroethane	ug/L	71		0%		42		0%
1,1-Dichloroethane	ug/L	71		0%		1600		0%
1,1-Dichloroethene	ug/L	71		0%		280		0%
1,1-Dichloropropene	ug/L	71		0%				0%
1,2,3-Trichlorobenzene	ug/L	71		0%				0%
1,2,3-Trichloropropane	ug/L	71		0%		0.5		0%
1,2,4-Trichlorobenzene	ug/L	55		0%		2		0%
1,2,4-Trimethylbenzene	ug/L	71	3	4%	9.3	61		0%
1,2-Dibromo-3-chloropropane	ug/L	71		0%		2		0%
1,2-Dibromoethane (EDB)	ug/L	78		0%		2		0%
1,2-Dichlorobenzene	ug/L	55		0%		1300		0%
1,2-Dichloroethane (EDC)	ug/L	73		0%		42		0%
1,2-Dichloropropane	ug/L	71		0%		15		0%
1,3,5-Trimethylbenzene	ug/L	71	2	3%	4.3	80		0%
1,3-Dichlorobenzene	ug/L	55		0%		960		0%
1,3-Dichloropropane	ug/L	71		0%				0%
1,4-Dichlorobenzene	ug/L	55		0%		190		0%
1,4-Dioxane	ug/L	6		0%				0%
2,2-Dichloropropane	ug/L	71		0%				0%
2-Butanone	ug/L	71		0%				0%
2-Chlorotoluene	ug/L	71		0%		160		0%
2-Hexanone	ug/L	71		0%				0%
4-Chlorotoluene	ug/L	71		0%				0%
4-Methyl-2-pentanone	ug/L	71		0%				0%
Acetone	ug/L	71	4	6%	25			0%
Benzene	ug/L	77	2	3%	0.92	24		0%
Bromobenzene	ug/L	71		0%				0%
Bromodichloromethane	ug/L	71		0%		0.9		0%
Bromoform	ug/L	71		0%		360		0%
Bromomethane	ug/L	71		0%		28		0%
Carbon tetrachloride	ug/L	71		0%		4.4		0%
Chlorobenzene	ug/L	71		0%		640		0%
Chloroethane	ug/L	71		0%				0%
Chloroform	ug/L	71		0%		12		0%
Chloromethane	ug/L	71		0%		340		0%
cis-1,2-Dichloroethene (DCE)	ug/L	71	1	1%	2.2			0%
cis-1,3-Dichloropropene	ug/L	71		0%				0%
Dibromochloromethane	ug/L	71		0%		2.2		0%
Dibromomethane	ug/L	71		0%				0%
Dichlorodifluoromethane	ug/L	71		0%		25		0%
Ethylbenzene	ug/L	77	6	8%	2000	2100		0%
Hexachlorobutadiene	ug/L	71		0%		8.1		0%
Isopropylbenzene	ug/L	71	7	10%	14			0%
Methyl tert-butyl ether (MTBE)	ug/L	73		0%				0%
Methylene chloride	ug/L	71		0%		940		0%
n-Propylbenzene	ug/L	71	7	10%	28			0%
p-Isopropyltoluene	ug/L	71		0%		1600		0%
sec-Butylbenzene	ug/L	71	2	3%	6.7			0%
Styrene	ug/L	71		0%		100		0%
tert-Butylbenzene	ug/L	71		0%				0%
Tetrachloroethene (PCE)	ug/L	71		0%		8.9		0%
Toluene	ug/L	77	4	5%	18	15000		0%
trans-1,2-Dichloroethene	ug/L	71		0%		250		0%
trans-1,3-Dichloropropene	ug/L	71		0%				0%
Trichloroethene (TCE)	ug/L	71		0%		8.4		0%
Trichlorofluoromethane	ug/L	71		0%		260		0%
Vinyl acetate	ug/L	6		0%		8000		0%
Vinyl chloride	ug/L	71		0%		2.4		0%
m,p-Xylenes	ug/L	71	4	6%	6900	1000	2	3%
o-Xylene	ug/L	71	5	7%	1600	1600		0%
Total Xylenes	ug/L	70	4	6%	8500			0%

Table 4-2 - Statistical Summary of Groundwater Quality Data from Phase 2 ESA

KC Worldwide Site Upland Area

Analyte	Units	No. Analyses	No. Detects	Detection Frequency	Max Detection	Preliminary Groundwater Screening Level (Industrial Land Use)	Number of Exceedances of Groundwater Screening Level	Groundwater Screening Level Exceedance Frequency
PAHs								
Acenaphthene	ug/L	66	34	52%	58	640		0%
Acenaphthylene	ug/L	66	2	3%	0.73	960		0%
Anthracene	ug/L	66	14	21%	3.9	26000		0%
Benzo(g,h,i)perylene	ug/L	66	1	2%	0.15			0%
Fluoranthene	ug/L	66	18	27%	6.4	90		0%
Fluorene	ug/L	66	27	41%	35	3500		0%
Phenanthrene	ug/L	66	24	36%	41			0%
Pyrene	ug/L	66	18	27%	9.8	2600		0%
2-Methylnaphthalene	ug/L	32		0%				0%
Naphthalene	ug/L	64	18	28%	200	360		0%
Benz(a)anthracene	ug/L	66	14	21%	1.5	0.031	7	11%
Benzo(a)pyrene	ug/L	66	9	14%	0.67	0.031	2	3%
Benzo(b)fluoranthene	ug/L	66	8	12%	0.28	0.031	3	5%
Benzo(k)fluoranthene	ug/L	66	2	3%	0.018	0.031		0%
Chrysene	ug/L	66	14	21%	2.6	0.031	9	14%
Dibenzo(a,h)anthracene	ug/L	66	1	2%	0.033	0.031	1	2%
Indeno(1,2,3-cd)pyrene	ug/L	66	1	2%	0.052	0.031	1	2%
Total cPAHs TEQ	ug/L	65	15	23%	0.854	0.031	5	8%
Other Semivolatiles								
1,2,4-Trichlorobenzene	ug/L	32		0%		2		0%
1,2-Dichlorobenzene	ug/L	32		0%		1300		0%
1,3-Dichlorobenzene	ug/L	32		0%		960		0%
1,4-Dichlorobenzene	ug/L	32		0%		190		0%
2,4,5-Trichlorophenol	ug/L	32		0%		3600		0%
2,4,6-Trichlorophenol	ug/L	32		0%		10		0%
2,4-Dichlorophenol	ug/L	32		0%		190		0%
2,4-Dimethylphenol	ug/L	32		0%		550		0%
2,4-Dinitrophenol	ug/L	32		0%		3500		0%
2-Chloronaphthalene	ug/L	32		0%		1000		0%
2-Chlorophenol	ug/L	32		0%		97		0%
2-Methylphenol	ug/L	32		0%				0%
2-Nitroaniline	ug/L	32		0%				0%
2-Nitrophenol	ug/L	32		0%				0%
3 & 4 Methylphenol	ug/L	32	1	3%	68			0%
3-Nitroaniline	ug/L	32		0%				0%
4,6-Dinitro-2-methylphenol	ug/L	32		0%				0%
4-Bromophenyl phenyl ether	ug/L	32		0%				0%
4-Chloro-3-methylphenol	ug/L	32		0%				0%
4-Chloroaniline	ug/L	32		0%				0%
4-Chlorophenyl phenyl ether	ug/L	32		0%				0%
4-Nitroaniline	ug/L	32		0%				0%
4-Nitrophenol	ug/L	32		0%				0%
Benzoic acid	ug/L	32		0%				0%
Benzyl alcohol	ug/L	32		0%				0%
Benzyl butyl phthalate	ug/L	32		0%		8.2		0%
Bis(2-chloro-1-methylethyl) ether	ug/L	32		0%		37		0%
Bis(2-chloroethoxy)methane	ug/L	32		0%				0%
Bis(2-chloroethyl) ether	ug/L	32		0%		1.4		0%
Bis(2-ethylhexyl) phthalate	ug/L	32		0%		5.9		0%
Carbazole	ug/L	32		0%				0%
Dibenzofuran	ug/L	32		0%				0%
Diethyl phthalate	ug/L	32	1	3%	4.1	28000		0%
Dimethyl phthalate	ug/L	32		0%		1100000		0%
Di-n-butyl phthalate	ug/L	32		0%		2900		0%
Di-n-octyl phthalate	ug/L	32		0%				0%
Hexachlorobenzene	ug/L	32		0%		1		0%
Hexachlorobutadiene	ug/L	32		0%		8.1		0%
Hexachlorocyclopentadiene	ug/L	32		0%		1100		0%
Hexachloroethane	ug/L	32		0%		8.9		0%
Isophorone	ug/L	32		0%		960		0%
Nitrobenzene	ug/L	32		0%		690		0%
N-Nitroso-di-n-propylamine	ug/L	32		0%		1		0%
N-Nitrosodiphenylamine	ug/L	32		0%		6		0%
Pentachlorophenol	ug/L	32		0%		10		0%
Phenol	ug/L	32		0%		560000		0%
2,4-Dinitrotoluene	ug/L	32		0%		9.1		0%
2,6-Dinitrotoluene	ug/L	32		0%				0%
Conventional Chemistry Parameters								
Sulfide	mg/L	30	8	27%	21.5			0%
Ammonia as Nitrogen	mg/L	30	23	77%	15.7	0.035	21	70%
Formaldehyde	ug/L	4	1	25%	30	1600		0%

Note: A blank indicates a value of zero, except for the screening level for which it indicates none available.

5 Preliminary Screening Levels

This section describes the numerical screening levels against which soil and groundwater data are compared for identifying constituents of concern during the Upland Area RI. The preliminary screening levels applied in the RI do not necessarily represent cleanup levels under MTCA. Additional information may be collected during the RI/FS to support selection of cleanup levels and/or remediation levels for the Upland Area, in accordance with MTCA. In accordance with MTCA, preliminary screening levels are not set at concentrations less than the practical quantitation limit (PQL) or natural background.

Sections 5.1 and 5.2 describe the derivation of preliminary groundwater and soil screening levels to be applied in the RI.

5.1 Groundwater Screening Levels

It is proposed that groundwater within the Upland Area is classified as nonpotable in accordance with WAC 173-340-720(2), as follows:

> **(2)(a) The groundwater does not serve as a current source of drinking water.** The Upland Area is supplied with potable water from the City of Everett, and this supply will continue in perpetuity. In accordance with the Growth Management Act objectives, the Snohomish County Health Department will not approve private wells if located within the water service area of an approved public water system, which is the case for the Upland Area.
>
> **(2)(b) The groundwater is not a potential future source of drinking water due to low yield or naturally poor water quality.** The existing data document that groundwater within the Upland Area is brackish, with total dissolved solids (TDS) commonly exceeding the 500 mg/L state drinking water standard. Brackish groundwater conditions throughout the fill are attributable to its proximity to the East Waterway (saltwater intrusion) and the fact that much of the fill was likely dredged from the marine environment.
>
> **(2)(c) It is unlikely that hazardous substances will be transported from the contaminated groundwater to groundwater that is a current or potential future source of drinking water, as defined in (a) and (b) of this subsection, at concentrations which exceed groundwater quality criteria published in chapter 173-200 WAC.** There are no drinking water wells within or downgradient of the Upland Area. Furthermore, Port Gardner Bay (Puget Sound) is the regional groundwater discharge area; therefore, regional groundwater flow is generally moving upward toward the discharge area, further limiting the potential for downward flow from the fill to deeper aquifers.
>
> **(2)(d) There is an extremely low probability that the ground water will be used for that purpose because of the site's proximity to surface water that is not suitable as a domestic water supply. At such sites, groundwater may be**

classified as nonpotable if each of the following conditions can be demonstrated[8]:

(i) There are known or projected points of entry of the groundwater into the surface water. Hydrogeologic data collected during the independent Phase 2 ESA documents that Upland Area groundwater discharges to the East Waterway;

(ii) The surface water is not classified as a suitable domestic water supply source under chapter 173-201A WAC. The East Waterway is a marine surface water body and does not classify as a suitable domestic water supply under Chapter 173-201A WAC; and

(iii) The groundwater is sufficiently hydraulically connected to the surface water that the groundwater is not practicable to use as a drinking water source. It is not practical to use Upland Area groundwater for a water supply due to the potential for drawing saline water into the water-bearing zone (saltwater intrusion); therefore, it is not practicable to use Upland Area groundwater as a drinking water source.

Because drinking water is not a practicable future use for groundwater at the Upland Area, groundwater screening levels for the RI are the most stringent criterion based on protection of the adjacent marine water body (East Waterway) and VI to future structures (indoor air) on the property. However, for the purposes of the RI, screening levels based on drinking water (potable) use are applied if surface water screening levels are not available, as required by Ecology. Sections 5.1.1 and 5.1.2 describe the screening criteria for marine protection and VI protection, respectively, that are incorporated into the groundwater screening level derivation. Section 5.1.3 describes application of potable groundwater screening levels. For arsenic, the 5 µg/L MTCA Method A groundwater cleanup level, based on background, is included in the groundwater screening criteria. In addition, because there are no marine water criteria for petroleum mixtures (TPH), MTCA Method A groundwater cleanup levels are included in the groundwater screening criteria for TPH mixtures in accordance with WAC 173-340-730(3)(iii)(C)). Note that the individual constituents comprising TPH mixtures (VOCs, PAHs, etc.) are also analyzed for, and have their own marine-based and VI-based groundwater screening levels.

Table 5-1 presents the water quality criteria incorporated into the groundwater screening level derivation, and the resulting most stringent groundwater screening levels to be applied for the RI.

5.1.1 Protection of Marine Water Quality

In accordance with MTCA, groundwater screening levels protective of surface water incorporate MTCA surface water cleanup levels including criteria from applicable state and federal laws (WAC 173-340-730). For protection of marine water quality, screening levels are the most stringent of the following aquatic life criteria (marine chronic) and human health criteria for consumption of aquatic organisms under state and federal laws:

[8] These determinations must be for reasons other than that the groundwater or surface water has been contaminated by a release of a hazardous substance at the site.

- MTCA standard Method B surface water cleanup levels based on human consumption of fish (human health only);
- Washington State Water Quality Standards (WAC 173-201A-240);
- Federal National Recommended Water Quality Criteria pursuant to Section 304(a) of the Clean Water Act; and
- The Federal National Toxics Rule (NTR; 40 CFR 131.36).

5.1.2 Protection from Vapor Intrusion

Volatilization of contaminants in shallow groundwater can represent a potential issue for VI to future structures (indoor air) or outdoor ambient air. For the purposes of this RI, conservative ("Tier 1") groundwater VI screening levels are calculated using the methodology from Ecology's vapor intrusion guidance (Ecology, 2009), and applying current (August 2013) air cleanup levels. Air concentrations protective of indoor air are more stringent than those for outdoor air; therefore, Ecology's guidance includes groundwater screening levels based on indoor air only. Measured soil vapor and ambient air data can also be used to empirically assess the groundwater-to-air pathway, in accordance with Ecology (2009).

5.1.3 Other

Many chemicals that are analyzed for during the RI do not have groundwater screening levels based on either marine surface water protection or VI protection. For those chemicals, MTCA standard Method B groundwater cleanup levels (based on potable groundwater use), if available, are applied as groundwater screening levels for the purposes of the RI, as requested by Ecology.

5.1.4 Point of Compliance for Groundwater Screening Levels

Under MTCA, the standard point of compliance for groundwater cleanup levels is throughout Upland Area groundwater, regardless of whether groundwater is potable or not (WAC 173-340-720(8)(b)). If it is not practicable to meet groundwater cleanup levels throughout the Site, Ecology may approve a conditional point of compliance for groundwater, in accordance with WAC 173-340-720(8)(c) and (d).

For volatile groundwater contaminants that can pose a risk via VI, protectiveness is achieved by meeting VI-based groundwater cleanup levels throughout Upland Area groundwater, or wherever structures would be built on grade in the future. Therefore, for VI protection, the point of compliance for Upland Area groundwater is throughout the shallowest aquifer (Fill Unit).

For the Upland Area, where groundwater's highest beneficial use is discharge to marine water, protectiveness of that beneficial use is dependent on meeting marine water criteria at the points where groundwater discharges to the East Waterway. Therefore, a groundwater conditional point of compliance may be established near the groundwater/surface water interface.

However, for the purposes of the RI, the MTCA standard point of compliance will be assumed, and data from each well will be compared against preliminary groundwater screening levels protective of both VI and marine environment. However, it will be important to evaluate shoreline monitoring well data relative to screening levels for

protection of the marine environment to inform the evaluation of remedial alternatives in the FS. As part of the RI/FS, more detailed evaluation of groundwater contaminant natural attenuation occurring between shoreline monitoring wells and the point of discharge to the marine environment (point of exposure) may be conducted.

Table 5-1 presents the groundwater screening criteria to be applied in the RI.

5.2 Soil Screening Levels

The planned future site use as an industrial shipyard with no public access meets Ecology's definition of an industrial property under MTCA (refer to Section 2.5). As such, the soil data will be evaluated relative to soil screening levels for industrial land use in the RI. Industrial soil screening levels are the most stringent concentration based on human-direct-contact and soil-leaching-to-groundwater exposure pathways. Screening levels for terrestrial ecological receptors are also incorporated for the RI. The values considered for each exposure pathway are described below.

Direct Contact Pathway

Soil concentrations protective of human direct contact under industrial land use are the more stringent of MTCA Standard Method C soil cleanup levels[9] and select MTCA Method A industrial soil cleanup levels.

Most MTCA Method A industrial soil cleanup levels are based on protection of groundwater for drinking water (potable) use. At the mill property, groundwater's highest beneficial use is discharge to marine water/sediment, not drinking water, as described in Section 5.1. Therefore, the Method A soil cleanup levels based on groundwater protection are not applicable, and this pathway is addressed separately using the most stringent groundwater screening levels developed in accordance with MTCA (described above). In addition, the Method A industrial direct-contact-based values are covered by including standard Method C cleanup levels in the screening level derivation. For the purposes of the RI, the Method A values that are included in the soil screening level derivation include arsenic (background-based), lead (no Method B value), total PCBs (an applicable or relevant and appropriate requirement [ARAR] from the federal Toxic Substances Control Act [TSCA]), and gasoline-, diesel-, and oil-range total petroleum hydrocarbons (TPH).

Risk-based Method C (industrial) soil screening levels can also be calculated for TPH mixtures, addressing all exposure pathways, if volatile petroleum hydrocarbon (VPH) and/or extractable petroleum hydrocarbon (EPH) data are collected to quantify concentrations of aromatic and aliphatic hydrocarbons in specific carbon ranges for the specific petroleum product, in accordance with MTCA.

Soil Leaching to Groundwater Pathway

Soil concentrations protective of groundwater's highest beneficial use are calculated conservatively using Ecology's variable parameter 3-phase partitioning model (WAC 173-340-747[5]), and using the most stringent groundwater screening level protective of VI for industrial land use and marine water quality (described in Section 5.1). Separate values are developed for unsaturated vs. saturated soil (MTCA-default dilution factors of

[9] Downloaded from Ecology's CLARC database.

20 vs. 1), in accordance with WAC 173-340-747(4)(e). MTCA-default parameters (WAC 173-340-747[4] and [5][10]) are used in the 3-phase model, except that a site-specific soil fractional organic carbon content (foc) of 0.0095 (0.95 percent) is used for calculation of soil:water partition coefficients (Kd = Koc x foc) for organics, in accordance with WAC 173-340-747(5)(b)(i). This is the average value from 28 Upland Area soil samples collected during the 2012 independent Phase 2 ESA.

The soil concentrations generated by this MTCA-default methodology are intentionally conservative, and are intended for preliminary screening in the RI. Soil concentrations above these screening levels may or may not actually be leaching contaminants to groundwater at concentrations of concern. MTCA provides a range of options to further evaluate site-specific soil concentrations protective of groundwater, including use of soil leaching tests and empirical groundwater quality data, as outlined in WAC 173-340-747. The soil-to-groundwater-based soil screening levels may not be considered for a chemical if it can be demonstrated that soil concentrations are protective of groundwater using methods in WAC 173-340-747.

Terrestrial Ecological Evaluation

Soil concentrations protective of terrestrial ecological receptors under an industrial land use are obtained from Table 749-3 of WAC 173-340-900.

Table 5-2 presents the soil screening criteria incorporated into the soil screening level derivation, and the resulting preliminary soil screening levels to be applied in the RI. If Ecology determines that the planned future use of the Upland Area qualifies for an exclusion from conducting a TEE in accordance with WAC 173-340-7491(1)(b), the TEE-based soil screening levels would not be applied in the RI.

5.2.1 Point of Compliance for Soil Screening Levels

In accordance with MTCA, the point of compliance for human direct contact with soil extends to 15 feet below grade, based on a reasonable maximum depth of excavation and assumed placement of excavated soils at the surface where contact occurs; therefore, for soil screening levels based on human direct contact, the soil point of compliance is to a depth of 15 feet. For soil screening levels based on groundwater protection, the soil point of compliance is all depths, above and below the water table. The standard point of compliance for soil screening levels based on terrestrial ecological receptors is also a depth of 15 feet below grade. For sites with institutional controls to prevent excavation of deeper soil, a conditional point of compliance may be set at the biologically active soil zone (assumed to extend to 6-foot depth; WAC 173-340-7490(4)(a)).

[10] Downloaded from Ecology's CLARC database.

Table 5-1 - Preliminary Groundwater Screening Levels

K-C Upland Area RI/FS, Everett, Washington

ANALYTE (BY GROUP)	APPLICABLE GROUNDWATER CRITERIA: Marine Surface Water Criteria for Establishing Method B Surface Water Cleanup Levels[a] — Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Ch. 173-201A WAC (ma-wac)	Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Clean Water Act §304 (ma-cwa)	Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - National Toxics Rule, 40 CFR 131 (ma-ntr)	Human Health Protection: Surface Water ARAR - Human Health – Marine – Clean Water Act §304 (hh-cwa)	Human Health Protection: Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131 (hh-ntr)	Human Health Protection: Surface Water, Method B Human Health, Most-Restrictive, Standard Formula (sw-b)	Human Health Protection: Surface Water, Method B Human Health, Most-Restrictive, Adjusted for ARARs[b] (hh)	Surface Water Cleanup Level for Marine Protection (marine)		Potable Groundwater Screening Level[c] (pot)	Groundwater Protective of Vapor Intrusion (Method C)[d] (vi-c)	Applicable Practical Quantitation Level (PQL)[e] (pql)	Most Stringent Groundwater Screening Level for Industrial Land Use	
Total Petroleum Hydrocarbons														
Gasoline Range Hydrocarbons in ug/L										800		100	800	*(pot)*
Diesel Range Hydrocarbons in ug/L										500		50	500	*(pot)*
Oil Range Hydrocarbons in ug/L										500		250	500	*(pot)*
Total TPHs in ug/L										500		250	500	*(pot)*
Metals														
Antimony in ug/L				640	4300	1000	640	640	*(hh)*			1	640	*(marine)*
Arsenic in ug/L	36	36	36	0.14	0.14	0.098	0.14	0.14	*(hh)*			1	5	*(footnote f)*
Barium in ug/L										2000		1	2000	*(pot)*
Beryllium ug/L						270	270	270	*(hh)*			1	270	*(marine)*
Cadmium in ug/L	9.3	8.8	9.3			41	41	8.8	*(ma-cwa)*			1	8.8	*(marine)*
Chromium (III) in ug/L						243000	243000	243000	*(hh)*			1	243000	*(marine)*
Chromium (VI) in ug/L	50	50	50			490	490	50	*(ma-wac)*			1	50	*(marine)*
Chromium (Total) in ug/L						243000	243000	243000	*(hh)*			1	243000	*(marine)*
Copper in ug/L	3.1	3.1				2900	2900	3.1	*(ma-wac)*			1	3.1	*(marine)*
Lead in ug/L	8.1	8.1	8.1					8.1	*(ma-wac)*			1	8.1	*(marine)*
Mercury in ug/L	0.025	0.94	0.025		0.15		0.15	0.025	*(ma-wac)*		1.9	0.1	0.1	*(pql)*
Nickel in ug/L	8.2	8.2	8.2	4600	4600	1100	1100	8.2	*(ma-wac)*			1	8.2	*(marine)*
Selenium in ug/L	71	71	71	4200		2700	2700	71	*(ma-wac)*			1	71	*(marine)*
Silver in ug/L	1.9	1.9	1.9			26000	26000	1.9	*(ma-wac)*			1	1.9	*(marine)*
Thallium in ug/L				0.47	6.3		0.47	0.47	*(hh)*			1	1	*(pql)*
Zinc in ug/L	81	81	81	26000		17000	17000	81	*(ma-wac)*			1	81	*(marine)*
Organometallics														
Tributyltin ug/L[h]		0.01						0.01	*(ma-cwa)*			1	1	*(pql)*
Conventionals														
Formaldehyde in ug/L										1600		100	1600	*footnote g*
Ammonia in mg/L	0.035							0.035	*(ma-wac)*			0.01	0.035	*(marine)*
Sulfide in mg/L												0.05		
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane in ug/L										1.7	74	1	1.7	*(pot)*
1,1,1-Trichloroethane in ug/L						930000	930000	930000	*(hh)*		12000	1	12000	*(vi-c)*
1,1,2 - Trichlorotrifluoroethane in ug/L										240000	2400	1	2400	*(vi-c)*
1,1,2,2-Tetrachloroethane in ug/L				4	11	6.5	11	11	*(hh)*			1	11	*(marine)*
1,1,2-Trichloroethane in ug/L				16	42	25	42	42	*(hh)*		79	1	42	*(marine)*
1,1-Dichloroethane in ug/L										1600		1	1600	*(pot)*
1,1-Dichloroethene in ug/L				7100	3.2	23000	7100	7100	*(hh)*		280	1	280	*(vi-c)*
1,1-Dichloropropene in ug/L												1		
1,2,3-Trichlorobenzene in ug/L												1		
1,2,3-Trichloropropane in ug/L										0.0015		1	1	*(pql)*
1,2,4-Trichlorobenzene in ug/L				70		2	2	2	*(hh)*		84	1	2	*(marine)*
1,2,4-Trimethylbenzene in ug/L											61	1	61	*(vi-c)*
1,2-Dibromo-3-chloropropane in ug/L										0.2		10	10	*(pql)*
1,2-Dibromoethane (EDB) in ug/L										0.05	2.7	1	1	*(pql)*
1,2-Dichlorobenzene in ug/L				1300	17000	4200	1300	1300	*(hh)*		5700	1	1300	*(marine)*
1,2-Dichloroethane (EDC) in ug/L				37	99	59	99	99	*(hh)*		42	1	42	*(vi-c)*
1,2-Dichloropropane in ug/L				15			15	15	*(hh)*		62	1	15	*(marine)*
1,3,5-Trimethylbenzene in ug/L										80		1	80	*(pot)*
1,3-Dichlorobenzene in ug/L				960	2600		960	960	*(hh)*			1	960	*(marine)*
1,3-Dichloropropane in ug/L												1		
1,4-Dichloro-2-Butene in ug/L												1		

Table 5-1 - Preliminary Groundwater Screening Levels

K-C Upland Area RI/FS, Everett, Washington

	APPLICABLE GROUNDWATER CRITERIA													
	Marine Surface Water Criteria for Establishing Method B Surface Water Cleanup Levels[a]													
	Aquatic Protection			**Human Health Protection**										
ANALYTE (BY GROUP)	Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Ch. 173-201A WAC *(ma-wac)*	Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Clean Water Act §304 *(ma-cwa)*	Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - National Toxics Rule, 40 CFR 131 *(ma-ntr)*	Surface Water ARAR - Human Health – Marine – Clean Water Act §304 *(hh-cwa)*	Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131 *(hh-ntr)*	Surface Water, Method B Human Health, Most-Restrictive, Standard Formula *(sw-b)*	Surface Water, Method B Human Health, Most-Restrictive, Adjusted for ARARs[b] *(hh)*	**Surface Water Cleanup Level for Marine Protection** *(marine)*		**Potable Groundwater Screening Level[c]** *(pot)*	**Groundwater Protective of Vapor Intrusion (Method C)[d]** *(vi-c)*	**Applicable Practical Quantitation Level (PQL)[e]** *(pql)*	**Most Stringent Groundwater Screening Level for Industrial Land Use**	
1,4-Dichlorobenzene in ug/L				190	2600		190	190	*(hh)*		17000	1	190	*(marine)*
2,2-Dichloropropane in ug/L												1		
2-Butanone in ug/L										4800	3800000	10	4800	*(pot)*
2-Chloroethyl Vinyl Ether in ug/L												1		
2-Chlorotoluene in ug/L										160		1	160	*(pot)*
2-Hexanone in ug/L												10		
4-Chlorotoluene in ug/L												1		
4-Methyl-2-pentanone in ug/L										640	1000000	10	640	*(pot)*
Acetone in ug/L										7200		10	7200	*(pot)*
Acrolein in ug/L				290	780		290	290	*(hh)*		6.4	1	6.4	*(vi-c)*
Acrylonitrile in ug/L				0.25	0.66	0.4	0.66	0.66	*(hh)*		160	1	1	*(pql)*
Benzene in ug/L				51	71	23	71	71	*(hh)*		24	0.35	24	*(vi-c)*
bis(2-chloroisopropyl)ether ug/L				65000	170000		65000	65000	*(hh)*			1	65000	*(marine)*
Bromobenzene in ug/L												1		
Bromochloromethane in ug/L												1		
Bromodichloromethane in ug/L				17	22	28	22	22	*(hh)*		0.9	1	1	*(pql)*
Bromoethane in ug/L												1		
Bromoform in ug/L				140	360	220	360	360	*(hh)*		2000	1	360	*(marine)*
Bromomethane in ug/L				1500	4000	970	970	970	*(hh)*		28	1	28	*(vi-c)*
Carbon disulfide in ug/L										800	870	1	800	*(pot)*
Carbon tetrachloride in ug/L				1.6	4.4	4.9	4.4	4.4	*(hh)*		5.6	1	4.4	*(marine)*
Chlorobenzene in ug/L				1600	21000	5000	1600	1600	*(hh)*		640	1	640	*(vi-c)*
Chloroethane in ug/L											40000	1	40000	*(vi-c)*
Chloroform in ug/L				470	470	6900	470	470	*(hh)*		12	1	12	*(vi-c)*
Chloromethane in ug/L											340	10	340	*(vi-c)*
cis-1,2-Dichloroethene (DCE) in ug/L										16		1	16	*(pot)*
cis-1,3-Dichloropropene in ug/L												1		
Dibromochloromethane in ug/L				13	34	21	34	34	*(hh)*		2.2	1	2.2	*(vi-c)*
Dibromomethane in ug/L										80		1	80	*(pot)*
Dichlorodifluoromethane in ug/L										1600	25	1	25	*(vi-c)*
Ethylbenzene in ug/L				2100	29000	6900	2100	2100	*(hh)*		6100	1	2100	*(marine)*
Hexachlorobutadiene in ug/L				18	50	30	50	50	*(hh)*		8.1	1	8.1	*(vi-c)*
Isopropylbenzene in ug/L										800	1600	1	800	*(pot)*
m,p-Xylenes in ug/L										1000		2	1000	*(pot)*
Methylene chloride in ug/L				590	1600	960	1600	1600	*(hh)*		940	5	940	*(vi-c)*
Methyl-Tert-Butyl Ether ug/L											190000	1	190000	*(vi-c)*
Methyliodide in ug/L												1		
n-Butylbenzene in ug/L												1		
n-Propylbenzene in ug/L												1		
o-Xylene in ug/L										1600		1	1600	*(pot)*
p-Isopropyltoluene in ug/L											1600	1	1600	*(vi-c)*
Pyridine in ug/L												1		
sec-Butylbenzene in ug/L												1		
Styrene in ug/L										100	18000	1	100	*(pot)*
tert-Butylbenzene in ug/L												1		
Tetrachloroethene (PCE) in ug/L				3.3	8.9	100	8.9	8.9	*(hh)*		240	1	8.9	*(marine)*
Toluene in ug/L				15000	200000	19000	15000	15000	*(hh)*		34000	1	15000	*(marine)*
trans-1,2-Dichloroethene in ug/L				10000		33000	10000	10000	*(hh)*		250	1	250	*(vi-c)*
trans-1,3-Dichloropropene in ug/L												1		
Trichloroethene (TCE) in ug/L				30	81	13	81	81	*(hh)*		8.4	1	8.4	*(vi-c)*

Table 5-1 - Preliminary Groundwater Screening Levels

K-C Upland Area RI/FS, Everett, Washington

ANALYTE (BY GROUP)	APPLICABLE GROUNDWATER CRITERIA: Marine Surface Water Criteria for Establishing Method B Surface Water Cleanup Levels[a] — Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Ch. 173-201A WAC (ma-wac)	Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Clean Water Act §304 (ma-cwa)	Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - National Toxics Rule, 40 CFR 131 (ma-ntr)	Human Health Protection: Surface Water ARAR - Human Health – Marine – Clean Water Act §304 (hh-cwa)	Human Health Protection: Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131 (hh-ntr)	Human Health Protection: Surface Water, Method B Human Health, Most-Restrictive, Standard Formula (sw-b)	Human Health Protection: Surface Water, Method B Human Health, Most-Restrictive, Adjusted for ARARs[b] (hh)	Surface Water Cleanup Level for Marine Protection (marine)		Potable Groundwater Screening Level[c] (pot)	Groundwater Protective of Vapor Intrusion (Method C)[d] (vi-c)	Applicable Practical Quantitation Level (PQL)[e] (pql)	Most Stringent Groundwater Screening Level for Industrial Land Use	
Trichlorofluoromethane in ug/L										2400	260	1	260	(vi-c)
Vinyl acetate in ug/L										8000	17000	10	8000	(pot)
Vinyl chloride in ug/L				2.4	530	3.7	2.4	2.4	(hh)		3.5	0.2	2.4	(marine)
Xylenes, total											670	1	670	(vi-c)
Polycyclic Aromatic Hydrocarbons (PAHs)														
Acenaphthene in ug/L				990		640	640	640	(hh)	960		0.05	640	(marine)
Acenaphthylene in ug/L										960		0.05	960	(pot)
Anthracene in ug/L				40000	110000	26000	26000	26000	(hh)			0.05	26000	(marine)
Benzo(g,h,i)perylene in ug/L												0.05		
Fluoranthene in ug/L				140	370	90	90	90	(hh)			0.05	90	(marine)
Fluorene in ug/L				5300	14000	3500	3500	3500	(hh)			0.05	3500	(marine)
Phenanthrene in ug/L												0.05		
Pyrene in ug/L				4000	11000	2600	2600	2600	(hh)			0.05	2600	(marine)
1-Methylnaphthalene in ug/L										1.5		0.05	1.5	(pot)
2-Methylnaphthalene in ug/L										32		0.05	32	(pot)
Naphthalene in ug/L						4900	4900	4900	(hh)		360	0.05	360	(vi-c)
Benz(a)anthracene in ug/L				0.018	0.031	0.30	0.031	0.031	(hh)			0.01	0.031	(marine)
Benzo(a)pyrene in ug/L				0.018	0.031	0.03	0.031	0.031	(hh)			0.01	0.031	(marine)
Benzo(b)fluoranthene in ug/L				0.018	0.031	0.30	0.031	0.031	(hh)			0.01	0.031	(marine)
Benzo(k)fluoranthene in ug/L				0.018	0.031	3.0	0.031	0.031	(hh)			0.01	0.031	(marine)
Chrysene in ug/L				0.018	0.031	30	0.031	0.031	(hh)			0.01	0.031	(marine)
Dibenzo(a,h)anthracene in ug/L				0.018	0.031	0.03	0.031	0.031	(hh)			0.01	0.031	(marine)
Indeno(1,2,3-cd)pyrene in ug/L				0.018	0.031	0.30	0.031	0.031	(hh)			0.01	0.031	(marine)
Total cPAHs TEQ in ug/L				0.018	0.031	0.03	0.031	0.031	(hh)			0.015	0.031	(marine)
Other Semi-Volatile Organics														
1,2,4-Trichlorobenzene in ug/L				70		2	2	2	(hh)		84	1	2	(marine)
1,2-Dichlorobenzene in ug/L				1300	17000	4200	1300	1300	(hh)		5700	1	1300	(marine)
1,3-Dichlorobenzene in ug/L				960	2600		960	960	(hh)			1	960	(marine)
1,4-Dichlorobenzene in ug/L				190	2600		190	190	(hh)		17000	1	190	(marine)
2,3,4,6-Tetrachlorophenol ug/L										480		10	480	(pot)
2,4,5-Trichlorophenol in ug/L				3600			3600	3600	(hh)			10	3600	(marine)
2,4,6-Trichlorophenol in ug/L				2.4	6.5	3.9	2.4	2.4	(hh)			10	10	(pql)
2,4-Dichlorophenol in ug/L				290	790	190	190	190	(hh)			10	190	(marine)
2,4-Dimethylphenol in ug/L				850		550	550	550	(hh)			10	550	(marine)
2,6-Dichlorophenol ug/L												30		
2,4-Dinitrophenol in ug/L				5300	14000	3500	3500	3500	(hh)			30	3500	(marine)
2-Chloronaphthalene in ug/L				1600		1000	1000	1000	(hh)			1	1000	(marine)
2-Chlorophenol in ug/L						97	97	97	(hh)			10	97	(marine)
2-Methylphenol in ug/L										400		10	400	(pot)
2-Nitroaniline in ug/L										160		3	160	(pot)
2-Nitrophenol in ug/L												10		
3,3'-Dichlorobenzidine in ug/L				0.028	0.077	0.046	0.077	0.077	(hh)			5	5	(pql)
3-Nitroaniline in ug/L												3		
4,6-Dinitro-2-methylphenol in ug/L												10		
4-Bromophenyl phenyl ether in ug/L												1		
4-Chloro-3-methylphenol in ug/L												3		
4-Chloroaniline in ug/L										0.22		5	5	(pql)
4-Chlorophenyl phenyl ether in ug/L												1		
4-Methylphenol in ug/L										40		2	40	(pot)
4-Nitroaniline in ug/L												3		

Table 5-1 - Preliminary Groundwater Screening Levels

K-C Upland Area RI/FS, Everett, Washington

ANALYTE (BY GROUP)	APPLICABLE GROUNDWATER CRITERIA: Marine Surface Water Criteria for Establishing Method B Surface Water Cleanup Levels[a] — Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Ch. 173-201A WAC (ma-wac)	Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Clean Water Act §304 (ma-cwa)	Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - National Toxics Rule, 40 CFR 131 (ma-ntr)	Human Health Protection: Surface Water ARAR - Human Health – Marine – Clean Water Act §304 (hh-cwa)	Human Health Protection: Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131 (hh-ntr)	Human Health Protection: Surface Water, Method B Human Health, Most-Restrictive, Standard Formula (sw-b)	Human Health Protection: Surface Water, Method B Human Health, Most-Restrictive, Adjusted for ARARs[b] (hh)	Surface Water Cleanup Level for Marine Protection (marine)		Potable Groundwater Screening Level[c] (pot)	Groundwater Protective of Vapor Intrusion (Method C)[d] (vi-c)	Applicable Practical Quantitation Level (PQL)[e] (pql)	Most Stringent Groundwater Screening Level for Industrial Land Use	
4-Nitrophenol in ug/L												10		
Aniline ug/L										7.7		1	7.7	*(pot)*
Azobenzene ug/L										0.8		1	1	*(pql)*
Benzoic acid in ug/L										64000		20	64000	*(pot)*
Benzyl alcohol in ug/L										800		5	800	*(pot)*
Benzyl butyl phthalate in ug/L				1900		8.2	8.2	8.2	*(hh)*			1	8.2	*(marine)*
Bis(2-chloro-1-methylethyl) ether in ug/L						37	37	37	*(hh)*			1	37	*(marine)*
Bis(2-chloroethoxy)methane in ug/L												1		
Bis(2-chloroethyl) ether in ug/L				0.53	1.4	0.85	1.4	1.4	*(hh)*		260	1	1.4	*(marine)*
Bis(2-ethylhexyl) phthalate in ug/L				2.2	5.9	3.6	5.9	5.9	*(hh)*			3	5.9	*(marine)*
Carbazole in ug/L												1		
Dibenzofuran in ug/L										16		1	16	*(pot)*
Diethyl phthalate in ug/L				44000	120000	28000	28000	28000	*(hh)*			1	28000	*(marine)*
Dimethyl phthalate in ug/L				1100000	2900000		1100000	1100000	*(hh)*			1	1100000	*(marine)*
Di-n-butyl phthalate in ug/L				4500	12000	2900	2900	2900	*(hh)*			1	2900	*(marine)*
Di-n-octyl phthalate in ug/L												1		
Hexachlorobenzene in ug/L				0.00029	0.00077	0.00047	0.00077	0.00077	*(hh)*			1	1	*(pql)*
Hexachlorobutadiene in ug/L				18	50	30	50	50	*(hh)*		8.1	3	8.1	*(vi-c)*
Hexachlorocyclopentadiene in ug/L				1100	17000	3600	1100	1100	*(hh)*			5	1100	*(marine)*
Hexachloroethane in ug/L				3.3	8.9	5.3	8.9	8.9	*(hh)*		86	2	8.9	*(marine)*
Isophorone in ug/L				960	600	1600	960	960	*(hh)*			1	960	*(marine)*
Nitrobenzene in ug/L				690	1900	1800	690	690	*(hh)*		1600	1	690	*(marine)*
N-Nitroso-di-n-propylamine in ug/L				0.51		0.82	0.51	0.51	*(hh)*			1	1	*(pql)*
N-Nitrosodiethanolamine ug/L												1		
N-Nitrosodimethylamine ug/L				3	8.1	4.9	3	3	*(hh)*			3	3	*(marine)*
N-Nitrosodiphenylamine in ug/L				6	16	9.7	6	6	*(hh)*			1	6	*(marine)*
Pentachlorophenol in ug/L	7.9	7.9	7.9	3	8.2	1.5	8.2	7.9	*(ma-wac)*			10	10	*(pql)*
Phenol in ug/L				1700000	4600000	560000	560000	560000	*(hh)*			1	560000	*(marine)*
2,4-Dinitrotoluene in ug/L				3.4	9.1	1400	9.1	9.1	*(hh)*			1	9.1	*(marine)*
2,6-Dinitrotoluene in ug/L										16		1	16	*(pot)*

Table 5-1 - Preliminary Groundwater Screening Levels

K-C Upland Area RI/FS, Everett, Washington

ANALYTE (BY GROUP)	APPLICABLE GROUNDWATER CRITERIA: Marine Surface Water Criteria for Establishing Method B Surface Water Cleanup Levels[a] — Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Ch. 173-201A WAC (ma-wac)	Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - Clean Water Act §304 (ma-cwa)	Aquatic Protection: Surface Water ARAR - Aquatic Life - Marine, Most Restrictive - National Toxics Rule, 40 CFR 131 (ma-ntr)	Human Health Protection: Surface Water ARAR - Human Health – Marine – Clean Water Act §304 (hh-cwa)	Human Health Protection: Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131 (hh-ntr)	Human Health Protection: Surface Water, Method B Human Health, Most-Restrictive, Standard Formula (sw-b)	Human Health Protection: Surface Water, Method B Human Health, Most-Restrictive, Adjusted for ARARs[b] (hh)	Surface Water Cleanup Level for Marine Protection (marine)		Potable Groundwater Screening Level[c] (pot)	Groundwater Protective of Vapor Intrusion (Method C)[d] (vi-c)	Applicable Practical Quantitation Level (PQL)[e] (pql)	Most Stringent Groundwater Screening Level for Industrial Land Use	
Polychlorinated Biphenyls (PCBs)														
Aroclor 1016 in ug/L			0.03			0.003	0.003	0.003	*(hh)*			0.2		
Aroclor 1221 in ug/L												0.4		
Aroclor 1232 in ug/L												0.2		
Aroclor 1242 in ug/L												0.2		
Aroclor 1248 in ug/L												0.2		
Aroclor 1254 in ug/L			0.03			0.0001	0.0001	0.0001	*(hh)*			0.2		
Aroclor 1260 in ug/L			0.03					0.03	*(ma-ntr)*			0.2		
Total PCBs in ug/L	0.03	0.03	0.03	0.000064	0.00017	0.00010	0.00017	0.00017	*(hh)*			1.6	1.6	*(pql)*
Dioxins/Furans														
2,3,7,8-TCDD in ug/L				5.1E-09	1.4E-08	8.6E-09	1.4E-08	1.4E-08	*(hh)*			1.0E-05		
1,2,3,7,8-PeCDD in ug/L												5.0E-05		
1,2,3,4,7,8-HxCDD in ug/L												5.0E-05		
1,2,3,6,7,8-HxCDD in ug/L												5.0E-05		
1,2,3,7,8,9-HxCDD in ug/L												5.0E-05		
1,2,3,4,6,7,8-HpCDD in ug/L												5.0E-05		
OCDD in ug/L												1.0E-04		
2,3,7,8-TCDF in ug/L												1.0E-05		
1,2,3,7,8-PeCDF in ug/L												5.0E-05		
2,3,4,7,8-PeCDF in ug/L												5.0E-05		
1,2,3,4,7,8-HxCDF in ug/L												5.0E-05		
1,2,3,6,7,8-HxCDF in ug/L												5.0E-05		
1,2,3,7,8,9-HxCDF in ug/L												5.0E-05		
2,3,4,6,7,8-HxCDF in ug/L												5.0E-05		
1,2,3,4,6,7,8-HpCDF in ug/L												5.0E-05		
1,2,3,4,7,8,9-HpCDF in ug/L												5.0E-05		
OCDF in ug/L												1.0E-04		
Total 2,3,7,8 TCDD (TEQ) in ug/L				5.1E-09	1.4E-08	8.6E-09	1.4E-08	1.4E-08	*(hh)*			6.3E-05	6.25E-05	*(pql)*

Notes:

a Method B Surface Water Cleanup Levels are as stringent as the following: ARARs, environmental effects, and human health protection. Criteria values taken from Ecology's on-line CLARC Database.

b Surface Water Method B human health levels established using the standard Method B formula in MTCA were compared to state and federal human health based ARARs. ARARs that are sufficiently protective under MTCA (i.e., less than a risk of 10-5 and HQ of 1) were selected as the cleanup level for human health protection.

c Upland Area groundwater is not be a practicable source of potable groundwater, but, for the purposes of the RI, potable groundwater screening levels are applied for those compounds without either marine water-based screening levels as requested by Ecology.

d Updated values provided by Andy Kallus, Ecology (August 2013).

e Analytical method reporting limits. PQLs for total cPAH (TEQ) and total TCDD (TEQ) are adjusted for TEFs.

f Based on background concentrations in Washington state (WAC 173-340-900 Table 720-1).

g Formaldehyde value based on protection of aquatic life (Anchor Environmental, 2008). Value is coincidentally equal to potable water screening level.

h Tributyltin aquatic life criterion is based on tributyltin oxide.

Table 5-2 - Preliminary Soil Screening Levels

K-C Upland Area RI/FS, Everett, Washington

ANALYTE (BY GROUP)	Most Stringent Groundwater Screening Level (Industrial) (ug/L)	APPLICABLE SOIL CRITERIA: Soil Protective of Groundwater — Constants and Coefficients [a]: K_{oc} (Soil Organic Carbon-Water Partitioning Coefficient for organics) (L/kg)	K_d (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (Hcc; unitless)	Calculated Values: Unsaturated Soil Concentration Protective of Leachability to Groundwater for Industrial Land Use (mg/kg)[b] (gwl-u)	Saturated Soil Concentration Protective of Leachability to Groundwater for Industrial Land Use (mg/kg)[c] (gwl-s)	Groundwater Exceedances Confirmed Empirically for Analyte? [m] (Y = yes; blank = no)	Soil, Method A, Industrial Land Use, Table Value (mg/kg)[d] (mA)	Soil Protective of Human Direct Contact[e]: Soil, Method C, Most-Restrictive Standard Formula Value, Direct Contact, Industrial Land Use (mg/kg) (mC)	Soil Protective of Terrestrial Species (mg/kg)[f] (TEE)	Natural Background Concentration (mg/kg)[g] (back)	Practical Quantitation Level (PQL) (mg/kg)[h] (pql)	Most Stringent Industrial Soil Screening Level (mg/kg): Unsaturated Soil		Saturated Soil	
Total Petroleum Hydrocarbons																
Gasoline Range Hydrocarbons	800						Y	30/100		5000		5	30/100	*(mA)*	30/100	*(mA)*
Diesel Range Hydrocarbons	500						Y	2000		6000		25	2000	*(mA)*	2000	*(mA)*
Oil Range Hydrocarbons	500						Y	2000				100	2000	*(mA)*	2000	*(mA)*
Metals																
Antimony	640		*45*	*0.00E+00*	580	29			1400			1	1400	*(mC)*	1400	*(mC)*
Arsenic	5		*29*	*0.00E+00*	2.9	0.15	Y	20	88	132	7	1	20	*footnote i*	20	*footnote i*
Barium	2000		*41*	*0.00E+00*	1600	83			700000	102		1	102	*(TEE)*	102	*(TEE)*
Beryllium	270		*790*	*0.00E+00*	4300	210			7000		0.6	1	7000	*(mC)*	7000	*(mC)*
Cadmium	8.8		*6.7*	*0.00E+00*	1.2	0.061			3500	14	1	1	14	*(TEE)*	14	*(TEE)*
Chromium (III)	243000		*1000*	*0.00E+00*	4900000	240000			5.3E+06	67	48	1	67	*(TEE)*	67	*(TEE)*
Chromium (VI)	50		*19*	*0.00E+00*	19	0.96			11000			1	11000	*(mC)*	11000	*(mC)*
Chromium (Total)	243000		*1000*	*0.00E+00*	4900000	240000			5.3E+06	67	48	1	67	*(TEE)*	67	*(TEE)*
Copper	3.1		*22*	*0.00E+00*	1.4	0.069	Y		140000	217	36	1	36	*(back)*	36	*(back)*
Lead	8.1		*10000*	*0.00E+00*	1600	81	Y	1000		118	24	1	118	*(TEE)*	81	*(gwl-s)*
Mercury	0.1		*52*	*4.70E-01*	0.1	0.0052			1050	5.5	0.07	0.1	5.5	*(TEE)*	5.5	*(TEE)*
Nickel	8.2		*65*	*0.00E+00*	11	0.54	Y		70000	980	48	1	48	*(back)*	48	*(back)*
Selenium	71		*5*	*0.00E+00*	7.4	0.38			18000	0.3		1	1	*(pql)*	1	*(pql)*
Silver	1.9		*8.3*	*0.00E+00*	0.32	0.016			18000			1	18000	*(mC)*	18000	*(mC)*
Thallium	1		*71*	*0.00E+00*	1.4	0.071						1				
Zinc	81		*62*	*0.00E+00*	100	5			1100000	360	85	1	360	*(TEE)*	360	*(TEE)*
Organometallics																
Tributyltin	1								1100			0.01	1100	*(mC)*	1100	*(mC)*
Conventionals																
Formaldehyde	1600								700000			0.05	700000	*(mC)*	700000	*(mC)*
Volatile Organic Compounds																
1,1,1,2-Tetrachloroethane	1.7	*86*		*1.0E-01*	0.035	0.0019			5000			0.05	5000	*(mC)*	5000	*(mC)*
1,1,1-Trichloroethane	12000	*140*		*7.1E-01*	380	19			7000000			0.05	7000000	*(mC)*	7000000	*(mC)*
1,1,2 - Trichlorotrifluoroethane	2400	*197*		*2.2E+01*	190	5.2			110000000			0.05	110000000	*(mC)*	110000000	*(mC)*
1,1,2,2-Tetrachloroethane	11	*79*		*1.4E-02*	0.21	0.011			660			0.05	660	*(mC)*	660	*(mC)*
1,1,2-Trichloroethane	42	*75*		*3.7E-02*	0.77	0.042			2300			0.05	2300	*(mC)*	2300	*(mC)*
1,1-Dichloroethane	1600	*53*		*2.3E-01*	23	1.3			700000			0.05	700000	*(mC)*	700000	*(mC)*
1,1-Dichloroethene	280	*65*		*1.1E+00*	5.1	0.25			180000			0.05	180000	*(mC)*	180000	*(mC)*
1,1-Dichloropropene												0.05				
1,2,3-Trichlorobenzene												0.25				
1,2,3-Trichloropropane	1	*116*		*1.4E-02*	0.026	0.0014			4.4			0.05	4.4	*(mC)*	4.4	*(mC)*
1,2,4-Trichlorobenzene	2	*1700*		*5.8E-02*	0.65	0.033			4500			0.25	4500	*(mC)*	4500	*(mC)*
1,2,4-Trimethylbenzene	61	*614*		*2.5E-01*	7.4	0.37						0.05				
1,2-Dibromo-3-chloropropane	10	*116*		*6.0E-03*	0.26	0.014			160			0.05	160	*(mC)*	160	*(mC)*
1,2-Dibromoethane (EDB)	1	*66*		*2.7E-02*	0.017	0.00091			66			0.05	66	*(mC)*	66	*(mC)*
1,2-Dichlorobenzene	1300	*380*		*7.8E-02*	99	5			320000			0.05	320000	*(mC)*	320000	*(mC)*
1,2-Dichloroethane (EDC)	42	*38*		*4.0E-02*	0.47	0.027			1400			0.05	1400	*(mC)*	1400	*(mC)*
1,2-Dichloropropane	15	*47*		*1.2E-01*	0.2	0.011						0.05				
1,3,5-Trimethylbenzene	80	*602*		*3.6E-01*	9.5	0.48			35000			0.05	35000	*(mC)*	35000	*(mC)*
1,3-Dichlorobenzene	960											0.05				
1,3-Dichloropropane												0.05				
1,4-Dichloro-2-Butene												0.05				
1,4-Dichlorobenzene	190	*620*		*1.0E-01*	23	1.2						0.05				
2,2-Dichloropropane												0.05				

Table 5-2 - Preliminary Soil Screening Levels

K-C Upland Area RI/FS, Everett, Washington

ANALYTE (BY GROUP)	Most Stringent Groundwater Screening Level (Industrial) (ug/L)	APPLICABLE SOIL CRITERIA: Soil Protective of Groundwater — Constants and Coefficients [a]: K_{oc} (Soil Organic Carbon-Water Partitioning Coefficient for organics) (L/kg)	K_d (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (Hcc; unitless)	Calculated Values: Unsaturated Soil Concentration Protective of Leachability to Groundwater for Industrial Land Use (mg/kg)[b] (gwl-u)	Saturated Soil Concentration Protective of Leachability to Groundwater for Industrial Land Use (mg/kg)[c] (gwl-s)	Groundwater Exceedances Confirmed Empirically for Analyte? [m] (Y = yes; blank = no)	Soil, Method A, Industrial Land Use, Table Value (mg/kg)[d] (mA)	Soil Protective of Human Direct Contact[e]: Soil, Method C, Most-Restrictive Standard Formula Value, Direct Contact, Industrial Land Use (mg/kg) (mC)	Soil Protective of Terrestrial Species (mg/kg)[f] (TEE)	Natural Background Concentration (mg/kg)[g] (back)	Practical Quantitation Level (PQL) (mg/kg)[h] (pql)	*Most Stringent Industrial Soil Screening Level (mg/kg)*: Unsaturated Soil		Saturated Soil	
2-Butanone	4800	4.51		2.3E-03	23	1.6			2100000			0.5	2100000	(mC)	2100000	(mC)
2-Chloroethyl Vinyl Ether												0.05				
2-Chlorotoluene	160	382.9		1.5E-01	12	0.63			70000			0.05	70000	(mC)	70000	(mC)
2-Hexanone												0.5				
4-Chlorotoluene												0.05				
4-Methyl-2-pentanone	640	12.6		5.6E-03	4.1	0.26			280000			0.5	280000	(mC)	280000	(mC)
Acetone	7200	0.58		1.6E-03	30	2.1			3200000			0.05	3200000	(mC)	3200000	(mC)
Acrolein	6.4	1		5.0E-03	0.027	0.0019			1800			0.05	1800	(mC)	1800	(mC)
Acrylonitrile	1	8.511		5.6E-03	0.0056	0.00037			240			0.05	240	(mC)	240	(mC)
Benzene	24	62		2.3E-01	0.39	0.021			2400			0.05	2400	(mC)	2400	(mC)
bis(2-chloroisopropyl)ether	65000											0.05				
Bromobenzene												0.05				
Bromochloromethane												0.05				
Bromodichloromethane	1	55		6.6E-02	0.015	0.00081			2100			0.05	2100	(mC)	2100	(mC)
Bromoethane												0.05				
Bromoform	360	130		2.2E-02	10	0.55			17000			0.05	17000	(mC)	17000	(mC)
Bromomethane	28	9		2.6E-01	0.17	0.01			4900			0.05	4900	(mC)	4900	(mC)
Carbon disulfide	800	46		1.2E+00	12	0.58			350000			0.05	350000	(mC)	350000	(mC)
Carbon tetrachloride	4.4	150		1.3E+00	0.15	0.0075			1900			0.05	1900	(mC)	1900	(mC)
Chlorobenzene	640	220		1.5E-01	29	1.5			70000			0.05	70000	(mC)	70000	(mC)
Chloroethane	40000	22		4.5E-01	360	20						0.05				
Chloroform	12	53		1.5E-01	0.17	0.0095			35000			0.05	35000	(mC)	35000	(mC)
Chloromethane	340	6		3.6E-01	2	0.12						0.5				
cis-1,2-Dichloroethene (DCE)	16	36		1.7E-01	0.18	0.01			7000			0.05	7000	(mC)	7000	(mC)
cis-1,3-Dichloropropene												0.05				
Dibromochloromethane	2.2	63		3.2E-02	0.035	0.0019			1600			0.05	1600	(mC)	1600	(mC)
Dibromomethane	80	22		3.4E-02	0.65	0.039			35000			0.05	35000	(mC)	35000	(mC)
Dichlorodifluoromethane	25	44		1.4E+01	0.92	0.018			700000			0.5	700000	(mC)	700000	(mC)
Ethylbenzene	2100	200		3.2E-01	89	4.6			350000			0.05	350000	(mC)	350000	(mC)
Hexachlorobutadiene	8.1	54000		3.3E-01	83	4.1			1700			0.25	1700	(mC)	1700	(mC)
Isopropylbenzene	800	698		4.7E-01	110	5.5			350000			0.05	350000	(mC)	350000	(mC)
m,p-Xylenes	1000	233		2.8E-01	49	2.5						0.1				
Methylene chloride	940	10		9.0E-02	5.7	0.36			18000			0.05	18000	(mC)	18000	(mC)
Methyl-Tert-Butyl Ether	190000	10.9		1.8E-02	1200	74						0.05				
Methyliodide												0.05				
n-Butylbenzene												0.05				
n-Propylbenzene									350000			0.05	350000	(mC)	350000	(mC)
o-Xylene	1600	240		2.1E-01	80	4.1			700000			0.05	700000	(mC)	700000	(mC)
p-Isopropyltoluene	1600											0.05				
Pyridine												0.05				
sec-Butylbenzene												0.05				
Styrene	100	910		1.1E-01	18	0.89			700000			0.05	700000	(mC)	700000	(mC)
tert-Butylbenzene												0.05				
Tetrachloroethene (PCE)	8.9	270		7.5E-01	0.5	0.025			240			0.025	240	(mC)	240	(mC)
Toluene	15000	140		2.7E-01	460	24			280000			0.05	280000	(mC)	280000	(mC)
trans-1,2-Dichloroethene	250	38		3.9E-01	3	0.16			70000			0.05	70000	(mC)	70000	(mC)
trans-1,3-Dichloropropene												0.05				
Trichloroethene (TCE)	8.4	94		4.2E-01	0.19	0.0099			1100			0.05	1100	(mC)	1100	(mC)
Trichlorofluoromethane	260	44		4.0E+00	5	0.18			1100000			0.05	1100000	(mC)	1100000	(mC)

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ANALYTE (BY GROUP)	Most Stringent Groundwater Screening Level (Industrial) (ug/L)	APPLICABLE SOIL CRITERIA: Soil Protective of Groundwater — Constants and Coefficients [a]: K_{oc} (Soil Organic Carbon-Water Partitioning Coefficient for organics) (L/kg)	K_d (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (Hcc; unitless)	Calculated Values: Unsaturated Soil Concentration Protective of Leachability to Groundwater for Industrial Land Use (mg/kg)[b] (gwl-u)	Saturated Soil Concentration Protective of Leachability to Groundwater for Industrial Land Use (mg/kg)[c] (gwl-s)	Groundwater Exceedances Confirmed Empirically for Analyte? [m] (Y = yes; blank = no)	Soil, Method A, Industrial Land Use, Table Value (mg/kg)[d] (mA)	Soil Protective of Human Direct Contact[e]: Soil, Method C, Most-Restrictive Standard Formula Value, Direct Contact, Industrial Land Use (mg/kg) (mC)	Soil Protective of Terrestrial Species (mg/kg)[f] (TEE)	Natural Background Concentration (mg/kg)[g] (back)	Practical Quantitation Level (PQL) (mg/kg)[h] (pql)	Most Stringent Industrial Soil Screening Level (mg/kg): Unsaturated Soil		Saturated Soil	
Vinyl acetate	8000	5.3		2.1E-02	40	2.7			3500000			0.05	3500000	(mC)	3500000	(mC)
Vinyl chloride	2.4	19		1.1E+00	0.023	0.0011			88			0.05	88	(mC)	88	(mC)
Xylenes (total)	670	230		2.8E-01	32	1.6			700000			0.05	700000	(mC)	700000	(mC)
Polycyclic Aromatic Hydrocarbons (PAHs)																
Acenaphthene	640	4900		6.4E-03	600	30			210000			0.03	210000	(mC)	210000	(mC)
Acenaphthylene	960											0.03				
Anthracene	26000	23000		2.7E-03	110000	5700			1100000			0.03	1100000	(mC)	1100000	(mC)
Benzo(g,h,i)perylene												0.03				
Fluoranthene	90	49000		6.6E-04	830	42			140000			0.03	140000	(mC)	140000	(mC)
Fluorene	3500	7700		2.6E-03	5100	260			140000			0.03	140000	(mC)	140000	(mC)
Phenanthrene												0.03				
Pyrene	2600	68000		4.5E-04	33000	1700			110000			0.03	110000	(mC)	110000	(mC)
1-Methylnaphthalene	1.5	2528		2.1E-02	0.72	0.036			4500			0.03	4500	(mC)	4500	(mC)
2-Methylnaphthalene	32	2478		2.1E-02	15	0.76			14000			0.03	14000	(mC)	14000	(mC)
Naphthalene	360	1200		2.0E-02	83	4.2			70000			0.03	70000	(mC)	70000	(mC)
Benz(a)anthracene	0.031	360000		1.4E-04								0.01				
Benzo(a)pyrene	0.031	970000		4.6E-05								0.01				
Benzo(b)fluoranthene	0.031	1200000		4.6E-03								0.01				
Benzo(k)fluoranthene	0.031	1200000		3.4E-05								0.01				
Chrysene	0.031	400000		3.9E-03								0.01				
Dibenzo(a,h)anthracene	0.031	1800000		6.0E-07								0.01				
Indeno(1,2,3-cd)pyrene	0.031	3500000		6.6E-05								0.01				
Total cPAHs TEQ	0.031	1350000		1.3E-03	7.9	0.40	Y		18	12		0.015	7.9	(gwl-u)	0.4	(gwl-s)
Other Semi-Volatile Organics																
1,2,4-Trichlorobenzene	2	1700		5.8E-02	0.65	0.033			4500			0.03	4500	(mC)	4500	(mC)
1,2-Dichlorobenzene	1300	380		7.8E-02	99	5			320000			0.03	320000	(mC)	320000	(mC)
1,3-Dichlorobenzene	960											0.03				
1,4-Dichlorobenzene	190	620		1.0E-01	23	1.2						0.03				
2,3,4,6-Tetrachlorophenol	480	280		3.6E-04	27	1.4			110000			0.03	110000	(mC)	110000	(mC)
2,4,5-Trichlorophenol	3600	1600		1.8E-04	1100	56			350000			0.3	350000	(mC)	350000	(mC)
2,4,6-Trichlorophenol	10	380		3.2E-04	0.76	0.039			3500			0.3	3500	(mC)	3500	(mC)
2,4-Dichlorophenol	190	150		1.3E-04	6.2	0.32			11000			0.3	11000	(mC)	11000	(mC)
2,4-Dimethylphenol	550	210		8.2E-05	24	1.3			70000			0.3	70000	(mC)	70000	(mC)
2,6-Dichlorophenol												0.3				
2,4-Dinitrophenol	3500	0.01		1.8E-05	14	1			7000			0.3	7000	(mC)	7000	(mC)
2-Chloronaphthalene	1000	2478		1.3E-02	470	24			280000			0.03	280000	(mC)	280000	(mC)
2-Chlorophenol	97	390		1.6E-02	7.5	0.39			18000			0.3	18000	(mC)	18000	(mC)
2-Methylphenol	400	91		4.9E-05	8.5	0.46			180000			0.3	180000	(mC)	180000	(mC)
2-Nitroaniline	160	111		2.4E-06	4	0.21			35000			0.03	35000	(mC)	35000	(mC)
2-Nitrophenol												0.03				
3,3'-Dichlorobenzidine	5	720		1.6E-07	0.7	0.035			290			0.03	290	(mC)	290	(mC)
3-Nitroaniline												0.9				
4,6-Dinitro-2-methylphenol												0.03				
4-Bromophenyl phenyl ether												0.03				
4-Chloro-3-methylphenol												0.3				
4-Chloroaniline	5	66		1.4E-05	0.082	0.0046			660			3	660	(mC)	660	(mC)
4-Chlorophenyl phenyl ether												0.03				
4-Methylphenol	40	300		4.1E-05	2.4	0.13			18000			0.3	18000	(mC)	18000	(mC)
4-Nitroaniline												0.9				

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4-Nitrophenol												0.3				
Aniline	7.7	70		8.3E-05	0.13	0.0073			25000			0.03	25000	(mC)	25000	(mC)
Azobenzene	1	3759		5.5E-04	0.72	0.036			1200			0.03	1200	(mC)	1200	(mC)
Benzoic acid	64000	0.6		6.3E-05	260	19			14000000			3	14000000	(mC)	14000000	(mC)
Benzyl alcohol	800	21		1.4E-05	6.4	0.39			350000			0.03	350000	(mC)	350000	(mC)
Benzyl butyl phthalate	8.2	14000		5.2E-05	22	1.1			69000			0.03	69000	(mC)	69000	(mC)
Bis(2-chloro-1-methylethyl) ether	37	83		3.0E-03	0.73	0.04			1900			0.3	1900	(mC)	1900	(mC)
Bis(2-chloroethoxy)methane												0.3				
Bis(2-chloroethyl) ether	1.4	76		7.4E-04	0.026	0.0014			120			0.3	120	(mC)	120	(mC)
Bis(2-ethylhexyl) phthalate	5.9	110000		4.2E-06	120	6.1			9400			0.3	9400	(mC)	9400	(mC)
Carbazole		3400		6.3E-07								0.06				
Dibenzofuran	16	9161		8.7E-03	28	1.4			3500			0.03	3500	(mC)	3500	(mC)
Diethyl phthalate	28000	82		1.9E-05	550	30			2800000			0.03	2800000	(mC)	2800000	(mC)
Dimethyl phthalate	1100000											0.03				
Di-n-butyl phthalate	2900	1600		3.9E-08	890	45			350000			0.03	350000	(mC)	350000	(mC)
Di-n-octyl phthalate		83000000		2.7E-03								0.03				
Hexachlorobenzene	1	80000		5.4E-02	15	0.76			82	17		0.03	17	(TEE)	17	(TEE)
Hexachlorobutadiene	8.1	54000		3.3E-01	83	4.1			1700			0.03	1700	(mC)	1700	(mC)
Hexachlorocyclopentadiene	1100	200000		1.1E+00	42000	2100			21000			0.09	21000	(mC)	21000	(mC)
Hexachloroethane	8.9	1800		1.6E-01	3.1	0.15			3500			0.03	3500	(mC)	3500	(mC)
Isophorone	960	47		2.7E-04	12	0.7			140000			0.03	140000	(mC)	140000	(mC)
Nitrobenzene	690	120		9.8E-04	18	0.98			7000			0.03	7000	(mC)	7000	(mC)
N-Nitroso-di-n-propylamine	1	24		9.2E-05	0.0085	0.00051			19			0.06	19	(mC)	19	(mC)
N-Nitrosodiethanolamine									47			0.06	47	(mC)	47	(mC)
N-Nitrosodimethylamine	3	23		7.4E-05	0.025	0.0015			2.6			0.06	2.6	(mC)	2.6	(mC)
N-Nitrosodiphenylamine	6	1300		2.1E-04	1.5	0.076			27000			0.06	27000	(mC)	27000	(mC)
Pentachlorophenol	10	590		1.0E-06	1.2	0.059			330	4.5		0.3	4.5	(TEE)	4.5	(TEE)
Phenol	560000	29		1.6E-05	5300	310			1100000			0.3	1100000	(mC)	1100000	(mC)
2,4-Dinitrotoluene	9.1	96		3.8E-06	0.2	0.011			7000			0.03	7000	(mC)	7000	(mC)
2,6-Dinitrotoluene	16	69		3.1E-05	0.27	0.015			3500			0.03	3500	(mC)	3500	(mC)
Polychlorinated Biphenyls (PCBs)																
Aroclor 1016		110000		8.2E-03								0.1				
Aroclor 1221												0.1				
Aroclor 1232												0.1				
Aroclor 1242												0.1				
Aroclor 1248												0.1				
Aroclor 1254		130500		1.2E-02								0.1				
Aroclor 1260		820000		1.4E-02								0.1				
Total PCBs	1.6	353500		7.8E-03	110	5.4		10	66	0.65		0.7	10	(mA)	10	(mA)

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Dioxins/Furans														
2,3,7,8-TCDD		*1.4E+07*		*4.2E-03*							5.2E-06	1.0E-06		
1,2,3,7,8-PeCDD												2.5E-06		
1,2,3,4,7,8-HxCDD												2.5E-06		
1,2,3,6,7,8-HxCDD												2.5E-06		
1,2,3,7,8,9-HxCDD												2.5E-06		
1,2,3,4,6,7,8-HpCDD												2.5E-06		
OCDD												5.0E-06		
2,3,7,8-TCDF												1.0E-06		
1,2,3,7,8-PeCDF												2.5E-06		
2,3,4,7,8-PeCDF												2.5E-06		
1,2,3,4,7,8-HxCDF												2.5E-06		
1,2,3,6,7,8-HxCDF												2.5E-06		
1,2,3,7,8,9-HxCDF												2.5E-06		
2,3,4,6,7,8-HxCDF												2.5E-06		
1,2,3,4,6,7,8-HpCDF												2.5E-06		
1,2,3,4,7,8,9-HpCDF												2.5E-06		
OCDF												5.0E-06		
Total 2,3,7,8 TCDD (TEQ)	6.3E-05	*1.4E+07*		*4.2E-03*	1.6E-01	8.1E-03			1.5E-03	2E-06	5.2E-06	6.3E-06	6.3E-06 *(pql)*	6.3E-06 *(pql)*

Notes:

a Values obtained from Ecology's on-line CLARC Database.

b Calculated values from 3-phase model, per MTCA Equation 747-1, with groundwater value (Cw) as most stringent land-use-specific groundwater screening level, site-specific foc = 0.0095, and MTCA-default Dilution Factor = 20. WAC 173-340-747 provides multiple additional means to evaluate soil concentrations protective of groundwater.

c Calculated values from 3-phase model, per MTCA Equation 747-1, with groundwater value (Cw) as most stringent land-use-specific groundwater screening level, site-specific foc = 0.0095, and MTCA-default Dilution Factor = 1. WAC 173-340-747 provides multiple additional means to evaluate soil concentrations protective of groundwater.

d Because Upland Area groundwater is not a practicable source of drinking water, many Method A soil cleanup levels are not applicable. Method A soil cleanup levels are used for TPH and if they are based on ARARs (PCBs) or state background (arsenic).

e Direct contact screening levels applicable for soils to 15-foot depth.

f Most stringent criterion for plants, soil biota, or wildlife in WAC 173-340-900 Table 749-3. If the site qualifies for a simplified TEE evaluation, use Table 749-2.

g From Ecology's Natural Background Soil Metals Concentrations in Washington State (Ecology, 1994).

h Analytical method reporting limits. PQLs for total cPAH (TEQ) and total TCDD (TEQ) are adjusted for TEFs.

i Based on background concentrations in Washington state (WAC 173-340-900 Table 720-1).

j Koc and Hcc values for 2,3,7,8-TCDD are not provided in CLARC; therefore Koc value is average of 9 literature values and Hcc value is from ATSDR (1998).

k Dioxin/furan natural background value from Ecology's Natural Background for Dioxins/Furans in Washington Soils—Technical Memorandum #8 (Ecology 2010).

m If the existing empirical groundwater data demonstrate no groundwater exceedances for a compound, the soil-leachability-to-groundwater pathway is considered incomplete for that compound, and the calculated soil-protective-of-groundwater criteria are not included for establishing that compound's preliminary soil screening levels.

6 Data Gaps and Remedial Investigation Approach

This section describes data gaps identified in the existing environmental characterization data, and the proposed RI methods to characterize contaminant nature, extent, and migration sufficiently to develop and evaluate alternative cleanup actions for the Upland Area in the FS. A significant amount of investigation has been completed on the Upland Area to date, as summarized in Section 3; however, only analytical data from the 2012 independent Phase 2 ESA will be formally incorporated into the RI. Data collected prior to the Phase 2 ESA will not be used in the RI/FS to make cleanup decisions.

An interim action will also be conducted in parallel with the RI to remove areas of known soil contamination. Figure 6-1 shows the preliminary locations and extents of the planned opportunistic cleanup areas. Following source removal, confirmation groundwater monitoring will be initiated downgradient of the cleanup excavations using existing and newly installed monitoring wells. Locations for confirmation monitoring wells are contingent upon actual dimensions of the excavations and the availability of appropriately located existing monitoring wells, and will be established in consultation with Ecology. The results from the interim action will be integrated into the RI/FS.

Together, the results from the Phase 2 ESA and the forthcoming results from interim action compliance monitoring are anticipated to be sufficient for characterizing many of the specific areas of concern across the Upland Area for the purposes of evaluating and selecting a cleanup action alternative.

Remaining data gaps for specific areas of the Upland Area have been identified based on the results of previous remedial actions and additional information obtained from historical research. These data gaps require further investigation to allow for the characterization of the nature and extent of contamination in soil and groundwater, which is then used in the development and evaluation of cleanup action alternatives for the Upland Area. The RI investigation presented below focuses on those areas that require additional characterization, including those areas not previously investigated.

Starting with this RI/FS Work Plan, the REC/HRECs defined in the Phase 1 ESA (AECOM, 2011) will be referred to in narrative based on their historical operations rather than REC or HREC names (e.g., REC 2 becomes Former Associated Oil Fuel Facilities, etc.). However, the proposed RI exploration identification numbers may maintain previous area-specific prefixes (e.g., REC 1) simply to avoid introducing a new set of prefixes.

The data gaps and RI approach to address the data gaps are presented below by area, organized generally from the south end to north end of the Upland Area. Figure 6-1 shows an overview of the data gap areas, preliminary RI exploration locations, and the boundaries for the detail maps that are presented as Figures 6-2 through 6-5 (organized from south to north). The detail maps (Figure 6-2 through 6-5) depict the proposed RI explorations with the Phase 2 ESA explorations color coded based on having soil or groundwater exceedances, which are detailed in Aspect (2013a). These maps also show the planned interim action cleanup areas. As stated above, confirmation monitoring well

locations for the interim action excavations will be determined in consultation with Ecology following completion of the soil removal, when final dimensions of the excavations are known.

At the end of this section, Figures 6-6 through 6-17 show the distribution of soil and groundwater sampling and analysis locations that will exist for the entire Upland Area once the proposed RI characterization is complete (i.e., combined Phase 2 ESA and proposed RI sampling). Planned locations for opportunistic soil cleanup, in which dense excavation verification soil sampling will be conducted, are also shown. The figures depict the sampling and analysis distribution for the following constituents or constituent groups: TPH, PAHs, SVOCs other than PAHs, VOCs, arsenic, cadmium, copper, lead, mercury, nickel, PCBs, and dioxins/furans. For the purposes of the RI/FS Work Plan, soil concentrations are compared against preliminary soil screening levels for a future industrial land use.

General notes regarding the proposed RI sampling and analysis are listed below:

- Unless otherwise stated, the proposed soil borings will be completed to depths of 15 feet; proposed monitoring wells will be constructed with 10-foot well screens positioned in a depth range to intercept the water table observed at the time of drilling. These specifications can be adjusted in the field based on observations during drilling. All new monitoring wells will be professionally surveyed to a common datum;
- Unless otherwise stated, a minimum of three soil samples will be retained from each boring for laboratory analysis. Unless otherwise stated for specific areas below, soil sample depths for chemical analysis will be selected based on field screening information during drilling of each exploration. For borings drilled to depth, the soil sample with field screening evidence indicating the highest contaminant concentration will be submitted for chemical analysis; in that case, a deeper sample with less contamination indicated by field screening will also be submitted for chemical analysis in an effort to define the vertical extent of contamination. If field screening does not indicate the presence of contamination at an exploration location, the three soil samples submitted for chemical analyses will be from depth intervals above the water table (vadose zone), straddling the water table (i.e., the vadose zone/saturated zone interface) observed at time of drilling, and approximately 3 feet below the water table observed at time of drilling;
- Proposed soil sample depths described below are relative to the soil grade below the veneer of recycled demolition debris material, where it is present. Sampling of the recycled material is addressed separately in Section 6.15;
- Existing monitoring wells proposed for sampling in the RI but rendered unusable by mill demolition activities will be decommissioned and replaced by drilling a new well located several feet from, and constructed with the same screened interval depth as, the existing well. Replacement wells will use the prior well ID number but with an “R” added at the end;

- Two groundwater sampling events will be conducted to cover seasonally high and low water table conditions, anticipated November 2013 (seasonally low water table) and February 2014 (seasonally high water table);
- During the two planned groundwater sampling events, concurrent depth-to-water measurements will be collected from all Upland Area monitoring wells in as short a time period as possible, particularly for the shoreline wells. Using the two rounds of data, groundwater elevation contour maps will be developed to supplement the Upland Area groundwater flow information presented in the Phase 2 ESA;
- Groundwater sampling will involve collection of unfiltered samples for total metals analysis. Additional sample volume will also be collected and field-filtered, and held pending receipt of total metals data. Those total metals detected at concentrations greater than respective groundwater screening levels will then be analyzed for dissolved metals as a point of comparison and verification;
- Groundwater field parameters (temperature, pH, specific conductance, dissolved oxygen, and oxidation reduction potential) will be measured during collection of each groundwater sample;
- Metals analyses for all soil and groundwater samples will include arsenic, copper, lead, mercury, nickel, zinc; these are the IHS metals defined from the extensive soil and groundwater sampling and analysis performed during the Phase 2 ESA (Aspect, 2013a);
- If soil constituent concentrations are detected exceeding the soil screening levels based on groundwater protection, leachability testing (i.e., SPLP or TCLP) may be conducted to evaluate soil concentrations that are protective of groundwater in accordance with MTCA, including use of the appropriate leaching test based on pH of the material being tested (WAC 173-340-747(7)(b));
- If sand-blasting media is encountered during exploration, that material will be analyzed for tributyltin (TBT). Likewise, if boiler ash is encountered during exploration, that material will be analyzed for dioxins/furans;
- At the two locations where the total toxic equivalent concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin (total TCDD [TEQ]) are detected in surface soil, a sample of deeper soil will also be analyzed for dioxins/furans.
- To support future work in the East Waterway RI/FS, analyses for the 209 PCB congeners (EPA Method 1668A), including the 12 dioxin-like congeners defined in Table 708-4 of WAC 173-340-900 and the other 197 congeners, will be conducted for the three RI soil samples with highest total PCB Aroclors concentrations based on EPA 8082A analyses. If there are less than three soil samples with detectable PCB Aroclors, then the PCB congener analysis may be performed on samples exhibiting the highest diesel- or oil-range TPH concentrations; and
- Groundwater analyses for the highly hydrophobic constituent groups dioxins/furans and PCBs will be conducted in areas where detected soil concentrations of the constituent group exceed respective soil screening levels based on leachability to groundwater (soil-to-groundwater pathway).

The field sampling and laboratory analysis methods to be employed for the RI characterization are detailed in the Sampling and Analysis Plan (Appendix A of this Work Plan).

6.1 Bulk Fuel Storage Facilities (Standard Oil and Associated Oil)

Data Gaps

The planned interim action will remove TPH-contaminated soil from the Associated Oil Company bulk fuel facilities located north of K-C's Distribution Warehouse located at the south end of the Upland Area. Currently, K-C intends to keep the Distribution Warehouse intact, so excavation beneath the warehouse is not planned as part of the interim action. Portions of the Standard Oil and Associated Oil Company bulk fuel facilities exist beneath the footprint of the Distribution Warehouse, and the nature and extent of TPH in soil and groundwater has not been fully evaluated for those facilities. Specifically, the extent of soil TPH exceedances is not delineated around the former Standard Oil fuel facilities, and beneath the south edge of Distribution Warehouse. Likewise, the extent of soil TPH exceedances at the Associated Oil Company facilities beneath the north end of the Distribution Warehouse is not delineated.

It is Aspect's understanding that planned investigation activities for the ExxonMobil/ADC site include additional soil sampling and analysis for petroleum compounds on the south side of the Distribution Warehouse as follows: two borings on K-C property (KC-SB01 and KC-SB02), one boring on BNSF property off the southeast corner of the Distribution Warehouse (BN-SB07), and one boring in Federal Avenue west of the Distribution Warehouse's southwest corner (FA-SB06) (AMEC, 2013).

Proposed RI Characterization

The scope of work to define the nature and extent of TPH in the area of the Standard Oil and Associated Oil Company bulk fuel storage and distribution operations beneath the Distribution Warehouse includes the following (Figure 6-2):

- Advance 16 soil borings and complete six of them as groundwater monitoring wells (REC2-B-13 through –B22, and REC1-MW-10 through –MW-15). These borings will be completed through the concrete floor of the Distribution Warehouse, except REC1-MW-15 located on the west side of the Warehouse (Figure 6-2).
- Collect soil samples from each of the borings for potential laboratory analysis. Based on the results of field screening, submit and analyze three samples collected from each boring for TPH in the gasoline-, diesel- and oil-range TPH, and PAHs. Soil samples from borings REC2-B-13, REC2-B-15, REC2-B-17, REC2-B-18, REC2-B-20, REC1-MW-11will also be analyzed for metals. Additionally, three samples from the collective borings with the highest detected concentrations of TPH will be subsequently submitted for analysis of volatile and extractable petroleum hydrocarbon fractions (VPH and/or EPH) to allow for the calculation of risk-based TPH soil cleanup levels, in accordance with MTCA.
- Collect two rounds of groundwater samples from the six new monitoring wells and the ten existing monitoring wells (REC1-MW-1 through -MW-9, and

shoreline well REC7-MW-4) and submit them for analysis of gasoline-, diesel-, and oil-range TPH, PAHs, and total suspended solids (TSS). In addition, wells REC1-MW-4, -MW-5, -MW-6, -MW-8, -MW-9, and REC7-MW-4 will be analyzed for metals to provide data between the petroleum release areas and the marine environment. Finally, groundwater samples from wells REC1-MW-3 and -MW-4 will also be analyzed for VOCs.

Warehouse Sub-Slab Vapor Sampling

Currently, we assume that the Distribution Warehouse will be maintained for future use. The Warehouse is constructed with a concrete floor slab on pile-supported grade beams, creating a sub-slab void space that ranges in depth from less than 1 foot on the north end to more than 4 feet on the south end. If, at the time of the RI sampling program, the Warehouse is still expected to stay in place for the future site use, three samples of vapor in the sub-slab void space (crawl space) will be collected to evaluate the potential future risk to human health though VI and inhalation of indoor air posed by the presence of petroleum hydrocarbons beneath the Distribution Warehouse. The vapor sampling locations will be determined based on the collective results of soil and groundwater samples collected from beneath the Distribution Warehouse and targeted on highest detected concentrations of petroleum (particularly gasoline-range if present). The vapor samples will be analyzed for petroleum hydrocarbon ranges and petroleum VOCs the Massachusetts Department of Environmental Protection Air Phase Petroleum Hydrocarbons (APH) method, consistent with Ecology (2009) vapor intrusion guidance. An ambient air sample would also be collected from outside the warehouse for reference.

The vapor sampling will be done after the RI soil data and first round of RI groundwater data are available. A vapor sampling plan will be submitted for Ecology discussion and approval prior to starting.

6.2 Central Maintenance Shop

Data Gaps

The source and extent of TPH, naphthalene, and cPAHs in groundwater at well CMS-MW-1, located at the downgradient edge of the shop, is not defined.

Proposed RI Characterization

The scope of work to address the data gaps in the Central Maintenance Shop Area includes the following (Figure 6-3):

- Advance three borings (CMS-B-4, CMS-B-5, and CMS-MW-2) adjacent to the Central Maintenance Shop, and complete boring CMS-MW-2, on the upgradient edge of the shop, as a groundwater monitoring well.
- Advance boring CMS-B-6 in the footprint of the Carpenter Shop immediately south of the Central Maintenance Shop.
- Collect soil samples from each boring for potential laboratory analysis. Based on the results of field screening, the prior soil data, and the objective of the work, submit three soil samples from each boring for analysis of gasoline-, diesel-, and oil-range TPH and PAHs. In addition, the soil samples from boring CMS-B-6 will be analyzed for metals.

- Collect two rounds of groundwater samples from new monitoring wells CMS-MW-1 and CMS-MW-2 and submit them for analysis of gasoline-, diesel-, and oil-range TPH, low-level PAHs, and TSS.

6.3 Old Paint Shop

Data Gaps

The Landau (1994b) investigation results indicated a historical release of paint thinner (p-isopropyltoluene), inferred from an old paint shop in the immediate area, with no evidence for migration of contaminated groundwater (see Section 3.1.4). Because the historical data will not be used for cleanup decision making, confirmation of soil and groundwater quality at that location is warranted for the RI.

Proposed RI Characterization

The scope of work to address the data gaps at the Old Paint Shop paint thinner release location includes the following (Figure 6-3):

- Advance one soil boring to be completed as a groundwater monitoring well (OPS-MW-1), positioned in the center of the identified paint thinner release location. Based on the results of field screening, collect and submit three soil samples from the boring for analysis of VOCs and metals.
- Collect two rounds of groundwater samples from the new monitoring well and submit them for analysis of VOCs and TSS.

6.4 Pulp Mill Area

Data Gaps

Investigation of the Pulp Mill Area has been previously limited by the presence of overlying structures. The presence of apparent SSL, containing elevated concentrations of metals, bis(2-ethyhexyl)phthalate, and TPH, encountered within the foundation of the Digester Building during demolition suggests a potential source of contaminants to groundwater in this area.

Proposed RI Characterization

The scope of work has been developed to characterize general soil and groundwater quality in this area and will include the following (Figure 6-3):

- Advance 18 soil borings and complete eight of them as groundwater monitoring wells (PM-B-1 through –B-10, and PM-MW-1 through –MW-8), as follows:
  - Boring PM-B-1 will be located in the used oil room, which contained a waste oil tank and drums for temporary storage of used oil and oil filters;
  - Boring PM-B-2 will be completed at the location of a 100-gallon diesel tank (emergency generator) that existed starting in the mid-1990s;
  - Boring PM-B-3 will be located on the west end of the Blow Pit Building where drums of lube oil were stored;
  - Boring PM-B-4 will be located within the west end of the Screen and Bleach Building 2,at the reported location of a PCB-containing transformer;

  - Boring PM-B-5 will be located within the footprint of the Pulp Drying building;
  - Boring PM-B-6 will be completed at the location of reported PCB-containing transformers on the south end of the Washer Building;
  - Borings PM-B-7, -B-8, -B-9, and –B-10 will be 3-foot borings completed at locations of reported PCB-containing transformers within the Pulp Mill area;
  - The borings to be completed as monitoring wells will include:
    - Wells PM-MW-1, -MW-2, and -MW-3 located around and downgradient of the Digester Building;
    - Wells PM-MW-4 and PM-MW-5 within the footprint of Screen/Beach Units 1 and 2, respectively. PM-MW-2 and PM-MW-5 also provide downgradient groundwater monitoring locations for the Central Maintenance Shop;
    - Well PM-MW-6 within the pulp mill lab chemical storage area and just downgradient of the used oil room/waste oil tank; and
    - Wells PM-MW-7 and PM-MW-8 along the shoreline downgradient of the entire Pulp Mill. PM-MW-8 is also within the footprint of the Heavy Duty Shop (the sump of that building was identified as REC 3 in AECOM, 2011).
- Collect and submit three soil samples from borings PM-MW-1 through –MW-8, PM-B-1, -B-2, and -B-4 for analysis of diesel- and oil-range TPH, SVOCs, and metals, and one sample (collected between 0 and 1 foot bgs) for PCBs. The water-table-depth soil sample from boring PM-MW-1, PM-B-2, -B-4, and -B-6 (at/near electrical transformer locations) will also be analyzed for PCBs. Each of the three soil samples from boring PM-B-1 (waste oil tank area) will also be analyzed for PCBs and VOCs. Collect and submit three soil samples from borings PM-B-3, -B-5, and -B-6 for analysis of diesel- and oil-range TPH, VOCs, and metals, and one sample (collected between 0 and 1 foot bgs) for SVOCs and PCBs. In addition, the 0- to 1-foot soil sample from borings within the Screen and Bleach Plant footprint (PM-B-2, PM-MW-4, PM-B-4, and PM-MW-5) and from boring PM-B-1 in the used oil room area (just south of the Baghouse) will also be analyzed for dioxins/furans.
- Collect soil samples from borings PM-B-7, -B-8, -B-9, and –B-10 at depths of 0 to 1 and 2 to 3 feet, for analysis of diesel- and oil-range TPH, PAHs, and PCBs.
- Collect two rounds of groundwater samples from the eight monitoring wells and submit for analysis of diesel- and oil-range TPH, SVOCs including low-level PAHs, metals, and TSS. Groundwater samples from well PM-MW-6 will also be analyzed for VOCs, and samples from the two shoreline monitoring wells PM-MW-7 and –MW-8 will also be analyzed for VOCs, ammonia, and dissolved sulfide.

6.5 Boilers Area

Data Gaps

The soil and groundwater quality in the Boilers Area has not been fully evaluated because of the above-ground structures. A specific data gap includes the source and extent of metals-contaminated groundwater at the downgradient edge of the Old Boiler House (as evidenced by groundwater data from well REC5-MW-1).

