REMEDIAL INVESTIGATION
Georgia-Pacific West Site
Bellingham, Washington
Prepared for: Port of Bellingham

Sections 1 through 9

Project No. 070188-001-08 • August 5, 2013 Final

Prepared in association with

ANCHOR QEA

Aspect CONSULTING

earth + water

August 5, 2013

Brian Sato
Washington Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, Washington 98008-5452

Re: Finalization of Remedial Investigation, Georgia-Pacific West Site
Project No. 070188-001-08

Dear Mr. Sato:

On behalf of the Port of Bellingham, this letter documents that this hardcopy version of the Remedial Investigation (RI) for the Georgia-Pacific West Site (Site) is the Final RI (Volume 1 to Remedial Investigation/Feasibility Study).

On June 18, 2013, the Draft Final RI and proposed Second Amendment to the Agreed Order (Amendment) for the Site were issued for the required 30-day public comment period. The public comment period closed on July 17, 2013. Three public comments were received, and Ecology responded to each comment in writing (Response to Comments, dated July 2013). Based on the public comments received, Ecology concluded that no revisions to the Draft Final RI document were required.

In this hardcopy version of the Final RI, the cover pages and binder spines have been changed to reflect the date and status as Final, but individual pages in the hardcopy versions of the document still say "Draft Final" with the May 13, 2013 date. We have also prepared and submitted an electronic version (.pdf) of the final RI where the date and status changes are reflected throughout the document.

Sincerely,
Aspect consulting, LLC

Steve Germiat, LHG, CGWP
Sr. Associate Hydrogeologist
sgermiat@aspectconsulting.com

cc: Brian Gouran, Port of Bellingham

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Georgia-Pacific West Site
Bellingham, Washington
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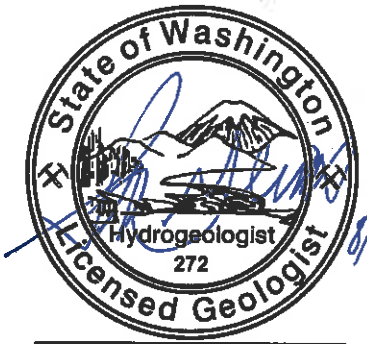
Project No. 070188-001-08 • August 5, 2013 Final

Aspect Consulting, LLC



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Acronym and Abbreviation List

°C	Degrees Celsius
°F	Degrees Fahrenheit
A	Aquifer cross sectional area
ADEC	Alaska Department of Environmental Conservation
ALTA	American Land Title Association
AP	Alcohol Plant
API	American Petroleum Institute
ARAR	Applicable or Relevant and Appropriate Requirement
ASB	Aerated stabilization basin
Aspect	Aspect Consulting LLC
AST	Above-ground storage tank
ATSDR	Agency for Toxic Substances and Disease Registry
BC	Bunker C Tank
bgs	Below ground surface
BH	Bag House
BNSF	Burlington Northern-Santa Fe Railway
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CD	Chip Dump
CD	Compact disk
cfs	Cubic feet per second
Chromium III	Trivalent chromium
Chromium VI	Hexavalent chromium
City	City of Bellingham
CLARC	Cleanup Levels and Risk Calculation database
cm	Centimeter
cm/sec	Centimeter per second
cis-1,2-DCE	cis-1,2 dichloroethene
CNF	Confined Nearshore Fill
COC	Contaminant of concern
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
CSM	Conceptual site model
DEIS	Draft environmental impact statement
DNR	Washington State Department of Natural Resources
DO	Dissolved oxygen
DOC	Dissolved organic carbon

DOH	Washington State Department of Health
DOSH	Washington State Department of Labor and Industries Division of Occupational Safety and Health
Ecology	Washington State Department of Ecology
EIS	Environmental impact statement
EPA	United States Environmental Protection Agency
EPH	Extractable petroleum hydrocarbons
ET	Electrical transformers
FDA	Food and Drug Administration
FEIS	Final environmental impact statement
FeS_2	Pyrite
FH	Fuel House
FM	Fire main
FS	Feasibility study
ft	Feet (or foot)
GF	General fill
GLF	Gas line feed
GMD	Glaciomarine Drift
GP	Georgia-Pacific Corporation
gpd	Gallons per day
gpm	Gallons per minute
GWI	Groundwater under the influence of surface water
H+	Hydrogen ion
Hg	Mercury
Hg(II)	Divalent mercury
HgS	Mercury sulfide
HpCDD	Hepta-chlorinated dioxin congener
HpCDF	Hepta-chlorinated furan congener
HxCDD	Hexa-chlorinated dioxin congener
HxCDF	Hexa-chlorinated furan congener
I	Horizontal hydraulic gradient
IPCC	Intergovernmental Panel on Climate Change
K	Hydraulic conductivity
Koc	Organic carbon-water partition coefficient
LB	Lab Building
LiDAR	Light detection and ranging
LLC	Limited liability company

LNAPL	Light non-aqueous phase liquid
LP	Lignin Plant
LW	Lignin Warehouse
MDL	Method detection limit
MG	Million Gallon Tanks
mg/kg	Milligrams of solute per kilogram of soil
mg/L	Milligrams of solute per liter of solution
MLLW	Mean lower low water
MW	Monitoring well
MTCA	Model Toxics Control Act (Chapter 173-340 WAC)
Mv	Millivolt
N	North
n_e	Effective porosity
NAPL	Non-aqueous phase liquid
NE	Northeast
NELAP	National Environmental Laboratory Accreditation
NJDEP	New Jersey Department of Environmental Protection
No.	Number
NOAA	National Oceanic and Atmospheric Administration
NOM	Natural organic matter
NNE	North-northeast
NNW	North-northwest
NTR	National Toxics Rule
NW	Northwest
NPDES	National Point Discharge Elimination System
OCDD	Octa-chlorinated dioxin congener
OCDF	Octa-chlorinated furan congener
OH-	Hydroxide ion
ORP	Oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PeCDD	Penta-chlorinated dioxin congener
PeCDF	Penta-chlorinated furan congener
PEL	Permissible exposure limit

pg/g	Picogram per gram
pH	Negative logarithm of hydrogen ion concentration
PID	Photoionization detector
PL	Parking lot
PMA	Port Management Agreement
Port	Port of Bellingham
PQL	Practical Quantitation Limit
PRISM	Parameter-elevation Regressions on Independent Slopes Model
QA	Quality assurance
QA/QC	Quality assurance/quality control
QC	Quality control
QAPP	Quality assurance project plan
PSE	Puget Sound Energy
RCRA	Resource, Conservation, and Recovery Act
RL	Reporting limit
RCW	Revised Code of Washington
Redox	Oxidation-reduction
Remerc	Mercury extraction and recovery system
RI	Remedial investigation
RI/FS	Remedial investigation/Feasibility study
RPD	Relative percent difference
SBLT	Sequential batch leaching test
SC	Sodium Bichromate Tank and Chromium Pipeline
SEM	Scanning electron microscopy
SEPA	State environmental policy act
Site	Georgia-Pacific West Site
SMS	Sediment management standards
SOW	Statement of work
SQS	Sediment quality standard
SVOC	Semivolatile organic compound
TCE	Trichloroethene
TCDD	2,3,7,8- tetrachlorodibenzo-p-dioxin
TCLP	Toxicity characteristic leaching procedure
TDS	Total dissolved solids
TEC	Total equivalent concentration
TEE	Terrestrial ecological evaluation

TEF	Toxicity equivalency factor
TEQ	Toxic equivalent concentration
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
TS	Truck Shop/Oil Storage
TSCA	Toxic Substances Control Act
TSS	Total suspended solids
USGS	United States Geological Survey
UW	University of Washington
v	Seepage velocity
VC	Vinyl chloride
VI	Vapor intrusion
VOC	Volatile organic compound
W	West
WNW	West-northwest
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
XRD	X-ray diffraction
µg/L	Micrograms of solute per liter of solution
$\mu g/m^3$	Micrograms of solute per cubic meter of air
µS/cm	Microsiemens per centimeter