Proposed RI Characterization

Because of the limited access to the Boilers Area during previous investigations, limited characterization has been completed in this area to date. The scope of work to address the data gaps in the Boilers Area includes the following (Figure 6-3):

- Advance seven borings and complete four of them as groundwater monitoring wells (BA-B-1 through -B-3, BA-MW-1 through –MW-4), as follows:
  - Boring BA-B-1 will be completed within the No. 14 Boiler Turbine Generator Building, where petroleum storage occurred (2,500-gallon lube oil and 500-gallon hydraulic oil);
  - Boring BA-B-2 will be completed in the southeast corner of the No. 10 Boiler, where PCB waste materials were accumulated (1990 and 1994 facility drawings);
  - Boring BA-B-3 at the termination of the above-ground diesel fuel pipeline within the footprint of Boiler No. 14;
  - Well BA-MW-1 will be completed within the footprint of the Old Boiler House (Dutch Ovens), upgradient of well REC5-MW-1 where elevated groundwater metals were detected;
  - Well BA-MW-2 will be completed near the downgradient edge of the No. 10 Boiler/SSL Recovery Building. Wells BA-MW-1 and BA-MW-2 also provide additional groundwater monitoring locations downgradient of the Acid Plant, immediately east of the No. 10 Boiler;
  - Well BA-MW-3 will be completed at the location of the Fly Ash Clarifier/Baghouse; and
  - Well BA-MW-4 will be completed on the downgradient edge of the No. 14 Boiler, at the location of a 20,000-gallon fuel tank (Bunker C fuel on 1994 facility drawing, and following the mid-1990s conversion from Bunker C to diesel as emergency backup for the boiler, diesel fuel on 1996 facility drawing and AECOM [2011] map).
- Collect and submit three soil samples from each boring except BA-B-3 for analysis of diesel- and oil-range TPH, SVOCs, and metals, and one sample from each boring (collected between 0 and 1 foot bgs) for PCBs and dioxins/furans. In addition, each of the three samples from boring BA-B-2 (PCB waste location) will be analyzed for PCBs. Soil samples from boring BA-B-3 (diesel pipeline) will be analyzed for diesel- and oil-range TPH and PAHs.
- Complete three additional borings as monitoring wells (BA-MW-5, BA-MW-6 and BA-MW-7) between existing well REC5-MW-1 and the shoreline, with two

located approximately 100 feet west of REC5-MW-1 and a shoreline well located further west. Collect and submit surface (0- to 1-foot) soil samples from each of the three borings for analysis of diesel- and oil-range TPH, VOCs, PAHs, and metals.

- Collect two rounds of groundwater samples from the seven new monitoring wells and existing well REC5-MW-1 submit them for analysis of diesel- and oil-range TPH, SVOCs including low-level cPAHs, metals, and TSS. The shoreline well BA-MW-7 will also be sampled and analyzed for ammonia and dissolved sulfide.
- Additional groundwater monitoring downgradient of the southern Boilers Area will be accomplished by installation and sampling of confirmation groundwater monitoring wells downgradient of the interim action excavations (Bunker C fuel oil USTs No. 71/72/73 and Boiler/Baghouse metals areas) once the final excavation extents are determined.

6.6 Acid Plant

Data Gaps

The Phase 2 ESA included assessment for potential acidic release and resulting metals contamination. Ecology requested additional soil and groundwater data from this location.

Proposed RI Characterization

The scope of work to further evaluate groundwater quality in this area includes the following (Figure 6-3):

- Drill the replacement well for AP-MW-1 (damaged during demolition). Collect and submit three soil samples from the boring for analysis of gasoline-, diesel- and oil-range TPH, PAHs, and metals.
- Collect two rounds of groundwater samples from monitoring well AP-MW-1 and submit them for analysis of gasoline-, diesel- and oil-range TPH, PAHs, TSS, and, during the second monitoring event only, metals.

6.7 Small Hydraulic Barker/Chipper Area

Data Gaps

Access to and characterization of the location of the Small Hydraulic Barker/Chipper area has been limited by the presence of above-ground structures during prior investigation activities. The structure, labeled as Stores Receiving on facility drawings, was also a paint shop with, on its north side, empty chemical barrel storage (1980 facility drawing), and a paint solvent waste accumulation area (1990 and 1994 facility drawings; see Attachment C-1 of Appendix C).

Proposed RI Characterization

The scope of work to evaluate soil and groundwater quality in this area includes the following (Figure 6-4):

- Advance six borings (SHB-B-1 through –B-5, SHB-MW-1 and SHB-MW-2) and complete two of them as groundwater monitoring wells (SHB-B-1 through –B-4, SHB-MW-1 and SHB-MW-2), as follows:

  - Borings SHB-B-1 and SHB-B-2 will be located within the Small Hydraulic Barker/Chipper's footprint;
  - Boring SHB-B-3 will be located at the paint solvent waste accumulation area on the Barker/Chipper's north side;
  - Boring SHB-B-4 will be completed at the location of a 2,500-gallon No. 2 fuel oil AST just north of the Barker/Chipper, installed in the mid-1990s (depicted on 1996 facility map and in AECOM [2011]);
  - Monitoring well SHB-MW-1 will be located in the footprint of the empty barrel storage area and downgradient of the paint solvent waste accumulation area; and
  - Shoreline monitoring well SHB-MW-2 will be located downgradient of this area to evaluate potential for migration of contaminants from the operation of the small hydraulic barker/chipper to the East Waterway.
- Collect and submit three soil samples from each boring for analysis of gasoline-, diesel-, and oil-range TPH, PAHs, VOCs, and metals.
- Collect two rounds of groundwater samples from the new monitoring wells and submit them for analysis of gasoline-, diesel- and oil-range TPH, PAHs, VOCs, metals, TSS. Groundwater samples from the shoreline well SHB-MW-2 will also be analyzed for ammonia and dissolved sulfide.

6.8 Chip Screen Building Area

Data Gaps

The Chip Screen Building Area reportedly housed fuel storage and PCB-containing transformers, and warrants characterization.

Proposed RI Characterization

To address the data gap in this area, the following scope of work will be completed:

- Boring CSB-B-1 will be completed at the location of a 540-gallon No. 2 fuel oil AST at the Chip Screen Building, installed in the mid-1990s (depicted on 1996 facility map but absent in AECOM [2011]). Based on field screening results, collect and submit three soil samples for analysis of diesel- and oil-range TPH, PAHs, and metals.
- Boring CSB-B-2 will be a 3-foot boring completed to assess presence of soil PCBs at the location of PCB-containing transformers within the Chip Screen Building footprint. Collect soil samples from this boring at depths of 0 to 1 and 2 to 3 feet, for analysis of diesel- and oil-range TPH, PAHs, and PCBs.

6.9 Engineering/Maintenance Building

Data Gaps

The 1990 facility map (Attachment C-1) references an electrical degreasing location near the southeastern end of the Engineering/Maintenance Building. The 1994 and 1996 facility maps do not reference that activity. Although means of degreasing are not known, evaluation for presence/absence of degreasing solvents is warranted at that location.

Proposed RI Characterization

To address the data gap in this area, the following scope of work will be completed:

- Advance soil boring EM-B-1 at the reported location of the degreasing activity (Figure 6-4). Based on field screening results, collect and submit three soil samples from the boring for analysis of gasoline-, diesel-, and oil-range TPH, PAHs, VOCs, and metals.

6.10 GF-9 Area

Data Gaps

The extent of soil TPH, naphthalene, and cPAH exceedance is not delineated upgradient of existing monitoring well GF9-MW-1, where marginal groundwater TPH and cPAH exceedances are detected.

Proposed RI Characterization

To address the data gap in this area, the following scope of work will be completed:

- Advance four new borings and complete two of them as monitoring wells (GF9-B-3, -B-4, -MW-2 and –MW-3; Figure 6-4).
- Based on field screening results, collect and submit three soil samples from each boring for analysis of gasoline-, diesel-, and oil-range TPH, and PAHs. Additionally, two samples with the highest detected concentrations of TPH will be subsequently submitted for analysis of VPH and/or EPH to allow for the calculation of risk-based soil TPH cleanup levels.
- Collect two rounds of groundwater samples from the two new monitoring wells and existing monitoring well GF9-MW-1 and submit them for analysis of gasoline-, diesel-, and oil-range TPH, low-level PAHs, and TSS.

6.11 Log Pond Fill

Data Gaps

The source and extent of elevated ammonia concentrations (highest detected) in shoreline groundwater from well MW-6 at the downgradient edge of the Log Pond fill are not defined. Groundwater from MW-6 also had dissolved arsenic, copper, and nickel exceedances, typical of groundwater across the Upland Area.

Proposed RI Characterization

The RI scope of work for the Log Pond Area will include the following:

- Install two monitoring wells within the Log Pond Area to further evaluate the Log Pond fill's potential effects on groundwater geochemistry (Figure 6-4). Well LP-MW-1 will be installed within the approximate center of the Log Pond Area. Well LP-MW-2 will be installed along the shoreline between existing well MW-6 and proposed shoreline well SHB-MW-2.
- Collect and submit three soil samples from each boring for analysis of diesel- and oil-range TPH, SVOCs, VOCs, and metals.
- Collect two rounds of groundwater samples from the two new monitoring wells for analysis of diesel- and oil-range TPH, cPAHs, metals, and TSS. Collect two

rounds of groundwater samples from existing well MW-6 and submit them for analysis of metals, ammonia, and dissolved sulfide.

6.12 Hydraulic Barker Building Area

Data Gaps

The lateral extent of oil-range TPH exceedance at one shallow soil sample within the (large) Hydraulic Barker Building is not defined.

Proposed RI Characterization

To address data gaps in the vicinity of the Hydraulic Barker Building, the scope of work for the RI will include the following:

- Advance three borings (HB-B-4 through –B-6), and submit three soil samples from each boring for diesel- and oil-range TPH and PAHs (Figure 6-4). Additionally, two samples with the highest detected concentrations of TPH will be subsequently submitted for VPH and EPH analysis to allow for the calculation of risk-based TPH soil cleanup levels.
- Although not conducted specifically to address the data gap identified for this area, two rounds of groundwater samples will be collected from monitoring well HB-MW-1 to further assess groundwater quality in this area. Groundwater samples will be analyzed for diesel- and oil-range TPH, PAHs, and TSS. In addition, the second round groundwater sample (high water table condition) will also be analyzed for metals.

6.13 Tissue Mill Area

Data Gaps

Investigation of the Tissue Mill (Paper Mill) Area has been previously limited by the presence of overlying structures. Similar to the Pulp Mill Area, the scope of work for the Tissue Mill Area has been developed primarily to characterize general soil and groundwater quality within this largely uncharacterized portion of the Upland Area. Portions of the Tissue Mill Area overlap with the Clark-Nickerson Lumber Company mill operations footprint; specific investigation to address data gaps associated with the lumber mill is addressed separately in Section 6.14.

Proposed RI Characterization

The RI scope of work for the Tissue Mill Area will include the following (Figure 6-4):

- Advance 18 soil borings and complete six of them as groundwater monitoring wells (TM-B-1 through –B-12, TM-MW-1 through –MW-6). In addition to one shoreline well downgradient of the entire Tissue Mill (TM-MW-6), the borings and wells will be positioned in areas where larger quantities of petroleum and paper mill chemicals were reportedly stored, and/or PCB-containing transformers reportedly were located, within the Tissue Mill, as follows:
  - TM-B-1 (pulp prep building): storage of paper mill and pulp prep chemicals, as well as lube oil and hydraulic oil, and the area of PCB-containing transformers;

  - TM-B-2: 2,400-gallon, 2,400-gallon, and 1,050-gallon lube oil, and 1,050-gallon hydraulic oil storage, and the location of PCB-containing transformers;
  - TM-B-3: 2,800-gallon, 2,800-gallon, 1,400-gallon, and 1,400-gallon lube oil storage, and the location of PCB-containing transformers;
  - TM-B-4: pair of 400-gallon No. 2 fuel oil tanks, and adjacent to a PCB-containing transformer;
  - TM-B-5: chemical storage, 55-gallon lube oil storage, and the location of a PCB-containing transformer;
  - TM-B-6: methanol waste accumulation;
  - TM-MW-1: within the footprint of the Paper Mill Chemical Storage Building;
  - TM-MW-2: 1,200-gallon lube oil, 700-gallon hydraulic oil, 242-gallon hydraulic oil, and 60-gallon lube oil (storage in basement);
  - TM-MW-3: 455-gallon hydraulic oil storage;
  - TM-MW-4: 2,150-gallon, 2,150-gallon, and 1,400-gallon lube oil storage; and
  - TM-MW-5: Within the transformer yard on the downgradient edge of the Tissue Mill (also at oil storage area for the Clark-Nickerson mill).
- Collect and submit three soil samples from borings TM-MW-1 through -MW-6, for analysis of diesel- and oil-range TPH, SVOCs, and metals, and one sample (collected between 0 and 1 foot bgs) for PCBs. Collect and submit three soil samples from borings TM-B-1 through -B-6 for analysis of diesel- and oil-range TPH, VOCs, and metals, and one sample (collected between 0 and 1 foot bgs) for PCBs and SVOCs; however, each of the three soil samples from TM-B-3 will be analyzed for SVOCs. In addition, at borings TM-MW-4, TM-MW-5, TM-B-1, -B-2, -B-3, -B-4, and –B-5, at electrical transformer locations, soil samples collected from the water table depth will also be analyzed for PCBs.
- Boring TM-B-7 will be a 3-foot boring completed to assess presence of soil PCBs at the location of PCB-containing transformers within the Tissue Mill. Likewise, borings TM-B-8 and -B-9 will be 3-foot borings completed to assess presence of soil PCBs within the footprint of the historical transformer yard (predating the PUD substation). Collect soil samples from these six borings at depths of 0 to 1 and 2 to 3 feet, for analysis of diesel- and oil-range TPH, PAHs, and PCBs.
- Borings TM-B-10 through -B-12 will be 3-foot borings completed to assess presence of soil PCBs at other PCB transformer locations. Collect soil samples from these three borings at depths of 0 to 1 and 2 to 3 feet, for analysis of diesel- and oil-range TPH and PCBs.
- Collect two rounds of groundwater samples from the two new monitoring wells TM-MW-1 through -MW-6 and submit for analysis of diesel- and oil-range TPH, low-level PAHs, metals, and TSS. The groundwater samples from well TM-MW-1, -MW-2, and -MW-4, will also be analyzed for VOCs. The groundwater samples from shoreline well TM-MW-6 will also be analyzed for VOCs, ammonia, and dissolved sulfide.

6.14 Clark-Nickerson Lumber Mill

The compilation of historical information for preparation of this Work Plan has more accurately identified the footprint of the Clark-Nickerson Lumber Company mill covering a large northern portion of the Upland Area (Figure 6-1). Besides the investigation activities conducted at the Naval Reserve Parcel, which is located within the lumber mill footprint, and three General Fill borings, little subsurface investigation has been conducted to assess potential impacts from operation of the lumber mill.

Proposed RI Characterization

The RI scope of work for the Clark-Nickerson Lumber Company Mill Area will include the following:

- Advance 17 borings and complete three of them, located on the western (downgradient) property boundary, as groundwater monitoring wells (CN-B-1 through -B-14 and CN-MW-1 through –MW-3; Figures 6-4 and 6-5). The new borings are targeted on the mill's primary operational areas (e.g., planing mill, sawmill, fuel storage, refuse burner), with additional borings positioned to provide spatial coverage of the mill's lumber storage areas. Of these new explorations, well CN-MW-1 is a shoreline well; however, there are five other monitoring wells, installed for other operational areas, located on the shoreline downgradient of the Clark-Nickerson Mill: REC7-MW-1, NRP-MW-3, NRP-MW-2, REC7-MW-2, and TM-MW-2. Likewise, there are explorations completed for the Tissue Mill area (Section 6.13) that overlap with the explorations for this area.
- Collect and submit three soil samples from each boring for analyses of diesel- and oil-range TPH, PAHs, and metals. Because borings CN-B-2 and –B-4 are located within the footprint of a historical transformer yard for the Scott paper mill, the 0- to 1-foot soil sample from each boring will also be analyzed for PCBs. Additionally, the shallowest two soil samples collected from the boring (CN-B-5) advanced at the location of a reported refuse burner will be submitted for analysis of dioxins/furans.
- Collect two rounds of groundwater samples from the three monitoring wells and submit them for analysis of diesel- and oil-range TPH, PAHs, metals, and TSS. The shoreline well will also be sampled and analyzed for ammonia and dissolved sulfide.

6.15 Recycled Demolition Debris

Data Gaps

Demolition of the pulp/paper mill structures involved generation of a very large quantity of demolition debris (estimated greater than 250,000 cubic yards of concrete and brick), which, in accordance with the demolition permit, was recycled and then graded across much of the Upland Area after the mill pavement was removed. The recycled material provides a permeable, drivable surface that is being graded to facilitate on-site infiltration. Beneficially reusing the material also has environmental benefits - it avoids filling landfills, avoids the export truck traffic and carbon emissions transporting it to

landfills, and replaces use of better resources (virgin aggregate) with associated import truck traffic/carbon emissions to achieve the same functional purpose.

While not required under the demolition permit, K-C voluntarily conducted sampling and analysis of the recycled material to document its general chemical quality. The sampling included one representative 5-point composite per approximately 5,000 cubic yards of material within stockpiles generated by the crushing machine. The sampling was conducted as part of the demolition project, and was not intended to satisfy the Interim Action Plan requirements for excavation backfill (Aspect, 2012c), since material had not yet to be identified for that purpose.

The sampling and analysis indicated that the recycled material that was placed on site contains contaminant concentrations less than industrial soil screening levels. The sampling included use of synthetic precipitation leaching procedure (SPLP) leaching tests where warranted to assess soil concentrations protective of groundwater quality, in accordance with MTCA.

K-C is placing and grading the material meeting industrial soil screening levels to provide a workable, permeable finished grade following mill demolition. The existing pavement will not be removed in the northern portion of the Upland Area – within and north of the secondary wastewater treatment area; in addition, the existing Distribution Warehouse is currently planned to remain in the southeast corner of the Upland Area, thus material will not be placed there. The recycled material was not placed below the water table, and has a typical thickness on the order of 1 to 4 feet. Only material meeting unrestricted soil screening levels based on the data was placed within 200 feet of the shoreline. Additional characterization of recycled material is warranted for purposes of the RI.

Proposed RI Characterization

The scope of work to further characterize the surficial veneer of recycled material includes the following:

- Establish a systematic 200-foot grid across the area of placed material beyond 200 feet of shoreline and a 100-foot grid across the area of material placed within 200 feet of the shoreline (note that prior sampling indicated the material meets unrestricted standards). Figure 6-1 depicts the samples on the systematic grid; exact sample locations can be adjusted somewhat based on field conditions. Within each grid node, collect a representative 5-point composite sample of the recycled material from a depth of 0 to 1 foot. Section A2.2 in Appendix A provides the composite sampling approach for each grid block. Analyze each sample for diesel- and oil-range TPH, SVOCs, priority pollutant metals, and PCBs.

6.16 Shoreline Groundwater Quality

Data Gaps

During the independent Phase 2 ESA, shoreline groundwater has been characterized by groundwater sampling and analyses at 15 shoreline monitoring wells positioned along the East Waterway shoreline; however, determining whether Upland Area groundwater represents an ongoing source of contaminants to the East Waterway is a principal priority

for the RI. Therefore, additional characterization of groundwater quality along the shoreline is warranted. The investigation into this data gap includes further assessing the source, magnitude, and extent of ammonia and selected metals concentrations exceeding marine-based screening levels at selected shoreline monitoring wells.

Proposed RI Characterization

The scope of work to address this data gap will include the following:

- Collect two rounds of groundwater samples from each of the 22 shoreline monitoring wells: 15 existing wells (MW-1, MW-2, MW-5, MW-6, NRP-MW-2, NRP-MW-3, OMS-MW-1, REC1-MW-9, REC3-MW-1, REC6-MW-2, REC-7-MW-1 through –MW-4, and UST70-MW-2) plus 7 new wells (BA-MW-2, CN-MW-1, LP-MW-2, PM-MW-7, PM-MW-8, SHB-MW-2, and TM-MW-2). Submit the samples for analysis of metals, ammonia, dissolved sulfide, and TSS. Groundwater samples from the shoreline wells will also be analyzed for other contaminants specific to their adjacent operational areas, as described in the preceding sections.

6.17 Upgradient Groundwater Quality

Data Gaps

Ecology requested additional data to define soil and groundwater quality along the upgradient edge of the Upland Area.

Proposed RI Characterization

The scope of work to address this data gap will include the following:

- Because well UG-MW-2 is being replaced (re-drilled), collect and submit three soil samples from its boring for analyses of gasoline-, diesel-, and oil-range TPH, PAHs, and metals.
- Collect two rounds of groundwater samples from each of the two upgradient monitoring wells UG-MW-1 and UG-MW-2. Submit the samples for analysis of analysis of gasoline-, diesel- and oil-range TPH, PAHs, and TSS, and, during the second round only (high water table condition), metals.

Table 6-1 - RI Soil Analyses Detail

K-C Upland Area RI/FS, Everett, Washington

RI Area	Exploration Identification	Sample Depth [1] (feet bgs)	Soil Sample Analyses								Area Specific Analytical Notes
			Gasoline-Range TPH	Diesel- and Oil-Range TPH	VOCs	Metals[2]	SVOCs	PAHs	PCBs[3]	Dioxins/ Furans[4]	
Bulk Fuel Storage Facilities (Standard Oil and Associated Oil)	REC2-B-13	Vadose Zone	✓	✓		✓		✓			Three samples from these borings with the highest detected concentrations of TPH will be subsequently submitted for analysis of VPH and/or EPH.
		Water Table	✓	✓		✓		✓			
		Saturated Zone	✓	✓		✓		✓			
	REC2-B-14	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	REC2-B-15	Vadose Zone	✓	✓		✓		✓			
		Water Table	✓	✓		✓		✓			
		Saturated Zone	✓	✓		✓		✓			
	REC2-B-16	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	REC2-B-17	Vadose Zone	✓	✓		✓		✓			
		Water Table	✓	✓		✓		✓			
		Saturated Zone	✓	✓		✓		✓			
	REC2-B-18	Vadose Zone	✓	✓		✓	✓				
		Water Table	✓	✓		✓	✓				
		Saturated Zone	✓	✓		✓	✓				
	REC2-B-19	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	REC2-B-20	Vadose Zone	✓	✓		✓		✓			
		Water Table	✓	✓		✓		✓			
		Saturated Zone	✓	✓		✓		✓			
	REC2-B-21	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	REC1-MW-10	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	REC1-MW-11	Vadose Zone	✓	✓		✓		✓			
		Water Table	✓	✓		✓		✓			
		Saturated Zone	✓	✓		✓		✓			
	REC1-MW-12	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	REC1-MW-13	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	REC1-MW-14	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	REC1-MW-15	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
Analyses Subtotal by Area			**45**	**45**	**0**	**18**	**3**	**42**	**0**	**0**	
Central Maintenance Shop	CMS-B-4	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	CMS-B-5	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	CMS-B-6	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CMS-MW-2	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
Analyses Subtotal by Area			**9**	**12**	**0**	**3**	**0**	**12**	**0**	**0**	
Old Paint Shop	OPS-MW-1	Vadose Zone			✓	✓					
		Water Table			✓	✓					
		Saturated Zone			✓	✓					
Analyses Subtotal by Area			**0**	**0**	**3**	**3**	**0**	**0**	**0**	**0**	

Table 6-1 - RI Soil Analyses Detail

K-C Upland Area RI/FS, Everett, Washington

RI Area	Exploration Identification	Sample Depth [1] (feet bgs)	Soil Sample Analyses								Area Specific Analytical Notes
			Gasoline-Range TPH	Diesel- and Oil-Range TPH	VOCs	Metals[2]	SVOCs	PAHs	PCBs[3]	Dioxins/ Furans[4]	
Pulp Mill Area	PM-B-1	0-1							✓	✓	
		Vadose Zone		✓	✓	✓	✓				
		Water Table		✓	✓	✓	✓		✓		
		Saturated Zone		✓	✓	✓	✓		✓		
	PM-B-2	0-1							✓	✓	
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	PM-B-3	0-1					✓		✓		
		Vadose Zone		✓	✓	✓					
		Water Table		✓	✓	✓					
		Saturated Zone		✓	✓	✓					
	PM-B-4	0-1					✓		✓	✓	
		Vadose Zone		✓	✓	✓					
		Water Table		✓	✓	✓			✓		
		Saturated Zone		✓	✓	✓					
	PM-B-5	0-1					✓		✓		
		Vadose Zone		✓	✓	✓					
		Water Table		✓	✓	✓					
		Saturated Zone		✓	✓	✓					
	PM-B-6	0-1					✓		✓		
		Vadose Zone		✓	✓	✓					
		Water Table		✓	✓	✓			✓		
		Saturated Zone		✓	✓	✓					
	PM-B-7	0-1		✓				✓	✓		
		2-3		✓				✓	✓		
	PM-B-8	0-1		✓				✓	✓		
		2-3		✓				✓	✓		
	PM-B-9	0-1		✓				✓	✓		
		2-3		✓				✓	✓		
	PM-B-10	0-1		✓				✓	✓		
		2-3		✓				✓	✓		
	PM-MW-1	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓		✓		
		Saturated Zone		✓		✓	✓				
	PM-MW-2	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	PM-MW-3	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	PM-MW-4	0-1							✓	✓	
		Vadose Zone		✓	✓	✓	✓				
		Water Table		✓	✓	✓	✓				
		Saturated Zone		✓	✓	✓	✓				
	PM-MW-5	0-1							✓	✓	
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	PM-MW-6	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	PM-MW-7	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	PM-MW-8	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
Analyses Subtotal by Area			**0**	**50**	**18**	**42**	**34**	**8**	**27**	**5**	

Table 6-1 - RI Soil Analyses Detail

K-C Upland Area RI/FS, Everett, Washington

RI Area	Exploration Identification	Sample Depth [1] (feet bgs)	Soil Sample Analyses								Area Specific Analytical Notes
			Gasoline-Range TPH	Diesel- and Oil-Range TPH	VOCs	Metals[2]	SVOCs	PAHs	PCBs[3]	Dioxins/ Furans[4]	
Boilers Area	BA-B-1	0-1							✓	✓	
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	BA-B-2	0-1							✓	✓	
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓		✓		
		Saturated Zone		✓		✓	✓		✓		
	BA-B-3	0-1									
		Vadose Zone		✓				✓			
		Water Table		✓				✓			
		Saturated Zone		✓				✓			
	BA-MW-1	0-1							✓	✓	
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	BA-MW-2	0-1							✓	✓	
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	BA-MW-3	0-1							✓	✓	
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	BA-MW-4	0-1							✓	✓	
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	BA-MW-5	0-1		✓	✓	✓		✓			
	BA-MW-6	0-1		✓	✓	✓		✓			
	BA-MW-7	0-1		✓	✓	✓		✓			
Analyses Subtotal by Area			**0**	**24**	**3**	**21**	**18**	**6**	**8**	**6**	
Acid Plant	AP-MW-1 (replacement)	Vadose Zone	✓	✓		✓		✓			
		Water Table	✓	✓		✓		✓			
		Saturated Zone	✓	✓		✓		✓			
Analyses Subtotal by Area			**3**	**3**	**0**	**3**	**0**	**3**	**0**	**0**	
Small Hydraulic Barker/ Chipper Area	SHB-B-1	Vadose Zone	✓	✓	✓	✓	✓				
		Water Table	✓	✓	✓	✓	✓				
		Saturated Zone	✓	✓	✓	✓	✓				
	SHB-B-2	Vadose Zone	✓	✓	✓	✓		✓			
		Water Table	✓	✓	✓	✓		✓			
		Saturated Zone	✓	✓	✓	✓		✓			
	SHB-B-3	Vadose Zone	✓	✓	✓	✓	✓				
		Water Table	✓	✓	✓	✓	✓				
		Saturated Zone	✓	✓	✓	✓	✓				
	SHB-B-4	Vadose Zone	✓	✓	✓	✓		✓			
		Water Table	✓	✓	✓	✓		✓			
		Saturated Zone	✓	✓	✓	✓		✓			
	SHB-MW-1	Vadose Zone	✓	✓	✓	✓		✓			
		Water Table	✓	✓	✓	✓		✓			
		Saturated Zone	✓	✓	✓	✓		✓			
	SHB-MW-2	Vadose Zone	✓	✓	✓	✓		✓			
		Water Table	✓	✓	✓	✓		✓			
		Saturated Zone	✓	✓	✓	✓		✓			
Analyses Subtotal by Area			**18**	**18**	**18**	**18**	**6**	**12**	**0**	**0**	
Chip Screen Bldg Area	CSB-B-1	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CSB-B-2	0-1		✓				✓	✓		
		.2-3		✓				✓	✓		
Analyses Subtotal by Area			**0**	**5**	**0**	**3**	**0**	**5**	**2**	**0**	
Engineering-Maintenance Building	EM-B-1	Vadose Zone	✓	✓	✓	✓		✓			
		Water Table	✓	✓	✓	✓		✓			
		Saturated Zone	✓	✓	✓	✓		✓			
Analyses Subtotal by Area			**3**	**3**	**3**	**3**	**0**	**3**	**0**	**0**	

Table 6-1 - RI Soil Analyses Detail

K-C Upland Area RI/FS, Everett, Washington

RI Area	Exploration Identification	Sample Depth [1] (feet bgs)	Soil Sample Analyses								Area Specific Analytical Notes
			Gasoline-Range TPH	Diesel- and Oil-Range TPH	VOCs	Metals[2]	SVOCs	PAHs	PCBs[3]	Dioxins/ Furans[4]	
GF-9 Area	GF9-MW-2	Vadose Zone	✓	✓				✓			Two samples from these borings with the highest detected concentrations of TPH will be subsequently submitted for analysis of VPH and/or EPH.
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	GF9-MW-3	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	GF9-B-3	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	GF9-B-4	Vadose Zone	✓	✓				✓			
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
Analyses Subtotal by Area			**12**	**12**	**0**	**0**	**0**	**12**	**0**	**0**	
Log Pond Fill	LP-MW-1	Vadose Zone		✓	✓	✓	✓				
		Water Table		✓	✓	✓	✓				
		Saturated Zone		✓	✓	✓	✓				
	LP-MW-2	Vadose Zone		✓	✓	✓	✓				
		Water Table		✓	✓	✓	✓				
		Saturated Zone		✓	✓	✓	✓				
Analyses Subtotal by Area			**0**	**6**	**6**	**6**	**6**	**0**	**0**	**0**	
Hydraulic Barker Building Area	HB-B-4	Vadose Zone	✓	✓				✓			Two samples from these borings with the highest detected concentrations of TPH will be subsequently submitted for analysis of VPH and/or EPH.
		Water Table	✓	✓				✓			
		Saturated Zone	✓	✓				✓			
	HB-B-5	Vadose Zone		✓				✓			
		Water Table		✓				✓			
		Saturated Zone		✓				✓			
	HB-B-6	Vadose Zone		✓				✓			
		Water Table		✓				✓			
		Saturated Zone		✓				✓			
Analyses Subtotal by Area			**3**	**9**	**0**	**0**	**0**	**9**	**0**	**0**	

Table 6-1 - RI Soil Analyses Detail

K-C Upland Area RI/FS, Everett, Washington

RI Area	Exploration Identification	Sample Depth [1] (feet bgs)	Soil Sample Analyses								Area Specific Analytical Notes
			Gasoline-Range TPH	Diesel- and Oil-Range TPH	VOCs	Metals[2]	SVOCs	PAHs	PCBs[3]	Dioxins/ Furans[4]	
Tissue Mill Area	TM-B-1	0-1					✓		✓		
		Vadose Zone		✓	✓	✓					
		Water Table		✓	✓	✓			✓		
		Saturated Zone		✓	✓	✓					
	TM-B-2	0-1					✓		✓		
		Vadose Zone		✓	✓	✓					
		Water Table		✓	✓	✓			✓		
		Saturated Zone		✓	✓	✓					
	TM-B-3	0-1							✓		
		Vadose Zone		✓	✓	✓	✓				
		Water Table		✓	✓	✓	✓		✓		
		Saturated Zone		✓	✓	✓	✓				
	TM-B-4	0-1					✓		✓		
		Vadose Zone		✓	✓	✓					
		Water Table		✓	✓	✓			✓		
		Saturated Zone		✓	✓	✓					
	TM-B-5	0-1					✓		✓		
		Vadose Zone		✓	✓	✓					
		Water Table		✓	✓	✓			✓		
		Saturated Zone		✓	✓	✓					
	TM-B-6	0-1					✓		✓		
		Vadose Zone		✓	✓	✓					
		Water Table		✓	✓	✓					
		Saturated Zone		✓	✓	✓					
	TM-B-7	0-1		✓				✓	✓		
		2-3		✓				✓	✓		
	TM-B-8	0-1		✓				✓	✓		
		2-3		✓				✓	✓		
	TM-B-9	0-1		✓				✓	✓		
		2-3		✓				✓	✓		
	TM-B-10	0-1		✓					✓		
		2-3		✓					✓		
	TM-B-11	0-1		✓					✓		
		2-3		✓					✓		
	TM-B-12	0-1		✓					✓		
		2-3		✓					✓		
	TM-MW-1	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	TM-MW-2	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	TM-MW-3	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
	TM-MW-4	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓		✓		
		Saturated Zone		✓		✓	✓				
	TM-MW-5	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓		✓		
		Saturated Zone		✓		✓	✓				
	TM-MW-6	0-1							✓		
		Vadose Zone		✓		✓	✓				
		Water Table		✓		✓	✓				
		Saturated Zone		✓		✓	✓				
Analyses Subtotal by Area			**0**	**48**	**18**	**36**	**26**	**6**	**31**	**0**	

Table 6-1 - RI Soil Analyses Detail

K-C Upland Area RI/FS, Everett, Washington

RI Area	Exploration Identification	Sample Depth [1] (feet bgs)	Soil Sample Analyses								Area Specific Analytical Notes
			Gasoline-Range TPH	Diesel- and Oil-Range TPH	VOCs	Metals[2]	SVOCs	PAHs	PCBs[3]	Dioxins/ Furans[4]	
Clark-Nickerson Mill	CN-B-1	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-2	0-1		✓		✓		✓	✓		
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-3	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-4	0-1		✓		✓		✓	✓		
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-5	Vadose Zone		✓		✓		✓		✓	
		Water Table		✓		✓		✓		✓	
		Saturated Zone		✓		✓		✓			
	CN-B-6	Vadose Zone	✓	✓		✓		✓			
		Water Table	✓	✓		✓		✓			
		Saturated Zone	✓	✓		✓		✓			
	CN-B-7	Vadose Zone	✓	✓		✓		✓			
		Water Table	✓	✓		✓		✓			
		Saturated Zone	✓	✓		✓		✓			
	CN-B-8	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-9	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-10	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-11	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-12	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-13	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-B-14	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-MW-1	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-MW-2	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
	CN-MW-3	Vadose Zone		✓		✓		✓			
		Water Table		✓		✓		✓			
		Saturated Zone		✓		✓		✓			
Analyses Subtotal by Area			**6**	**51**	**0**	**51**	**0**	**51**	**2**	**2**	
Upgradient	UG-MW-2 (replacement)	Vadose Zone	✓	✓		✓		✓			
		Water Table	✓	✓		✓		✓			
		Saturated Zone	✓	✓		✓		✓			
Analyses Subtotal by Area			**3**	**3**	**0**	**3**	**0**	**3**	**0**	**0**	
Recycled Demolition Debris	RM-SS-XX *(See Fig 6-1 for numbering)*	0-1		✓		✓	✓		✓		These are 5-point composite samples within each grid block (refer to text). Metals analyes for these samples = **priority pollutant metals**.
	No. of samples =	42									
Analyses Subtotal by Area			**0**	**42**	**0**	**42**	**42**	**0**	**42**	**0**	

Notes:

[1]Except where specified, soil sample depth will be determined in the field based on the results of field screening and soil recovery. Where soil is covered with recycled material, soil sample depths are relative to the underlying soil surface.

[2]Metals analyses include arsenic, copper, lead, mercury, nickel, and zinc, unless otherwise indicated.

[3]Three soil samples with highest total PCB concentrations will be analyzed for PCB congeners.

[4]Within the pulp mill and boilers area, the two surface soil sample locations with the highest surface-soil TCDD (TEQ) concentrations will additionally be analyzed for dioxin/furans in subsurface soil. Dioxins/furans will also be analyzed at soil boring locations where an accumulation of ash is observed.

Table 6-2 - RI Groundwater Analyses Detail

K-C Upland Area RI/FS, Everett, Washington

RI Area	Monitoring Well Identification	New or Existing Monitoring Well	Groundwater Sample Analyses[1]							
			Gasoline-Range TPH	and Oil-Range TPH	VOCs	Metals[2,3]	SVOCs incl low-level PAHs	Low-Level PAHs	Ammonia & Sulfides	TSS
Bulk Fuel Storage Facilities (Standard Oil and Associated Oil)	REC1-MW-1	Existing	✓	✓				✓		✓
	REC1-MW-2	Existing	✓	✓				✓		✓
	REC1-MW-3	Existing	✓	✓	✓			✓		✓
	REC1-MW-4	Existing	✓	✓	✓	✓		✓		✓
	*REC1-MW-5 **	Existing	✓	✓		✓		✓		✓
	REC1-MW-6	Existing	✓	✓		✓		✓		✓
	REC1-MW-7	Existing	✓	✓				✓		✓
	*REC1-MW-8 **	Existing	✓	✓		✓		✓		✓
	REC1-MW-9	Existing	✓	✓		✓		✓	✓	✓
	REC1-MW-10	New	✓	✓			✓			✓
	REC1-MW-11	New	✓	✓				✓		✓
	REC1-MW-12	New	✓	✓				✓		✓
	REC1-MW-13	New	✓	✓				✓		✓
	REC1-MW-14	New	✓	✓		✓		✓		✓
	REC1-MW-15	New	✓	✓				✓		✓
Analyses Subtotal by Area Per Event			**15**	**15**	**2**	**6**	**1**	**14**	**1**	**15**
Central Maintenance Shop	CMS-MW-1	Existing	✓	✓				✓		✓
	CMS-MW-2	New	✓	✓				✓		✓
Analyses Subtotal by Area Per Event			**2**	**2**	**0**	**0**	**0**	**2**	**0**	**2**
Old Paint Shop	OPS-MW-1	New			✓					✓
Groundwater Sample Analyses Subtotal by			**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
Pulp Mill Area	PM-MW-1	New		✓		✓	✓			✓
	PM-MW-2	New		✓		✓	✓			✓
	PM-MW-3	New		✓		✓	✓			✓
	PM-MW-4	New		✓		✓	✓			✓
	PM-MW-5	New		✓		✓	✓			✓
	*PM-MW-6**	New		✓	✓	✓	✓			✓
	PM-MW-7	New		✓	✓	✓	✓		✓	✓
	PM-MW-8	New		✓	✓	✓	✓		✓	✓
Analyses Subtotal by Area Per Event			**0**	**8**	**3**	**8**	**8**	**0**	**2**	**8**
Boilers Area	REC5-MW-1	Existing		✓		✓	✓			✓
	BA-MW-1	New		✓		✓	✓			✓
	BA-MW-2	New		✓		✓	✓			✓
	BA-MW-3	New		✓		✓	✓			✓
	BA-MW-4	New		✓		✓	✓			✓
	*BA-MW-5 **	New		✓		✓	✓			✓
	*BA-MW-6 **	New		✓		✓	✓			✓
	BA-MW-7	New		✓		✓	✓		✓	✓
Analyses Subtotal by Area Per Event			**0**	**8**	**0**	**8**	**8**	**0**	**1**	**8**
Acid Plant	AP-MW-1	Existing	✓	✓				✓		✓
Groundwater Sample Analyses Subtotal by			**1**	**1**	**0**	**0**	**0**	**1**	**0**	**1**
Small Hydraulic Barker/Chipper Area	*SHB-MW-1 **	New	✓	✓	✓	✓		✓		✓
	SHB-MW-2	New	✓	✓	✓	✓		✓	✓	✓
Analyses Subtotal by Area Per Event			**2**	**2**	**2**	**2**	**0**	**2**	**1**	**2**
Log Pond Fill	**MW-6**	Existing				✓			✓	✓
	LP-MW-1	New		✓		✓		✓	✓	✓
	LP-MW-2	New		✓		✓		✓	✓	✓
Analyses Subtotal by Area Per Event			**0**	**2**	**0**	**3**	**0**	**2**	**3**	**3**

Table 6-2 - RI Groundwater Analyses Detail

K-C Upland Area RI/FS, Everett, Washington

RI Area	Monitoring Well Identification	New or Existing Monitoring Well	Groundwater Sample Analyses[1]							
			Gasoline-Range TPH	and Oil-Range TPH	VOCs	Metals[2,3]	SVOCs incl low-level PAHs	Low-Level PAHs	Ammonia & Sulfides	TSS
Hydraulic Barker Bldg	HB-MW-1	Existing		✓				✓		✓
Analyses Subtotal by Area Per Event			**0**	**1**	**0**	**0**	**0**	**1**	**0**	**1**
GF-9 Area	GF9-MW-1	Existing	✓	✓				✓		✓
	GF9-MW-2	New	✓	✓				✓		✓
	GF9-MW-3	New	✓	✓				✓		✓
Analyses Subtotal by Area Per Event			**3**	**3**	**0**	**0**	**0**	**3**	**0**	**3**
Tissue Mill Area	TM-MW-1	New		✓	✓	✓		✓		✓
	TM-MW-2	New		✓	✓	✓	✓			✓
	TM-MW-3	New		✓		✓		✓		✓
	TM-MW-4	New		✓	✓	✓		✓		✓
	TM-MW-5	New		✓		✓	✓			✓
	TM-MW-6	New		✓	✓	✓	✓		✓	✓
Analyses Subtotal by Area Per Event			**0**	**6**	**4**	**6**	**3**	**3**	**1**	**6**
Clark-Nickerson Lumber Mill	**CN-MW-1**	New		✓		✓		✓	✓	✓
	CN-MW-2	New		✓		✓		✓		✓
	CN-MW-3	New		✓		✓		✓		✓
Analyses Subtotal by Area Per Event			**0**	**3**	**0**	**3**	**0**	**3**	**1**	**3**
Shoreline Groundwater Quality (not called out in other areas)	**MW-1**	Existing				✓			✓	✓
	MW-2	Existing				✓			✓	✓
	MW-5	Existing				✓			✓	✓
	NRP-MW-2	Existing				✓			✓	✓
	NRP-MW-3	Existing				✓			✓	✓
	OMS-MW-1	Existing				✓			✓	✓
	REC3-MW-1	Existing				✓			✓	✓
	REC6-MW-2	Existing				✓	✓		✓	✓
	REC7-MW-1	Existing				✓		✓	✓	✓
	REC7-MW-2	Existing				✓	✓		✓	✓
	REC7-MW-3	Existing				✓		✓	✓	✓
	REC7-MW-4	Existing	✓	✓		✓		✓	✓	✓
	UST70-MW-2	Existing				✓			✓	✓
Analyses Subtotal by Area Per Event			**1**	**1**	**0**	**12**	**2**	**3**	**12**	**12**
Upgradient	UG-MW-1	Existing	✓	✓				✓		✓
	UG-MW-2	Existing	✓	✓				✓		✓
Groundwater Sample Analyses Subtotal by			**2**	**2**	**0**	**0**	**0**	**2**	**0**	**2**
TOTAL ANALYSES			**26**	**54**	**12**	**48**	**22**	**36**	**22**	**67**

Notes:

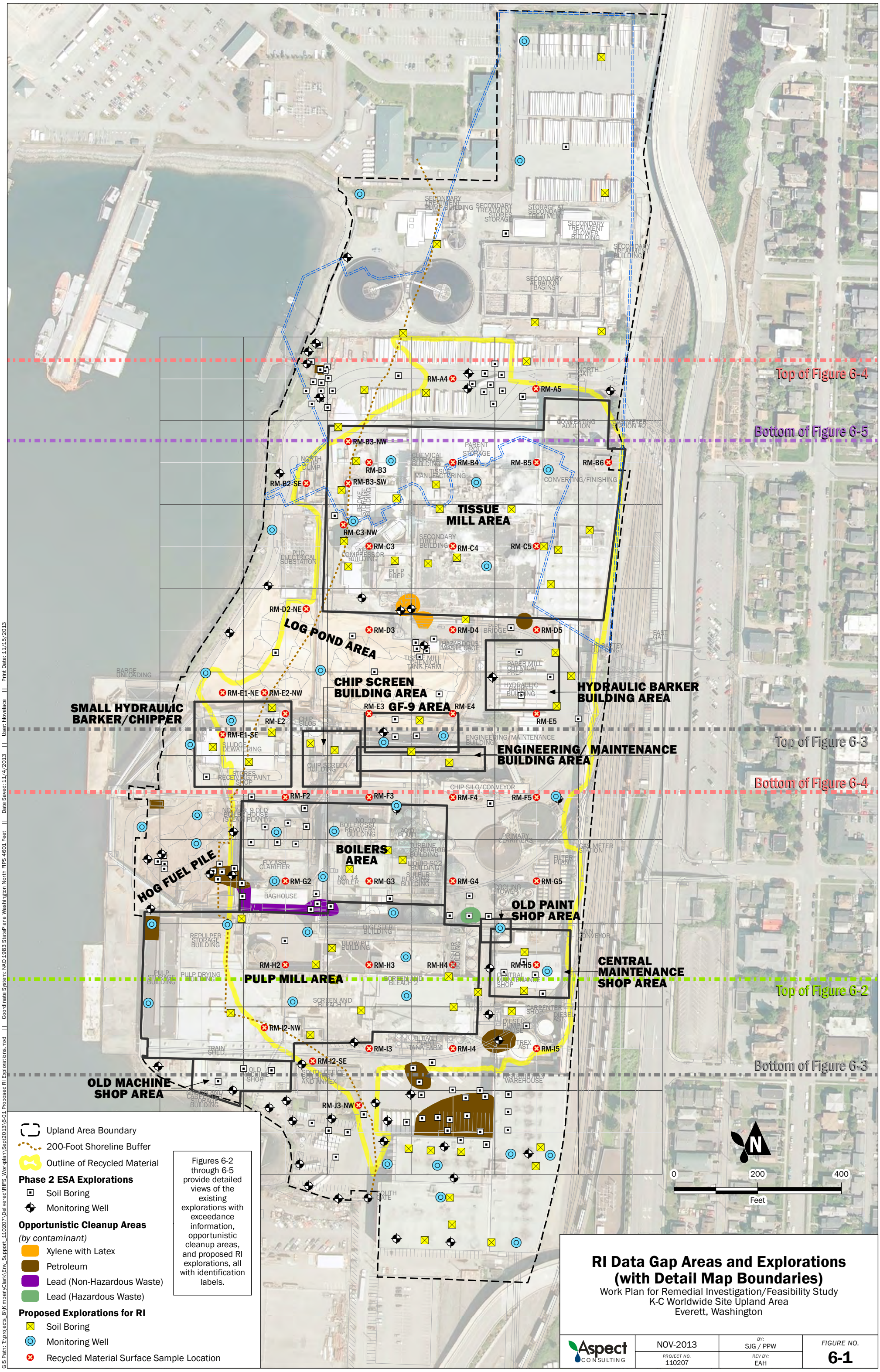
[1]Groundwater samples to be collected during dry- and wet-season sampling events.

[2]Groundwater sampling will involve collection of unfiltered samples for total metals analysis. Additional sample volume will also be collected and field-filtered, and held pending receipt of total metals data. Those total metals detected at concentrations greater than respective groundwater screening levels will then be analyzed for dissolved metals as a point of comparison and verification.

[3]Metals analyses include arsenic, copper, lead, mercury, nickel, and zinc.

Wells in **Bold** are designated shoreline wells to be sampled within time window 1 hour +/- of lower low tide.

Wells with * are within 200 ft of shoreline and are to be sampled within time window 2 hour before and 3 hour after lower low tide.

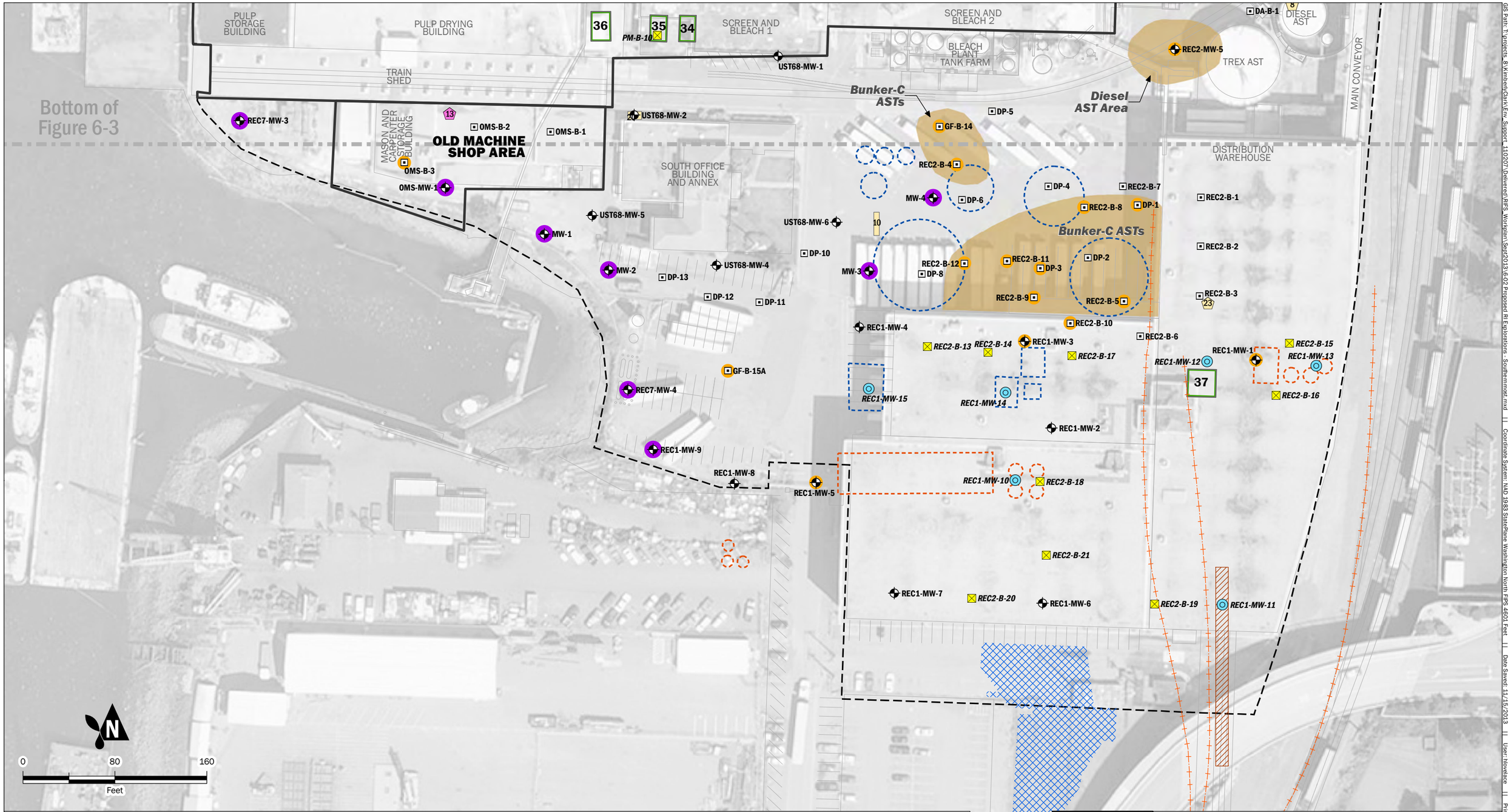


RI Data Gap Areas and Explorations (with Detail Map Boundaries)

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	NOV-2013	BY: SJG / PPW	FIGURE NO. 6-1
	PROJECT NO. 110207	REV BY: EAH	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\6-01 Proposed RI Explorations.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/4/2013 || User: hlovelace || Print Date: 11/15/2013

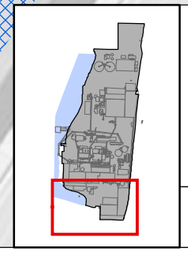


- Proposed RI Boring Location
- Proposed RI Monitoring Well Location
- Existing Soil Boring
- Existing Monitoring Well
- Exploration Location with One or More Exceedance of Soil Screening Level
- Exploration Location with One or More Exceedance of Groundwater Screening Level
- Upland Area Boundary
- ExxonMobil/ADC Cleanup Excavation (2011-2012)
- Opportunistic Cleanup Areas for Petroleum
- Approximate Location of Former Associated Oil Co. Facilities
- Approximate Location of Former Standard Oil Facilities
- Former Associated Oil Co. Railroad Spur
- Former Associated Oil Co. Railroad Loading Dock

Historical Hazardous Substance Location

(see Figure 2-2)

- Petroleum
- Other Misc Waste
- 1985 Locations of PCB Transformers



Proposed RI Explorations for Southernmost Portion of Upland Area

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect Consulting	NOV-2013	BY: SJG / PPW	FIGURE NO. 6-2
	PROJECT NO. 110207	REV BY: ---	

Proposed RI Boring Location
Proposed RI Monitoring Well Location
Existing Soil Boring
Existing Monitoring Well
Existing Exploration Location with One or More Exceedance of Soil Screening Level
Existing Exploration Location with One or More Exceedance of Groundwater Screening Level
Upland Area Boundary
Opportunistic Cleanup Areas for Petroleum
Opportunistic Cleanup Areas for Lead (Non-Hazardous Waste)
Opportunistic Cleanup Areas for Lead (Hazardous Waste)

Historical Hazardous Substance Location
(see Figure 2-2)
Petroleum
Waste Accumumlation (PCB)
Other Misc Waste
1985 Locations of PCB Transformers

Bottom of Figure 6-4
Top of Figure 6-2

STORES RECEIVING/PAINT SHOP
SMALL HYDRAULIC AREA
CHIP SILOS
ENGINEERING/MAINTENANCE BUILDING
CHIP SILO/CONVEYOR
Rail Car Dumper Hydraulic System Building
Diesel UST 70
Bunker-C USTs 71/72/73
NO. 7, 8, 9 OLD BOILER HOUSE (STEAM PLANT)
NO. 10 BOILER/SSL REVOVERY BUILDING
ACID PLANT
PRIMARY CLARIFIERS
BOILERS AREA
FLY ASH CLARIFIER
NO. 14 BOILER
TURBINE GENERATOR BUILDING
SULFUR BURNING BUILDING
GAS METER STATION
FILTER PLANT
BAGHOUSE
COOLING TOWER
GF11
OLD PAINT SHOP AREA
Heavy Duty Shop Sump
PULP STORAGE BUILDING
REPULPER STORAGE BUILDING
Boiler/Baghouse Area
DIGESTER BUILDING
BLOW PIT BUILDING
WASHER BUILDING
MAIN CONVEYOR
CENTRAL MAINTENANCE SHOP AREA
PULP MILL AREA
CENTRAL MAINTENANCE SHOP
PULP DRYING BUILDING
SCREEN AND BLEACH 1
SCREEN AND BLEACH 2
BRAIN SHED
OLD MACHINE SHOP AREA
OLD MACHINE SHOP
SOUTH OFFICE BUILDING AND ANNEX
BLEACH PLANT TANK FARM
Bunker-C ASTs

SHB-MW-2 SHB-B-1 SHB-B-2 SHB-B-3 GF-B-10
CSB-B-1
AP-MW-1R AP-MW-1 GF-B-8 UG-MW-2R UG-MW-2
Boiler-B-4 Boiler-B-5 Boiler-B-3A Boiler-B-3 Boiler-B-3B Boiler-HA-2A Boiler-HA-2B Boiler-HA-2C Boiler-B-1 Boiler-B-2
BA-MW-1 BA-MW-2 BA-MW-3 BA-MW-4 BA-MW-5 BA-MW-6 BA-MW-7 BA-B-1 BA-B-2 BA-B-3
REC5-MW-1 REC5-HA-1 REC5-HA-2 REC5-HA-3 REC5-HA-4 REC5-HA-5 REC5-HA-6
UST70-MW-1 UST70-MW-2 UST70-B-1 UST70-B-2 UST70-B-3 UST70-B-4
UST71-MW-1 UST71-B-1 UST71-B-2 UST71-B-3 UST71-B-4 Boiler-MW-1
REC3-MW-1
PM-MW-1 PM-MW-2 PM-MW-3 PM-MW-4 PM-MW-5 PM-MW-6 PM-MW-7 PM-MW-8 PM-B-1 PM-B-2 PM-B-3 PM-B-4 PM-B-5 PM-B-6 PM-B-7 PM-B-8 PM-B-9 PM-B-10
GF-B-12 GF-B-11 GF11-B-1 GF11-B-2 GF11-B-3 GF-B-13 GF-B-14
OPS-MW-1
CMS-B-1 CMS-B-2 CMS-B-3 CMS-B-4 CMS-B-5 CMS-MW-1 CMS-MW-2
DA-MW-1 CMS-B-6
UST68-MW-1 UST68-MW-2
REC7-MW-3
OMS-B-1 OMS-B-2
DP-5

N
0 80 160
Feet

Proposed RI Explorations for South-Central Portion of Upland Area

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect Consulting	NOV-2013	BY: SJG / PPW	FIGURE NO. 6-3
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\Kimberly-Clark\Env_Support_110207\Deliverer\RIFS_Workplan\Sept2013\6-03 Proposed RI Explorations - South-Central.mxd | | Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet | | Date Saved: 11/15/2013 | | User: hlovelace | | Print Date: 11/15/2013

Bottom of Figure 6-5

Top of Figure 6-3

Naval Reserve Parcel UST Area

Former Transformer Yard

Xylene UST 29 Latex Spill

Hydraulic Barker Vault

Hydraulic Barker Building

Hazardous Waste Accumulation Unit

Papermill Chemical Prep

LOG POND AREA

SMALL HYDRAULIC AREA

CHIP SCREEN BUILDING AREA

GF-9 AREA

ENGINEERING AND MAINTENANCE BUILDING AREA

HYDRAULIC BARKER BUILDING AREA

TISSUE MILL AREA

CONVERTING ADDITION

CONVERTING/FINISHING

CHEMICAL STORAGE BUILDING

PARENT ROLL STORAGE

TISSUE MANUFACTURING

BROKE STORAGE BUILDING

PUD ELECTRICAL SUBSTATION

AIR COMPRESSOR BUILDING

PULP PREP

TISSUE MILL CHEMICAL TANK FARM

HR SAFTEY BUILDING

BARGE UNLOADING

CHIP SILOS

STORES RECEIVING/PAINT SHOP

CHIP SCREEN BUILDING

ENGINEERING/MAINTENANCE BUILDING

CHIP SILO/CONVEYOR

HYDRAULIC BARKER BUILDING

NRP-B-3 NRP-B-5 NRP-B-6 NRP-B-22 NRP-B-8 NRP-B-7 NRP-B-4 NRP-B-18 NRP-B-19 NRP-B-17 NRP-B-2 NRP-B-20 NRP-B-21 NRP-MW-2 NRP-MW-1

GF-B-4 CN-B-7 CN-B-14 NRP-MW-5 NRP-B-14 NRP-B-11 CN-B-9 NRP-B-9 NRP-B-16 NRP-MW-4 NRP-B-12 NRP-B-10 NRP-B-15 GF-B-3 NRP-B-13 UG-MW-1

CN-B-6 CN-B-2 TM-MW-1 CN-B-1 CN-B-4 CN-B-5 TM-MW-2 TM-MW-3 TM-B-2 TM-B-5 GF-B-5 TM-MW-5 TM-MW-6 TM-B-8 TM-B-9 TM-B-1 TM-B-3 TM-B-10 TM-B-7 TM-B-11 TM-B-6 TM-MW-4 TM-B-12 TM-B-4 GF-B-6 GF-B-7

REC7-MW-2 REC6-MW-2 REC6-MW-1 UST69-MW-1 UST29-MW-1 MW-6 LP-MW-2 LP-MW-1 DP-19 DP-18 DP-20 DP-21 DP-22 HW-B-1 HW-B-3 HW-B-4 HW-B-2 HB-B-1 HB-B-4 HB-B-2 HB-B-5 HB-MW-1 HB-B-3 HB-B-6 SHB-MW-1 SHB-B-4 SHB-MW-2 SHB-B-1 SHB-B-2 GF-B-10 CSB-B-1 CSB-B-2 GF9-B-1 GF9-B-3 GF9-MW-1 GF-B-9 GF9-B-2 GF9-MW-3 GF9-MW-2 GF9-B-4 EM-B-1

7 12 11 8 9 13 17 10 15 18 19 20 22 26 28 29 30 16 21 14 25 24 23

Proposed RI Boring Location
Proposed RI Monitoring Well Location
Existing Soil Boring
Existing Monitoring Well
Existing Exploration Location with One or More Exceedance of Soil Screening Level
Existing Exploration Location with One or More Exceedance of Groundwater Screening Level
Upland Area Boundary
Clark-Nickerson Lumber Mill Footprint (Approx)
Opportunistic Cleanup Areas for Xylene with Latex
Opportunistic Cleanup Areas for Petroleum

Historical Hazardous Substance Location
(see Figure 2-2)
Petroleum
Waste Accumumlation (PCB)
Other Misc Waste
1985 Locations of PCB Transformers

N
0 100 200
Feet

Proposed RI Explorations for North-Central Portion of Upland Area

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect Consulting	NOV-2013	BY: SJG / PPW	FIGURE NO. 6-4
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\Kimberly\Clark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\6-04 Proposed RI Explorations - North-Central.mxd | | Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet | | Date Saved: 11/15/2013 | | User: hlovelace | | Print Date: 11/15/2013

Proposed RI Boring Location
Proposed RI Monitoring Well Location
Existing Soil Boring
Existing Monitoring Well
Existing Exploration Location with One or More Exceedance of Soil Screening Level
Existing Exploration Location with One or More Exceedance of Groundwater Screening Level
Upland Area Boundary
Clark-Nickerson Lumber Mill Footprint (Approx)
Opportunistic Cleanup Areas for Petroleum

Historical Hazardous Substance Location
(see Figure 2-2)
Other Misc Waste
Petroleum

CN-MW-3
CN-B-3
GF-B-1
CN-MW-2
CN-MW-1
CN-B-12
16
SECONDARY TREATMENT PUMP BUILDING
SECONDARY TREATMENT STORES STORAGE
SECONDARY TREATMENT BLOWER BUILDING
GF-B-2
CN-B-11
REC7-MW-1
SECONDARY AERATION BASINS
CN-B-8
CN-B-10
CN-B-13
NRP-MW-3
NRP-B-1
MW-5
Naval Reserve Parcel UST Area
NRP-B-3
NRP-MW-2
25
NRP-B-5
NRP-B-6
NRP-B-22
NRP-B-8
NRP-B-4
NRP-B-7
NRP-B-17
NRP-B-18
NRP-B-19
NRP-MW-1
NRP-B-2
NRP-B-20
NRP-B-21
CN-B-7
CN-B-14
GF-B-4
NRP-MW-5
NRP-B-14
NRP-B-11
CN-B-9
NRP-B-9
NRP-B-16
NRP-B-12
NRP-MW-4
NRP-B-10
NRP-B-15
GF-B-3
NRP-B-13
UG-MW-1
CONVERTING ADDITION
CN-B-6
TISSUE MILL AREA
PARENT ROLL STORAGE
23
Top of Figure 6-4

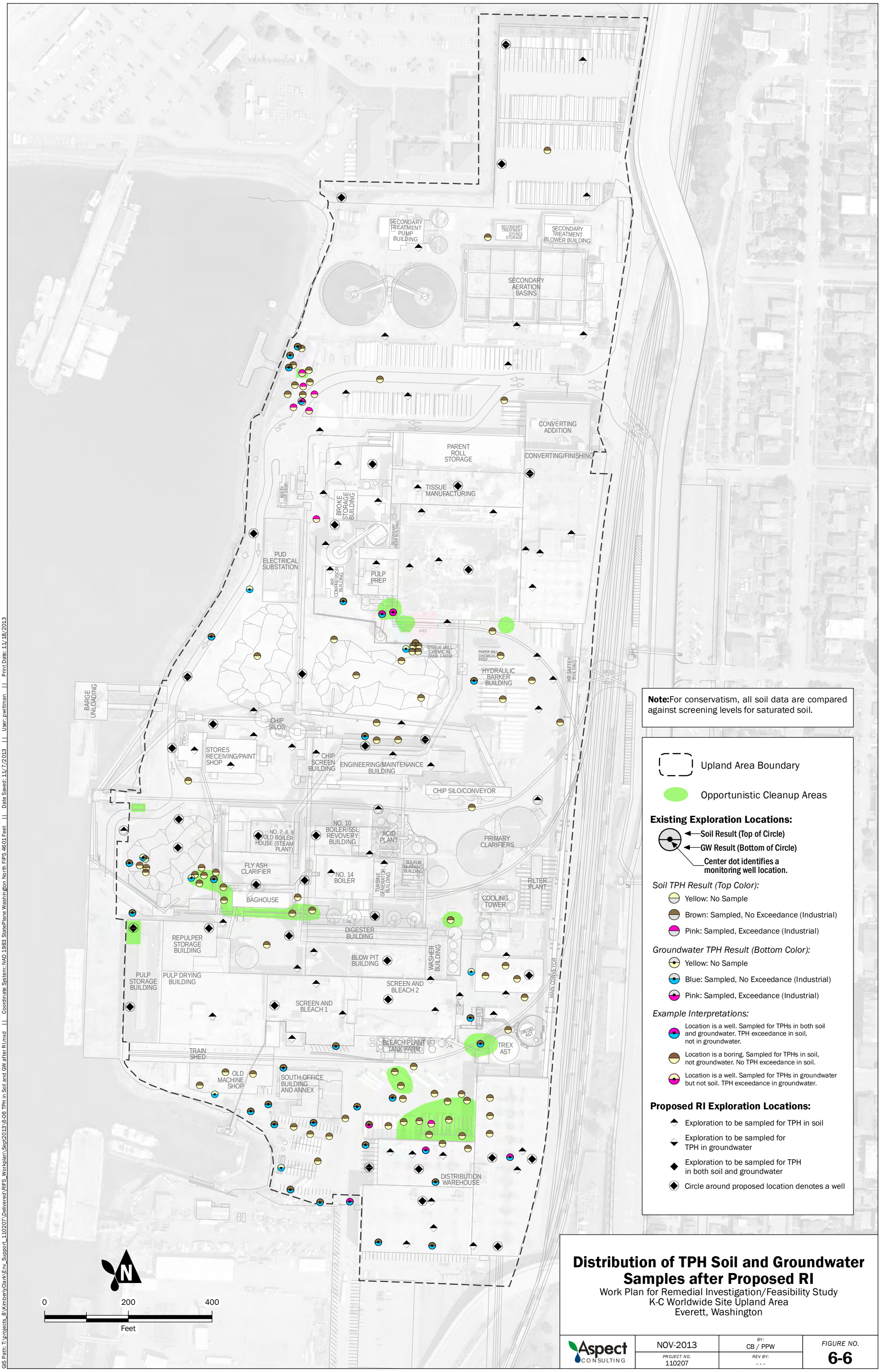
N
0 100 200
Feet

Proposed RI Explorations for Northernmost Portion of Upland Area

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	NOV-2013	BY: SJG / PPW	FIGURE NO. 6-5
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\Kimberly Clark\Env_Support_110207 \Delivered\RIFS_Workplan Sept2013\6-05 Proposed RI Explorations - Northernmost.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/15/2013 || User: hlovelace || Print Date: 11/15/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)

GW Result (Bottom of Circle)

Center dot identifies a monitoring well location.

Soil TPH Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater TPH Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for TPHs in both soil and groundwater. TPH exceedance in soil, not in groundwater.
- Location is a boring. Sampled for TPHs in soil, not groundwater. No TPH exceedance in soil.
- Location is a well. Sampled for TPHs in groundwater but not soil. TPH exceedance in groundwater.

Proposed RI Exploration Locations:

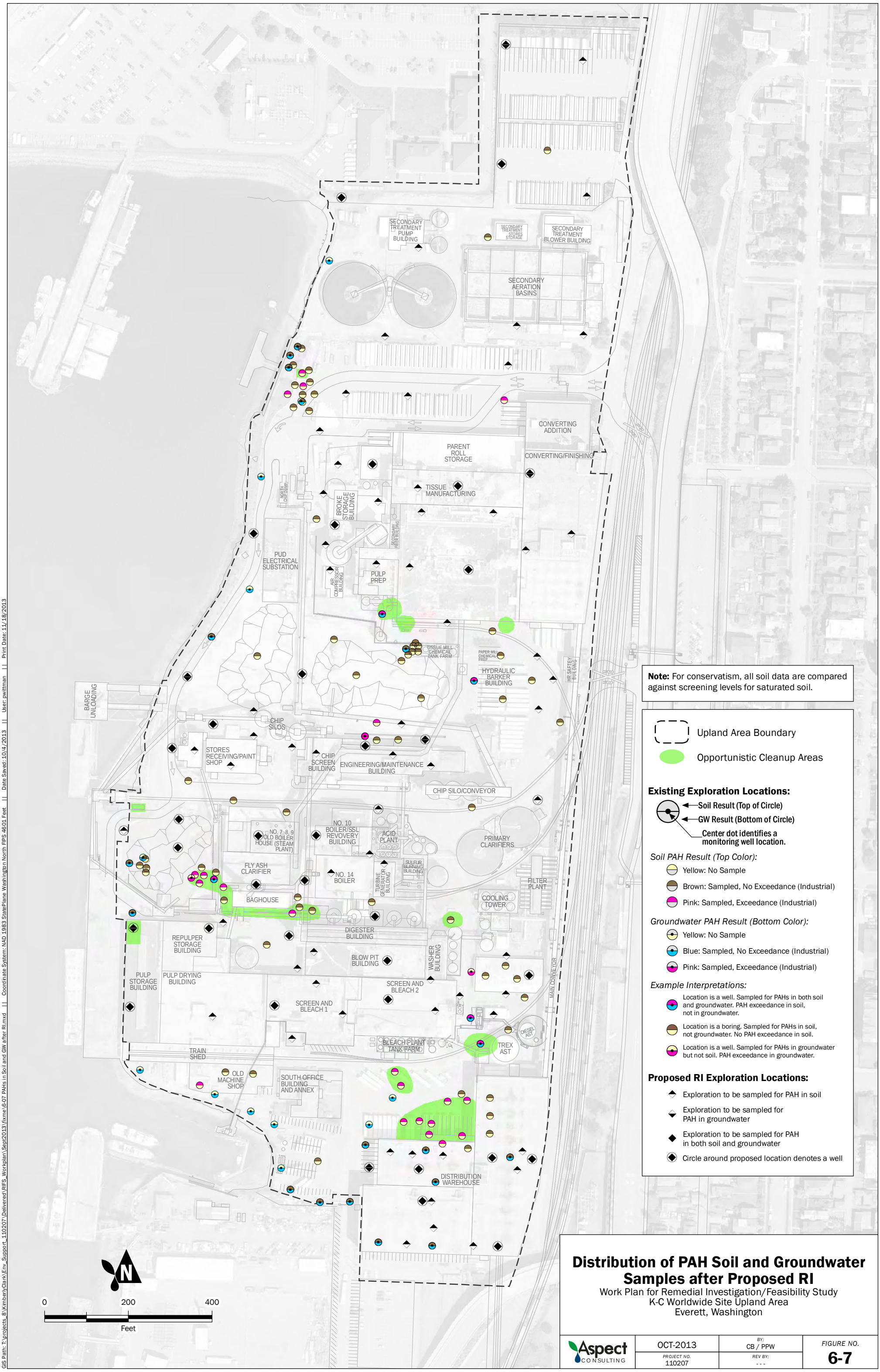
- Exploration to be sampled for TPH in soil
- Exploration to be sampled for TPH in groundwater
- Exploration to be sampled for TPH in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of TPH Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	NOV-2013	BY: CB / PPW	FIGURE NO. 6-6
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\6-06 TPH in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/7/2013 || User: pwittman || Print Date: 11/18/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)
GW Result (Bottom of Circle)
Center dot identifies a monitoring well location.

Soil PAH Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater PAH Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for PAHs in both soil and groundwater. PAH exceedance in soil, not in groundwater.
- Location is a boring. Sampled for PAHs in soil, not groundwater. No PAH exceedance in soil.
- Location is a well. Sampled for PAHs in groundwater but not soil. PAH exceedance in groundwater.

Proposed RI Exploration Locations:

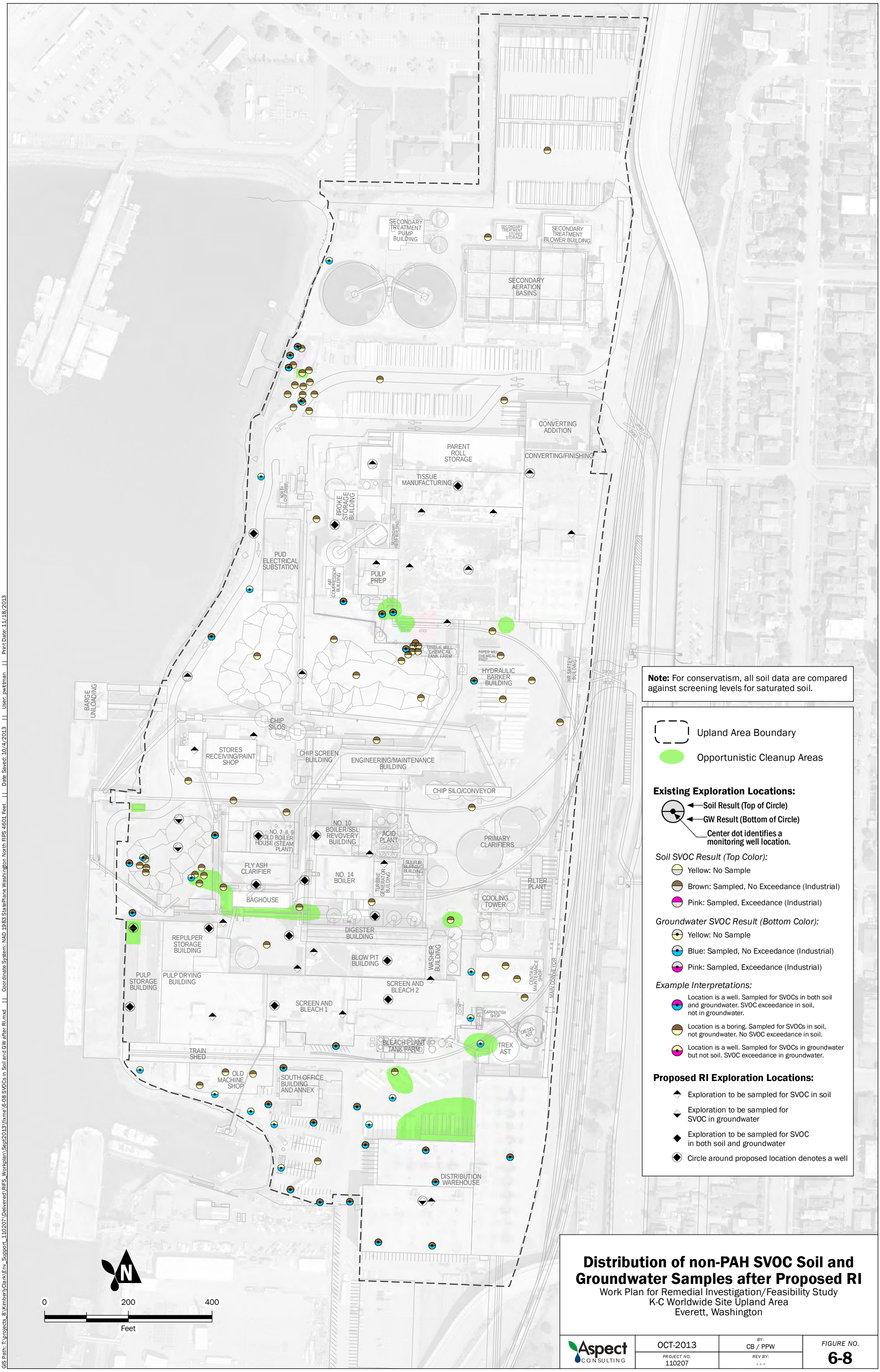
- Exploration to be sampled for PAH in soil
- Exploration to be sampled for PAH in groundwater
- Exploration to be sampled for PAH in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of PAH Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-7
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-07 PAHs in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)

GW Result (Bottom of Circle)

Center dot identifies a monitoring well location.

Soil SVOC Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater SVOC Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for SVOCs in both soil and groundwater. SVOC exceedance in soil, not in groundwater.
- Location is a boring. Sampled for SVOCs in soil, not groundwater. No SVOC exceedance in soil.
- Location is a well. Sampled for SVOCs in groundwater but not soil. SVOC exceedance in groundwater.

Proposed RI Exploration Locations:

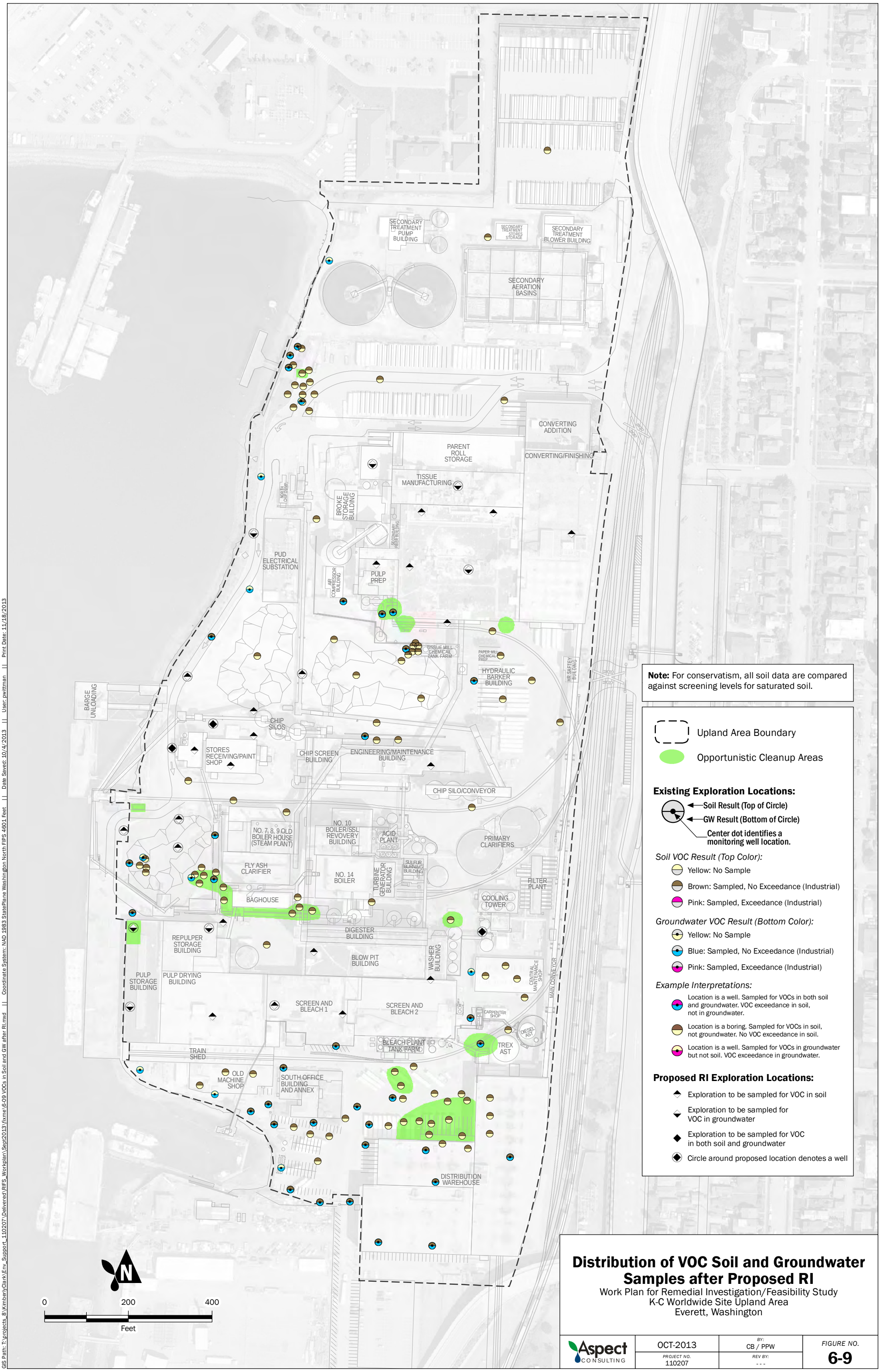
- Exploration to be sampled for SVOC in soil
- Exploration to be sampled for SVOC in groundwater
- Exploration to be sampled for SVOC in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of non-PAH SVOC Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-8
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-08 SVOCs in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)

GW Result (Bottom of Circle)

Center dot identifies a monitoring well location.

Soil VOC Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater VOC Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for VOCs in both soil and groundwater. VOC exceedance in soil, not in groundwater.
- Location is a boring. Sampled for VOCs in soil, not groundwater. No VOC exceedance in soil.
- Location is a well. Sampled for VOCs in groundwater but not soil. VOC exceedance in groundwater.

Proposed RI Exploration Locations:

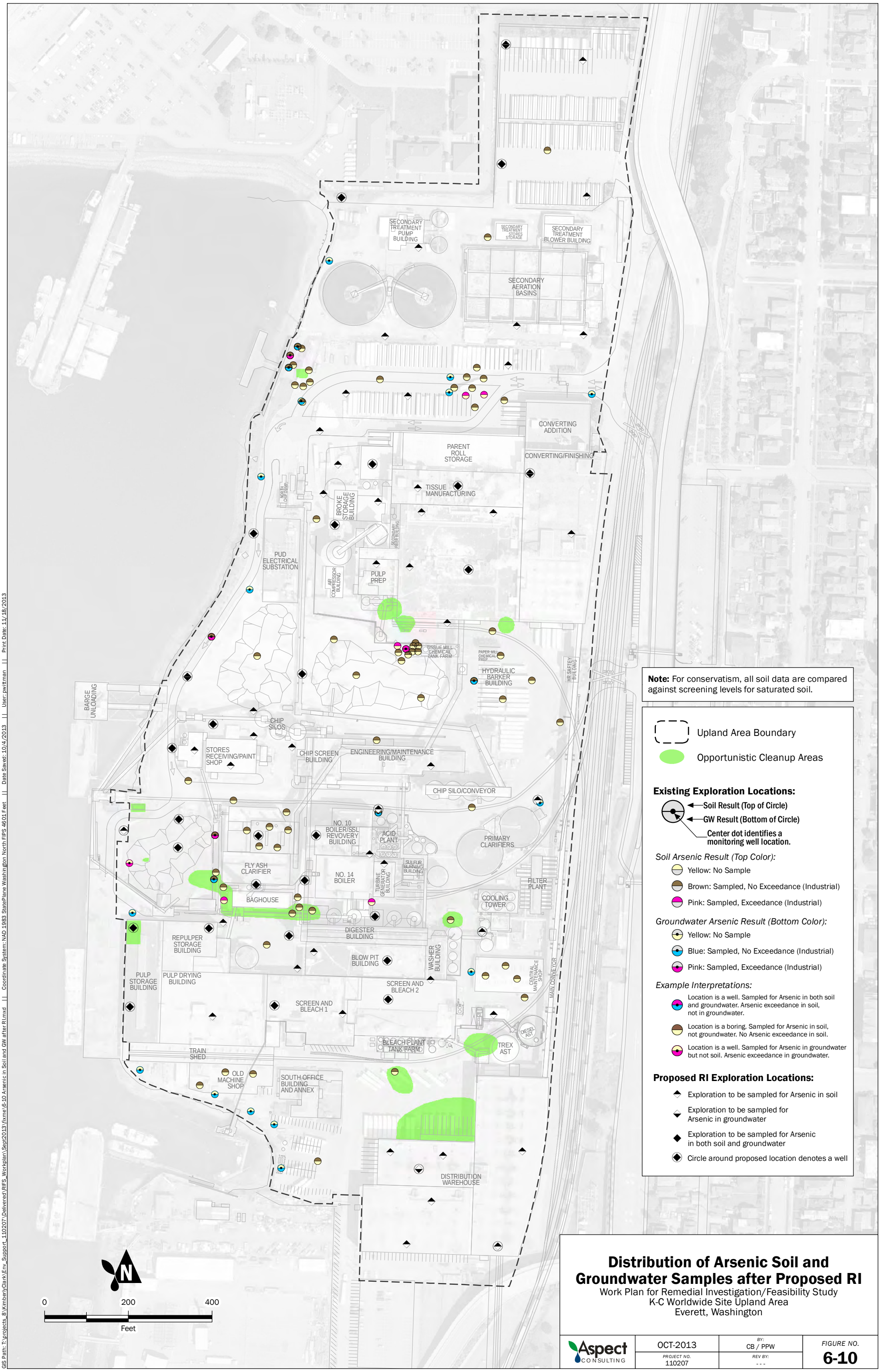
- Exploration to be sampled for VOC in soil
- Exploration to be sampled for VOC in groundwater
- Exploration to be sampled for VOC in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of VOC Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-9
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-09 VOCs in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)
GW Result (Bottom of Circle)
Center dot identifies a monitoring well location.

Soil Arsenic Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater Arsenic Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for Arsenic in both soil and groundwater. Arsenic exceedance in soil, not in groundwater.
- Location is a boring. Sampled for Arsenic in soil, not groundwater. No Arsenic exceedance in soil.
- Location is a well. Sampled for Arsenic in groundwater but not soil. Arsenic exceedance in groundwater.

Proposed RI Exploration Locations:

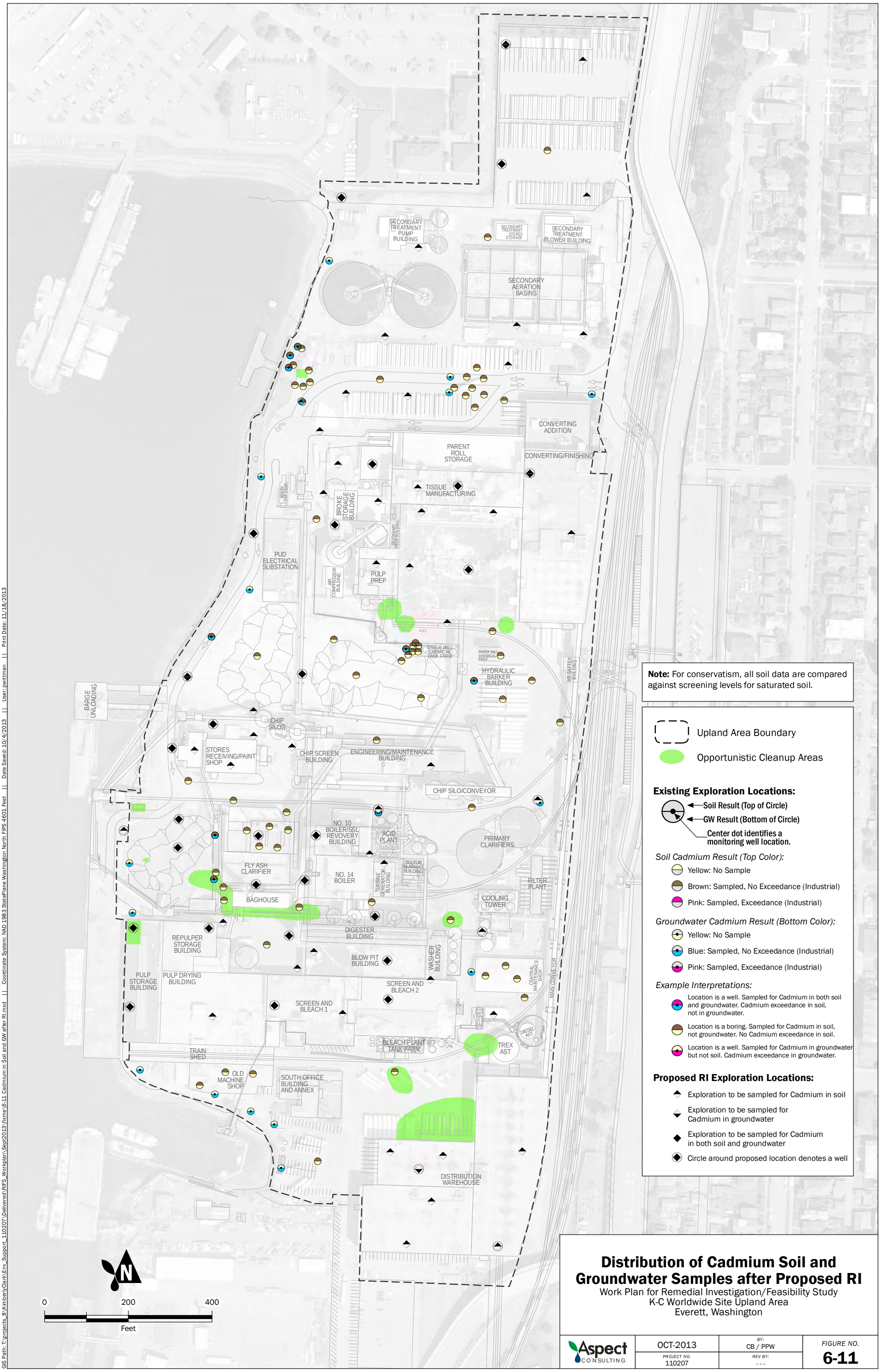
- Exploration to be sampled for Arsenic in soil
- Exploration to be sampled for Arsenic in groundwater
- Exploration to be sampled for Arsenic in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of Arsenic Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-10
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-10 Arsenic in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)
GW Result (Bottom of Circle)
Center dot identifies a monitoring well location.

Soil Cadmium Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater Cadmium Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for Cadmium in both soil and groundwater. Cadmium exceedance in soil, not in groundwater.
- Location is a boring. Sampled for Cadmium in soil, not groundwater. No Cadmium exceedance in soil.
- Location is a well. Sampled for Cadmium in groundwater but not soil. Cadmium exceedance in groundwater.

Proposed RI Exploration Locations:

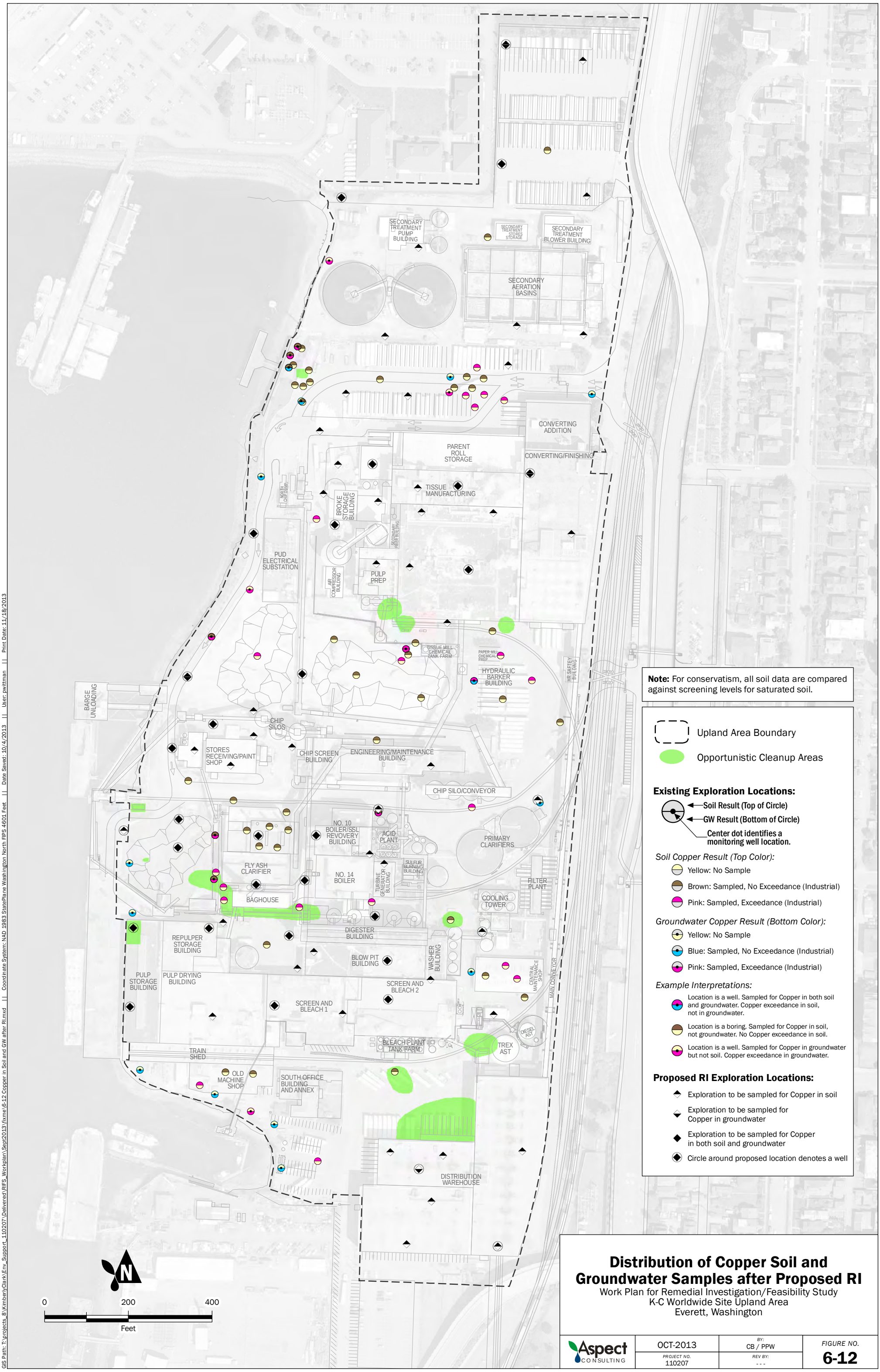
- Exploration to be sampled for Cadmium in soil
- Exploration to be sampled for Cadmium in groundwater
- Exploration to be sampled for Cadmium in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of Cadmium Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-11
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-11 Cadmium in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)
GW Result (Bottom of Circle)
Center dot identifies a monitoring well location.

Soil Copper Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater Copper Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for Copper in both soil and groundwater. Copper exceedance in soil, not in groundwater.
- Location is a boring. Sampled for Copper in soil, not groundwater. No Copper exceedance in soil.
- Location is a well. Sampled for Copper in groundwater but not soil. Copper exceedance in groundwater.

Proposed RI Exploration Locations:

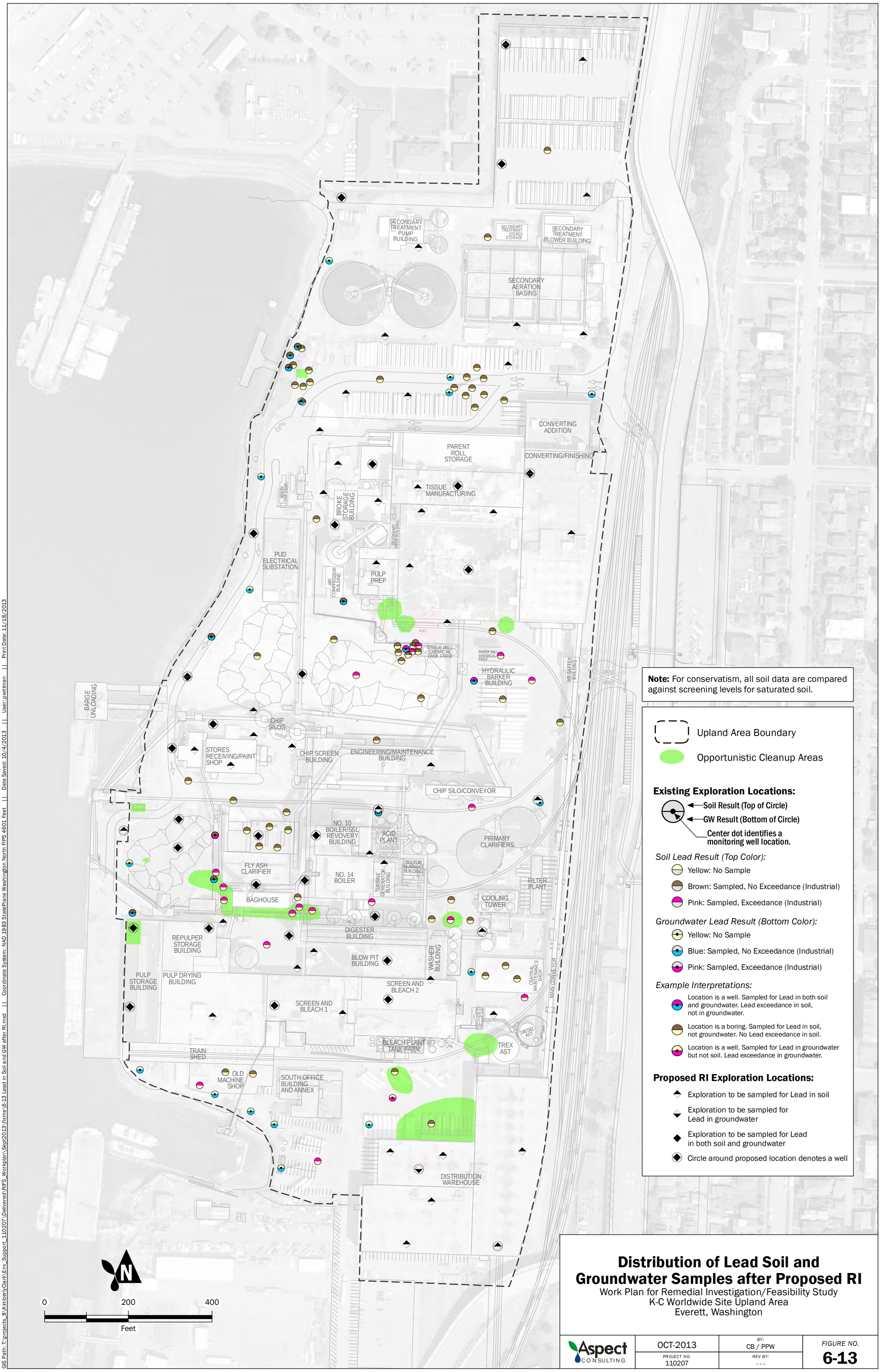
- Exploration to be sampled for Copper in soil
- Exploration to be sampled for Copper in groundwater
- Exploration to be sampled for Copper in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of Copper Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-12
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-12 Copper in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)
GW Result (Bottom of Circle)
Center dot identifies a monitoring well location.

Soil Lead Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater Lead Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for Lead in both soil and groundwater. Lead exceedance in soil, not in groundwater.
- Location is a boring. Sampled for Lead in soil, not groundwater. No Lead exceedance in soil.
- Location is a well. Sampled for Lead in groundwater but not soil. Lead exceedance in groundwater.

Proposed RI Exploration Locations:

- Exploration to be sampled for Lead in soil
- Exploration to be sampled for Lead in groundwater
- Exploration to be sampled for Lead in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of Lead Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-13
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-13 Lead in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013

SECONDARY TREATMENT PUMP BUILDING
SECONDARY TREATMENT STORES STORAGE
SECONDARY TREATMENT BLOWER BUILDING
SECONDARY AERATION BASINS
CONVERTING ADDITION
CONVERTING/FINISHING
PARENT ROLL STORAGE
TISSUE MANUFACTURING
BROKE STORAGE BUILDING
SECONDARY FEED BUILDING
PUD ELECTRICAL SUBSTATION
AIR COMPRESSOR BUILDING
PULP PREP
TISSUE MILL CHEMICAL TANK FARM
PAPER MILL CHEMICAL PREP
HYDRAULIC BARKER BUILDING
HR SAFETY BUILDING
BARGE UNLOADING
CHIP SILOS
STORES RECEIVING/PAINT SHOP
CHIP SCREEN BUILDING
ENGINEERING/MAINTENANCE BUILDING
CHIP SILO/CONVEYOR
NO. 10 BOILER/SSL REVOVERY BUILDING
ACID PLANT
PRIMARY CLARIFIERS
FLY ASH CLARIFIER
NO. 14 BOILER
TURBINE GENERATOR BUILDING
SULFUR BURNING BUILDING
FILTER PLANT
BAGHOUSE
COOLING TOWER
REPULPER STORAGE BUILDING
DIGESTER BUILDING
BLOW PIT BUILDING
WASHER BUILDING
CENTRAL MAINTENANCE SHOP
MAIN CONVEYOR
PULP STORAGE BUILDING
PULP DRYING BUILDING
SCREEN AND BLEACH 2
SCREEN AND BLEACH 1
BLEACH PLANT TANK FARM
DIESEL AST
TREX AST
TRAIN SHED
OLD MACHINE SHOP
SOUTH OFFICE BUILDING AND ANNEX
DISTRIBUTION WAREHOUSE

Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)
GW Result (Bottom of Circle)
Center dot identifies a monitoring well location.

Soil Mercury Result (Top Color):
- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater Mercury Result (Bottom Color):
- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:
- Location is a well. Sampled for Mercury in both soil and groundwater. Mercury exceedance in soil, not in groundwater.
- Location is a boring. Sampled for Mercury in soil, not groundwater. No Mercury exceedance in soil.
- Location is a well. Sampled for Mercury in groundwater but not soil. Mercury exceedance in groundwater.

Proposed RI Exploration Locations:
- Exploration to be sampled for Mercury in soil
- Exploration to be sampled for Mercury in groundwater
- Exploration to be sampled for Mercury in both soil and groundwater
- Circle around proposed location denotes a well

N

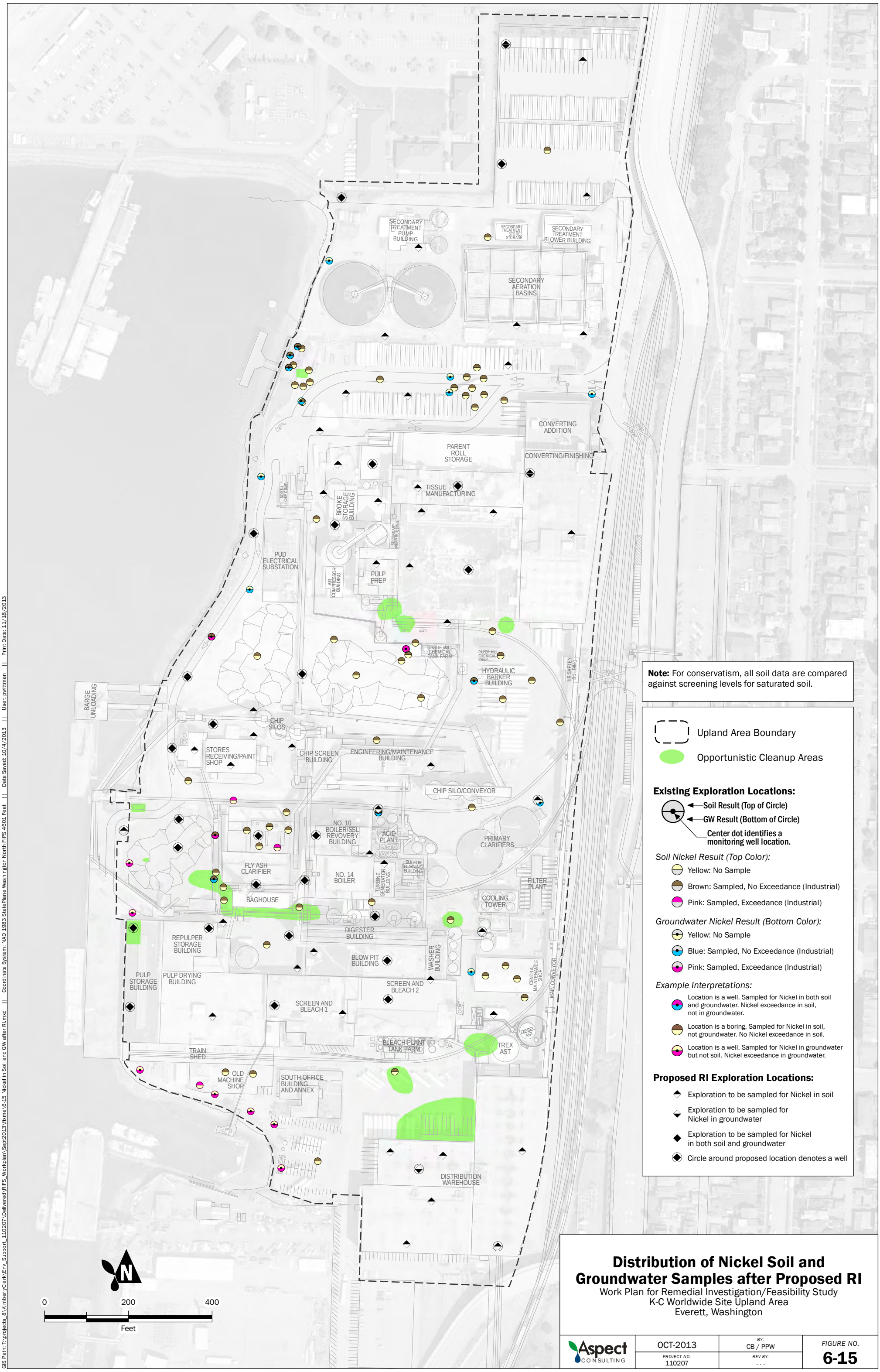
0 200 400
Feet

Distribution of Mercury Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-14
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-14 Mercury in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)
GW Result (Bottom of Circle)
Center dot identifies a monitoring well location.

Soil Nickel Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater Nickel Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for Nickel in both soil and groundwater. Nickel exceedance in soil, not in groundwater.
- Location is a boring. Sampled for Nickel in soil, not groundwater. No Nickel exceedance in soil.
- Location is a well. Sampled for Nickel in groundwater but not soil. Nickel exceedance in groundwater.

Proposed RI Exploration Locations:

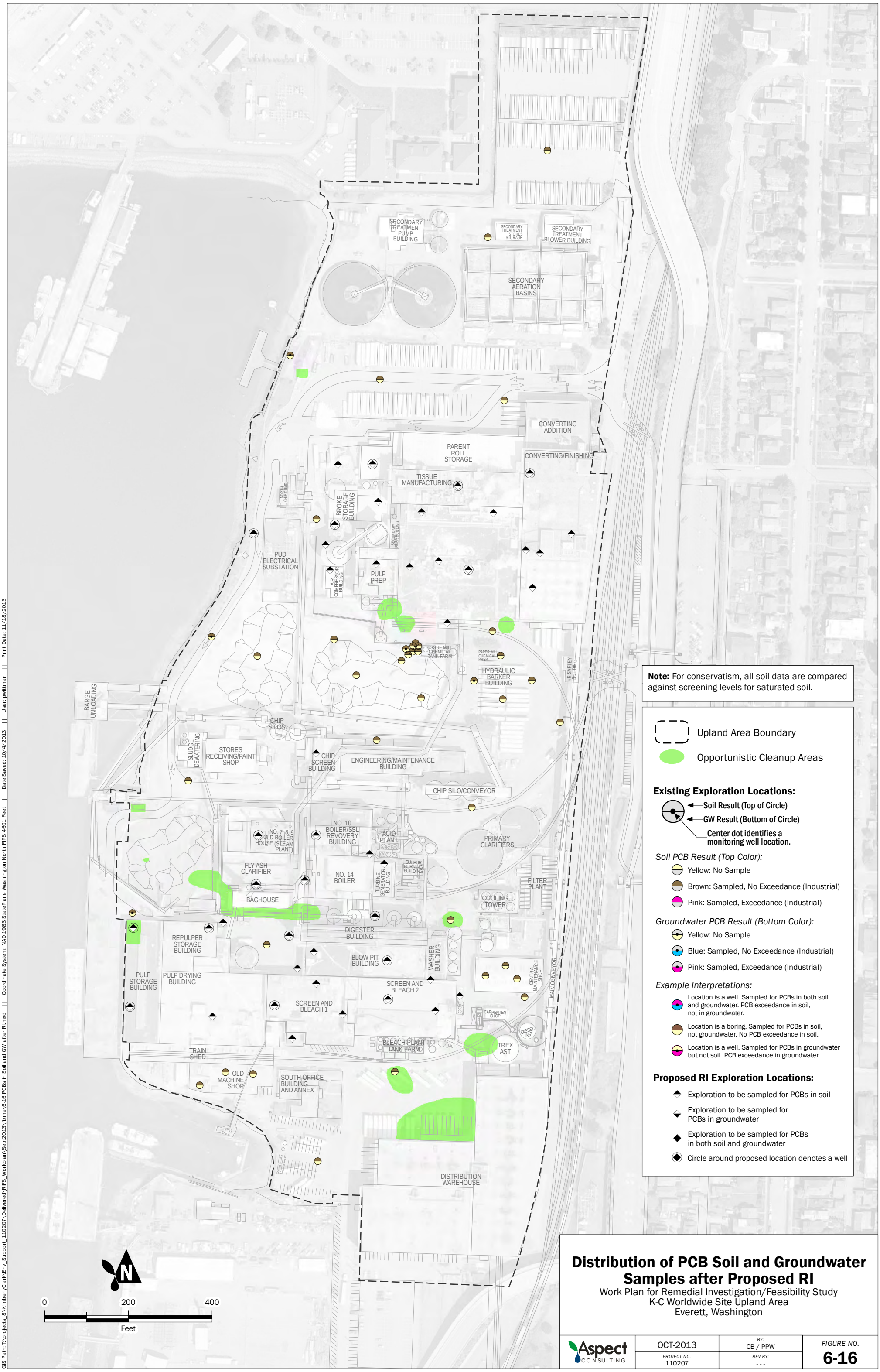
- Exploration to be sampled for Nickel in soil
- Exploration to be sampled for Nickel in groundwater
- Exploration to be sampled for Nickel in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of Nickel Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-15
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-15 Nickel in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013



Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)
GW Result (Bottom of Circle)
Center dot identifies a monitoring well location.

Soil PCB Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater PCB Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for PCBs in both soil and groundwater. PCB exceedance in soil, not in groundwater.
- Location is a boring. Sampled for PCBs in soil, not groundwater. No PCB exceedance in soil.
- Location is a well. Sampled for PCBs in groundwater but not soil. PCB exceedance in groundwater.

Proposed RI Exploration Locations:

- Exploration to be sampled for PCBs in soil
- Exploration to be sampled for PCBs in groundwater
- Exploration to be sampled for PCBs in both soil and groundwater
- Circle around proposed location denotes a well

Distribution of PCB Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-16
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-16 PCBs in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013

SECONDARY TREATMENT PUMP BUILDING
SECONDARY TREATMENT STORES STORAGE
SECONDARY TREATMENT BLOWER BUILDING
SECONDARY AERATION BASINS
CONVERTING ADDITION
PARENT ROLL STORAGE
CHEMICAL STORAGE BUILDING
TISSUE MANUFACTURING
BROKE STORAGE BUILDING
NORTH CHIP DOME
SECONDARY FEED BUILDING
CONVERTING/FINISHING
PUD ELECTRICAL SUBSTATION
AIR COMPRESSOR BUILDING
PULP PREP
TISSUE MILL CHEMICAL TANK FARM
PAPER MILL CHEMICAL PREP
HR SAFETY BUILDING
HYDRAULIC BARKER BUILDING
BARGE UNLOADING
CHIP SILOS
SLUDGE DEWATERING
STORES RECEIVING/PAINT SHOP
CHIP SCREEN BUILDING
ENGINEERING/MAINTENANCE BUILDING
CHIP SILO/CONVEYOR
NO. 7, 8, 9 OLD BOILER HOUSE (STEAM PLANT)
NO. 10 BOILER/SSL REVOVERY BUILDING
ACID PLANT
PRIMARY CLARIFIERS
FLY ASH CLARIFIER
NO. 14 BOILER
SULFUR BURNING BUILDING
TURBINE GENERATOR BUILDING
FILTER PLANT
BAGHOUSE
COOLING TOWER
DIGESTER BUILDING
REPULPER STORAGE BUILDING
BLOW PIT BUILDING
WASHER BUILDING
CENTRAL MAINTENANCE SHOP
MAIN CONVEYOR
PULP STORAGE BUILDING
SCREEN AND BLEACH 2
PULP DRYING BUILDING
SCREEN AND BLEACH 1
CARPENTER SHOP
DIESEL AST
BLEACH PLANT TANK FARM
TREX AST
TRAIN SHED
OLD MACHINE SHOP
SOUTH OFFICE BUILDING AND ANNEX
DISTRIBUTION WAREHOUSE

Note: For conservatism, all soil data are compared against screening levels for saturated soil.

Upland Area Boundary

Opportunistic Cleanup Areas

Existing Exploration Locations:

Soil Result (Top of Circle)
GW Result (Bottom of Circle)
Center dot identifies a monitoring well location.

Soil Dioxins/Furans Result (Top Color):

- Yellow: No Sample
- Brown: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Groundwater Dioxins/Furans Result (Bottom Color):

- Yellow: No Sample
- Blue: Sampled, No Exceedance (Industrial)
- Pink: Sampled, Exceedance (Industrial)

Example Interpretations:

- Location is a well. Sampled for Dioxins/Furans in both soil and groundwater. Dioxins/Furans exceedance in soil, not in groundwater.
- Location is a boring. Sampled for Dioxins/Furans in soil, not groundwater. No Dioxins/Furans exceedance in soil.
- Location is a well. Sampled for Dioxins/Furans in groundwater but not soil. Dioxins/Furans exceedance in groundwater.

Proposed RI Exploration Locations:

- Exploration to be sampled for Dioxins/Furans in soil
- Exploration to be sampled for Dioxins/Furans in groundwater
- Exploration to be sampled for Dioxins/Furans in both soil and groundwater
- Circle around proposed location denotes a well

N

0 200 400

Feet

Distribution of Dioxin/Furan Soil and Groundwater Samples after Proposed RI

Work Plan for Remedial Investigation/Feasibility Study
K-C Worldwide Site Upland Area
Everett, Washington

Aspect CONSULTING	OCT-2013	BY: CB / PPW	FIGURE NO. 6-17
	PROJECT NO. 110207	REV BY: ---	

GIS Path: T:\projects_8\KimberlyClark\Env_Support_110207\Delivered\RIFS_Workplan\Sept2013\tixme\6-17 Dioxin-Furan in Soil and GW after RI.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 10/4/2013 || User: pwittman || Print Date: 11/18/2013

7 Feasibility Study Approach

The purpose of the FS is to develop and evaluate cleanup action alternatives and to support the selection of a cleanup alternative. This section presents the elements that will be included in the FS Report for the Upland Area in accordance with the guidance and provisions specified in MTCA.

The objective of the FS process is to make an informed risk-based selection of the cleanup action alternative that is most appropriate for the Upland Area. The FS process includes identifying applicable or relevant and appropriate requirements (ARARs) for cleanup, establishing cleanup action objectives and cleanup standards that are protective of human health and the environment, identifying extents of contaminated media where remedial action is needed, identifying and evaluating potentially applicable cleanup technologies for those media, and incorporating the retained cleanup technologies into cleanup action alternatives to address all aspects of Upland Area contamination. The cleanup action alternatives are then evaluated against specific MTCA criteria pertaining to protectiveness, effectiveness, permanence, implementability, cost, and consideration of public concerns to facilitate selection of a preferred remedy. Each of the components involves consideration of site-specific data and the planned future land use. The following sections describe the general tasks that will be performed as part of the FS.

7.1 Establish Cleanup Standards

Cleanup standards will be established in the FS to evaluate the sufficiency of cleanup action alternatives to meet the remedial action objectives. Cleanup standards include cleanup levels, points of compliance and remediation levels. In accordance with WAC 173-340-350(9), cleanup levels will be established for hazardous substances in each medium and for each pathway where a release has occurred using WAC 173-340-700 through -760. Remediation levels may be developed, if appropriate, in accordance with WAC 173-340-355. MTCA requires evaluation of cleanup action alternatives that meet the cleanup levels at both standard and conditional points of compliance; the points of compliance will be established in the FS in accordance with WAC 173-340-320 through -360.

7.2 Identify Applicable or Relevant and Appropriate Requirements

MTCA requires that all cleanup actions comply with applicable local, state, and federal laws, which are defined as “legally applicable requirements and those requirements that the department determines…are relevant and appropriate requirements”. The applicable local, state, and federal laws will be identified for the Upland Area in the FS Report. The FS Report will include an evaluation of the compliance requirements of the State Environmental Policy Act (SEPA) and other potentially applicable laws and regulations. Ecology will make the final determination as to whether the requirements have been appropriately identified and are legally applicable or relevant and appropriate.

When performing remedial actions within the Upland Area under the Order, K-C will be exempt from the procedural requirements of Chapters 70.94 (Washington Clean Air Act), 70.95 (Solid Waste Management Act), 70.105 (Hazardous Waste Management Act), 90.48 (Water Pollution Control), and 90.58 (Shoreline Management Act) Revised Code of Washington (RCW), and of laws requiring or authorizing local government permits or approvals; however, K-C must still comply with the substantive requirements of such permits or approvals.

The starting point for Applicable or Relevant and Appropriate Requirements (ARARs) is Ecology's Model Toxics Control Act (MTCA) regulations (Chapter 173-340 WAC) that address implementation of a cleanup and define cleanup standards under the MTCA statute (Chapter 173.105D RCW). While ARARs will be defined during the FS specific to cleanup alternatives, other potential ARARs include the following:

1. State Water Pollution Control Act (Chapter 90.48 RCW);
2. Water Resources Act (Chapter 90.54 RCW);
3. Applicable surface water quality criteria published in the water quality standards for surface waters of the State of Washington (Chapter 173-201A WAC);
4. Applicable surface water quality criteria published under Section 304 of the Clean Water Act;
5. Applicable surface water quality criteria published under National Toxics Rule (40 C.F.R. Part 131);
6. Washington State Hazardous Waste Management Act (Chapter 70.105 RCW);
7. State Dangerous Waste Regulations (Chapter 173-303 WAC);
8. Solid Waste Management-Reduction and Recycling (Chapter 70.95 RCW);
9. Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 RCW);
10. Washington Clean Air Act (Chapter 70.94 RCW);
11. Puget Sound Clean Air Agency Regulations (http://www.pscleanair.org);
12. Occupational Safety and Health Act (OSHA), 29 CFR Subpart 1910.120;
13. Washington Industrial Safety and Health Act (WISHA);
14. Shoreline Management Act (Chapter 90.58 RCW);
15. Archaeological and Cultural Resources Act (Chapter 43.53 RCW);
16. Archaeological and Historic Preservation Act (Chapter 43.334 RCW), and
17. State Environmental Policy Act (SEPA; Chapter 43.21C RCW, Chapter 197-11 WAC, and Chapter WAC 173-802).

7.3 Delineate Media Requiring Remedial Action

The results of the RI will be relied upon to identify and delineate the areas and/or volumes of affected media to be included in the evaluation of cleanup action alternatives.

7.4 Develop Remedial Action Objectives

Remedial action objectives (RAOs) will be presented in the FS report as the basis for the evaluation of cleanup action alternatives. The RAOs will identify the goals to be achieved by a cleanup alternative to meet cleanup standards and provide adequate protection of human health and the environment. The RAOs will be action-specific, to achieve environmental protection independent of a chemical criterion, and/or media-specific, to achieve a cleanup level.

7.5 Develop and Screen Cleanup Action Alternatives

This section describes the FS process by which applicable cleanup action alternatives will be developed for the Upland Area. The objective of the FS process is to develop a range of technically feasible cleanup action alternatives for detailed analysis. MTCA allows for an initial screening of cleanup action alternatives, when appropriate, to reduce the number of alternatives carried forward to the detailed analysis. MTCA stipulates that cleanup action alternatives may be eliminated from further consideration in the FS if they consist of one or both of the following:

- Alternatives that do not meet the minimum requirements specified in WAC 173-340-360, including those alternatives for which costs are clearly disproportionate; or
- Alternatives or components that are not technically possible.

Aspect will conduct an initial screening of remediation technologies to determine which meet the minimum requirements of MTCA for cleanup, and are technically possible. A cleanup action alternative may consist of a combination of remediation technologies or regulatory mechanisms and will be identified for further evaluation based on the initial screening. The cleanup action alternatives developed for further evaluation will protect human health and the environment by eliminating, reducing, or otherwise controlling risks posed through each exposure pathway and migration route, as required by WAC 173-340-350.

7.6 Conduct Detailed Analysis of Cleanup Action Alternatives

The primary criteria for evaluating the cleanup action alternatives are the minimum requirements established by MTCA. As defined in WAC 173-340-360, the selected cleanup action must meet the minimum “threshold” requirements as follows:

- Protect human health and the environment;
- Comply with the cleanup standards (WAC 700 through 173-340-760);
- Comply with applicable local, state, and federal laws; and

- Provide for compliance monitoring (WAC 173-340-410, and 720 through 173-340-760).

Additionally, the selected cleanup action will:

- Use permanent solutions to the maximum extent practicable (as defined in WAC 173-340-360(3));
- Provide for a reasonable restoration time frame (as defined in WAC 173-340-360(4)); and
- Consider public concerns (WAC 173-340-600).

7.7 Disproportionate Cost Analysis

MTCA defines a permanent solution as one in which cleanup standards can be met without further action. To determine whether a cleanup action alternative is permanent to the "maximum extent practicable", MTCA requires that a disproportionate cost analysis (DCA) be conducted (WAC 173-340-360(3)(b)). A comparative analysis of the cleanup action alternatives is conducted using the following evaluation criteria in the DCA:

- *Protectiveness*: Overall protectiveness of human health and the environment;
- *Permanence*: The degree to which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances;
- *Cost*: The cost to implement the alternative;
- *Effectiveness over the long term*: The degree of certainty, the reliability of the alternative, the magnitude of residual risk, and the effectiveness of controls;
- *Management of short-term risks*: The risk to human health and the environment associated with implementation of the cleanup action alternative;
- *Technical and administrative implementability*: Technical feasibility of the cleanup action alternative and administrative and regulatory requirements; and
- *Consideration of public concerns*: Whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns.

The evaluation will provide the basis for selection of a preferred cleanup action alternative. In accordance with MTCA, preference will be given to the cleanup action alternative that uses permanent solutions to the maximum extent practicable. If the preferred cleanup action alternative is clearly the most permanent, a DCA may not be conducted.

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Limitations

Work for this project was performed for Kimberly-Clark Worldwide, Inc. (Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

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APPENDIX A

Sampling and Analysis Plan

Appendix A Contents

List of Tables

A1 Introduction

This Sampling and Analysis Plan (SAP) has been prepared for the Kimberly-Clark Worldwide, Inc. (K-C) Site Upland Area (Upland Area) as Appendix A to the Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) to meet the requirements of Agreed Order No. DE 9476 (Agreed Order) issued by the Washington State Department of Ecology (Ecology) and entered into by Kimberly-Clark Worldwide, Inc.

The purpose of this SAP is to ensure that field sample collection, handling, and laboratory analysis conducted during the Upland Area RI/FS will generate data to meet project-specific data quality objectives (DQOs) in accordance with the Model Toxics Control Act (MTCA) requirements (WAC 173-340-350). This SAP is comprised of two major components: a Field Sampling Plan (FSP) defining field protocols and a Quality Assurance Project Plan (QAPP) defining analytical protocols. It is the responsibility of the Aspect Consulting, LLC (Aspect) personnel and subcontracted analytical laboratory personnel performing the RI/FS sampling and analysis activities to adhere to the requirements of the FSP and QAPP.

The Field Sampling Plan (Section A2) and Quality Assurance Project Plan (Section A3) are presented below.

A2 Field Sampling Plan

A2.1 Soil Borings and Soil Sampling

Soil sampling will be conducted during the RI to assess the nature and extent of soil contamination in the Upland Area. Soil samples will be obtained using direct-push and/or hollow-stem auger drilling methods. The specific soil sample locations, depths, and chemical analyses are provided in Section 6 of the Work Plan, with Tables 6-1 and 6-2 tabulating the specific chemical analyses for each soil and groundwater samples, respectively, to be collected. The following subsections detail the procedures for soil sample collection, handling, identification, and sample quality assurance/quality control (QA/QC).

Aspect will subcontract with a Washington-licensed resource protection well driller to complete soil borings in accordance with requirements of Chapter 173-160 WAC. Soil borings may be advanced using either direct push (i.e., Geoprobe) or, where geotechnical data (blow counts) are to be obtained in addition to environmental samples, hollow-stem auger.

In the event that hollow-stem auger is employed during the RI, soil borings advanced using a direct-push rig and will be sampled on a continuous basis. Each boring will be advanced to collect samples at depth intervals specified in the Work Plan or as determined by field screening. The direct-push drilling method provides continuous cores of soil, depending on soil recovery, returned within disposable 1.5-inch-diameter plastic

liners (4-foot or 5-foot lengths). The liners are sliced longitudinally and opened to access the soil core.

In the event that hollow-stem auger is employed during the RI, soil samples advanced using hollow-stem auger will be collected at 2.5-foot depth intervals to the total depth of exploration using a 2-inch-outside-diameter split-spoon sample tube driven into the ground at the bottom of a borehole by blows from a 140-pound slide hammer falling through a distance of 30 inches. Additional samples can also be collected for environmental soil sampling purposes. The sample tube is driven 18 inches into the ground and the number of blows needed for the tube to penetrate each 6-inch increment is recorded. The sum of the number of blows required for the second plus third 6-inch increments of penetration is termed the "standard penetration resistance" or the "N-value". If 50 blows are insufficient to advance it through a 6-inch interval, the penetration after 50 blows is recorded. The split spoon sampler is decontaminated after each sample is collected.

A2.1.1 Soil Sample Collection and Handling Procedures

Irrespective of drilling method, a geologist from Aspect will oversee the drilling activities and preparation of a geologic log for each of the explorations completed. The field representative will visually classify the soils in accordance with ASTM Method D 2488 and record soil descriptions, field screening results, and other relevant details (e.g., staining, debris, odors, etc.) on the boring log form. If samples are collected for chemical analysis, the sample ID and depth will also be recorded on the log.

In addition to soil classification, the field representative will screen the soil from the core immediately after opening using a photoionization detector (PID) to monitor for the presence of volatile organic compounds (VOCs). Samples that generate a reading on the PID clearly above background levels will be submitted for TPH-Gx and VOC 8260 analysis. The PID will be calibrated daily in the field using the manufacturer's calibration standard (100 ppm isobutylene gas). A calibration test, referred to as a "bump test", will be performed as necessary in the field using the calibration gas to check that the PID remains properly calibrated throughout the day.

In areas of known or suspected petroleum contamination, soil samples will also be field-screened for presence of petroleum using a sheen test: placing a small aliquot of soil (about a tablespoon) into a cup containing water, gently shaking, and watching for presence of petroleum sheen. In areas of known or suspected petroleum contamination, soil samples can also be field screened for the presence of petroleum using a dye test: placing a small aliquot of soil into a plastic cup containing water, gently shaking, adding a hydrophobic dye such as Sudan IV, and watching for colorimetric change. Care will be taken to differentiate sheen created by petroleum (iridescent swirl of colors, does coalesce after being disturbed) versus other organic matter (angular "waxy" sheets", do not coalesce after being disturbed), and recording the information appropriately. The perceived magnitude of petroleum sheen (slight, moderate, heavy) will be recorded with corresponding odors if observed.

All soil samples to be submitted for VOC analyses will be collected in accordance with U.S. Environmental Protection Agency (EPA) Method 5035A. The soil aliquot for VOC analysis will be collected from the undisturbed soil sample core using a laboratory-

supplied modified disposable plastic syringe as required by the EPA Method 5035A, and placed in pre-weighed laboratory supplied vials.

For all other analyses, the soil samples will be removed from the sampler using a stainless steel spoon and placed in a stainless steel bowl for homogenization with the stainless steel spoon. Gravel-sized material greater than approximately 0.5 inch will be removed from the sample during mixing. A representative aliquot of the homogenized soil will be placed into certified-clean jars supplied by the analytical laboratory.

QC soil samples (e.g., field duplicates, rinsate blanks, and trip blanks) will be collected at the respective frequencies prescribed in Section A3.5 of the QAPP.

Each soil boring not completed as a monitoring well will be decommissioned with hydrated granular bentonite in accordance with requirements of Chapter 173-160 WAC.

A.2.1.2 Soil Sample Identification

Each soil sample collected for chemical analysis will be assigned a unique sample identification number including the boring number and the depth from which the sample was collected. For example, the soil sample collected from boring B-20 at a depth of 7 to 8 feet below ground surface (bgs) would be identified as B-20-7-8.

A2.2 Sampling of Recycled Demolition Debris

Demolition of the pulp/paper mill structures involved generation of a very large quantity of concrete and brick, which is being recycled and then graded across the surface of much of the Upland Area. Preliminary sampling and analysis was conducted when the material was in stockpiles during the demolition project. Following placement and final grading, sampling and analysis will be conducted to assess the nature and extent of contamination in the surficial veneer of recycled material for purposes of the RI.

As described in Section 6.16 of the Work Plan, the recycled material will be sampled on a 200-foot grid outside the 200-foot shoreline buffer and at 100-foot grid inside of the shoreline buffer. For each grid block, a 5-point composite sample of the upper foot of material will be collected. Within the 200-foot grid blocks, the five subsamples will be located at the approximate grid block center point and at four points 50 feet from the center - in the north, east, south, and west directions. Within the 100-foot grid blocks, the five subsamples will be located at the approximate grid block center point and at four points 25 feet from the center - in the north, east, south, and west directions.

Samples of recycled material will be collected using a decontaminated shovel; however, if the material is too compacted to allow shovel penetration, a backhoe can be used to excavate a shallow hole, with material sampled from the sidewalls. A representative aliquot (approximately 16-ounce volume) of material will be collected at each subsample location and placed in a stainless steel bowl for homogenization with a stainless steel spoon. A representative aliquot of the homogenized composited material will be placed into certified-clean containers supplied by the analytical laboratory. Given the wide range of particle sizes comprising the material, the laboratory will crush the sample to allow its analysis.

A geologist from Aspect will log the composite material sampled from each grid block, visually classifying it in accordance with ASTM Method D 2488 and recording material descriptions, field screening results, and other relevant details (e.g., staining, debris, odors, etc.). In addition to soil classification, the field representative will screen each sample using a photoionization detector (PID) to monitor for the presence of VOCs.

QC soil samples (e.g., field duplicates, rinsate blanks, and trip blanks) will be collected at the respective frequencies prescribed in Section A3.5 of the QAPP.

Each sample of recycled material collected for chemical analysis will be assigned a unique sample identification number including the exploration number and the depth from which the sample was collected.

A2.3 Monitoring Well Installation and Development

A2.3.1 Monitoring Well Installation

Monitoring wells will be constructed by a state-licensed, resource protection well driller and in accordance with Chapter 173-160 WAC. An Aspect field geologist will oversee and document installation of each monitoring well, including completion of an As-Built Well Completion Diagram.

New monitoring wells will be constructed with 1-inch or 2-inch-diameter threaded Schedule 40 PVC slotted screen and blank casing. Well screens will be 0.010-inch (10 slot) slotted screen, either 5 feet or 10 feet in length depending on field conditions, unless light non-aqueous phase liquid (LNAPL), may be present. If light non-aqueous phase liquid petroleum may be present, a 10-foot screen will be placed to straddle the water table observed at the time of drilling, and will span the expected depth range of water table fluctuation (i.e., water table fluctuation is expected to be less than 3 feet at shoreline wells, and less than 0.5 feet at 200 feet or farther inland of the shoreline). An artificial filter pack consisting of 10/20 silica sand will be placed around the well screen, and an annular seal consisting of bentonite chips will be placed above the filter pack. A concrete surface seal will be set at grade for each new monitoring well. The finished monitoring wells will be protected with a steel flush-mount monument, or steel above-ground monument, embedded in the concrete surface seal.

A2.3.2 Monitoring Well Development

Following installation, each new monitoring well will be developed to remove fine-grained material from inside the well casing and filter pack to the extent practical, and to improve hydraulic communication between the well screen and the surrounding water-bearing formation. Depth to water will be measured at start and end of development. The new 1-inch-diameter wells will be developed using a peristaltic pump and downhole ¼-inch tubing surged gently along the length of the well screen; a downhole submersible well development pump can be used for new 2-inch-diameter wells. Each well will be developed until visual turbidity is reduced to minimal levels (below 5 NTU if practical) or until a maximum of 15 casing volumes of water has been removed.

A2.4 Groundwater Sampling

Groundwater samples will be collected and handled in accordance with the procedures described below:

- Groundwater samples from wells located within 200 feet of the East Waterway shoreline will be sampled within 2 hours before or 3 hours after a lower low tide. However, the designated shoreline wells will be sampled within 1 hour before or after lower low tide.
- The locking well cap will be removed and the depth-to-groundwater will be measured from the surveyed location to the nearest 0.01 foot using an electronic water level measuring device. The depth to the bottom of the monitoring well will also be measured to evaluate siltation of the monitoring well. The water level indicator will be decontaminated between wells.
- Each monitoring well will be purged at a low-flow rate less than 0.5 liter per minute (Puls and Barcelona, 1996) using a peristaltic pump and dedicated tubing (polyethylene tubing with a short length of silicon tubing through the pump head). The tubing intake will be placed just below the center of the saturated section of well screen. During purging, field parameters (temperature, pH, specific electrical conductance, dissolved oxygen, and oxidation-reduction potential [ORP]) will be monitored using a YSI meter and flow-through cell, or equivalent. These field parameters will be recorded at 2- to 4-minute intervals throughout well purging until they stabilize. Stabilization is defined as three successive readings where the parameter values vary by less than 10% (or 0.5 mg/L dissolved oxygen if the readings are below 1 mg/L). However, no more than three well casing volumes will be purged prior to groundwater sample collection. Three turbidity measurements will also be made before collecting the sample (Hach 2100Q turbidimeter).
- Samples with a field-measured specific electrical conductance greater than 1,000 µS/cm or turbidity greater than 25 nephelometric turbidity units (NTU) will be denoted as such on the chain-of-custody (COC) form, so that the laboratory can employ appropriate sample preparation techniques to avoid analytical interferences for specific analyses (refer to Sections A3.3.2 and A3.3.3).
- If the monitoring well is completely dewatered during purging, samples will be collected when sufficient recharge has occurred to allow filling of all sample containers.
- Once purging is complete, the groundwater samples will be collected using the same low-flow rate directly into laboratory-supplied sample containers. Samples for dissolved metals analyses will be filtered using an in-line 0.45 µm filter; at least 0.5 liter of water will be purged through the filter prior to sample collection.
- QC groundwater samples (e.g., field duplicates and trip blanks) will be collected at the respective frequencies prescribed in Section A3.5.1.
- Following sampling, the wells cap and monument cap will be secured. Each well's dedicated tubing will be retained in a labeled Ziploc bag for subsequent

sampling events. Any damaged or defective well caps or monuments will be noted and scheduled for replacement, if necessary.

A2.4.1 Groundwater Sample Identification

Each groundwater sample will be assigned a unique sample identification number that includes the well number and the 8-digit date on which the sample was collected. For example, a groundwater sample collected from monitoring well MW-10 on May 30, 2012, would be identified as MW-10-053012.

A2.5 Sub-Slab Vapor Sampling

If conducted, samples of sub-slab vapor within the void space beneath the Distribution Warehouse floor slab will be 8-hour, time-integrated samples, collected using 6-liter (L) laboratory-certificated evacuated Summa canisters with air drawn from the sub-slab void space via a small hole drilled through the floor slab. A field blank ambient air sample would also be collected from outside the building, using Summa canister, for reference. Each Summa canister will be equipped with a pressure gauge and a calibrated flow controller.

Prior to being shipped to the site, the Summa canisters will be evacuated to a vacuum pressure of 25 to 30 inches of mercury (Hg) by the analytical laboratory. A final vacuum pressure reading greater than ambient (i.e., zero inches Hg) indicates a valid sample; however, each canister will be targeted for a vacuum pressure of approximately 5 inches Hg to provide a margin of safety.

A2.5.1 Sampling Equipment and Materials

The following equipment and materials are required for collection of sub-slab vapor samples from the void space beneath the Distribution Warehouse floor slab:

- Rotary hammer drill.
- 5/8-inch diameter drill bit.
- 1½-inch diameter drill bit.
- ¾-inch diameter bottle brush.
- Wet/dry vacuum.
- Extension cord.
- Generator (if no power is available on site).
- Assembled Vapor Pin™.
- Vapor Pin™ installation/extraction tool.
- Dead blow hammer.
- Vapor Pin™ flush mount cover.
- VOC-free hole patch material (hydraulic cement) and putty knife, if removal of the Vapor Pin™ is planned following sampling.
- Air pump and flow meter for purging vapor point.

- 1-L Tedlar® bags for collection of purged vapors.
- 6-L Summa canisters with appropriate flow controllers, pressure gauges, fittings, and crescent wrench for collection of vapor samples.
- Disposable ¼-inch outer diameter Teflon®-lined tubing for each sample.
- A reliable watch or stop watch and calculator.
- Field notebook, applicable sampling analysis plan, and chain of custody.
- Appropriate personal protective equipment (PPE).

A2.5.2 Sub-Slab Vapor Point Installation

Use the following steps to install Vapor Pins™:

- Check for buried obstacles (utilities, piping, electrical lines, etc.) prior to proceeding.
- Set up wet/dry vacuum to collect drill cuttings.
- Drill a 1½-inch diameter hole at least 1¾-inches into the slab.
- Drill a 5/8-inch diameter hole in the center of the previously drilled hole through the slab and approximately 1-inch into the underlying soil (if present).
- Remove the drill bit, brush the hole with the bottle brush, and remove loose cuttings with the vacuum.
- Place the lower end of the Vapor Pin™ assembly into the drilled hole. Unscrew the threaded coupling from the handle of installation/extraction tool, place the small hole located in the handle of the installation/extraction tool over the Vapor Pin™ to protect the barb fitting/cap, and tap the Vapor Pin™ into place using a dead blow hammer. Make sure the installation/extraction tool is aligned parallel to the Vapor Pin™ to avoid damaging the barb fitting.
- Cover the Vapor Pin™ with a flush mount cover.

A2.5.3 Sample Collection

The methodology for the collection of sub-slab vapor samples is as follows:

- Remove the flush mount cover and Vapor Pin™ cap, connect sample tubing to the barb fitting of the Vapor Pin™ using piece of silicone tubing.
- Purge the vapor port and sample tubing at 100 milliliters per minute (mL/min) or less using the air pump. Capture purged vapor in a 1-L Tedlar® bag for release to the outdoors. Three-to-five tubing volumes should be removed. Use the following equation to calculate volume to be purged:

$$V = \pi \times r^2 \times l$$

Where:

V = Volume of tubing

r = the inner radius of the tubing being used [inches]

l = the length of the tubing being used [inches]

$\pi = 3.14$

(Convert to ml using 1 $inch^3$ = 16.387 ml to determine how long to purge port)

- Connect the sample tubing to the 6-L Summa canister using provided fittings and flow controller.
- Begin sample collection by opening the valve on the Summa canister, immediately record the vacuum on the gauge as the "initial pressure".
- Record sample information in the field book and/or applicable field forms including:
  - Canister number and sample identification,
  - Sample start date and times,
  - Location of sample (distance from walls shown on building floor plan), and
  - Initial and final pressure of canister.
- Check the Summa canister vacuum pressure after 4 hours to verify sampling flow rate appears correct for an 8-hour sample. The final vacuum pressure at the end of sampling should be approximately 5 inches Hg. If the canister has already reached this point, sampling is complete, the canister valve should be closed, and the pressure recorded as the "final pressure" on the sample tag, the field book, and applicable field forms. Sample collection will be considered complete, regardless of final pressure, after the 8-hour sample period has elapsed.
- Record the vacuum pressure of the Summa canister and time at the end of sampling on the sample tag for that canister, in the field book, and/or on the applicable field forms.
- Verify that the Summa canister valve is closed, remove the flow controller, and replace the threaded cap at the top of the canister. Discard sample tubing.
- Replace the Vapor Pin™ cap and flush mount cover.
- Label Summa canisters with the following information: sample identification, date and time sample was collected, the starting and ending canister pressure, the site name, and the company name. Include this information in the field book and transfer pertinent information to the Chain-of-Custody record.
- Pack all Summa canisters in the original shipping containers, sealed with a custody seal, and send to the lab for analysis. The official holding time for Summa canisters is 30 days. However, attempt to get samples to the lab as soon as possible (within 2 days is practical) to allow lab time to conduct re-runs, dilutions, and low-level analyses, as necessary prior to sample expiration.

A2.6 Sample Custody and Field Documentation

A2.6.1 Sample Custody

Upon collection, samples will be placed upright in a cooler. Ice or blue ice will be placed in each cooler to meet sample preservation requirements. Inert cushioning material will be placed in the remaining space of the cooler as needed to limit movement of the sample containers. If the sample coolers are being shipped, not hand carried, to the laboratory, the COC form will be placed in a waterproof bag taped to the inside lid of the cooler for shipment.

After collection, samples will be maintained in Aspect's custody until formally transferred to the analytical laboratory. For purposes of this work, custody of the samples will be defined as follows:

- In plain view of the field representatives;
- Inside a cooler that is in plain view of the field representative; or
- Inside any locked space such as a cooler, locker, car, or truck to which the field representative has the only immediately available key(s).

A COC record provided by the laboratory will be initiated at the time of sampling for all samples collected. The record will be signed by the field representative and others who subsequently take custody of the sample. Couriers or other professional shipping representatives are not required to sign the COC form; however, shipping receipts will be collected and maintained as a part of custody documentation in project files. A copy of the COC form with appropriate signatures will be kept by Aspect's project manager.

Upon sample receipt, the laboratory will fill out a cooler receipt form to document sample delivery conditions. A designated sample custodian will accept custody of the shipped samples and will verify that the COC form matches the samples received. The laboratory will notify the Aspect project manager, as soon as possible, of any issues noted with the sample shipment or custody.

A2.6.2 Field Documentation

While conducting field work, the field representative will document pertinent observations and events, specific to each activity, on field forms (e.g., boring log form, as-built well completion form, well development form, groundwater sampling form, etc.) and/or in a field notebook, and, when warranted, provide photographic documentation of specific sampling efforts. Field notes will include a description of the field activity, sample descriptions, and associated details such as the date, time, and field conditions.

A2.7 Groundwater Level Monitoring

Depth-to-groundwater measurements will be conducted in monitoring wells using an electric well sounder, graduated to 0.01 foot. Where there is potential for light or dense non-aqueous phase liquid (NAPL), an oil-water interface probe will be used to measure water levels and evaluate the presence of separate-phase product—either floating or at the bottom of the well.

A2.8 Exploration Surveying

Horizontal coordinates for each soil sampling location will be recorded using a hand-held global positioning system (GPS) instrument with real-time differential correction. The horizontal coordinates and elevations of monitoring wells included in the assessment will be surveyed by a licensed surveyor relative to a common horizontal and vertical datum. Monitoring well top-of-casing elevations will be surveyed to the nearest 0.01 foot, and horizontal coordinates to the nearest 0.1 foot, or better. Each well will be surveyed at the marked spot on the top of the PVC well casing from which depth-to-water measurements are collected.

A2.9 Decontamination and Investigative-Derived Waste Management

All non-disposable sampling equipment (stainless steel spoons and bowls) will be decontaminated before collection of each sample. The decontamination sequence consists of a scrub with a non-phosphate (Alconox) solution, followed by tap water (potable) rinse, and finished with thorough spraying with deionized or distilled water. A solvent rinse – methanol or hexane – may be used to remove petroleum product from sampling equipment prior to the decontamination procedure described above.

Investigation-derived waste (IDW) water generated during equipment decontamination and monitoring well development and sampling will be containerized in labeled drums and then discharged to the City of Everett's sanitary sewer under the terms of K-C's Discharge Authorization. If this is not possible, the containerized IDW water will be disposed of appropriately at a permitted off-site disposal facility.

Soil cuttings from borings and disposable personal protective equipment (PPE) will be placed in labeled Department of Transportation (DOT)-approved drums pending the analytical results to determine appropriate disposal. Each drum will be labeled with the following information:

- Non Classified IDW
- Content of the drum (soil, water, PPE) and its source (i.e., the exploration[s] from which the contents came);
- Date IDW was generated; and
- Name and telephone number of the contact person.

The drums of IDW will be temporarily consolidated on-site, profiled (in accordance with applicable waste regulations) based on available analytical data, and disposed of appropriately at a permitted off-site disposal facility. Containers of IDW will be on site less than 90 days from date of generation.

Documentation for off-site disposal of IDW will be maintained in the project file.

A3 Quality Assurance Project Plan

This QAPP identifies QC procedures and criteria required to ensure that data collected during the RI/FS are of known quality and acceptable to achieve project objectives. Specific protocols and criteria are also set forth in this QAPP for data quality evaluation, upon the completion of data collection, to determine the level of completeness and usability of the data. It is the responsibility of the project personnel performing or overseeing the sampling and analysis activities to adhere to the requirements of the FSP and this QAPP.

A3.1 Purpose of the QAPP

As stated in the Washington State Department of Ecology's (Ecology) Guidelines for Preparation of Quality Assurance Project Plans for Environmental Studies (Ecology Publication No. 04-03-030, July 2004), specific goals of this QAPP are as follows:

- Focus project manager and project team to factors affecting data quality during the planning stage of the project;
- Facilitate communication among field, laboratory, and management staff as the project progresses;
- Document the planning, implementation, and assessment procedures for QA/QC activities for the investigation;
- Ensure that the DQOs are achieved; and
- Provide a record of the project to facilitate final report preparation.

The DQOs for the project include both qualitative and quantitative objectives, which define the appropriate type of data, and specify the tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support the environmental assessment. To ensure that the DQOs are achieved, this QAPP details aspects of data collection including analytical methods, QA/QC procedures, and data quality reviews. This QAPP describes both quantitative and qualitative measures of data to ensure that the DQOs are achieved. DQOs dictate data collection rationale, sampling and analysis designs that are presented in the main body of the Work Plan, and sample collection procedures that are presented in the FSP (Section A2 of this Appendix).

A3.2 Project Organization and Responsibilities

The project consultant team involved with data generation includes representatives from Aspect, Pyron Environmental, Inc. (Pyron), and Friedman and Bruya, Inc. (FBI), which is an accredited laboratory with the Ecology. FBI will also subcontract specific chemical analyses to ALS Environmental of Kelso, Washington. Key individuals and their roles on this project are as follows:

Aspect Project Manager – Steve Germiat, Aspect. The project manager is responsible for the successful completion of all aspects of this project, including day-to-day

management, production of reports, liaison with K-C and regulatory agencies, and coordination with the project team members. The Aspect project manager is also responsible for resolution of non-conformance issues, is the lead author on project plans and reports, and will provide regular, up-to-date progress reports and other requested project information to K-C and Ecology.

Field Manager – Carla Brock or Bob Hanford, Aspect. The field manager is responsible for overseeing the field sampling program outlined in this plan, including collecting representative samples and ensuring that they are handled properly prior to transfer of custody to the project laboratory. The field manager will manage procurement of necessary field supplies, assure that monitoring equipment is operational and calibrated in accordance with the specifications provided herein, and act as the Site Health and Safety Officer.

Data Quality Manager – Mingta Lin, Pyron. The data quality manager is responsible for developing data quality objectives, selecting analytical methods, coordinating with the analytical laboratory, overseeing laboratory performance, and approving QA/QC procedures. The data quality manager is also responsible for conducting QA validation of the analytical data reports received from the project laboratory.

Laboratory Project Manager – Mike Erdahl, FBI. The laboratory project manager is responsible for ensuring that all laboratory analytical work for soil and water media complies with project requirements, and acting as a liaison with the project manager, field manager, and data quality manager to fulfill project needs on the analytical laboratory work. This responsibility applies to work the laboratory project manager subcontracts to another laboratory.

A3.3 Analytical Methods and Reporting Limits

Analytical methodologies applied to the analyses of samples collected during the RI/FS are in accordance with the following documents:

- USEPA SW Methods – USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- USEPA Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, Office of Water, U.S. Environmental Protection Agency, August 2002, EPA-821-R-02-019.
- USEPA Method 1688A - Chlorinated Biphenyl Congeners in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS. August 2003.
- Krone, C. A., D. W. Brown, D. G. Burrows, R. G. Bogar, S.-L. Chan, and U. Varanasi. A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound. Environ. Res. 27:1-18. March 1989.USEPA Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983 and updates.
- Standard Methods for the Examination of Water and Wastewater, American Public Health Association, 20th Edition, 1995.

- Ecology Analytical Methods for Petroleum Hydrocarbons. Publication No. ECY 97-602. June 1997.

Table A-1 lists the laboratory analytical methods for soil and groundwater analyses to be performed during the RI/FS, along with samples containers, preservation, and analytical holding times for each analysis.

A3.3.1 Method Detection Limit and Method Reporting Limit

The method detection limit (MDL) is the minimum concentration of a compound that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero. MDLs are established by the laboratory using prepared samples, not samples of environmental media.

Estimated detection limit (EDL), as defined in SW846 Method 8290 (dioxins/furans), is the minimum concentration a compound can be reported as detected using the high resolution gas chromatography (HRGC)/high resolution mass spectrometry (HRMS) methodology.

EDL is a sample- and analyte-specific detection limit that is based on the signal-to-noise ratio present in the sample for each analyte at the time of analysis. EDL is defined as follows:

$$EDL = \frac{2.5 \times H_x \times Q_{is}}{H_{is} \times W \times \overline{RF}_n}$$

where:

EDL = estimated detection limit for homologous 2,3,7,8-substituted PCDDs/PCDFs.

H*x* = sum of the height of the noise level for each quantitation ion for the unlabeled target compound.

H*is* = sum of the height of the noise level for each quantitation ion for the labeled internal standard.

W = weight of the sample, in gram.

RF = calculated mean relative response factor for the analyte.

Q*is* = quantity of the internal standard added to the sample before extraction, in pictogram.

The method reporting limit (RL) is defined as the lowest concentration at which a chemical can be accurately and reproducibly quantified, within specified limits of precision and accuracy, for a given environmental sample. The RL can vary from sample to sample depending on sample size, sample dilution, matrix interferences, moisture content, and other sample-specific conditions. As a minimum requirement for organic analyses, the RL should be equivalent to or greater than the concentration of the lowest calibration standard in the initial calibration curve. The expected MDLs (EDLs for

dioxins/furans and PCB congeners) and RLs are summarized in Table A-3, A-4, and A-5 for water and soil samples, respectively.

A3.3.2 Sample Preparation for Metals Analysis of Brackish Groundwater Samples

Saline water samples may create analytical interferences for trace metals analyses due to the high levels of dissolved solids in the samples. To achieve optimal detection limits and minimize accuracy bias, a combination of additional sample preparation/analysis techniques, including reductive precipitation (EPA Method 1640 & ALS Laboratory SOP MET RPMS *Rev. 7*), hydrided atomic absorption spectrometry (SW846 Method 7742A), and/or direct dilution may be applied in cases of brackish water samples. Saline groundwater samples are indicated by elevated specific electrical conductance of the samples. To assist the laboratory in identifying saline groundwater samples, the field-measured specific conductance for each groundwater sample with conductance greater than 1,000 µS/cm will be recorded on the corresponding COC document.

A3.3.3 Sample Preparation for Analyses of Hydrophobic Constituents in Turbid Groundwater Samples

Turbid water samples may create high bias not representative of groundwater quality for analyses of hydrophobic compounds (e.g., polycyclic aromatic hydrocarbons [PAHs], polychlorinated biphenyls [PCBs], dioxins/furans). To limit potential for turbidity bias, groundwater samples with field-measured turbidities greater than 25 NTU will be centrifuged in the laboratory prior to analysis for PAHs. Any groundwater samples to be analyzed for PCBs or dioxins/furans will be centrifuged prior to analysis. Groundwater samples for VOC or TPH-Gx analysis will not be centrifuged.

A3.4 Data Quality Objectives

DQOs, including the Measurement Quality Indicators (MQIs)—precision, accuracy, representativeness, comparability, completeness, and sensitivity (namely PARCCS parameters) —and sample-specific RLs are dictated by the data quality objectives, project requirements, and intended uses of the data. For this project, the analytical data must be of sufficient technical quality to determine whether contaminants are present and, if present, whether their concentrations are greater than or less than applicable screening criteria based on protection of human health and the environment.

The quality of data generated through this RI will be assessed against the MQIs set forth in this QAPP. Specific QC parameters associated with each of the MQIs are summarized in Table A-2. Specific MQI goals and evaluation criteria (i.e., MDLs, RLs, percent recovery (%R) for accuracy measurements, relative percent difference (RPD) for precision measurements, are defined in Table A-3 and A-4. Definitions of these parameters and the applicable QC procedures are presented below.

A3.4.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared with their average values. Analytical precision is measured through matrix

spike/matrix spike duplicate (MS/MSD) samples and laboratory control samples/laboratory control sample duplicate (LCS/LCSD) for organic analysis and through laboratory duplicate samples for inorganic analyses.

Analytical precision is quantitatively expressed as the relative percent difference (RPD) between the LCS/LCSD, MS/MSD, or laboratory duplicate pairs and is calculated with the following formula:

$$RPD\ (\%) = 100 \times \frac{|S - D|}{(S + D)/2}$$

where:
S = analyte concentration in sample
D = analyte concentration in duplicate sample

Analytical precision measurements will be carried out at a minimum frequency of 1 per 20 samples for each matrix sampled, or one per laboratory analysis group. Laboratory precision will be evaluated against laboratory quantitative RPD performance criteria as defined in Tables A-3, A-4, and A-5 for specific analytical methods and sample matrices. . If the control criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. The RPD will be evaluated during data review and validation. The data reviewer will note deviations from the specified limits and will comment on the effect of the deviations on reported data.

A3.4.2 Accuracy

Accuracy measures the closeness of the measured value to the true value. The accuracy of chemical test results is assessed by "spiking" samples with known standards (surrogates, blank spikes, or matrix spikes) and establishing the average recovery. Accuracy is quantified as the %R. The closer the %R is to 100%, the more accurate the data.

Surrogate recovery will be calculated as follows:

$$\text{Recovery}\ (\%) = \frac{MC}{SC} \times 100$$

where:

SC = spiked concentration
MC = measured concentration

MS percent recovery will be calculated as follows:

$$\text{Recovery}\ (\%) = \frac{MC - USC}{SC} \times 100$$

where:

SC = spiked concentration

MC = measured concentration
USC = unspiked sample concentration

Accuracy measurements on MS samples will be carried out at a minimum frequency of 1 in 20 samples per matrix analyzed. Blank spikes will also be analyzed at a minimum frequency of 1 in 20 samples (not including QC samples) per matrix analyzed. Surrogate recoveries for organic compounds will be determined for each sample analyzed for respective compounds. Laboratory accuracy will be evaluated against the performance criteria defined in Table A-3, A-4, and A-5. . If the control criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. Percent recoveries will be evaluated during data review and validation, and the data reviewer will comment on the effect of the deviations on the reported data.

A3.4.3 Representativeness

Representativeness measures how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the matrix sampled. The FSP sampling techniques and sample handling protocols (e.g., homogenizing, storage, preservation, and use of duplicates and blanks) have been developed to ensure representative samples. Only representative data will be used in the RI/FS. Sampling locations for RI/FS activities are described in Section 6 of the RI/FS Work Plan. The RI/FS field sampling procedures are described in the FSP (Section A2) of this SAP.

The representativeness of a data point is determined by assessing the integrity of the sample upon receipt at the laboratory (e.g., consistency of sample ID and collection date/time between container labels vs. COC forms, breakage/leakage, cooler temperature, preservation, headspace for VOA containers, etc.); compliance of method required sample preparation and analysis holding times; the conditions of blanks (trip blank, rinsate blank, field blank, method/preparation blank, and calibration blank) associated with the sample; and the overall consistency of the results within a field duplicate pair.

A3.4.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. This goal will be achieved through the use of standard techniques to collect samples, USEPA-approved standard methods to analyze samples, and consistent units to report analytical results. Data comparability also depends on data quality. Data of unknown quality cannot be compared.

A3.4.5 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid. Results will be considered valid if the precision, accuracy, and representativeness objectives are met and if RLs are sufficient for the intended uses of the data. Completeness is calculated as follows:

$$Completeness\ (\%) = \frac{V}{P} \times 100$$

where:

V = number of valid measurements
P = number of measurements taken

Valid and invalid data (i.e., data qualified with the R flag [rejected]) will be identified during data validation. The target completeness goal for this project is 95%.

A3.4.6 Sensitivity

Sensitivity depicts the level of ability an analytical system (i.e., sample preparation and instrumental analysis) of detecting a target component in a given sample matrix with a defined level of confidence. Factors affecting the sensitivity of an analytical system include: analytical system background (e.g., laboratory artifact or method blank contamination), sample matrix (e.g., mass spectrometry ion ratio change, co-elution of peaks, or baseline elevation), and instrument instability.

A3.5 Quality Control Procedures

Field and laboratory QC procedures are outlined below.

A3.5.1 Field Quality Control

Beyond use of standard sampling protocols defined in the FSP, field QC procedures include maintaining the field instrumentation used. Field instruments (e.g., PID for evaluating presence of VOCs in soil samples, and the YSI meter for measuring field parameters during groundwater sampling) are maintained and calibrated regularly prior to use, in accordance with manufacturer recommendations.

In addition, field QC samples will be collected and submitted for analyses to monitor the precision and accuracy associated with field procedures. Field QC samples to be collected and analyzed for this RI include field duplicates, trip blanks, and equipment rinsate blanks. The definition and sampling requirements for field QC samples are presented below.

Blind Field Duplicates

Blind field duplicate samples are used to check for sampling and analysis reproducibility; however, the field duplicate sample results include variability introduced during both field sampling and laboratory preparation and analysis, and EPA data validation guidance provides no specific evaluation criteria for field duplicate samples. Advisory evaluation criteria are set forth at 35% for RPD (if both results are greater than 5 times the RL) and 2 times the RLs for concentration difference (if either of the result is less than 5 times the RL) between the original and field duplicate results.

Field Duplicates will be submitted “blind” to the laboratory as discrete samples (i.e., given unique sample identifiers to keep the duplicate identity unknown to the laboratory), but will be clearly identified in the field log. **Field duplicate samples will be collected at a frequency of 5% (1 per 20) of the field samples for each matrix and analytical method, but not less than one duplicate per sampling event per matrix.**

If a given soil sample depth interval lacks sufficient volume (recovery) to supply material for a planned analysis and its field duplicate analysis, the field duplicate aliquot will be collected for that analysis from another depth interval in that same location if practical.

Trip Blank

Trip blank samples will be used to monitor possible VOC cross contamination occurring during sample transport. Trip blank samples are prepared and supplied by the laboratory using organic-free reagent-grade water into a VOC vial prior to the collection of field samples. The trip blank sample vials are placed with and accompany the VOC and gasoline-range TPH samples through the entire transporting process. **One trip blank will be collected for each soil sampling round and each groundwater sampling round where VOC or gasoline-range TPH analyses are conducted.**

In case a target compound is present in a trip blank, results for all samples shipped with this trip blank will be evaluated and data qualified accordingly if determined that the results are affected.

Equipment Rinsate Blank

Equipment rinsate blanks are collected to determine the potential of cross-contamination introduced by soil sampling equipment that is used between samples. Groundwater sampling is conducted using dedicated equipment; therefore, rinsate blanks are not needed for groundwater sampling QC. The deionized water used for soil sampling equipment decontamination is rinsed through the decontaminated sampling equipment and collected into adequate sample containers for analysis of VOCs, low-level PAHs, and priority pollutant metals The blank is then processed, analyzed, and reported as a regular field sample. **One rinsate blank will be conducted for each round of soil sampling.** The rinsate blank sampled will be labeled with a "RB-" prefix and the date it is collected (e.g., RB-5-29-13).

A3.5.2 Laboratory Quality Control

The laboratories' analytical procedures must meet requirements specified in the respective analytical methods or approved laboratory standard operating procedures (SOPs), e.g., instrument performance check, initial calibration, calibration check, blanks, surrogate spikes, internal standards, and/or labeled compound spikes. Specific laboratory QC analyses required for this project will consist of the following at a minimum:

- Instrument tuning, instrument initial calibration, and calibration verification analyses as required in the analytical methods and the laboratory standard operating procedures (SOPs);
- Laboratory and/or instrument method blank measurements at a minimum frequency of 5% (1 per 20 samples) or in accordance with method requirements, whichever is more frequent; and
- Accuracy and precision measurements as defined in Table A-2, at a minimum frequency of 5% (1 per 20 samples) or in accordance with method requirements, whichever is more frequent. In cases where a pair of MS/MSD or MS/laboratory duplicate analyses are not performed on a project sample, a set of LCS/LCSD

analyses will be performed to provide sufficient measures for analytical precision and accuracy evaluation.

The laboratory's QA officers are responsible for ensuring that the laboratory implements the internal QC and QA procedures detailed in FBI's Quality Assurance Manual.

A3.6 Corrective Actions

If routine QC audits by the laboratory result in detection of unacceptable conditions or data, actions specified in the laboratory SOPs will be taken. Specific corrective actions are outlined in each SOP used and can include the following:

- Identifying the source of the violation;
- Reanalyzing samples if holding time criteria permit;
- Resampling and analyzing;
- Evaluating and amending sampling and analytical procedures; and/or
- Accepting but qualifying data to indicate the level of uncertainty.

If unacceptable conditions occur, the laboratory will contact Aspect's project manager to discuss the issues and determine the appropriate corrective action. Corrective actions taken by the laboratory during analysis of samples for this project will be documented by the laboratory in the case narrative associated with the affected samples.

In addition, the project data quality manager will review the laboratory data generated for this investigation to ensure that project DQOs are met. If the review indicates that non-conformances in the data have resulted from field sampling or documentation procedures or laboratory analytical or documentation procedures, the impact of those non-conformances on the overall project data usability will be assessed. Appropriate actions, including re-sampling and/or re-analysis of samples may be recommended to the project manager to achieve project objectives.

A3.7 Data Reduction, Quality Review, and Reporting

All data will undergo a QA/QC evaluation at the laboratory which will then be reviewed by the Aspect database manager and the project data quality manager. Initial data reduction, evaluation, and reporting at the laboratory will be carried out in full compliance with the method requirement and laboratory SOPs. The laboratory internal review will include verification (for correctness and completeness) of electronic data deliverable (EDD) accompanied with each laboratory report. The Aspect database manager will verify the completeness and correctness of all laboratory deliverables (i.e., laboratory report and EDDs) before releasing the deliverables for data validation.

A3.7.1 Minimum Data Reporting Requirements

The following sections specify general and specific requirements for analytical data reporting to provide sufficient deliverables for project documentation and data quality assessment.

General Requirements

The following requirements apply to laboratory reports for all types of analyses:

- A laboratory report will include a cover page signed by the laboratory director, the laboratory QA officer, or his/her designee to certify the eligibility of the reported contents and the conformance with applicable analytical methodology.
- Definitions of abbreviations, data flags and data qualifiers used in the report.
- Cross reference of field sample names and laboratory sample identity for all samples in the SDG.
- Completed COC document signed and dated by parties of acquiring and receiving.
- Completed sample receipt document with record of cooler temperature and sample conditions upon receipt at the laboratory. Anomalies such as inadequate sample preservation, inconsistent bottle counts, and sample container breakage, and communication record and corrective actions in response to the anomalies will be documented and incorporated in the sample receipt document. The document will be initialed and dated by personnel that complete the document.
- Case narrative that addresses any anomalies or QC outliers in relation to sample receiving, sample preparation, and sample analysis on samples in the sample delivery group (SDG). The narrative will be presented separately for each analytical method and each sample matrix.
- All pages in the report are to be paginated. Any insertion of pages after the laboratory report is issued will be paginated with starting page number suffixed with letters (e.g., pages inserted between pages 134 and 135 should be paginated as 134A, 134B, etc.)
- Any resubmitted or revised report pages will be submitted to Aspect with a cover page stating the reason(s) and scope of resubmission or revision, and signed by laboratory director, QA officer, or the designee.

Specific Requirements

The following presents specific requirements for laboratory reports:

- Sample results: Sample results will be evaluated and reported down to the MDLs. Detections at levels greater than the MDLs but less than the RLs will be reported and flagged with “J”. Results less than the MDLs (or EDLs) will be reported at the RLs and flagged with “U”. All soil sample results will be reported on a dry-weight basis. The report pages for sample results (namely Form 1s) will, at minimum, include sample results, RLs, unit, proper data flags, dates of sample collection, preparation, and analysis, dilution factor, percent moisture (for solid samples), and sample volume (used for analysis).
- Instrument run log: The run log will list, in chronological order, all analytical runs on field samples, QC samples, calibrations, and calibration verification analyses in the SDG with data file name (and/or legible laboratory codes) and analysis date/time for each analytical run.

- Original sample preparation and analyst worksheet: Initialed and dated by analyst and reviewer.
- GC/MS and inductively coupled plasma (ICP)/MS tune report: Including ion abundance ratios and criteria for all required ions.
- Initial calibration summary: Including data file name for each calibration standard file; response factor (RF) or calibration factor (CF) for each calibration standard and each target and surrogate compound; average RF or CF, percent relative standard deviation (%RSD), correlation coefficient, or coefficient of determination; and absolute and relative retention times and ion ratios for HRGC/HRMS methods for each target compound and surrogate (labeled) compounds. As applicable and if required by the methods, initial calibrations should be verified with a second-source standard (namely the initial calibration verification [ICV]) at the mid-point concentration of the initial calibration. ICV results should be reported as part of the initial calibration.
- Calibration verification summary: Including true amount, calculated amount, and percent difference (%D), or percent drift ($\%D_f$) as applicable, for target compounds.
- Method blank and calibration blank (as applicable such as metals analyses) results.
- LCS and LCSD (if matrix spike duplicate analysis is not performed) results with laboratory acceptance criteria for %R and RPD.
- Surrogate spike results with laboratory acceptance criteria for %R.
- MS and MSD results with laboratory acceptance criteria for %R and RPD. In cases where MS/MSD analyses were not performed on a project sample, LCS/LCSD analyses should be performed and reported instead.
- Internal standard (as applicable) results: Internal standard absolute retention times and response areas in field samples, QC analyses, and associated calibration verification analyses.
- Labeled compound (HRGC/HRMS methodology only) results, ion abundance ratios, and recovery.

A3.8 Data Quality Verification and Validation

Reported analytical results will be qualified by the laboratory to identify QC concerns in accordance with the specifications of the analytical methods. Additional laboratory data qualifiers may be defined and reported by the laboratory to more completely explain QC concerns regarding a particular sample result. All data qualifiers will be defined in the laboratory's narrative reports associated with each case.

A Level 4 validation (as defined in EPA, 2009) will be performed on dioxins/furans data (by SW846 Method 8290) and PCB congener data (by EPA Method 1668A). A Level 2b validation will be performed on the remaining data. In cases where a systematic QC problem is suspected, such as unusual detections of an analyte or consistent outlying results of a QC parameter, a more detailed review, including a Level 4 validation, will be

performed on laboratory records pertinent to the concerned analysis to further evaluate the extend of the QC issue and the final data quality and usability. The actual level of validation for each data point will be entered in the electrical database submitted to the Ecology Environmental Information Management system (EIMs)., Data validation will be conducted following the guidance below:

- USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dibenzo-*p*-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review, Office of Superfund Remediation and Technical Innovation, U.S. Environmental Protection Agency, September 2011, USEPA 540/R-11/016
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, Office of Superfund Remediation and Technical Innovation, U.S. Environmental Protection Agency, January 2010, USEPA 540/R-10/011
- USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technical Innovation, U.S. Environmental Protection Agency, June 2008, USEPA-540-R-08-01.
- USEPA Region 10 Standard Operating Procedure for the Validation of Polychlorinated Dibenzo-p-Dioxin (PCDD) and Polychlorinated Dibenzofuran (PCDF) Data, January 1996.
- USEPA Region 10 Standard Operating Procedure for the Method 1668 Toxic, Dioxin-like, PCB Data, December 1995.

The data validation will examine and verify the following parameters against the method requirements and laboratory control limits specified in Tables A-3, A-4, and A-5:

- Sample management and holding times;
- Instrument performance check, calibration, and calibration verification;
- Laboratory and field blank results;
- Detection and reporting limits;
- Laboratory replicate results;
- MS/MSD results;
- LCS and/or standard reference material results;
- Field duplicate results;
- Surrogate spike recovery (organic analyses only);
- Internal standard recovery (internal calibration methods only);
- Inter-element interference check (ICP analyses only);
- Serial dilution (metals only);
- Labeled compound recovery (isotope dilution methods only); and
- Ion ratios for detected compounds (high resolution GC/MS methods only).

Data qualifiers will be assigned based on outcome of the data validation. Data qualifiers are limited to and defined as follows:

- U - The analyte was analyzed for but was determined to be non-detect above the reported sample quantitation limit, or the quantitation limit was raised to the concentration found in the sample due to blank contamination.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ - The analyte was not detected above the reported quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified.
- DNR - Do not report from this analysis; the result for this analyte is to be reported from an alternative analysis.

In cases of multiple analyses (such as an undiluted and a diluted analysis) performed on one sample, the optimal result will be determined and only the determined result will be reported for the sample.

The scope and findings of the data validation will be documented and discussed in the Data Validation Report(s). The Data Validation Report(s) will be appended to the RI report.

A3.9 Preventative Maintenance Procedures and Schedules

Preventative maintenance in the laboratory will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments and inspection and monitoring of carrier gases, solvents, and glassware used in analyses. Details of the maintenance procedures are addressed in the respective laboratory SOPs.

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

Maintenance and calibration of instruments used in the field for sampling (e.g., PID for evaluating presence of VOCs in soil samples, and the YSI meter for measuring field parameters during groundwater sampling) will be conducted regularly in accordance with manufacturer recommendations prior to use.

A3.10 Performance and System Audits

The Aspect project manager has responsibility for reviewing the performance of the laboratory QA program; this review will be achieved through regular contact with the analytical laboratory's project manager. To ensure comparable data, all samples of a given matrix to be analyzed by each specified analytical method will be processed consistently by the same analytical laboratory.

A3.11 Data and Records Management

Records will be maintained documenting all activities and data related to field sampling and chemical analyses.

A3.11.1 Field Documentation

Raw data received from the analytical laboratory will be reviewed, entered into a computerized database, and verified for consistency and correctness. The database will be updated based on data review and independent validation if necessary.

The following field data will be included in the database:

- Sample location coordinates
- Sample type (i.e., groundwater or soil)
- Soil or groundwater sampling depth interval

Information regarding whether concentrations represent total phase (unfiltered samples) or dissolved phase (filtered samples) will be compiled and stored in the database. Data will be submitted to Ecology's Environmental Information Management (EIM) database once data have been reviewed and validated.

A3.11.2 Analytical Data Management

Raw data received from the analytical laboratory will be reviewed, entered into a computerized database, and verified for consistency and correctness. The database will be updated based on data review and independent validation if necessary.

The following field data will be included in the database:

- Sample location coordinates
- Sample type (i.e., groundwater or soil)
- Soil or groundwater sampling depth interval

Information regarding whether concentrations represent total phase (unfiltered samples) or dissolved phase (filtered samples) will be compiled and stored in the database. Data will be submitted to Ecology's Environmental Information Management (EIM) database once data have been reviewed and validated.

A4 References for Appendix A

Ecology, 2004, Collecting and Preparing Soil Samples for VOC Analysis, Implementation Memorandum Number 5, June 17, 2004.

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USEPA, 1995, USEPA Region 10 Standard Operating Procedure for the Method 1668 Toxic, Dioxin-like, PCB Data, December 1995.

USEPA, 1996, USEPA Region 10 Standard Operating Procedure for the Validation of Polychlorinated Dibenzo-p-Dioxin (PCDD) and Polychlorinated Dibenzofuran (PCDF) Data, January 1996.

USEPA, 2008, Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technical Innovation, U.S. Environmental Protection Agency, June 2008, USEPA-540-R-08-01.

USEPA, 2009, Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, January 13 2009. EPA 540-R-08-005.