1 Introduction

1.1 Site Description and Background

The Georgia-Pacific West Site (Site) is a waterfront industrial property acquired by the Port of Bellingham (Port) from Georgia-Pacific Corporation (GP) in January 2005. The Site, located at 300 West Laurel Street in Bellingham, Washington, encompasses approximately 64 acres on the south side of the Whatcom Waterway. A Pulp and Tissue Mill operated at the Site from 1926 through 2007. The Site is bordered on the north by the Whatcom Waterway (at mudline), on the east and south by the Burlington Northern-Santa Fe Railway (BNSF) main line, and on the west by the Bellingham Shipping Terminal and Bellingham Bay (Figure 1-1).

Note: The figures in this document contain directional references for both true north and "Mill north" as established by GP, with the "Mill north" axis approximately 45 degrees west of true north (see compass rose on figures). For ease of discussion, and consistency with previous environmental reports, the text in this document uses "Mill north" as its directional reference. In the "Mill north" reference, the Whatcom Waterway is oriented east-west on the north side of the Site.

Figure 1-2 depicts the Site boundary, and adjacent property boundaries obtained from the 2004 American Land Title Association (ALTA) survey and the Whatcom County parcel database. Land ownership within the Site includes the Port of Bellingham, State of Washington (managed by Department of Natural Resources [DNR]), BNSF, and the City of Bellingham, who owns easements for public roads (e.g., Laurel Street). Puget Sound Energy's Encogen Northwest co-generation power plant is located south of the BNSF railroad, south of the central area of the Site.

The Site includes a portion of the Bellingham Shipping Terminal immediately west of the former GP Mill and a portion of BNSF property south of it. That portion of the Site includes both Port-owned upland parcels, and adjacent state-owned aquatic lands that have been filled. The Port entered into lease agreements with the state for various state-owned parcels between the 1920s and 1962, for the purposes of conducting Port terminal operations. Since 1997, the Port has managed the state-owned land under a Port Management Agreement (PMA) signed with Washington State DNR.

The Site is defined by the extent of contamination caused by the release of hazardous substances at the Site. The Site constitutes a Facility under RCW 70.105D.020(5). Figure 1-2 depicts the Site boundary defined in the Agreed Order and RI/FS Work Plan (Aspect, 2009a). At the conclusion of this RI, the Site boundary is redefined to encompass the identified extent of contamination caused by releases of hazardous substances from the Site.

The Port is currently undergoing evaluation of potential future land uses, including continued industrial use or potential rezoning to accommodate mixed use redevelopment. Contamination from historical industrial activities on the Site has impacted upland soils

and groundwater with a variety of constituents including mercury and other metals, and petroleum hydrocarbons.

In 1999 and 2002, GP entered into a pair of Agreed Orders with the Washington State Department of Ecology (Ecology) to perform facility decommissioning and a remedial investigation/feasibility study (RI/FS) for a portion of the property known as the Chlor-Alkali plant. In addition to decommissioning the former Chlor-Alkali plant, GP independently conducted a significant amount of environmental investigation (including an RI/FS) and cleanup work for the Chlor-Alkali plant area. In 2004, GP also conducted an extensive Phase II Environmental Site Assessment for the remaining portion of the property, the Pulp and Tissue Mill, prior to completion of the property transaction with the Port.

The Port has entered an Agreed Order No. 6834 with Ecology to complete a RI/FS for the Site in accordance with WAC 173-340-350 and the Statement of Work (SOW) and Schedule in the Agreed Order. This RI report, Volume 1 of the RI/FS, is a required deliverable under the Agreed Order.

In August 2011, the Port and Ecology executed the first amendment to Agreed Order No. DE 6834, which required completion of a multi-phase interim action. The goal of the interim action was to remove contaminated soil and building materials that serve as sources of contaminants to groundwater and/or air at two areas of the Site. The results from the interim action are not included in this RI, but will be incorporated into the subsequent FS.

1.2 Document Organization

This report has been prepared in general accordance with the Ecology approved "Annotated Outline for RI/FS Documents". Following this introductory Section 1, the remaining sections of this RI document are organized as follows:

- **Section 2** provides background information including a history of the Site, a brief overview of previous environmental studies and independent cleanup actions conducted to date, an overview of the RI/FS objectives, and a brief explanation of how the RI/FS integrates with other documents pertinent to cleanup of the Site.
- **Section 3** describes the methods and quality control (QC) provisions used in development of the RI under Agreed Order No. 6834 (field methods are further detailed in Appendix A along with copies of exploration logs).
- **Section 4** summarizes the Site's environmental setting, including the physical site conditions, natural resources, historical and cultural resources, and land use.
- **Section 5** presents Site screening levels for environmental media developed as part of this RI/FS. This section summarizes the principal environmental receptors and exposure pathways for which the screening levels are protective.
- **Section 6** defines subareas of the Site that had remaining data gaps to be filled in the current RI as defined in the RI/FS Work Plan.

- **Section 7** presents a conceptual site model (CSM) for each of the Site subareas. The CSM for each subarea identifies the following: contaminants of concern and their sources, nature and extent of contamination, contaminant fate and transport, environmental exposure pathways and receptors, and, based on that collective information, the RI conclusions.
- **Section 8** provides a brief summary of the RI findings, and considerations and recommendations for the FS.
- **Section 9** presents references cited in the RI.

Appendices to this RI report include:

- **Appendix A** describes field procedures used for the collection of the RI characterization data, and includes copies of the exploration logs for Site borings and monitoring wells from that effort.
- **Appendix B** provides detailed data and analyses supporting the Site hydrogeologic characterization.
- **Appendix C** provides a conceptual model for transport and attenuation of mercury at the Site.
- **Appendix D** is a report, prepared by MWH Americas Inc., presenting petrographic analysis of aquifer matrix mineralogy, to support contaminant transport evaluations.
- **Appendix E** includes reports, prepared by Frontier Geosciences and Air Toxics, describing the RI sampling and analysis data for soil vapor and ambient air.
- **Appendix F** presents information supporting development of Site-specific soil screening levels for petroleum hydrocarbons, as well as statistical analysis of background groundwater pH data.
- **Appendix G** is a report, prepared by Ecology, presenting the petroleum biomarker analysis results for groundwater in the Million Gallon Tanks subarea.
- **Appendix H** presents the analytical data quality review reports, prepared by Pyron Environmental, and copies of the laboratory reports (in electronic format on CD) for data collected during the current RI.