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Table A-1 - Analytical Methods, Sample Containers, Preservation, and Holding Times

Sample Matrix	Analytical Parameter	Analytical Method	Sample Container	No. Containers	Preservation Requirements	Holding Time
Soil	Gasoline Range TPH	NWTPH-Gx	Method 5035A, 40-ml vials	4	4°C ±2°C, Freeze within 48 hours to <-7°C	14 days
	Diesel and Motor Oil Range TPH	NWTPH-Dx/SW846 Method 3630 (Silica Gel Cleanup)	4 ounce jar	1	4°C ±2°C	14 days for extraction; 40 days for analysis
	VOCs	Method 8260C	Method 5035A, 40-ml vials	4	4°C ±2°C, Freeze within 48 hours to <-7°C	14 days
	Low-level PAHs	Method 8270D-SIM	4 ounce jar	1	4°C ±2°C	14 days for extraction; 40 days for analysis
	Total Metals other than Hg	Method 200.8	4 ounce jar	1	4°C ±2°C	6 months
	Total Mercury	Method 1631E	4 ounce jar	1	4°C ±2°C	28 days
	SVOCs	Method 8270D	4 ounce jar	1	4°C ±2°C	14 days for extraction; 40 days
	PCBs	Method 8082A	4 ounce jar	1	4°C ±2°C	extraction; 40 days for analysis
	Tri-butyl tin	Krone et al.	4 ounce jar	1	4°C ±2°C	extraction; 40 days for analysis
	Total Organic Carbon	ASTM D4129-05 Single Replicate	4 ounce jar	1	4°C ±2°C	14 days
	pH	Method 9045C	4 ounce jar	1	4°C ±2°C	28 days
	Dioxins/Furans	Method 8290	4 ounce jar (must separate from all others)	1	4°C ±2°C, Freeze within 14 days to <-7°C	1 year for extraction, 1 yer for analysis
	PCB Congeners	Method 1668A	4 ounce jar (must separate from all others)	1	4°C ±2°C, Freeze within 14 days to <-7°C	1 year for extraction, 1 yer for analysis

Table A-1 - Analytical Methods, Sample Containers, Preservation, and Holding Times

Sample Matrix	Analytical Parameter	Analytical Method	Sample Container	No. Containers	Preservation Requirements	Holding Time
Groundwater	Gasoline Range TPH	Method NWTPH-Gx	40-mL VOA Vials	3	4°C ±2°C, HCl pH < 2	14 days
	Diesel and Motor Oil Range TPH	NWTPH-Dx/SW846 Method 3630 (Silica Gel Cleanup)	500-mL Amber Glass	1	4°C ±2°C	7 days for extraction, 40 days for analysis
	VOCs	Method 8260C	40-mL VOA Vials	4	4°C ±2°C, 2 with HCl pH < 2, 2 without HCl	14 days for analysis
	Low-level PAHs	Method 8270D-SIM	1-L Amber Glass	2	4°C ±2°C	7 days for extraction, 40 days for analysis
	SVOCs with low-level PAHs	Method 8270D	1-L Amber Glass	3	4°C ±2°C	7 days for extraction, 40 days for analysis
	Dissolved Metals other than Hg	Method 200.8 (non-brackish),	500-mL HDPE	2 (for potential brackish water)	4°C ±2°C, HNO3 pH < 2 (after filtration)	180 days
	Dissolved Mercury	Method 1631 (non-brackish)	500-mL Fluoropoly	1 (for potential brackish water)	4°C ±2°C, HNO3 HCl pH < 2	28 days
	Total Metals other than Hg	Method 200.8 (non-brackish)	500-mL HDPE	2 (for potential brackish water)	4°C ±2°C, HNO3 pH < 2	180 days
	Total Mercury	Method 1631 (non-brackish)	500-mL Fluoropoly	1 (for potential brackish water)	4°C ±2°C, HNO3 HCl pH < 2	28 days
	Dissolved Metals other than Hg (Brackish)	200.7/ 7742 (Se)	500-mL HDPE	2	4°C ±2°C, HNO3 pH < 2 (after filtration)	180 days
	Dissolved Mercury (Brackish)	7740A	500-mL HDPE	1	4°C ±2°C, HNO3 pH < 2 (after filtration)	28 days
	Total Metals other than Hg (Brackish)	200.7/ 7742 (Se)	500-mL HDPE	2	4°C ±2°C, HNO3 pH < 2	180 days
	Total Mercury (Brackish)	7740A	500-mL HDPE	1	4°C ±2°C, HNO3 pH < 2	28 days
	Ammonia	Method 350.1	500-mL HDPE	1	4°C ±2°C, H2SO4 pH < 2	28 days
	Dissolved Sulfide	Method 376.2	500-mL HDPE	1	4°C ±2°C, Zinc Acetate and NaOH pH > 9 (after filtration)	7 days
	Formaldehyde	Method 8315A	1-L Amber Glass	1	4°C ±2°C	3 days
	TSS	SM2540D	500-mL HDPE	1	4°C ±2°	7 days
	TDS	SM2540C	500-mL HDPE	1	4°C ±2°	7 days

Table A-2 QC Parameters Associated with PARCCS

Data Quality Indicators	QC Parameters
Precision	RPD values of:
	(1) LCS/LCS Duplicate
	(2) MS/MSD
	(3) Field Duplicates
Accuracy/Bias	Percent Recovery (%R) or Percent Difference (%D) values of:
	(1) Initial Calibration and Calibration Verification
	(2) LCS
	(3) MS
	(4) Surrogate Spikes
	Results of:
	(1) Instrument and Calibration Blank
	(2) Method (Preparation) Blank
	(3) Trip Blank
	(4) Equipment Rinsate Blank
Representativeness	Results of All Blanks
	Sample Integrity (CoC and Sample Receipt Forms)
	Holding Times
Comparability	Sample-specific reporting limits
	Sample Collection Methods
	Laboratory Analytical Methods
Completeness	Data qualifiers
	Laboratory deliverables
	Requested/Reported valid results
Sensitivity	MDLs and MRLs

Notes:

LCS – Laboratory Control Sample
MDL - Method detection limit
MRL - Method reporting limit
MS/MSD - Matrix spike/matrix spike duplicate

Table A-3 Measurement Quality Objectives for Water Samples

Analyte Name	MDL[(A)]	MRL	LCS/LCS %R[(A)]	MS/MSD %R[(A)]	RPD (%)	Surrogate %R[(A)]
Conventional Chemical Parameters (mg/L)						
Total Suspended Solids	4	10	80-120	75-125	20	n/a
Total Dissolved Solids	4	10	80-120	75-125	20	n/a
Sulfide	0.02	0.05	80-120	75-125	20	n/a
Ammonia as Nitrogen	0.2	0.5	80-120	75-125	20	n/a
Total and Dissolved Metals by EPA 200.8 (µg/L)						
Antimony	0.037	1.0	82-111	70-123	20	n/a
Arsenic	0.072	1.0	81-118	51-167	20	n/a
Beryllium	0.032	1.0	53-159	68-151	20	n/a
Cadmium	0.043	1.0	86-118	86-115	20	n/a
Chromium (Total)	0.15	1.0	80-119	71-130	20	n/a
Copper	0.051	1.0	81-120	52-134	20	n/a
Lead	0.039	1.0	84-120	85-115	20	n/a
Nickel	0.11	1.0	83-119	71-120	20	n/a
Selenium	0.039	1.0	77-124	41-185	20	n/a
Silver	0.042	1.0	85-116	73-114	20	n/a
Thallium	0.045	1.0	85-120	87-116	20	n/a
Zinc	0.32	1.0	82-120	51-142	20	n/a
Total and Dissolved Mercury by EPA 1631 (µg/L)						
Mercury	0.0002	0.1	78-123	78-124	20	n/a
Total and Dissolved Selenium (in brackish water) by SW7742 (µg/L)						
Selenium	0.2	1	80-120	75-125	20	n/a
Volatile Organic Compounds (VOCs) by SW8260C (µg/L)						
1,1,1,2-Tetrachloroethane	0.23	1	84-127	73-137	20	n/a
1,1,1-Trichloroethane	0.061	1	83-130	60-146	20	n/a
1,1,2,2-Tetrachloroethane	0.048	1	66-126	51-154	20	n/a
1,1,2-Trichloroethane	0.054	1	75-124	68-131	20	n/a
1,1-Dichloroethane	0.054	1	79-121	70-128	20	n/a
1,1-Dichloroethene	0.13	1	67-136	60-136	20	n/a
1,1-Dichloropropene	0.096	1	77-129	69-133	20	n/a
1,2,3-Trichlorobenzene	0.21	1	65-136	69-148	20	n/a
1,2,3-Trichloropropane	0.074	1	67-124	53-150	20	n/a
1,2,4-Trimethylbenzene	0.097	1	82-125	59-146	20	n/a
1,2-Dibromo-3-chloropropane	0.12	10	57-141	32-164	20	n/a
1,2-Dibromoethane (EDB)	0.12	1	82-125	69-134	20	n/a
1,2-Dichloroethane (EDC)	0.078	1	73-132	69-133	20	n/a
1,2-Dichloropropane	0.079	1	77-123	78-125	20	n/a
1,3,5-Trimethylbenzene	0.078	1	80-126	66-137	20	n/a
1,3-Dichloropropane	0.06	1	76-126	71-128	20	n/a
1,4-Dioxane	tbd	10	30-160	30-160	20	n/a
2,2-Dichloropropane	0.12	1	55-143	36-154	20	n/a
2-Butanone	0.43	10	57-149	10-129	20	n/a
2-Chlorotoluene	0.04	1	77-127	66-127	20	n/a
2-Hexanone	0.25	10	64-152	10-185	20	n/a
4-Chlorotoluene	0.073	1	78-128	65-130	20	n/a
4-Methyl-2-pentanone	0.39	10	70-140	10-185	20	n/a
Acetone	0.9	10	60-155	10-182	20	n/a
Benzene	0.045	0.35	69-134	76-125	20	n/a
Bromobenzene	0.069	1	80-121	75-124	20	n/a
Bromodichloromethane	0.067	1	81-133	61-150	20	n/a
Bromoform	0.11	1	74-136	65-142	20	n/a
Bromomethane	0.048	1	55-143	47-169	20	n/a
Carbon tetrachloride	0.1	1	75-158	56-152	20	n/a
Chlorobenzene	0.08	1	83-114	77-122	20	n/a
Chloroethane	0.2	1	58-146	46-160	20	n/a
Chloroform	0.071	1	80-121	65-132	20	n/a
Chloromethane	0.11	10	45-156	25-166	20	n/a
cis -1,2-Dichloroethene (DCE)	0.09	1	80-123	71-127	20	n/a
cis-1,3-Dichloropropene	0.095	1	82-132	72-132	20	n/a
Dibromochloromethane	0.071	1	84-133	70-139	20	n/a
Dibromomethane	0.077	1	82-125	66-141	20	n/a
Dichlorodifluoromethane	0.12	1	25-158	10-172	20	n/a
Ethylbenzene	0.058	1	77-124	69-135	20	n/a
Hexachlorobutadiene	0.37	1	53-141	60-143	20	n/a
Isopropylbenzene	0.046	1	87-122	65-142	20	n/a
m,p -Xylenes	0.77	2	83-125	69-135	20	n/a
Methyl tert-butyl ether (MTBE)	0.063	1	64-147	74-127	20	n/a
Methylene chloride	1.5	5	39-148	67-132	20	n/a
n -Propylbenzene	0.11	1	74-126	58-144	20	n/a
o -Xylene	0.085	1	86-121	68-137	20	n/a
p-Isopropyltoluene	0.16	1	82-127	65-141	20	n/a
sec -Butylbenzene	0.18	1	80-125	64-140	20	n/a
Styrene	0.11	1	85-127	71-133	20	n/a
tert -Butylbenzene	0.11	1	85-127	65-137	20	n/a
Tetrachloroethene (PCE)	0.082	1	76-121	73-129	20	n/a

Table A-3 Measurement Quality Objectives for Water Samples

Toluene	0.052	1	72-122	76-122	20	n/a
trans -1,2-Dichloroethene	0.062	1	68-128	72-129	20	n/a
trans -1,3-Dichloropropene	0.1	1	80-136	76-130	20	n/a
Trichloroethene (TCE)	0.18	1	80-120	66-135	20	n/a
Trichlorofluoromethane	0.083	1	50-150	44-165	20	n/a
Vinyl acetate	tbd	10	30-160	30-160	20	n/a
Vinyl chloride	0.075	0.2	50-154	36-166	20	n/a
1,2-Dichloroethane-d4	n/a	n/a	n/a	n/a	n/a	57-121
Toluene-d8	n/a	n/a	n/a	n/a	n/a	63-127
4-Bromofluorobenzene	n/a	n/a	n/a	n/a	n/a	60-133
Semivolatile Organic Compounds (SVOCs) by SW8270D (µg/L)						
1,2,4-Trichlorobenzene	0.155	1	67-102	67-115	20	n/a
1,2-Dichlorobenzene	0.12	1	56-110	50-150	20	n/a
1,3-Dichlorobenzene	0.155	1	59-105	50-150	20	n/a
1,4-Dichlorobenzene	0.17	1	59-107	50-150	20	n/a
2,4,5-Trichlorophenol	1	10	53-117	50-150	20	n/a
2,4,6-Trichlorophenol	0.95	10	65-116	50-150	20	n/a
2,4-Dichlorophenol	1.1	10	55-114	50-150	20	n/a
2,4-Dimethylphenol	1.35	10	44-103	50-150	20	n/a
2,4-Dinitrophenol	6.5	30	53-123	50-150	20	n/a
2,4-Dinitrotoluene	0.215	1	44-128	50-150	20	n/a
2,6-Dinitrotoluene	0.14	1	54-123	50-150	20	n/a
2-Chloronaphthalene	0.145	1	49-118	50-150	20	n/a
2-Chlorophenol	0.8	10	61-108	50-150	20	n/a
2-Methylnaphthalene	0.21	1	55-119	50-150	20	n/a
2-Methylphenol	0.9	10	41-95	50-150	20	n/a
2-Nitroaniline	1.25	3	59-126	50-150	20	n/a
2-Nitrophenol	0.9	10	53-116	50-150	20	n/a
3 & 4 Methylphenol	1.5	20	24-138	50-150	20	n/a
3-Nitroaniline	0.95	3	34-112	50-150	20	n/a
4,6-Dinitro-2-methylphenol	1.65	30	58-124	50-150	20	n/a
4-Bromophenyl phenyl ether	0.12	1	57-115	50-150	20	n/a
4-Chloro-3-methylphenol	1.15	10	49-123	50-150	20	n/a
4-Chloroaniline	0.265	3	24-106	50-150	20	n/a
4-Chlorophenyl phenyl ether	0.15	1	59-113	50-150	20	n/a
4-Nitroaniline	1	10	23-173	50-150	20	n/a
4-Nitrophenol	2.95	10	10-102	50-150	20	n/a
Benzoic acid	18.5	50	10-59	50-150	20	n/a
Benzyl alcohol	1	10	52-106	50-150	20	n/a
Benzyl butyl phthalate	0.14	1	50-128	50-150	20	n/a
bis (2-Chloro-1-methylethyl) ether	0.09	10	53-113	50-150	20	n/a
bis(2-Chloroethoxy)methane	0.26	1	52-122	50-150	20	n/a
bis (2-Chloroethyl) ether	0.18	10	44-117	50-150	20	n/a
bis (2-Ethylhexyl) phthalate	0.185	10	50-127	50-150	20	n/a
Carbazole	0.325	1	33-140	50-150	20	n/a
Dibenzofuran	0.14	1	39-128	50-150	20	n/a
Diethyl phthalate	0.2	1	48-121	50-150	20	n/a
Dimethyl phthalate	0.165	1	54-115	50-150	20	n/a
Di-n-butyl phthalate	0.155	1	51-121	50-150	20	n/a
Di-n-octyl phthalate	0.12	1	54-129	50-150	20	n/a
Hexachlorobenzene	0.14	1	66-109	50-150	20	n/a
Hexachlorobutadiene	0.2	1	57-112	50-150	20	n/a
Hexachlorocyclopentadiene	0.2	3	24-132	50-150	20	n/a
Hexachloroethane	0.165	1	56-115	50-150	20	n/a
Isophorone	0.17	1	66-121	50-150	20	n/a
Nitrobenzene	0.25	1	55-116	50-150	20	n/a
N-Nitroso-di-n-propylamine	0.18	10	34-102	50-150	20	n/a
N-Nitrosodiphenylamine	0.135	1	62-111	50-150	20	n/a
Pentachlorophenol	1.35	10	52-129	50-150	20	n/a
Phenol	0.43	10	22-64	50-150	20	n/a
2-Fluorophenol	n/a	n/a	n/a	n/a	n/a	10-137
Phenol-d6	n/a	n/a	n/a	n/a	n/a	10-100
Nitrobenzene-d5	n/a	n/a	n/a	n/a	n/a	11-153
2-Fluorobiphenyl	n/a	n/a	n/a	n/a	n/a	21-159
2,4,6-Tribromophenol	n/a	n/a	n/a	n/a	n/a	10-210
Terphenyl-d14	n/a	n/a	n/a	n/a	n/a	51-143
Polycyclic Aromatic Hydrocarbons (PAHs) by SW8270D-SIM (µg/L)						
Acenaphthene	0.001	0.05	45-122	54-131	20	n/a
Acenaphthylene	0.000425	0.05	50-119	29-148	20	n/a
Anthracene	0.00065	0.05	50-121	32-132	20	n/a
Benz(a)anthracene	0.00065	0.01	48-117	53-86	20	n/a
Benzo(a)pyrene	0.001475	0.01	46-126	55-88	20	n/a
Benzo(b)fluoranthene	0.000475	0.01	49-128	44-100	20	n/a
Benzo(g,h,i)perylene	0.0006	0.05	47-127	44-82	20	n/a
Benzo(k)fluoranthene	0.000975	0.01	54-122	63-80	20	n/a
Chrysene	0.000625	0.01	52-117	54-87	20	n/a

Table A-3 Measurement Quality Objectives for Water Samples

Dibenzo(a,h)anthracene	0.000525	0.01	52-130	52-90	20	n/a
Fluoranthene	0.00035	0.05	49-123	42-131	20	n/a
Fluorene	0.00095	0.05	52-121	40-134	20	n/a
Indeno(1,2,3-cd)pyrene	0.00075	0.01	51-129	46-84	20	n/a
Naphthalene	0.000775	0.05	50-117	57-114	20	n/a
Phenanthrene	0.000875	0.05	50-116	31-146	20	n/a
Pyrene	0.00075	0.05	44-125	50-83	20	n/a
Anthracene-d10	n/a	n/a	n/a	n/a	n/a	36-135
Benzo(a)anthracene-d12	n/a	n/a	n/a	n/a	n/a	36-136
Nitrobenzene-d5	n/a	n/a	n/a	n/a	n/a	50-150
2-Fluorobiphenyl	n/a	n/a	n/a	n/a	n/a	50-150
Terphenyl-d14	n/a	n/a	n/a	n/a	n/a	50-150
PCB Aroclors by SW8082A (µg/L)						
Aroclor 1016	0.049	0.2	50-103	25-144	30	n/a
Aroclor 1221	0.049	0.4	n/a	n/a	n/a	n/a
Aroclor 1232	0.049	0.2	n/a	n/a	n/a	n/a
Aroclor 1242	0.049	0.2	n/a	n/a	n/a	n/a
Aroclor 1248	0.049	0.2	n/a	n/a	n/a	n/a
Aroclor 1254	0.049	0.2	n/a	n/a	n/a	n/a
Aroclor 1260	0.049	0.2	56-100	40-127	30	n/a
Tetrachloro-m-xylene	n/a	n/a	n/a	n/a	n/a	50-150
1,2-Dibromoethane (EDB) by SW8011 (µg/L)						
1,2-Dibromoethane (EDB)	0.0026	0.01	70-130	50-150	10	n/a
Formaldehyde by SW8315 (µg/L)						
Formaldehyde	25	100	33-115	33-115	30	n/a
Gasoline Range Hydrocarbons by NWTPH-Gx (µg/L)						
Gasoline Range Hydrocarbons	5.7	100	58-142	53-117	20	n/a
Bromofluorobenzene	n/a	n/a	n/a	n/a	n/a	51-134
Diesel and Motor Oil Range Hydrocarbons by NWTPH-Dx (µg/L)						
Diesel Range Hydrocarbons	6.1	50	63-142	50-150	20	n/a
Oil Range Hydrocarbons	23	250	50-150	50-150	20	n/a
o-Terphenyl	n/a	n/a	n/a	n/a	n/a	50-150

Notes:

[A] - Based on current laboratory control criteria. Some values may vary slightly between instruments and can be subject to change as the laboratory updates the charted values periodically.

%R - Percent recovery

LCS/LCSD - Laboratory control samples and laboratory control sample duplicate

MDL - Method detection limit

mg/L - milligram per liter

MRL - Method reporting limit

MS/MSD - Matrix spike and matrix spike duplicate

n/a - not applicable

RPD - Relative percent difference

tbd - to be determined

µg/L - microgram per liter

Table A-4 Measurement Quality Objectives for Soil Samples

Analyte Name	MDL[(A)]	MRL	LCS/LCS %R[(A)]	MS/MSD %R[(A)]	RPD (%)	Surrogate %R[(A)]
Metals by EPA 200.8 (mg/kg)						
Antimony	0.034	1.0	71-116	28-151	20	n/a
Arsenic	0.15	1.0	79-112	56-125	20	n/a
Beryllium	0.1	1.0	76-146	66-136	20	n/a
Cadmium	0.046	1.0	88-114	85-117	20	n/a
Chromium (Total)	0.23	1.0	81-117	63-120	20	n/a
Copper	0.02	1.0	86-116	46-133	20	n/a
Lead	0.041	1.0	83-118	64-139	20	n/a
Nickel	0.017	1.0	86-118	54-125	20	n/a
Selenium	0.14	1.0	83-113	64-118	20	n/a
Silver	0.02	1.0	85-113	83-112	20	n/a
Thallium	0.023	1.0	88-127	86-120	20	n/a
Zinc	0.35	1.0	84-121	49-129	20	n/a
Mercury by EPA 1631 (mg/kg)						
Mercury	0.00037	0.1	73-131	54-156	20	n/a
Volatile Organic Compounds (VOCs) by SW8260C (mg/kg)						
1,1,1,2-Tetrachloroethane	0.0065	0.05	69-135	31-143	20	n/a
1,1,1-Trichloroethane	0.0038	0.05	62-131	10-156	20	n/a
1,1,2,2-Tetrachloroethane	0.0048	0.05	56-143	28-140	20	n/a
1,1,2-Trichloroethane	0.0049	0.05	75-113	30-142	20	n/a
1,1-Dichloroethane	0.0018	0.05	68-115	19-140	20	n/a
1,1-Dichloroethene	0.0062	0.05	47-128	10-160	20	n/a
1,1-Dichloropropene	0.0038	0.05	69-128	17-140	20	n/a
1,2,3-Trichlorobenzene	0.022	0.25	62-130	20-144	20	n/a
1,2,3-Trichloropropane	0.0059	0.05	61-137	25-144	20	n/a
1,2,4-Trimethylbenzene	0.0095	0.25	76-125	10-182	20	n/a
1,2-Dibromo-3-chloropropane	0.012	0.5	61-136	11-161	20	n/a
1,2-Dibromoethane (EDB)	0.0054	0.05	74-132	28-142	20	n/a
1,2-Dichloroethane (EDC)	0.0042	0.05	56-135	12-160	20	n/a
1,2-Dichloropropane	0.004	0.05	72-127	30-135	20	n/a
1,3,5-Trimethylbenzene	0.004	0.05	76-126	18-149	20	n/a
1,3-Dichloropropane	0.0044	0.05	72-130	31-137	20	n/a
2,2-Dichloropropane	0.0035	0.05	57-133	10-158	20	n/a
2-Butanone	0.022	0.5	57-123	19-147	20	n/a
2-Chlorotoluene	0.0052	0.05	74-121	31-134	20	n/a
2-Hexanone	0.015	0.5	33-152	15-166	20	n/a
4-Chlorotoluene	0.0053	0.05	75-122	31-136	20	n/a
4-Methyl-2-pentanone	0.036	0.5	45-145	24-155	20	n/a
Acetone	0.077	0.5	52-141	10-163	20	n/a
Benzene	0.002	0.03	68-114	29-129	20	n/a
Bromobenzene	0.0035	0.05	72-122	34-130	20	n/a
Bromodichloromethane	0.0033	0.05	72-130	23-155	20	n/a
Bromoform	0.0069	0.05	56-132	21-156	20	n/a
Bromomethane	0.02	0.5	38-114	10-163	20	n/a
Carbon tetrachloride	0.0045	0.05	60-139	9-164	20	n/a
Chlorobenzene	0.0034	0.05	76-111	32-129	20	n/a
Chloroethane	0.0087	0.5	20-153	10-176	20	n/a
Chloroform	0.0023	0.05	66-120	21-145	20	n/a
Chloromethane	0.004	0.5	27-133	10-126	20	n/a
cis -1,2-Dichloroethene (DCE)	0.0024	0.05	72-113	25-135	20	n/a
cis-1,3-Dichloropropene	0.003	0.05	75-136	28-144	20	n/a
Dibromochloromethane	0.0052	0.05	74-125	28-150	20	n/a
Dibromomethane	0.0047	0.05	70-120	23-145	20	n/a
Dichlorodifluoromethane	0.0047	0.5	10-146	10-142	20	n/a
Ethylbenzene	0.0033	0.05	64-123	32-137	20	n/a
Hexachlorobutadiene	0.021	0.25	50-153	19-142	20	n/a
Isopropylbenzene	0.0031	0.05	76-127	31-142	20	n/a
m,p -Xylenes	0.0054	0.1	78-122	34-136	20	n/a
Methyl tert-butyl ether (MTBE)	0.0027	0.05	60-123	21-145	20	n/a
Methylene chloride	0.13	0.5	42-132	10-156	20	n/a
n -Propylbenzene	0.0033	0.05	74-124	23-146	20	n/a
o -Xylene	0.0037	0.05	77-124	33-134	20	n/a
p-Isopropyltoluene	0.005	0.05	70-132	21-149	20	n/a
sec -Butylbenzene	0.0052	0.05	71-130	23-145	20	n/a
Styrene	0.0024	0.05	74-126	35-137	20	n/a
tert -Butylbenzene	0.0041	0.05	73-130	30-137	20	n/a
Tetrachloroethene (PCE)	0.0054	0.025	72-114	20-133	20	n/a
Toluene	0.0014	0.05	66-126	35-130	20	n/a
trans -1,2-Dichloroethene	0.005	0.05	67-127	14-137	20	n/a
trans -1,3-Dichloropropene	0.0051	0.05	72-132	26-149	20	n/a
Trichloroethene (TCE)	0.0063	0.03	68-114	21-139	20	n/a
Trichlorofluoromethane	0.0022	0.5	10-196	10-176	20	n/a
Vinyl chloride	0.0038	0.05	22-139	10-138	20	n/a
1,2-Dichloroethane-d4	n/a	n/a	n/a	n/a	n/a	62-142
Toluene-d8	n/a	n/a	n/a	n/a	n/a	55-145

Table A-4 Measurement Quality Objectives for Soil Samples

Analyte Name	MDL[(A)]	MRL	LCS/LCS %R[(A)]	MS/MSD %R[(A)]	RPD (%)	Surrogate %R[(A)]
4-Bromofluorobenzene	n/a	n/a	n/a	n/a	n/a	65-139
Semivolatile Organic Compounds (SVOCs) by SW8270D (mg/kg)						
1,2,4-Trichlorobenzene	0.0033	0.03	67-100	50-150	20	n/a
1,2-Dichlorobenzene	0.0047	0.03	62-103	50-150	20	n/a
1,3-Dichlorobenzene	0.00395	0.03	66-101	50-150	20	n/a
1,4-Dichlorobenzene	0.0032	0.03	63-105	50-150	20	n/a
2,4,5-Trichlorophenol	0.0195	0.3	53-119	50-150	20	n/a
2,4,6-Trichlorophenol	0.0095	0.3	48-126	50-150	20	n/a
2,4-Dichlorophenol	0.013	0.3	53-113	50-150	20	n/a
2,4-Dimethylphenol	0.0405	0.3	39-110	50-150	20	n/a
2,4-Dinitrophenol	0.05	0.9	38-127	50-150	20	n/a
2,4-Dinitrotoluene	0.00165	0.03	59-113	50-150	20	n/a
2,6-Dinitrotoluene	0.0027	0.03	65-115	50-150	20	n/a
2-Chloronaphthalene	0.0038	0.03	60-106	50-150	20	n/a
2-Chlorophenol	0.0145	0.3	64-109	50-150	20	n/a
2-Methylnaphthalene	0.0034	0.03	56-114	50-150	20	n/a
2-Methylphenol	0.016	0.3	41-106	50-150	20	n/a
2-Nitroaniline	0.0055	0.03	53-121	50-150	20	n/a
2-Nitrophenol	0.0145	0.3	49-121	50-150	20	n/a
3 & 4 Methylphenol	0.029	0.6	30-178	50-150	20	n/a
3-Nitroaniline	0.01	3	18-91	50-150	20	n/a
4,6-Dinitro-2-methylphenol	0.0405	0.9	47-127	50-150	20	n/a
4-Bromophenyl phenyl ether	0.0035	0.03	72-102	50-150	20	n/a
4-Chloro-3-methylphenol	0.0105	0.3	65-113	50-150	20	n/a
4-Chloroaniline	0.7	3	10-75	50-150	20	n/a
4-Chlorophenyl phenyl ether	0.0027	0.03	69-111	50-150	20	n/a
4-Nitroaniline	0.03	3	10-167	50-150	20	n/a
4-Nitrophenol	0.048	0.9	54-118	50-150	20	n/a
Benzoic acid	0.115	1.5	56-125	50-150	20	n/a
Benzyl alcohol	0.005	0.3	48-120	50-150	20	n/a
Benzyl butyl phthalate	0.0029	0.03	61-117	50-150	20	n/a
bis (2-Chloro-1-methylethyl) ether	0.0048	0.03	59-103	50-150	20	n/a
bis(2-Chloroethoxy)methane	0.00235	0.03	63-111	50-150	20	n/a
bis (2-Chloroethyl) ether	0.00475	0.03	43-116	50-150	20	n/a
bis (2-Ethylhexyl) phthalate	0.19	0.48	65-118	50-150	20	n/a
Carbazole	0.007	0.03	73-105	50-150	20	n/a
Dibenzofuran	0.00335	0.03	48-114	50-150	20	n/a
Diethyl phthalate	0.0034	0.03	66-105	50-150	20	n/a
Dimethyl phthalate	0.00265	0.03	67-101	50-150	20	n/a
Di-n-butyl phthalate	0.0049	0.03	67-107	50-150	20	n/a
Di-n-octyl phthalate	0.0042	0.03	71-120	50-150	20	n/a
Hexachlorobenzene	0.003	0.03	52-116	50-150	20	n/a
Hexachlorobutadiene	0.00345	0.03	66-104	50-150	20	n/a
Hexachlorocyclopentadiene	0.0055	0.09	39-119	50-150	20	n/a
Hexachloroethane	0.00345	0.03	55-117	50-150	20	n/a
Isophorone	0.00205	0.03	65-116	50-150	20	n/a
Nitrobenzene	0.0055	0.03	65-103	50-150	20	n/a
N-Nitroso-di-n-propylamine	0.00315	0.03	61-105	50-150	20	n/a
N-Nitrosodiphenylamine	0.0033	0.03	51-104	50-150	20	n/a
Pentachlorophenol	0.027	0.3	50-130	50-150	20	n/a
Phenol	0.0135	0.3	60-108	50-150	20	n/a
2-Fluorophenol	n/a	n/a	n/a	n/a	n/a	50-150
Phenol-d6	n/a	n/a	n/a	n/a	n/a	50-150
Nitrobenzene-d5	n/a	n/a	n/a	n/a	n/a	50-150
2-Fluorobiphenyl	n/a	n/a	n/a	n/a	n/a	50-150
2,4,6-Tribromophenol	n/a	n/a	n/a	n/a	n/a	50-150
Terphenyl-d14	n/a	n/a	n/a	n/a	n/a	50-150
Polycyclic Aromatic Hydrocarbons by SW8270D-SIM (mg/kg)						
Acenaphthene	0.00028	0.01	56-109	49-109	20	n/a
Acenaphthylene	0.00029	0.01	53-110	44-116	20	n/a
Anthracene	0.00044	0.01	57-103	41-104	20	n/a
Benz(a)anthracene	0.00115	0.01	50-106	42-114	20	n/a
Benzo(a)pyrene	0.0021	0.01	49-111	48-109	20	n/a
Benzo(b)fluoranthene	0.0029	0.01	56-122	49-123	20	n/a
Benzo(g,h,i)perylene	0.00315	0.01	57-124	14-132	20	n/a
Benzo(k)fluoranthene	0.003	0.01	57-122	46-122	20	n/a
Chrysene	0.0014	0.01	47-114	38-118	20	n/a
Dibenzo(a,h)anthracene	0.002	0.01	59-127	24-138	20	n/a
Fluoranthene	0.000325	0.01	60-118	41-117	20	n/a
Fluorene	0.0011	0.01	55-114	48-112	20	n/a
Indeno(1,2,3-cd)pyrene	0.0031	0.01	59-123	23-130	20	n/a
Naphthalene	0.00055	0.01	61-110	22-137	20	n/a
Phenanthrene	0.000435	0.01	61-108	40-110	20	n/a
Pyrene	0.00065	0.01	60-116	48-115	20	n/a

Table A-4 Measurement Quality Objectives for Soil Samples

Analyte Name	MDL[(A)]	MRL	LCS/LCS %R[(A)]	MS/MSD %R[(A)]	RPD (%)	Surrogate %R[(A)]
Anthracene-d10	n/a	n/a	n/a	n/a	n/a	18-150
Benzo(a)anthracene-d12	n/a	n/a	n/a	n/a	n/a	40-143
Nitrobenzene-d5	n/a	n/a	n/a	n/a	n/a	50-150
2-Fluorobiphenyl	n/a	n/a	n/a	n/a	n/a	50-150
Terphenyl-d14	n/a	n/a	n/a	n/a	n/a	50-150
Polychlorinated Biphenyls (PCBs) Aroclors by SW8082A (mg/kg)						
Aroclor 1016	0.026	0.1	50-150	50-150	20	n/a
Aroclor 1221	0.026	0.1	n/a	n/a	20	n/a
Aroclor 1232	0.026	0.1	n/a	n/a	20	n/a
Aroclor 1248	0.026	0.1	n/a	n/a	20	n/a
Aroclor 1254	0.026	0.1	n/a	n/a	20	n/a
Aroclor 1260	0.021	0.1	50-150	50-150	20	n/a
Decachlorobiphenyl	n/a	n/a	n/a	n/a	n/a	50-150
Tetrachloro-meta-xylene	n/a	n/a	n/a	n/a	n/a	50-150
Tri-butyl Tin by Krone, et al. (µg/kg)						
Tri-butyl Tin	0.43	1	10-122	10-115	40	n/a
Tri-propyl Tin	n/a	n/a	n/a	n/a	n/a	10-120
Gasoline Range Hydrocarbons by NWTPH-Gx (mg/kg)						
Gasoline Range Hydrocarbons	0.064	2	58-142	53-117	20	n/a
Bromofluorobenzene	n/a	n/a	n/a	n/a	n/a	58-139
Diesel and Motor Oil Range Hydrocarbons by NWTPH-Dx (mg/kg)						
Diesel Range Hydrocarbons	1.2	50	63-142	50-150	20	n/a
Oil Range Hydrocarbons	1.1	250	50-150	50-150	20	n/a
o-Terphenyl	n/a	n/a	n/a	n/a	n/a	50-150
Dioxins and Furans by SW8290C (ng/kg)						
2,3,7,8-TCDD	EDL	0.5	50-150	50-150	20	n/a
1,2,3,7,8-PeCDD	EDL	2.5	50-150	50-150	20	n/a
1,2,3,4,7,8-HxCDD	EDL	2.5	50-150	50-150	20	n/a
1,2,3,6,7,8-HxCDD	EDL	2.5	50-150	50-150	20	n/a
1,2,3,7,8,9-HxCDD	EDL	2.5	50-150	50-150	20	n/a
1,2,3,4,6,7,8-HpCDD	EDL	2.5	50-150	50-150	20	n/a
OCDD	EDL	5	50-150	50-150	20	n/a
2,3,7,8-TCDF	EDL	0.5	50-150	50-150	20	n/a
1,2,3,7,8-PeCDF	EDL	2.5	50-150	50-150	20	n/a
2,3,4,7,8-PeCDF	EDL	2.5	50-150	50-150	20	n/a
1,2,3,4,7,8-HxCDF	EDL	2.5	50-150	50-150	20	n/a
1,2,3,6,7,8-HxCDF	EDL	2.5	50-150	50-150	20	n/a
1,2,3,7,8,9-HxCDF	EDL	2.5	50-150	50-150	20	n/a
2,3,4,6,7,8-HxCDF	EDL	2.5	50-150	50-150	20	n/a
1,2,3,4,6,7,8-HpCDF	EDL	2.5	50-150	50-150	20	n/a
1,2,3,4,7,8,9-HpCDF	EDL	2.5	50-150	50-150	20	n/a
OCDF	EDL	5	n/a	n/a	20	n/a
TCDD, Total	EDL	0.5	n/a	n/a	20	n/a
PeCDD, Total	EDL	2.5	n/a	n/a	20	n/a
HxCDD, Total	EDL	2.5	n/a	n/a	20	n/a
HpCDD, Total	EDL	2.5	n/a	n/a	20	n/a
TCDF, Total	EDL	0.5	n/a	n/a	20	n/a
PeCDF, Total	EDL	2.5	n/a	n/a	20	n/a
HxCDF, Total	EDL	2.5	n/a	n/a	20	n/a
HpCDF, Total	EDL	2.5	n/a	n/a	20	n/a
2,3,7,8-TCDD-C13	n/a	n/a	n/a	n/a	n/a	40-135
1,2,3,7,8-PeCDD-C13	n/a	n/a	n/a	n/a	n/a	40-135
1,2,3,6,7,8-HeCDD-C13	n/a	n/a	n/a	n/a	n/a	40-135
1,2,3,4,6,7,8-HpCDD-C13	n/a	n/a	n/a	n/a	n/a	40-135
OCDD-C13	n/a	n/a	n/a	n/a	n/a	40-135
2,3,7,8-TCDF-C13	n/a	n/a	n/a	n/a	n/a	40-135
1,2,3,7,8-PeCDF-C13	n/a	n/a	n/a	n/a	n/a	40-135
1,2,3,4,7,8-HeCDF-C13	n/a	n/a	n/a	n/a	n/a	40-135
1,2,3,4,6,7,8-HpCDF-C13	n/a	n/a	n/a	n/a	n/a	40-135
2,3,7,8-TCDD-Cl37	n/a	n/a	n/a	n/a	n/a	40-135

Notes:

[(A)] - Based on current laboratory control criteria. Some values may vary slightly between instruments and can be subject to change as the laboratory updates the charted values periodically.

%R - Percent recovery

EDL - Estimated detection limit; value is calculated based on actual instrument response on a sample-specific basis.

LCS/LCSD - Laboratory control samples and laboratory control sample duplicate

MDL - Method detection limit

mg/kg - milligram per kilogram

MRL - Method reporting limit

MS/MSD - Matrix spike and matrix spike duplicate

n/a - not applicable

ng/kg - nanogram per kilogram

RPD - Relative percent difference

Table A-5 - Measurement Quality Objectives for PCB Congeners in Soil Samples

Congener	CAS No.	EDL[(A)]	MRL[(A)]	Unit	LCS %R[(A)]	MS/MSD %R	Precision RPD	Labeled Compound %R
PCB 1	2051-60-7	40	100	ng/Kg	50-150	50-150	50	n/a
PCB 2	2051-61-8	2	5	ng/Kg	n/a	n/a	n/a	n/a
PCB 3	2051-62-9	45	100	ng/Kg	50-150	50-150	50	n/a
PCB 4	13029-08-8	85	250	ng/Kg	50-150	50-150	50	n/a
PCB 5	16605-91-7	5	25	ng/Kg	n/a	n/a	n/a	n/a
PCB 6	25569-80-6	5	25	ng/Kg	n/a	n/a	n/a	n/a
PCB 7	33284-50-3	10	25	ng/Kg	n/a	n/a	n/a	n/a
PCB 8	34883-43-7	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 9	34883-39-1	10	25	ng/Kg	n/a	n/a	n/a	n/a
PCB 10	33146-45-1	10	25	ng/Kg	n/a	n/a	n/a	n/a
PCB 11	2050-67-1	50	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 12	2974-92-7	15	50	ng/Kg	n/a	n/a	n/a	n/a
PCB 13	2974-90-5	15	50	ng/Kg	n/a	n/a	n/a	n/a
PCB 14	34883-41-5	15	50	ng/Kg	n/a	n/a	n/a	n/a
PCB 15	2050-68-2	90	250	ng/Kg	50-150	50-150	50	n/a
PCB 16	38444-78-9	20	50	ng/Kg	n/a	n/a	n/a	n/a
PCB 17	37680-66-3	45	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 18	37680-65-2	100	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 19	38444-73-4	20	50	ng/Kg	50-150	50-150	50	n/a
PCB 20	38444-84-7	95	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 21	55702-46-0	25	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 22	38444-85-8	45	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 23	55720-44-0	25	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 24	55702-45-9	25	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 25	55712-37-3	25	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 26	38444-81-4	40	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 27	38444-76-7	30	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 28	7012-37-5	95	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 29	15862-07-4	40	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 30	35693-92-6	100	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 31	16606-02-3	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 32	38444-77-8	40	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 33	38444-86-9	25	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 34	37680-68-5	35	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 35	37680-69-6	40	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 36	38444-87-0	40	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 37	38444-90-5	65	250	ng/Kg	50-150	50-150	50	n/a
PCB 38	53555-66-1	40	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 39	38444-88-1	45	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 40	38444-93-8	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 41	52663-59-9	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 42	36559-22-5	30	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 43	70362-46-8	45	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 44	41464-39-5	95	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 45	70362-45-7	25	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 46	41464-47-5	50	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 47	2437-79-8	95	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 48	70362-47-9	40	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 49	41464-40-8	55	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 50	62796-65-0	30	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 51	68194-04-7	25	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 52	35693-99-3	95	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 53	41464-41-9	30	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 54	15968-05-5	60	250	ng/Kg	50-150	50-150	50	n/a
PCB 55	74338-24-2	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 56	41464-43-1	50	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 57	74472-33-6	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 58	41464-49-7	65	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 59	74472-33-6	30	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 60	33025-41-1	65	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 61	33284-53-6	85	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 62	54230-22-7	30	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 63	74472-34-7	70	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 64	52663-58-8	35	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 65	33284-54-7	95	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 66	32598-10-0	80	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 67	73575-53-8	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 68	73575-52-7	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 69	60233-24-1	55	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 70	32598-11-1	85	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 71	41464-46-4	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 72	41464-42-0	80	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 73	74338-23-1	45	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 74	32690-93-0	85	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 75	32598-12-2	30	100	ng/Kg	n/a	n/a	n/a	n/a

Table A-5 - Measurement Quality Objectives for PCB Congeners in Soil Samples

Congener	CAS No.	EDL[(A)]	MRL[(A)]	Unit	LCS %R[(A)]	MS/MSD %R	Precision RPD	Labeled Compound %R
PCB 76	70362-48-0	85	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 77	32598-13-3	85	250	ng/Kg	50-150	50-150	50	n/a
PCB 78	70362-49-1	85	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 79	41464-48-6	85	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 80	33284-52-5	90	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 81	70362-50-4	90	250	ng/Kg	50-150	50-150	50	n/a
PCB 82	52663-62-4	65	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 83	60145-20-2	110	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 84	52663-60-2	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 85	65510-45-4	50	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 86	55312-69-1	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 87	38380-02-8	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 88	55215-17-3	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 89	73575-57-2	95	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 90	68194-07-0	120	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 91	68194-05-8	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 92	52663-61-3	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 93	73575-56-1	110	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 94	73575-55-0	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 95	38379-99-6	110	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 96	73575-54-9	105	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 97	41464-51-1	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 98	60233-25-2	110	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 99	38380-01-7	110	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 100	39485-83-1	110	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 101	37680-73-2	120	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 102	68194-06-9	110	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 103	60145-21-3	115	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 104	56558-16-8	115	250	ng/Kg	50-150	50-150	50	n/a
PCB 105	32598-14-4	55	100	ng/Kg	50-150	50-150	50	n/a
PCB 106	70424-69-0	70	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 107	70424-68-9	50	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 108	70362-41-3	135	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 109	74472-35-8	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 110	38380-03-9	120	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 111	39635-32-0	120	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 112	74472-36-9	125	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 113	68194-10-5	120	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 114	74472-37-0	60	250	ng/Kg	50-150	50-150	50	n/a
PCB 115	74472-38-1	120	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 116	18259-05-7	50	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 117	68194-11-6	50	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 118	31508-00-6	95	250	ng/Kg	50-150	50-150	50	n/a
PCB 119	56558-17-9	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 120	68194-12-7	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 121	56558-18-0	105	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 122	76842-07-4	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 123	65510-44-3	75	250	ng/Kg	50-150	50-150	50	n/a
PCB 124	70424-70-3	135	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 125	74472-39-2	75	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 126	57465-28-8	70	250	ng/Kg	50-150	50-150	50	n/a
PCB 127	39635-33-1	140	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 128	38380-07-3	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 129	55215-18-4	105	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 130	52663-66-8	70	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 131	61798-70-7	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 132	38380-05-1	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 133	35694-04-3	85	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 134	52704-70-8	65	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 135	52744-13-5	55	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 136	38411-22-2	45	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 137	35694-06-5	150	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 138	35065-28-2	105	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 139	56030-56-9	100	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 140	59291-64-4	100	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 141	52712-04-6	45	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 142	41411-61-4	155	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 143	68194-15-0	65	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 144	68194-14-9	85	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 145	74472-40-5	160	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 146	51908-16-8	90	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 147	68194-13-8	90	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 148	74472-41-6	160	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 149	38380-04-0	90	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 150	68194-08-1	165	500	ng/Kg	n/a	n/a	n/a	n/a

Table A-5 - Measurement Quality Objectives for PCB Congeners in Soil Samples

Congener	CAS No.	EDL[(A)]	MRL[(A)]	Unit	LCS %R[(A)]	MS/MSD %R	Precision RPD	Labeled Compound %R
PCB 151	52663-63-5	55	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 152	68194-09-2	120	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 153	35065-27-1	65	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 154	60145-22-4	55	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 155	33979-03-2	170	500	ng/Kg	50-150	50-150	50	n/a
PCB 156	38380-08-4	65	250	ng/Kg	50-150	50-150	50	n/a
PCB 157	69782-90-7	65	250	ng/Kg	50-150	50-150	50	n/a
PCB 158	74472-42-7	50	100	ng/Kg	n/a	n/a	n/a	n/a
PCB 159	39635-35-3	175	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 160	41411-62-5	105	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 161	74472-43-8	175	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 162	39635-34-2	175	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 163	74472-44-9	105	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 164	74472-45-0	70	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 165	74472-46-1	180	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 166	41411-63-6	60	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 167	52663-72-6	55	250	ng/Kg	50-150	50-150	50	n/a
PCB 168	59291-65-5	65	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 169	32774-16-6	80	250	ng/Kg	50-150	50-150	50	n/a
PCB 170	35065-30-6	80	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 171	52663-71-5	185	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 172	52663-74-8	190	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 173	68194-16-1	185	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 174	38411-25-5	95	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 175	40186-70-7	190	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 176	52663-65-7	195	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 177	52663-70-4	70	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 178	52663-67-9	110	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 179	52663-64-6	115	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 180	35065-29-3	70	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 181	74472-47-2	200	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 182	60145-23-5	200	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 183	52663-69-1	200	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 184	74472-48-3	200	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 185	52712-05-7	200	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 186	74472-49-4	205	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 187	52663-68-0	95	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 188	74487-85-7	115	250	ng/Kg	50-150	50-150	50	n/a
PCB 189	39635-31-9	90	250	ng/Kg	50-150	50-150	50	n/a
PCB 190	41411-64-7	115	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 191	74472-50-7	210	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 192	74472-51-8	210	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 193	69782-91-8	70	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 194	35694-08-7	85	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 195	52663-78-2	215	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 196	42740-50-1	215	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 197	33091-17-7	125	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 198	68194-17-2	100	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 199	52663-75-9	100	250	ng/Kg	n/a	n/a	n/a	n/a
PCB 200	52663-73-7	125	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 201	40186-71-8	220	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 202	2136-99-4	220	500	ng/Kg	50-150	50-150	50	n/a
PCB 203	52663-76-0	220	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 204	74472-52-9	225	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 205	74472-53-0	225	500	ng/Kg	50-150	50-150	50	n/a
PCB 206	40186-72-9	225	500	ng/Kg	50-150	50-150	50	n/a
PCB 207	52663-79-3	225	500	ng/Kg	n/a	n/a	n/a	n/a
PCB 208	52663-77-1	230	500	ng/Kg	50-150	50-150	50	n/a
PCB 209	2051-24-3	75	250	ng/Kg	50-150	50-150	50	n/a
PCB 1L	n/a	n/a	n/a	Percent	15-140	15-140	n/a	15-150
PCB 3L	n/a	n/a	n/a	Percent	15-140	15-140	n/a	15-150
PCB 4L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 15L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 19L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 37L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 54L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 77L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 81L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 104L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 105L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 114L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 118L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 123L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 126L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 155L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150

Table A-5 - Measurement Quality Objectives for PCB Congeners in Soil Samples

Congener	CAS No.	EDL[(A)]	MRL[(A)]	Unit	LCS %R[(A)]	MS/MSD %R	Precision RPD	Labeled Compound %R
PCB 156L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 157L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 167L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 169L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 188L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 189L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 202L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 205L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 206L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 208L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 209L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 28L	n/a	n/a	n/a	Percent	40-125	40-125	n/a	30-135
PCB 111L	n/a	n/a	n/a	Percent	40-125	40-125	n/a	30-135
PCB 178L	n/a	n/a	n/a	Percent	40-125	40-125	n/a	30-135

Notes:

[(A)] - Based on current laboratory control criteria. Some values may vary slightly between instruments and can be subject to change as the laboratory updates the charted values periodically.

%R - Percent recovery

EDL - Estimated detection limit; value is calculated based on actual instrument response on a sample-specific basis.

LCS/LCSD - Laboratory control samples and laboratory control sample duplicate

MDL - Method detection limit

MRL - Method reporting limit

MS/MSD - Matrix spike and matrix spike duplicate

n/a - not applicable

ng/kg - nanogram per kilogram

RPD - Relative percent difference

Table A-6 - Measurement Quality Objectives for PCB Congeners in Water Samples

Congener	CAS No.	EDL[(A)]	MRL[(A)]	Unit	LCS %R[(A)]	MS/MSD %R	Precision RPD	Labeled Compound %R
PCB 1	2051-60-7	410	1000	pg/L	50-150	50-150	50	n/a
PCB 2	2051-61-8	20	50	pg/L	NA	NA	NA	n/a
PCB 3	2051-62-9	440	1000	pg/L	50-150	50-150	50	n/a
PCB 4	13029-08-8	860	2500	pg/L	50-150	50-150	50	n/a
PCB 5	16605-91-7	55	250	pg/L	NA	NA	NA	n/a
PCB 6	25569-80-6	65	250	pg/L	NA	NA	NA	n/a
PCB 7	33284-50-3	75	250	pg/L	NA	NA	NA	n/a
PCB 8	34883-43-7	605	2500	pg/L	NA	NA	NA	n/a
PCB 9	34883-39-1	100	250	pg/L	NA	NA	NA	n/a
PCB 10	33146-45-1	110	250	pg/L	NA	NA	NA	n/a
PCB 11	2050-67-1	525	5000	pg/L	NA	NA	NA	n/a
PCB 12	2974-92-7	140	500	pg/L	NA	NA	NA	n/a
PCB 13	2974-90-5	140	500	pg/L	NA	NA	NA	n/a
PCB 14	34883-41-5	155	500	pg/L	NA	NA	NA	n/a
PCB 15	2050-68-2	915	2500	pg/L	50-150	50-150	50	n/a
PCB 16	38444-78-9	175	500	pg/L	NA	NA	NA	n/a
PCB 17	37680-66-3	430	1000	pg/L	NA	NA	NA	n/a
PCB 18	37680-65-2	1000	2500	pg/L	NA	NA	NA	n/a
PCB 19	38444-73-4	210	500	pg/L	50-150	50-150	50	n/a
PCB 20	38444-84-7	960	2500	pg/L	NA	NA	NA	n/a
PCB 21	55702-46-0	255	500	pg/L	NA	NA	NA	n/a
PCB 22	38444-85-8	450	500	pg/L	NA	NA	NA	n/a
PCB 23	55720-44-0	250	500	pg/L	NA	NA	NA	n/a
PCB 24	55702-45-9	265	500	pg/L	NA	NA	NA	n/a
PCB 25	55712-37-3	275	500	pg/L	NA	NA	NA	n/a
PCB 26	38444-81-4	415	500	pg/L	NA	NA	NA	n/a
PCB 27	38444-76-7	295	500	pg/L	NA	NA	NA	n/a
PCB 28	7012-37-5	960	2500	pg/L	NA	NA	NA	n/a
PCB 29	15862-07-4	415	1000	pg/L	NA	NA	NA	n/a
PCB 30	35693-92-6	1000	2500	pg/L	NA	NA	NA	n/a
PCB 31	16606-02-3	760	2500	pg/L	NA	NA	NA	n/a
PCB 32	38444-77-8	420	1000	pg/L	NA	NA	NA	n/a
PCB 33	38444-86-9	255	1000	pg/L	NA	NA	NA	n/a
PCB 34	37680-68-5	370	1000	pg/L	NA	NA	NA	n/a
PCB 35	37680-69-6	385	1000	pg/L	NA	NA	NA	n/a
PCB 36	38444-87-0	350	1000	pg/L	NA	NA	NA	n/a
PCB 37	38444-90-5	660	2500	pg/L	50-150	50-150	50	n/a
PCB 38	53555-66-1	415	1000	pg/L	NA	NA	NA	n/a
PCB 39	38444-88-1	425	1000	pg/L	NA	NA	NA	n/a
PCB 40	38444-93-8	595	2500	pg/L	NA	NA	NA	n/a
PCB 41	52663-59-9	595	2500	pg/L	NA	NA	NA	n/a
PCB 42	36559-22-5	305	1000	pg/L	NA	NA	NA	n/a
PCB 43	70362-46-8	470	2500	pg/L	NA	NA	NA	n/a
PCB 44	41464-39-5	975	2500	pg/L	NA	NA	NA	n/a
PCB 45	70362-45-7	255	1000	pg/L	NA	NA	NA	n/a
PCB 46	41464-47-5	505	1000	pg/L	NA	NA	NA	n/a
PCB 47	2437-79-8	975	2500	pg/L	NA	NA	NA	n/a
PCB 48	70362-47-9	380	1000	pg/L	NA	NA	NA	n/a
PCB 49	41464-40-8	575	2500	pg/L	NA	NA	NA	n/a
PCB 50	62796-65-0	290	1000	pg/L	NA	NA	NA	n/a
PCB 51	68194-04-7	255	1000	pg/L	NA	NA	NA	n/a
PCB 52	35693-99-3	955	2500	pg/L	NA	NA	NA	n/a
PCB 53	41464-41-9	290	1000	pg/L	NA	NA	NA	n/a
PCB 54	15968-05-5	590	2500	pg/L	50-150	50-150	50	n/a
PCB 55	74338-24-2	600	2500	pg/L	NA	NA	NA	n/a
PCB 56	41464-43-1	490	1000	pg/L	NA	NA	NA	n/a
PCB 57	74472-33-6	625	2500	pg/L	NA	NA	NA	n/a
PCB 58	41464-49-7	635	2500	pg/L	NA	NA	NA	n/a
PCB 59	74472-33-6	285	1000	pg/L	NA	NA	NA	n/a
PCB 60	33025-41-1	655	2500	pg/L	NA	NA	NA	n/a
PCB 61	33284-53-6	855	2500	pg/L	NA	NA	NA	n/a
PCB 62	54230-22-7	285	1000	pg/L	NA	NA	NA	n/a
PCB 63	74472-34-7	690	2500	pg/L	NA	NA	NA	n/a
PCB 64	52663-58-8	350	1000	pg/L	NA	NA	NA	n/a
PCB 65	33284-54-7	975	2500	pg/L	NA	NA	NA	n/a
PCB 66	32598-10-0	810	2500	pg/L	NA	NA	NA	n/a
PCB 67	73575-53-8	735	2500	pg/L	NA	NA	NA	n/a
PCB 68	73575-52-7	745	2500	pg/L	NA	NA	NA	n/a
PCB 69	60233-24-1	575	2500	pg/L	NA	NA	NA	n/a
PCB 70	32598-11-1	855	2500	pg/L	NA	NA	NA	n/a
PCB 71	41464-46-4	595	2500	pg/L	NA	NA	NA	n/a
PCB 72	41464-42-0	790	2500	pg/L	NA	NA	NA	n/a
PCB 73	74338-23-1	470	2500	pg/L	NA	NA	NA	n/a
PCB 74	32690-93-0	855	2500	pg/L	NA	NA	NA	n/a
PCB 75	32598-12-2	285	1000	pg/L	NA	NA	NA	n/a
PCB 76	70362-48-0	855	2500	pg/L	NA	NA	NA	n/a
PCB 77	32598-13-3	845	2500	pg/L	50-150	50-150	50	n/a
PCB 78	70362-49-1	855	2500	pg/L	NA	NA	NA	n/a
PCB 79	41464-48-6	865	2500	pg/L	NA	NA	NA	n/a
PCB 80	33284-52-5	875	2500	pg/L	NA	NA	NA	n/a
PCB 81	70362-50-4	885	2500	pg/L	50-150	50-150	50	n/a

Table A-6 - Measurement Quality Objectives for PCB Congeners in Water Samples

Congener	CAS No.	EDL[(A)]	MRL[(A)]	Unit	LCS %R[(A)]	MS/MSD %R	Precision RPD	Labeled Compound %R
PCB 82	52663-62-4	665	2500	pg/L	NA	NA	NA	n/a
PCB 83	60145-20-2	1085	2500	pg/L	NA	NA	NA	n/a
PCB 84	52663-60-2	620	2500	pg/L	NA	NA	NA	n/a
PCB 85	65510-45-4	520	1000	pg/L	NA	NA	NA	n/a
PCB 86	55312-69-1	745	2500	pg/L	NA	NA	NA	n/a
PCB 87	38380-02-8	745	2500	pg/L	NA	NA	NA	n/a
PCB 88	55215-17-3	590	2500	pg/L	NA	NA	NA	n/a
PCB 89	73575-57-2	975	2500	pg/L	NA	NA	NA	n/a
PCB 90	68194-07-0	1205	5000	pg/L	NA	NA	NA	n/a
PCB 91	68194-05-8	590	2500	pg/L	NA	NA	NA	n/a
PCB 92	52663-61-3	575	2500	pg/L	NA	NA	NA	n/a
PCB 93	73575-56-1	1105	2500	pg/L	NA	NA	NA	n/a
PCB 94	73575-55-0	605	2500	pg/L	NA	NA	NA	n/a
PCB 95	38379-99-6	1105	2500	pg/L	NA	NA	NA	n/a
PCB 96	73575-54-9	1050	2500	pg/L	NA	NA	NA	n/a
PCB 97	41464-51-1	745	2500	pg/L	NA	NA	NA	n/a
PCB 98	60233-25-2	1105	2500	pg/L	NA	NA	NA	n/a
PCB 99	38380-01-7	1085	2500	pg/L	NA	NA	NA	n/a
PCB 100	39485-83-1	1105	2500	pg/L	NA	NA	NA	n/a
PCB 101	37680-73-2	1205	5000	pg/L	NA	NA	NA	n/a
PCB 102	68194-06-9	1105	2500	pg/L	NA	NA	NA	n/a
PCB 103	60145-21-3	1125	2500	pg/L	NA	NA	NA	n/a
PCB 104	56558-16-8	1140	2500	pg/L	50-150	50-150	50	n/a
PCB 105	32598-14-4	545	1000	pg/L	50-150	50-150	50	n/a
PCB 106	70424-69-0	715	2500	pg/L	NA	NA	NA	n/a
PCB 107	70424-68-9	515	1000	pg/L	NA	NA	NA	n/a
PCB 108	70362-41-3	1355	5000	pg/L	NA	NA	NA	n/a
PCB 109	74472-35-8	745	2500	pg/L	NA	NA	NA	n/a
PCB 110	38380-03-9	1215	5000	pg/L	NA	NA	NA	n/a
PCB 111	39635-32-0	1215	5000	pg/L	NA	NA	NA	n/a
PCB 112	74472-36-9	1225	5000	pg/L	NA	NA	NA	n/a
PCB 113	68194-10-5	1205	5000	pg/L	NA	NA	NA	n/a
PCB 114	74472-37-0	600	2500	pg/L	50-150	50-150	50	n/a
PCB 115	74472-38-1	1215	5000	pg/L	NA	NA	NA	n/a
PCB 116	18259-05-7	520	1000	pg/L	NA	NA	NA	n/a
PCB 117	68194-11-6	520	1000	pg/L	NA	NA	NA	n/a
PCB 118	31508-00-6	965	2500	pg/L	50-150	50-150	50	n/a
PCB 119	56558-17-9	745	2500	pg/L	NA	NA	NA	n/a
PCB 120	68194-12-7	735	2500	pg/L	NA	NA	NA	n/a
PCB 121	56558-18-0	1045	2500	pg/L	NA	NA	NA	n/a
PCB 122	76842-07-4	585	2500	pg/L	NA	NA	NA	n/a
PCB 123	65510-44-3	750	2500	pg/L	50-150	50-150	50	n/a
PCB 124	70424-70-3	1355	5000	pg/L	NA	NA	NA	n/a
PCB 125	74472-39-2	745	2500	pg/L	NA	NA	NA	n/a
PCB 126	57465-28-8	680	2500	pg/L	50-150	50-150	50	n/a
PCB 127	39635-33-1	1390	5000	pg/L	NA	NA	NA	n/a
PCB 128	38380-07-3	620	2500	pg/L	NA	NA	NA	n/a
PCB 129	55215-18-4	1055	2500	pg/L	NA	NA	NA	n/a
PCB 130	52663-66-8	680	2500	pg/L	NA	NA	NA	n/a
PCB 131	61798-70-7	605	2500	pg/L	NA	NA	NA	n/a
PCB 132	38380-05-1	625	2500	pg/L	NA	NA	NA	n/a
PCB 133	35694-04-3	845	2500	pg/L	NA	NA	NA	n/a
PCB 134	52704-70-8	670	2500	pg/L	NA	NA	NA	n/a
PCB 135	52744-13-5	560	2500	pg/L	NA	NA	NA	n/a
PCB 136	38411-22-2	455	1000	pg/L	NA	NA	NA	n/a
PCB 137	35694-06-5	1500	5000	pg/L	NA	NA	NA	n/a
PCB 138	35065-28-2	1055	2500	pg/L	NA	NA	NA	n/a
PCB 139	56030-56-9	980	2500	pg/L	NA	NA	NA	n/a
PCB 140	59291-64-4	980	2500	pg/L	NA	NA	NA	n/a
PCB 141	52712-04-6	465	1000	pg/L	NA	NA	NA	n/a
PCB 142	41411-61-4	1555	5000	pg/L	NA	NA	NA	n/a
PCB 143	68194-15-0	670	2500	pg/L	NA	NA	NA	n/a
PCB 144	68194-14-9	835	2500	pg/L	NA	NA	NA	n/a
PCB 145	74472-40-5	1585	5000	pg/L	NA	NA	NA	n/a
PCB 146	51908-16-8	910	2500	pg/L	NA	NA	NA	n/a
PCB 147	68194-13-8	895	2500	pg/L	NA	NA	NA	n/a
PCB 148	74472-41-6	1620	5000	pg/L	NA	NA	NA	n/a
PCB 149	38380-04-0	895	2500	pg/L	NA	NA	NA	n/a
PCB 150	68194-08-1	1640	5000	pg/L	NA	NA	NA	n/a
PCB 151	52663-63-5	560	2500	pg/L	NA	NA	NA	n/a
PCB 152	68194-09-2	1190	5000	pg/L	NA	NA	NA	n/a
PCB 153	35065-27-1	650	2500	pg/L	NA	NA	NA	n/a
PCB 154	60145-22-4	560	2500	pg/L	NA	NA	NA	n/a
PCB 155	33979-03-2	1695	5000	pg/L	50-150	50-150	50	n/a
PCB 156	38380-08-4	660	2500	pg/L	50-150	50-150	50	n/a
PCB 157	69782-90-7	660	2500	pg/L	50-150	50-150	50	n/a
PCB 158	74472-42-7	480	1000	pg/L	NA	NA	NA	n/a
PCB 159	39635-35-3	1740	5000	pg/L	NA	NA	NA	n/a
PCB 160	41411-62-5	1055	2500	pg/L	NA	NA	NA	n/a
PCB 161	74472-43-8	1760	5000	pg/L	NA	NA	NA	n/a
PCB 162	39635-34-2	1775	5000	pg/L	NA	NA	NA	n/a
PCB 163	74472-44-9	1055	2500	pg/L	NA	NA	NA	n/a
PCB 164	74472-45-0	680	5000	pg/L	NA	NA	NA	n/a
PCB 165	74472-46-1	1805	5000	pg/L	NA	NA	NA	n/a

Table A-6 - Measurement Quality Objectives for PCB Congeners in Water Samples

Congener	CAS No.	EDL[(A)]	MRL[(A)]	Unit	LCS %R[(A)]	MS/MSD %R	Precision RPD	Labeled Compound %R
PCB 166	41411-63-6	620	2500	pg/L	NA	NA	NA	n/a
PCB 167	52663-72-6	575	2500	pg/L	50-150	50-150	50	n/a
PCB 168	59291-65-5	650	2500	pg/L	NA	NA	NA	n/a
PCB 169	32774-16-6	805	2500	pg/L	50-150	50-150	50	n/a
PCB 170	35065-30-6	810	2500	pg/L	NA	NA	NA	n/a
PCB 171	52663-71-5	1870	5000	pg/L	NA	NA	NA	n/a
PCB 172	52663-74-8	1885	5000	pg/L	NA	NA	NA	n/a
PCB 173	68194-16-1	1870	5000	pg/L	NA	NA	NA	n/a
PCB 174	38411-25-5	930	2500	pg/L	NA	NA	NA	n/a
PCB 175	40186-70-7	1915	5000	pg/L	NA	NA	NA	n/a
PCB 176	52663-65-7	1925	5000	pg/L	NA	NA	NA	n/a
PCB 177	52663-70-4	705	2500	pg/L	NA	NA	NA	n/a
PCB 178	52663-67-9	1105	2500	pg/L	NA	NA	NA	n/a
PCB 179	52663-64-6	1145	2500	pg/L	NA	NA	NA	n/a
PCB 180	35065-29-3	680	2500	pg/L	NA	NA	NA	n/a
PCB 181	74472-47-2	1980	5000	pg/L	NA	NA	NA	n/a
PCB 182	60145-23-5	1990	5000	pg/L	NA	NA	NA	n/a
PCB 183	52663-69-1	2005	5000	pg/L	NA	NA	NA	n/a
PCB 184	74472-48-3	2015	5000	pg/L	NA	NA	NA	n/a
PCB 185	52712-05-7	2005	5000	pg/L	NA	NA	NA	n/a
PCB 186	74472-49-4	2035	5000	pg/L	NA	NA	NA	n/a
PCB 187	52663-68-0	955	2500	pg/L	NA	NA	NA	n/a
PCB 188	74487-85-7	1175	2500	pg/L	50-150	50-150	50	n/a
PCB 189	39635-31-9	885	2500	pg/L	50-150	50-150	50	n/a
PCB 190	41411-64-7	1170	2500	pg/L	NA	NA	NA	n/a
PCB 191	74472-50-7	2090	5000	pg/L	NA	NA	NA	n/a
PCB 192	74472-51-8	2100	5000	pg/L	NA	NA	NA	n/a
PCB 193	69782-91-8	680	2500	pg/L	NA	NA	NA	n/a
PCB 194	35694-08-7	850	2500	pg/L	NA	NA	NA	n/a
PCB 195	52663-78-2	2135	5000	pg/L	NA	NA	NA	n/a
PCB 196	42740-50-1	2145	5000	pg/L	NA	NA	NA	n/a
PCB 197	33091-17-7	1225	5000	pg/L	NA	NA	NA	n/a
PCB 198	68194-17-2	1015	2500	pg/L	NA	NA	NA	n/a
PCB 199	52663-75-9	1015	2500	pg/L	NA	NA	NA	n/a
PCB 200	52663-73-7	1225	5000	pg/L	NA	NA	NA	n/a
PCB 201	40186-71-8	2200	5000	pg/L	NA	NA	NA	n/a
PCB 202	2136-99-4	2210	5000	pg/L	50-150	50-150	50	n/a
PCB 203	52663-76-0	2220	5000	pg/L	NA	NA	NA	n/a
PCB 204	74472-52-9	2235	5000	pg/L	NA	NA	NA	n/a
PCB 205	74472-53-0	2245	5000	pg/L	50-150	50-150	50	n/a
PCB 206	40186-72-9	2255	5000	pg/L	50-150	50-150	50	n/a
PCB 207	52663-79-3	2265	5000	pg/L	NA	NA	NA	n/a
PCB 208	52663-77-1	2275	5000	pg/L	50-150	50-150	50	n/a
PCB 209	2051-24-3	765	2500	pg/L	50-150	50-150	50	n/a
PCB 1L	n/a	n/a	n/a	Percent	15-140	15-140	n/a	15-150
PCB 3L	n/a	n/a	n/a	Percent	15-140	15-140	n/a	15-150
PCB 4L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 15L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 19L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 37L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 54L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 77L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 81L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 104L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 105L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 114L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 118L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 123L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 126L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 155L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 156L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 157L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 167L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 169L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 188L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 189L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 202L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 205L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 206L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 208L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 209L	n/a	n/a	n/a	Percent	30-140	30-140	n/a	25-150
PCB 28L	n/a	n/a	n/a	Percent	40-125	40-125	n/a	30-135
PCB 111L	n/a	n/a	n/a	Percent	40-125	40-125	n/a	30-135
PCB 178L	n/a	n/a	n/a	Percent	40-125	40-125	n/a	30-135

Notes:

[(A)] - Based on current laboratory control criteria. Some values may vary slightly between instruments and can be subject to change as the laboratory updates the charted values periodically.

%R - Percent recovery

EDL - Estimated detection limit; value is calculated based on actual instrument response on a sample-specific basis.

LCS/LCSD - Laboratory control samples and laboratory control sample duplicate

MDL - Method detection limit

MRL - Method reporting limit

MS/MSD - Matrix spike and matrix spike duplicate

n/a - not applicable

pg/L - picogram perliter

RPD - Relative percent difference

APPENDIX B

Archaeological Resource Assessment (prepared by SWCA)

Archaeological Resources Assessment for the Kimberly-Clark Worldwide Site Upland Area, Everett, Snohomish County, Washington

Archaeological Resources Assessment for the Kimberly-Clark Worldwide Site Upland Area, Everett, Snohomish County, Washington

REDACTED FOR GENERAL DISTRIBUTION

March 25, 2013

Report Number 24976

SWCA/Northwest Archaeological Associates
Seattle, Washington

ARCHAEOLOGICAL RESOURCES ASSESSMENT FOR THE KIMBERLY-CLARK WORLDWIDE SITE UPLAND AREA, EVERETT, SNOHOMISH COUNTY, WASHINGTON

Report Prepared for
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By
Brandy Rinck, Sharon Boswell, and Johonna Shea

March 25, 2013

Report Number 24976

REDACTED FOR GENERAL DISTRIBUTION

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ABSTRACT

The Kimberly-Clark Worldwide (K-C WW) upland area was developed for historical pulp and paper manufacturing and the area is contaminated as a result of the industrial operations. The existing pulp and paper mill will be demolished to prepare the upland area for cleanup and eventual land use change. The Department of Ecology and K-C WW, Inc. have executed an Agreed Order to complete studies related to future cleanup as well as opportunistic interim action cleanup activities during demolition of the mill. As required by the Interim Action Plan, which is Exhibit C to the Agreed Order, SWCA Environmental Consultants has assessed the probability for encountering archaeological deposits or objects during cleanup of the contaminated K-C WW upland area, concentrating on 11 areas called out in opportunistic cleanup plans. This assessment includes background information on the setting of the project area, expectations for buried cultural resources based on previous investigations in the vicinity, and a GIS-based probability map showing areas with low, medium, and high potential to harbor significant archaeological materials in the entire K-C WW Upland project area. Areas with high probability for buried cultural resources will be addressed during future project construction and a monitoring and discovery plan will be developed for use during opportunistic cleanup.

TABLE OF CONTENTS

Cover: Overview of Port Gardner waterfront, looking north from approximately Hewitt Ave, showing the project area. Photograph by R. King and D.W. Baskerville, taken March 1, 1892. Everett Public Library, King and Baskerville Collection, Image 0065.

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The Department of Ecology (Ecology) and Kimberly-Clark Worldwide (K-C WW), Inc. have executed an Agreed Order to complete studies for future cleanup as well as interim cleanup activities within the K-C WW Upland Area on the Everett waterfront at 2600 Federal Avenue. The most recent mill on the property has since closed and the mill structures will be demolished in preparation for land use change. The area was contaminated by past industrial operations with petroleum, heavy metals, and volatile organic compounds that warrant remediation opportunistically during mill demolition. K-C WW has contracted with Aspect Consulting LLC (Aspect) to plan the mill cleanup efforts and Aspect retained SWCA Environmental Consultants (SWCA) to assess the probability for encountering archaeological deposits or objects during the interim action cleanups. This assessment includes background information on the natural and cultural setting of the project area, expectations for buried cultural resources based on previous archaeological and geotechnical investigations in the K-C WW upland area vicinity, and a probability map showing areas with low, medium, and high potential to contain significant archaeological materials.

Project Location and Description

The project is in Section 19 of Township 29 North, Range 5 East, Willamette Meridian (Figure 1). The K-C WW property includes about 56 acres of uplands and 12 acres of adjacent tidelands. The west property boundary is adjacent to the East Waterway in Port Gardner Bay of Possession Sound and the east property boundary is at the BNSF Railroad right-of-way. The north project boundary is at the foot of 21st Street and the south project boundary is at the foot of Everett Avenue.

In December 2012, an Agreed Order was signed by Ecology and K-C WW, Inc. in order to complete this project. The Agreed Order requires a Remedial Investigation and Feasibility Study (RI/FS) and a Cleanup Action Plan (CAP) prior to the start of final cleanup of the K-C WW Upland Area. The Agreed Order allows for opportunistic cleanup of contamination, called interim action, during mill demolition that will occur while the RI/FS is underway. The Agreed Order only covers the upland portion of the property, so no cleanup activities are currently planned for the 12 acres of tidelands on K-C WW's property. The tidelands will be addressed under a separate future Agreed Order. K-C WW, Inc. is now conducting the studies needed to draft the Cleanup Action Plan and would like to complete opportunistic cleanup interim actions while the studies are carried out, since the mill structures are being demolished (Figure 2). At the time of this assessment, 11 specific areas are identified where opportunistic cleanup will occur, including the Naval Reserve Parcel UST area (1), Xylene UST 29/Latex Spill (2), Rail Car Dumper Hydraulic System Building (3), Diesel UST 70 (4), Bunker C USTs71/72/73 (5), Boiler/Baghouse Area (6), Heavy Duty Shop sump (7), GF 11 (8), Diesel AST Area (9), Bunker C ASTa (10), Bunker C ASTb (11) (Figure 3). Additional areas may be identified for opportunistic cleanup as demolition proceeds.

Most of the contamination to be cleaned up is within historical fill, but some cleanup excavations will penetrate into underlying naturally deposited sediment. Because all the contaminated areas to be targeted during interim action are not currently known, excavation quantities and dimensions cannot yet be estimated. No vegetation removal or in-water work, including dredging, drilling, dumping, filling, mining, bulk-heading, pile driving, or piling removal will occur during the opportunistic interim action cleanup efforts.

Regulatory Context

The project is subject to the Washington State Environmental Policy Act (SEPA) that requires the project proponent to identify any places or objects listed on, or eligible for national, state, or local preservation

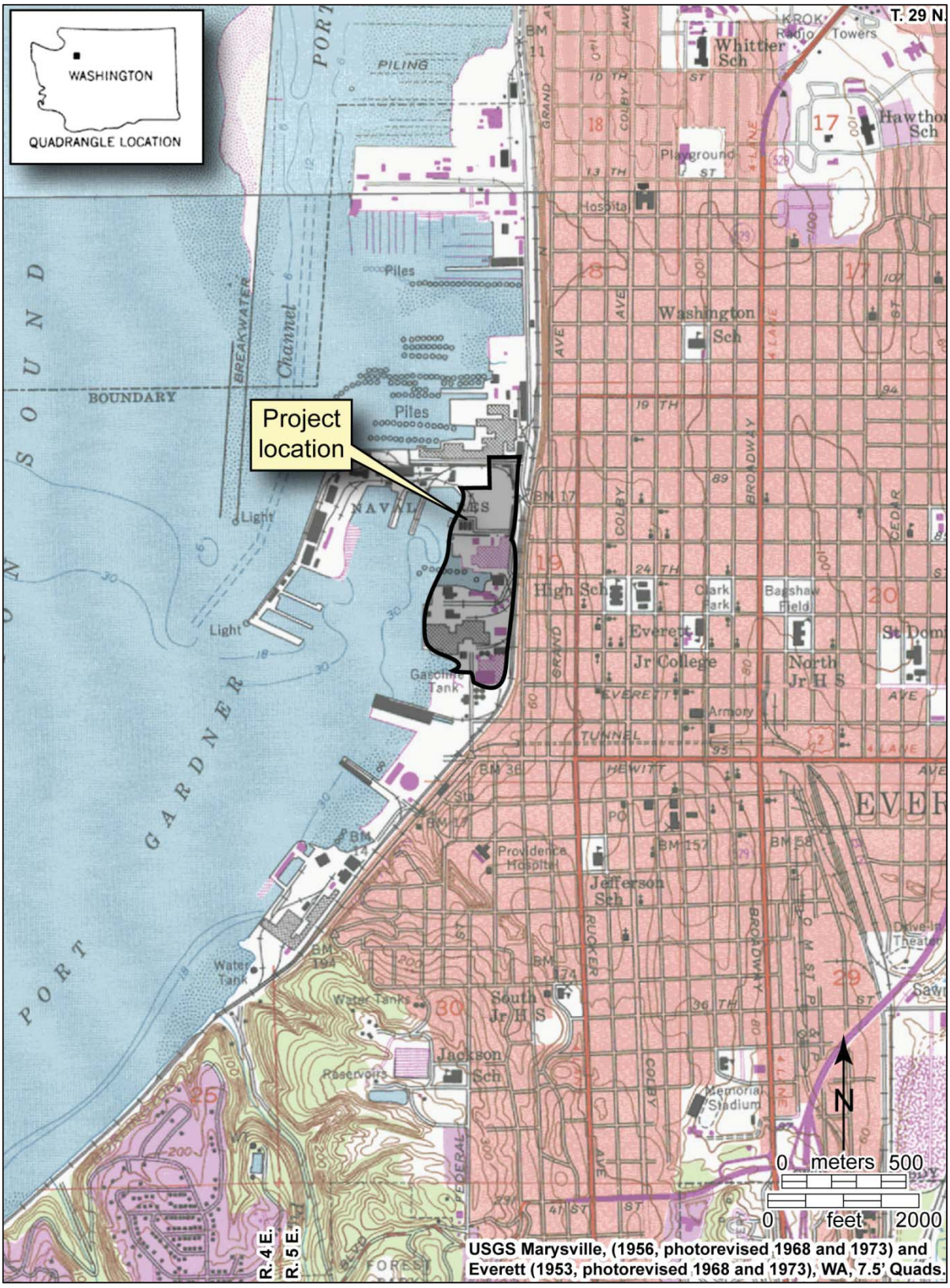

Figure 1. Project location.

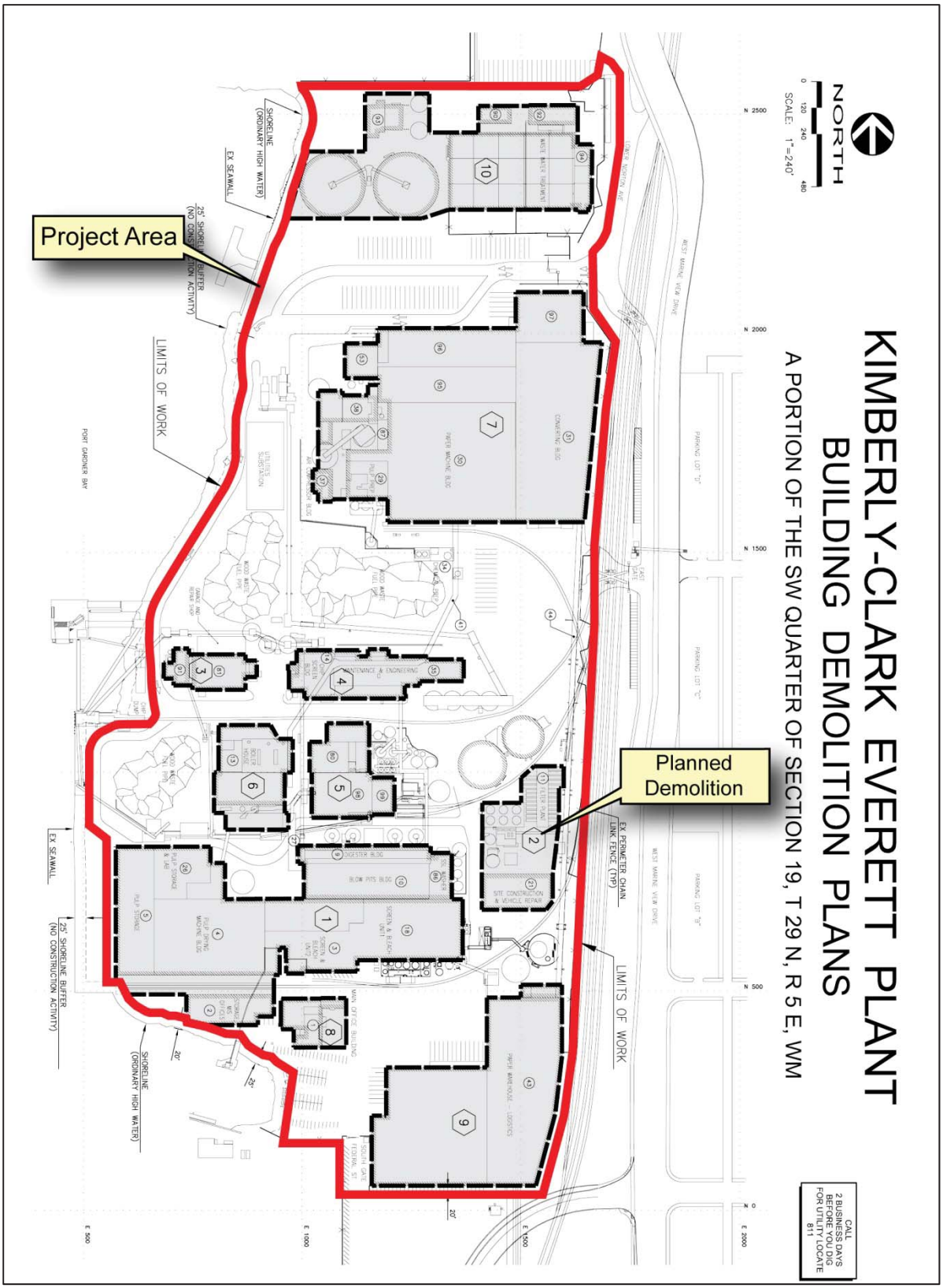

Figure 2. K-C WW upland project area showing the uplands, tidelands, and mill structures demolished during interim action cleanup efforts.

Figure 3. Proposed opportunistic cleanup locations in the K-C WW upland area.

registers in the vicinity of the project. The regulation also requires proponents to describe evidence for sites of historic, archaeological, scientific, or cultural importance in the vicinity of a project, and describe proposed measures to reduce or control impacts to those sites. Agencies are encouraged by SEPA to consult with others to find acceptable ways to avoid or mitigate any adverse impacts that may be caused by the project. Ecology prepared a SEPA checklist to identify potential project impacts to the surrounding environment in 2012 and determined the environmental cleanup will have no probable significant adverse impacts.

The project is also subject to several Washington state laws pertaining to archaeological cultural resources. For example, the Archaeological Sites and Resources Act [RCW 27.53] prohibits knowingly excavating or disturbing prehistoric and historic archaeological sites on public or private land. The Indian Graves and Records Act [RCW 27.44] prohibits knowingly destroying American Indian graves and provides that inadvertent disturbance through construction or other activities requires re-interment under supervision of the appropriate Indian tribe. In order to prevent the looting or depredation of sites, any maps, records, or other information identifying the location of archaeological sites, historic sites, artifacts, or the site of traditional ceremonial, or social uses and activities of Indian Tribes are also exempt from disclosure [RCW 42.56.300]. One goal of this assessment is to assist Aspect, Ecology, and K-C WW, Inc. in complying with these state laws and regulations.

Tribal Coordination

The current work at the K-C WW upland area is part of the Puget Sound Initiative (PSI) and Ecology has engaged the Tulalip Tribes about the PSI in the past. Ecology has developed contacts with cultural and natural resource staff members within the tribal community and has met with them to discuss PSI cleanup sites and cultural resources. Most of this communication has been in relation to other cleanup efforts in Port Gardner, but the Tulalip Tribes have been provided with specific information concerning the K-C WW upland area, as well. [redacted]

SETTING

Port Gardner is a shallow saltwater embayment on the northwest tip of the Everett Peninsula at the mouth of the Snohomish River. The Port is partially separated from Possession Sound by Jetty Island, a 2-mile-long, narrow, manmade island that blocks the dredged East Waterway of the Snohomish River mouth from being naturally filled with sediment. Port Gardner has been influenced by geologic events and geomorphologic changes throughout its history, including ice sheet glaciation, tectonic activity, climate change, and sea-level rise, and these processes have shaped the modern topography of the area. Human settlement and subsistence pursuits within the project area were structured by the attraction of and ease of access to abundant natural resources in the lowland delta, shoreline, and estuarine environments of the Snohomish River delta. Environmental diversity and a variety of natural resources concentrated in the project vicinity created an ideal location for both pre-contact and early Euroamerican populations. Ethnographic and historic records provide complementary information

about more recent native cultural land use practices. Historical development of Port Gardner, especially dredging and filling, altered the natural geomorphology of the project vicinity.

Natural Setting

The environmental setting of the project area informs our expectations for cultural resources that may be found in its vicinity. Archaeological evidence indicates that people were living in what is now Washington by at least 13,800 years ago (Waters et al. 2011). Sea level fluctuation, climate variation, and tectonic activity have been the dominant forces of environmental change since the end of the Pleistocene. These environmental changes have affected the potential distribution of resources used by people as well as the suitability of particular landforms for human occupation throughout the Holocene. Other changes in the preservation and visibility of the archaeological record can be attributed to more recent development of the vicinity.

Geology

The Project is in the Puget Lowland, a large structural trough between the Cascade Range and the Olympic Mountains (Orr and Orr 1996). The Puget Lowland developed as a fore-arc basin during early subduction of the Juan de Fuca tectonic plate beneath the North America plate. More specifically, the project vicinity is bounded by active fault zones in the Everett Basin (Golder Associates, Inc. 2007). The Tertiary period sedimentary bedrock that is buried deep below the project area is covered by thick (305 to 945 meters) unconsolidated sediment that mainly originates from glacial ice (Johnson et al. 1996, 2001; Jones 1999; Mosher et al. 2000).

The modern topography and surficial geology of the Puget Lowland is the result of multiple continental glaciations that extended south from what is now British Columbia during the Pleistocene, between 1.8 million and 10,000 years ago. The last glacial maximum, known regionally as the Vashon Stade of the Fraser glaciation, began about 25,000 years ago and ended abruptly with the onset of climatic warming at the end of the Pleistocene (Easterbrook 2003). The Cordilleran Ice Sheet reached its maximum extent near the present town of Tenino, 83 miles (134 kilometers) southwest of the K-C WW upland area, about 16,950 calibrated years before the present (BP) during the Vashon Stade. The ice over the project area was about 1,300 meters (4,265 feet) at its thickest (Clague et al. 1980; Thorson 1989). The ice sheet retreated rapidly from the Puget Lowland after about 13,650 years ago if expressed as an uncalibrated radiocarbon date (Menard 1985; Porter and Swanson 1998; Thorson 1989). Large glacial lakes commonly formed along the ice front as the ice sheet retreated, inundating the land in the Puget Lowland that was not covered by ice. Most of the surficial deposits east of the project area were deposited during the Fraser glaciation, including glacial till that was deposited directly by ice and outwash that was deposited by glacial meltwater (Armstrong et al. 1965; Booth 1994; Booth and Goldstein 1994; Booth et al. 2004; Johnson et al. 2001; Menard 1985; Polenz et al. 2005).

Incision occurred when the Cordilleran Ice Sheet overrode the outwash, creating a number of large deep troughs and meltwater channels. As a result, the geomorphology of the Lowland is now dominated by well-defined, north-south-trending ridges that are separated by extensive uplands blanketed by glacial drift or till. The surfaces of the uplands commonly have topographic depressions that are occupied by small lakes and bogs (Mullineaux 1970). Much of the upland surfaces have not been extensively modified by postglacial erosion, except where streams have carved short, steep-sided canyons down to the Puget Sound. Pigeon Creek, which empties into Possession Sound just south of the K-C WW upland area, is an example of a creek that drains the glacial upland.

Global sea level was about 119 meters (390 feet) below the present shoreline during the last glacial maximum because of the large amount of water locked up in the ice. Global sea level rose rapidly as ice sheets around the world melted at the close of the Pleistocene. Marine water flooded the Puget Lowland after the ice sheet retreated past Admiralty Inlet, connecting the Puget Sound to the Pacific Ocean. Continued global sea level rise raised sea level to between 55 and 73 meters (180 and 240 feet) in elevation around 13,500 BP (Anundsen et al. 1994; Blunt et al. 1987; Booth et al. 2004; Carlstad 1992; Dethier et al. 1995, Easterbrook 2003, 1966; Kovanen and Slaymaker 2004; Polenz et al. 2005; Porter and Swanson 1998; Swanson 1994; Thorson 1980, 1981). The K-C WW upland area is at a very low modern elevation, so the entire project area would have been inundated during this marine high stand.

Relative sea level in the Puget Sound remained elevated and in sync with global sea level trends until the land in the Pacific Northwest began to rebound from the weight of the ice sheet (Thorson 1989). Depressed land areas uplifted up to 80 meters (260 feet) in the northern Puget Lowland, with the amount of uplift decreasing to the south where the ice was thinner. Uplift in the Everett vicinity is estimated at approximately 40 meters (130 feet) (Thorson 1989). Rebound of the land outpaced global sea level rise between about 12,000 and 9,000 years ago. The K-C WW upland area would have been exposed above the shoreline during the period of rebound. Rebound was complete by about 9,000 years ago and global sea level rise was once again the dominant geologic force in the region. Continued sea level rise quickly drowned the earliest Holocene shorelines again after about 9,000 years ago and renewed deltaic sedimentation and formation of deltas in Puget Sound embayments, such as the Snohomish River delta in Port Gardner (Crandell 1963; Dragovich et al. 1994). After 7,000 years ago, the rate of global sea level rise began to slow. Relative sea level was about 5 meters (16 feet) below the modern shoreline by about 5,000 years ago (Dragovich et al. 1994).

The Puget Lowland is geologically active due to structural deformation associated with the Cascadia Subduction Zone. Research on the Snohomish River delta, about 2 miles (3.2 kilometers[km]) north of the K-C WW upland area, found evidence for at least five episodes of plate movement since about AD 800 that resulted in three episodes of liquefaction, at least one abrupt subsidence event, and at least one tsunami (Bourgeois and Johnson 2001). The evidence for tectonic activity could be linked to a number of different fault zones and known tectonic events in the Lowland. Faulting on the Utsalady strand of the Darrington-Devils Mountain Fault Zone (DDMFZ), 21 miles (34 km) northwest of Everett on Camano Island, at least twice within the last 2,200 years may be responsible for some evidence for plate movement recorded in the Snohomish delta sediments (Johnson et al. 2003, 2004). Tectonic activity on the Seattle Fault Zone (SFZ), 26 miles (39 km) to the south, is known to have occurred in the past 1100 years and may also be responsible for signals of delta subsidence (Johnson et al. 2004). At least some of the Snohomish delta evidence also relates to tectonic activity along the South Whidbey Island Fault Zone (SWFZ), which crosses the Puget Sound just south of the project area (Johnson et al. 1996). Movement along these boundaries affects the condition and location of archaeological materials buried within the Snohomish River delta. Because movement along the fault zones differ in direction and magnitude during each event it is unclear just how much vertical offset the project area has experienced throughout the Holocene. One of the consequences of the vertical movement is the possibility of deeply buried archaeological sites in Snohomish River delta and floodplain sediments, especially if subsidence has governed. Sudden subsidence may preserve archaeological sites by quickly burying them through bank sloughing or sedimentation along the shoreline. A landslide appears to have occurred east of the K-C WW upland area in the past, based on the slumped nature of the bluffs to the north in historic documents and the now relatively gentle slope from the upland to the shoreline. Sediment composing the bluffs backing the coast probably collapsed into the sea, burying the shoreline.

Geomorphology

The East Waterway was historically dredged between the mainland shoreline and the mouth of the Snohomish River. The dredge was used as fill, called "Tract O," which maintained separation between the Snohomish River channel and the waterway that reaches a depth of 30 feet below mean lower low water (MLLW) (Eldridge and Orlob 1951). The K-C WW upland area is on the east side of the East Waterway. The surficial geology of the entire project area is mapped as artificial fill (Qf) (Menard 1985). This means fill is present across the entire surface of the K-C WW upland area, but the fill is of varying thicknesses, depending on the underlying landform. It is probable that some of the fill came from dredging the waterway or other dredging that commonly took place on the delta. It is also probable that the fill in the project area originated as mill waste and was dumped directly into Port Gardner from the shoreline (Orlob and Eldridge 1954).

A small bench of sandy advance outwash (Qgat) is mapped along the hillside at the east edge of the project. These outwash deposits are very old, representing the transition from the Fraser glacial period to pre-Fraser deposition, and they predate the arrival of humans to the region. The bench may be a landslide deposit that sloughed off of the bluffs and into Port Gardner during the Pleistocene. Vashon till (Qgt) is mapped to the east of the project boundary on the glacial upland at Everett (Menard 1985). Soils mapped in the project vicinity reflect the glacial origin of the sediments they formed within. For example, soils along Grand Avenue at the east edge of the project are mapped as Alderwood-Urban land complex (Debose and Klungland 1983). Alderwood soils form in glacial drift on glacially modified foothills and valleys. Everett soils, which form in glacial till, are mapped on the uplands east of the project (Debose and Klungland 1983). Cultural materials, if present, would not be deeply buried within the glacial soils and sediments. The project area is classified by soil scientists as Urban Land (NRCS 2013). There is potential for cultural materials to be buried deeply below fill along the historical shoreline where beach alluvium is below the urban land. The glacial sediment bench is a unique feature along the Puget Sound coastline between Mukilteo and Everett, which is mainly characterized by steep bluffs. The gentler slope in the project vicinity would have provided easier access down to the waterfront from the uplands.

Puget Sound shorelines are typically low-energy environments and are composed of mixed sand and gravel beaches. A beach profile that consists of one part gravelly or coarse sandy steep foreshore and one part low-gradient sandy or muddy low-tide terrace is typical of the region. Most of the sediment that has collected on the beach berm and backshore is too coarse to be carried by waves or tidal currents on a daily basis because it was deposited during winter storms. Sediment on the upper foreshore is moved little by little along the shoreline because it is the right size to be carried as bedload in the swash zone of waves. Tidal currents and waves carry finer-grained sediment down the coastline in suspension following longshore drift currents, dropping the silts and clays on the tideflat and in marshes when energy slows. The major source of sediment coming in to the project area before historical filling began was probably derived from the surrounding bluffs. The large variation in buried beach deposits in the project area attests to the glacial source of the beach sediment. Wave-induced erosion and the toe of the bluffs and gravity would have dislodged and reworked till, outwash, glaciomarine, and glaciolacustrine deposits in the vicinity into a heterogeneous beach. Another source of sediment into the project area would be the Snohomish River, which empties into Port Gardner and forms a wide delta just north of the project. Prevailing winds arrive from the south east, so waves would push sediment from the river into the project area. Even with such vast sediment sources, the Everett coastline in the project vicinity appeared to have been relatively straight without barrier or accretionary landforms. The wide berm in the project area is evidence for healthy past sources of sediment.

The Snohomish River Delta

The Snohomish River begins at the confluence of the Skykomish and Snoqualmie Rivers near Monroe, WA and ends in Port Gardner Bay. About 7.5 miles (12 kilometers) upstream from Port Gardner, the main channel of the Snohomish River splits into four distributaries including Ebey, Steamboat, and Union Sloughs and the Snohomish River channel mainstem. The distributaries of the Snohomish River occupy the entire bottom of the wide valley, which is bounded to the north and south by glacial moraines. The river delta filled in this valley forming the flat deltaic plain that the Snohomish River runs across today. Channel migration has reworked the delta plain resulting in a floodplain environment with wetlands transitioning downstream into estuaries that are heavily influenced by tides (Snohomish County Public Works Department 1991). Port Gardner Bay communicates with Possession Sound, which is bounded by the Everett mainland on the east and Whidbey Island on the west and it opens to Puget Sound on the south and to Port Susan and Saratoga Passage at the north.

Lower sea-levels during the early Holocene drove the Snohomish River to cut down through glacial sediment to reach a lower base-level. Elevated mid-Holocene sea level resulted in sedimentation in the valley bottom and infilling of the valley that was incised just a few thousand years earlier. Sedimentation in the valley bottom led to delta progradation at the river mouth. Port Gardner filled with sediment and the low-lying Holocene shorelines were buried. The lower Snohomish River valley filled from south to north with the oldest alluvium around Lowell and the youngest near Everett and then from east to west to reach around the Everett peninsula (Armstrong et al. 1965). The Snohomish River channels matured over time and developed meanders, levees, and sloughs in which they deposited gravels, sand and silt. The delta had been aggrading at a relatively constant rate until historic logging practices altered natural processes in the basin. The 1 to 4 meters of sediment exposed in the main river channel and slough cut banks in the lower delta typically reveal deposits accumulated during the last 1500 years (Bourgeois and Johnson 2001). According to Bourgeois and Johnson (2001), the Snohomish River delta channels and marshes have not migrated laterally since about 800 AD. The delta continued to grow west and curved around the Everett Peninsula throughout the late Holocene. Today, the very edge of the delta is just north of the project. The delta has not filled in Port Gardner in the vicinity of the project, so there is very deep water in the bay just west of the shoreline that is useful for harboring ships. The delta did provide alluvial sediment south of its proximal margin during the late Holocene and Snohomish River alluvium contributed to widening of the marsh and tideflats in the project vicinity.

Flora and Fauna

Vegetation across the Puget Lowland has changed significantly since the end of the Pleistocene. Lodgepole pine colonized newly deglaciated surfaces, followed quickly by Douglas fir, spruce, and alder. The climate of the Pacific Northwest was warmer and drier than today between about 10,000 and 6000 BP, with drought-like conditions in the summers (Whitlock 1992). Forests were more open and prairies were common throughout the Puget Lowland. Conditions similar to those today developed after 6000 BP as temperatures cooled and precipitation increased. Closed-canopy forest of western red cedar, western hemlock, and Douglas fir had become established in the Puget Lowland by about 5000 BP. Climate and vegetation have remained generally stable in western Washington since the mid-Holocene (Whitlock 1992).