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Vicinity Map

GP West Site RI/FS
Bellingham, WA

DATE: Sep 2010	PROJECT NO. 070188
DESIGNED BY: SJG	
DRAWN BY: PPW	FIGURE NO. 1-1
REVISED BY: ---	

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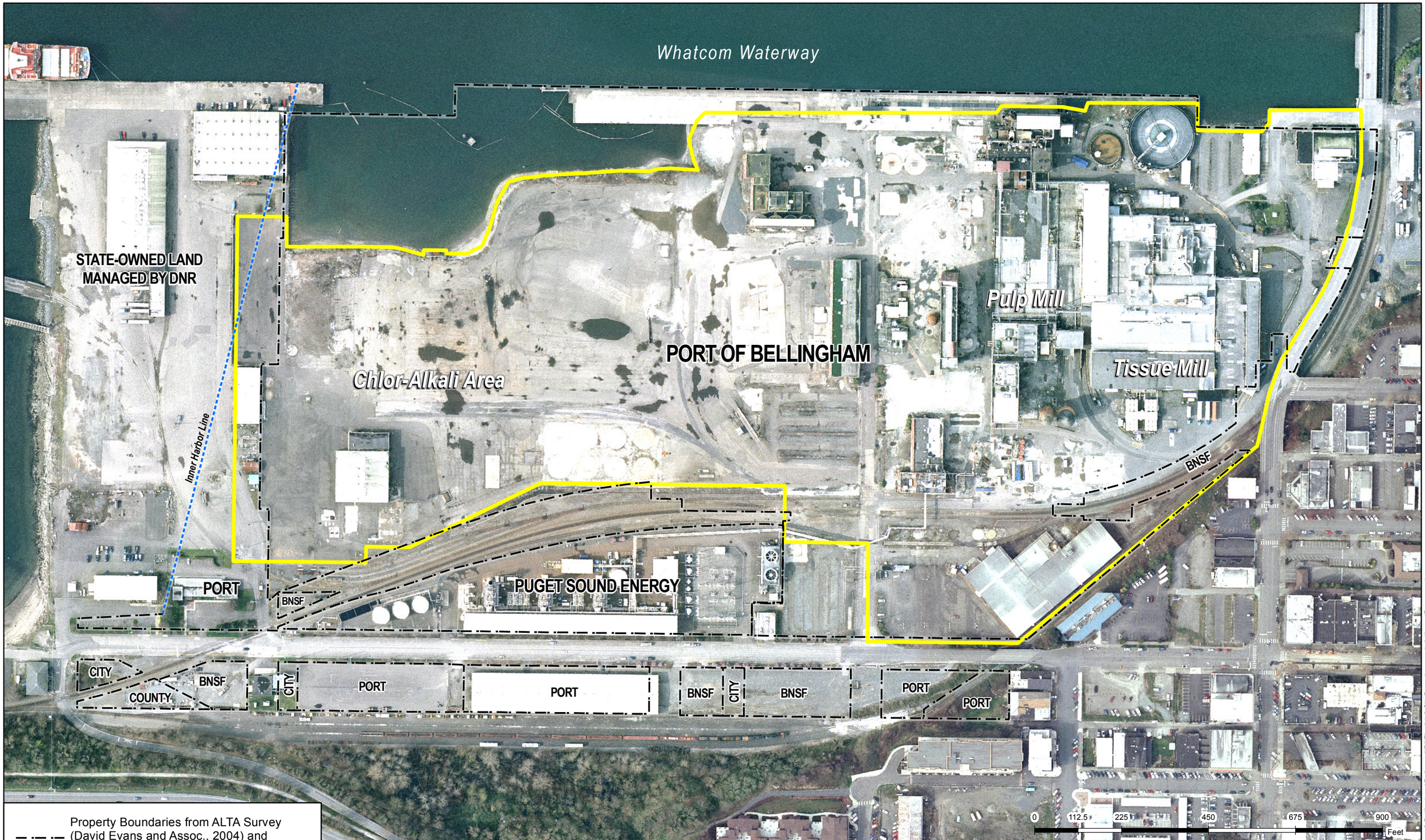

Property Boundaries from ALTA Survey (David Evans and Assoc., 2004) and City of Bellingham GIS Tax Parcel Database

Inner Harbor Line

Site Boundary

MILL NORTH

TRUE NORTH

45°

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Site Boundary and Adjacent Properties

GP West Site RI/FS
Bellingham, WA

DATE: Apr 2013	PROJECT NO. 070188
DESIGNED BY: SJG	
DRAWN BY: PPW	FIGURE NO. 1-2
REVISED BY: PPW	

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2 Project Background

2.1 Site History

In general terms, the Site includes the Chlor-Alkali area (former Chlor-Alkali plant and surrounding area) on the west, and the former Pulp and Tissue Mill area on the east, as shown on Figure 1-2. (Note that the terms Chlor-Alkali plant and Chlorine Plant have been used interchangeably in the Site history, depending on author, and are synonymous. This RI uses the term Chlor-Alkali plant). The industrial history for each of those primary areas is summarized below, based on information presented in ENSR (1994a) for the Chlor-Alkali area, and in Aspect (2004b) for the former Pulp and Tissue Mill area. Information on previous Agreed Orders for the Chlor-Alkali area of the Site is also provided in this section. Figure 2-1 depicts general operational areas of the former Mill and Chlor-Alkali plant areas, which are referenced throughout this report.

2.1.1 Former Chlor-Alkali Plant

The former Chlor-Alkali plant used a mercury cell technology to produce chlorine and sodium hydroxide (caustic) for use at the Pulp and Tissue Mill in bleaching and pulping wood fiber, and for off-site commercial sale. Hydrogen was also produced at the Chlor-Alkali plant and used as fuel in the Tissue Mill. GP constructed the Chlor-Alkali plant on approximately 4 acres of previously undeveloped land in the southwestern portion of the Site. The Chlor-Alkali plant operated from 1965 through 1999.

The following sections summarize relevant historical activities at the former Chlor-Alkali plant, including industrial operations, waste generation and handling, filling of the former Log Pond with sediment dredged from the Whatcom Waterway, and previous Agreed Orders with Ecology directing site investigation and remediation.

2.1.1.1 Chlor-Alkali Plant Operations

Chlorine and caustic were produced at the plant using the closed-loop deNora mercury cell process. Chlorine gas was generated electrolytically from a saturated solution of sodium chloride (brine). The pH of the input brine solution was increased by adding caustic to precipitate impurities such as calcium and magnesium, and then reduced again by addition of hydrochloric acid prior to entering the electrolytic cells. The precipitated impurities were removed from the brine by settling and filtering. The removed solids were a waste product managed by GP.

The mercury cells were rectangular steel troughs having a slight downward slope from inlet to outlet. The electrolytic cell contained a cathode consisting of mercury flowing on the bottom of the trough from inlet to outlet (the brine floated on top of the mercury), and titanium anodes along the full length of the cell. Figure 2-2 is a schematic representation of the mercury cell chlor-alkali process (reproduced from http://www.eurochlor.org/animations/mercury-cell.asp).

At the anode (positively charged), chlorine gas was evolved from negatively charged chloride ions in the brine and the chlorine gas was extracted from the cell.

At the cathode (negatively charged), elemental sodium was evolved from positively charged sodium ions in the brine. The sodium combined with the mercury forming an amalgam leaving the cell and traveling to a decomposer filled with graphite. In the decomposer, graphite served as the anode and the amalgam served as the cathode. The amalgam and water flowing through the cell came into direct contact with the graphite. The sodium-mercury amalgam was decomposed by water with the formation of sodium hydroxide, the reformation of elemental mercury, and the production of hydrogen gas. Having passed through the cell, the brine was stripped of residual chlorine and returned to the brine saturator to be re-saturated with salt. The mercury was reused within the cell.

At the mercury cell inlet and outlet, the mercury could be exposed to the atmosphere. To limit its volatilization, the mercury was covered with flowing water, referred to as seal water. The seal water was initially discharged to the GP Log Pond until 1970, when a recycling system was installed.

2.1.1.2 Chlor-Alkali Plant Waste Generation and Handling

According to ENSR (1994a), mercury-containing wastes generated at the former Chlor-Alkali plant over its history included:

1. **Brine treatment wastes:** Solids from saturators and from clarifier/brine filter backwash;
2. **Mercury seal water:** Water covering the mercury to prevent its volatilization;
3. **Hydrogen condensate:** Water condensed from hydrogen gas from its cooling;
4. **Chlorine condensate:** Water condensed from chlorine gas from its cooling;
5. **Caustic wastes:** Caustic filter backwash (after 1970);
6. **Stormwater runoff:** Mercury-containing runoff from the vicinity of the Chlor-Alkali plant;
7. **Cell flushing water:** Brine discharged daily from the mercury cells to flush accumulated solids;
8. **Cell room cleaning water:** Water used to wash the cell exteriors and flush the Cell Building floors to sewer; and
9. **Leaks and spills:** Accidental leaks and spills anywhere in the Chlor-Alkali plant.