Today, the Puget Lowland is part of the *Tsuga heterophylla* (western hemlock) vegetation zone, which is characterized by forests of western hemlock, western red cedar, and Douglas fir (Franklin and Dyrness 1973). Ground cover in the western hemlock vegetation zone is typically comprised of dense shrub and herbaceous undergrowth of sword fern, salal, Oregon grape, ocean spray, blackberry, red huckleberry,

and red elderberry. Big leaf maple, red alder, black cottonwood, and other riparian plants thrive on the Snohomish River floodplain to the northeast. Wetlands and marshes typically support willow, alder, reeds, wapato, nettles, grasses, and skunk cabbage and these species would be found in the project vicinity (Franklin and Dyrness 1973). Estuarine environments contain salal, tule, cattail, stinging nettle, and a variety of roots and bulbs (Deur and Turner 2005). Plants that may have been present in the K-C WW upland site vicinity prior to historical development that would have been useful for food include blackberry, serviceberry, cranberry, thimbleberry, huckleberry, bracken, wood, and sword ferns, wild carrots, rose hips, tiger lilies, and crab apples. Numerous other plants found in the region provided fuel, medicines, and materials for tools, shelter, and transportation (Gunther 1945).

Large terrestrial animals that were once or are still found in the K-C WW upland area vicinity include elk, deer, black bear, coyote, bobcat, and mountain lion. Smaller mammals, including rabbit, squirrel, chipmunk, raccoon, weasel, beaver, and river otter are also resident around the APE (Ingles 1965; Larrison 1967). Migratory birds, such as geese, ducks, swans, and other water fowl are seasonally abundant in saltwater bays, sloughs, and on the river delta in the project vicinity (Angell and Balcomb 1982). Marine animal resources in north Puget Sound include several species of salmon, steelhead, flounder, perch, rockfish, dogfish, lingcod, herring, smelt, and sole (Miller and Borton 1980). Five salmon species use the Snohomish River for spawning and rearing, including Chinook, coho, chum, pink, and sockeye salmon, and steelhead, rainbow trout, cutthroat trout, and bull trout also use the river and would have been available for local fishers (Snohomish Basin Salmon Recovery Forum 2005). Although the project area is saltwater, the salmon species would have entered the Snohomish River by passing through its mouth, which is adjacent to the K-C WW upland area. Herring populations spawned in shallows in the Port Gardner, making them important forage fish for salmon populations and humans (Washington State Conservation Commission 2000). Mussels, clams, oysters, sea urchins, and other shellfish are available in various intertidal environments in the vicinity as well (Kozloff 1996). Marine mammals including harbor seal, sea lion, porpoise, orca, and whales also frequent the Puget Sound seasonally or year-round (Kruckeburg 1991).

Cultural Setting

People have lived on the accessible shores of Port Gardner Bay [redacted] for thousands of years. Native people used the [redacted] shoreline for shellfish collection, hunting, plant gathering and fishing. [redacted]. The shorelines were developed quickly after the Euroamericans converted their interests in the region from exploration to settlement. The history of this area is one of changing economic strategies, residence patterns, and population growth.

Prehistory

Evidence for the first human presence in the region roughly corresponds with glacial retreat from the Puget Lowland (Carlson 1990). The earliest well-established cultural period in North America, designated the Paleoindian period, is poorly defined and is represented by a few archaeological sites. A small number of isolated fluted projectile points that are characteristic of the Paleoindian period have been found in western Washington (Avey n.d.; Carlson 1990; Kopperl et al. 2010; Meltzer and Dunnell 1987; Osborne 1956). Other evidence of possible early human occupation involving the pursuit of now-extinct fauna was found at the Manis mastodon site on the Olympic Peninsula, radiocarbon dated to about 12,000 years ago (Gustafson et al. 1979; Gustafson and Manis 1984; Kirk and Daugherty 1978). Inferences about Paleoindian lifeways have been limited to presumptions about activities based on the isolated stone tools and their rare association with large extinct mammals, with few additional insights

on subsistence economy or other aspects of culture. The projectile point styles of the Paleoindian period apparently did not persist past 10,000 years ago as they were replaced by regional variants (Carlson and Dalla Bona 1996).

Holocene occupation of the Puget Sound region is better understood than occupation during the Paleoindian period. Archaeological sites that represent the Early period (8000 to 5000 BP) or Old Cordilleran culture are locally termed "Olcott," [redacted] (Butler 1961; Fladmark 1982; Kidd 1964; Mattson 1985). Typical Olcott artifacts are large stemmed or leaf-shaped points, scrapers, cobble flake tools and blade cores formed of basalt and dacite toolstone (Carlson 1990). Olcott sites are often located on glacial terraces or along lakes on glacial uplands (Wessen and Welch 1991). Many Olcott sites are classified as stone tool manufacturing sites because archaeological features with faunal and plant remains are ordinarily absent (Morgan 1999). Olcott assemblages are usually interpreted as evidence of an early, highly mobile hunting and gathering adaptation. Age estimates of Olcott sites have been inferred based on their similarity to dated components of assemblages from archaeological sites in British Columbia, as well as using projectile point cross-dating, obsidian hydration analysis, and luminescence dating of two archaeological sites [redacted] (Carlson and Dalla Bona 1996; Chatters et al. 2011). This land use pattern may have persisted for over 6,000 years and near its end is marked by increasing reliance on marine and riverine resources. Marine resource use may extend back farther in time, but evidence that might exist on early shorelines has been inundated by rising sea levels which reached near-modern elevations only about 5000 BP.

After about 5000 BP, larger populations organized in more complex ways to exploit a wide range of locally available resources including large and small mammals, shellfish, fish, berries, roots, and bulbs, with an increasing emphasis on salmon over time. Shell middens containing large quantities of shellfish remains and marine fish and mammal bone are common on the saltwater shoreline. Groundstone, bone, antler, and shell tools became increasingly common and more diversified through time. Full-scale development of marine-oriented cultures on the coast and inland hunting, gathering, and riverine fishing traditions as represented in the ethnographic record are apparent after about 2500 BP (Blukis Onat 1987). Large semi-sedentary populations occupied cedar plank houses located at river mouths and confluences and on protected shorelines. Artifacts made of both local and imported materials occur, indicating complex and diversified technologies for fishing, hunting, food processing, and storage. Wealth-status objects, status differentiation in burials, art objects, and ornaments are also represented during this period (Ames and Maschner 1999; Blukis Onat 1987; Matson and Coupland 1995; Fladmark 1982). Contact with Euroamericans in the late 18th Century lead to drastic changes in all Native American communities in the region, especially due to disease (Boyd 1998; Campbell 1989).

Ethnography

Ancestors of the Snohomish people lived in the project vicinity at the time of European contact. The traditional territory of the Snohomish stretched from the south half of Camano Island to the Snohomish River valley and along the mainland coastline from Mukilteo to Warm Beach (Baenen 1981; Indian Claims Commission 1974; Osmundson 1964; Ruby and Brown 1992). The *Sdo'hobc* band of the Snohomish lived along the lower Snohomish River [redacted]. The people [redacted] practiced a semi-sedentary, hunter-gatherer lifestyle that was oriented toward marine and coastal resources. They collected shellfish and fished for halibut, herring, smelt, eulachon, flounder, seal, and salmon (Baenen 1981; Haeberlin and Gunther 1930; Suttles and Lane 1990; Twedell 1974). They also hunted for deer and bear on the islands and uplands (Baenen 1981; Pembroke 1981).

Snohomish people resided in winter villages that consisted of large, multi-family plank houses [redacted]. Groups would leave the villages for shellfish, marine and freshwater fish, land game, waterfowl, sprouts, roots, bulbs, berries, and nuts during the spring, summer, and fall months and these resources were stored for winter, traded, or processed to be consumed (Suttles and Lane 1990). The project area would have provided numerous resources, predominantly marine fish and shellfish, but tules, cattails, and red cedar bark were also collected from marshes and used for making mats, rope, baskets, and other household items. Families would travel up the coast or across the Sound to establish their seasonal temporary camps (Baenen 1981; Deur and Turner 2005; Pembroke 1981; Smith 1941; Twedell 1974).

[redacted]

Isaac Ingalls Stevens, the first territorial governor and Superintendent of Indian Affairs, had a mandate to make treaties with the indigenous inhabitants of Washington to facilitate settlement of the region. Stevens negotiated a treaty with the Duwamish, Suquamish, Kikiallus, Stillaguamish, Snohomish, Skagit, Sauk-Suiattle, Swinomish and Lummi at Point Elliott in 1855 (Boswell 2007; Richards 1993). The treaty gave the tribes payment, retention of hunting and fishing rights, and services in exchange for lands (Lane 1973, 1975). The treaty also established the Port Madison and Snohomish (now Tulalip) Reservations where tribal members were supposed to move. The Tulalip Tribes are comprised of descendents of the Snohomish, Stillaguamish, Snoqualmie, Skykomish, Skagit, and Samish people (Ruby and Brown 1992:244; Swanton 1968). The Tulalip Reservation on the north side of Port Gardner Bay was carved out of Snohomish lands, so many Snohomish people chose to settle there. [redacted]

History

Historic settlement was slow to reach the heavily forested shoreline along Port Gardner Bay, but the abundant timber drew crews of loggers who supplied sawmills established along other parts of coastal Puget Sound as early as 1853. It was not until about 1861 or 1862, however, that the first non-Native settler, Dennis Brigham, claimed land along the shores of what is now the Everett peninsula. The former Massachusetts carpenter built a small farm and later filed for a homestead patent on a 160-acre parcel that includes a portion of the project area. The 1869 General Land Office (GLO) plat of the Port Gardner shoreline shows the Brigham property and the location of a building within the project area (Dilgard and Riddle 1973:5,8; LeWarne et al. 2005:66; Interstate Publishing 1909:I-314; O'Donnell 1993:6).

Several other settlers followed Brigham to this peninsula within a few years, including Erskine Kromer, who settled immediately to the south, and John King, who claimed land to the north. Kromer evidently worked for the telegraph company that planned to connect the United States with Europe from the west by running a line along the Pacific coast and then across the Bering Strait to Siberia and on through Russia (Figures 4 and 5). The Russian-American telegraph project, conceived by entrepreneur Perry Collins, was undertaken by the Western Union Company. A portion of the line was completed through

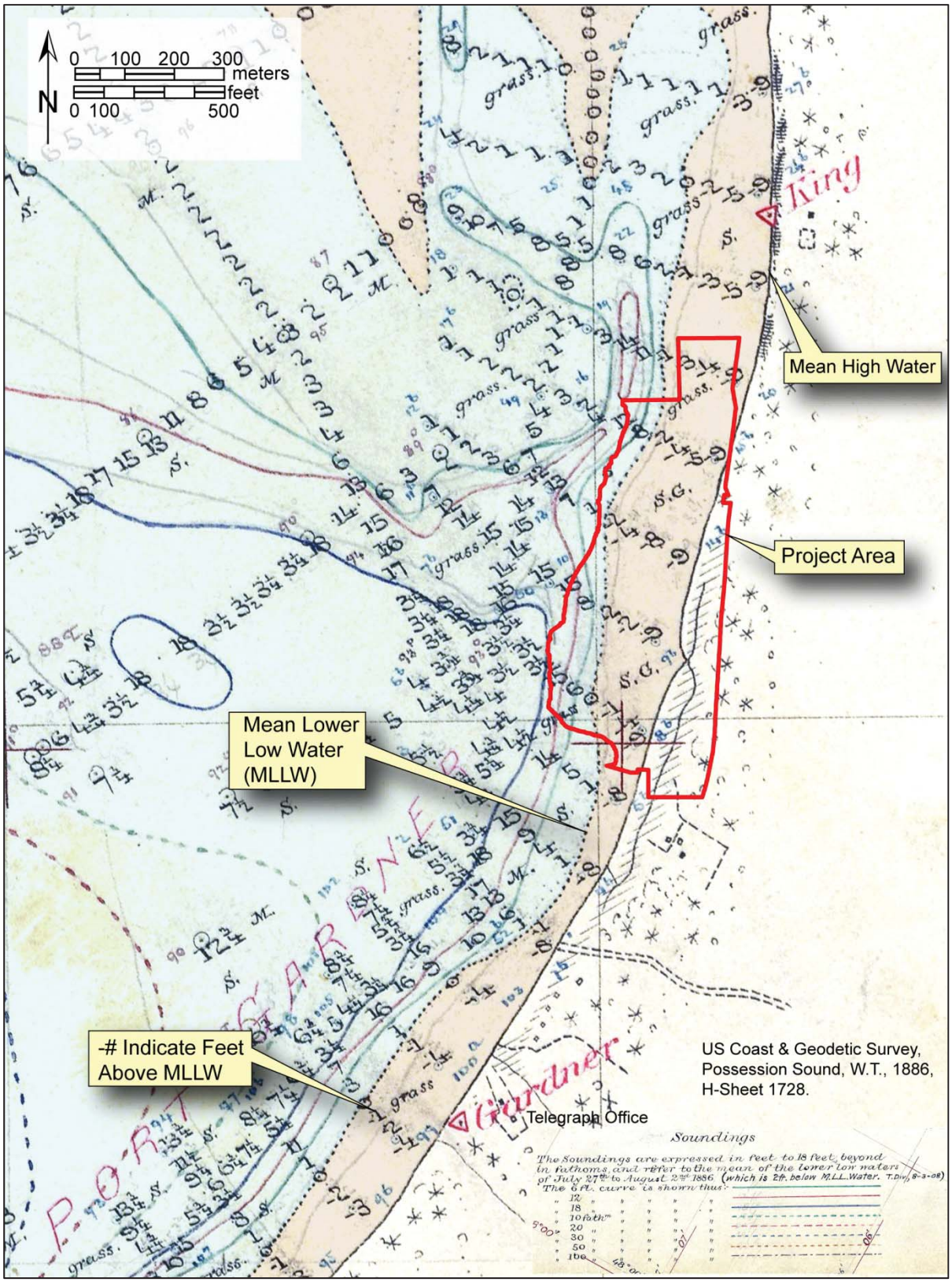

Figure 4. Historical H-sheet showing the mean historic shoreline and low water line; note the telegraph office and small structures shown just south of the project area in 1886.

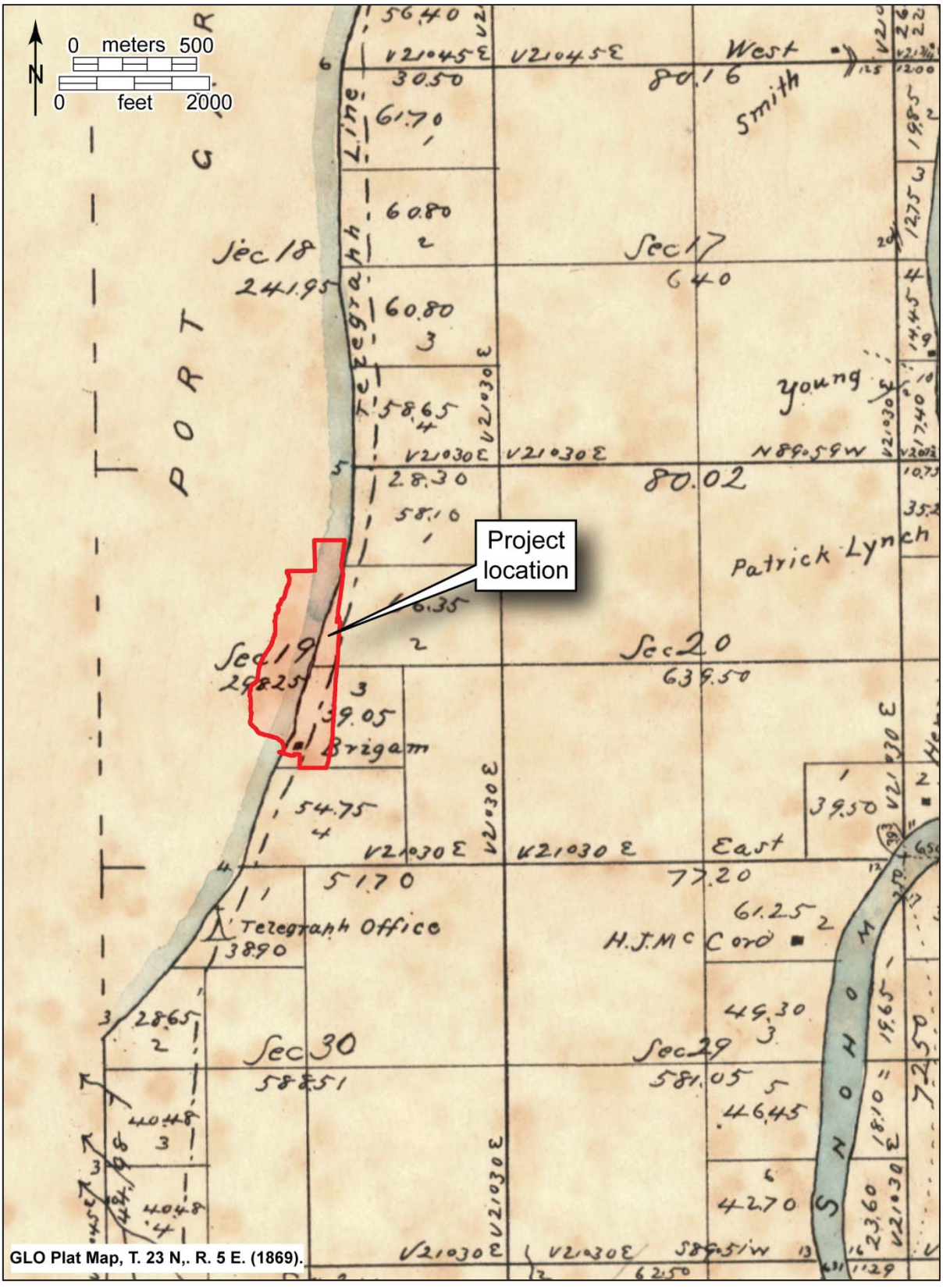

Figure 5. GLO plat map from 1869 showing Brigham's cabin mapped in the southern part of the project area and the telegraph line running through the east edge of the project.

Oregon, Washington and into British Columbia, but the effort was abandoned in 1867 after the transatlantic cable was successfully completed, offering a more direct link from the United States to Europe. The GLO map (Figure 5) shows that the Russian-American telegraph line extended along the Port Gardner Bay shoreline through the project area and that a building to the south on Kromer's property was used as a telegraph office (LeWarne et al. 2005:66; Ault 1975:3, 11-12).

The timber industry was the economic mainstay of the Puget Sound region during the early decades of development, and it became the focus of growth for Snohomish County when it separated from Island County in January 1861. Once transportation routes were established, the exploitation of the area's vast forest resources expanded quickly. Both logging and processing first began near coastal waterways, which provided easiest access, but then moved inland along rivers. Later, new roads and ultimately rail lines provided a means to transport logs as well as finished products (LeWarne et al. 2005:63).

Despite the advantageous location of the Everett peninsula, which was bounded by the bay and the Snohomish River, it took several more decades for a town to develop on the site. Not until 1889, the year that Washington became a state, did several entrepreneurs begin to accumulate land with the idea of platting a new city they planned to call Port Gardner. Brigham had sold his homestead along the bay in 1883 to Edmond Smith and by 1889 that parcel was purchased by Wyatt Rucker, who with his brother Bethel was a primary promoter of the new town. He and other investors acquired additional land that ultimately totaled approximately 800 acres (Interstate Publishing 1909:I-317) (Figure 6).

At the time that the Ruckers and their associates were involved in platting the townsite, a larger and more prominent group of investors also took an interest in the peninsula. The landscape had the natural characteristics of a profitable port with room for new industry but also proximity to the developing Monte Cristo mining district. A syndicate put together by Henry Hewitt of Tacoma and Charles Colby of New York obtained substantial backing from John D. Rockefeller and other Eastern investors and eventually purchased much of the Rucker group's interest in the site. The Everett Land Company was incorporated in November 1890 and in the following year began work to survey and lay out blocks of the new city to be known as Everett (Whitfield 1926:II-359, 361).

This development also coincided with the completion of the Seattle and Montana Railroad, a subsidiary of the Great Northern Railroad, which passed through Everett and connected Puget Sound with the Canadian Pacific Railroad. Several other towns along the Seattle and Montana right-of-way were platted at the same time, but it was Everett that eventually experienced the greatest growth. The Everett Land Company quickly attracted large industrial enterprises including a shipbuilding plant, a pulp and paper mill, a wire nail factory and several sawmills. Among these initial enterprises was the Parminter, Robinson and Company mill, which was located within the project area along Port Gardner Bay near the foot of 21st and 22nd Streets (Figure 7). The mill was in operation as early as 1892, and the complex included the first home of one of the mill owners, Thomas Robinson, and his family (Interstate Publishing 1909:I-326; Cameron et al. 2005: 108-109; Norman 2007) (Figure 8).

The prospect that the Great Northern's transcontinental line, which crossed the Cascade Mountains to the coast over Stevens Pass, would use Everett as its terminus fueled even more speculative interest in the future of the town. When the railroad was completed in 1893, however, James J. Hill chose Seattle as his line's main Pacific Coast port rather than Everett. The new city on Port Gardner Bay faced a short-term setback that was exacerbated by a severe nationwide economic downturn and disputes over tideland ownership. By 1897 the Everett Land Company had gone into receivership and industrial growth slowed considerably (Interstate Publishing 1909:I-326).

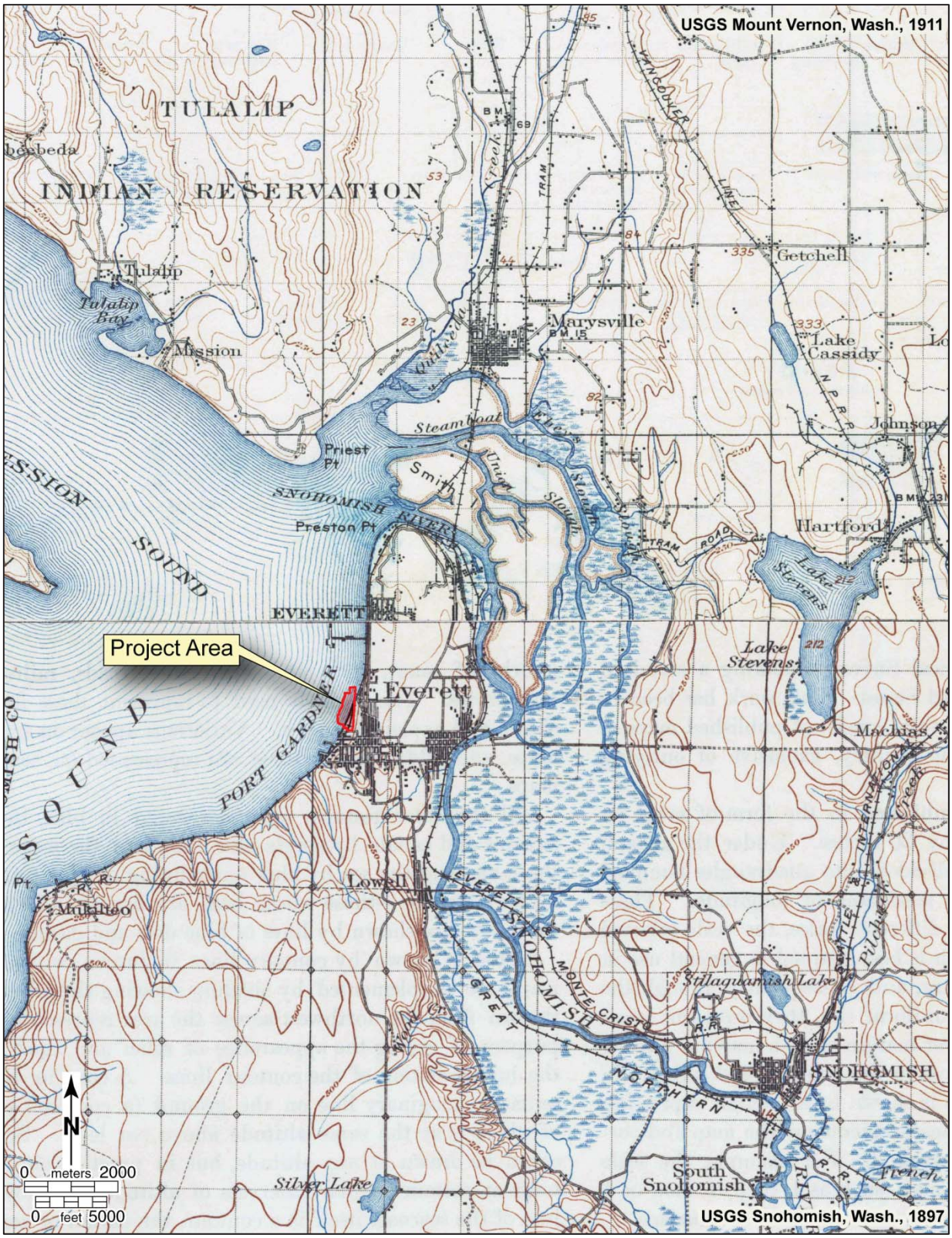

Figure 6. Early development in the vicinity of Everett, 1897 and 1911.

Figure 7. Birdseye view of the project area in 1893, showing the Parminter, Robinson Mill to the north and the Rucker Dock to the south.

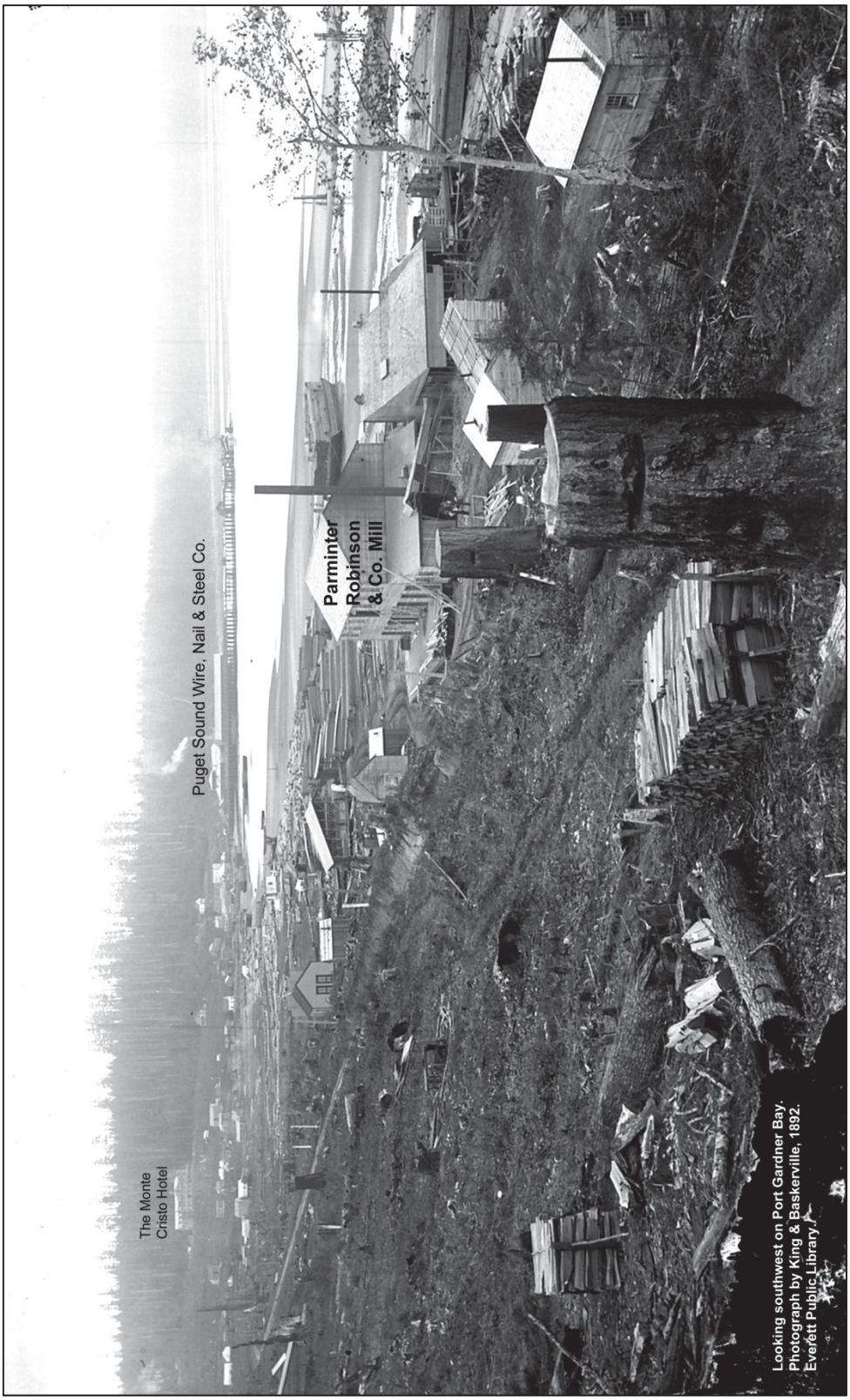

Figure 8. Overview of the project vicinity looking southwest from approximately 21st St and Grand Ave, 1892.

Hill helped the city to rebound when he acquired the Land Company's remaining property and in January of 1900 formed a new syndicate called the Everett Improvement Company under the capable direction of John McChesney. The Weyerhaeuser Company had just purchased more than 900,000 acres of Northwest timber land from the Northern Pacific Railroad, which Hill controlled, and both he and McChesney recognized Everett's prospects as a major milling center. Not only did Weyerhaeuser soon construct its first Northwest mill on Port Gardner Bay, but several other Midwestern lumbermen quickly built plants along the waterfront to take advantage of the region's extensive forest resources. A number of other manufacturing facilities were also located on the bay as well as "riverside" on the Snohomish River, but at the heart of Everett's development was the burgeoning timber-processing industry. The expansion proceeded so rapidly that by 1901 Everett had nine sawmills and thirteen shingle mills (Figure 9) (Cameron et al. 2005: 11-112, 119, 135-136; Interstate Publishing 1909:283-284).

Clark-Nickerson Lumber Company

Among the plants constructed during this period of unprecedented growth was the Clark-Nickerson Lumber Company, which was also backed by several prominent industrialists. The business was organized by David Clough, a former governor of Minnesota and acquaintance of Hill, who with M.J. Clark and E.A. Nickerson developed a large sawmill on 46 acres along the bay at the north end of the current project area. As with other businesses on the waterfront, the Everett Improvement Company donated this land to the company as long as a plant was built on the site. Originally some of this property had been given to the Thomas Robinson Manufacturing Company to erect a new sash and door plant, possibly on a portion of the original Parminter, Robinson mill site. When Clark-Nickerson expressed interest in the same location, Robinson agreed to move onto a parcel immediately to the north, just outside the current project area (Whitfield 1926:II-360-361; *Pacific Lumber Trade Journal* 6(6) Oct 1900:23)

Construction of both new plants began almost immediately. On its property Clark-Nickerson built a state-of-the art sawmill and planing facility that was in operation by September of 1901. According to trade journals, the mill had a capacity of 300,000 feet when running three shifts and could plane more than 100,000 feet per day. Once the mill was operational the company expanded the yard to 200 by 500 feet and work also continued work on a new dock that would provide deep-water moorage (*Pacific Lumber Trade Journal* 6(6) Oct 1900:23*; Columbia River and Oregon Timberman* II (2) Dec. 1900:7). By the following spring Clark-Nickerson installed a new gang flooring machine and also an electric light plant. The company was evidently shipping its lumber to California, Mexico, Hawaii and South Africa, so it further improved its wharf for larger ocean-going vessels. Contracts were let to dredge a channel around the dock, removing 50,000 yards of sediment and leaving a channel 24 feet deep at low tide and 200 feet wide (see Appendix C, Map 2) (*Pacific Lumber Trade Journal* 6(12) April 1901: 15; 7(2) June 1901: 15).

The company's major stockholder, E.A. Nickerson, sold his shares in the spring of 1901 to another Midwest industrialist, D.M. Robbins, who was the brother-in-law of David Clough. With the new management, trade journals reported that development plans included construction of large yards so that the company could maintain a stock of 15,000,000 to 20,000,000 feet of lumber at any time. In order to accomplish this goal it was necessary to fully utilize its site, which had expanded to 54 acres, by driving piles and filling a much large area. There were also rumors that the company had purchased a steamer line between Washington and California (*Pacific Lumber Trade Journal* 7(4) August 1901: 18).

E. A. Nickerson, the former head of Clark-Nickerson, became a half owner of the nearby Robinson Mill, which was renamed the Robinson Manufacturing Company. With the new infusion of capital the

Figure 9. The Port Gardner waterfront in 1902.

company made improvements to its sash and door factory and began to fill more of the tidelands around the site to build a substantial wharf. Evidently the first step was to build a retaining wall around the property and then to erect a flume that was connected to the Clark-Nickerson sawmill. The flume, which began operation in the fall of 1901, carried the mill's sawdust and waste for use as fill for Robinson's wharf. According to one publication, "Within a few months the entire site will be filled, thus preventing destruction by teredo, and making a good foundation for future buildings" (*Pacific Lumber Trade Journal* 7(7) Nov. 1901:15; *Pacific Lumber Trade Journal* 7(5) Sept 1901: 15).

At the same time, Clark-Nickerson also made improvements to its plant. The company constructed a new brick and stone building to house two 150-horsepower boilers for the planing mill and dry kiln. Work began soon thereafter on a new dry kiln and also the installation of a complete sprinkling system. The Sanborn Fire Insurance map of the Clark-Nickerson complex in 1902 shows that much of the plant was built on a wharf extending at a southwesterly angle from the shoreline with the sawmill, machine shop, lath mill and other associated buildings on the wharf's southwest section. The dry kiln and planing mill were located on what was called the Upper Wharf to the north, and lumber was stored in sheds and on piles and timbers (see Appendix C, Map 2). During this period the company was expanding its shipping in the cargo trade to Africa, Asia and Australia, and despite its dredged dock space, some vessels evidently anchored offshore in deep water opposite the Clark-Nickerson Mill where they were not as severely affected by the tides (*Pacific Lumber Trade Journal* 7(5) Sept 1901: 15; 7(9) Jan 1902: 15; 7(11) March 1902: 14; Sanborn 1902).

Clark-Nickerson was initially the largest mill on the waterfront, but over time other mills surpassed it in size. By 1910 the number of timber-related industries in Everett had grown to 11 lumber mills, 16 shingle mills and 17 combination plants, spread out along the bay as well as riverside (Cameron et al. 2005:136) (Figure 10). Historian Norman Clark identified a "sawdust baronage" of powerful entrepreneurs who ran these plants, led by David Clough who went on from Clark-Nickerson to build "a galaxy of milling and logging outfits" in which many of his extended family members were involved (Clark 1970:59-60). To keep pace in the industry, Clark-Nickerson expanded and made improvements to its plant, adding lumber yards that extended north to the property line with the Robinson mill as well as east along the railroad. In addition, several fuel bins and a large refuse burner were installed along the south side of the sawmill (see Appendix C, Map 4) (Figure 11) (Sanborn 1914).

Everett Flour Mill

With new wood products facilities springing up along the bay, other industries were also attracted to the site. By the fall of 1900 the Everett Flour Mill Company had begun building a facility on what a newspaper called "…a desolate stretch of bog land on the shore of the bay, about 1000 feet south of the big lumber mill of Clark-Nickerson and Co…." The Everett Improvement Company donated nearly four acres in what is now the project area to the mill owners with the provision that a facility would be built capable of producing at least 600 barrels per day. A 50 by 225-foot area was filled as a base for the five-story plant and adjacent buildings, which were completed in early 1901. The main mill building was set on concrete piers and was a prominent landmark along the water front. At a point along mean high tide a structure for shavings and sawdust was also erected and eventually Great Northern railroad spurs provided access for shipping (see Appendix C, Map 1) (Whitfield 1926: II-361; *Seattle Times*, Sept. 13, 1900:; Sanborn 1902).

By 1914 a grain elevator and a flour and feed warehouse had been added inland from the main building. The company produced a popular brand of flour known as "Best Ever-ett" and remained in operation until the 1920s (Figure 12) (see Appendix C, Map 3). The facility was purchased by Sperry Flour

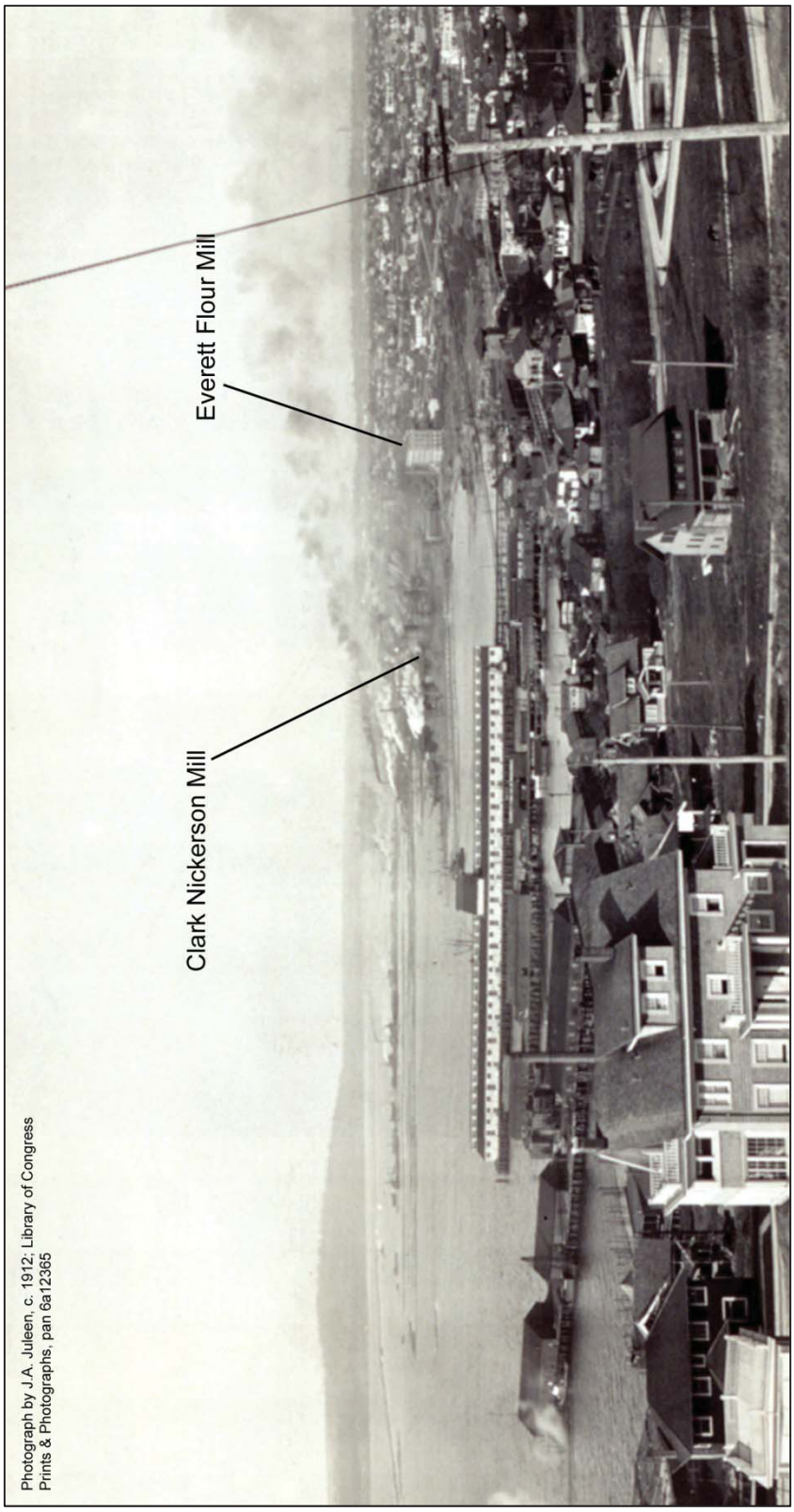

Figure 10. Overview of Port Gardner showing the Clark-Nickerson Mill and the Everett Flour Mill, c. 1912.

Figure 11. Overview of the Clark-Nickerson Mill, c. 1927.

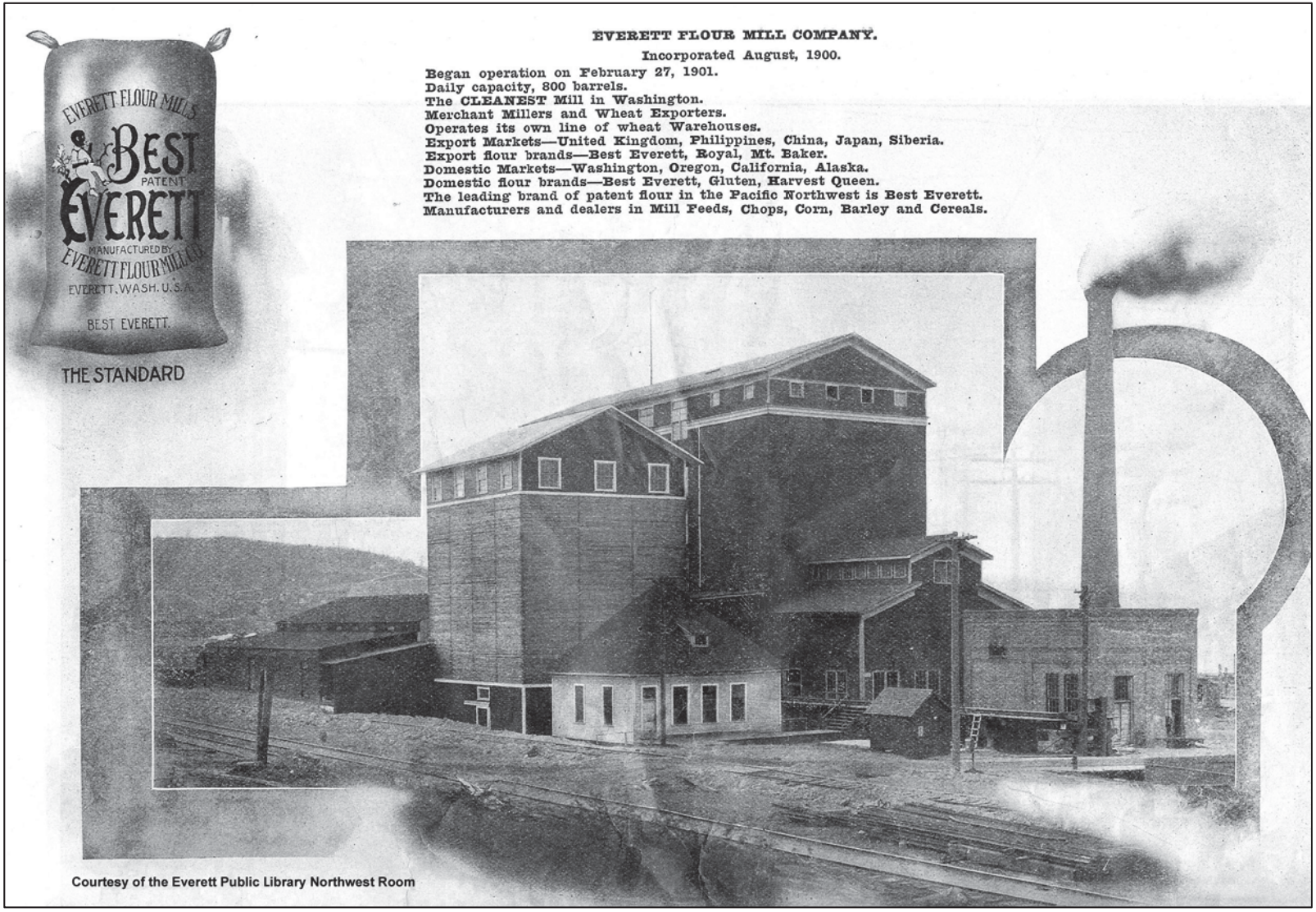

Figure 12. Advertisement showing the Everett Flour Mill, c. 1915.

Company, which operated the mill for a few years. In 1926 the old mill buildings were dismantled and removed and Sperry moved to a new location (Sanborn 1914; Whitfield 1926:II-361).

In addition to these industrial plants, the waterfront in the project area was lined with small cabins and houses that the Sanborn map of 1902 identified as "Squatters' Shacks." Stretched along the high tide line south of the Everett Flour Mill as well as east of the Clark-Nickerson wharf near the railroad tracks, these small dwellings likely housed waterfront workers, sailors and other laborers and their families (see Appendix C, Maps 1, 2). Little is known about these people, but by 1914 Sanborn maps show no more of these dwellings, so possibly these squatters were forced out through legal action initiated by the Everett Improvement Company (see Appendix C, Maps 3, 4). The tideland areas at the base of 24th or 25th streets south of the flour mill and also at the foot of Everett Avenue were popular public bathing beaches before later industrial development took place (Figure 13). Sanborn maps and photographs show one or two small bathhouses and boat rentals that were interspersed with the other dwellings along this part of the waterfront in the project area (see Appendix C, Maps 1, 2) (Sanborn 1902; 1914; Dilgard and Riddle 1973: 40).

Low wages, dangerous working conditions and repeated rises and falls in the lumber market made life difficult for industrial workers, some of whom likely lived in the squatters' shacks in the project area. All of Snohomish County became strongly unionized in the early twentieth century, and industry leaders like Clough used whatever tactics necessary to keep profits high and stem the influence of organized labor. A shingleweavers' strike in 1916 ultimately led to tragic clash between union members and the police that resulted in seven deaths and became known as the Everett Massacre (O'Donnell 1993: 38-40).

American participation in World War I soon caused significant changes along the waterfront. The government's need for vessels as part of the defense effort led private investors to construct a shipyard on Port Gardner Bay between the base of Everett Avenue and 25th Street south of the Everett Flour Mill site in the project area. The Norway-Pacific Construction and Dry Dock Company, with modern facilities to build steel ships, was completed in the fall of 1918. Despite some contracts in hand, the company's timing was extremely poor. The signing of the Armistice in November of 1918 caused demand for ships to collapse and the company soon faced bankruptcy. By 1925 the plant was dismantled and the shipyard's main building was torn down (Whitfield 1926:I-404; Polk 1919:742).

A more successful wartime measure was the establishment of the Port of Everett. The business community saw a port district as the means to encourage new commercial and industrial enterprises along the waterfront. In a special election held in July of 1918 the public overwhelmingly agreed. During the boom years of the 1920s annual shipping tonnage climbed sharply, and many new businesses located along the waterfront while some of the established ones expanded or became more diversified. Near the end of this huge growth period, the land south of the Clark-Nickerson mill, including the property on which the Everett Flour Mill and the Norway Pacific shipyard had once stood, was sold to a new enterprise called the Puget Sound Pulp and Timber Company (Whitfield 1926:I-404).

Puget Sound Pulp and Timber Company

Much of the following discussion on Puget Sound Pulp and Timber Company and its successor companies was developed as part of the Level II Documentation for the Kimberly-Clark Mill Site Main Office Building (Boswell and Sharley 2012). The Puget Sound Pulp and Timber Company was incorporated in 1929 and had an initial valuation of $12 million, all privately financed by investors who planned to build a large state-of-the-art pulp plant in Everett. Its principals were from the Pacific Coast and had been active in various areas of the forest products industry for several decades. The president,

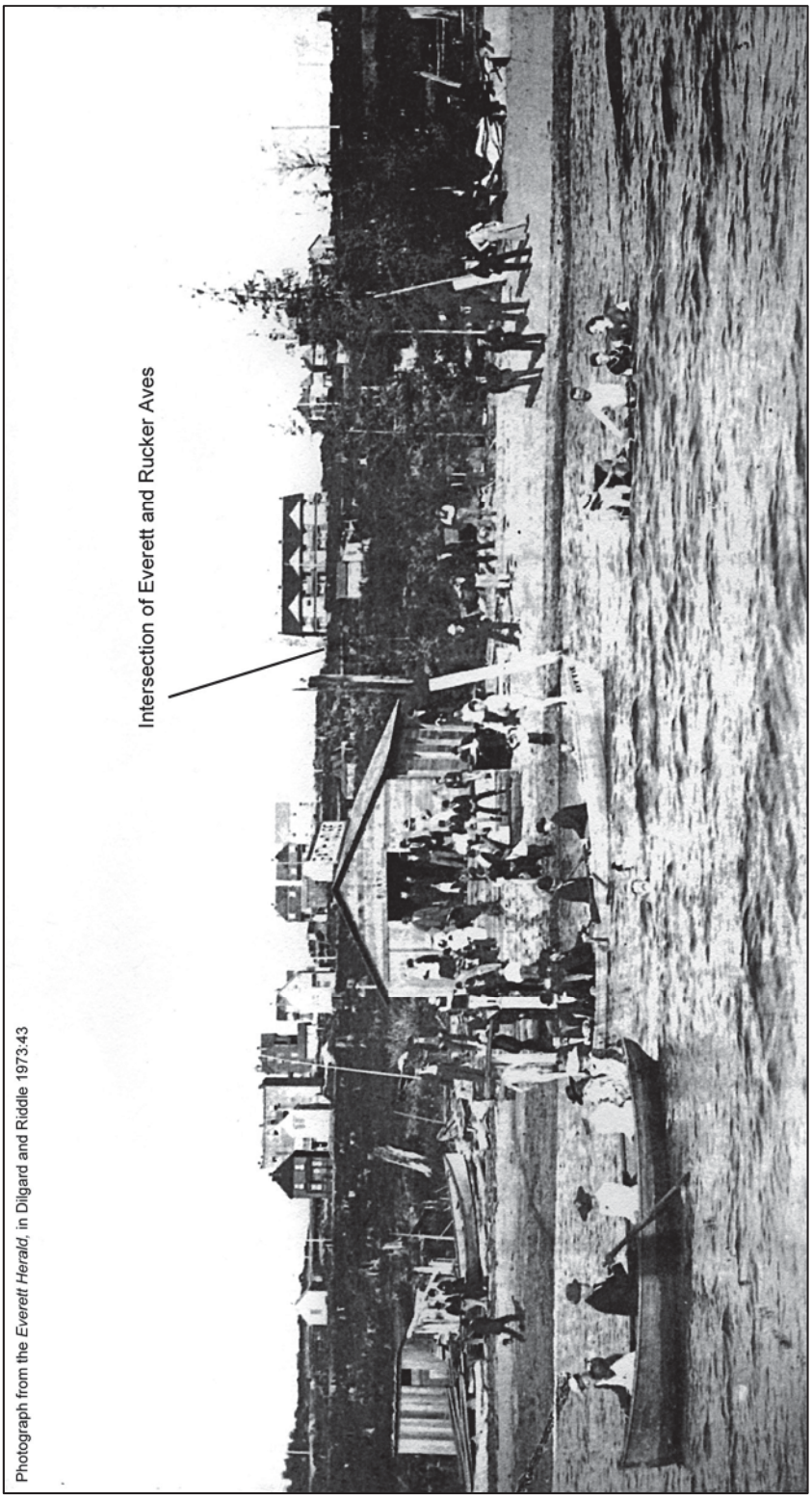

Figure 13. The bathing beach at the south end of the project area, near the base of Everett Ave., 1905. The bath house depicted is likely the one shown in block 618 on the 1902 Sanborn Fire Insurance Map (see Appendix C, Map 1).

Ossian Anderson, had previously served as the head of the San Juan Pulp Manufacturing Company of Bellingham and Fidalgo Pulp Manufacturing Company in Anacortes, and both of these companies were merged into the new corporation. Directors came from Northwest business, banking and industry, including U.M. Dickey, president of Consolidated Dairy Products, and H.M. Robbins, who was head of the Clark-Nickerson Lumber Company (*Pacific Pulp and Paper Industry* 3 (5), April 1920:35-36; (3(7), June 1929:32).

The property chosen for the Puget Sound Pulp and Timber Company mill was a 32-acre parcel on the Everett waterfront adjacent to the Clark-Nickerson Lumber Company operations, sometimes referred to as "the old shipyard site."'

Puget Sound Pulp and Timber chose Hardy S. Ferguson, a renowned consulting engineer on pulp and paper mill projects, to design and oversee construction of the mill. Ferguson wanted to incorporate all of the latest engineering practices into the facility and based some of his design and machinery choices on successful Swedish mills. Ferguson came to Everett in August of 1929 to initiate the construction phase of the project. There he finalized plans with his personal representative J. H. McCarthy, who would serve as resident engineer (*Pacific Pulp and Paper Industry* 3(5), Apr. 1929:36; 3(12) Nov. 1929:36; 3(10) Sept. 1929).

Bids were quickly solicited and awards made on major construction contracts. Albertson, Cornell Brothers of Tacoma were named the general contractors for the project with Isaacson Ironworks of Seattle supplying the structural steel. One of the first major tasks was to dredge a 30-foot channel in front of the mill site on Port Gardner Bay and develop moorage for ocean-going vessels. Puget Sound Bridge and Dredging Company and its subcontractors began this work as soon as contracts were let in late August of 1929. Original specifications called for a 610' by 88' dock as well as a bulkhead and stone riprap along the shoreline. American Pile Driving Company of Everett drove several thousand piles for the wharf after the dredging company had moved its spoils to fill low-lying areas of the site (*Pacific Pulp and Paper Industry* 3(10) Sept. 1929, 3(11), Oct. 1929:42; *Pacific Builder and Engineer*, Aug. 31, 1929: 5; Sept. 14, 1929:6; *Everett Herald*, Sept. 4, 1929).

Very quickly after dredging and pile driving for the new wharf began, plant construction got underway at the pulp mill site. The first building to break ground was the company office, which would become the center for all business operations. Puget Sound Pulp and Timber Company executives and mill supervisors were housed temporarily in offices in downtown Everett until the building was completed. The company hoped to move into its new quarters on the south end of the mill site by December, so construction moved quickly with footings in place and foundation poured by early October of 1929 (*Everett Daily News*, Oct. 27, 1929:6; *Pacific Pulp and Paper Industry* 3(10) Oct. 1929:42; 4(1) Jan. 1930:62).

Several unusual features of the overall mill plan set the Puget Sound Pulp and Timber Company's new facility apart and also addressed the goals of promoting efficiency and full utilization of timber while limiting waste. One of these innovations was to incorporate a large sawmill within the pulp processing layout. This mill would be used to break down logs into cants of uniform sizes, which would then be fed by uniquely designed conveyors into a corresponding series of chippers to make wood chips for the pulp. Some of these chippers were among the largest ever installed on the West Coast and could accommodate squares that were up to 20 inches in diameter. Mill supervisors could control the quality of the material used in the process and an elaborate washing system would further ensure that the logs would be as clean and defect-free as possible. Puget Sound Pulp and Timber also had its own timber holdings and planned to provide a steady supply of logs in 40 foot lengths of diameters ranging from 12 to 40 inches (*Pacific Pulp and Paper Industry* 3(13) Dec. 1929: 35).

Other notable innovations included straight and noticeably wider digester pipes that made it easier to dump the digester into the blowpits and handle the stock more gently. In addition, larger wooden blend tanks could hold several batches of pulp as they moved between the digester and drying room, eliminating any slight differences among batches. Scandinavian fourdrinier drying machines purchased for the mill dried the pulp in much thinner sheets than American-made machines and were the most modern available in Europe and completely new on the West Coast (*Pacific Pulp and Paper Industry* 5(4) Mar. 1931:47-48).

The mill was essentially designed in a "U" shape so that material could be moved efficiently through the manufacturing process. From the sawmill and cut-up plant where the logs were first processed, the cants moved up two steel-belt conveyors to the chipping plant and chip screen room, which were housed in an adjoining steel and brick building. Once processed, refined chips were then sent on long rubber conveyor belts to storage hoppers over the digesters, while sawdust was diverted to the hogged fuel conveyor from the sawmill. An acid plant with a standard two-tower system received the necessary chemicals, including sulphur, limestone and lime, which were first sent to storage facilities by an overhead tram from the dock.

The digester building contained five digesters, each with 18-ton yield capacity. These units had the ability to cook the chips in three different ways and were outfitted with specially placed pipes to permit easier drainage of the cooking liquor. The cooked stock was then washed and separated before being combined in a large blending tank to ensure pulp uniformity. An extensive screening process followed before the brown stock was sent through a two-stage bleaching process. A separate building housed the bleach liquor plant, which chlorinated lime paste and stored the bleaching liquid until it was sent through rubber pipes to the bleach room. The material was then moved into a large machine room which housed two dryers. These machines were able to dry 100 tons of pulp per day, forming pulp sheets and using pressure rollers to keep the sheets in contact with the drying cylinders. Storage warehouses and a separate laboratory for quality control and monitoring of all the chemical processes completed the main components of the mill (*Pacific Pulp and Paper Industry* 4(8), July 1930: 25-26; 4(10), Sept. 1930: 47, 49-54).

Among the other early work begun at the site was excavation for the blowpits and sulphur storage and driving of the piles for the digester building. Footings for the stores and repair building were also begun in early October and foundation work for acid storage tanks as well as the plant and tower. In order to get supplies to the mill site as quickly as possible during construction, the company negotiated with the Great Northern Railroad to build a 1500-foot line into the property. Once the spur was in place, needed materials were sidetracked and readily available for contractors' use. Later the railroad constructed additional spurs within the complex, including one directly from the Great Northern main line to the dock for easy movement of the pulp to market by both transcontinental and overseas shipping (*Pacific Pulp and Paper Industry* 3(10) Oct. 1929:42; 4(7) June 1930: 33; *Everett Herald*, Sept. 27, 1929:1; *Everett Daily News*, Oct. 27, 1929:6).

Local newspapers and industry journals regularly described the progress of the huge project, which employed at least 200 men as the construction process gained momentum. Good fall weather helped to keep the work on schedule, if not ahead of the original predictions for a late summer start-up date. Once steel was unloaded at the site, contractors began raising the steel superstructures for some of the plant's main buildings in November of 1929. By January 1930 some of the plant machinery had also

begun to arrive. The first ocean-going vessel to use the company's new wharf, the 4211-ton *S.S. Lena Luckenbach*, docked in early March, unloading more than 300 tons of cast-iron pipe for construction use. The machine room was among the final segments of the mill to be finished, with the fourdrinier drying

machines from Sweden arriving at the dock near the end of May. By the beginning of June, mill construction was nearing completion (*Everett Daily News*, Oct, 25, 1929:8; *Pacific Pulp and Paper Industry* 4(1) Jan. 1930:62; 4(3) Mar. 1930:48; 4(7) June 1930:33).

Testing began on various sections of the new mill to make sure the equipment was in running order. The sawmill was the first to operate with its initial batch of logs broken down into cants on June 12, 1930 (Figure 14). The acid system and the digesters were started up a few days later, and the pulp mill followed, with finished pulp running through the drying machines. The first operation as a complete unit took place on July 1st, coinciding with the delivery of the first water from the City of Everett's new Sultan River pipeline (*Pacific Pulp and Paper Industry* 4(8) July 1930:25).

As the economic depression worsened in 1931, industry publications reported that Ossian Anderson had made several trips to the East Coast and California, contacting buyers and later "negotiating matters of far-reaching consequences" (*Pacific Pulp and Paper Industry* 5(12) Nov. 1931:14). The Anacortes mill halted production again for a number of months in early 1932 and it was followed by the closure of the Everett facility on June 1st. When production in Everett resumed on July 20, 1932, management announced that it would "conduct its operations on a curtailed basis commensurate with the requirements of the market and the mill's trade" (*Pacific Pulp and Paper Industry* 6(9) Aug. 1932:13). Behind the scenes, however, negotiations were underway to solve the severe financial problems facing the company. According to summaries of court documents and other sources, Puget Sound Pulp and Timber had originally mortgaged its holdings for $4.5 million, and the financial firm of Pierce, Fair and Company had raised the funds by selling shares in a syndicate at $1000 each. The company had been able to meet its obligations until August of 1931, when it paid only half of the bond interest with the rest in the form of a note. By June 1932 the syndicate had received no further interest payments and so a partitioning agreement was negotiated in which the Bellingham, Anacortes and Clear Lake properties were released from the mortgage, but the syndicate retained the Everett mill and the Hartford and Eastern Railroad as well as some timber lands in Snohomish County (*Pacific Pulp and Paper Industry* 8(2) Feb. 1934:6-7; Adams 1951:161).

Throughout this period the whole harbor area was undergoing changes. To improve opportunities for new businesses to locate in Everett during these difficult financial times, the Port of Everett began a project to fill part of the tidelands near the foot of 21st Street as part of an agreement with the pulp company. It was important to maintain deep-water access, so the Port developed what was called Tract O, which added protective fill west of Puget Sound Pulp and Timber land to within 300 feet of the south end of the jetty. This jetty, which had been built and then extended by the Corps of Engineers since the 1890s, stretched more than 2300 feet south of the Snohomish River mouth. Its purpose was to act in conjunction with dikes to prevent silting of the harbor while maintaining portions of the Snohomish River as a fresh-water port. These projects had never been entirely successful and repeated dredging was necessary. The fill added by the Port in the early 1930s created the East Waterway which was intended to remain free of silt deposition (Dilgard and Riddle 1973:49-51, 54).

Formation of the Soundview Pulp Company

The Soundview Pulp Company, formed on July 15, 1932, took title to the Puget Sound Pulp and Timber property and became the manager of the assets, although Ossian Anderson continued to operate the mill under a friendly lease arrangement of $1 per month. A proposal by Soundview directors to merge

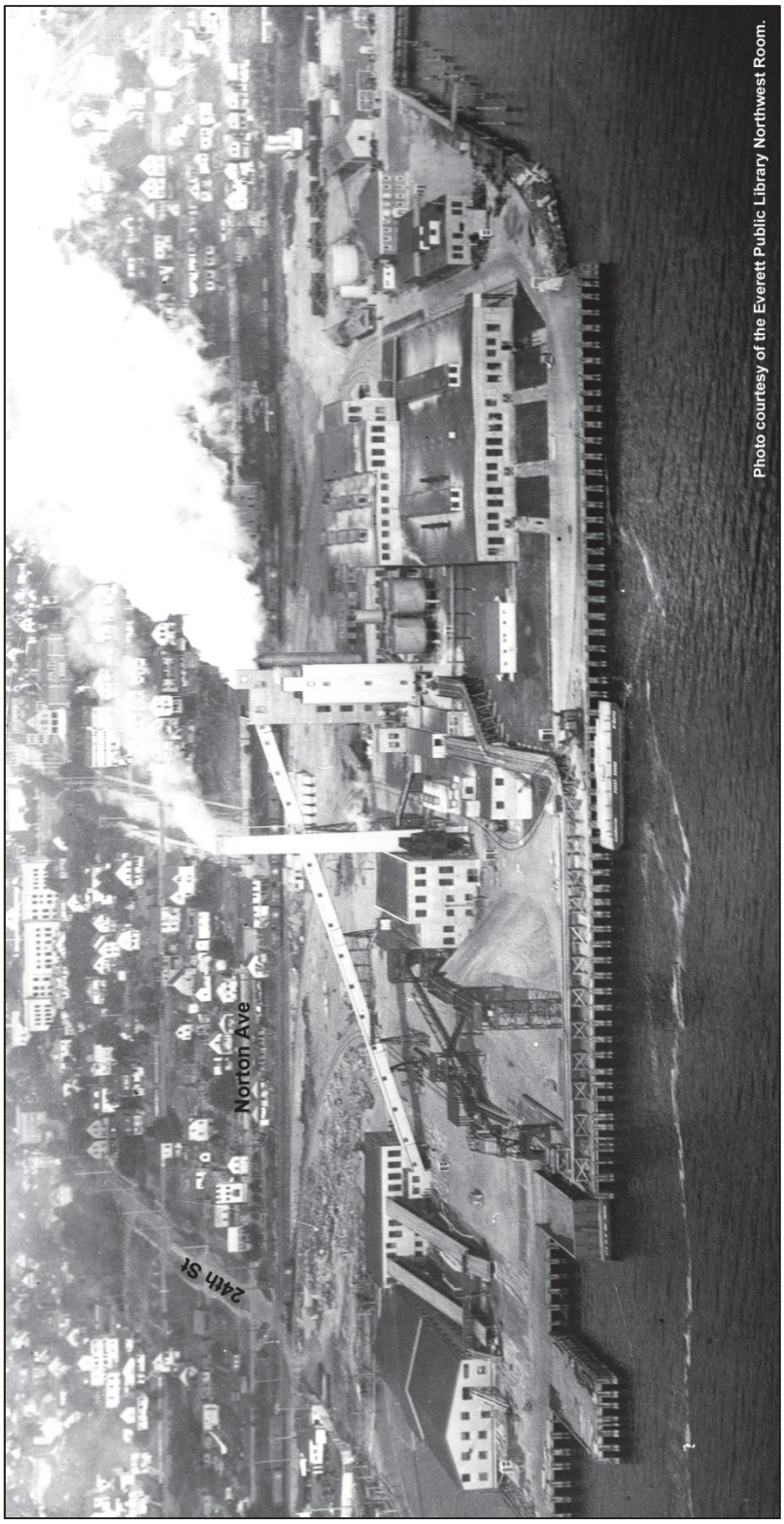

Figure 14. Puget Sound Pulp and Timber Company mill nearing completion in 1930.

with two other pulp and paper companies led to a legal battle with some of the minority shareholders, and the courts eventually voided the merger. Soundview then ended its lease with Puget Sound Pulp and Timber Company and on March 1, 1934, took over management of the Everett mill. G. J. Armbruster remained as the superintendent of the plant and Leo Burdon, who had lengthy experience in the industry, was named operating manager. U.M. Dickey, a Seattle businessman and vice president of the Board of Directors, became the general manager of the mill. Most of the rest of the officers and directors of Soundview were prominent San Francisco businessmen (*Pacific Pulp and Paper Industry* 8(3) Mar. 1934:24; Soundview Minute Book, Vol. 1, Washington State University (WSU) Manuscripts, Archives and Special Collections (MASC), Cage 251).

On the recommendations of Dickey, the company made a number of upgrades and additions to various parts of the mill. Among the changes were improvements to the acid tower, installation of a new sprinkler system in the dryer and warehouse buildings and the purchase of two automatic wood barkers for the sawmill to increase log utilization. Probably the most significant additions were two new bleaching units that would allow production of the highest quality bleached pulp and increase the overall capacity of the plant. As Dickey argued to the Board:

> The reputation of the mill has suffered under Puget Sound Pulp and Timber Co. administration by a combination of the absence of adequate bleaching facilities and an effort on the part of management to crowd the productive capacity of the mill. This adverse reputation is a serious obstacle to the sale of the mill's product and it is of great importance that a reputation for high quality product should be gained as well as that the mill should be mechanically equipped to produce pulp even up to the grade required for cellophane and rayon use (Soundview Minute Book, Vol. 1, May 14, 1934, WSU,MASC).

Throughout his tenure at Soundview, Dickey continued to urge the Board to make improvements to the mill and increase its productive capacity. The installation of acid heating and digester circulating systems as well as several additional digesters were among the initial projects that brought new technological innovations to the facility. In what later became one of his most important contributions, Dickey also encouraged the company to develop a timber acquisition plan that would ensure a steady log supply. (Soundview Minute Book, Vol. 1, Nov. 9, 1934; Dec. 26, 1934; Vol. IV, May 10, 1937, WSU,MASC; *Everett Daily Herald*, Feb. 8, 1954: 21, 27).

U.M. Dickey replaced Harry Fair as president of the Soundview Pulp Company after an election of the Board of Directors on August 6, 1936, and Fair became chairman of the Board. During that year the company also made a major new investment in the expansion of the mill's capacity. A complete new processing unit, which included an acid plant, boilers, digesters, and a bleach plant as well as dryers and other equipment, was added to the complex (Figure 15). The mill's output was boosted to nearly 600 tons of bleached sulphite wood pulp per day, and the new equipment also gave the mill the capability of producing some of the highest grades of specialty paper. The company financed the $2.1 million addition by the sale of nearly 21,000 new shares of capital stock as well as two $500,000 issues of debentures (Soundview Minute Book, Vol. III, Aug. 6, 1936; Adams 1951:162; *The Argus* 43, June 20, 1936:4).

Pulp industry prospects continued to improve as the United States moved closer to World War II. A local newspaper published Soundview's forecast that it would be able to pay off its $1 million debt for the new addition to the plant within two years. As soon as the United States entered the war, however, the plant was subject to the needs of the defense effort. The company agreed to invest $170,000 in the equipment to produce nitrate pulp for military use under the direction of the War Production Board. At the Board meeting in late October of 1942 Soundview directors were also notified that all of the

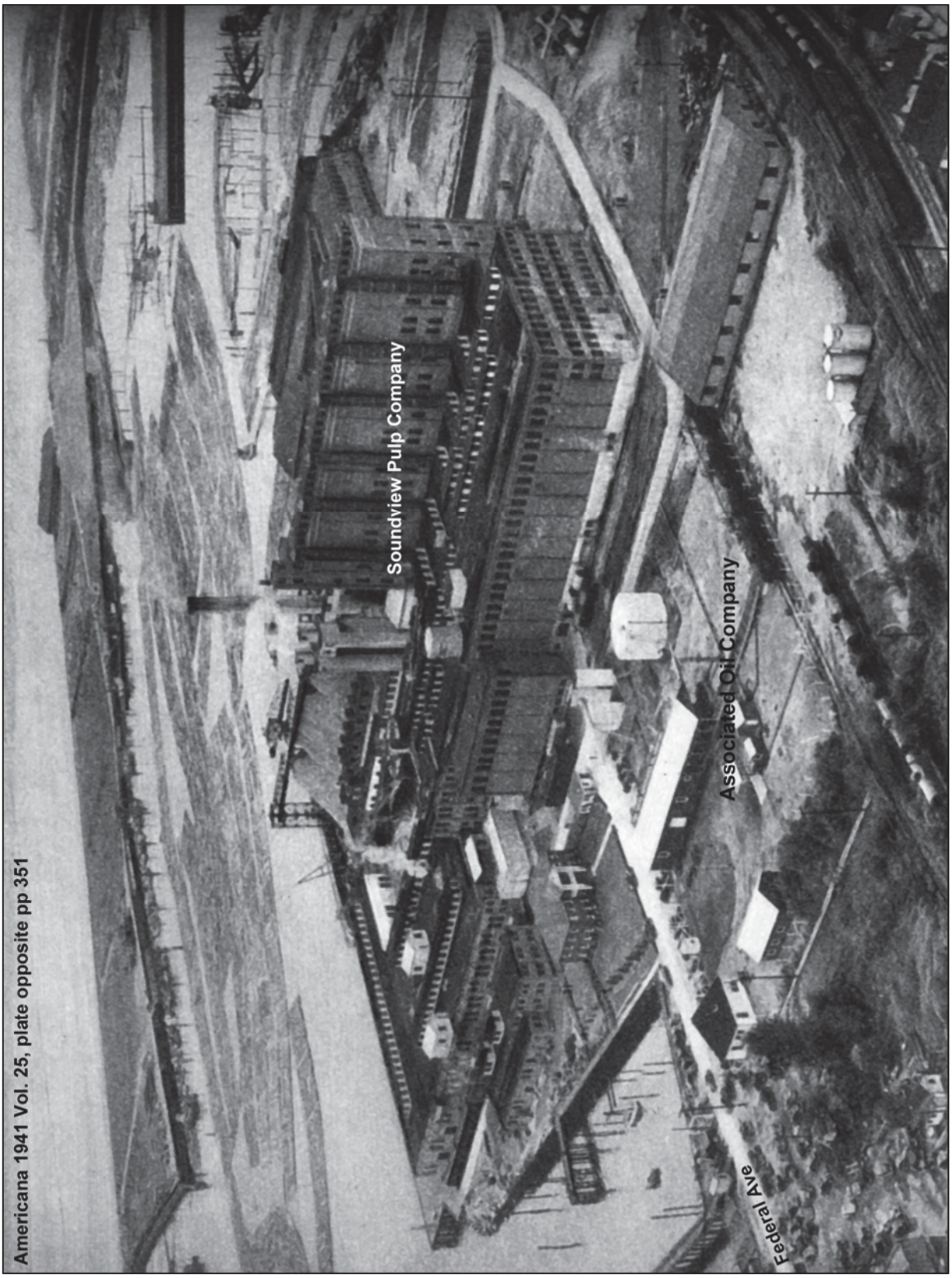

Figure 15. The Soundview Pulp Company, c. 1940

production of the mill after November 1 of that year would be allocated for war purposes (*Seattle Times*, Jan. 22, 1937; Soundview Minute Book, Vol, IV, July 29, 1942; Oct. 26, 1942).

As the war years came to an end, Soundview was in a sound financial position to continue its expansion of the mill. As timber conservation increasingly became a focus of the industry, the company once again added new equipment that applied the latest technology to these goals. In 1945 the company installed a new system for debarking pulp wood logs that made use of hydraulic pressure to save an additional 20 percent of the wood fiber when the bark was removed. The company was also one of the first in the industry to use the chemi-pulp or hot acid process as well as the SO2 recovery process in pulp production (*Everett Daily Herald*, Feb. 8, 1954:20).

Soundview Pulp Company was already the largest single sulphite pulp producing plant in the world when Scott Paper Company representatives came West to discuss a possible merger in the summer of 1951. Scott had been searching for a new location for a Pacific Coast mill, and Soundview's waterfront site and large timber holdings were attractive as was its strong cash position. The plan to exchange shares of common stock to carry out the merger received the approval of directors from both companies by November of 1951 (*Pulp and Paper* 25(13), Dec. 1951:40).

Scott's goal was to build a new paper plant at the Everett site and use the Soundview pulp facility and timber resources to establish an integrated paper manufacturing and distribution operation. Once the merger was complete, construction of the paper mill began adjacent to the pulp mill. By December of 1953, the first of the company's new high-speed paper machines had begun production and a second went on line a few months later. At the grand opening of the new facility in February of 1954, plans were already underway to construct another new section for two more of these high-speed units and related equipment for installation in 1955 (*Scott Broadcast*, 10(8) Nov. 1954:1).

Environmental concerns and changing industry practices characterized the more recent history of the Everett mill as pulp and paper production continued. New state and federal regulations on pollution control influenced continuing plant upgrades over the decades. In 1964 Scott completed a wastewater treatment facility at the Everett site. A decade later, the company converted the mill to an ammonia-based sulphite process and installed a recovery furnace (Figure 16). A secondary treatment facility for effluent was constructed in 1979. Other innovative programs included a joint project with the Snohomish County PUD to build a cogeneration plant to provide electrical power as well as steam for the company's tissue plant (Zwaller and Cross 2003:1).

After Scott merged with the Kimberly Clark Corporation in 1995, additional investments were made at the plant to put in place new technologies for better environmental protection as well as more efficient plant production (Figure 17). The company constructed a larger wastewater treatment system and added a new effluent outfall in cooperation with the cities of Everett and Marysville. In 2000 Kimberly Clark converted the pulp-making operation to a chlorine dioxide system, which produces less dioxin than the older chlorine process. To meet new company goals, Kimberly-Clark attempted to sell the mill. When negotiations failed, all mill operations ended in April 2012 and the last of the Everett waterfront mills shut down permanently (Benbow and Batdorf 2012:1).

Figure 16. The Scott Paper Company in 1977.

Figure 17. The Kimberly-Clark Mill in 2006.

PREVIOUS INVESTIGATIONS

Fifteen cultural resources investigations have been completed within 1 mile of the project, including general overviews, field surveys and project-related assessments (Table 1). Early cultural resources investigations were usually regional, large-scale surveys, summaries, and inventories of known resources for agencies like the National Park Service, the United States Army Corps of Engineers (USACE), and the Office of Archaeology and Historic Preservation (now Department of Archaeology and Historic Preservation [DAHP]) (Blukis Onat 1987; Dunnell and Fuller 1975; Miss and Campbell 1991). Archaeological investigations became more targeted and project related later in time.

Table 1. Previous Cultural Resource Investigations Within Approximately One Mile of the Project Area.

AUTHOR	DATE	PROJECT	RESULTS*
Dunnell and Fuller	1975	An Archaeological Survey of Everett Harbor and the Lower Snohomish Estuary-Delta	None
Blukis Onat	1987	Resource Protection Planning Process Identification of Prehistoric Archaeological Resources in the Northern Puget Sound Study-Unit	Overview
Evans-Hamilton	1988	The Location, Identification and Evaluation of Potential Submerged Cultural Resources In Three Puget Sound Dredged Material Disposal Sites	None
Robinson	1990	A Cultural Resources Survey of SR 5: Everett Park and Ride Preliminary Site #8, Snohomish County, Washington	None
Miss and Campbell	1991	Prehistoric Cultural Resources of Snohomish County, Washington	None
Demuth	1998	Technical Report: Historic, Cultural, and Archaeological Resources Assessment for Everett-to-Seattle Commuter Rail Project Environmental Impact Statement	Historic buildings
Johnson	2000	Letter Report: Proposed California Street Overpass, Everett, Washington	None
Barnard and Gordon	2005	Sunken Vessels and Aircraft Containing Hazardous Materials in Puget Sound	One sunken vessel
Johnson Partnership	2005	Appendix I: Cultural and Historic Resource Analysis 12th Street Marina & North Marina Redevelopment 3333Project Port of Everett	Historic buildings
Juell	2006	Archaeological Site Assessment of Sound Transit's Sounder: Everett-to-Seattle Commuter Rail System, King and Snohomish Counties, Washington	None
Hartmann	2008	Technical Report: Cultural Resources Assessment for the Swift Bus Rapid Transit Project, Snohomish County, Washington	None
Baker and Allen	2010	Cultural Resource Inventory for the Community Health Centers of Snohomish County – Replacement of the Broadway Clinic Building Project, Everett, Snohomish County, Washington	None
Lenz et al.	2011	Cultural Resource Assessment for the Broadway Bridge Replacement Project, Everett, Washington	Historic bridge and two buildings
McDaniel	2011	Cultural Resources Inventory Report, Everett Shipyard Cleanup Project, 1016 14th Street, Everett, Washington	None
Boswell and Sharley	2012	Level II Documentation of the Kimberly-Clark Mill Site Main Office Building	Historic building

*Newly recorded cultural material identified within one mile of project area.

By the 1990s, archaeological investigations were more commonly associated with transportation-related projects. For example, cultural resources investigations were completed for the Washington State Department of Transportation's (WSDOT) Everett Park and Ride and California Street Overpass projects, as well as for the Swift Bus Rapid Transit project that WSDOT accomplished in partnership with Snohomish County (Hartman 2008, Johnson 2000, Robinson 1990). Cultural resources investigations

related to transportation projects were also undertaken for Sound Transit's Everett to Seattle Commuter Rail line and the City of Everett's Broadway Bridge replacement over the Burlington Northern Santa Fe (BNSF) Railroad (Demuth 1998; Juell 2006; Lenz et al. 2011).

Two previous cultural resources investigations were completed for the Port of Everett, including one for the 12th Street Marina and North Marina redevelopment project and one for the cleanup of the Everett Shipyard [redacted] (Johnson Partnership 2005; McDaniel 2011). One historic bridge and historic buildings were identified in the project vicinity by Demuth (1998), the Johnson Partnership (2005), and Lenz et al. (2011). Two other previous investigations highlight cultural resources submerged in the port, including one for dredging by the USACE and one related to cleanup of spills associated with sunken vessels by the Environmental Protection Agency (EPA) (Barnard and Gordon 2005; Evans Hamilton 1988). Barnard and Gordon (2005) identified a sunken vessel called the *Al-ind-esk-a-sea* in Port Gardner at 222 feet below sea level [redacted]. Cleanup in the project vicinity also sponsored Level III documentation of the K-C WW upland area mill main office building before it was demolished as part of this project (Boswell and Sharley 2012). Just one assessment not associated with transportation was recently completed for the Community Health Centers of Snohomish County for replacement of a clinic in Everett (Baker and Allen 2010).

Two cultural resources have been recorded within 1 mile of the project (Table 2). One of these resources is a pre-contact lithic isolate and the other is an historic church. Site 45SN88 is a bipointed CCS knife (10 by 4.5 centimeters wide and 12 millimeters thick) identified during private home construction [redacted] (Mattson 1980). The isolate's setting was further described in 1991 when a new site form was filled out, but the artifact was not illustrated and no new data was presented (Stenholm 1991). The forms state that any other cultural materials that may have once associated with the knife have since been destroyed. Site 45SN555 is the Trinity Episcopal Church cemetery (columbariam), located adjacent to the Trinity Church Sanctuary originally constructed ca. 1920 (DAHP 2013). The church still stands [redacted]. There are no previously recorded sites within the project boundary.

Table 2. Previously Recorded Sites Within Approximately One Mile of the Project Area.

SITE NO.	COMPILER/DATE	AGE	DESCRIPTION	[redacted]
45SN88	Mattson 1980; Stenholm 1991	Pre-contact	Connerman Site (Lithic isolate)	
45SN555	DAHP 2013	Historic	Trinity Episcopal Church Columbariam	

This assessment is focused on archaeological resources and does not address historic buildings in the K-C WW upland vicinity. Nine surveys of historic buildings have already been completed within 1 mile of the APE and historic buildings have been documented as a result. These surveys are not included in Table 1. One contingency of the SEPA determination of no significant adverse project impacts was that demolition of the Puget Sound Pulp and Timber Main Office Building could not occur until adequate evaluation, documentation and recordation of the building was complete, which was fulfilled in 2012 (Boswell and Sharley 2012; Kimberly-Clark Worldwide, Inc. 2012). The results of previously completed cultural resources investigations provide expectations for cultural resources in the project vicinity.

EXPECTATIONS

Although the K-C WW upland area has been altered by filling, diking, pile driving, wharf building, and more recent shoreline development, it is still sensitive for significant buried cultural resources. Background research summarized above indicates that the vicinity was used intensively by Native Americans prior to Euroamerican settlement. [redacted] otential also exists for encountering other types of fishing and resource procurement camps or features along the historical shoreline. Archaeological remains along the Port Gardner shoreline may include evidence of village and camp sites; fishing, hunting, and shellfish collection and processing sites; and locations of other traditional activities (Table 3).

Table 3. Native American Site Types and Activities that May Be Represented in the Project Area.

SITE TYPE/ ACTIVITY	ARCHAEOLOGICAL EVIDENCE	ASSOCIATED LANDFORM
Village	Archaeological remains would consist of midden containing discarded shell and bone, scatters and concentrations of fire-modified rock, as well as a variety of stone, bone, or wooden tools and debris from stone tool making. The remains of buildings, poles, and other structures may be present and organic materials, such as mats and basketry, could be preserved in buried wet sites.	Beach, Backshore, or Upland
Seasonal Campsite	Archaeological remains of campsites may consist of middens containing discarded shell and bone, scatters or concentrations of fire-modified rock, and stone, bone, or wooden tools. Debris from stone tool making may be present and it is possible the remains of shelter poles, mats, and planks may be preserved. Less diversity of faunal, lithic, and feature remains	Beach, Backshore, or Upland
Sweat lodge	Archaeological evidence of such a structure would consist of a concentration or scatter of fire-modified rock and, perhaps, structural remains.	Beach, Backshore, or Upland
Cemeteries	Archaeological evidence of a burial would be human bones that may be associated with grave goods or other artifacts.	Beach, Backshore, or Upland
Cooking	Archaeological evidence of cooking activities would be dominated by fire-modified rock (FMR), with larger concentrations of FMR representing oven features. Pit features may contain identifiable charred food remains.	Beach, Foreshore, Backshore, or Upland
Weir Fishing	Archaeological remains of weir fishing in the project area would be difficult to identify. If present, fish weirs would consist of a series of aligned posts or stakes that have been pointed on one end with woody fibers, twigs, or other material woven horizontally between. The weirs are most likely to be along the shoreline where tidal channels or streams emptied into Port Gardner.	Foreshore or Marsh
Line or net fishing	Archaeological evidence for the continued use of a fishing area could result in accumulation of anchor stones or weights. Isolated artifacts, such as hooks, could also be present, but would be difficult to identify.	Foreshore or Marsh
Shellfish collection and processing	Shell middens are a widespread type of archaeological site. In addition to marking past locations of village and camp sites, middens form in shellfish processing areas. Middens at residential sites usually contain a mix of bone, lithic debitage, FMR, and tools. Midden made from refuse at a shellfish processing site is dominated by shell.	Foreshore or Beach
Sea-mammal Hunting	Little archaeological evidence of these resource procurement activities would be left at the hunting site; however, butchered bone may be in nearby camps or villages. Pointed stakes may remain below low water levels today.	Foreshore, Marsh, or Delta
Duck hunting	Archaeological evidence of duck nets would consist of the remains of paired posts. Duck or geese bones may be present in village or camp middens and projectile points or other hunting equipment could be identified. Little archaeological evidence of duck hunting activities would be left at the hunting site.	Beach, Foreshore, Backshore, or Upland
Land Mammal hunting	Isolated projectile points could be found alone or with butchered bone near a kill site. Projectile points may also be in a village or camp and would provide evidence of game hunting activities.	Upland, Beach, or Backshore

Table 3. Native American Site Types and Activities that May Be Represented in the Project Area.

SITE TYPE/ ACTIVITY	ARCHAEOLOGICAL EVIDENCE	ASSOCIATED LANDFORM
Wood & Fiber Collection	Archeological evidence of plant collection activities includes, bark peeled cedar trees, cedar trees with plank removals or bark stripping, structural remains, expedient lithic flake and cobble implements, fire-modified rock from cooking, processing , or fabrication fires and preserved mats, basketry, or other fiber or wood products.	Upland, Beach, Foreshore, Backshore, or Marsh
Toolstone collection and tool manufacture	Processes of stone tool fabrication using chipping and grinding would leave discarded stone debitage behind as part of the archaeological record. Broken Discarded or misplaced tools could be identified in camps, villages, or as isolated finds.	Upland, Beach, or Backshore
Petroglyphs	Archaeological evidence of a petroglyph would be a marking or pecking pattern carved onto or into a strategic rock face, boulder, or large cobble.	Beach, Foreshore, or Backshore

Recent studies have documented subsidence of the Snohomish delta and, depending on degree and location, sudden subsidence could have preserved pre-contact or ethnographic period archaeological sites by quickly burying them through bank sloughing or sedimentation. The portions of the project area that were once part of the backshore and beach landforms were particularly susceptible to burial by landslides and mass wasting from the uplands east of the project area. In fact, it appears a large landslide occurred at the north end of the project area in the past based on the slumped bluff profile and inclined vegetation. The intertidal zone is predominantly vulnerable to liquefaction and subsidence related to tectonic activity, which would result in disturbance and burial by sedimentation. Sub-tidal portions of the project area would also be prone to subsidence and sedimentation, but probably do not harbor archaeological resources. Delta and shoreline environments provide excellent potential for preservation of archaeological sites where wave action is subdued (Lewarch et al. 1996; Stanley and Warne 1997; Waters 1992).

Deltas are composed of bottomset, foreset, and topset beds and only the sub-aerial topset beds of a delta would be stable enough to occupy or preserve evidence of pre-contact human occupation. Most of the project area was at least partially inundated as a marsh on the delta front prior to historic development. Pre-contact archaeological deposits in the project area would most likely be related to hunting, fishing, or other marsh-type resource procurement and sites, if present, would be buried under fine-grained intertidal alluvium that historically accumulated on top. Pre-contact archaeological materials or ethnographic deposits in this setting would probably exhibit signs of tidal reworking or rapid burial as a result of alluvial processes on the delta front or subsidence. More substantial pre-contact and ethnographic period archaeological sites associated with cooking, camping, and habitation would probably be on elevated landforms, if present, near the former shoreline along the east margin of the property where a beach was once present.

The project area is also very sensitive for historical archaeological resources. Although a number of Euroamerican explorers and traders visited Port Gardner between the 1820s and 1850s, the permanent Euroamerican presence along Port Gardner's southeast shoreline dates to the early 1860s. Archaeological evidence of Euroamerican visitors may be found in archaeological sites in the vicinity and would consist of artifacts like glass beads, metal tools and pots, guns, buttons and other new materials and technologies. Historical cultural materials dating after 1862 are more clearly attributed to Euroamericans and could include architectural, industrial, domestic and other assemblages (Table 4). Cultural materials associated with nineteenth-century homesteading, mills and railroads, early industry, and residential occupation may be in the project area. Euroamerican entrepreneurs significantly altered

Table 4. Historical Site Types and Activities that May Be Represented in the Project Area.

SITE TYPES / ACTIVITIES	ARCHAEOLOGICAL EVIDENCE	ASSOCIATED LANDFORM
Early Homestead	Archaeological evidence of early historic homesteading could be in the form of agricultural ditches, levees, old roads and foundations, structures in ruin, debris concentrations, or artifact scatters. Highest potential for encountering these would be at the south end of the property near the foot of Everett Avenue, closest to Brigham's cabin.	Upland, Beach, Backshore, or Marsh
Great Northern Railroad	Archaeological evidence of the Railroad in the project vicinity might consist of wooden trestle, ties, metal spikes, pilings, a particular kind of fill under the trestles, metal hardware, ruins of support structures, and mass deposits of industrial debris along the tracks, such as piles of slag, coal, cinders, and other debris. These materials are expected to be more common along the east edge of the project area.	Upland, Beach, Marsh, Backshore, or Foreshore
Everett Flour Mill	Pilings of wood and concrete, horizontal decking, discarded machinery, demolition debris, industrial artifacts, abandoned utilities, and railroad remains are all forms of archaeological evidence related to the Everett Flour Mill that may be in the project area. These materials may be buried below fill and debris associated with the Puget Sound Pulp and Timber Company.	Upland, Beach, Marsh, Backshore, or Foreshore
Clark-Nickerson Lumber Co. Mill	Pilings, bulkheads, horizontal decking, discarded machinery, demolition debris, industrial artifacts, abandoned utilities, and railroad remains may be buried below mill deposits associated with the Puget Sound Pulp and Timber Company.	Upland, Beach, Marsh, Foreshore, or Sub-tidal delta
Puget Sound Pulp and Timber Company	Pilings, bulkheads, horizontal decking, discarded machinery, demolition debris, industrial artifacts, abandoned utilities, and railroad remains, building foundations and evidence for past structures where piers were historically present below fill laid down by the Soundview Pulp Company or disturbed by excavations for new utilities and construction by later mill owners.	Upland, Beach, Marsh, Backshore, Foreshore, or Sub-tidal delta
Soundview Pulp Company	Pilings, horizontal decking, structural foundations, discarded machinery, demolition debris, industrial artifacts, abandoned utilities, and railroad remains.	Upland, Beach, Marsh, Backshore, Foreshore, or Sub-tidal delta
Scott Paper Company	Pilings, horizontal decking, structural foundations, discarded machinery, demolition debris, industrial artifacts, abandoned utilities, and railroad remains related to the Scott Paper Company . It may be difficult to discriminate between cultural materials related to Soundview Pulp Company and Scott Paper Company.	Upland, Beach, Marsh, Backshore, Foreshore, or Sub-tidal delta
Log dumps and rafting areas	Modern maps of the project vicinity show pilings in the rafting areas marked on historic maps. Other archaeological features, such as rope, waterlogged rafts, pilings, horizontal decking, industrial artifacts, or logging tools like peaveys, cable, and chain could be present.	Marsh, Foreshore, or Sub-tidal delta
Debris concentrations	If the debris is industrial in origin it may contain tools, hardware, or byproducts. If the debris originates from a residential source it may contain broken home items, ceramics, empty bottles, or other evidence for residential and social activities. The concentrations or scatters of artifacts may be interbedded with layers of wood waste or fill.	Upland, Beach, Marsh, Backshore, or Foreshore
Temporary Dwellings	Remains of squatter shacks, structures or artifact scatters at the lower fill boundary in the vicinity of their shacks south of the mill. Deposits could contain information regarding lifestyles of employees belonging to identifiable ethnic or socioeconomic groups. Evidence for the ethnicity of squatter occupants may be in the form of structural architecture or imported items, such as ceramics, clothing, medicines, or food jars.	Upland, Beach, or Backshore

and filled the shoreline and old beach surfaces are certainly present below the fill. The fill itself might contain historical archaeological deposits or objects in the form of artifact dumps or scatters and possibly stable surfaces that could have been occupied between fill events. Maps of the project area show docks and wharves expanding at a great pace, especially between 1900 and 1910 and between 1929 and 1936.

Three deposits, or strata, were expected in the project area based on background research and review of the previously completed borings that will be discussed below. Fill would be below the dock structures and along the shoreline parallel with the upland. Delta sands and dredged sediment would be expected in the intertidal portions of the project area that are not covered with fill, where sediments are largely the product of modern delta progradation and active estuarine processes. The top 10 feet of fill is expected to be highly disturbed by repeated mill construction cycles and utility installation and

upgrades. Deeper fill may be less disturbed and its stratification may reflect the historic context. Natural deposits are expected to be rare above 20 fbs, as the entire Snohomish River mouth is controlled and artificial. Holocene-age deposits below the fill are expected to grade from coarse to fine from northeast to southwest across the project area, as one moves from more proximal to distal along the delta shoreline.

METHODS

Research began with examination of records at the Department of Archaeology and Historic Preservation (DAHP) for previously recorded sites and reports of previous investigations in the project vicinity. Other background information was collected from ethnographic and historic accounts, regional cultural resource investigations, the collections of local historical societies, and from environmental reports and other sources. The holdings of the Everett Public Library, the Seattle Public Library, and the University of Washington Library and Special Collections were searched for information related to the Everett waterfront. General Land Office (GLO) and Bureau of Land Management (BLM) cadastral survey and land entry records were reviewed, and researchers completed a search of historical maps in Washington State University's on-line map collection and the online resources of the Great Northern/Northern Pacific Railway Historical Society, as well as at the University of Washington and Everett Public Libraries. Copies of numerous industry trade publications were also found at the University Washington Library as were microfilm of historic newspapers. Photographs in the University of Washington's and Everett Public Library's digital collections were also reviewed.

Geoarchaeological analysis was undertaken once historical and environmental research was complete. Previously completed geotechnical investigations provide a means of researching buried landforms and their histories within the project area. Geotechnical data was reviewed to determine depth of fill across the K-C WW upland area and to find out if sufficient evidence is available below the fill to characterize contrasting environmental settings that could have hosted early inhabitants. The logs of 154 previously completed borings were then reviewed and 69 of the most descriptive logs recounting the deepest deposits in the K-C WW upland are were selected to be entered into a Rockworks™ software database. A summary of the core data entered into the database is in Appendix B. The borelogs reviewed were provided by K-C WW, Inc. and compiled by Aspect Consulting for this project. The purpose of the geotechnical investigations was installation of groundwater sampling monitoring wells and understanding the extent of soil contamination. The boreholes were drilled using direct push or hollow stem auger methods by Cascade Drilling and using hand augering methods by Aspect. The results of geotechnical analysis will eventually be presented in a report, but a document summarizing the cores was not available for this assessment (Germiat 2013). Bores ranged from 1 to 31.5 fbs with an average depth of 14 feet below the surface (fbs). The average depth to the base of the limited selection of cores used for this geoarchaeological assessment is 17.7 fbs. The results of geoarchaeological analysis are in the following section. The borelog data was used to construct a 3-dimensional model of the fill topography and detailed cross-sections were also compiled to aid in the development of the sensitivity maps found at the end of this assessment.

All the background research allowed for formulation of the expectations for cultural resources in the project area, as described above. These combined data were then used to model the sensitivity for buried cultural resources in the project area, especially within the 11 areas slated for opportunistic cleanup. The sensitivity model uses a limited number of geomorphic variables to predict the risk of clean up or other actions intersecting Native American or historical archaeological sites. The geomorphic variables, such as beach or marsh that were defined from the results of geotechnical borings, are

combined with ethnographic and historical information to be as complete a representation as possible. SWCA used ArcGIS Spatial Analyst, an extension of the ESRI ArcGIS software program designed to analyze spatial data and relationships, to build the archaeological sensitivity model. Spatial Analyst is particularly useful for suitability modeling, that is, combining a variety of data sets to identify the most suitable or likely places for a particular activity or occurrence. GIS layers are created from the data sets and the layers are stacked or overlaid. Although questions remain about precise locations of archaeological material in the project area, this assessment has characterized areas of risk within the K-C WW upland area in a way that allows planners to take areas assigned a moderate to high risk for buried cultural resources into account when designing cleanup procedures.

Models oversimplify complex systems and the results of modeling should be used with caution. Additional data that would greatly increase the accuracy and utility of this model includes bathymetry information dating to between 1902 and 1936 and data from archaeologically monitored borehole and other excavations. The following model only reflects sensitivity for cultural resources based on information collected from archaeological and geotechnical sources. Contemporary Native American use of the shoreline may include additional sensitive areas and other areas of traditional value that could be affected by cleanup activities may also exist in the project boundary.

GEOARCHAEOLOGICAL ANALYSIS

Existing borehole data from the K-C WW upland area was categorized by the project geoarchaeologists using a facies approach that organized the downhole lithology into vertical and lateral sequences. Three strata, Fill, Holocene, and Pleistocene were identified in the borings. Each sediment layer logged by Aspect is a unit with distinct observable physical properties, such as color, lithology, texture, and sedimentary structure, called a lithofacies and each stratum hosts a number of lithofacies (Miall 2000). Each lithofacies is the product of a depositional process and has a set of distinctive lithologic characteristics. Lithofacies analyses develop interpretations of past environments by characterizing the geometry of deposits and modes of sedimentation within a localized area, and are an important tool for reconstruction of the local landscape history (Eyles et al. 1985; Gilbertson 1995; Miall 2000; Reading 1978). Lithofacies analyses also offer a way to generate reasonable expectations regarding areas of potential archaeological sensitivity within a study area because grouping depositional sequences on the basis of facies types facilitates interpretation of landscape characteristics, assists in identification of site formation processes, determines the suitability of the physical substrate for habitation or as potential resource areas, and establishes a relative chronological sequence. A 3-dimensional model of the fill topography and detailed cross-sections were compiled to facilitate the following geoarchaeological discussion (Figures 18 through 23). Eleven lithofacies were identified in the Fill stratum and 17 lithofacies were identified in the Holocene stratum (Table 5). Individual facies were not named for Pleistocene deposits, which pre-date the arrival of humans to the region.

Fill

The 11 lithofacies identified in the fill are named for their dominant constituent and include layers of Asphalt, Brick, Concrete, Rubble, Peat, Gravel, Sand, Silt, Clay, Wood, and Voids (Table 5). Many of the fill layers are contaminated and give off a petroleum odor. The materials used to fill in the tideflats west

Figure 18. Map of previously completed borings used to model the sub-surface stratigraphy in the project area and cross-section transects in relation to opportunistic cleanup areas.

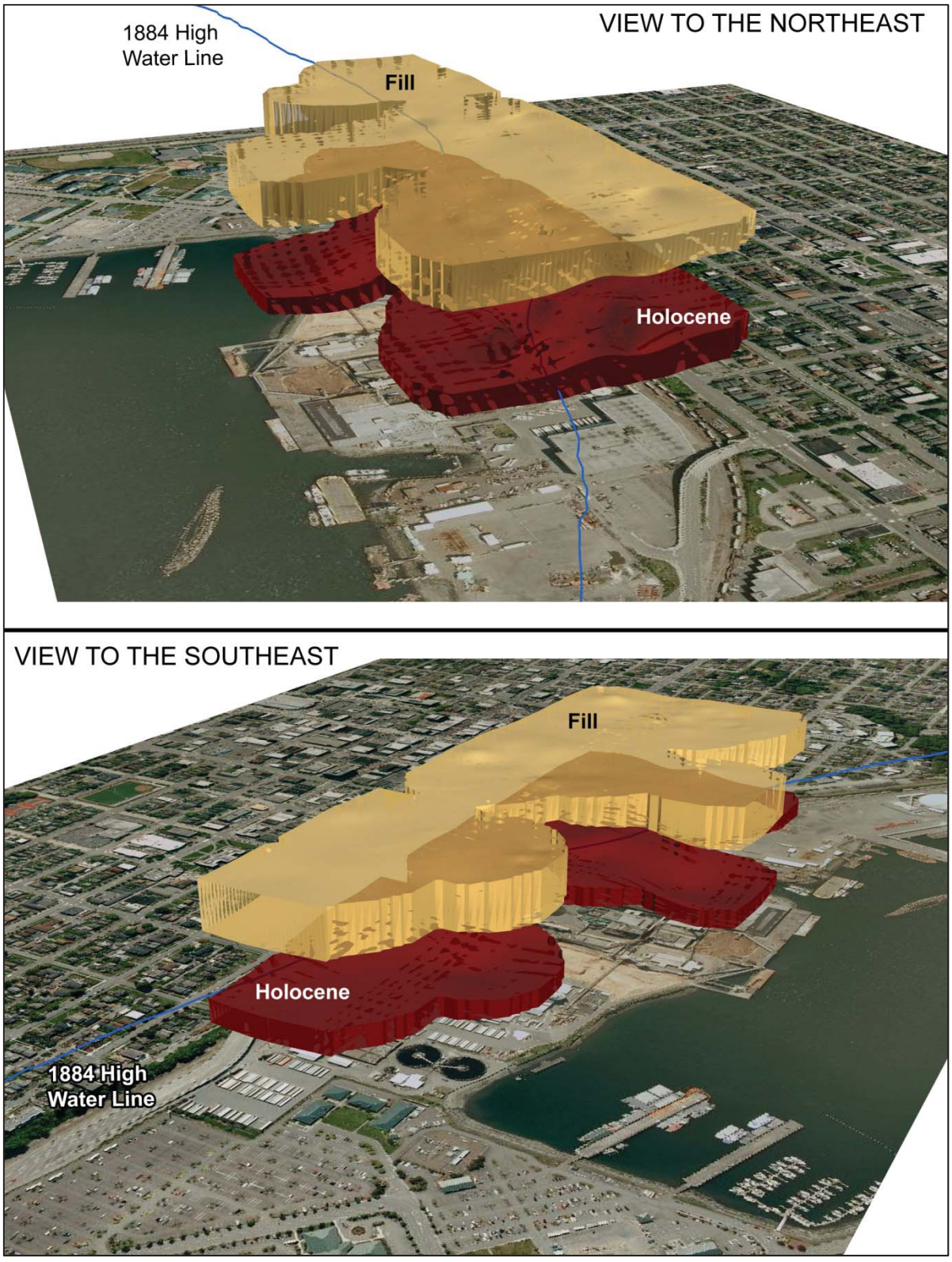

Figure 19. 3-D model of project area stratigraphy showing fill and Holocene deposits overlain by the streetscape.

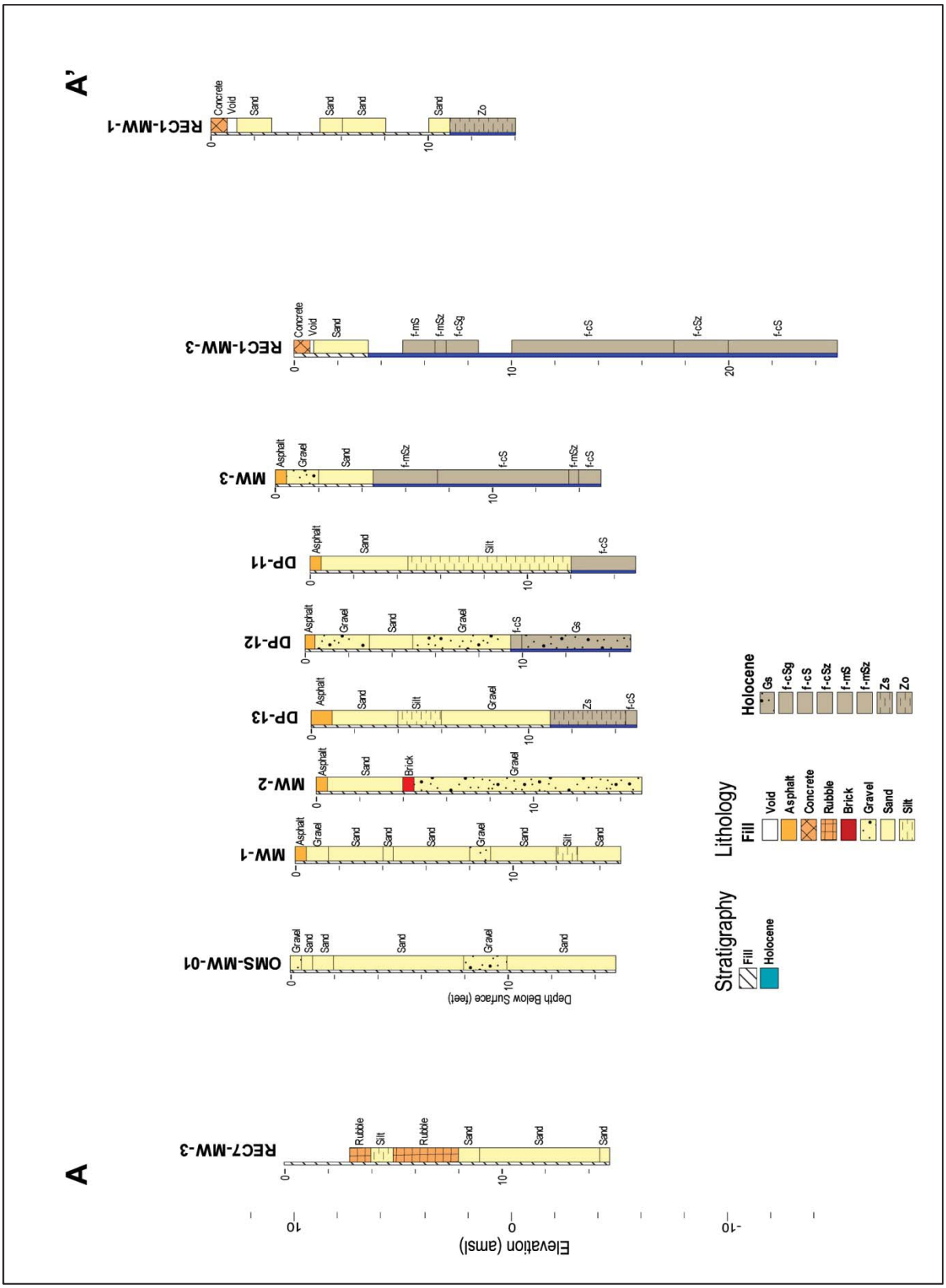

Figure 20. A-A' cross-section.

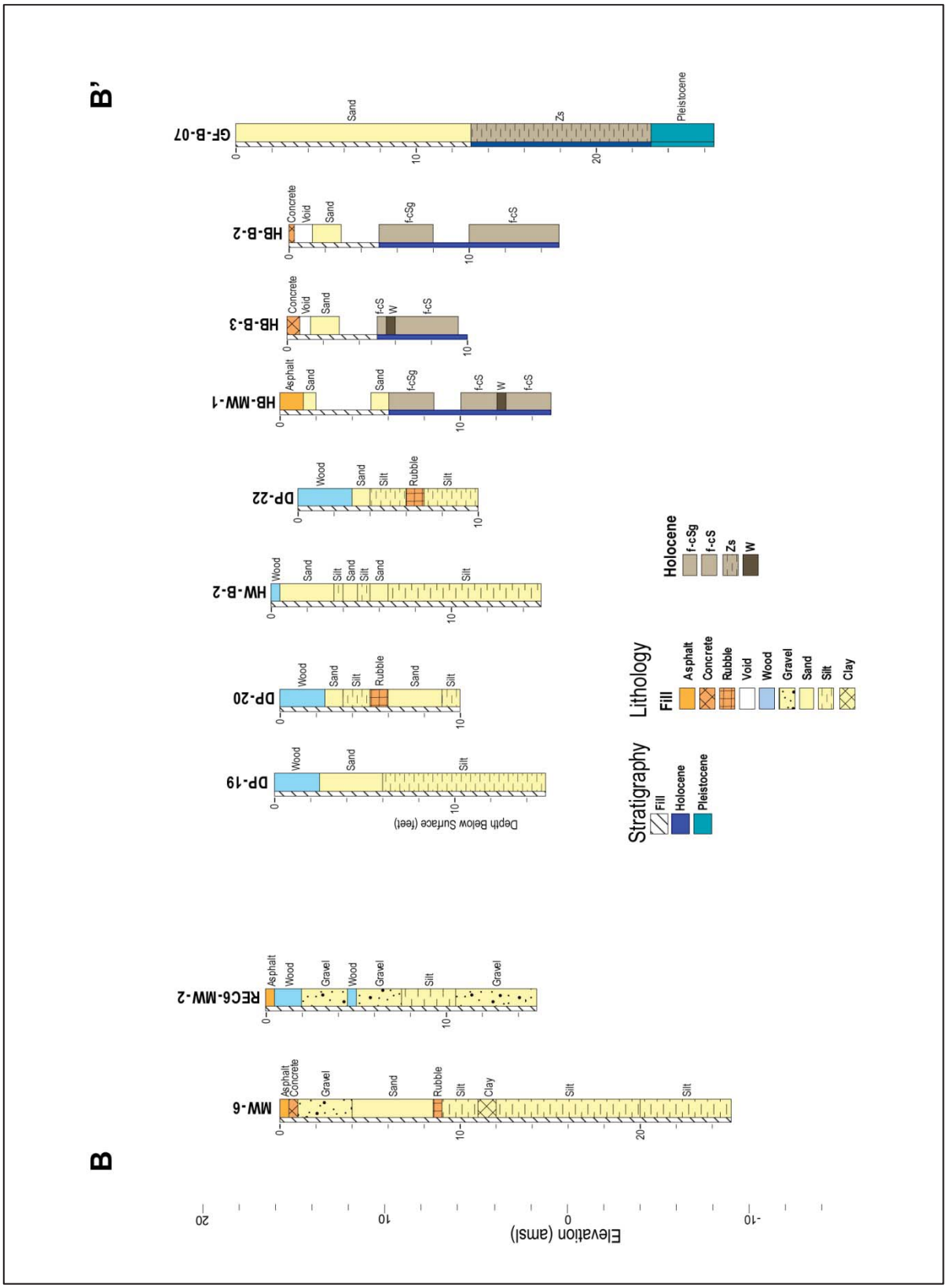

Figure 21. B-B' cross-section.

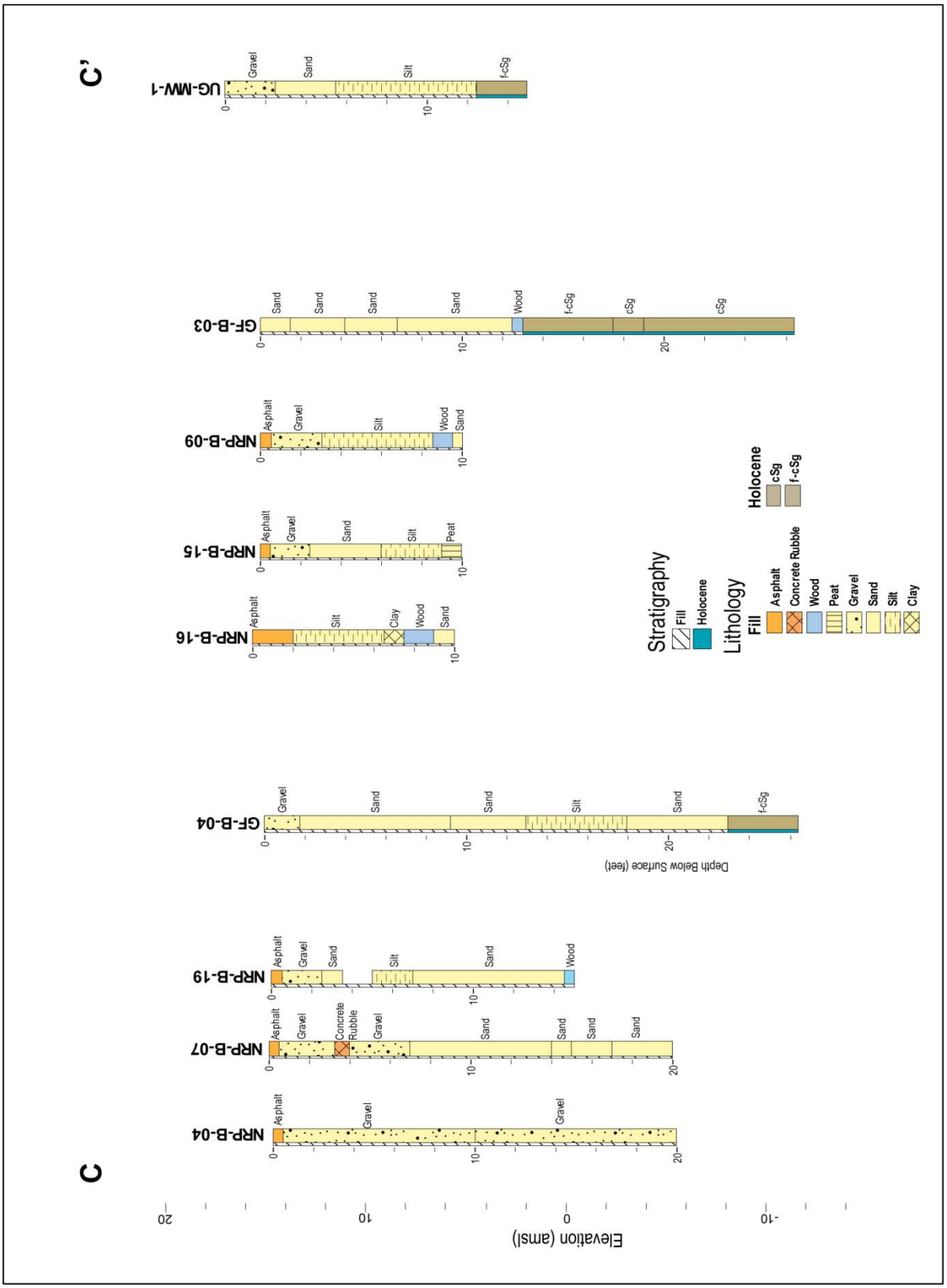

Figure 22. C-C' cross-section.

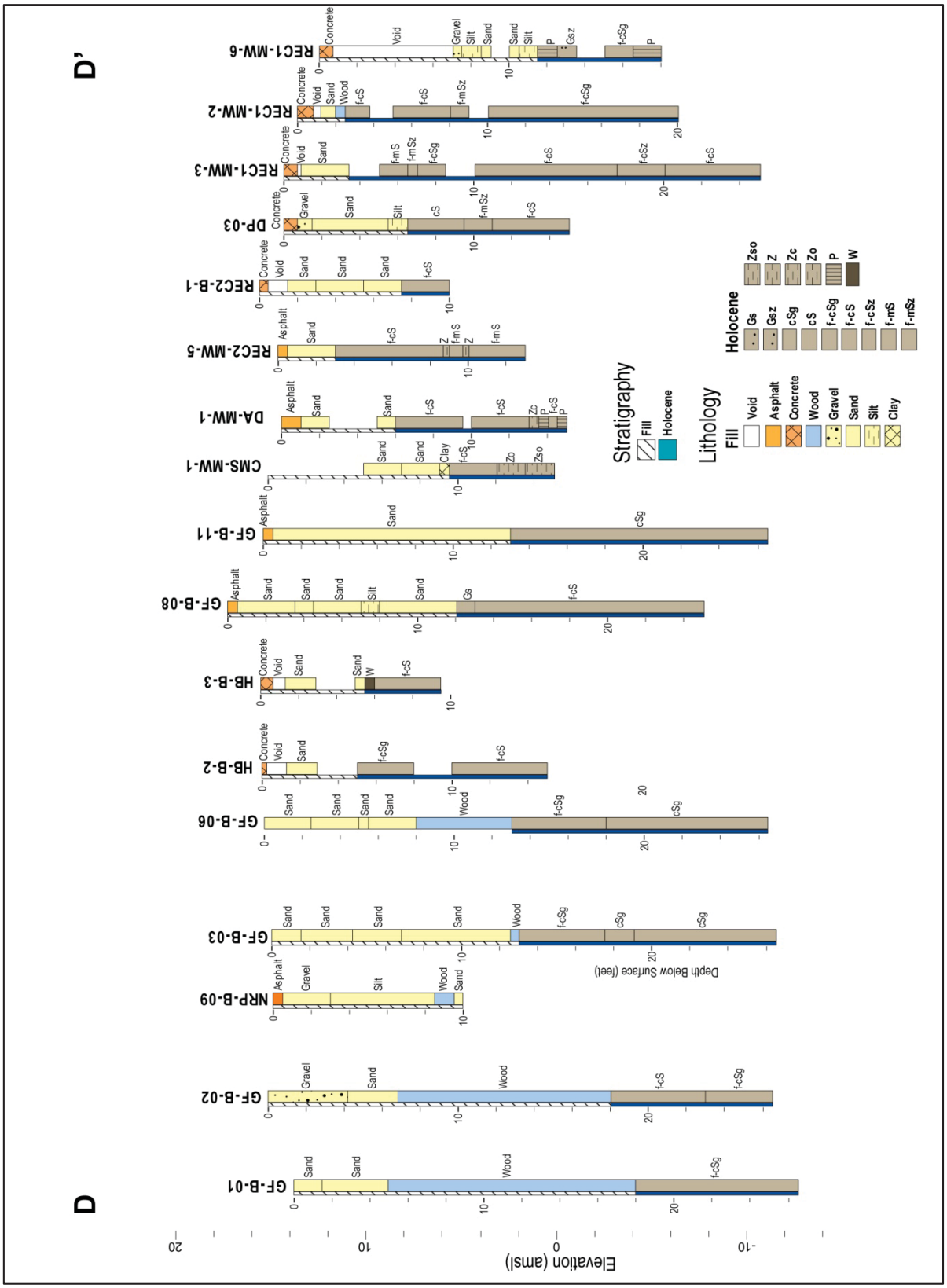

Figure 23. D-D' cross-section.

Table 5. Typical Descriptions of the Historical Fill and Holocene-aged Lithofacies Recorded in Borings in the K-C WW Upland Area With Inferred Depositional Environments and Shorthand Nomenclature.

FILL LITHOFACIES	TYPICAL DESCRIPTION
Asphalt	Asphalt; mainly at the ground surface.
Brick	Bricks in a matrix of sand and gravels with other wood debris and plastic.
Concrete	Concrete; mainly at the ground surface.
Rubble	Concrete rubble in a matrix of silty, gravelly, sand.
Peat	Dark brown peat with a large component of sawdust.
Gravel	Grayish brown, sandy or silty, angular to sub-rounded, small to very large pebbles, sometimes with scattered shell fragments and dispersed cultural debris; commonly described as crushed rock.
Sand	Brown to dark gray, usually gravelly, sometimes silty, fine to very coarse sand with iron oxide mottles, organic and woody debris, and scattered shell fragments; gravels range from very few to common, very small to large pebbles when present; silt is commonly concentrated in thin beds within the sand units when present; scattered historical cultural debris; highly variable deposit.
Silt	Varies from black to brown to bluish gray, sometimes gravelly and usually sandy, silt with scattered organic and woody debris; gravels are few to common, sub-rounded to angular, small to large pebbles when present; sometimes with a significant amount of wood waste; rarely clayey.
Clay	Dark gray to grayish green, usually silty, clay.
Wood	Wood chips, sawdust, and wood waste.
Void	Structural void space.

HOLOCENE LITHOFACIES	TYPICAL DESCRIPTION	INFERRED DEPOSITIONAL ENVIRONMENT
Gs	Dark brownish gray, sandy, sub-rounded, small to large pebbles.	Beach or Upland
Gsz	Gray, sandy, silty, small to very large pebbles with many organic debris.	
cSg	Gray, gravelly, coarse to very coarse sand with few to common, rounded, very small to large pebbles; sometimes with few woody debris.	
cS	Gray, coarse to very coarse sand with a few pebbles.	
f-cSg	Gray, occasionally silty, gravelly, fine to very coarse sand; gravels are few to common, small to large pebbles; sometimes with few wood chips or shell fragments.	
f-cSzg	Dark brown, gravelly, very silty, fine to medium sand.	
f-cS	Black to dark gray to brown, sometimes silty, gravelly, fine to very coarse sand with a few small to large pebbles; sometimes with organic or woody debris and scattered shell fragments.	Backshore, Foreshore, or Beach
f-cSz	Gray, silty, fine to coarse sand with very few, very small pebbles; silt component commonly in the form of thin interbeds with small organic debris.	
f-mS	Brown to dark gray, fine to medium sand sometimes with very few, small to very large pebbles and scattered shells; sometimes slightly silty.	
f-mSz	Dark gray to gray, silty, fine to medium sand; usually with organic debris and shells.	
Zs	Black to dark gray, sandy silt; sometimes laminated and organic-rich; sometimes with very few, small pebbles; sand is usually fine- to medium-sized.	
Zso	Dark brown, fine to coarse sandy, organic-rich silt.	
Z	Brown or gray silt	Marsh, Backshore, or Sub-tidal delta
Zo	Dark brown peaty silt to organic-rich silt with woody debris.	
W	Wood.	
P	Brown fibrous peat.	
Zc	Gray clayey silt.	

LITHOFACIES BASED ON MODAL GRAIN SIZE	SECONDARY PROPERTIES OF NATURAL DEPOSITS	MODIFIERS FOR SAND
G – Gravel	g – gravelly	c – coarse
S – Sand	s – sandy	m – medium
Z – Silt	z – silty	f - fine
W – Wood	c – clayey	
P – Peat	o – organic-rich	

of the historical shoreline are mainly composed of thick sand layers with pockets of gravel and silt. Gravels are more common above about 6 fbs and silt is more common below about 6 fbs, suggesting the early sources of fill were from offshore dredging activities and the fill source later changed. Wood debris related to mill waste is also a common component in the fill west of the historical shoreline, especially in the top 15 feet of fill north of borehole HB-B-2, in the form of wood chips and sawdust (see Figure 18).

Layers of wood and sawdust were also called out as individual deposits in the borelogs. Other cultural materials identified as discrete deposits in the fill include bricks and concrete rubble. Brick in borehole MW-2 at 4 fbs, drilled along the historical average low water level, may relate to mill structures built by the Soundview Pulp Company. Nearby borelogs noted nails, tile, ceramics, charred wood, and slag in the sand between 4.5 and 6 fbs as well. Rubble is commonly found between 5 and 9 fbs in cores drilled west of the historical shoreline on what would have been the tideflats, or foreshore landform, prior to the 1930s. This rubble is probably related to dumping off of the piers rather than *in situ* structural debris. Rubble in borehole REC7-MW-3 at the west edge of property may relate to mill construction after about 1930 and rubble in borehole NRP-B-07 between 3 and 4 fbs could be part of the expanded Clark Nickerson Mill, as well.

The fill thickens from east to west, from about 10 to 23 feet (see Figure 19). Many cores did not sample deeply enough to characterize the base of the fill, especially west of the historic shoreline. The fill east of the historic shoreline is almost completely composed of sand, and is an average of 6 feet thick (varies from 2.5 to 12 feet). Void spaces are at the top of the fill east of the historical shoreline and they represent the empty space between current pile-supported floor slabs of structures that were drilled through and the underlying sedimentary fill. Units recorded as voids are not equivalent to samples with no recovery. Evidence of the squatters, buried mill materials or structures, and any other historic surfaces were generally absent from cores drilled on the beach and backshore portion of the shoreline that would have been the highest elevation land in the historical project area. One layer of wood at about 2 fbs in borehole REC-1-MW-2 could be related to the squatters or bath houses that were in the southern project area between 1902 and 1914 (see Appendix C, Maps 1, 2).

Holocene-age Deposits

The naturally deposited, or Holocene, facies types are also classified according to the modal grain-size of the depositional layer, indicated with a capital letter. Table 5 includes the shorthand nomenclature scheme used to categorize the naturally deposited sediments in the project area, as well as a list of secondary properties used to further describe those lithofacies. Glacial deposits below the Holocene sediment were not usually encountered in the shallow borings, but the brown, gravelly, silty, fine to coarse sand below 23 fbs at the base of borehole GF-B-07 and compact, gray, silty, fine to very coarse sand also below 23 fbs at the base of borehole GF-B-13 are probably glacial in origin.

A layer dominated by sand-sized sediments would be designated with the letter “S.” Secondary properties were designated by a lower-case letter appearing to the right of the capital letter. The lower case letters may represent secondary constituents of the depositional unit, or may be used as an additional descriptor term for the modal grain-size. For example, in the facies type f-mSz, “S” indicates that sand is the primary constituent; the “f-m” shows the sand ranges from fine to medium in texture, and the “z” signals silt as a secondary component. The 17 lithofacies in Table 5 relate to different sub-environments of Port Gardner, such as the sub-tidal delta, marsh, upland, beach, foreshore, and backshore. The borelogs include gravelly (Gs and Gsz), sandy (cSg, cS, f-cSg, f-cS, f-cSzg, f-cSz, f-mS, and f-mSz), silty (Zs, Zso, Z, Zo, and Zc), and organic (W and P) facies (Table 5).

Natural deposits below the fill across the project area are mostly composed of sand, mainly thick deposits of f-cS, cS, and f-mS that are sometimes silty (f-mSz and f-cSz) or gravelly (Gs, f-cSg, and cSg). The coarser deposits of sand and gravelly sand represent a beach environment, while the finer-grained sands suggest a foreshore or intertidal depositional environment. Beach sands and gravels are sometimes interbedded with deposits of natural wood (W). One layer of black, f-cS with scattered shell fragments below the fill from 12-15 fbs in DP-11 could represent a cultural deposit. The coarser deposits are concentrated north of borehole GFB-11, but are found across the project area too. Finer-grained sands and silts are concentrated south of borehole GFB-11, but are also distributed across the project area. Natural deposits are more variable along the intertidal zone where the sand deposits are interbedded with naturally deposited units of silt (Zs, Zso, Zo, Z, and Zc) and gravel (Gs and Gsz). Backshore sediments deposited along the far eastern edge of the property include silt (Zo) and peat (P) units. The natural deposits were not described in great detail on the geotechnical borelogs, so it is not possible to define any evidence for landslides or subsidence based on the existing data.

Other borehole data is available from the south end of the current project collected for ExxonMobil Environmental Services (AMEC 2010). The stratigraphy there is described as consisting of fill overlying recent marsh deposits and glacial sediment by the geotechnicians. Mixed beds of fill including layers of Sand, Silt, "Peat," and Wood extend to depths of between 20 and 27 fbs. The fill contains pockets of wood and brick debris up to 10 fbs. The fill deposits below an average of 20 fbs overlie a more homogeneous unit of Holocene-aged, organic-rich and clayey silt or a unit of medium sand. The more homogenous deposits beneath the fill were originally interpreted as part of the fill, however, AMEC (2010) state the silt and fine-grained sands are probably intertidal deposits. Materials that occur at depths greater than 27 fbs were interpreted to be Pleistocene-aged glacial deposits. Glaciers pre-date the arrival of humans to the region and therefore, only the very surface of a glacial deposit harbors potential for buried cultural materials. Similar stratigraphy is expected across the project area.

SENSITIVITY MODELING

The major goal of this assessment was to model the sensitivity for buried cultural resources within the K-C WW upland project area based on background research and existing geotechnical data. Geomorphic landforms defined in GIS provided the base-line data set for model building and evidence for historic development of the shoreline was overlain on top of the modeled pre-development coastline. Existing borehole data provides a third dimension of information allowing us to determine how deeply sensitivity for cultural resources extends and what types of archaeological resources might be present within depth ranges. Although the following results apply to the entire K-C WW upland area, specific formation and cultural histories are provided for the 11 areas slated for opportunistic cleanup, as excavation is imminent in those spots. Targeted site formation and cultural histories can be compiled relatively quickly for other specific locations within the K-C WW upland area in the future, if needed, now that the model has been constructed.

Landforms

Landforms act as the ideal base for the sensitivity map because, as related to the shoreline, the landforms in the project area represent availability for use and occupation. Landforms that are always underwater are assigned low sensitivity for buried cultural resources. Moderate sensitivity is given to landforms that are intertidal and were therefore used for resource procurement or other ephemeral activities. Landforms that are rarely inundated along the shoreline are assigned high sensitivity for buried cultural resources, as these would be the types of landforms past people would have lived or

camped on and used for other activities, such as resource processing and cooking. Modern filling of the project area results in geologic maps that classify the lad as urban. So, bathymetric data from early historic maps was used to determine which portions of the project area were sub-tidal, intertidal, and sub-aerial. Sub-aerial landforms identified in the project area include the upland, beach, and backshore. Intertidal landforms in the project area are the foreshore, which includes the tideflats, and marsh. Finally, the delta front is the only sub-tidal landform identified in the K-C WW upland area.

Vicinities of alluvial fans and wetlands would have provided rich resources and potential camping areas during the early Holocene, while glacial terraces were the preferred landforms for occupation. During the middle Holocene, wetlands, the shoreline, and forested uplands would have been landforms on which resource procurement and temporary camping took place, and glacial uplands and creek mouths were the preferred locations for occupation. With the exception of glacial uplands, many of these landforms have been inundated by sea-level rise during the Holocene. The shoreline, especially sand spits and creek mouths, became the preferred landforms for occupation during the late Holocene. The following paragraphs introduce these landforms and discuss them in terms of potential to contain archaeological materials.

Snohomish River Delta

Deltas are complex estuarine and nearshore land systems that were highly productive for pre-contact people. The distal end of the Snohomish River delta is just north of the project area and most of the delta landform in the project vicinity is sub-tidal. The sub-tidal portion of the delta was used much less often by Native Americans than the sub-aerial portion [redacted]. Delta-front silts and sands supported marsh environments, as well as river channel distributaries, at the delta front. Topographically low areas between distributary tidal channels often consist of muddy floodplain sediment or marsh grasses and silt if they are not completely inundated. Littoral drift cells in Port Gardner push sediment-laden plumes of fresh water south from the mouth of the Snohomish River to distribute fine-grained alluvium along the shoreline (Mutti et al. 2000).

Marsh

Tidal marshes are wetlands dominated by herbaceous plant species, such as grasses, rushes, or reeds, at the ecotone between aquatic and terrestrial land systems. Marshes provide habitat for plant and animal species that have adapted to flooded conditions with low oxygen levels. Marshes were highly productive for pre-contact peoples providing saltwater and freshwater fish, shellfish, waterfowl, terrestrial mammals, and a range of plant species useful for technical, food, and medicinal purposes. Salt water marshes, like those at the mouth of the Snohomish River, are found along protected coastlines and they are tidally influenced each day. Salt marshes flourish where sediment collects faster than the rate of delta subsidence, as it did on the Snohomish delta until historic development. The slow currents in the Snohomish River estuary allowed the fine particles in suspension in the river to be trapped by the marsh vegetation and to drop. This way, the salt marshes on top of the delta allowed the delta to grow west into Port Gardner throughout the Holocene.

Foreshore

The foreshore, or intertidal zone, is the portion of a shoreline that is inundated at high tide and exposed at low tide. Tideflats occupy the foreshore where tidal action is moderate and plenty of sediment is available, like at the mouth of the Snohomish River. The surface of the tide flat gently slopes from the beach to the subtidal zone in deeper water. The tideflat surface is marked by meandering channels, typically created during ebbing flow. Tideflats support abundant and diverse resources important to Native Americans, such as shellfish, migratory birds, and plants like tule and cattail for making mats,

stinging nettle for fiber for cordage and nets, as well as estuarine roots, rhizomes, and bulbs. Site types associated with the foreshore include weirs and traps made with posts and flexible withes. Temporary camps could be established seasonally on adjacent high ground. Beach foreshores that do not host extensive tideflats can also be important sources of resources, offering suitable substrates for formation of eelgrass beds and spawning grounds for various species of fish (Jackson et al. 2002).

Beach

Beaches are coastal accumulations of sediment, usually of clasts that are sand-sized or larger. The sediment from the beach buried in the K-C WW upland area derived from the Snohomish River delta and the bluffs to the east. The sediment was moved by tides and waves to form the beach after about 5,000 years ago (Johannessen and MacLennan 2007). Beaches have characteristic profile forms, which are determined by the steepness of the waves and the size of sediment (Downing 1983; Masselink and Hughes 2003; Thomas and Goudie 2000). Beaches are usually dry landforms, except during severe winter storms, so they were preferred for human use and occupation. Beaches provided easy access to the surrounding bay, marshes and tideflat resources and the upland where hunting and gathering also occurred. They also represent a high point in the shoreline topography that may have been utilized by Native Americans and early Euroamericans alike.

Backshore

The backshore is the supratidal portion of a beach that is usually only inundated during storms. A low ridge or berm usually separates the backshore from the beach berm (Elliott 1978). Backshore zones of beaches along the Puget Sound shores are usually narrow because the beaches are backed by bluffs and uplands rather than the dune fields that are typical of a wider coastal plain. Backshore zones can sometimes be inundated by fresh water if creeks draining the uplands flow along the bluff base. Wetlands will develop in wetter portions of the backshore, which would be attractive resource procurement locations for Native Americans. People could occupy the drier portions of the backshore environment and they would be protected from onshore winds and most waves. The east edge of the backshore in the project area appears to have been wet, according to historic maps (see Figure 4).

Upland

The bluffs ringing much of Puget Sound began forming shortly after the retreat of the continental glaciers, and in fact, most probably developed only after sea level began stabilizing about 5,000 years ago (Downing 1983; Shipman 2004). The bluff edges, and uplands behind, would have been available to inhabitants of the region beginning in the early Holocene. These areas may have supported camps of early hunter-gatherers who moved from location to location with little specialization in settlement type. These early camps would be characterized by Olcott or earlier style stone tools and fire modified rock (FMR) from campfires. Later users, more focused on the marine shoreline where fish, shellfish, and sea mammals could be found, were more likely to use the uplands and bluffs for special purposes, some related to resources like the cedar, game animals, berries, and other plants found there, as well as other purposes unrelated to subsistence, like burials. The project area marks a portion of the coastline where the bluffs are not extremely steep and the shoreline could have been accessed relatively easily from the upland.

The horizontal extent of the six historical landforms results in a model of the sensitivity for late pre-contact cultural resources in the project area. The applicability of the model is limited to the mid-Holocene and later because sea level variability before about 5,000 years ago did not allow development of productive littoral habitats. The resulting GIS map (Figure 24) depicts areas of high, medium, and low risk for finding pre-contact or very early historical period Native American archaeological sites. Highest risk areas, according to the model, are along the historic beach and sub-aerial landforms and the lowest potential for identification of sites is in areas that were historically inundated, like the sub-tidal delta. Moderate levels of risk for identification of pre-contact or very early historical period Native American archaeological sites is assigned to the intertidal zone, including the foreshore and marsh landforms, where human use was limited and sites are generally ephemeral in type. About half of the 11 opportunistic cleanup areas are on landforms with high sensitivity for buried resources. These are the Xylene UST 29/Latex Spill (2), GF 11 (8), Diesel AST Area (9), Bunker C ASTa (10), and Bunker C ASTb (11) proposed cleanup areas (Table 6). The Naval Reserve Parcel UST Area (1), Bunker C USTs71/72/73 (5), and Boiler/Baghouse Area (6) are on landforms with moderate sensitivity for buried cultural resources and the Rail Car Dumper Hydraulic System Building (3), Diesel UST 70 (4), and Heavy Duty Shop sump (7) are on the sub-tidal delta that has been assigned low sensitivity. There are no cleanup areas proposed on the upland.

Cultural materials associated with the earliest historical occupation of the project vicinity would also be along the shoreline on the beach or backshore landforms that were dry and available for use in the early 1860s. As marshland was reclaimed for agricultural use and drained the marshes became available for occupation as well. So, sensitivity for early historic cultural resources looks very similar to the sensitivity map for pre-contact cultural resources. Most of the earliest development in the vicinity was at the northeast edge of the project at the Robinson Mill, nearest areas 1 and 2. James Brigham settled at the far south end of the project and his cabin may have been as close as the foot of California Street, nearest areas 10 and 11 (see Figure 5).

Borehole data provides vertical limits to the sensitivity for buried historical cultural materials, as well as ground-truths information about the contents of the historic fill. For example, Cultural debris, such as brick and concrete fragments, woody debris, charred wood, slag, cinders, tile, ceramic fragments, and glass were described in the fill in MW-1, MW-2, DP-12, DP-13, DP-20, DP-22, GF9-MW-1, REC1-MW-9, REC7-MW-3, NRP-B-07, and UST70-B-2. Only one of these borings, NRP-B-7 is within one of the 11 proposed cleanup areas, in the Naval Reserve Parcel UST Area (1). The borehole data, in general, show deeper fill to the west where the project area was once part of Port Gardner and shallower fill to the east along the historical beach. Both the fill and underlying natural deposits are highly variable, so it is not possible to make broad generalizations about their nature for the entire project area. Instead, the stratigraphy will be characterized by proposed opportunistic cleanup area. Table 6 also describes the depth of the fill and the general stratigraphy of each opportunistic cleanup area, based on the borehole data. Sensitivity for buried cultural resources increases where fill is slightly shallower.

By overlaying the outline of the shoreline in 1886, and the shoreline with wharves in 1902, 1914, 1957, and 2013, we can observe a progression of waterfront development that generally trends from east to west and from north to south across the project vicinity. Areas where piers overlap, or where piers have been present since the shoreline was first developed, indicate areas that have not been dredged and where cultural materials would be preserved (Figure 25). Areas with the highest preservation potential are areas 1, and 8 through 11, which all have moderate to high potential for buried early historical and pre-contact cultural resources.

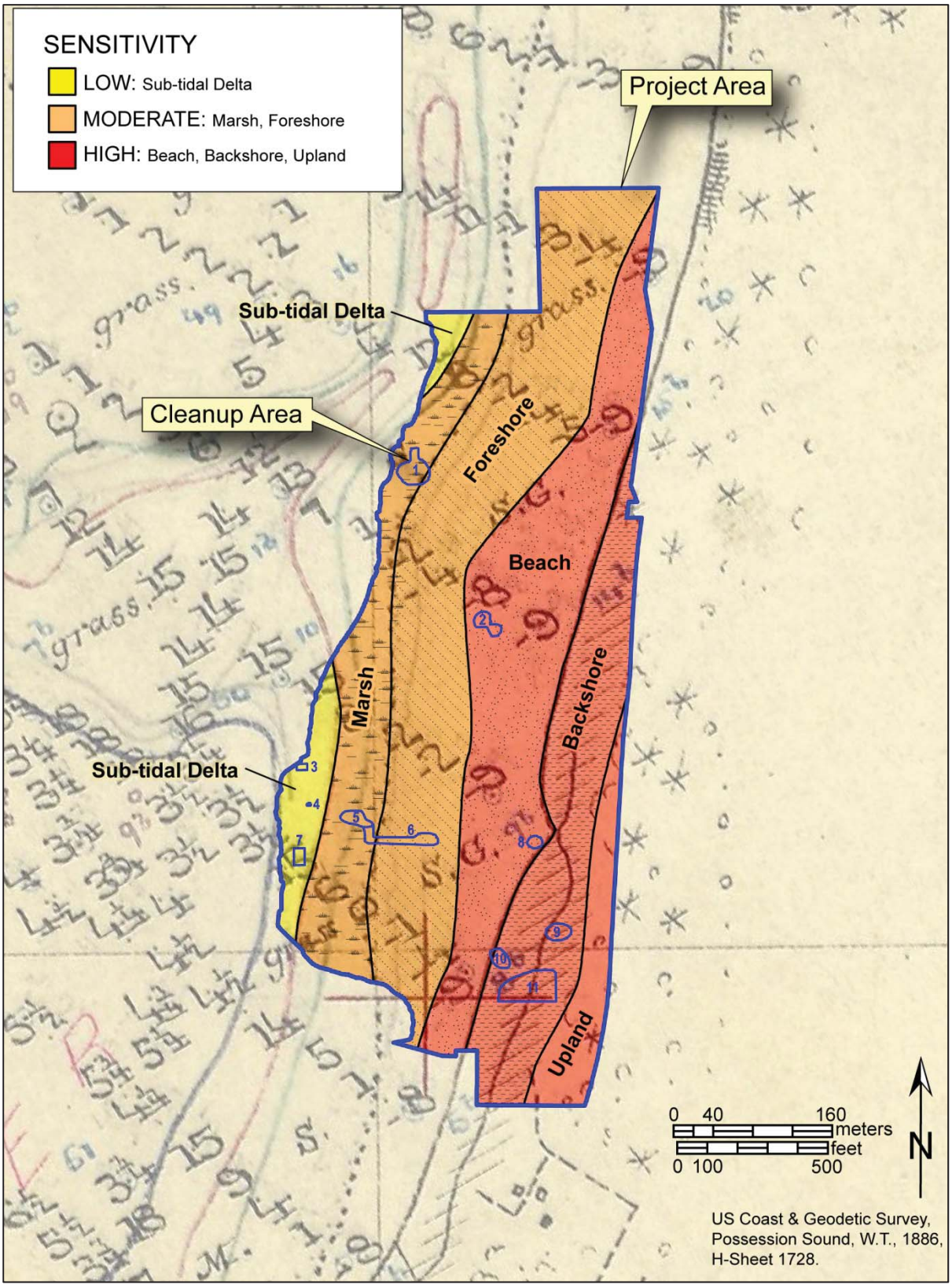

Figure 24. Areas of risk for finding pre-contact, early historical period Native American and early historical period archaeological sites, based on landforms and the historical shoreline.

Table 6. Sensitivity for Buried Cultural Resources by Cleanup Area With Summary of Fill and Holocene Stratigraphy Characteristics Based on Analyzed Borehole Data.

AREA NO.	NAME	LANDFORM	CHARACTER-IZATION OF NATURAL DEPOSITS	SENSITIVITY FOR PRE-CONTACT AND <1900 HISTORIC	EXPECTED DEPTH OF FILL	CHARACTER-IZATION OF FILL	SENSITIVITY FOR HISTORIC >1900
1	Naval Reserve Parcel UST Area	Marsh	Natural deposits not sampled	Moderate	Over 20 feet	Mixed fill to 7 fbs; Sand 7-15 fbs; Woody debris 15-17 fbs; Sand to 20 fbs	Moderate
2	Xylene UST 29/Latex Spill	Beach	Natural deposits not sampled	High	Over 12.5 feet	Gravels to 6 fbs; Silt 6-12.5 fbs	Low
3	Rail Car Dumper Hydraulic System Building	Sub-tidal Delta	Natural deposits not sampled	Low	Over 20 feet	No borings in area 3; Gravels expected near surface overlying Sand based on nearby borings	Low
4	Diesel UST 70	Sub-tidal Delta	Natural deposits not sampled	Low	Over 15 feet	Gravelly to 2.5 fbs; Sandy to 15 feet	Low
5	Bunker C USTs71/72/73	Marsh	Natural deposits not sampled	Moderate	Up to 30 feet	Wood chips and rubble 0-5 fbs; Gravel 5-12 fbs; Beds of Sand and wood chips 12-20 fbs; Sand to at least 30 fbs	Low
6	Boiler/ Baghouse Area	Marsh	Natural deposits not sampled	Moderate	Over 12 feet	Gravelly sand or silt 0-3 fbs; Wood and concrete 4-5 fbs	Low
7	Heavy Duty Shop sump	Sub-tidal Delta	Natural deposits not sampled	Low	Over 15 feet	No borings in area 7; Sand expected 0-15 fbs based on nearby borings	Low
8	GF 11	Beach	Pebbly sand with wood fragments 13-26.5 fbs	High	About 13 fbs	Sand 0-13 fbs	High
9	Diesel AST Area	Backshore	Bedded fine to coarse sand and silt 3-13 fbs; shells below 12.5 fbs	High	About3 fbs	Sand 0-3 fbs	High
10	Bunker C ASTa	Backshore	Gravelly coarse sand 10 - 26 fbs; overlying organic-rich silt to 31.5 fbs	High	About 10 fbs	Gravel 0-2; Sand 0-10	High
11	Bunker C ASTb	Backshore	Sometimes silty or peaty sand 8-12 fbs overlying gravelly sand to at least 20 fbs	High	Varies greatly from about 6 to 15 feet	A foot of gravel overlying Sand or Silt 5.5-8 fbs; Some rubble above 3 fbs; Wood at base of fill where it is deeper	High

Sanborn maps provide detail about the historical activities that occurred in the project area over time and they allow targeted expectations to be formulated on where certain types of sites might be within the project area (Table 7). Sanborn maps show areas where people may have dumped cultural debris off the piers or where concentrations of structural remains, artifacts of a certain type, or specific industrial materials might be identified. For example, the squatters housing along the shoreline south of the mill shown on the 1902 Sanborn maps present an opportunity to identify cultural materials related to residential and social themes dating to between 1902 and 1914 at the base of the historic fill. Foundations and related deposits of structures that are shown on both the 1914 and 1957 Sanborn maps might still be present just below the modern asphalt and concrete surfaces of the decommissioned mill today.

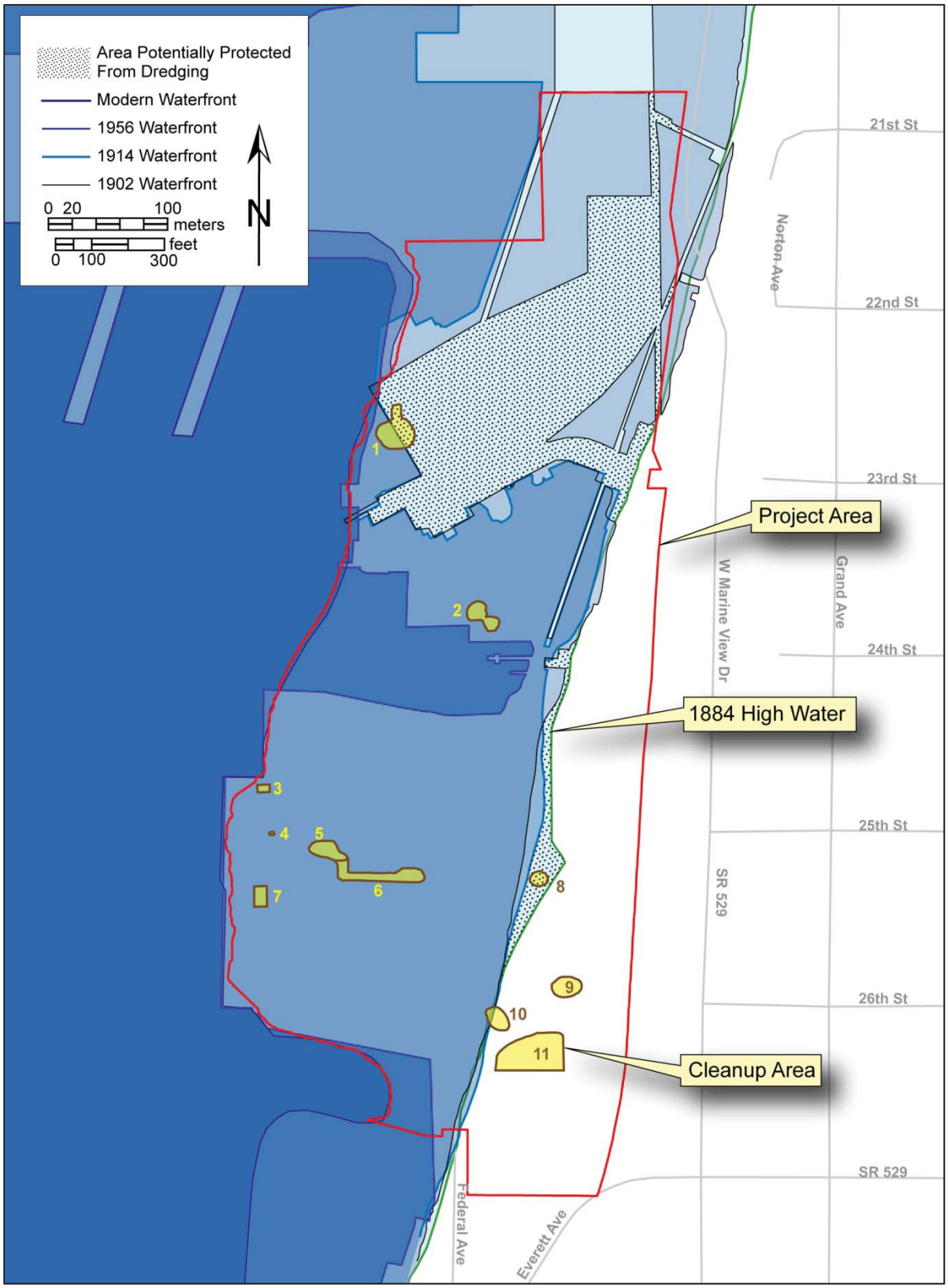

Figure 25. Map showing pre-fill shoreline and outlines of piers from historic maps from 1902, 1914, 1957 and 2013; shaded areas mark parts of the project area that have been protected from dredging.

Table 7. Historical Activities By Cleanup Area Over Time Based on Sanborn Maps and Sensitivity for Historical Cultural Resources Dating After 1900.

AREA NO.	1902	1914	1957
1	Clark-Nickerson Deep Water Dock	Clark-Nickerson Shipping Wharf	US Naval Reserve Training Center
2	Port Gardner/Beach	Port Gardner/Beach	Scott Paper Stock Tanks and pump near stock preparation area
3	Port Gardner	Port Gardner	Open wharf area near hog fuel pile; between slicer dock and Tractor shed at the Scott Paper Mill
4	Port Gardner	Port Gardner	Open wharf area near hog fuel pile; between slicer dock and Tractor shed at the Scott Paper Mill
5	Port Gardner/Salt marsh	Port Gardner/Salt marsh	Transit corridor for machines and mill waste between the Boiler and Paper Warehouse at the Scott Paper Mill
6	Port Gardner/Salt Marsh	Port Gardner/Salt Marsh	Sulphur storage, Burner, Cooler, and Digester Buildings of the Scott Paper Mill
7	Port Gardner	Port Gardner	Pulp warehouse of the Scott Paper Mill
8	Beach with Squatters Shacks	Beach just west of Nassau Road	Open wharf area between Scott paper office, the filter plant, the digester building, and the blow pits
9	Along backshore of beach with Squatters Shacks at the west edge of Nassau Road	Intersection of Nassau Rd and 26th Street	Open area at the northwest corner of the Scott paper General Warehouse headquarters
10	Beach and Backshore with Squatters Shacks	Open space just southeast of intersection between Federal Road and 26th Street; likely beach-like and sometimes wet.	Associated Oil Company Oil/Fuel Tank yard; below tanks
11	Along backshore of beach with Squatters Shacks	Open beach between Nassau and Federal roads	Associated Oil Company Oil/Fuel Tank yard; below tanks and near pumps

Sanborn maps can also be used to show where cultural materials would not be expected based on an absence of historic occupation or where more recent disturbance might have obscured archaeological evidence of earlier historic occupation. Table 7 shows a time-series catalog of culture history based on Sanborn information for each of the 11 opportunistic cleanup areas. These data correspond with the maps provided in Appendix C. Area 1 has moderate potential for buried historical resources and areas 8 through 11 have high potential for historical cultural resources. These results are similar to the sensitivity for buried pre-contact and early historical cultural materials and good preservation potential.

CONCLUSION AND RECOMMENDATIONS

The model of sensitivity for buried cultural resources in the K-C WW upland project area shows that potential is highest for both pre-contact Native American cultural resources and historical cultural materials along the pre-fill natural Port Gardner shoreline. The results are based on background research, historic maps, and existing geotechnical data. Although questions remain about precise locations of archaeological material within the K-C WW upland area, this overview has characterized areas of risk in a way that allows planning for future clean up. Above all, this assessment has shown the abundance of known resources and potential for cultural resources around the Port Gardner shoreline. In moving forward planners should take into account the locations and settings of known and suspected archaeological sites in the vicinity, as well as high and moderate risk areas within the project area, when designing cleanup procedures. Mitigation undertaken as a consequence of inadvertent discovery during implementation of cleanup can be costly and time consuming.

Excavation work associated with the interim cleanup actions will primarily occur in fill. It has already been determined that the cleanup actions will be observed by a geologist who will ensure the

excavation does not extend below the fill and that a professional archaeologist will only be contacted to assess the find if a potential archaeological object is observed by the geologist. SWCA recommends this process be applied to areas assigned low to moderate risk for buried cultural resources and an Inadvertent Discovery Plan (IDP) should be devised for this work. Proposed cleanup areas with low to moderate sensitivity for cultural resources are the Naval Reserve Parcel UST Area (1), Rail Car Dumper Hydraulic System Building (3), Diesel UST 70 (4), Bunker C USTs71/72/73 (5), Boiler/Baghouse Area (6), and Heavy Duty Shop sump (7). SWCA also recommends an archaeological monitor be present to view any excavation below the fill in areas assigned low to moderate potential for buried cultural resources and that details of this process be defined in a Monitoring and Discovery Plan (M&DP).

SWCA recommends that an archaeologist be present to monitor interim actions in areas assigned high risk for buried cultural resources. Proposed cleanup areas with high sensitivity for cultural resources are the Xylene UST 29/Latex Spill (2), GF 11 (8), Diesel AST Area (9), Bunker C ASTa (10), and Bunker C ASTb (11) cleanup areas. Additional archaeological investigations are recommended in areas assigned high risk for buried cultural resources where cleanup investigations would breach the fill and penetrate the underlying natural sediment. In addition, appropriate Native American tribes should be contacted to inquire about traditional cultural resources and other areas of traditional value that could be affected by the proposed project and may not have been previously recorded by archaeologists.

In the event that construction activities reveal such resources and an archaeological monitor is not present during the construction work, the contractor should cease construction and follow the steps defined in the IDP. If any construction activities encounter human remains, whether burials, isolated teeth, bones, or mortuary items, work in that area should stop immediately and the area surrounding the discovery should be secured.

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APPENDIX A: CORRESPONDENCE

APPENDIX A HAS BEEN REDACTED

APPENDIX B: CORE LOG SUMMARY

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83)		STRATIGR-APHY	DEPTH (fbs)		LITHOLOGY	DESCRIPTION
	NORTHING	EASTING		TOP	BOTTOM		
AP-MW-1	558440.324	5314929.122	Fill	0	0.5	Asphalt	Asphalt.
				0.5	6.5	Sand	Brown to dark gray, fine to medium sand with very few pebbles; moist; iron-oxide-gray mottles and scattered shells and organic debris.
			Holocene	6.5	8.5	f-mSz	Dark gray, silty, fine to medium sand; wet; scattered organic debris and shells; many organics and shells between 8 and 8.5 fbs.
				8.5	15	f-cS	Dark gray, fine to very coarse sand with very few pebbles.
Boiler-MW-1	558322.106	5314877.542	Fill	0	0.7	Concrete	Concrete.
				0.7	2	Silt	Dark gray, sandy, gravelly, silt; numerous organic debris; moist; petroleum-like odor.
				2	3.8	Sand	Dark gray, gravelly, fine to medium sand; moist; slight petroleum-like odor.
				5	9	Sand	Dark gray, coarse sand with faint petroleum-like odor; moist.
				10	14	Sand	Gray, gravelly, fine to very coarse sand; gravels are few to common, very small pebbles; wet; visible separate phase product and strong petroleum-like odor at 12 fbs.
				15	20	Sand	Gray, coarse to very coarse sand with very few, very small pebbles; wet; numerous shell fragments.
CMS-MW-1	558511.368	5314815.391	Fill	5	7	Sand	Dark gray, slightly silty, fine to medium sand; wet.
				7	9	Sand	Dark gray, fine to coarse sand with very few, small to large pebbles; wet.
				9	9.5	Clay	Dark gray, silty clay; wet.
			Holocene	9.5	12	f-cS	Dark gray, fine to coarse sand with few, small to large pebbles; wet.
				12	13.5	Zo	Dark brown, organic-rich silt; peat-like; wet.
				13.5	15	Zso	Dark brown, fine to coarse sandy, organic-rich silt; wet.
DA-MW-1	558511.66	5314781.801	Fill	0	1	Asphalt	Asphalt.
				1	2.5	Sand	Dark gray, gravelly, very silty, fine to medium sand; moist.
				5	6	Sand	Dark gray, gravelly, very silty, fine to medium sand; wet; plastic sheeting at 6 fbs.
			Holocene	6	9.5	f-cS	Dark gray, fine to coarse sand with very few, scattered pebbles; wet.
				10	13	f-cS	Dark gray, fine to coarse sand with very few, scattered pebbles; wet.
				13	13.5	Zc	Gray, clayey silt; wet.
				13.5	14	P	Brown, fibrous peat; wet.
				14	14.5	f-cS	Brownish gray, fine to medium sand with common to many organic debris; wet.
				14.5	15	P	Brown, fibrous peat; wet.
DP-03	558485.448	5314704.175	Fill	0	0.75	Concrete	Concrete, 9 inches thick.
				0.75	1.5	Gravel	Brown, sandy, angular, small to large pebbles; wet.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83)		STRATIGR-APHY	DEPTH (fbs)		LITHOLOGY	DESCRIPTION
	NORTHING	EASTING		TOP	BOTTOM		
				1.5	5.5	Sand	Brown to gray, silty, gravelly, fine to coarse sand; wet; wood at 4 fbs; strong petroleum-like odor.
				5.5	6.5	Silt	Black silt.
			Holocene	6.5	9.5	cS	Gray, coarse to very coarse sand with very few, scattered pebbles; wet.
				9.5	11	f-mSz	Dark gray, silty, fine to medium sand; wet.
				11	15	f-cS	Gray, fine to coarse sand with very few, scattered pebbles; wet.
DP-11	558411.289	5314693.101	Fill	0	0.5	Asphalt	Asphalt.
				0.5	4.5	Sand	Brown to dark brown, gravelly, fine to coarse sand; very moist.
				4.5	12	Silt	Dark gray, silt with scattered woody debris; wet; slight hydrogen sulfide odor.
			Holocene	12	15	f-cS	Black, fine to coarse sand with scattered shell fragments; wet; hydrogen sulfide odor.
DP-12	558397.478	5314694.045	Fill	0	0.5	Asphalt	Asphalt.
				0.5	3	Gravel	Brown, very silty, pebbles with a trace of sand; moist.
				3	5	Sand	Brown, gravelly, fine to coarse sand; moist; contains burnt and melted plastic and charred brick.
				5	9.5	Gravel	Brown, very silty, sub-angular, small to large pebbles; contains charred brick and burnt and melted plastic between 5 and 8 fbs.
			Holocene	9.5	10	f-cS	Black, fine to coarse sand; wet.
				10	15	Gs	Dark brown to dark gray, very sandy, sub-rounded, small to large pebbles; wet; hydrogen sulfide odor at 14 fbs.
DP-13	558385.311	5314698.949	Fill	0	1	Asphalt	Asphalt.
				1	4	Sand	Brown, very gravelly, fine to coarse sand; very moist.
				4	6	Silt	Dark brown, silt with few pebbles; very moist.
				6	11	Gravel	Brown, very silty, sub-angular, small to large pebbles; wet; contains firebrick, ceramic and wood fragments.
			Holocene	11	14.5	Zs	Dark gray to black, sandy silt; wet.
				14.5	15	f-cS	Black, fine to coarse sand; wet; trace of silt.
DP-18	558349.088	5315040.737	Fill	0	2.5	Wood	Wood chips.
				2.5	10	Silt	Gray, sandy, gravelly, silt; gravels are common, sub-rounded, small to large pebbles.
DP-19	558404.633	5315054.31	Fill	0	2.5	Wood	Wood chips.
				2.5	6	Sand	Gray, very silty, fine to medium sand with few, small to large pebbles; moist.
				6	15	Silt	Gray to bluish gray, silt with few pebbles.
DP-20	558421.516	5315028.792	Fill	0	2.5	Wood	Wood chips.
				2.5	3.5	Sand	Gray, gravelly, silty, fine to medium sand; moist.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83) NORTHING	EASTING	STRATIGR-APHY	DEPTH (fbs) TOP	BOTTOM	LITHOLOGY	DESCRIPTION
				3.5	5	Silt	Dark gray, gravelly, sandy silt; moist.
				5	6	Rubble	Concrete rubble.
				6	9	Sand	Black, gravelly, silty, fine to medium sand; wood chips at 7 fbs; wet.
				9	10	Silt	Brown, sandy silt; wet.
DP-22	558469.126	5315013.547	Fill	0	3	Wood	Wood chips.
				3	4	Sand	Gray, very silty, fine to medium sand; moist.
				4	6	Silt	Dark gray, sandy, gravelly silt; moist.
				6	7	Rubble	Concrete rubble.
				7	10	Silt	Mottled gray and brown, sandy silt; moist.
GF9-MW-1	558429.183	5314984.615	Fill	0	0.5	Asphalt	Asphalt.
				0.5	1.5	Sand	Brown, gravelly, very silty, fine to medium sand; moist.
				1.5	3.5	Sand	Brown, gravelly, fine to coarse sand with brick debris; moist.
				5	6.5	Sand	Dark gray and brown, gravelly, fine to coarse sand; wet.
				6.5	9	Sand	Dark gray, very silty, fine to coarse sand; wet.
				10	12	Sand	Dark gray, silty, fine to coarse sand; wet.
				12	15	f-cS	Dark gray, slightly silty, fine to coarse sand; wet.
GF-B-01	558549.941	5315414.397	Fill	0	1.5	Sand	Gray, slightly silty, gravelly, fine to very coarse sand; gravels are common, very small to large pebbles; loose; slightly moist.
				1.5	5	Sand	Gray, silty, fine to medium sand; loose; moist to wet.
				5	18	Wood	Wood chips; becomes loose below 8 fbs and very loose below 11 fbs.
			Holocene	18	26.5	f-cSg	Gray, gravelly, fine to very coarse sand; gravels are few to common, very small pebbles; very loose; wet; trace of silt.
GF-B-02	558508.19	5315350.092	Fill	0	4.2	Gravel	Silty gravel.
				4.2	6.8	Sand	Black, silty, fine to medium sand; wet; moderately compact.
				6.8	18	Wood	Wood chips.
			Holocene	18	23	f-cS	Gray, fine to coarse sand with trace of silt; very loose; wet.
				23	26.5	f-cSg	Gray, gravelly, fine to very coarse sand; gravels are few to common, very small pebbles.
GF-B-03	558523.561	5315231.763	Fill	0	1.5	Sand	Gray, gravelly, fine to very coarse sand; gravels are common to many, rounded, small to very large pebbles; loose; slightly moist.
				1.5	4.2	Sand	Gray, fine to medium sand; "clean"; moist; loose.
				4.2	6.8	Sand	Gray, silty, fine to very coarse sand with very few pebbles and woody debris.
				6.8	12.5	Sand	Gray, slightly silty, fine to medium sand; loose; wet; gradual lower boundary.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83) NORTHING	EASTING	STRATIGR-APHY	DEPTH (fbs) TOP	BOTTOM	LITHOLOGY	DESCRIPTION
				12.5	13	Wood	Wood chips.
			Holocene	13	17.5	f-cSg	Gray, gravelly, fine to very coarse sand with very few, scattered wood chips; very loose; wet.
				17.5	19	cSg	Gray, gravelly, coarse to very coarse sand; gravels are few to common, very small pebbles; very loose; wet.
				19	26.5	cSg	Gray, gravelly, coarse to very coarse sand; gravels are few to common, very small pebbles; very loose, becoming compact below 25 fbs; wet.
GF-B-04	558432.762	5315244.419	Fill	0	1.8	Gravel	Grayish brown, slightly silty, slightly sandy, gravel; slightly moist.
				1.8	9.25	Sand	Gray, silty, fine to medium sand; loose; moist.
				9.25	13	Sand	Gray, fine to coarse sand with trace of silt; very loose; wet.
				13	18	Silt	Interbedded gray, sandy silt and silty, fine to coarse sand; soft; wet.
				18	23	Sand	Gray, silty, fine to coarse sand with wood chips; very loose; wet.
			Holocene	23	26.5	f-cSg	Gray, gravelly, fine to very coarse sand; gravels are few to common, very small pebbles; trace of silt; loose; wet.
GF-B-05	558389.354	5315141.537	Fill	0	1.8	Sand	Gray, gravelly, fine to coarse sand; loose; slightly moist.
				1.8	5.5	Sand	Fine to coarse sand with few pebbles and coarse sand; loose; very moist.
				5.5	11.5	Sand	Coarse to very coarse sand with few pebbles; very loose; wet; shells present below 8 fbs; organic or slight hydrocarbon odor at 8 fbs; trace of silt at 10 fbs.
				11.5	14.5	Sand	Gravelly, coarse to very coarse sand; gravels are common, very small pebbles; contains shells.
				14.5	15.5	Sand	Silty, fine to medium sand with woody debris; very loose.
				15.5	23	Sand	Gray, coarse to very coarse sand with trace organics; moderately compact; wet; organic or slight hydrocarbon odor.
				23	26.5	Gravel	Gravelly, coarse sand to coarse sandy, very small pebbles with very few shells; slight organic or hydrocarbon odor.
GF-B-06	558519.817	5315063.666	Fill	0	2.5	Sand	Gray, very gravelly, fine to coarse sand; gravels are very many; loose; slightly moist; slightly musty odor.
				2.5	5	Sand	Gray, fine to coarse sand with trace of silt; moderately compact; slightly moist.
				5	5.5	Sand	Gravelly, coarse to very coarse sand; gravels are few to common, very small pebbles; loose; wet.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83) NORTHING	EASTING	STRATIGR-APHY	DEPTH (fbs) TOP	BOTTOM	LITHOLOGY	DESCRIPTION
				5.5	8	Sand	Gray, gravelly, coarse to very coarse sand; gravels are few to common, very small pebbles; loose; slightly moist; trace of silt; becomes moderately compact near 7.5 fbs.
				8	13	Wood	Wood chips.
			Holocene	13	18	f-cSg	Gravelly, fine to coarse sand; loose; wet; trace of silt/clay.
				18	26.5	cSg	Gray, gravelly, coarse sand to coarse sandy, rounded, small to very large pebbles; wet; moderately compact; trace woody debris.
GF-B-07	558570.694	5314998.645	Fill	0	13	Sand	Brown, slightly silty, gravelly, fine to very coarse sand; gravels are few to common, very small to large pebbles; very loose; moist to wet; becomes gray with trace silt below 6 fbs; common to many woody debris below 10 fbs.
			Holocene	13	23	Zs	Gray, sandy silt with laminae of reddish brown, organic-rich silt; soft; wet; becomes very stiff below 21 fbs.
			Pleistocene	23	26.5	Pleistocene	Brown, silty, fine to coarse sand with very few pebbles; diamict fabric present; compact; wet.
GF-B-08	558508.404	5314935.195	Fill	0	0.5	Asphalt	Asphalt.
				0.5	3.5	Sand	Gray, gravelly, silty, fine to coarse sand; moist.
				3.5	4.5	Sand	Brown, gravelly, coarse to very coarse sand; gravels are few to common, very small pebbles.
				4.5	7	Sand	Brown, fine to medium sand with iron staining.
				7	8	Silt	Dark gray, very sandy, silt and very silty, sand; very moist.
				8	12	Sand	Brown to gray, gravelly, fine to coarse sand, fining upwards; gravels are few to common, very small pebbles; wet.
			Holocene	12	13	Gs	Gray, sandy, small to large pebbles; wet.
				13	25	f-cS	Gray, fine to coarse sand with few pebbles; wet; many woody debris at 14 fbs; becomes mostly coarse sand below 20 fbs; slight hydrogen sulfide odor at 23 fbs.
GF-B-10	558301.411	5314948.696	Fill	0	2	Concrete	Concrete.
				2	4.5	Sand	Brownish gray, silty, fine to medium sand; loose; moist.
				4.5	5	Silt	Brown, sandy silt; moist; moderately compact.
				5	6.8	Sand	Gray, silty sand; loose; moist.
				6.8	8	Silt	Brown, sandy silt; wet; compact.
				8	20	Sand	Gray, gravelly, coarse to very coarse sand; gravels are few to common, very small pebbles; loose; wet; trace of silt.
			Holocene	20	23	f-cS	Fine to coarse sand; very loose.
				23	26.5	f-cSz	Gray, silty, fine to coarse sand with very few, very small pebbles; moderately compact; wet.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83)		STRATIGR-APHY	DEPTH (fbs)		LITHOLOGY	DESCRIPTION
	NORTHING	EASTING		TOP	BOTTOM		
GF-B-11	558495.264	5314852.948	Fill	0	0.5	Asphalt	Asphalt.
				0.5	13	Sand	Black to dark gray, silty, fine to medium sand; charcoal odor; loose; becomes fine to coarse and wet below 10 fbs.
			Holocene	13	26.5	cSg	Gray, gravelly, coarse sand; gravels are few to common, very small pebbles; moderately compact; wet; gravels increase, with layer of wood chips 1 inch thick at 20 fbs; trace of silt and fine sand, common wood fragments at 25 fbs.
GF-B-12	558361.815	5314831.065	Fill	0	0.5	Asphalt	Asphalt.
				0.5	7	Sand	Mottled brownish orange, slightly silty, gravelly, fine to coarse sand.
				7	10	Silt	Dark gray, very (fine to medium) sandy, silt; wet; wood at 8.5 fbs.
GF-B-13	558550.526	5314797.836	Fill	0	6.8	Sand	Grayish brown, slightly silty, gravelly, fine to very coarse sand; gravels are common to many, angular, very small to very large pebbles; loose; moist.
			Holocene	6.8	9.2	f-cS	Fine to coarse sand with few, very small pebbles and shell fragments; loose; wet.
				9.2	11	f-cSg	Gravelly, fine to very coarse sand with shell fragments; gravels are few to common, very small pebbles; poorly-sorted; loose to very loose; wet; wood chips or debris between 12 and 13 fbs.
				11	14	f-cS	Fine to very coarse sand with very few, very small pebbles; poorly sorted.
				14	23	f-cS	Slightly silty, fine to very coarse sand with shell fragments and very few, scattered, very small pebbles; very loose; slight sulfide odor.
			Pleistocene	23	25.5	Pleistocene	Gray, very silty, fine to very coarse sand; very compact; wet; diamict fabric.
GF-B-14	558457.719	5314741.026	Fill	0	2	Sand	Brown, sometimes silty, gravelly, fine to coarse sand; gravels are few to common, very small to large pebbles; petroleum-like odor; very loose; slightly moist.
				2	6.8	Sand	Gray, fine to medium sand with trace shells; faint petroleum-like odor.
			Holocene	6.8	23	f-cSg	Gray, gravelly, fine to very coarse sand; gravels are few to common, very small to large pebbles; very loose; wet; becomes moderately compact below 10.5 fbs; compact below 20 fbs.
				23	26	cSg	Gray, gravelly, coarse to very coarses sand; gravels are few to common, very small pebbles; wet; compact.
				26	26.1	Zo	Organic-rich silt with woody debris; 0.5 inch thick.
				26.1	31.5	Z	Brown silt; very soft; wet; slight hydrogen sulfide odor.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83)		STRATIGR-APHY	DEPTH (fbs)		LITHOLOGY	DESCRIPTION
	NORTHING	EASTING		TOP	BOTTOM		
GF-B-15A	558403.407	5314674.63	Fill	0	13	Sand	Brown, gravelly, fine to coarse sand with few building debris; gravels are few to common, very small to very large pebbles; wet; moderately compact; very loose below 5 fbs; gray to black below 10 fbs.
				13	18	Gravel	Black, slightly silty, gravel; wet; moderately compact.
			Holocene	18	28	f-cS	Dark gray to black, slightly silty, fine to coarse sand with trace shell fragments; few, very small to small pebbles below 25 fbs; very loose; wet.
				28	31.5	f-cSg	Gray, gravelly, fine to coarse sand with very few shell fragments; gravels are few to common, very small to large pebbles; trace of silt; very compact; wet.
HB-B-2	558549.459	5315028.561	Fill	0	0.3	Concrete	Concrete.
				0.3	1.3	Void	Empty void.
				1.3	2.9	Sand	Brown, slightly silty, gravelly, fine to coarse sand; moist.
			Holocene	5	8	f-cSg	Brown, gravelly, fine to coarse sand; trace of silt; moist to wet; color becomes brown to black below 6.5 fbs.
				10	15	f-cS	Dark brown to black, fine to coarse sand with few pebbles and trace of silt; wet.
HB-B-3	558528.739	5315014.26	Fill	0	0.7	Concrete	Concrete.
				0.7	1.3	Void	Empty void.
				1.3	2.9	Sand	Brown, fine to medium sand with very few pebbles; becomes fine to coarse sand at 2.5 fbs; moist.
			Holocene	5	5.5	f-cS	Brown, fine to coarse sand with very few pebbles; wet.
				5.5	6	W	Wood.
				6	9.5	f-cS	Brown, fine to coarse sand with very few pebbles; wet.
HB-MW-1	558507.404	5315027.084	Fill	0	1.3	Asphalt	Asphalt.
				1.3	2	Sand	Brown, slightly silty, fine to coarse sand with few pebbles; moist.
				5	6	Sand	Brown, fine to coarse sand with few pebbles and brick fragments; moist.
			Holocene	6	8.5	f-cSg	Black, slightly silty, gravelly, fine to coarse sand; gravels are common, small to large pebbles; wet.
				10	12	f-cS	Dark gray, fine to coarse sand with few, small to large pebbles; wet.
				12	12.5	W	Wood.
				12.5	15	f-cS	Gray, fine to coarse sand with few, small to large pebbles; wet.
HW-B-2	558458.965	5315044.854	Fill	0	0.5	Wood	Wood chips.
				0.5	3.5	Sand	Gray, gravelly, fine to very coarse sand; gravels are few to common, very small to large pebbles; very moist.
				3.5	4	Silt	Dark brown, gravelly, sandy silt; moist.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83) NORTHING	EASTING	STRATIGR-APHY	DEPTH (fbs) TOP	BOTTOM	LITHOLOGY	DESCRIPTION
				4	4.8	Sand	Gray, gravelly, fine to very coarse sand; gravels are common, very small to large pebbles; wet.
				4.8	5.5	Silt	Dark brown, sandy silt; wet.
				5.5	6.5	Sand	Gray, gravelly, fine to very coarse sand; gravels are common, very small to large pebbles; wet.
				6.5	15	Silt	Gray, gravelly, sandy silt with scattered wood and organic debris; wet; becomes slightly clayey below 9 fbs.
MW-1	558353.754	5314709.511	Fill	0	0.5	Asphalt	Asphalt with gravel.
				0.5	1.5	Gravel	Brown to gray, silty, sandy, subrounded, small to very large pebbles; very moist; 2-inch thick bed of organic debris at 1 fbs.
				1.5	4	Sand	Brown, gravelly, fine to coarse sand; gravels are common, small to very large pebbles; very moist.
				4	4.5	Sand	Brown, very silty, fine to medium sand; very moist.
				4.5	8	Sand	Brown, fine to coarse sand with fill debris (charred wood, nails, ceramic fragments, black, and orange debris) between 4.75 and 6 fbs; very moist.
				8	9	Gravel	Gray, very sandy, rounded, small to large pebbles; wet.
				9	12	Sand	Gray, fine to coarse sand; wet.
				12	13	Silt	Gray, sandy silt; wet.
				13	15	Sand	Gray, fine to coarse sand with common silt laminae; wet.
MW-2	558371.086	5314700.402	Fill	0	0.5	Asphalt	Asphalt.
				0.5	4	Sand	Gray to brown, gravelly, fine to coarse sand; very moist.
				4	4.5	Brick	Debris including brick, wood and plastic.
				4.5	15	Gravel	Brown to gray, slightly sandy, very silty, sub-rounded, small to very large pebbles with historic debris including brick, plastic, tile/ceramics, wood; wet; becomes black below12 fbs.
MW-3	558440.108	5314702.097	Fill	0	0.5	Asphalt	Asphalt.
				0.5	2	Gravel	Gray, sandy, silty, sub-rounded, small to very large pebbles; very moist.
				2	4.5	Sand	Gray, fine to coarse sand with few, small to very large pebbles; wet.
			Holocene	4.5	7.5	f-mSz	Dark gray, silty, fine to medium sand with many shell fragments; wet.
				7.5	13.5	f-cS	Gray, fine to coarse sand; wet.
				13.5	14	f-mSz	Gray, silty, fine to medium sand; wet.
				14	15	f-cS	Gray, fine to coarse sand with few, small to large pebbles; wet.
MW-5	558366.856	5315260.038	Fill	0	1	Sand	Grass over topsoil.
				1	3	Silt	Brown to gray, fine to medium sandy, silt; very moist.
				3	11	Silt	Dark gray, sandy, gravelly silt; very moist.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83)		STRATIGR-APHY	DEPTH (fbs)		LITHOLOGY	DESCRIPTION
	NORTHING	EASTING		TOP	BOTTOM		
				11	13	Silt	Organic-rich silt with many woody and organic debris: wet.
				13	15	Sand	Dark gray, fine to coarse sand with many shells and woody debris; wet.
MW-6	558315.292	5315053.852	Fill	0	0.5	Asphalt	Asphalt.
				0.5	1	Concrete	Concrete.
				1	4	Gravel	Dark gray, sandy, sub-rounded to angular, small to very large pebbles; moist.
				4	8.5	Sand	Dark gray, fine to medium sand with few shell fragments; moist.
				8.5	9	Rubble	Concrete rubble.
				9	11	Silt	Gray, slightly sandy, silt with few, small to large pebbles; moist.
				11	12	Clay	Grayish green, clay; moist.
				12	20	Silt	Gray, fine to medium sandy, silt with few, small to very large pebbles; moist; becomes wet below 16 fbs; wood debris at 17.5 fbs.
				20	25	Silt	Gray to dark gray, gravelly silt; wet.
NRP-B-04	558370.987	5315238.504	Fill	0	0.5	Asphalt	Asphalt.
				0.5	10	Gravel	Gray, sandy, angular, small to very large pebbles; trace to slightly silty; moist.
				10	20	Gravel	Gray, silty, angular, small to very large pebbles; wet; faint petroleum-like odor; rainbow sheen between 15 and 20 fbs.
NRP-B-07	558376.979	5315237.88	Fill	0	0.5	Asphalt	Asphalt, post-holed to 1 fbs due to utilities.
				0.5	3.25	Gravel	Brown, silty, sandy, angular, small to large pebbles; moist.
				3.25	4	Rubble	Concrete rubble.
				4	7	Gravel	Very silty, very sandy, angular, small to very large pebbles; few small cobbles; moist.
				7	14	Sand	Gray, fine to coarse sand; very moist; strong petroleum-like odor; heavy rainbow and bleb sheen; many organic debris at 9 fbs.
				14	15	Sand	Dark gray, very silty, fine to medium sand; wet.
				15	17	Sand	Gray, fine to medium sand; trace organics; wet.
				17	20	Sand	Dark gray, very silty, fine to medium sand; wet; wood at 19.75 fbs.
NRP-B-09	558508.069	5315247.218	Fill	0	0.5	Asphalt	Asphalt.
				0.5	3	Gravel	Brownish gray, sandy, angular gravel; crushed rock; moist.
				3	8.5	Silt	Dark gray, fine to medium sandy, silt; moist.
				8.5	9.5	Wood	Wood.
				9.5	10	Sand	Dark gray, fine to coarse sand; wet.
NRP-B-15	558495.378	5315234.536	Fill	0	0.5	Asphalt	Asphalt.
				0.5	2.5	Gravel	Light gray, angular pebbles; crushed rock; moist.
				2.5	6	Sand	Dark gray, very silty, fine to medium sand; moist.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83)		STRATIGR-APHY	DEPTH (fbs)		LITHOLOGY	DESCRIPTION
	NORTHING	EASTING		TOP	BOTTOM		
				6	9	Silt	Gray, sandy silt; wet.
				9	10	Peat	Dark brown, peat; wet; (may be sawdust from mill).
NRP-B-16	558486.855	5315239.941	Fill	0	2	Asphalt	Asphalt, crushed rock and gravel.
				2	6.5	Silt	Dark gray, slightly sandy, silt; moist.
				6.5	7.5	Clay	Dark gray, silty clay; wet.
				7.5	9	Wood	Wood.
				9	10	Sand	Gray, fine to coarse sand; wet.
NRP-B-19	558385.296	5315232.214	Fill	0	0.5	Asphalt	Asphalt.
				0.5	2.5	Gravel	Gray, silty, angular gravel; crushed rock; moist.
				2.5	3.5	Sand	Light brown to dark gray, fine to medium sand with silt beds; moist.
				5	7	Silt	Dark gray, sandy silt; very moist to wet.
				7	14.5	Sand	Dark gray, coarse sand with very few shells; wet; very thin interbeds of wood and organic silt at 9.5 fbs; trace silt between 11 and 13 fbs.
				14.5	15	Wood	Wood.
NRP-B-20	558370.404	5315222.238	Fill	0	0.5	Asphalt	Asphalt
				0.5	2	Sand	Gray, very gravelly, very silty, fine to medium sand; moist.
				2	3.5	Sand	Gray, slightly silty, fine to medium sand; moist; thin bed of silt near 3.5 fbs.
				5	12.5	Sand	Gray, fine to very coarse sand with very few shells; wet.
				12.5	13.5	Sand	Dark gray, very silty, fine to medium sand; many organic and woody debris; wet.
				13.5	15	Sand	Gray, fine to coarse sand with trace organics; wet.
NRP-B-22	558375.905	5315247.315	Fill	0	0.5	Asphalt	Asphalt.
				0.5	3	Gravel	Gray, silty, angular gravels; crushed rock; moist.
				5	8	Gravel	Gray, silty, angular gravels; crushed rock; moist.
				10	10.5	Sand	Gray, gravelly, silty, fine to medium sand; wet.
				10.5	12.5	Sand	Dark gray, fine to medium sand with trace of silt; wet; sheen and strong petroleum-like odor at 11-12 fbs.
				15	16.5	Sand	Dark gray, fine to medium sand with many organic debris; wet.
				16.5	17	Wood	Wood.
				17	17.5	Sand	Dark gray, fine to medium sand with many organic debris; wet.
NRP-MW-5	558483.792	5315247.692	Fill	0	3	Gravel	Gray, slightly silty, fine to coarse sandy, angular, very small to very large pebbles; crushed rock.
				3	4	Silt	Gray to dark gray, clayey silt; moist.
				4	5.5	Sand	Dark gray, fine to medium sand; moist to wet.
				5.5	6	Gravel	Gray, sandy, silty, gravel; moist.
				6	7	Clay	Dark gray, silty, clay; wet.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83)		STRATIGR-APHY	DEPTH (fbs)		LITHOLOGY	DESCRIPTION
	NORTHING	EASTING		TOP	BOTTOM		
				7	8	Gravel	Dark gray, very (fine to coarse) sandy, small to large pebbles with charred wood debris.
				8	15	Sand	Gray, fine to coarse sand; wet; slightly silty layer at 12 fbs; scattered shells at 13 fbs.
OMS-MW-01	558327.129	5314721.098	Fill	0	0.5	Gravel	Gravel surface.
				0.5	1	Sand	Brown, fine to coarse sand; moist.
				1	2	Sand	Brown, gravelly, fine to very coarse sand; gravels are few to common, very small to very large pebbles; moist.
				2	8	Sand	Brown, fine to very coarse sand with very few to few, small to large pebbles; moist.
				8	10	Gravel	Brown, very sandy, sub-rounded, small to large pebbles; moist.
				10	15	Sand	Brown, fine to coarse sand; wet; becomes dark gray below 13.5 fbs; hydrogen sulfide smell near 15 fbs.
REC1-MW-1	558543.368	5314681.471	Fill	0	0.7	Concrete	Concrete.
				0.7	1.2	Void	Empty void.
				1.2	2.8	Sand	Gray, fine to coarse sand; moist.
				5	6	Sand	Gray, slightly silty, fine to coarse sand with very few, small to very large pebbles; wet.
				6	8	Sand	Gray, very gravelly, fine to coarse sand; wet.
				10	11	Sand	Gray, gravelly, fine to coarse sand; wet.
			Holocene	11	14	Zo	Organic-rich silt; woody; very moist to wet.
REC1-MW-2	558489.627	5314661.796	Fill	0	0.8	Concrete	Concrete.
				0.8	1.2	Void	Empty void.
				1.2	2	Sand	Brown, gravelly, fine to very coarse sand; gravels are common, very small to very large pebbles; moist.
				2	2.5	Wood	Wood.
			Holocene	2.5	3.8	f-cS	Brown, fine to medium sand with few, small to very large pebbles; moist.
				5	8	f-cS	Brown, fine to coarse sand with few, small to very large pebbles; moist.
				8	9	f-mSz	Gray, silty, fine to medium sand; we.
				10	20	f-cSg	Gray, fine to very coarse sand with few, small to large pebbles.
REC1-MW-3	558481.904	5314684.582	Fill	0	0.7	Concrete	Concrete.
				0.7	0.9	Void	Empty void.
				0.9	3.4	Sand	Brown, gravelly, fine to very coarse sand; moist.
			Holocene	5	6.5	f-mS	Brown, fine to medium sand with few, small to very large pebbles and scattered shells; moist.
				6.5	7	f-mSz	Gray, silty, fine to medium sand; wet.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83) NORTHING	EASTING	STRATIGR-APHY	DEPTH (fbs) TOP	BOTTOM	LITHOLOGY	DESCRIPTION
				7	8.5	f-cSg	Gray, gravelly, fine to very coarse sand with many shells; gravels are few to common, very small pebbles; wet.
				10	17.5	f-cS	Gray, fine to coarse sand; wet.
				17.5	20	f-cSz	Gray, fine to coarse sand interbedded with silt in thin interbeds; many organic debris in silt beds.
				20	25	f-cS	Brown to gray, fine to coarse sand with very few, small to large pebbles; wet.
REC1-MW-5	558427.6	5314645.633	Fill	0	0.3	Asphalt	Asphalt.
				0.3	1	Concrete	Concrete.
				1	4	Sand	Brown, fine to very coarse sand; moist; pocket of fine to medium sand at 2 fbs.
				5	9	Sand	Brown, fine to very coarse sand; moist.
			Holocene	10	12	f-mS	Dark gray, fine to medium sand; sheen and petroleum-like odor; wet.
				12	15	cSg	Gravelly, coarse sand.
				15	23.5	f-cS	Fine to very coarse sand with very few, small to very large pebbles; trace silt; wood at 16.5 fbs; pocket of silt at 19 fbs.
				23.5	24	Z	Brown silt; wet.
				24	25	f-cS	Gray, fine to very coarse sand; wet.
REC1-MW-6	558488.544	5314615.306	Fill	0	0.7	Concrete	Concrete.
				0.7	7	Void	Void.
				7	7.5	Gravel	Dark brown, silty, sandy gravel; moist.
				7.5	8.5	Silt	Brown, fine to medium sandy, silt; becomes gravelly below 8 fbs.
				8.5	9	Sand	Gray, fine to very coarse sand with few, small to very large pebbles; wet.
				10	10.5	Sand	Gray, fine to very coarse sand with few, small to very large pebbles; wet.
				10.5	11.5	Silt	Mottled brown and gray, gravelly, fine to very coarse sandy, silt; gravels are common, angular, small to large pebbles; wet.
			Holocene	11.5	12.5	P	Brown, fibrous peat; wet.
				12.5	13.5	Gsz	Gray, sandy, silty, small to very large pebbles with many organic debris; wet.
				15	16.5	f-cSg	Gray, very gravelly, fine to very coarse sand; wet.
				16.5	18	P	Brown, fibrous peat; wet.
REC1-MW-7	558449.147	5314616.841	Fill	0	0.9	Concrete	Concrete.
				0.9	5.1	Void	Empty void.
				5.1	7.5	Sand	Brown, slightly silty, fine to medium sand with very few pebbles; moist.
				7.5	8.5	Sand	Gray, silty, sand with few, small to very large pebbles; wet.
			Holocene	10	12	Zs	Brown to gray, sandy silt with very few pebbles; wet; wood at 11.5 fbs.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83) NORTHING	EASTING	STRATIGR-APHY	DEPTH (fbs) TOP	BOTTOM	LITHOLOGY	DESCRIPTION
				12	12.5	f-cS	Gray, fine to very coarse sand with very few pebbles; wet.
				12.5	13.5	Zc	Gray, clayey silt; wet.
				13.5	14	f-cS	Gray, fine to very coarse sand; wet.
				15	15.5	f-cS	Gray, fine to very coarse sand; wet.
				15.5	16.5	Zc	Brownish gray, clayey silt; numerous organics; wet.
				16.5	17.5	f-cS	Gray, fine to very coarse sand; wet.
REC1-MW-8	558405.958	5314644.789	Fill	0	0.5	Asphalt	Asphalt.
				0.5	2.5	Sand	Brown, gravelly, silty, fine to very coarse sand; moist.
				2.5	3.5	Sand	Brown, fine to very coarse sand with very few pebbles; brick debris; moist.
				3.5	4	Gravel	Black, silty, fine to medium sandy, small pebbles to cobbles; moist.
				5	6	Sand	Brown, gravelly, fine to very coarse sand; moist.
				6	7	Gravel	Black, silty, fine to medium sandy, small pebbles to cobbles; moist.
				7	8	Gravel	Brown, sandy gravel; wet.
				10	10.5	Sand	Brownish gray, gravelly, fine to very coarse sand; gravels are few to common, very small pebbles; wet.
				10.5	13.5	Gravel	Brown to black, sandy, small pebbles to cobbles; wet; becomes red at 13 fbs.
			Holocene	15	20	f-cS	Gray, fine to very coarse sand with very few, small to very large pebbles; wet.
REC1-MW-9	558384.153	5314653.126	Fill	0	0.5	Asphalt	Asphalt.
				0.5	1	Sand	Brown, slightly silty, fine to medium sand; moist.
				1	2	Gravel	Dark brown to dark gray, silty, sandy, sub-rounded, small to large pebbles; fill debris.
				2	3	Sand	Brown, very silty, fine to medium sand with fill debris and very few pebbles; very moist.
				5	8	Sand	Dark brown to black, silty, very gravelly, fine to medium sand with brick and other fill debris; very moist; gravels decrease below 6.5 fbs.
				8	9	Sand	Dark gray, gravelly sand; wet.
				10	11	Sand	Brown, gravelly sand; wet.
				11	12	Sand	Gray, silty, gravelly, fine to very coarse sand; wet.
				12	14.5	Sand	Black, gravelly, fine to very coarse sand; wet; becomes brown below 13.5 fbs.
			Holocene	14.5	15	f-cSzg	Dark brown, gravelly, very silty, fine to medium sand; wet.
REC2-B-1	558527.528	5314724.121	Fill	0	0.5	Concrete	Concrete.
				0.5	1.5	Void	Void.
				1.5	3	Sand	Brown, gravelly, fine to very coarse sand; gravels are common, very small to large pebbles.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83) NORTHING	EASTING	STRATIGR-APHY	DEPTH (fbs) TOP	BOTTOM	LITHOLOGY	DESCRIPTION
				3	5.5	Sand	Brown, gravelly, fine to medium sand; gravels are common, small to large pebbles; moist.
				5.5	7.5	Sand	Brown, gravelly, fine to very coarse sand; gravels are common, very small to large pebbles; moist.
			Holocene	7.5	10	f-cS	Dark gray, fine to medium sand with scattered shells; wet.
REC2-MW-5	558519.469	5314763.228	Fill	0	0.5	Asphalt	Asphalt.
				0.5	3	Sand	Dark gray to black, very silty, fine to medium sand with few, small to very large pebbles; moist; petroleum-like odor; slight bleb sheen from 0-2 fbs.
			Holocene	3	8.7	f-cS	Gray, slightly silty, fine to very coarse sand with few, small to very large pebbles; wet.
				8.7	9	Z	Gray silt; wet.
				9	9.7	f-mS	Dark gray, fine to medium sand; wet.
				9.7	10	Z	Gray silt; wet.
				10	13	f-mS	Dark gray, slightly silty, fine to medium sand; wet; many shell fragments below 12.5 fbs.
REC3-MW-1	558263.503	5314851.458	Fill	0	0.7	Concrete	Concrete; 8 inches thick.
				0.7	15	Sand	Brown, fine to very coarse sand with very few pebbles; trace to slightly silty; moist; wet below 11 fbs; 1-inch thick lens of silt at 14 fbs.
REC5-MW-1	558322.16	5314909.506	Fill	0	1	Concrete	Concrete.
				1	6.5	Sand	Dark gray , fine to very coarse sand with very few pebbles; moist; fine to medium sand at 3 fbs; wood at 4 fbs.
				6.5	8.5	Sand	Gray, silty, fine to medium sand; wet.
				8.5	12	Sand	Gray, fine to very coarse sand with very few, very small pebbles; wet.
				12	14	Sand	Dark gray, very silty, fine to medium sand; wood at 12.5 fbs; wet.
				14	14.5	Silt	Gray silt with common, organic debris and shell fragments; wet.
				14.5	15	Sand	Gray, very silty, fine to medium sand; wet.
REC6-MW-1	558447.012	5315075.183	Fill	0	0.5	Concrete	Concrete.
				0.5	2.5	Gravel	Pea gravel; white liquid at bottom of pea gravel.
				2.5	3.5	Sand	Brown, fine to very coarse sand; wet.
				3.5	5	Gravel	Pea gravel.
				5	12.5	Silt	Dark gray, sandy silt with very few pebbles; strong sweet odor.
REC6-MW-2	558342.278	5315088.956	Fill	0	0.5	Asphalt	Asphalt.
				0.5	2	Wood	Wood chips; post-holed for utilities.
				2	4.5	Gravel	Dark gray, sandy, very silty, small to very large pebbles; moist.
				4.5	5	Wood	Wood chips.
				5	7.5	Gravel	Dark gray, very silty, sub-rounded, small to very large pebbles; wet.

Table B-1. Core Log Summary.

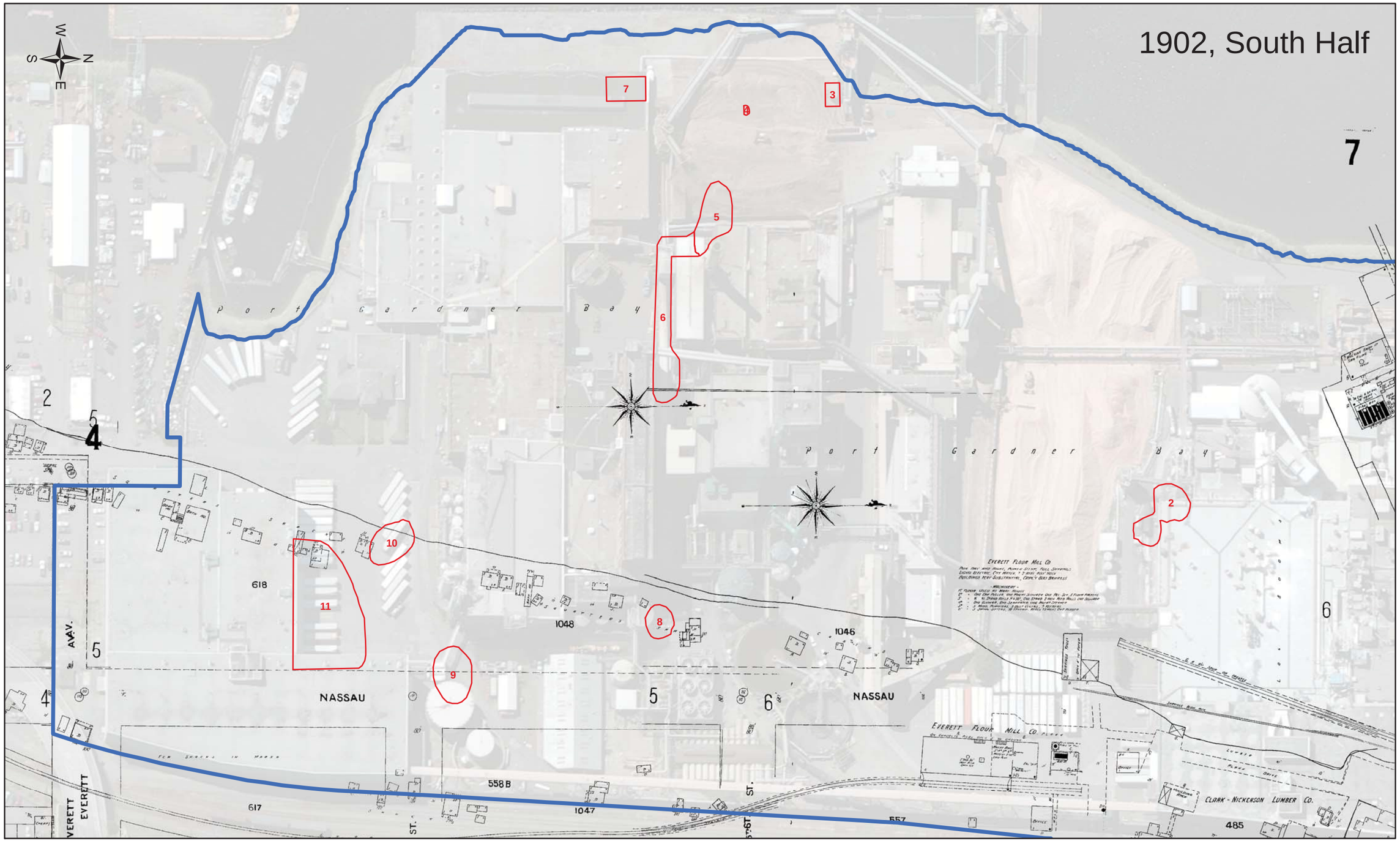
BORING	UTMs (Zone 10, NAD83)		STRATIGR-APHY	DEPTH (fbs)		LITHOLOGY	DESCRIPTION
	NORTHING	EASTING		TOP	BOTTOM		
				7.5	10.5	Silt	Mottled gray and brown, slightly sandy, gravelly silt; wet.
				10.5	15	Gravel	Black to dark gray, very sandy, very silty, sub-rounded to sub-angular, small to very large pebbles; slight hydrogen sulfide odor.
REC7-MW-1	558393.286	5315329.502	Fill	0	2	Gravel	Gravel fill.
				2	3.5	Sand	Brown, silty, gravelly, fine to medium sand with iron staining.
				3.5	4.5	Silt	Gray silt; moist.
				4.5	6	Sand	Gray, fine to medium sand; moist.
				6	15	Sand	Brown to gray, coarse to very coarse sand; woody debris at 7 fbs; becomes wet with few shell fragments at 7.5 fbs; many organic debris between 11 and 15 fbs.
REC7-MW-2	558348.344	5315171.238	Fill	0	0.5	Asphalt	Asphalt.
				0.5	4.5	Silt	Brown, sandy, very gravelly, silt; gravels are many, sub-rounded, small to large pebbles.
				4.5	5	Cinders	Black, charred debris.
				5	7.5	Sand	Brown, silty, fine to medium sand; wet; becomes gray at 7 fbs.
				7.5	15	Sand	Dark gray, coarse to very coarse sand.
REC7-MW-3	558272.176	5314737.262	Fill	3	4	Rubble	Concrete rubble.
				4	5	Silt	Brown silt; moist; many woody organic debris at 4.5 fbs.
				5	8	Rubble	Concrete rubble.
				8	9	Sand	Brown, silty, fine to medium sand; wet.
				9	14.5	Sand	Brown, fine to medium sand, grading to coarse to very coarse sand below 10 fbs; wet.
				14.5	15	Sand	Brown, gravelly, coarse to very coarse sand.
UG-MW-1	558587.288	5315237.815	Fill	0	2.5	Gravel	Asphalt debris, crushed rock and gravel fill.
				2.5	5.5	Sand	Dark gray, fine to medium sand; wood debris at 4 fbs.
				5.5	12.5	Silt	Dark gray, slightly clayey, slightly sandy, silt with many wood and organic debris below 8 fbs, may be mill wood waste.
			Holocene	12.5	15	f-cSg	Gray, gravelly, fine to very coarse sand; gravels are few to common, very small to large pebbles; wet.
UG-MW-2	558557.778	5314939.763	Fill	0	1	Concrete	Concrete.
				1	2.5	Sand	Dark gray, sand with brick debris.
				2.5	7.5	Silt	Dark gray, silt with very few pebbles; moist to wet.
			Holocene	7.5	13.5	f-cSg	Dark gray, gravelly, fine to very coarse sand; gravels are few to common, very small to very large pebbles; wet; orangish gray color from 9-12.5 fbs.
				13.5	15	Zs	Dark gray, fine to medium sandy silt.

Table B-1. Core Log Summary.

BORING	UTMs (Zone 10, NAD83)		STRATIGR-APHY	DEPTH (fbs)		LITHOLOGY	DESCRIPTION
	NORTHING	EASTING		TOP	BOTTOM		
UST68-MW-1	558414.396	5314758.451	Fill	0	0.5	Asphalt	
				0.5	6	Sand	Brown, fine to medium sand; moist.
				6	6.5	Silt	Gray silt; very moist.
				6.5	14	Sand	Brown, fine to medium sand; wet; becomes gray below 8 fbs; 2-inch thick layer of silt at 9 fbs.
			Holocene	14	15	f-mSz	Gray, silty, fine to medium sand; wet.
UST69-MW-1	558410.753	5315082.183	Fill	0	0.5	Asphalt	Asphalt.
				2	11.75	Sand	Brown, fine to very coarse sand with few pebbles; moist.
				11.75	12	Silt	Silt lens, 4 inches thick.
				12	14.5	Sand	Dark gray, fine to medium sand.
				14.5	15	Wood	Wood debris.
UST70-B-2	558272.735	5314884.485	Fill	0	1	Wood	Wood chips - hogged fuel.
				1	4	Sand	Brown sand with few pebbles; moist.
				4	8	Sand	Dark brown, slightly silty, sand; moist.
				8	9	Rubble	Concrete rubble.
				9	15	Sand	Gray, slightly silty, gravelly, fine to very coarse sand; gravels are common, small to very large pebbles; wet.
UST71-B-4	558311.734	5314874.365	Fill	0	2.5	Wood	Wood chips - hogged fuel.
				2.5	5	Gravel	Gray, sandy, very silty, sub-rounded, small to large pebbles; moist;
				5	10.5	Gravel	Gray, small to very large pebbles.
				10.5	14	Sand	Dark brown, very silty, fine to medium sand; wet.
				14	30	Sand	Gray, fine to medium sand with a bed of coarse sand between 18 and 19 fbs.

APPENDIX C: SANBORN MAPS

1902, South Half



Sanborn Map Company Insurance Map of Everett, Washington, 1902, Sheets 4, 5, & 6.

0 50 100 150 200 Feet

0 10 20 30 40 50 Meters

Legend

Proposed Cleanup Area

Project Boundary

Map 1 of 6

SWCA Environmental Consultants

1902, North Half

Sanborn Map Company Insurance Map of Everett, Washington, 1902, Sheets 6, 7, & 8.

0 50 100 150 200 Feet

0 10 20 30 40 50 Meters

Legend

Proposed Cleanup Area

Project Boundary

Map 2 of 6

SWCA Environmental Consultants

1914, South Half

Sanborn Map Company Insurance Maps of Everett, including Lowell, Washington, 1914, Sheets 83, 84, & 85.

SWCA Environmental Consultants

0 50 100 150 200 Feet

0 10 20 30 40 50 Meters

Legend

Proposed Cleanup Area

Project Boundary

Map 3 of 6

1914, North Half

Sanborn Map Company Insurance Maps of Everett, including Lowell, Washington, 1914, Sheets 82 & 83.

0 50 100 150 200 Feet

0 10 20 30 40 50 Meters

Legend

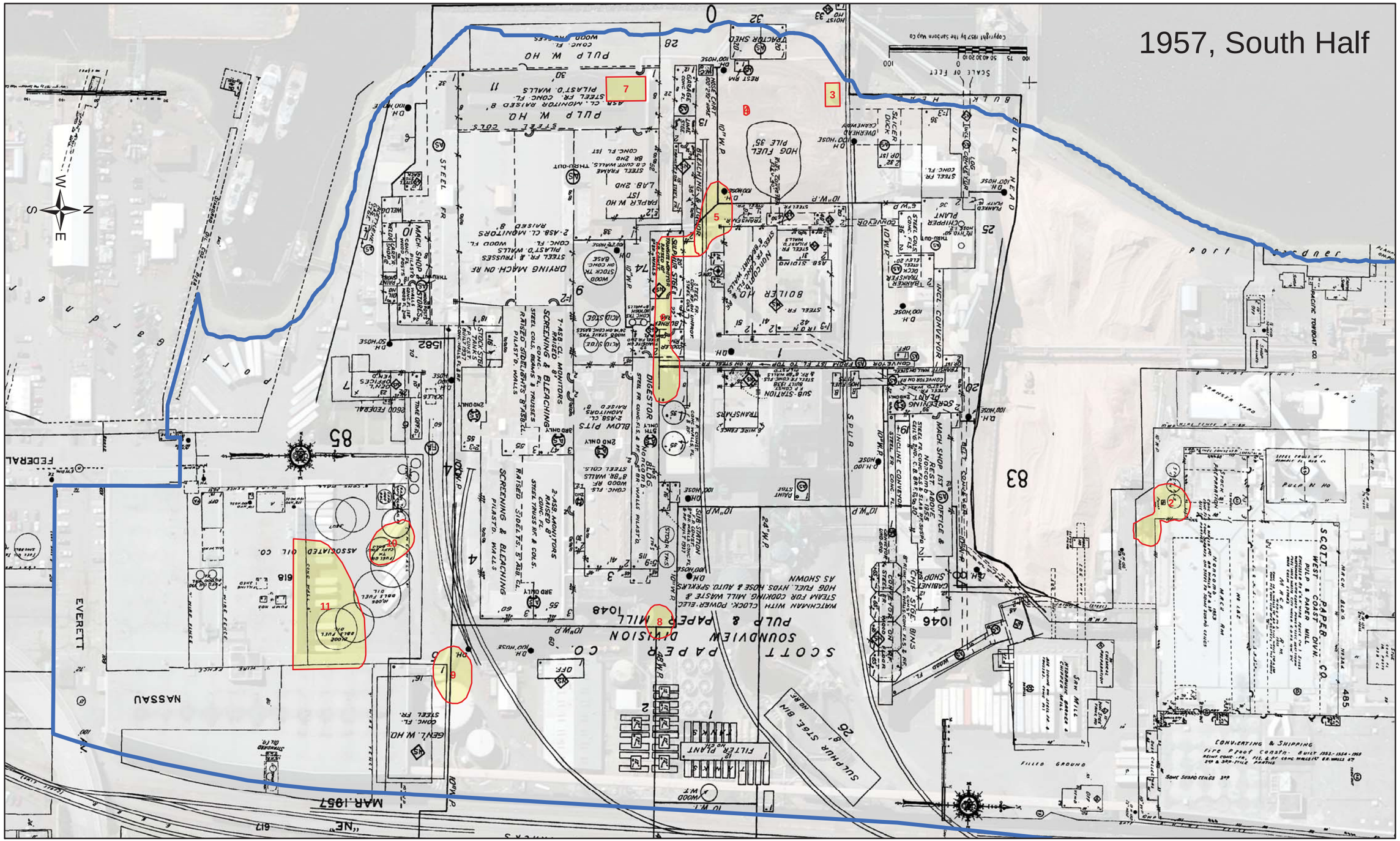
Proposed Cleanup Area

Project Boundary

Map 4 of 6

SWCA Environmental Consultants

1957, South Half



Sanborn Map Company Insurance Maps of Everett, Washington, 1957, Volume 1, Sheets 83, 84, & 85.

0 50 100 150 200 Feet

0 10 20 30 40 50 Meters

Legend

- Proposed Cleanup Area
- Project Boundary

Map 5 of 6

SWCA Environmental Consultants

1957
North Half

Sanborn Map Company Insurance Maps of Everett, Washington, 1957, Volume 1, Sheets 81 & 83.

0 50 100 150 200 Feet
0 10 20 30 40 50 Meters

Legend

- Proposed Cleanup Area
- Project Boundary

Map 6 of 6

SWCA Environmental Consultants

Cultural Resources Monitoring and Discovery Plan for the Kimberly-Clark Worldwide Site Upland Area, Everett, Snohomish County, Washington

CULTURAL RESOURCES MONITORING AND DISCOVERY PLAN FOR THE KIMBERLY-CLARK WORLDWIDE SITE UPLAND AREA, EVERETT, SNOHOMISH COUNTY, WASHINGTON

Report Prepared for

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August 16, 2013

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TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The Kimberly-Clark Worldwide (K-C WW) upland area was developed for pulp and paper manufacturing and operated as the same for nearly a century. The Department of Ecology and K-C WW, Inc. have executed an Agreed Order to complete studies related to contamination on the property and future cleanup of the area as well as opportunistic interim action cleanup activities during demolition of the historic pulp and paper mill. A cultural resources assessment that included background information on the setting of the project area, expectations for buried cultural resources based on previous investigations in the vicinity, and a GIS-based probability map showing areas with low, medium, and high potential to harbor significant archaeological materials was prepared as required by the Interim Action Plan (Rinck et al. 2013). This monitoring and discovery plan was developed for use during opportunistic cleanup according to recommendations made in that assessment.

Project Location and Description

The project is in Section 19 of Township 29 North, Range 5 East, Willamette Meridian (Figure 1). The K-C WW property includes about 56 acres of uplands and 12 acres of adjacent tidelands. The west property boundary is adjacent to the East Waterway in Port Gardner Bay of Possession Sound and the east property boundary is at the BNSF Railroad right-of-way. The north project boundary is at the foot of 21st Street and the south project boundary is at the foot of Everett Avenue.

Most of the contamination to be cleaned up is within historical fill, but some cleanup excavations may penetrate into underlying naturally deposited sediment. Because all the contaminated areas to be targeted during interim action are not currently known, excavation quantities and dimensions cannot yet be estimated. No vegetation removal or in-water work, including dredging, drilling, dumping, filling, mining, bulk-heading, pile driving, or piling removal will occur during the opportunistic interim action cleanup efforts. At the time of the cultural resources assessment, 11 specific areas were identified where opportunistic cleanup will occur, including the Naval Reserve Parcel UST area (1), Xylene UST 29/Latex Spill (2), Rail Car Dumper Hydraulic System Building (3), Diesel UST 70 (4), Bunker C USTs71/72/73 (5), Boiler/Baghouse Area (6), Heavy Duty Shop sump (7), GF 11 (8), Diesel AST Area (9), Bunker C ASTa (10), Bunker C ASTb (11) (Figure 2). Additional areas may be identified for opportunistic cleanup as demolition proceeds.

Regulatory Setting

The project is subject to the Washington State Environmental Policy Act (SEPA) that requires the project proponent to identify any places or objects listed on, or eligible for national, state, or local preservation registers in the vicinity of the project. The regulation also requires proponents to describe evidence for sites of historic, archaeological, scientific, or cultural importance in the vicinity of a project, and describe proposed measures to reduce or control impacts to those sites. Agencies are encouraged by SEPA to consult with others to find acceptable ways to avoid or mitigate any adverse impacts that may be caused by the project.

The project is also subject to several Washington state laws pertaining to archaeological cultural resources. For example, the Archaeological Sites and Resources Act [RCW 27.53] prohibits knowingly excavating or disturbing prehistoric and historic archaeological sites on public or private land. The Indian Graves and Records Act [RCW 27.44] prohibits knowingly destroying American Indian graves and provides that inadvertent disturbance through construction or other activities requires re-interment under supervision of the appropriate Indian tribe. In order to prevent the looting or depredation of

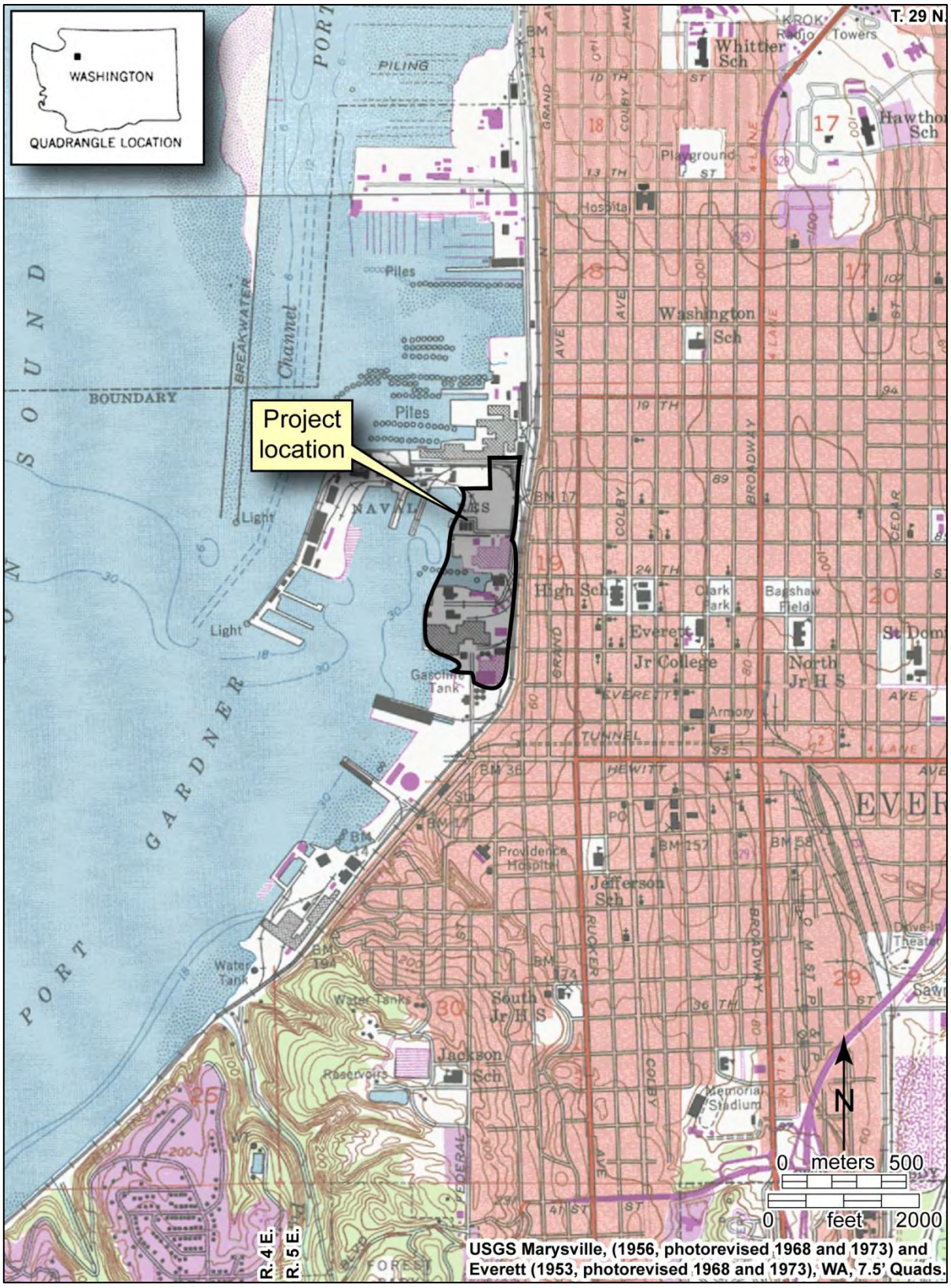

Figure 1. Project location.

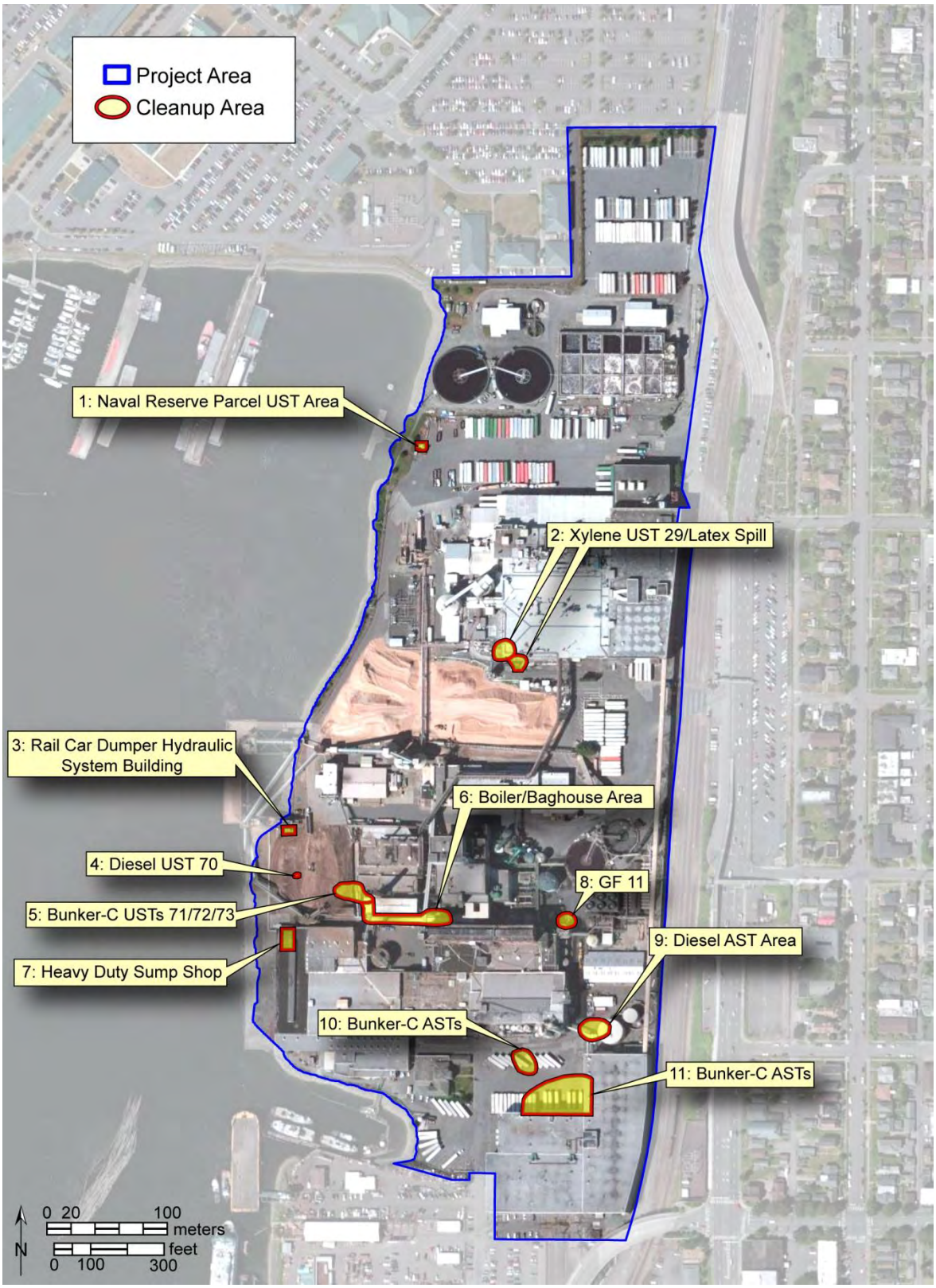

Figure 2. Proposed opportunistic cleanup locations in the K-C WW upland area.

sites, any maps, records, or other information identifying the location of archaeological sites, historic sites, artifacts, or the site of traditional ceremonial, or social uses and activities of Indian Tribes are also exempt from disclosure [RCW 42.56.300].

The Tulalip Tribes have communicated to Ecology that the Everett waterfront is a very culturally sensitive area. The previous cultural resources assessment was completed due to the Tribe's and other interested parties' concern for cultural resources in the K-C WW upland vicinity.

Archaeological Background

The K-C WW upland area is on the east side of the East Waterway, which was historically dredged between the mainland shoreline and the Snohomish River estuary (Eldridge and Orlob 1951). Variable amounts of fill are present across the entire surface of the K-C WW upland area. Some of the fill came from dredging the East Waterway or other dredging that took place on the Snohomish River delta. Fill in the project area also originated as mill waste and was dumped directly into Port Gardner from the shoreline (Orlob and Eldridge 1954). Natural deposits below the fill include sediments deposited in backshore, beach, foreshore, marsh, and sub-tidal deltaic environments. There is potential for pre-contact and early historical cultural materials to be buried deeply below the fill along the historical shoreline where beach alluvium, backshore alluvium, and glacial soils are below the urban land. There, the fill is slightly thinner and cultural materials, if present, would not be as deeply buried compared to the west half of the project area where fill was deposited on the foreshore and into the marsh and Port Gardner. The fill could harbor stable surfaces with potential for historical cultural materials, as well.

People have lived on the accessible shores of Port Gardner Bay for thousands of years. Native people used the Everett shoreline for shellfish collection, hunting, plant gathering and fishing and several ethnographic villages and camps were near the project area (Baenen 1981; Haeberlin and Gunther 1930; Smith 1940, 1941; Swanton 1968; Twedell 1974; Waterman et al 2001). The shorelines were developed quickly after the Euroamericans arrived to the region and then converted their interests from exploration to settlement. Land in the project area transferred hands from early settlers, such as Dennis Brigham, Erskine Kromer, John King, and Wyatt Rucker, to larger companies, such as the Clark-Nickerson Lumber Company and the Everett Flour Mill. Around 1929, the Puget Sound Pulp and Timber Company consolidated holdings across most of the project area and they expanded the piers and wharves greatly. Later, the Soundview Pulp Company took over the property and they continued to expand the mill site. The Soundview Pulp Company merged with the Scott Paper Company around 1950 and Scott merged with the Kimberly Clark Corporation in 1995. Mill operations ended in April 2012 and the last of the Everett waterfront mills shut down permanently. For more information about the setting of the project, please review the initial cultural resources assessment (Rinck et al. 2013).

Potential for Discovery of Cultural Resources

Although the K-C WW upland area has been altered by filling, diking, pile driving, wharf building, and more recent shoreline development, there is still some risk of discovering buried cultural resources. Background research summarized above indicates that the project vicinity was used intensively by Native Americans prior to Euroamerican settlement. However, most of the project area was at least partially inundated on the delta front prior to historic development. Pre-contact archaeological deposits in the project area would most likely be related to hunting, fishing, or other resource procurement activities that would have occurred in a marshy environment and sites, if present, would be buried under fine-grained intertidal alluvium that historically accumulated on top of any buried pre-contact surfaces. Pre-contact archaeological materials or ethnographic deposits in this setting would probably

exhibit signs of tidal reworking or rapid burial as a result of alluvial processes on the delta front or subsidence. More substantial pre-contact and ethnographic period archaeological sites associated with cooking, camping, and habitation would probably be on elevated landforms, if present, near the former shoreline along the east margin of the property where a beach was once present. Natural deposits are expected to be rare above 20 feet below the surface (fbs). Holocene-age deposits below the fill are expected to grade from coarser to finer from northeast to southwest across the project area, as one moves from more proximal to distal along the delta shoreline.

The project area also may contain historical archaeological resources. Although a number of Euroamerican explorers and traders visited Port Gardner between the 1820s and 1850s, the permanent Euroamerican presence along Port Gardner's southeast shoreline dates to the early 1860s. Archaeological evidence of Euroamerican visitors may be found in archaeological sites in the vicinity and would consist of artifacts like glass beads, metal tools and pots, guns, buttons and other new materials and technologies. Historical cultural materials dating after 1862 are more clearly attributed to Euroamericans and could include architectural, industrial, domestic and other assemblages. Cultural materials associated with nineteenth-century homesteading, mills and railroads, early industry, and residential occupation may be in the project area. Euroamerican entrepreneurs significantly altered and filled the shoreline and old beach surfaces are certainly present below the fill. The fill itself might contain historical archaeological deposits or objects in the form of artifact dumps or scatters and possibly stable surfaces that could have been occupied between fill events. Maps of the project area show docks and wharves expanding at a great pace, especially between 1900 and 1910 and between 1929 and 1936. The top 10 feet of fill is expected to be highly disturbed by repeated mill construction cycles and utility installation and upgrades. Deeper fill may be less disturbed and its stratification may reflect the historic context.

Bathymetric data from early historic maps was used to determine which portions of the project area were sub-tidal, intertidal, and sub-aerial (Rinck et al. 2013). Sub-aerial landforms identified in the project area include the upland, beach, and backshore. Intertidal landforms in the project area are the foreshore and marsh. Finally, the delta front is the only sub-tidal landform identified in the K-C WW upland area. The horizontal extent of the six historical landforms results in a model of the sensitivity for cultural resources in the project area. Figure 3 depicts areas of high, medium, and low risk for finding archaeological sites. Highest risk areas are along the historic beach and sub-aerial landforms and the lowest potential for identification of sites is in areas that were historically inundated, like the sub-tidal delta. Moderate levels of risk for identification of archaeological sites is assigned to the intertidal zone, including the foreshore and marsh landforms, where human use was limited and sites are generally ephemeral in type. About half of the 11 opportunistic cleanup areas demarcated so far are on landforms with high sensitivity for buried resources.

Excavation work associated with the interim cleanup actions will primarily occur in fill. It has already been determined that the cleanup actions will be observed by a geologist who will ensure the excavation does not extend below the fill and that a professional archaeologist will only be contacted to assess the find if a potential archaeological object is observed by the geologist. SWCA recommended an archaeological monitor be present to view any excavation below the fill in areas assigned moderate potential for buried cultural resources and that an archaeologist be present to monitor interim actions at the base of the fill and below in areas assigned high risk for buried cultural resources. This boundary is very important to archaeologists, as it harbors very high potential for cultural resources.

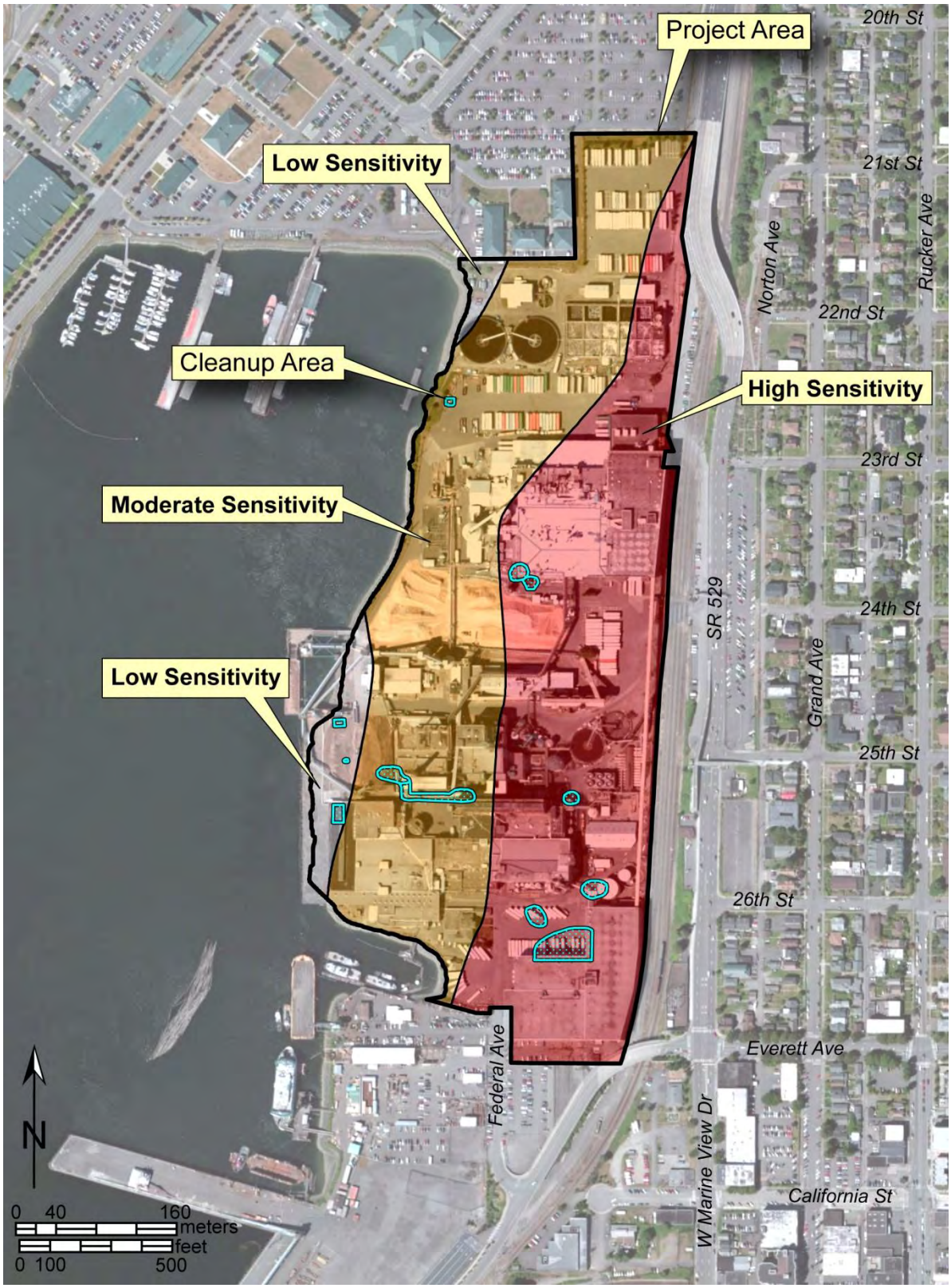

Figure 3. Areas of risk for finding pre-contact, early historical period Native American and early historical period archaeological sites, based on landforms and the historical shoreline.

Briefing

Briefing of construction personnel on expectations for cultural resources can be arranged, if needed. A briefing is especially important if unmonitored excavations in areas with potential for cultural resources will occur. If archaeologically monitored excavations occur, the briefing provides an opportunity for machinery operators and the archaeological monitor to discuss communication protocols and a plan of action in case cultural materials are identified. The briefing will include information on the legal context of cultural resources protection. In most cases, this briefing would be informal and would occur before work the first morning of interim action excavations. The briefing will be conducted by a qualified archaeologist.

UNMONITORED DISCOVERY

An archaeological monitor that has completed 40 hours of Hazardous Waste Operations and Emergency Response (HAZWOPER) training will be on site during the excavation of naturally deposited sediment below the fill in areas assigned moderate potential for buried cultural resources. An archaeologist that has completed 40 hours of Hazardous Waste Operations and Emergency Response (HAZWOPER) training will also be present to monitor interim actions at the base of the fill and below in areas assigned high risk for buried cultural resources. It is the responsibility of K-C WW, Inc., or their representatives at Aspect, to notify SWCA when the base of the fill is encountered, or suspected in the moderate and highly sensitive portions of the project area. In the event that archaeological deposits, human remains, or isolated artifacts are discovered when a monitor is *not* present it will be the responsibility of the K-C WW Upland Site Area Project Manager (or designated representative) to stop construction work in the vicinity of any potential discovery, and keep work stopped while contacting the archaeological Monitoring Supervisor to inform him of the potential cultural materials. Collection of the cultural materials by employees, construction personnel or others with access to the project is prohibited by State law.

Typical markers of pre-contact human activity include: fire-modified rock (FMR), animal bone, concentrations of shell, ground and flaked stone tools and flaked stone tool-making debris, burned earth, cordage or fiber, organically stained sediments, charcoal, ash, and exotic rocks and minerals.

Typical markers of significant historic-period human activity may include: significant deposits of domestic refuse such as bottles, ceramics and cans, and intact structural remains such as building foundations, boardwalks, or other structural elements.

MONITORED DISCOVERY

Communication Protocol

The Archaeological Monitor will communicate with the Construction Superintendent via Aspect to make general requests, or inquiries pertaining to equipment movement, placement of back dirt for examination, or excavation scheduling. The Archaeological Monitor also may need to communicate with excavation equipment operators to understand the timing and procedures of construction excavation at the start of each day. Construction spoils will almost certainly be contaminated with petroleum, heavy metals, and/or volatile organic compounds, so Aspect and the Construction Superintendent will find the best way for the Archaeological Monitor to make their necessary

observations within the limits of safety wherever feasible. Excavation trenches without shoring would only be directly accessed if deemed safe by Aspect and if less than 4 feet in depth. Aspect will communicate excavation procedures directly to the equipment operator in a fashion agreed upon by the Construction Superintendant.

Aspect will direct equipment operators and the Archaeological Monitor may ask the Aspect representative to temporarily pause excavation for observation. Temporary pauses would be on the order of one minute, to take a photograph or collect a depth measurement, for example. If the Archaeological Monitor determines that archaeological materials may be exposed in a particular area based on visual evidence, the Archaeological Monitor may ask the K-C WW Upland Area Project Manager and the Construction Superintendent to request that equipment operators modify construction excavation procedures to provide exposures of subsurface stratigraphy, in order to confirm the presence of any such resources in that area. For example, the Archaeological Monitor may request that Aspect direct the equipment operators to remove thin lifts of fill or sterile sediment to provide more extensive horizontal exposures of a potential cultural resource. Some areas may be cordoned off to allow more time to examine possible archaeological deposits. If needed, work may be stopped in an area sufficient to assess resources that may be significant and time will be provided for additional evaluation by field archaeologists. If the Archaeological Monitor determines a potentially significant archaeological resource is present, then no excavation will take place in the site without an excavation permit.

Work Stoppage

If any archaeological resources are discovered during monitored or unmonitored cleanup investigation activities, work will be stopped immediately and Ecology, the Department of Archaeology and Historic Preservation (DAHP), the City of Everett Planning and Community Development Department, and the Tulalip and Suquamish Tribes Cultural Resources Departments will be notified that day if possible, and no later than the close of the next business day (see contact list). An archeologist will be retained for an onsite inspection of the archaeological resource and the parties mentioned above will be invited to participate. The archaeologist will document the discovery and provide a professionally documented site form and report to the above-listed parties. Ground disturbing construction activities will be halted in the area of discovery large enough to ensure that integrity of the find is not compromised, although construction activities may continue elsewhere in the project area. In the event of discovery of human remains, work will be immediately halted in the discovery area and the remains will be covered and secured against further disturbance. The Everett Police Department and Snohomish County Medical Examiner will be immediately contacted, along with the DAHP Physical Anthropologist and authorized Tribal representatives.

Discovery Procedures

The following outlines the steps that will occur if cultural resources are discovered during construction. If the discovery occurs when the Archaeological Monitor is not present, the Project Manager (or designated representative) will ensure that construction does not continue in the vicinity of the discovery and will notify the Archaeological Monitor. If the discovery occurs during monitoring, the Archaeological Monitor will request work stoppage at the spot where possible cultural resources are identified and the following protocol will occur:

1. When cultural resources are discovered, the Archaeological Monitor will a) identify the nature of the discovery, and b) conduct preliminary evaluation. The Project Manager will assure

cessation of work at the location of the discovery. If possible, work would be redirected elsewhere by Aspect while evaluation is undertaken, but dewatering makes this scenario unlikely. Preliminary evaluation is usually a relatively quick process, but may require the assistance of the archaeological Monitoring Supervisor.

2. If the identified cultural resource appears relatively intact or relates to Native American occupation, the Archaeological Monitor or Monitoring Supervisor will request that the Project Manager (or the designated representative) notify the affected Tribes and the DAHP of the discovery.
3. The Archaeological Monitor will record, on standard forms, all pre-contact and/or intact historical cultural material. Initial efforts will focus on establishing the nature, provenience, and integrity of any discovery. Documentation methods may include photographs, sketches, scaled drawings, and written descriptions. During the work stoppage, the Project Manager will grant sufficient time to evaluate the discovery and will communicate with the Construction Superintendent. The Archaeological Monitor will ensure that the Monitoring Supervisor and Project Manager are fully briefed on the discovery.
4. Preliminary evaluation will not include excavation into an archaeological site without an excavation permit. If excavation into an archaeological site is needed to evaluate the resource, the Monitoring Supervisor will apply for an emergency excavation permit from the DAHP. The application process may require consultation with K-C WW, Inc., Ecology, the DAHP, the City of Everett Planning and Community Development Department, and/or the Tulalip and Suquamish Tribes Cultural Resources Departments. Any artifacts inadvertently removed from the resource prior to it being recorded as an archaeological site will be turned over to K-C WW, Inc. for curation arrangements.
5. Documentation of the discovery will be assembled and forwarded to K-C WW, Inc. via Aspect. K-C WW, Inc. will consult with the DAHP and affected Tribes. Project activity will be prohibited in the vicinity of the discovery and may not proceed until consultation with the DAHP and all affected Tribes have concluded that a) the resource is not eligible for listing in the National Register of Historic Places (NRHP), or any state or local registers, or b) that the resource is determined eligible for listing in the NRHP, but further activities beyond a determined buffer will not negatively impact the resource.
6. If consultation between K-C WW, Inc., Ecology, the DAHP, and affected Tribes determines that the archaeological resource is eligible for listing in the NRHP and that cleanup activities will have a negative impact on the archaeological resource, then it will be recommended that K-C WW, Inc. alter their cleanup plans avoid the site. If K-C WW, Inc. wishes to continue cleanup within the register eligible archaeological site as planned, additional archaeological investigations will be required prior to cleanup. Any archaeological site investigation would be conducted under a research design and discussed as part of an excavation permit application.
6. A letter report including the results of monitoring will be submitted by SWCA to Aspect for K-C WW, Inc. review at the conclusion of the project. If archaeological resources are identified and additional archaeological investigations take place, their methods and results may be summarized in supplemental documents after any necessary analysis is complete.

Human Remains

At the time that any bone that may be human is discovered, construction activity in the vicinity of the discovery will cease immediately to allow the Archaeological Monitor to conduct preliminary analysis of

the bone to determine if the remains are human. If the Archaeological Monitor is not present and bone is discovered, work will be stopped and the Project Manager will contact the archaeological Monitoring Supervisor. No additional earth moving or stockpiling of materials will occur within 30 feet of the bone and the area of discovery will be avoided until the Archaeological Monitor and/or Monitoring Supervisor arrive. The bone is not to be handled or photographed by anyone other than a professional archaeologist, law enforcement official, medical examiner, or tribal member.

If the remains are determined to be human, or possibly human:

1. The Archaeological Monitor or Monitoring Supervisor will immediately notify the Project Manager.
2. Upon receiving notice, the Project Manager, shall immediately notify the Everett Police Department and Snohomish County Medical Examiner (ME) and request that the ME determine if the remains are forensic or non-forensic. Contemporaneous with notifying local law enforcement and ME, the Project Manager (or designated representative) shall also notify the affected tribes and DAHP of the discovery.
3. If the ME determines the remains are non-forensic, the DAHP will take jurisdiction over the discovery. If the ME determines the remains are forensic, the Everett Police Department will take jurisdiction over the discovery.
4. If the ME determines the remains are non-forensic, the State Physical Anthropologist with the DAHP will make a determination if the remains are Indian or non-Indian and report that finding to the affected parties.
5. The DAHP will handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains. The consultation process will help to determine if, when, and how project construction will resume.
6. SWCA will prepare a final report that describes the discovery, notification of affected parties, steps taken in response to the discovery, and the final disposition of the non-forensic human remains.

CONFIDENTIALITY

Archaeological properties are of a sensitive nature, and sites where cultural resources are discovered can become targets of vandalism and illegal removal activities. All parties shall keep and maintain as confidential all information regarding any discovered cultural resources, particularly the location of known or suspected archaeological property, and exempt all such information from public disclosure consistent with the National Historic Preservation Act (NHPA) and State Law RCW 42.56.300. K-C WW Inc. and Aspect shall limit access to any project related cultural resources records to authorized persons with a need to know the information. Project personnel and contractors should especially keep the discovery of any found or suspected human remains confidential, including refraining from contacting the media or sharing information regarding the discovery with the public.

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APPENDIX C

Summary of Historical Hazardous Waste Management, K-C Mill

This appendix summarizes the Kimberly-Clark (K-C) mill's historical management of hazardous/dangerous wastes under the federal Resource Conservation and Recovery Act (RCRA). The Washington State Department of Ecology (Ecology) implements the federal RCRA requirements under the state Dangerous Waste Regulations (Chapter 173-303 WAC). The summary is based on review of documents provided by Ecology from their RCRA files and information provided by K-C.

No documentation is available regarding management of hazardous/dangerous wastes before the passage of RCRA in 1977. Communications with former employees indicate that hazardous substances were generally stored in the top floor of the pump mill above the bleach plant and used oils/lubricants were stored on the north wall of the Distribution Warehouse close to the Central Maintenance Shop before that area was reworked.

The first documentation of the mill's RCRA program is a November 14, 1980, letter from Scott Paper to the United States Environmental Protection Agency (EPA) with a completed Hazardous Waste Permit Application-Part A. The application included a facility drawing (included in Attachment C-1) showing a laboratory chemical storage area within the Pulp Mill, and an empty chemical barrel storage area adjacent to the Paint Shop immediately south of the Log Pond. The facility was assigned the RCRA ID number WAD009250820.

In 1982, RCRA management in the State of Washington was transitioned from EPA to Ecology. The facility's transition to the state program was documented in a revised Hazardous Waste Permit Application-Part A that was submitted to Ecology on August 9, 1982.

Ecology conducted a RCRA inspection on November 17, 1982, as documented in an internal Ecology memorandum dated November 29, 1982. The inspection clarified the materials that would be managed as dangerous waste: mercuric chloride, halogenated solvents (trichloroethylene and Brulins), non-halogenated solvents (Red Band, Shell Sol 71, xylene, ethyl acetate, ethyl ether, methanol, and acetone, toluene, and methylethyl ketone), and urea formaldehyde resin sludge. The inspection also documented that, prior to August 1982, the facility had generated zinc-contaminated boiler ash due to the burning of used tires in the hog fuel boiler. An August 25, 1982, letter from Scott Paper to Ecology states that rubber tires were burned in the hog fuel boiler between January 1981 and June 1982, generating an estimated 2,525 cubic yards of material, which was reportedly placed as fill during filling of the Log Pond.

In December 1983, Scott Paper requested (and Ecology agreed) to withdraw the RCRA Part A permit application since the facility no longer met the requirements as a dangerous waste storage facility (i.e., no dangerous waste was stored for longer than 90 days); however, the mill remained a large quantity generator of dangerous wastes until its closure in 2012 (RCRA ID number WAD009250820).

Another Ecology dangerous waste compliance inspection was conducted in early 1984, as documented in an internal Ecology memorandum dated January 16, 1984. The inspection documented that the mill is capable of generating dangerous wastes including mercuric chloride, halogenated and non-halogenated solvents, and resin sludge. The inspection documented generation of two dangerous waste streams in 1982: mercuric chloride and laboratory test solutions, and reported that waste solvents burned in the hog fuel boiler

should have been reported in Scott's 1982 dangerous waste annual report. The inspection also reviewed a 1983 investigation by state Labor and Industries and EPA regarding the alleged boiler burning of a waste oil-solvent mixture containing PCBs. Labor and Industries and EPA determined that that the oil-solvent mixture did not contain PCBs at the time of their investigation. Ecology had not been notified of the 1983 investigation at the time it occurred.

Ecology conducted a Potential Hazardous Waste Site Preliminary Assessment on November 27, 1984. The assessment identified the aforementioned 2,525 cubic yards of zinc-laden ash, and noted that, prior to 1982, the facility had dumped solvents on the hog fuel pile prior to boiler burning to increase the fuel's energy output. In addition, the assessment indicated that small quantities of solvents and acids were generated and drummed for transport off site to a permitted recycler. The assessment recommended that soil sampling for solvents be conducted in the hog fuel area if possible.

Ecology conducted a RCRA inspection on May 17, 1985. In a letter dated May 31, 1985, Ecology notified the facility of the following violations of the Dangerous Waste Regulations: a lack of triple rinsing for containers holding dangerous wastes, a lack of specificity in the facility Personnel Training Plan, and deficiencies in the facility Contingency Plan. Scott Paper provided responses to the violations in a letter dated July 30, 1985. A follow-up letter from Ecology extending the deadline for compliance indicates a meeting occurred on September 4, 1985. No further documentation regarding these issues was located, suggesting they were resolved.

An annotated version of a 1985 map showing electrical transformer locations across the facility is included in Attachment C-1. A Toxic Substances Control Act (TSCA) inspection conducted by Ecology on February 29, 1988, documented 40 Askeral (100% PCB oil) transformers and three non-PCB-containing transformers at the facility. The inspection noted that the transformers are in isolated situations (including locked vaults) with leak-proof flooring and curbs and drip management devices, and noted that what oil leaks occur are a result of sampling the transformer oils. No concerns were identified in the inspection report; in fact, the inspector noted "The Attachments, all other documents and the equipment inspected seemed to be the best case of PCB transformer management that this inspector has experienced." EPA reviewed Ecology's TSCA inspection report and concluded that there were no violations of the PCB regulations and stated that Scott's PCB management program appeared to be "exemplary." (June 1, 1988, letter from EPA to Scott Paper).

Attachment C-1 includes an annotated version of the 1990 facility chemical locations map, presumably created as part of the Hazardous Materials and Wastes Management Program.

The facility reported to Ecology a leak in the 50% caustic storage tank (estimated 170 gallons) in a letter dated October 20, 1992. The leak was reportedly contained and cleaned up, as documented in a follow up letter dated January 19, 1993, from the Scott Paper to Ecology's Industrial Section.

Ecology conducted a dangerous waste inspection on January 13, 1993, documented in a letter from Ecology dated April 1, 1993. The inspection reported generation and off-site management of the following wastes: mercuric chloride, mercury from spill mixed with

saw dust, a mixture of non-halogenated solvents and paint, petroleum distillates, naphtha solvent, trichloroethylene, a mixture of dodecylquanidine hydrochloride, methylene bis-thiocyanate, and isopropyl alcohol, a mixture of water, rust/soil, and kerosene/gasoline, petroleum naptha, cleaning liquid, and lacquer thinner. A review of dangerous waste manifests from 1991 indicated compliance with the Dangerous Waste Regulations. No violations were found during the inspection.

In 1994, the facility updated pages to the Hazardous Materials and Wastes Management Program. The updates included two figures of note: "Everett Chemical Storage and Handling Locations Pulp/Utilities/Secondary Treatment" and "Everett Paper Mill Chemical Storage & Handling Locations". Annotated versions of the figures are included in Attachment C-1.

In 1995, Scott Paper reported a 525-gallon spill of sodium bisulfite to the mill's wastewater treatment system. Ecology issued a warning, but no enforcement order, as discussed in an Ecology letter dated March 29, 1995.

In 1996, the facility updated pages to the Hazardous Materials and Wastes Management Program to meet contingency plan requirements under Chapter 173-303 WAC. The update includes two figures of note: "Buildings and Grounds Chemical Storage and Handling Locations, Pulp/Utilities/Secondary Treatment", and "Buildings and Grounds Chemical Storage and Handling Locations (for Paper Mill area)", which are very similar to the 1994 versions of the maps. Annotated versions of the figures are included in Attachment C-1.

Hazardous Waste Accumulation Unit

The Hazardous Waste Accumulation Unit (HWAU, aka "haz waste cage") was a 90-day hazardous waste accumulation unit in which hazardous and non-hazardous waste materials generated at the mill were temporarily stored prior to proper off-site disposal. Prior to closure, K-C accumulated waste materials within the accumulation unit for periods less than 90 days, and handled and disposed of the wastes in accordance with applicable requirements of Chapter 173-303 WAC. Closure of the HWAU, one of the final steps in mill demolition, is detailed in the body of this report.

Management of Hazardous Substances during Mill Closure

During closure of the mill facility, K-C removed the remaining chemical inventory from each portion of the mill prior to its demolition. To do this, K-C contracted with Veolia ES Technical Solutions to perform a "chemical sweep" of the entire mill, in which surplus chemical inventory is identified, profiled for disposition, and then loaded and transported for proper off-site recycling, treatment, and/or disposal in accordance with applicable laws, regulations, and permits. As part of this effort, Veolia cleaned the mill's chemical storage tanks to prepare them for demolition. When additional small containers of hazardous substances were encountered during demolition, the demolition contractor, Cambria Contracting, profiled them for off-site recycling or disposal and staged them temporarily in the HWAU pending transport. Ecology conducted a Dangerous Waste Inspection of the mill while these chemical management activities were underway, and

concluded that the procedures were being done in conformance with Chapter 173-303 WAC, as described in the RCRA Closure Report for the mill (Aspect, 2013b)

Ecology Dangerous Waste Inspection during Mill Closure (November 2012)

Robert Carruthers of Ecology's Industrial Section conducted a dangerous waste inspection of K-C's mill on November 7, 2012 to assess whether mill closure and demolition was being conducted in accordance with the state Dangerous Waste Regulations (Chapter 173-303 WAC).

Based on the inspection, Ecology concluded that closure of the K-C Everett site is being done in conformance with Chapter 173-303 WAC. A copy of Ecology's inspection report is included in Appendix A to the RCRA Closure Report for the mill (Aspect, 2013b).

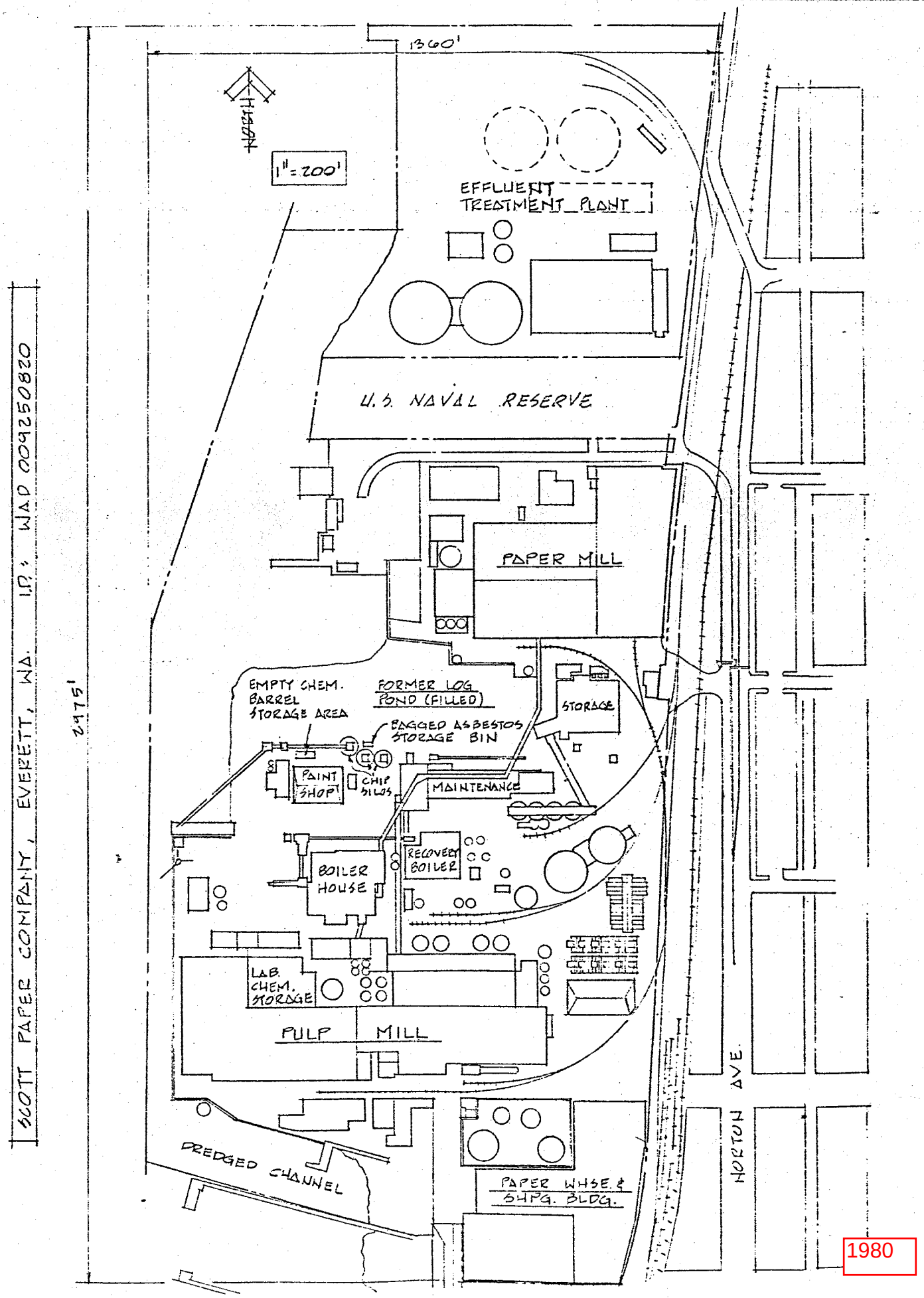
ATTACHMENT C-1

Historical Maps Depicting Hazardous Substance Use/Storage Locations

Continued from page 4.

Form Approved OMB No. 158-S80004

V. FACILITY DRAWING *(see page 4)*



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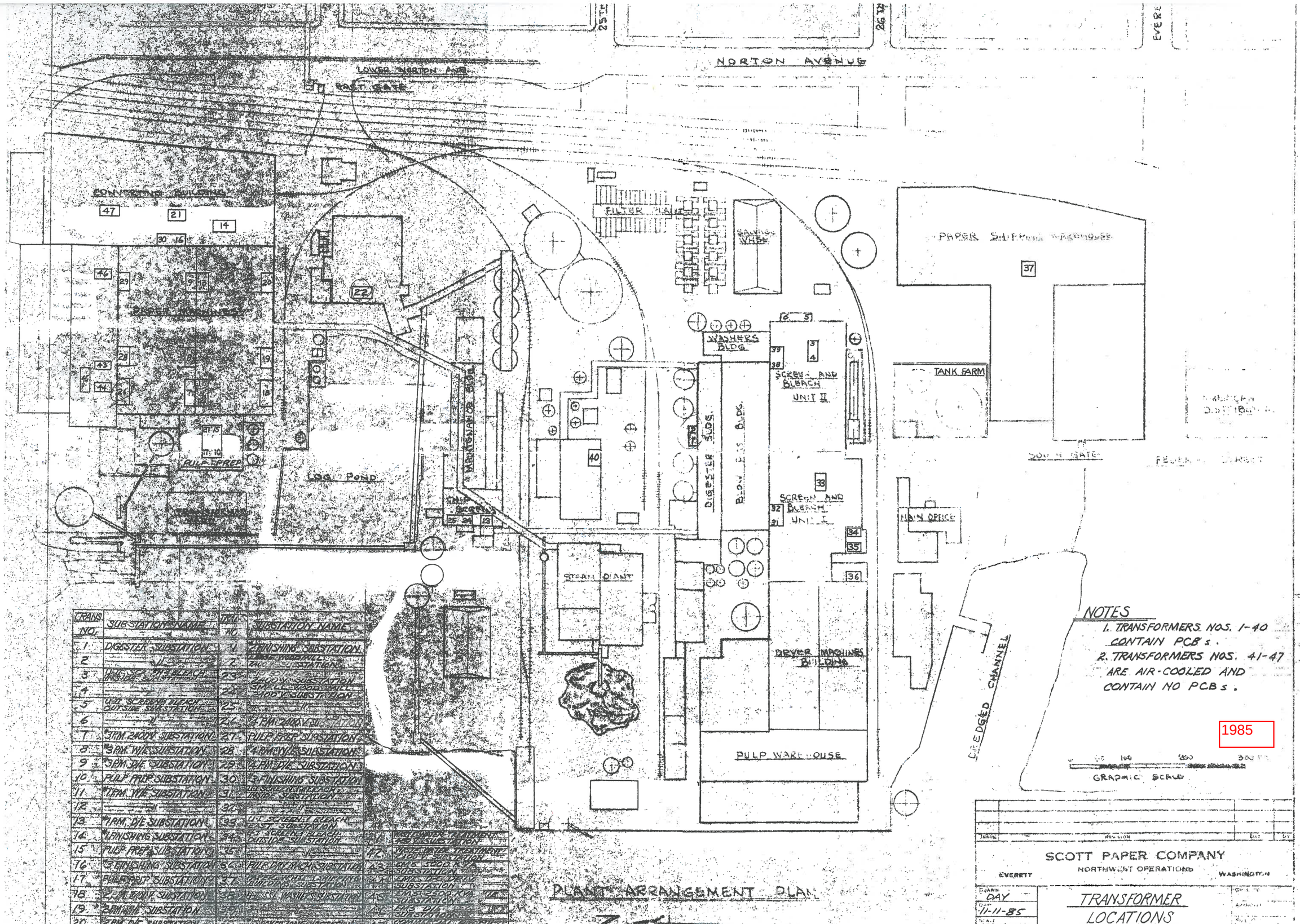


TRANS. NO.	SUBSTATION NAME	TRANS. NO.	SUBSTATION NAME
1	DIGESTER SUBSTATION	19	FINISHING SUBSTATION
2	"	20	PAPER WAREHOUSE SUBSTATION
3	DIGESTER & BLEACH PLANT SUBSTATION	23	2400V SUBSTATION
4		24	SPARE TRANSFORMER 2400V SUBSTATION
5	U.I. SCREEN & BLEACH OUTSIDE SUBSTATION	25	"
6	"	26	4 P.M. 2400V SUBSTATION
7	3 P.M. 2400V SUBSTATION	27	PULP PREP SUBSTATION
8	3 P.M. W.E. SUBSTATION	28	4 P.M. W.E. SUBSTATION
9	3 P.M. D.E. SUBSTATION	29	4 P.M. D.E. SUBSTATION
10	PULP PREP SUBSTATION	30	3 FINISHING SUBSTATION
11	1 P.M. W.E. SUBSTATION	31	U.II SCREEN & BLEACH INSIDE SUBSTATION
12		32	"
13	1 P.M. D.E. SUBSTATION	33	U.I. SCREEN & BLEACH EAST SUBSTATION
14	1 FINISHING SUBSTATION	34	U.I. SCREEN & BLEACH OUTSIDE SUBSTATION
15	PULP PREP SUBSTATION	35	"
16	3 FINISHING SUBSTATION	36	PULP DRYER MACHINE SUBSTATION
17	PULP PREP SUBSTATION	37	PAPER WAREHOUSE SUBSTATION
18	2 P.M. W.E. SUBSTATION	38	WASHERS SUBSTATION
19	2 P.M. D.E. SUBSTATION	39	"
20	2 P.M. D.E. SUBSTATION	40	DIGESTER SUBSTATION

TRANS. NO.	SUBSTATION NAME
41	WASTE WATER TREATMENT 2400V SUBSTATION
42	WASTE WATER TREATMENT 2400V SUBSTATION
43	EMS 2400 V SUBSTATION
44	MAIN DE PREP SUBSTATION
45	FIRE 2400 KV SUBSTATION
46	FIRE DIESEL
47	FIRE DIESEL

PLANT ARRANGEMENT PLAN

NOTES

1. TRANSFORMERS NOS. 1-40 CONTAIN PCB's.
2. TRANSFORMERS NOS. 41-47 ARE AIR-COOLED AND CONTAIN NO PCB's.

1985

GRAPHIC SCALE

SCOTT PAPER COMPANY
NORTHWEST OPERATIONS
EVERETT WASHINGTON

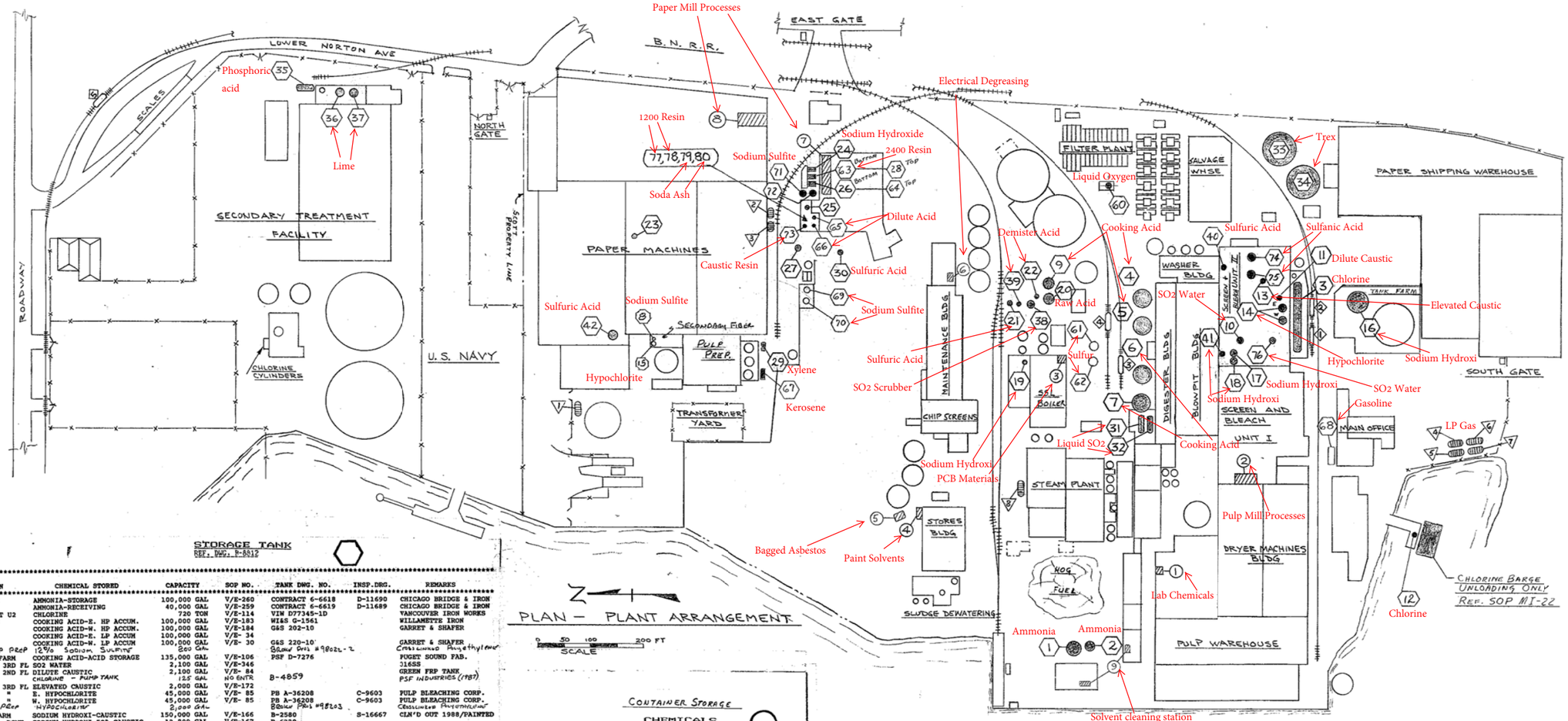
DRAWN	DAY
DATE	11-11-85
SCALE	AS NOTED

TRANSFORMER LOCATIONS

EB-26A

437

436



STORAGE TANK

REF. DWG. B-8812

TK	LOCATION	CHEMICAL STORED	CAPACITY	SOP NO.	TANK DWG. NO.	INSP.DRG.	REMARKS
1	PULP DOCK	AMMONIA-STORAGE	100,000 GAL	V/E-260	CONTRACT 6-6618	D-11690	CHICAGO BRIDGE & IRON
2	" "	AMMONIA-RECEIVING	40,000 GAL	V/E-259	CONTRACT 6-6619	D-11689	CHICAGO BRIDGE & IRON
3	BLEACH PLT U2	CHLORINE	720 TON	V/E-114	VIN D77345-1D		VANCOUVER IRON WORKS
4	DIGESTERS	COOKING ACID-E. HP ACCUM.	100,000 GAL	V/E-183	WI&S G-1561		WILLAMETTE IRON
5	"	COOKING ACID-W. HP ACCUM.	100,000 GAL	V/E-184	G&S 202-10		GARRET & SHAFER
6	"	COOKING ACID-E. LP ACCUM	100,000 GAL	V/E- 34			
7	"	COOKING ACID-W. LP ACCUM	100,000 GAL	V/E- 30	G&S 220-10		GARRET & SHAFER
8	P.M. PULP PREP	12% SODIUM SULFITE	200 GAL		Baker Drg #98021-2		Cross-Linked Polyethylene
9	SSL TANK FARM	COOKING ACID-ACID STORAGE	135,000 GAL	V/E-106	PSF D-7276		PUGET SOUND FAB.
10	BL PLT U2 3RD FL	SO2 WATER	2,100 GAL	V/E-346			316SS
11	BL PLT U2 2ND FL	DILUTE CAUSTIC	2,100 GAL	V/E- 84			GREEN FRP TANK
12	CL2. DOCK	CHLORINE - PULP TANK	125 GAL	NO ENTR	B-4859		PSF INDUSTRIES (1987)
13	BL PLT U2 3RD FL	ELEVATED CAUSTIC	2,000 GAL	V/E-172			
14	E " " "	E. HYPOCHLORITE	45,000 GAL	V/E- 85	PB A-36208	C-9603	PULP BLEACHING CORP.
14	W " " "	W. HYPOCHLORITE	45,000 GAL	V/E- 85	PB A-36208	C-9603	PULP BLEACHING CORP.
15	PM. PULP PREP	HYPOCHLORITE	2,000 GAL		Baker Drg #98203		Cross-Linked Polyethylene
16	S. TANK FARM	SODIUM HYDROXI-CAUSTIC	150,000 GAL	V/E-166	B-2580	S-16667	CLN'D OUT 1988/PAINTED
17	BL PLT U2, BSMT	SODIUM HYDROXI-50% CAUSTIC	13,800 GAL	V/E-167	B-6339		
18	BL PLT U2, BSMT	SODIUM HYDROXI-DILUTE CAUST	3,000 GAL	V/E-168	B-6339		
19	EVAP BUILDING	SODIUM HYDROXI-CAUSTIC	1,500 GAL	V/E- 44	T-1508		
20	SSL TANK FARM	RAW ACID SETTLING	135,000 GAL	V/E-111	PSF D-7228		PUGET SOUND FAB.
21	" " "	SULFURIC ACID	6,400 GAL	V/E- 10	B-15317	D-12685	
22	" " "	DEMISTER ACID STORAGE	15,000 GAL	V/E- 82	S-13592B		CHEM-PROOF
23	#4 PM MEZZANINE	(OUT OF SERVICE)	1,400 GAL	V/E-116	S-888		
24	P M CHEM PREP	SODIUM HYDROXIDE-CAUSTIC	10,000 GAL	V/E-106	DFSV2-W1-BIC		
25	" " "	(EMPTY)	10,000 GAL	V/E-104	DCFSV-341-B8		
26	" " "	(EMPTY)	10,000 GAL	V/E-107	C-4830		
27		(REMOVED)					
28	" " "	EMPTY	10,000 GAL	V/E-105	C-4830		
29	P M PULP PREP	XYLENE	12,500 GAL	V/E-151	CTM1092-11-5-31		
30	" " CHEM "	SULFURIC ACID-WEAK	10,000 GAL	V/E-113		D-6289	
31	DIGESTERS	N. LIQUID SO2	25,000 GAL	V/E-146	B-6650	S-14854	
32	"	S. LIQUID SO2	25,000 GAL	V/E-146	B-6650	S-14854	
33	TREX FARM	TREX	1,100,000 GAL	V/E- 25			
34	"	TREX	1,100,000 GAL	V/E- 25			
35	SEC. W W TREAT.	PHOSPHORIC ACID	16,000 GAL	V/E- 69			
36	" " "	N. LIME (NOT HAZARDOUS)	160 TON	V/E- 77			
37	" " "	S. LIME (NOT HAZARDOUS)	160 TON	V/E- 78			
38	SSL TANK FARM	SO2 SCRUBBER TANK	350,000 GAL	V/E-162	D-89087 (GESHIG)		ERSHIG
39	" " "	DEMISTER ACID - MIX	1,000 GAL	V/E-161	S-13579		
40	BLEACH PLT/3 FLR	SULFURIC ACID-pH CONTROL	350 GAL	V/E-221	C-8967		SCOTT
41	" " " "	SODIUM HYDROXI-pH CONTROL	600 GAL	NO ENTR			
42	NO. 5 P M	SULFURIC ACID	1,500 GAL	V/E-533			LIQUID AIR
60	FILTER PLANT	LIQUID OXYGEN	11,000 GAL	NO ENTR			
61	SULFUR UNLOAD	SULFUR STORAGE - E.	41,000 GAL	V/E-146		D-12642	
62	SULFUR UNLOAD	SULFUR STORAGE - W.	41,000 GAL	V/E-146		D-12643	
63	PM CHEM PREP	2400 RESIN	10,000 GAL	V/E-109	C-4830		
64	PM CHEM PREP	(EMPTY)	10,000 GAL	V/E-108	C-4830		
65	PM CHEM PREP	EAST DILUTE ACID/4%H2SO4	3,008 GAL	V/E-	C-9063		CHEMPROOF
66	PM CHEM PREP	WEST DILUTE ACID/4%H2SO4	1,744 GAL	V/E	C-9063		CHEMPROOF
67	PM PULP PREP	(OUT OF SERVICE)		NO ENTR			KEROSENE TANK
68	OFFICE AREA	GASOLINE	300 GAL	NO ENTR			
69	PM CHEM PREP	E. SODIUM SULFITE		V/E- 99			
70	PM CHEM PREP	W. SODIUM SULFITE		V/E- 98			
71	PM CHEM PREP	E. CAUSTIC SODA 1/2%		V/E- 96			
72	PM CHEM PREP	(EMPTY)		V/E- 97			
73	PM CHEM PREP	CAUSTIC RESIN COOLER		V/E- 91			
74	BL PLT U2 3D FLR	E. SULFANIC ACID	450 GAL	V/E-222	CHEMPROOF		PO 5E-04880
75	BL PLT U2 3D FLR	W. SULFANIC ACID	450 GAL	V/E-223	CHEMPROOF		PO 5E-04880
76	BL PLT U2 3D FLR	AUX. SO2 WATER	3,000 GAL	V/E-345			
77	PM CHEM PREP	1200 RESIN EAST	10,000 GAL	V/E- 93			
78	PM CHEM PREP	1200 RESIN WEST	10,000 GAL	V/E- 94			
79	PM CHEM PREP	EAST SODA ASH	6,000 GAL	V/E-100			
80	PM CHEM PREP	WEST SODA ASH	6,000 GAL	V/E-101			

NOTE: NOS. 43-59 ASSIGNED TO HAZARDOUS PIPING SYSTEMS WITHOUT TANKS.
SEE HAZARDOUS PIPING INSPECTION PROGRAM IN MAINTENANCE CONTROL.

PLAN — PLANT ARRANGEMENT

0 50 100 200 FT
SCALE

CONTAINER STORAGE

CHEMICALS

REF. DWG. B-8812

NO.	CHEMICALS
1	LABORATORY CHEMICALS
2	PULP MILL PROCESSES
3	P C B MATERIALS
4	PAINT SOLVENTS
5	BAGGED ASBESTOS
6	ELECTRICAL DEGREASING
7	PAPER MILL PROCESSES
8	PAPER MILL PROCESSES
9	SOLVENT CLEANING STATION

RAILROAD TANK CARS

REF. DWG. B-8812

NO.	CHEMICALS	CAP.
1	CHLORINE	55
2	T R E X	92
3	ANHYDROUS AMMONIA	80
4	LIQUID SO2	90
5	OCCASIONAL HOLDING AREA FOR CHLORINE, ANHYDROUS AMMONIA, AND LIQUID SO2.	

LIQUID PETROLEUM GAS TANKS

NO.	TANK LOCATION	MATERIAL STORED	CAPACITY	TANK SER.NO.	REMARKS
1	WEST OF EB-5 BROKE STORAGE	PROPANE	1000 GAL	793556	CAL GAS TANK
2	PM EMERG LIGHTING	PROPANE	100 GAL	76681	CAL GAS TANK
3	PM EMERG LIGHTING	PROPANE	120 GAL	710766	CAL GAS TANK
4	MAIN OFF PARK LOT	PROPANE	1000 GAL	445703	CAL GAS TANK
5	MAIN OFF PARK LOT	PROPANE	1000 GAL	373726	CAL GAS TANK
6	MAIN OFF PARK LOT	PROPANE	1000 GAL	495563	CAL GAS TANK
7	MAIN OFF PARK LOT	PROPANE	1000 GAL	495558	CAL GAS TANK
8	N SIDE HP BOILERS	PROPANE	120 GAL	507865	CAL GAS TANK

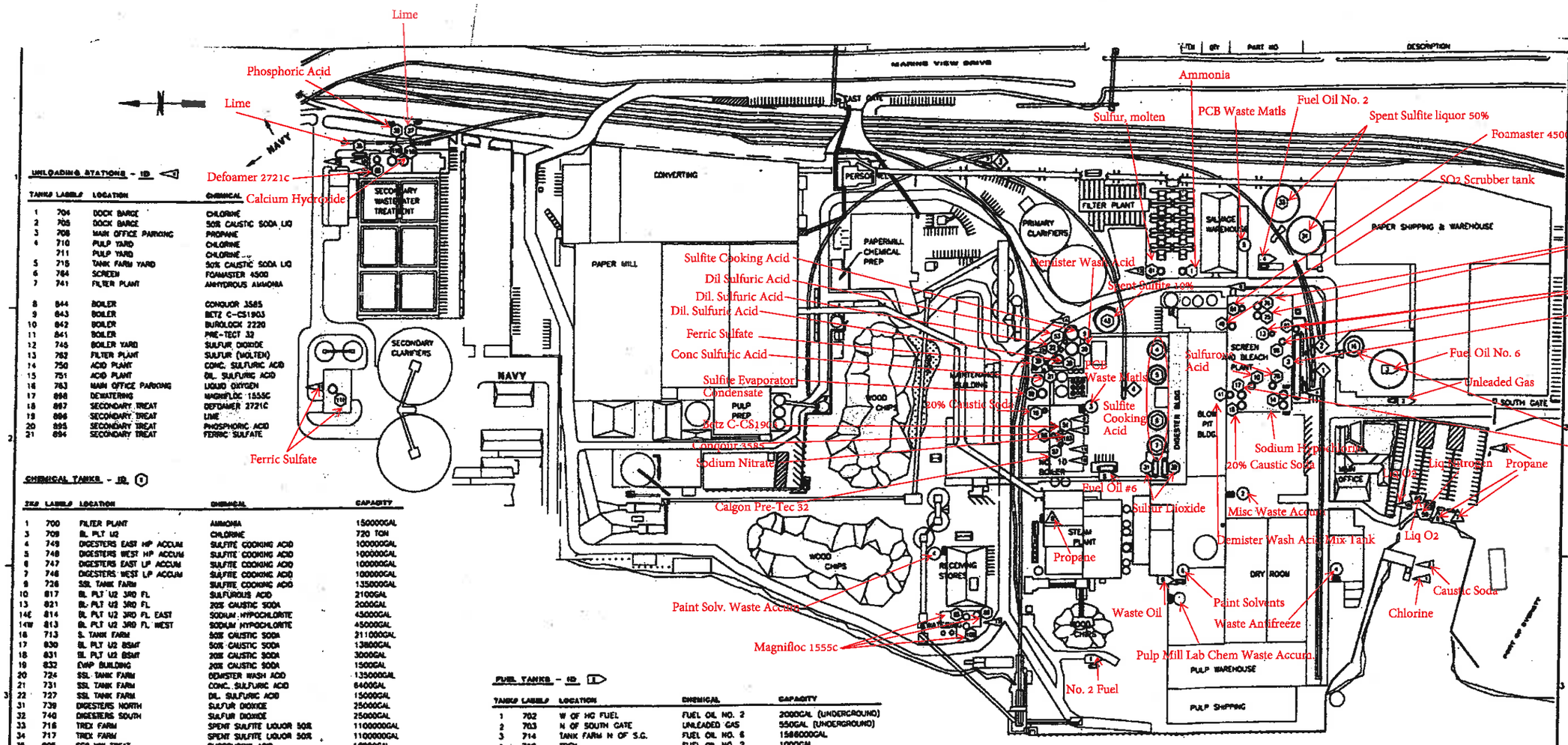
NO. — PROPANE TANK
NO. — RAILROAD TANK CAR
NO. — CONTAINER STORAGE
NO. — CHEMICAL STORAGE TANK
LEGEND

1990

ISSUE	REVISION	DATE	BY
H	REVISIONS FOR SO2 SCRUBBER	2/7/90	DW
G	ADD TANK 12 TO LIST	8/3/89	WRR
F	REVISE AND ADD TANK INFORMATION	7/14/89	SFR
E	REVISE - ADD STG. TANK AND PROPANE TANK INFO.	4/25/89	SFR
D	REVISE AND ADD TANK INFORMATION	6/11/85	SFR
C	ADD LIQUID OXYGEN	11-16-84	EHR
B	ADDED R.R. TANK CARS	6-17-81	FIL
A	COMBINED B-8812 & C-6982, ADDED CONTAINER STORAGE	6-5-81	FIL

SCOTT PAPER COMPANY
EVERETT NORTHWEST OPERATIONS WASHINGTON

DRAWN	HAZARDOUS SUBSTANCES STORAGE LOCATIONS	CHECKED	
DATE		APPROVED	
SCALE		FILE KEY EB-1A	
JOB NO.	PROJECT	DRAWING NO. D 9012	ISSUE H



UNLOADING STATIONS - ID ◁

TANK#	LABEL#	LOCATION	CHEMICAL
1	704	DOCK BARGE	CHLORINE
2	705	DOCK BARGE	50% CAUSTIC SODA LIQ
3	708	MAIN OFFICE PARKING	PROPANE
4	710	PULP YARD	CHLORINE
	711	PULP YARD	CHLORINE
5	715	TANK FARM YARD	50% CAUSTIC SODA LIQ
6	784	SCREEN	FOAMASTER 4500
7	741	FILTER PLANT	ANHYDROUS AMMONIA
8	844	BOILER	CONQUOR 3585
9	843	BOILER	BETZ C-CS1903
10	842	BOILER	BUROLOCK 2220
11	841	BOILER	PRE-TECT 32
12	745	BOILER YARD	SULFUR DIOXIDE
13	782	FILTER PLANT	SULFUR (MOLTEN)
14	750	ACID PLANT	CONC. SULFURIC ACID
15	751	ACID PLANT	DIL. SULFURIC ACID
16	783	MAIN OFFICE PARKING	LIQUID OXYGEN
17	898	DEWATERING	MAGNIFLOC 1555C
18	897	SECONDARY TREAT	DEFOAMER 2721C
19	896	SECONDARY TREAT	LIME
20	895	SECONDARY TREAT	PHOSPHORIC ACID
21	894	SECONDARY TREAT	FERRIC SULFATE

CHEMICAL TANKS - ID ①

TK#	LABEL#	LOCATION	CHEMICAL	CAPACITY
1	700	FILTER PLANT	AMMONIA	150000GAL
3	709	BL PLT U2	CHLORINE	720 TON
4	749	DIGESTERS EAST HP ACCUM	SULFITE COOKING ACID	100000GAL
5	748	DIGESTERS WEST HP ACCUM	SULFITE COOKING ACID	100000GAL
6	747	DIGESTERS EAST LP ACCUM	SULFITE COOKING ACID	100000GAL
7	746	DIGESTERS WEST LP ACCUM	SULFITE COOKING ACID	100000GAL
8	726	SSL TANK FARM	SULFITE COOKING ACID	135000GAL
10	817	BL PLT U2 3RD FL	SULFUROUS ACID	2100GAL
13	821	BL PLT U2 3RD FL	20% CAUSTIC SODA	2000GAL
14E	814	BL PLT U2 3RD FL EAST	SODIUM HYPOCHLORITE	45000GAL
14W	813	BL PLT U2 3RD FL WEST	SODIUM HYPOCHLORITE	45000GAL
16	713	S. TANK FARM	50% CAUSTIC SODA	211000GAL
17	830	BL PLT U2 BSMT	50% CAUSTIC SODA	13800GAL
18	831	BL PLT U2 BSMT	20% CAUSTIC SODA	3000GAL
19	832	EVAP BUILDING	20% CAUSTIC SODA	1500GAL
20	724	SSL TANK FARM	DEMISTER WASH ACID	135000GAL
21	731	SSL TANK FARM	CONC. SULFURIC ACID	6400GAL
22	727	SSL TANK FARM	DIL. SULFURIC ACID	15000GAL
31	739	DIGESTERS NORTH	SULFUR DIOXIDE	25000GAL
32	740	DIGESTERS SOUTH	SULFUR DIOXIDE	25000GAL
33	716	TREX FARM	SPENT SULFITE LIQUOR 50%	1100000GAL
34	717	TREX FARM	SPENT SULFITE LIQUOR 50%	1100000GAL
35	905	SEC WW TREAT	PHOSPHORIC ACID	18000GAL
36	903	SEC WW TREAT NORTH	LIME	160 TON
37	904	SEC WW TREAT SOUTH	LIME	160 TON
38	729	SSL TANK FARM	CONC. SULFURIC ACID	35000GAL
39	730	SSL TANK FARM	FERRIC SULFATE (DEM MIX)	1000GAL
40	824	BL PLT 3RD FL	SO2 SCRUBBER TANK	350GAL
41	818	BL PLT 3RD FL	DEMISTER WASH ACID MIX TANK	600GAL
43	723	SSL TANK FARM	SPENT SULFITE 10%	640000GAL
53	725	SSL TANK FARM	DIL. SULFURIC ACID	14600GAL
54	845	SSL BOILER	BETZ C-CS1903	4500GAL
56	846	SSL BOILER	CONQUOR 3585	1500GAL
57	848	SSL BOILER	CALGON PRE-TEC 32	4500GAL
61	743	SULFUR	SULFUR (MOLTEN)	50000GAL
74	823	BL PLT U2 3RD FL EAST	SULFAMIC ACID	450GAL
75	822	BL PLT U2 3RD FL WEST	SULFAMIC ACID	450GAL
76	816	BL PLT U2 3RD FL	SULFUROUS ACID	3000GAL
82	906	SEC WW TREAT	DEFOAMER 2721C	80000GAL
84	826	SCREEN 2ND FL	FOAMASTER 4500	5300GAL
85	900	DEWATERING	MAGNIFLOC 1565C	1700GAL
86	901	DEWATERING	MAGNIFLOC 1555C	8000GAL
89	732	ACID YARD	SULFITE EVAPORATOR CONDENSATE	51700GAL
97	712	YARD	20% CAUSTIC SODA	17700GAL
98	860	SCREEN	20% CAUSTIC SODA	2000GAL
103	852	#10 BOILER	SODIUM NITRATE	1100GAL
109	902	DEWATERING	MAGNIFLOC 1565C	1700GAL
110	907	SEC WW TREAT (N. & S.)	CALCIUM HYDROXIDE	11500GAL
111	898	SEC WW TREAT	FERRIC SULFATE	8000GAL

FUEL TANKS - ID ①

TANK#	LABEL#	LOCATION	CHEMICAL	CAPACITY
1	702	W OF HC FUEL	FUEL OIL NO. 2	2000GAL (UNDERGROUND)
2	703	N OF SOUTH GATE	UNLEADED GAS	550GAL (UNDERGROUND)
3	714	TANK FARM N OF S.G.	FUEL OIL NO. 6	1568000GAL
4	718	TREX	FUEL OIL NO. 2	1000GAL
5	761	S OF SSL BOILER	FUEL OIL NO. 6	200000GAL
8	738	N. OF PULP MILL LAB	WASTE OIL	700GAL

LIQUID PETROLEUM GAS TANKS - ID ⚠

TANK#	LABEL#	LOCATION	CHEMICAL	CAPACITY
6	707	MAIN OFFICE PARKING	PROPANE	1000GAL
7	707	MAIN OFFICE PARKING	PROPANE	1000GAL
8	736	N SIDE HF BOILER	PROPANE	500GAL

CRYOGENS - ID ⑤

TANK#	LABEL#	LOCATION	CHEMICAL	CAPACITY
50	770	MAIN OFFICE YARD	LIQUID NITROGEN	3000GAL
60	728	MAIN OFFICE YARD	LIQUID OXYGEN	11000GAL

WASTE ACCUMULATION SITES - ID ②
< NOT STORAGE >

#	CHEMICAL
1	PULP MILL LAB CHEMICALS
2	MISCELLANEOUS
3	PCB WASTE MATERIALS
4	PAINT SOLVENTS
5	WASTE ANTIFREEZE

RAILROAD TANK CARS - ID ④

#	CHEMICAL	CAPACITY
1&2	CHLORINE	55 TONS
3	ANHYDROUS AMMONIA (2)	80 TONS
4	LIQUID SO2	90 TONS

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1994

REV.	REVISION NOTE	DATE	BY
B	REVISED PER ENGINEER MARKUP'S	9/2/94	D.S

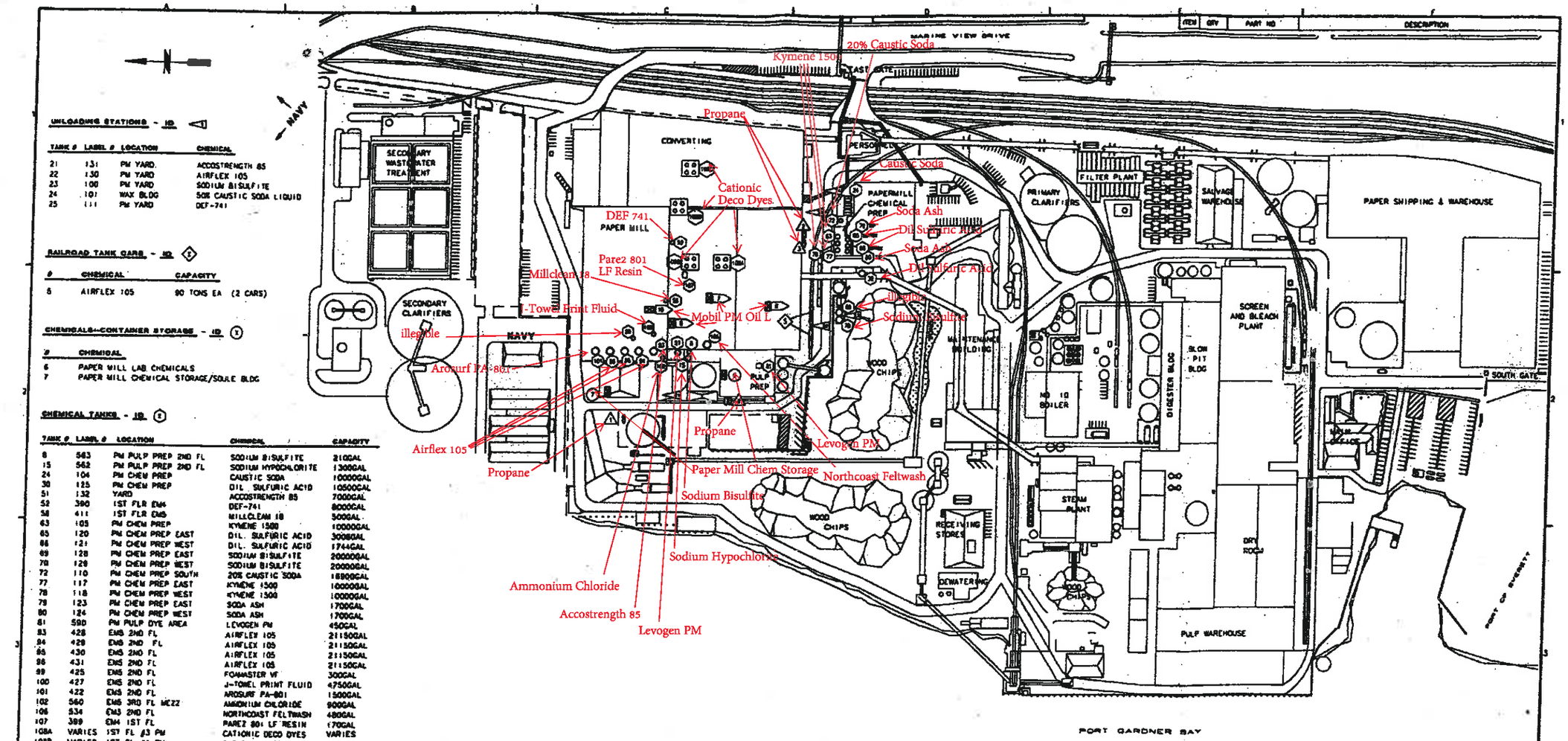
SCOTT
SCOTT WORLDWIDE

EVERETT CHEMICAL STORAGE & HANDLING LOCATIONS PULP/UTILITIES/SEC. TREATMENT

08-97-00-00

B-18000-W-01 B

Attachment 5-2A



UNLOADING STATIONS - ID ◁1

TANK #	LABEL #	LOCATION	CHEMICAL
21	131	PM YARD	ACCOSTRENGTH 85
22	130	PM YARD	AIRFLEX 105
23	100	PM YARD	SODIUM BISULFITE
24	101	WAX BLDG	50% CAUSTIC SODA LIQUID
25	111	PM YARD	DEF-741

RAILROAD TANK CARS - ID ◇2

#	CHEMICAL	CAPACITY
8	AIRFLEX 105	90 TONS EA (2 CARS)

CHEMICALS-CONTAINER STORAGE - ID ①

#	CHEMICAL
6	PAPER MILL LAB CHEMICALS
7	PAPER MILL CHEMICAL STORAGE/SOULE BLDG

CHEMICAL TANKS - ID ②

TANK #	LABEL #	LOCATION	CHEMICAL	CAPACITY
8	563	PM PULP PREP 2ND FL	SODIUM BISULFITE	210GAL
15	562	PM PULP PREP 2ND FL	SODIUM HYPOCHLORITE	1300GAL
24	104	PM CHEM PREP	CAUSTIC SODA	10000GAL
30	125	PM CHEM PREP	OIL SULFURIC ACID	10500GAL
51	132	YARD	ACCOSTRENGTH 85	7000GAL
52	390	1ST FLR EM4	DEF-741	8000GAL
58	411	1ST FLR EM5	MILLCLEAM 18	500GAL
63	105	PM CHEM PREP	KYMENE 1500	10000GAL
65	120	PM CHEM PREP EAST	OIL SULFURIC ACID	3000GAL
66	121	PM CHEM PREP WEST	OIL SULFURIC ACID	1744GAL
69	128	PM CHEM PREP EAST	SODIUM BISULFITE	20000GAL
70	129	PM CHEM PREP WEST	SODIUM BISULFITE	20000GAL
72	110	PM CHEM PREP SOUTH	20% CAUSTIC SODA	18900GAL
77	117	PM CHEM PREP EAST	KYMENE 1500	10000GAL
78	118	PM CHEM PREP WEST	KYMENE 1500	10000GAL
79	123	PM CHEM PREP EAST	SODA ASH	1700GAL
80	124	PM CHEM PREP WEST	SODA ASH	1700GAL
81	590	PM PULP DYE AREA	LEVOGEN PM	450GAL
83	428	EM5 2ND FL	AIRFLEX 105	21150GAL
84	429	EM5 2ND FL	AIRFLEX 105	21150GAL
85	430	EM5 2ND FL	AIRFLEX 105	21150GAL
86	431	EM5 2ND FL	AIRFLEX 105	21150GAL
99	425	EM5 2ND FL	FOAMASTER VF	300GAL
100	427	EM5 2ND FL	J-TOWEL PRINT FLUID	4750GAL
101	422	EM5 2ND FL	AROSURF PA-801	1500GAL
102	560	EM5 3RD FL MEZZ	AMMONIUM CHLORIDE	900GAL
106	534	EM3 2ND FL	NORTHCOAST FELTWASH	480GAL
107	389	EM4 1ST FL	PAREZ 801 LF RESIN	170GAL
108A	VARIES	1ST FL #3 PM	CATIONIC DECO DYES	VARIES
108B	VARIES	1ST FL #4 PM	CATIONIC DECO DYES	VARIES
108C	VARIES	1ST FL UNIT 11	CATIONIC DECO DYES	VARIES
108D	VARIES	3RD FL MEZZ #4	CATIONIC DECO DYES	VARIES

FUEL TANKS - ID ③

TANK #	LABEL #	LOCATION	CHEMICAL	CAPACITY
6	155	1ST FLOOR EM1	MOBIL PM OIL L	2800GAL
7	184	1ST FLOOR EM3	MOBIL PM OIL L	2150GAL
8	409	1ST FLOOR EM4	MOBIL PM OIL L	4870GAL
10	419	EM5 PIT	MOBIL PM OIL L	2500GAL

LIQUID PETROLEUM GAS TANKS - ID ⚠

TANK #	LABEL #	LOCATION	CHEMICAL	CAPACITY
1	168	W EM5 BROKE STORAGE	PROPANE	1000GAL
2	141	PM EMERG LIGHTING	PROPANE	100GAL
3	113	PM EMERG LIGHTING	PROPANE	120GAL
9	133/134	W EM5 YARD	PROPANE	30GAL

REV.	REVISION NOTE	DATE	BY
B	REVISED PER MARKUPS		

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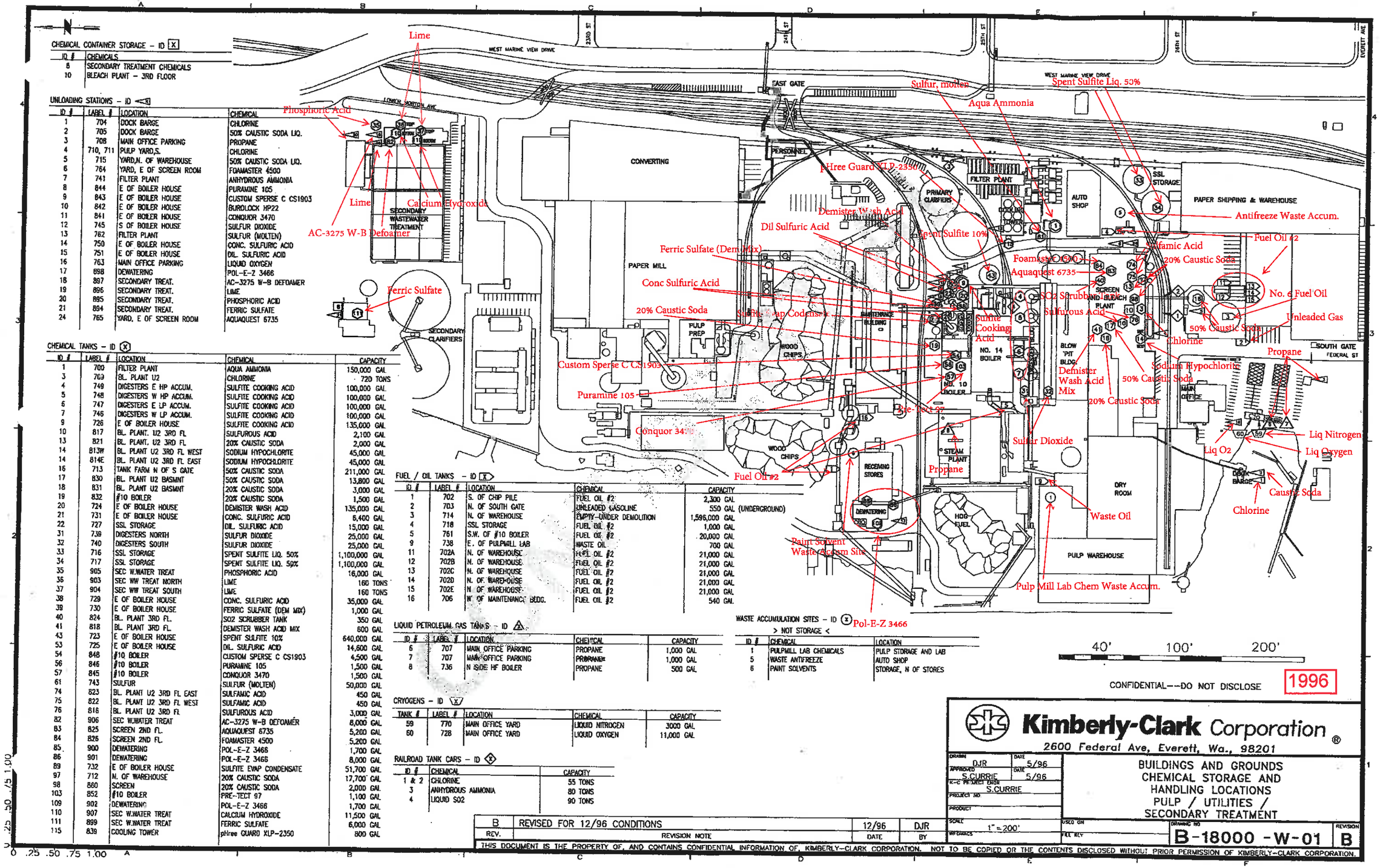
1994

SCOTT
SCOTT WORLDWIDE

EVERETT PAPER MILL
CHEMICAL STORAGE &
HANDLING LOCATIONS

8/23/93
F883-0047
08-92-00-00
B-18000-W-02 B

ATTACHMENT 5-2B



CHEMICAL CONTAINER STORAGE – ID [X]

ID #	CHEMICALS
8	SECONDARY TREATMENT CHEMICALS
10	BLEACH PLANT – 3RD FLOOR

UNLOADING STATIONS – ID [<]

ID #	LABEL #	LOCATION	CHEMICAL
1	704	DOCK BARGE	CHLORINE
2	705	DOCK BARGE	50% CAUSTIC SODA LIQ.
3	708	MAIN OFFICE PARKING	PROPANE
4	710, 711	PULP YARD,S.	CHLORINE
5	715	YARD,N. OF WAREHOUSE	50% CAUSTIC SODA LIQ.
6	764	YARD, E OF SCREEN ROOM	FOAMASTER 4500
7	741	FILTER PLANT	ANHYDROUS AMMONIA
8	844	E OF BOILER HOUSE	PURAMINE 105
9	843	E OF BOILER HOUSE	CUSTOM SPERSE C CS1903
10	842	E OF BOILER HOUSE	BUROLOCK HP22
11	841	E OF BOILER HOUSE	CONQUOR 3470
12	745	S OF BOILER HOUSE	SULFUR DIOXIDE
13	762	FILTER PLANT	SULFUR (MOLTEN)
14	750	E OF BOILER HOUSE	CONC. SULFURIC ACID
15	751	E OF BOILER HOUSE	DIL. SULFURIC ACID
16	763	MAIN OFFICE PARKING	LIQUID OXYGEN
17	898	DEWATERING	POL-E-Z 3466
18	897	SECONDARY TREAT.	AC-3275 W-B DEFOAMER
19	896	SECONDARY TREAT.	LIME
20	895	SECONDARY TREAT.	PHOSPHORIC ACID
21	894	SECONDARY TREAT.	FERRIC SULFATE
24	765	YARD, E OF SCREEN ROOM	AQUAQUEST 6735

CHEMICAL TANKS – ID [X]

ID #	LABEL #	LOCATION	CHEMICAL	CAPACITY
1	709	FILTER PLANT	AQUA AMMONIA	150,000 GAL
3	709	BL. PLANT U2	CHLORINE	720 TONS
4	749	DIGESTERS E HP ACCUM.	SULFITE COOKING ACID	100,000 GAL
5	748	DIGESTERS W HP ACCUM.	SULFITE COOKING ACID	100,000 GAL
6	747	DIGESTERS E LP ACCUM.	SULFITE COOKING ACID	100,000 GAL
7	746	DIGESTERS W LP ACCUM.	SULFITE COOKING ACID	100,000 GAL
9	726	E OF BOILER HOUSE	SULFITE COOKING ACID	135,000 GAL
10	817	BL. PLANT. U2 3RD FL	SULFUROUS ACID	2,100 GAL
13	821	BL. PLANT. U2 3RD FL	20% CAUSTIC SODA	2,000 GAL
14	813W	BL. PLANT U2 3RD FL WEST	SODIUM HYPOCHLORITE	45,000 GAL
14	814E	BL. PLANT U2 3RD FL EAST	SODIUM HYPOCHLORITE	45,000 GAL
16	713	TANK FARM N OF S GATE	50% CAUSTIC SODA	211,000 GAL
17	830	BL. PLANT U2 BASMNT	50% CAUSTIC SODA	13,800 GAL
18	831	BL. PLANT U2 BASMNT	20% CAUSTIC SODA	3,000 GAL
19	832	#10 BOILER	20% CAUSTIC SODA	1,500 GAL
20	724	E OF BOILER HOUSE	DEMISTER WASH ACID	135,000 GAL
21	731	E OF BOILER HOUSE	CONC. SULFURIC ACID	6,400 GAL
22	727	SSL STORAGE	DIL. SULFURIC ACID	15,000 GAL
31	739	DIGESTERS NORTH	SULFUR DIOXIDE	25,000 GAL
32	740	DIGESTERS SOUTH	SULFUR DIOXIDE	25,000 GAL
33	716	SSL STORAGE	SPENT SULFITE LIQ. 50%	1,100,000 GAL
34	717	SSL STORAGE	SPENT SULFITE LIQ. 50%	1,100,000 GAL
35	905	SEC W.WATER TREAT	PHOSPHORIC ACID	16,000 GAL
36	903	SEC WW TREAT NORTH	LIME	160 TONS
37	904	SEC WW TREAT SOUTH	LIME	160 TONS
38	729	E OF BOILER HOUSE	CONC. SULFURIC ACID	35,000 GAL
39	730	E OF BOILER HOUSE	FERRIC SULFATE (DEM MIX)	1,000 GAL
40	824	BL. PLANT 3RD FL.	SO2 SCRUBBER TANK	350 GAL
41	818	BL. PLANT 3RD FL.	DEMISTER WASH ACID MIX	600 GAL
43	723	E OF BOILER HOUSE	SPENT SULFITE 10%	640,000 GAL
53	725	E OF BOILER HOUSE	DIL. SULFURIC ACID	14,600 GAL
54	848	#10 BOILER	CUSTOM SPERSE C CS1903	4,500 GAL
56	846	#10 BOILER	PURAMINE 105	1,500 GAL
57	845	#10 BOILER	CONQUOR 3470	1,500 GAL
61	743	SULFUR	SULFUR (MOLTEN)	50,000 GAL
74	823	BL. PLANT U2 3RD FL EAST	SULFAMIC ACID	450 GAL
75	822	BL. PLANT U2 3RD FL WEST	SULFAMIC ACID	450 GAL
76	818	BL. PLANT U2 3RD FL	SULFUROUS ACID	3,000 GAL
82	906	SEC W.WATER TREAT	AC-3275 W-B DEFOAMER	8,000 GAL
83	825	SCREEN 2ND FL.	AQUAQUEST 6735	5,200 GAL
84	826	SCREEN 2ND FL.	FOAMASTER 4500	5,200 GAL
85	900	DEWATERING	POL-E-Z 3466	1,700 GAL
86	901	DEWATERING	POL-E-Z 3466	8,000 GAL
89	732	E OF BOILER HOUSE	SULFITE EVAP CONDENSATE	51,700 GAL
97	712	N. OF WAREHOUSE	20% CAUSTIC SODA	17,700 GAL
98	860	SCREEN	20% CAUSTIC SODA	2,000 GAL
103	852	#10 BOILER	PRE-TECT 97	1,100 GAL
109	902	DEWATERING	POL-E-Z 3466	1,700 GAL
110	907	SEC W.WATER TREAT	CALCIUM HYDROXIDE	11,500 GAL
111	899	SEC W.WATER TREAT	FERRIC SULFATE	6,000 GAL
115	839	COOLING TOWER	pHree GUARD XLP-2350	800 GAL

FUEL / OIL TANKS – ID [X]

ID #	LABEL #	LOCATION	CHEMICAL	CAPACITY
1	702	S. OF CHIP PILE	FUEL OIL #2	2,300 GAL
2	703	N. OF SOUTH GATE	UNLEADED GASOLINE	550 GAL (UNDERGROUND)
3	714	N. OF WAREHOUSE	EMPTY-UNDER DEMOLITION	1,596,000 GAL
4	718	SSL STORAGE	FUEL OIL #2	1,000 GAL
5	761	S.W. OF #10 BOILER	FUEL OIL #2	20,000 GAL
9	738	E. OF PULPMILL LAB	WASTE OIL	700 GAL
11	702A	N. OF WAREHOUSE	FUEL OIL #2	21,000 GAL
12	702B	N. OF WAREHOUSE	FUEL OIL #2	21,000 GAL
13	702C	N. OF WAREHOUSE	FUEL OIL #2	21,000 GAL
14	702D	N. OF WAREHOUSE	FUEL OIL #2	21,000 GAL
15	702E	N. OF WAREHOUSE	FUEL OIL #2	21,000 GAL
16	706	W. OF MAINTENANCE BLDG.	FUEL OIL #2	540 GAL

LIQUID PETROLEUM GAS TANKS – ID [⚠]

ID #	LABEL #	LOCATION	CHEMICAL	CAPACITY
6	707	MAIN OFFICE PARKING	PROPANE	1,000 GAL
7	707	MAIN OFFICE PARKING	PROPANE	1,000 GAL
8	736	N SIDE HF BOILER	PROPANE	500 GAL

CRYOGENS – ID [V]

TANK #	LABEL #	LOCATION	CHEMICAL	CAPACITY
59	770	MAIN OFFICE YARD	LIQUID NITROGEN	3000 GAL
60	728	MAIN OFFICE YARD	LIQUID OXYGEN	11,000 GAL

RAILROAD TANK CARS – ID [◇]

ID #	CHEMICAL	CAPACITY
1 & 2	CHLORINE	55 TONS
3	ANHYDROUS AMMONIA	80 TONS
4	LIQUID SO2	90 TONS

WASTE ACCUMULATION SITES – ID [S]

> NOT STORAGE <

ID #	CHEMICAL	LOCATION
1	PULPMILL LAB CHEMICALS	PULP STORAGE AND LAB
5	WASTE ANTIFREEZE	AUTO SHOP
6	PAINT SOLVENTS	STORAGE, N OF STORES

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Kimberly-Clark Corporation ®

2600 Federal Ave, Everett, Wa., 98201

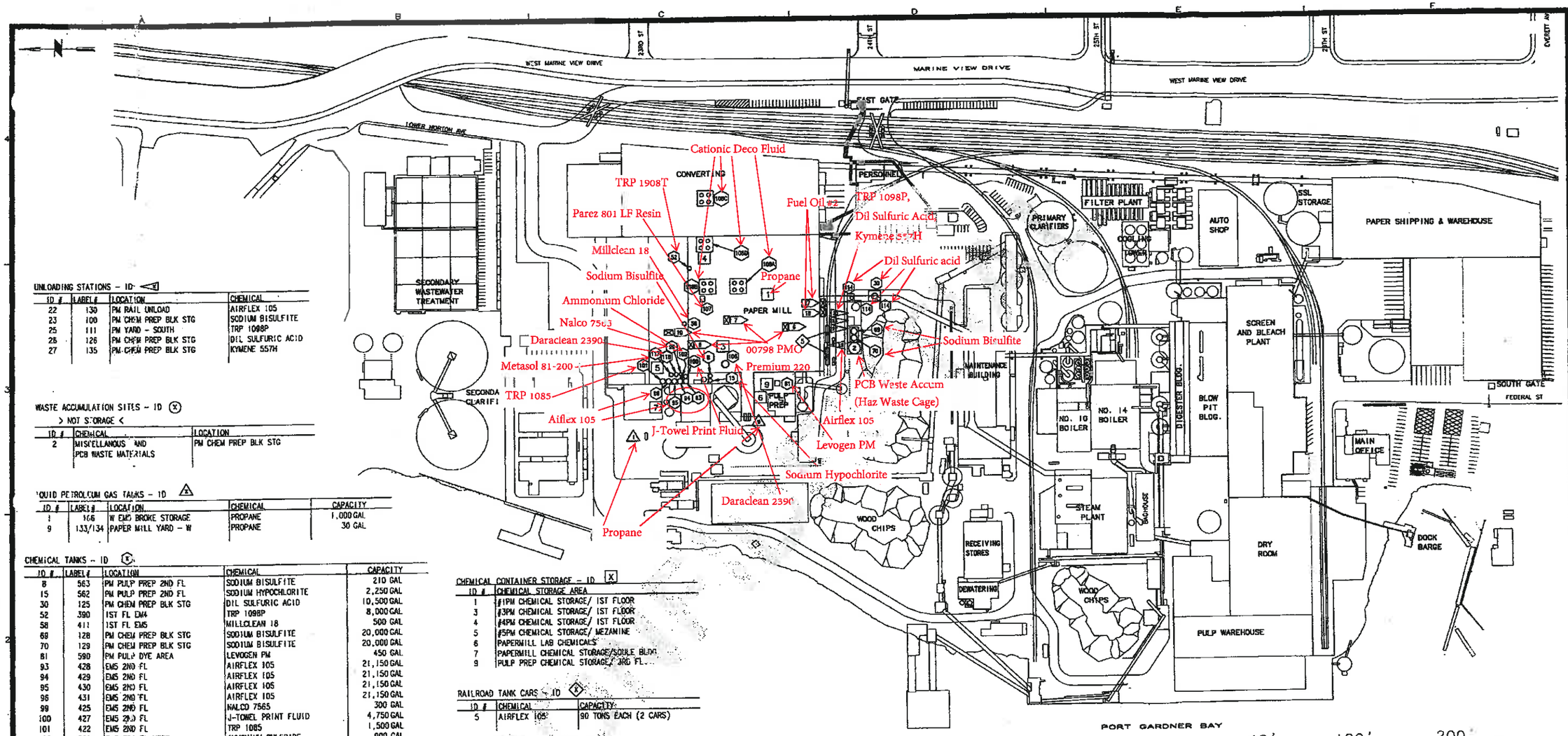
DRAWN	DJR	DATE	5/96
APPROVED	S.CURRIE	DATE	5/96
K-C PROJECT ENGR	S.CURRIE		
PROJECT NO			
PRODUCT			
SCALE	1" = 200'		
MFG/MACS			

BUILDINGS AND GROUNDS
CHEMICAL STORAGE AND
HANDLING LOCATIONS
PULP / UTILITIES /
SECONDARY TREATMENT

USCO GN | DRAWING NO B-18000-W-01 | REVISION B

FIL REV

REV.	REVISION NOTE	DATE	BY
B	REVISED FOR 12/96 CONDITIONS	12/96	DJR



UNLOADING STATIONS – ID ◁

ID #	LABEL #	LOCATION	CHEMICAL
22	139	PM RAIL UNLOAD	AIRFLEX 105
23	109	PM CHEM PREP BLK STG	SODIUM BISULFITE
25	111	PM YARD – SOUTH	TRP 1098P
26	126	PM CHEM PREP BLK STG	OIL SULFURIC ACID
27	135	PM CHEM PREP BLK STG	KYMENE 557H

WASTE ACCUMULATION SITES – ID ⓧ

> NOT STORAGE <

ID #	CHEMICAL	LOCATION
2	MISCELLANOUS AND PCB WASTE MATERIALS	PM CHEM PREP BLK STG

LIQUID PETROLEUM GAS TANKS – ID ⚠

ID #	LABEL #	LOCATION	CHEMICAL	CAPACITY
1	106	W EMS BROKE STORAGE	PROPANE	1,000 GAL
9	133/134	PAPER MILL YARD – W	PROPANE	30 GAL

CHEMICAL TANKS – ID ⓚ

ID #	LABEL #	LOCATION	CHEMICAL	CAPACITY
8	563	PM PULP PREP 2ND FL	SODIUM BISULFITE	210 GAL
15	562	PM PULP PREP 2ND FL	SODIUM HYPOCHLORITE	2,250 GAL
30	125	PM CHEM PREP BLK STG	OIL SULFURIC ACID	10,500 GAL
52	390	1ST FL EM4	TRP 1098P	8,000 GAL
58	411	1ST FL EM5	MILLCLEAN 18	500 GAL
69	128	PM CHEM PREP BLK STG	SODIUM BISULFITE	20,000 GAL
70	129	PM CHEM PREP BLK STG	SODIUM BISULFITE	20,000 GAL
81	590	PM PULP DYE AREA	LEVOGEN PM	450 GAL
93	428	EM5 2ND FL	AIRFLEX 105	21,150 GAL
94	429	EM5 2ND FL	AIRFLEX 105	21,150 GAL
95	430	EM5 2ND FL	AIRFLEX 105	21,150 GAL
96	431	EM5 2ND FL	AIRFLEX 105	21,150 GAL
99	425	EM5 2ND FL	NALCO 7565	300 GAL
100	427	EM5 2ND FL	J-TOWEL PRINT FLUID	4,750 GAL
101	422	EM5 2ND FL	TRP 1085	1,500 GAL
102	560	EM5 3RD FL MEZZ	AMMONIUM CHLORIDE	900 GAL
106	534	EM3 1ST FL	DARACLEAN 2390	480 GAL
107	399	EM4 1ST FL	PAREZ 801 LF RESIN	170 GAL
112	169	PM CHEM PREP BLK STG	KYMENE 557H	23,000 GAL
113	170	PM CHEM PREP BLK STG	CAUSTIC SODA	1,500 GAL
114	171	PM CHEM PREP BLK STG	OIL SULFURIC ACID	500 GAL
108A	VARIES	EM3 1ST FL	CATIONIC DECO FLUID	VARIES
108B	VARIES	EM4 1ST FL	CATIONIC DECO FLUID	VARIES
108C	VARIES	UNIT 1: 1ST FL	CATIONIC DECO FLUID	VARIES
108D	VARIES	EM4 3RD FL MEZZ	CATIONIC DECO FLUID	VARIES
117	432	EM5 2ND FL	METASOL 81-200	300 GAL
118	353	EM5 MEZ 3RD FL	DARACLEAN 2390	60 GAL

CHEMICAL CONTAINER STORAGE – ID ⓧ

ID #	CHEMICAL STORAGE AREA
1	#1PM CHEMICAL STORAGE/ 1ST FLOOR
3	#3PM CHEMICAL STORAGE/ 1ST FLOOR
4	#4PM CHEMICAL STORAGE/ 1ST FLOOR
5	#5PM CHEMICAL STORAGE/ MEZANINE
6	PAPERMILL LAB CHEMICALS
7	PAPERMILL CHEMICAL STORAGE/SOUTH BLDG.
9	PULP PREP CHEMICAL STORAGE/ 3RD FL.

RAILROAD TANK CARS – ID ◇

ID #	CHEMICAL	CAPACITY
5	AIRFLEX 105	90 TONS EACH (2 CARS)

FUEL OIL TANKS – ID ⓡ

ID #	LABEL #	LOCATION	CHEMICAL	CAPACITY
6	155	1ST FL EM1	00798 PMO PREMIUM 220	2,800 GAL
7	164	1ST FL EM3	00798 PMO PREMIUM 220	2,150 GAL
8	409	1ST FL EM4	00798 PMO PREMIUM 220	4,870 GAL
10	419	EM5 PIT	00798 PMO PREMIUM 220	2,500 GAL
17	113	S. OF PAPER MACH. BLDG.	FUEL OIL #2	400 GAL
18	114	S. OF PAPER MACH. BLDG.	FUEL OIL #2	400 GAL

0 .25 .50 .75 1.00

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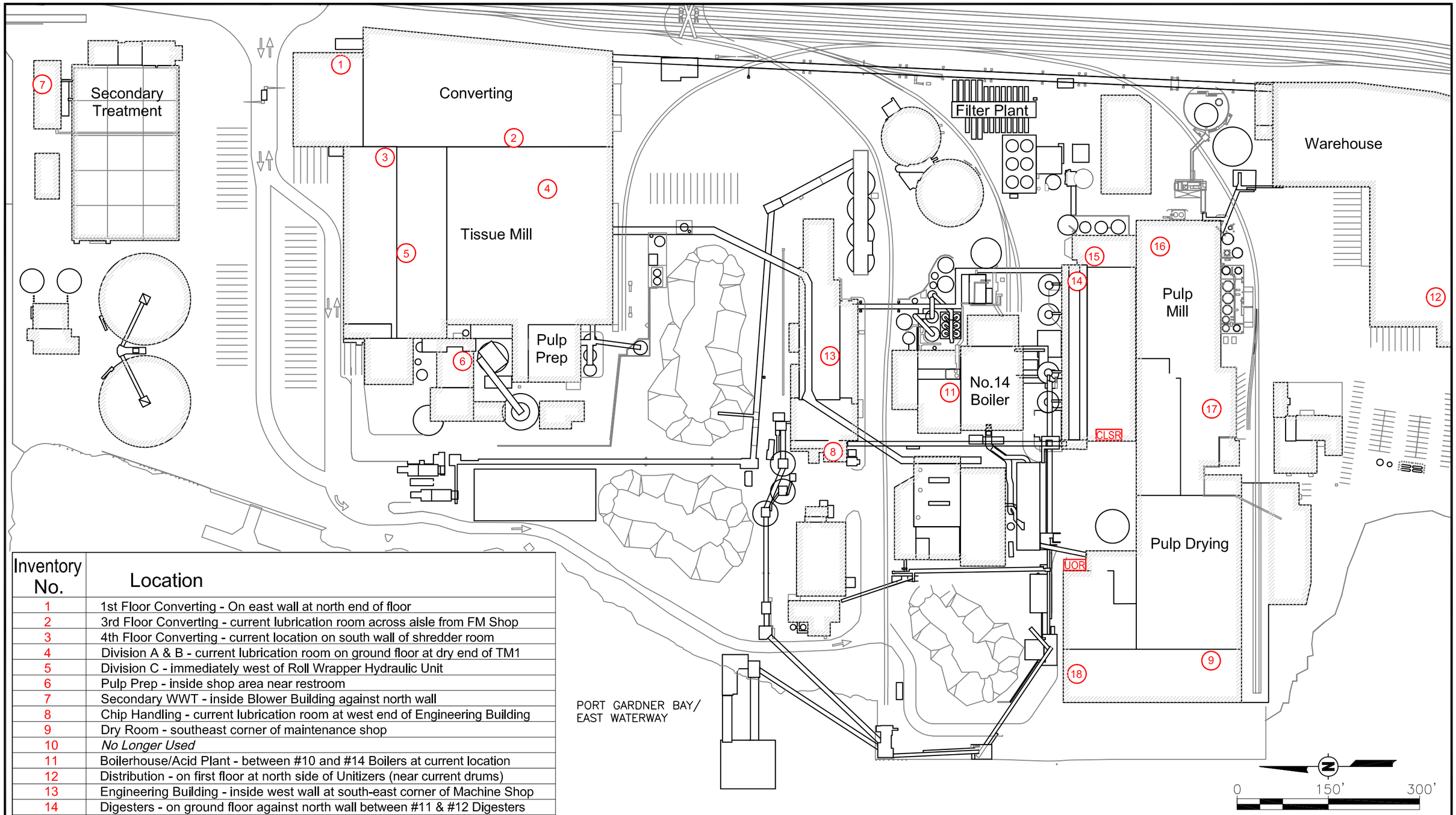
DRAWN	DJR	DATE	5/96
APPROVED	S.CURRIE	DATE	5/96
K-C PROJECT ENGR	S.CURRIE		
PROJECT NO.			
PRODUCT			
SCALE	1" = 200'	USED ON	
INFORMATION		FILE KEY	

BUILDINGS AND GROUNDS CHEMICAL STORAGE AND HANDLING LOCATIONS

DRAWING NO. B-18000-W-02 REVISION B

REV.	REVISION NOTE	DATE	BY
B	REVISED FOR 12/96 CONDITIONS	12/96	DJR



Inventory No.	Location
1	1st Floor Converting - On east wall at north end of floor
2	3rd Floor Converting - current lubrication room across aisle from FM Shop
3	4th Floor Converting - current location on south wall of shredder room
4	Division A & B - current lubrication room on ground floor at dry end of TM1
5	Division C - immediately west of Roll Wrapper Hydraulic Unit
6	Pulp Prep - inside shop area near restroom
7	Secondary WWT - inside Blower Building against north wall
8	Chip Handling - current lubrication room at west end of Engineering Building
9	Dry Room - southeast corner of maintenance shop
10	*No Longer Used*
11	Boilerhouse/Acid Plant - between #10 and #14 Boilers at current location
12	Distribution - on first floor at north side of Unitizers (near current drums)
13	Engineering Building - inside west wall at south-east corner of Machine Shop
14	Digesters - on ground floor against north wall between #11 & #12 Digesters
15	SSL Washers - ground floor of SSL Building in NW corner where currently exists
16	Screen & Bleach - 3rd Floor outside of current shop area in northwest corner
17	Screen & Bleach - north side Screened Brown Stock Chest, on ground floor
18	Dry Room Fork Trucks - northwest corner of Bale Room in current area
CLSR	Central Lube Storage Room - east side of Pulp/Utilities Courtyard
UOR	Used Oil Room - west side of Pulp/Utilities Courtyard

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AREA LUBRICATION STATION LOCATIONS

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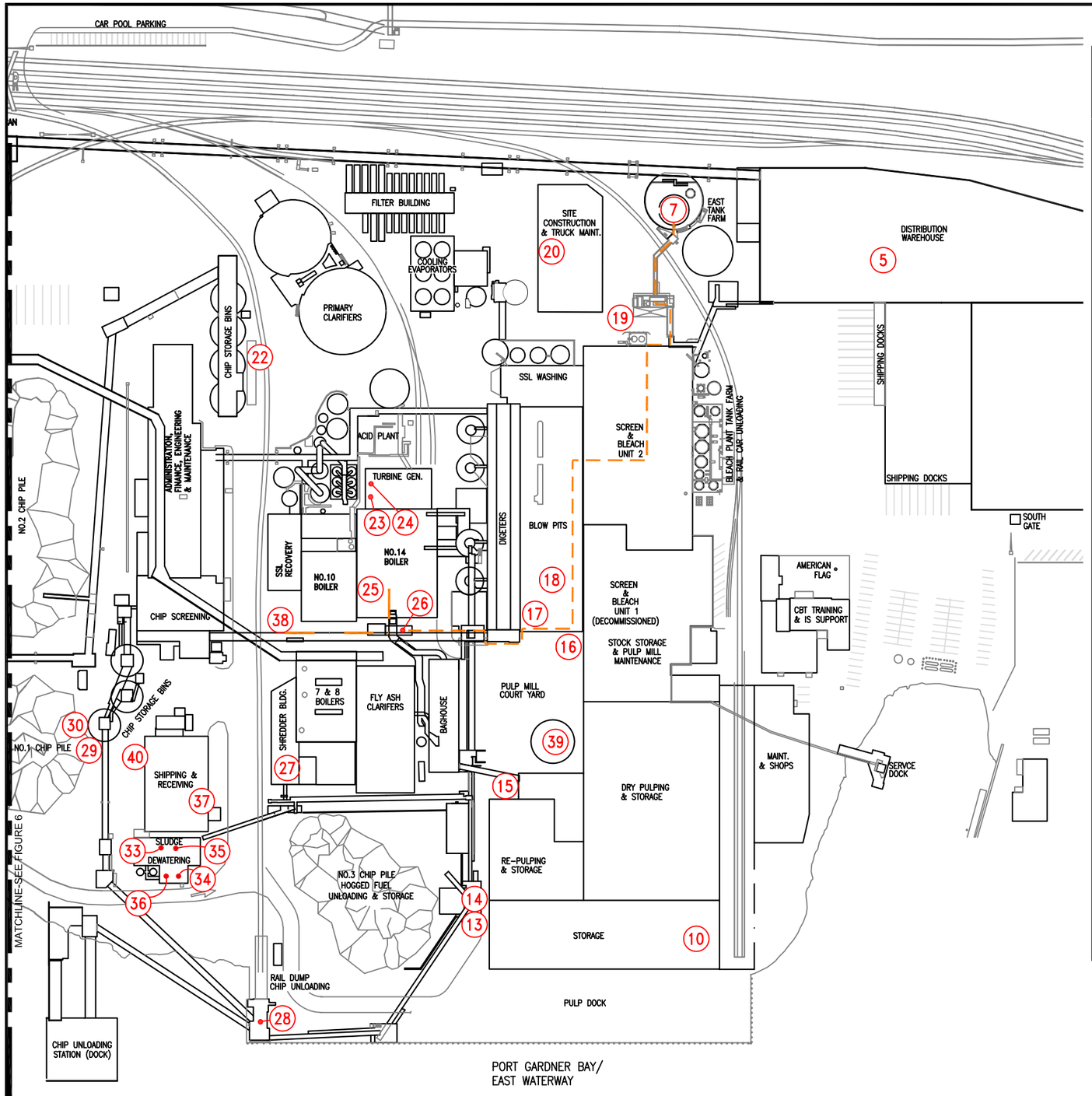
PROJECT NO.	DRAWN BY:	DATE:	
60197578	ALB	03/09/2011	**FIGURE 4**



Oil Based Products Storage Locations Map - South

Location ID	Location Description	Content	Storage Capacity
1	*No Longer Used*		
2	””		
3	””		
4	””		
5	Distribution Warehouse, No.1 Unitizers Oil System	Unitizers Hydraulic Oil System	80 gal.
5	Distribution Warehouse, No.2 Unitizers Oil System	Unitizers Hydraulic Oil System	80 gal.
6	””		
7	South of Warehouse Tank Farm	Fuel Oil No.2	250,000 gal.
8	””		
9	””		
10	Dry Room, Bale Press No.1	Hydraulic Oil System	132 gal.
10	Dry Room, Bale Press No.2	Hydraulic Oil System	132 gal.
11	””		
12	””		
13	Under Chip Conveyor near Heavy Equipment Shop	Drum Storage	55 gal. Drums
14	Stoker	Hydraulic Oil	500 gal.
15	Used Oil Room	Used Oil Tank	700 gal.
15	Used Oil Room	Used Oil Drum Storage	55 gal.
15	Used Oil Room	Used Oil Filter Bin	390 gal.
15	Used Oil Room	Used Oil Filter Trough	105 gal.
16	Pulp Mill - South East Corner (Court Yard)	Diesel - Emergency Generator	100 gal.
17	Central Lube Storage Room	Lubricating Oil	55 gal. Drums
18	Blow Pits, Air Compressor Room	Oil Drum Storage	55 gal. Drums
19	Pulp Mill - East (Across Roadway)	Decommisioned Diesel Tank - Empty	300 gal.
20	””		
21	””		
22	Chip Truck Dump - Inside	Hydraulic Oil	260 gal.
23	No.14 Boiler, 1st Floor - East	Lubricating Oil	2,500 gal.
24	No.14 Boiler, 1st Floor - East	Hydraulic Oil	500 gal.
25	No.14 Boiler, 1st Floor - (Central)	Hydraulic Oil	500 gal.
26	No.14 Boiler - West (Outside)	Fuel Oil No.2	20,000 gal.
27	Shredder Building - West	Hydraulic Oil	455 gal.
28	Rail Dump Hydraulic System	Hydraulic Oil	664 gal.
29	South of No.1 Chip Pile	Fuel Oil No.2	2,500 gal.
30	Bay View Mobile Service	Hydraulic Oil	250 gal.
30	Bay View Mobile Service	Engine Oil	250 gal.
30	Bay View Mobile Service	Transmission Oil	250 gal.
31	””		
32	””		
33	DeWatering Totes	Nalco 61505 / Core Shell 71301	275 gal. Totes
34	DeWatering Run	Nalco 61505 / Core Shell 71301	1,700 gal.
35	DeWatering Bulk	Nalco 61505 / Core Shell 71301	8,000 gal.
36	DeWatering Mix	Nalco 61505 / Core Shell 71301	1,700 gal.
37	Shipping & Receiving	Oil Drum Storage	55 gal. Drums
38	Under Conveyor (outside of No.10 Boiler)	Diesel Tank	500 gal.
39	Top of Blend Chest, Gear Box	Lubricating Oil	80 gal.
39	Courtyard next to Blend Chest	Used Oil	55 gal.
40	Paint Shed	Mineral Spirits	55 gal. Drums

N

0 150’ 300’

NOTE:
1) DIESEL FUEL OIL PIPE LINE TO DAY TANK
2) DIESEL FUEL OIL PIPED TO BOILER
3) SOME DRUM STORAGE AREAS HAVE BEEN CONVERTED TO LUBE STATIONS. THESE LOCATIONS ARE NOW ILLUSTRATED ON THE LUBE STATION FIGURE.

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OIL BASE PRODUCTS STORAGE LOCATIONS SOUTH MILL

PROJECT NO.	DRAWN BY:	DATE:	
60197578	ALB	03/09/2011	**FIGURE 5**

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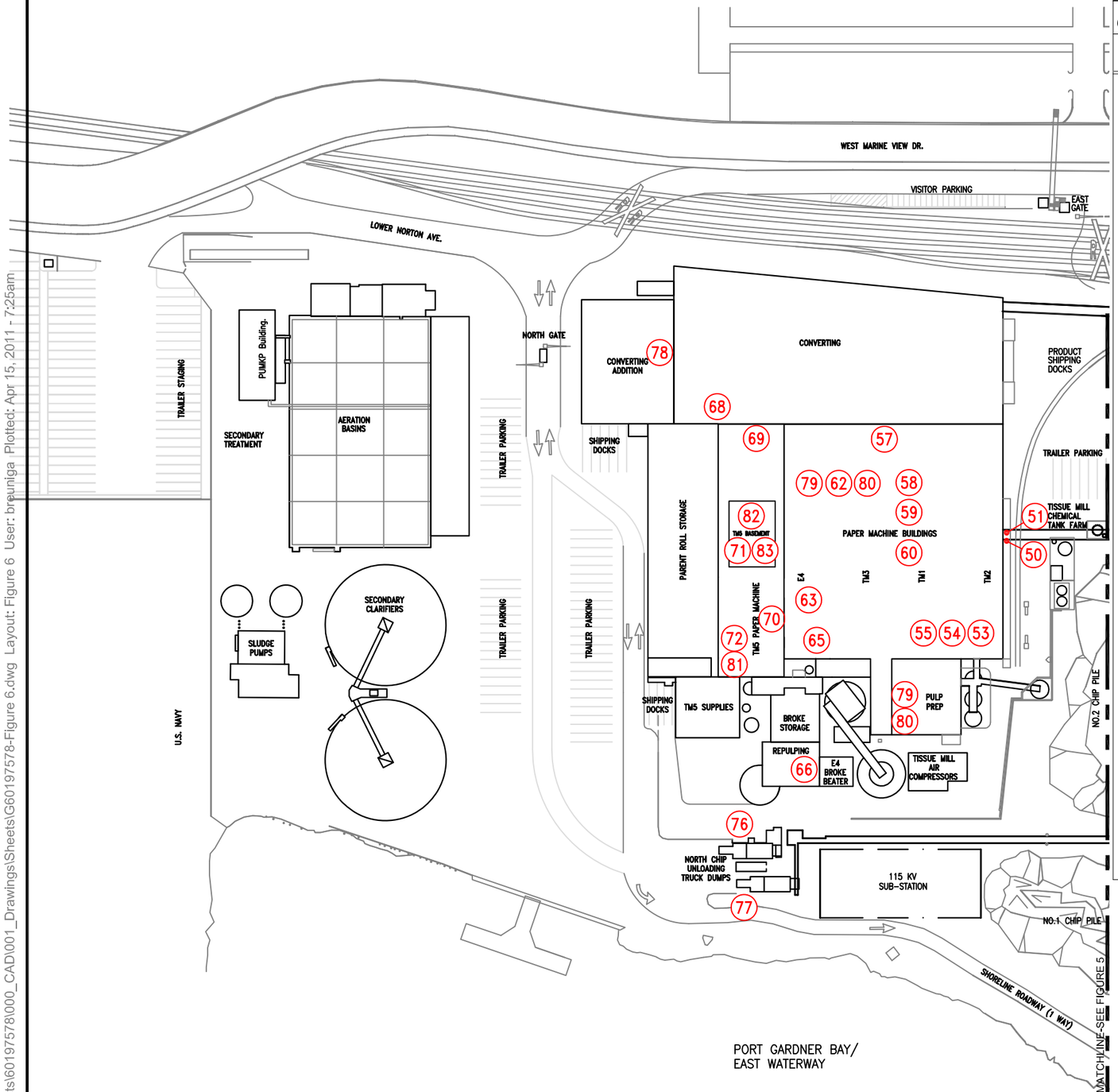

Oil Based Products Storage Locations Map - North

Location ID	Location Description	Content	Storage Capacity
50	Paper Machine Building. - South (Outside), Emergency Generator	Fuel Oil No. 2	400 gal.
51	Paper Machine Building. - South (Outside), Emergency Generator	Fuel Oil No. 2	400 gal.
52	*No Longer Used*		
53	Paper Machine No.2, 1st Fl. South West	Hydraulic Oil	90 gal.
54	Paper Machine No.1, 1st Fl. South West	Hydraulic Oil	90 gal.
55	Paper Machine No.1 & 2, 1st Fl. South West	Lube Oil	2,800 gal.
55	Paper Machine No.1 & 2, 1st Fl. South West	Lube Oil	2,800 gal.
55	Paper Machine No.1, 1st Fl. South West	Lube Oil	1,400 gal.
55	Paper Machine No.2, 1st Fl. South West	Lube Oil	1,400 gal.
57	Paper Machine Building, near TM5, North Central, Baler #1	Hydraulic Oil	132 gal.
57	Paper Machine Building, near TM5, North Central, Baler #2	Hydraulic Oil	132 gal.
58	Paper Machine No.3, 1st Fl. Central East	Hydraulic Oil	90 gal.
59	Paper Machine No.3, 1st Fl. Central East	Lube Oil	1,400 gal.
59	Paper Machine No.3, 1st Fl. Central East	Lube Oil	2,150 gal.
59	Paper Machine No.3, 1st Fl. Central East	Lube Oil	2,150 gal.
60	Paper Machine Building, 1st Fl., outside Paper Mill Oil House, TM1, spill supply clost empty.	Drum Storage	55 gal. Drums
61	--		
62	Paper Machine No.4, 1st Fl. North East	Hydraulic Oil	90 gal.
63	Paper Machine No.4, 1st Fl. North Central	Lube Oil	2,400 gal.
63	Paper Machine No.4, 1st Fl. North Central	Lube Oil	1,050 gal.
63	Paper Machine No.4, 1st Fl. North Central	Lube Oil	2,400 gal.
64	--		
65	Paper Machine Building. - North West, Simz	Hydraulic Oil	1050 gal.
66	Broke Storage & Repulping, South West, Baler Hydraulic System	Hydraulic Oil	235 gal.
67	--		
68	Converting Building, 4th Fl., North West, Shredder	Hydraulic Oil	455 gal.
69	Paper Machine No.5, East Wall, DRC Baler	Hydraulic Oil	235 gal.
70	Paper Machine No.5, Yankee Fan Lube System, 3rd Fl.	Lube Oil	80 gal.
71	Paper Machine No.5, Basement	Lube Oil	1,200 gal.
71	Paper Machine No.5, Basement	Hydraulic Oil	700 gal.
72	Paper Machine No.5, 1st Floor - North West, Roll Wrap Hydraulic	Hydraulic Oil	400 gal.
73	--		
74	--		
75	--		
76	Truck Dump, North East Unit	Hydraulic Oil	380 gal.
77	Truck Dump, North West Unit	Hydraulic Oil	380 gal.
78	Converting Building, 1st Fl., North Central, Columbia Palletizer	Hydraulic Oil	183 gal.
79	Paper Machine No.4, 1st Fl. Central, Vaccum Gear Box	Lube Oil	55 gal.
79	Paper Machine No.4, 1st Fl. Central, Vaccum Gear Box	Lube Oil	55 gal.
80	Paper Machine No.4, 1st Fl. Central, Water Jet Slitter	Hydraulic Oil	80 gal.
80	Paper Machine No.4, 1st Fl. Central, Water Jet Slitter	Hydraulic Oil	80 gal.
81	Paper Machine No.5, 2nd Fl. West, Vacuum Turbine	Lube Oil	284 gal.
82	Paper Machine No.5, Basement, Reel Loading Hydraulic	Hydraulic OIl	242 gal.
83	Paper Machine No.5, Basement, Diesel Motor	Diesel	60 gal.

0 150' 300'

NOTE:

1) SOME DRUM STORAGE AREAS HAVE BEEN CONVERTED TO LUBE STATIONS. THESE LOCATIONS ARE NOW ILLUSTRATED ON THE LUBE STATION FIGURE.

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OIL BASE PRODUCTS STORAGE LOCATIONS NORTH MILL

PROJECT NO.	DRAWN BY:	DATE:	
60197578	ALB	03/09/2011	**FIGURE 6**

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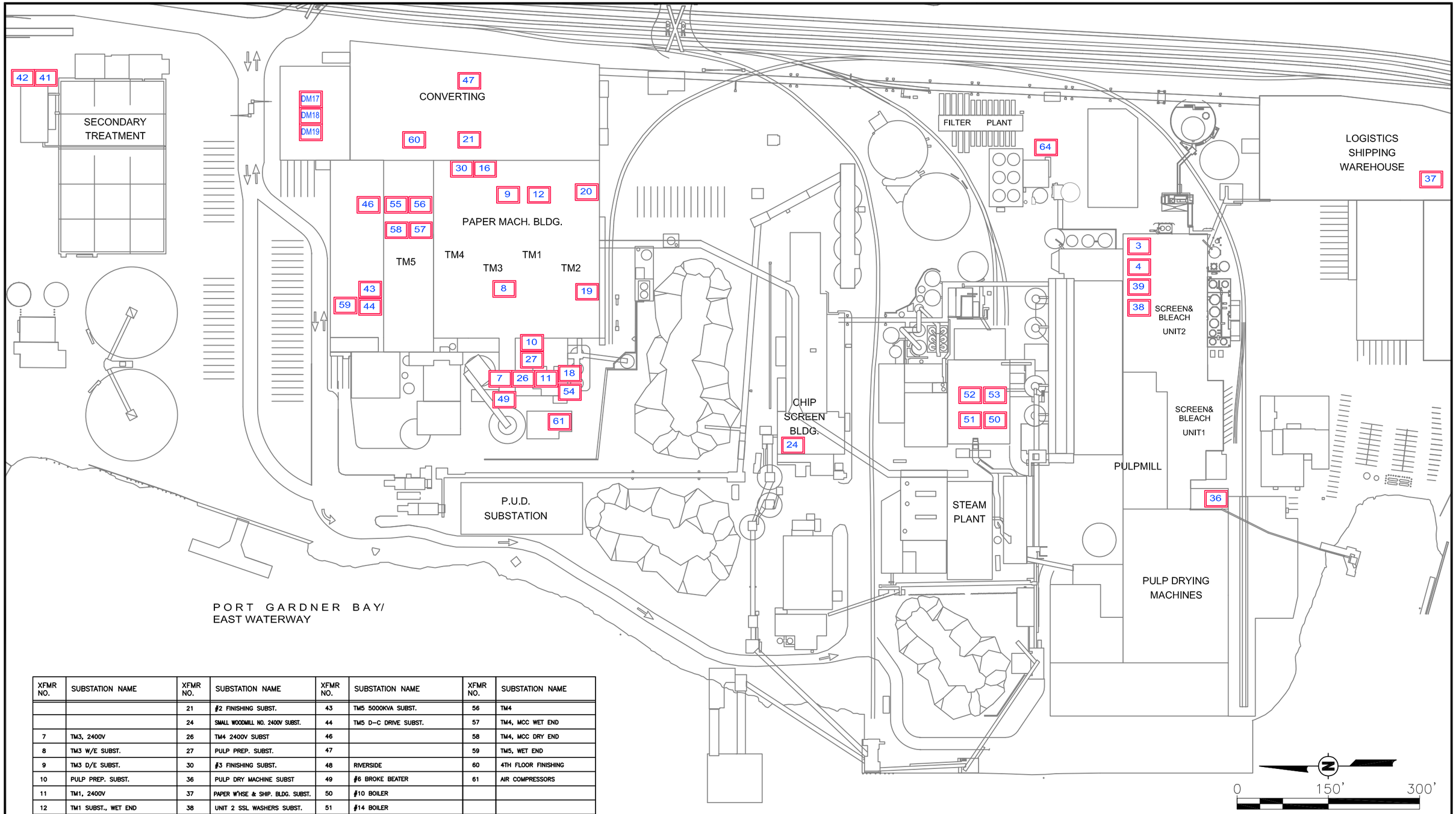


XFMR NO.	SUBSTATION NAME	XFMR NO.	SUBSTATION NAME	XFMR NO.	SUBSTATION NAME	XFMR NO.	SUBSTATION NAME
		21	#2 FINISHING SUBST.	43	TM5 5000KVA SUBST.	56	TM4
		24	SMALL WOODMILL NO. 2400V SUBST.	44	TM5 D-C DRIVE SUBST.	57	TM4, MCC WET END
7	TM3, 2400V	26	TM4 2400V SUBST	46		58	TM4, MCC DRY END
8	TM3 W/E SUBST.	27	PULP PREP. SUBST.	47		59	TM5, WET END
9	TM3 D/E SUBST.	30	#3 FINISHING SUBST.	48	RIVERSIDE	60	4TH FLOOR FINISHING
10	PULP PREP. SUBST.	36	PULP DRY MACHINE SUBST	49	#6 BROKE BEATER	61	AIR COMPRESSORS
11	TM1, 2400V	37	PAPER W'HSE & SHIP. BLDG. SUBST.	50	#10 BOILER		
12	TM1 SUBST., WET END	38	UNIT 2 SSL WASHERS SUBST.	51	#14 BOILER		
16	TM5 FINISHING SUBST.	39	2ND FLOOR EAST SUBST.	52	#14 BOILER	64	FILTER PLANT
18	TM2 2400V SUBST			53	#10 BOILER		
19	TM2 W/E SUBST			54	TM4, 4160V	DM17	E4 ISOLATION TRANSFORMER
20	TM2 D/E SUBST	42	WASTE WATER TREAT. 2400V SUBST.	55	TM4	DM18	E4 ISOLATION TRANSFORMER
						DM19	E4 ISOLATION TRANSFORMER

LEGEND:

9 NON PCB SUBSTATION

EVERETT PAPER MILL PHASE I ESA
KIMBERLY-CLARK
EVERETT, WASHINGTON

EVERETT MILL SUBSTATION LOCATIONS

PROJECT NO.	DRAWN BY:	DATE:	
60197578	ALB	03/09/2011	**FIGURE 7**

AECOM

File: L:\work\Projects\60197578\000_CAD\001_Drawings\Sheets\G60197578-Figure 7.dwg Layout: Figure 7 User: breuniga Plotted: Apr 15, 2011 - 7:27am

APPENDIX D

Site-Specific Health and Safety Plan

PROJECT-SPECIFIC HEALTH AND SAFETY PLAN

Property Name:	K-C Pulp and Paper Mill – Everett, Washington		
Project Number:	110207		
Prepared By:	Eli R. Patmont	Date:	7/22/13
Reviewed By:	Robert Hanford	Date:	8/13/13

1 INTRODUCTION

This project-specific health and safety plan establishes procedures and practices to protect employees of Aspect Consulting, LLC (Aspect) from potential hazards posed by field activities at the subject site. In this health and safety plan, measures are provided to minimize potential exposure, accidents, and physical injuries that may occur during daily activities and adverse conditions. Contingency arrangements are also provided for emergency situations.

2 EMERGENCY CONTACT INFORMATION

PROPERTY LOCATION	Former K-C Pulp and Paper Mill 2600 Federal Avenue, Everett, WA **All entry/egress is through the North Gate, which is secure.**
NEAREST HOSPITAL	Providence Regional Medical Center 1321 Colby Avenue Everett, WA (425) 261-2000 **Attached figure shows route to hospital.**
EMERGENCY RESPONDERS	Police, Ambulance, Fire ……**911**
OTHER CONTACTS	Bryan Lust (cell), K-C on site: (425) 210 3284 Bob Hanford, Aspect Consulting (cell): (206) 276-9256 Steve Germiat, Aspect Consulting (cell): (206) 619-6743 Aspect Consulting, Seattle Office: (206) 328-7443
IN EVENT OF EMERGENCY, CALL FOR HELP AS SOON AS POSSIBLE	Give the following information: ✓ **Where You Are:** address, cross streets, or landmarks ✓ **Phone Number** you are calling from ✓ **What Happened:** type of accident, injury ✓ **How Many Persons** need help ✓ **What is Being Done** for the victims ✓ **You Hang Up Last:** let whomever you called hang up first

In case of serious injuries or other emergency, immediately call Bob Hanford, Aspect Corporate Safety Officer, at (206) 780-7729 or (206)-276-9256. If no response, call Doug Hillman at (206) 328-7443 or Tim Flynn at (206) 780-9370.

3 PERSONNEL ORGANIZATION AND CHAIN OF COMMAND

The Aspect Project Manager assigns the Site Safety Supervisor and other field personnel for this project, and has ultimate responsibility for developing this project-specific health and safety plan and ensuring it is complied with during project execution. The Aspect Site Safety Supervisor has responsibility and authority for Aspect employees' safety during site activities. Other Aspect personnel on site have the responsibility to comply with this project-specific health and safety plan in coordination with the Site Safety Supervisor.

Aspect Personnel			
Role	**Name**	**Office Phone**	**Mobile/Cell Phone**
Project Manager	Steve Germiat	206-838-5830	206-619-6743
Site Safety Supervisor	Bob Hanford	206-780-7729	206-276-9556
Other Field Personnel	Matthew Von der Ahe	206-838-5843	206-718-9548
Other Field Personnel	Amy Tice	206-838-6585	206-334-7690
Other Field Personnel	Aaron Pruitt	206-838-6587	206-595-6615
Aspect's Subcontractors Working On Site			
Name	**Task/Role**	**Contact**	**Phone**
Applied Professional Services	Private utility locate	Jerry Goodrich	866-474-6446
Cascade Drilling	Driller	Jaymen Lauer	425-485-8908
Dakota Concrete Coring	Concrete Coring		253-638-2350

Aspect will inform its subcontractors working onsite of potential fire, explosion, health, safety or other hazards associated with planned site activities, and can make available to them this project-specific health and safety plan. **However, all subcontractors are solely responsible for preparation of their own health and safety plan, and for the safety of their employees.**

4 SITE CONTROL PLAN

4.1 Property Description

Property Name:	Former K-C Pulp and Paper Mill	
Property Location or Address:	2600 Federal Avenue, Everett, Washington	
Owners/Tenants:	Kimberly-Clark	
Current Property Use:	Vacant	
Past Use of Property (if different):	Pulp and paper mill	
Designated Hazardous Waste Site?	Yes	(federal, state, other): State
Industrial Site?	Yes (former)	
Topography:	Relatively flat. Puget Sound (East Waterway of Port Gardner Bay) forms the western property boundary of the Site.	
Surround Land Use/Nearest Population:	Commercial/industrial with BNSF railroad tracks adjacent to the east. Residential east of railroad tracks across Marine View Drive.	
Drinking Water/Sanitary Facilities:	On site in job trailer at north gate.	
Site Map:	See main body of RI/FS Work Plan.	

4.2 Site Access Control

Describe controls to be used to prevent entry by unauthorized persons:

- The property is closed to the public (fenced with secured gate).
- Traffic cones, barriers, chain-link fence, and caution tape, as needed.

Describe how exclusion zones and contamination reduction zones will be designated:

- Drilling and test pit activities will be performed in multiple areas of the property.
- The area immediately adjacent to each boring/monitoring well/test pit location will be considered an exclusion zone.
- The subcontractor will mark the limits of the exclusion zone using cones, caution tape, etc.
- The contamination reduction zone will be located adjacent to the driller's/excavation contractor's mobile decontamination trailer, and will include steam cleaning equipment for equipment decontamination.
- Aspect field personnel will remain vigilant about preventing unauthorized persons from approaching the exclusion zone.

4.3 Worker Hygiene Practices

Aspect personnel will use the following hygiene practices while working on site:

- No person will eat, drink, chew gum or tobacco in potentially contaminated areas. Drinking of replacement fluids for heat stress control will be permitted only in areas that are free from contamination, except in emergency situations.
- Smoking is prohibited except in designated areas of the site.
- Long hair will be secured away from the ace so that it does not interfere with any activities.
- All personnel leaving potentially contaminated areas will wash their hands and face prior to entering any eating areas.

- Personnel leaving potentially contaminated areas will shower (including washing hair) and change to clean clothing as soon as practical after leaving the property.

4.4 Emergency Communications

Aspect workers on site will have a mobile (cell) phone on site, which will be used for communications should an emergency arise. Phone numbers for Aspect site personnel are listed in Section 3: Personnel Organization and Chain of Command.

4.5 Nearest Medical Assistance

FIRST CALL 911. The route from the site to the nearest hospital is shown in the attached figure.

5 SITE WORK PLAN

Proposed Work Activities On Site:	• Soil sampling using geoprobe and hollow stem auger drilling techniques; • Excavation of test pits using track-mounted excavator or backhoe; • Install and develop monitoring wells; and • Groundwater monitoring using a peristaltic pump.
Objectives of Site Activities:	Characterize nature and extent of potential site contamination.
Proposed Work Dates:	Fall 2013-Winter 2014
Will On-site Personnel Potentially be Exposed to Hazardous Substances?	Yes. The property historically included a sulfite pulp and paper mill with associated support facilities. Based on the Independent Phase 2 ESA (Aspect; dated March 15, 2013)), potential chemical hazards include: • Petroleum hydrocarbons (principally diesel- and oil-range, with less gasoline-range) • Polycyclic aromatic hydrocarbons (PAHs) from fuels and creosote • Heavy metals (arsenic, cadmium, copper, lead, mercury, nickel, zinc) • Polychlorinated biphenyls (PCBs)
Do Personnel Conducting Site Activities have Training in Accordance with WAC 296-843-200?	Yes

6 DECONTAMINATION

Goals	Procedures
To prevent the distribution of contaminants outside the exclusion zone or cross-contamination of samples, the following procedures will be used to decontaminate sample equipment.	• Decontamination process involving Alconox wash, tap water rinse, and deionized water rinse (with air dry). • Methanol or hexane rinse may be used only to remove organic chemicals that cannot be removed efficiently with soap and water (e.g., petroleum product). • Dedicated tubing used for groundwater sampling will be disposed of or retained (bagged) for future use, but not decontaminated and not used between wells.
To prevent the distribution of contaminants outside the exclusion zone, unnecessary vehicles will not be allowed inside the exclusion zone. For vehicles required in the exclusion zone (e.g., drill rig, excavator), the following decontamination procedures will be used to prevent contamination from leaving the exclusion zone:	• Steam clean drilling equipment and excavator bucket that advances below ground surface.
To minimize or prevent worker exposure to hazardous substances, all personnel working in the exclusion zone and contamination reduction zones will comply with the following decontamination procedures:	• Wash boots and rain gear that have come into contact with soil or groundwater with Alconox/tap water and air dry. • Dispose of disposable personal protective equipment (PPE such as gloves, Tyvek) into Department of Transportation (DOT)-approved and appropriately labeled 55-gallon drums for future disposal. • To prevent distribution of contaminants outside the exclusion zone, do not allow unnecessary vehicles inside the exclusion zone.
Soil cuttings, monitoring well purge water, and decontamination wastewater will be managed in the following manner:	• Soil cuttings from each location will be placed in DOT-approved drums. Appropriate disposition of the cuttings will be based on soil quality data collected from the program. • Decontamination wastewater and monitoring well purge water will be combined in DOT-approved 55-gallon drums at the property for future disposal. Appropriate disposition of the water will be based on groundwater quality data collected from the program.

7 HAZARD ANALYSIS

The potential hazards and corresponding control measures for planned site work activities are as follows:

Work Activity	Primary Potential Hazards	Control Measures
Drilling borings/monitoring wells, soil sampling	• Getting hit by drill rig equipment, especially from overhead.	• Stay back from rig whenever possible and stay alert. • Modified Level D PPE (with hard hat, traffic vest, steel-toe boots).
	• Excessive noise.	• Wear hearing protection.
	• Chemical exposure (skin contact, ingestion, inhalation).	• Modified Level D PPE. • Air monitoring if in areas of suspected VOCs.
Test pits, soil sampling	• Getting hit by excavator.	• Wear traffic vest. • Stay back from excavator and maintain eye contact with operator.
	• Falling into open excavation.	• Do not enter excavation >4 feet deep unless properly shored or sloped. • Stay back from unstable slopes. • Sample from excavator bucket where needed.
	• Chemical exposure (skin contact, ingestion, inhalation).	• Modified Level D PPE. • Air monitoring if in areas of suspected VOCs.
Soil sampling by hand augers or surface grabs	• Chemical exposure (skin contact, ingestion, inhalation).	• Modified Level D PPE. • Air monitoring if in areas of suspected VOCs.
Well development and groundwater sampling	• Chemical exposure (skin or eye contact, ingestion).	• Modified Level D PPE. • Securely join pump tubing and other connectors.
All	• Getting hit by other trucks working on the property.	• Wear traffic vest. • Stay back from roads and stay alert.
	• Railroad traffic on road entering site.	• Stay alert to railroad traffic. • Obey railroad alerts at road crossings.
	• Heat stress	• Take breaks, seek shade, and increase fluid intake.

Potentially Hazardous Chemicals Known or Suspected at the Property and Permissible Exposure Limits (air)					
Substance	**Medium**	**OHSA PEL**	**OSHA STEL**	**IDLH**	**Carcinogen or Other Hazard**
Gasoline-Range Petroleum	Soil, GW	10 ppmv	15 ppmv	250 ppmv	T
Diesel- and Oil-Range Petroleum	Soil, GW	1 ppmv	5 ppmv	500 ppmv	T
PCBs	Soil, GW	--	150 ppmv	900 ppmv	C
cPAHs	Soil, GW	0.2 mg/m^3	--	--	C
Benzene	Soil, GW	1 ppmv	5 ppmv	500 ppmv	C
Toluene	Soil, GW	200 ppmv	--	500 ppmv	T
Ethylbenzene	Soil, GW	100 ppmv	--	800 ppmv	T
Xylenes	Soil, GW	100 ppmv	150 ppmv	900 ppmv	T
Heavy Metals (arsenic, lead, mercury, etc.)	Soil, GW	As: 0.01 mg/m^3 Pb: 0.05 mg/m^3 Hg: 0.01 mg/m^3	As: -- Pb: -- Hg: 0.03 mg/m^3	As: 0.01 mg/m^3 Pb: 0.05 mg/m^3 Hg: 0.01 mg/m^3	Arsenic: C

Notes:
-- = none established
C = carcinogen
cPAH = carcinogenic polycyclic aromatic hydrocarbon
GW = groundwater
IDLH = immediately dangerous to life or health
N/A = not applicable/not available
OHSA = Occupational Safety and Health Administration
T = toxic
PCB = polychlorinated biphenyl
PEL = permissible exposure level (8-hour time-weighted average)
STEL = short-term exposure level

Chemicals Known or Suspected On-site (check box)			
Chemical Class	**Known**	**Possible**	**Unlikely**
Corrosive (if expected, specify)		X	
Ignitable (if expected, specify)			X
Reactive			X
Volatile		X	
Radioactive			X
Explosive			X
Biological Agent			X
Particulate or Fibers			X
If known or likely, describe:			

8 PERSONAL PROTECTIVE EQUIPMENT

Based on the hazards identified above, the following personal protective equipment (PPE) will be required for the following field activities. This section specifies both an initial level of protection

and a more protective (contingency) level or protection, in the event conditions should change. The contingency defines the PPE that will be available on site.

Work Activity	Level of Protection	
	Initial	Contingency
Drilling/ test pits/soil sampling	D	Mod. D or C
Well development/groundwater sampling	D	Mod. D or C
Sample handling	D	Mod. D or C
Other activities (list):		

Each level of protection will incorporate the following equipment (specify type of protective clothing, boots, gloves, respiratory cartridges or other protection, safety glasses, hardhat, and hearing protection):

Level of Protection	Specific PPE
Level D	Work clothing, traffic vest, rubber (nitrile) gloves, steel toe and shank boots, safety glasses, hearing protection, and hardhat.
Modified D	Level D plus Tyvek coveralls or rain gear, and neoprene outer gloves.
Level C	Level D plus air-purifying respirator with combination organic vapor/HEPA dust cartridges.

NOTE: Project personnel are not permitted to deviate from the specified levels of protection without the prior approval of the Site Safety Supervisor. A traffic vest is not needed if work clothes are suitably visible (e.g., orange/yellow rain gear or white/yellow chemical protective clothing).

9 AIR MONITORING

Air monitoring will be conducted for all subsurface explorations (soil borings, monitoring wells, and test pit excavations) to identify potentially hazardous environments and determine reference or background concentrations. Air monitoring can be used to define exclusion zones. Air monitoring can also be conducted to evaluate relative concentrations of volatile organic chemicals in samples.

The following equipment will be used to monitor air quality in the breathing zone during work activities:

Monitoring Instrument	Calibration Frequency	Parameters of Interest	Sampling Frequency
PID	Daily	Volatile organic compounds	• During collection of each soil sample during drilling. • During trenching if workers smell gasoline odor. • During routine monitoring of remediation equipment.
Detector tube (*specify chemical)*	As required	Benzene	• As needed based on PID monitoring

Use the following action levels to determine the appropriate level of personal protection to be used during field activities:

Monitoring Instrument	Reading in Breathing Zone	Action	Comments
PID	10 PID units above background for 5 minutes	Confirm with detector tube (*benzene)* or upgrade to Level C (air-purifying respirator with organic vapor cartridge).	Alternatively, use engineering controls (ventilation) or leave location and return at a later time.
Detector tube (*specify chemical)*	> PEL	Upgrade to Level C (air-purifying respirator with organic vapor cartridge).	Leave location pending further evaluation by Aspect Safety Officer.
PID	100 PID units above background for 5 minutes	Leave location pending further evaluation by Aspect Safety Officer.	

10 SAFETY EQUIPMENT

The following safety equipment will be on site during the proposed field activities:

Other Required Items (check items required)	
First aid kit	X
Eyewash (e.g., bottled water)	X
PID	X
Drinking water	X
Fire extinguisher	
Brush fan	
Wind sox	
Other:	

11 SPILL CONTAINMENT

Will the proposed field work include the handling of bulk chemicals?	Yes	No X
If yes, describe spill containment provisions for the property:		

12 CONFINED SPACE ENTRY

Will the proposed field work include confined space entry?	Yes	No X
If yes, attach to this plan the confined space entry checklist and permit.		

13 ASPECT TRAINING AND MEDICAL MONITORING

Aspect employees who perform site work are responsible for understanding potential health and safety hazards of the site. All Aspect site workers will have health and safety training for hazardous waste operations, in accordance with WAC 296-843-200. In addition, Aspect requires medical monitoring for all employees potentially exposed to chemical hazards in concentrations in excess of the permissible exposure limit (PEL) for more than 30 days per year, as required under WAC 296-843-210. Employees who use respirators for their work will have a respirator medical evaluation as required under Chapter 296-842-WAC.

14 DISCLAIMER

Aspect Consulting, LLC does not guarantee the health or safety of any person entering these property. Because of the potentially hazardous nature of this property and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury and illness at this property. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other property without prior evaluation by trained health and safety personnel.

FIELD SAFETY PLAN CONSENT AGREEMENT

Aspect Consulting Employees

I have reviewed the project specific health and safety plan, dated July 22, 2013 for the K-C Everett RI fieldwork. I understand the purpose of the plan and I consent to adhere to its procedures and guidelines while conducting activities on site that are described in the plan.

Employee Printed Name	Signature	Date

Site Visitors

I have been briefed on the contents of the project-specific health and safety plan. I am responsible for my own health and safety.

Visitor Printed Name and Organization/Company	Signature	Date

FIELD SAFETY MEETING MINUTES

Site Name _____Project No. _____

Meeting Location _____

Meeting Date _____ Time _____ Conducted by_____

Pre-field Work Orientation_____ Weekly Safety Meeting_____ Other_____

Subject Discussed _____

_____

_____

_____

Site Safety Supervisor Comments _____

_____

_____

_____

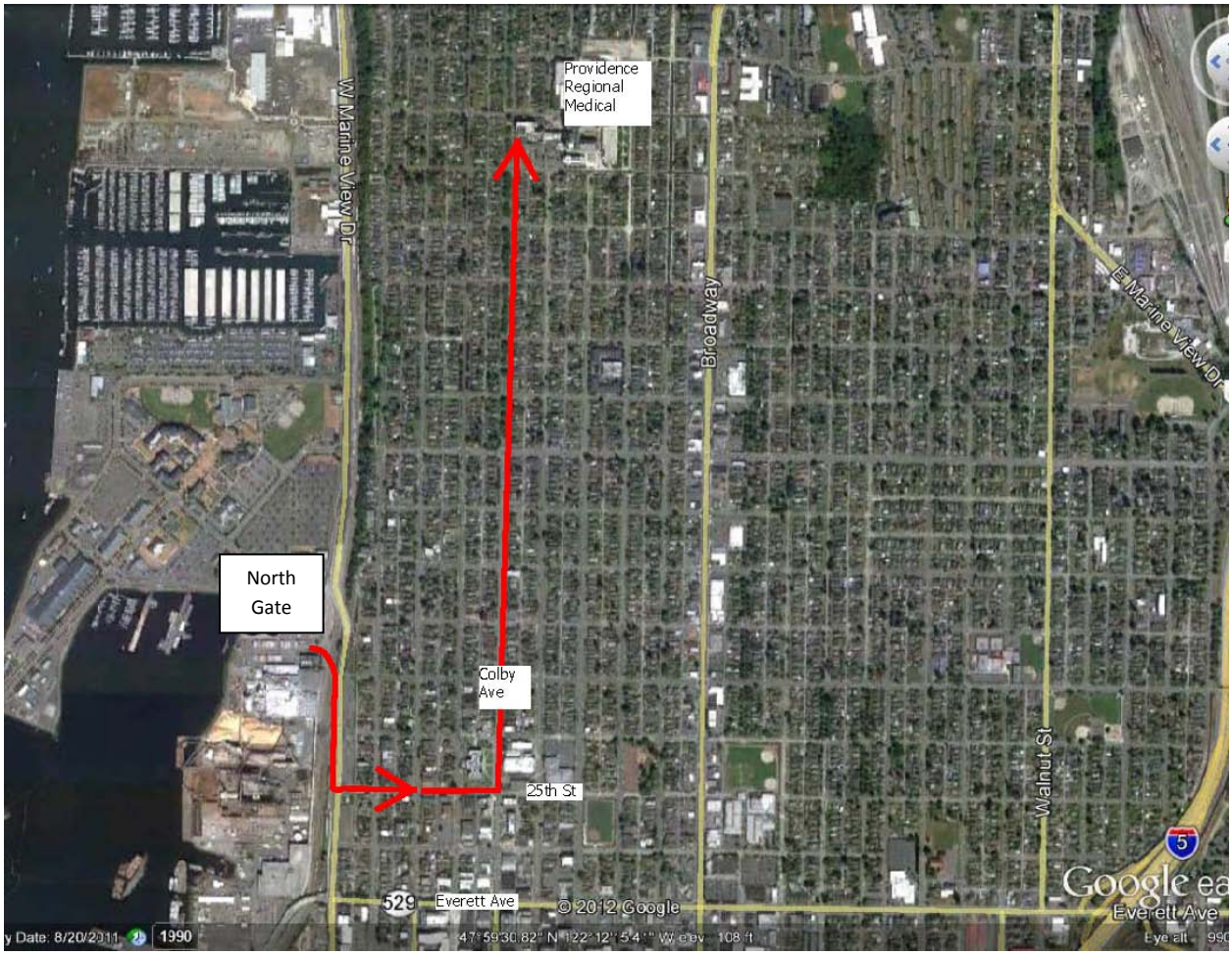
Participants

Printed Name (and company if subcontractor)	Signature

Figure 1: Route to Hospital Map

K-C Everett Mill, 2600 Everett Avenue, 98201, to

Providence Regional Medical Center, 1321 Colby Avenue, 98201 (425-261-2000)



Directions:

- From North Gate, go right. Proceed south through K-C parking lot to stop light on 25th St.
- Go east on 25th, four blocks.
- Turn left on Colby Avenue.
- Proceed north on Colby Ave approximately 1.3 miles.
- Providence Medical is on your right.

Figure 1: Route to Hospital Map