A generalized chronology of GP's management of the Chlor-Alkali plant process wastes is as follows:

- **1965-1970:** Discharged wastewaters via Outfall 7 directly to the GP Log Pond, which, at that time, extended inland adjacent to the Chlor-Alkali plant (Outfall 7 shown on Figure 2-1).
- **1970:** Implemented process improvements to reduce waste discharge to the Log Pond, including recirculation/reuse of process fluids within the plant and construction of an earthen Wastewater Settling Basin in a newly filled area between the Chlor-Alkali plant and the GP Log Pond to reduce suspended solids prior to discharge. Wastewater from the settling basin was discharged to the

waterway via Outfall 7, which had been extended to the north end of the new fill area, approximately at the current shoreline of the Log Pond (see Figure 2-1).

- **1973:** Improved the settling basin, including filtration of effluent to further reduce solids prior to discharge.
- **1974:** Constructed wastewater improvements to reduce mercury discharges to the waterway. This included construction of two brine sludge tanks upstream of the settling basin to remove suspended particulate, and construction of a treatment system using sulfide precipitation and filtration of the precipitate to remove dissolved and particulate mercury from settling basin effluent and decanted water from the brine sludge tanks. The sulfide precipitate was landfilled.
- **1976:** Removed accumulated solids from the Wastewater Settling Basin and chemically stabilized the solids by a proprietary process (Chemfix) using 2.4 percent by volume sodium silicate and 1.7 percent by volume Portland cement. Approximately 8,000 cubic yards of this material were reportedly contained within an area of approximately 2 acres (Chemfix on Figure 2-1). The solidified Chemfix material is capped with (from bottom up) a layer of bank run fill; a geotextile membrane (DuPont Typar®, lapped and glued, and extending beyond the lateral extent of Chemfix); a 6-inch layer of sand; and two layers of asphalt together totaling 5 to 6 inches in thickness. A 1977 Ecology Order specifies maintenance requirements for the cover material over the Chemfix (previous Agreed Orders for the Site are discussed below).
- **1980:** Closed the Wastewater Settling Basin and filled it with clean fill, and landfilled the excavated sludge in Arlington, Oregon. Constructed a new wastewater collection sump and surge storage tank to replace the settling basin surge capacity.
- **1980-1992:** Implemented further improvements to reduce mercury concentrations discharged, including routing all wastewater to the aerated stabilization basin (ASB) north of the Whatcom Waterway, and decommissioning of Outfall 7.
- **1993:** Constructed a chemical extraction and recovery system ("Remerc process") to recover mercury from brine sludges and wastewater treatment plant sludges. The Remerc process met the RCRA universal treatment standards for pretreating the wastes prior to their landfilling as listed hazardous waste (K071 and K106).
- **1999:** Closed the Chlor-Alkali plant.

2.1.1.3 Whatcom Waterway Dredging (1974)

In 1974, GP implemented a dredging project within the Whatcom Waterway in accordance with Ecology requirements. The project removed surface sediments from within the Whatcom Waterway by dredging, and placed the dredged materials within a portion of the former Log Pond to construct a land-based log handling facility. GP constructed an earthen dike around about 8 acres of the Log Pond northeast of the Chlor-Alkali plant. Sediments from the Log Pond and Whatcom Waterway were hydraulically

dredged and placed in the diked area. The dredge fill was topped with gravel and paved with asphalt, creating new upland area. The City of Bellingham developed an Environmental Impact Statement (EIS) and issued a Shorelines Management Permit for the project. The Army Corps of Engineers also issued a permit for the project. It appears that the bulkhead along the now-filled former Log Pond shoreline remains buried in place.

2.1.1.4 Previous Agreed Orders

In 1977, Ecology issued Agreed Order DE 77-336, requiring GP to manage the Chemfix material through either off-site disposal or installation and long-term maintenance of an impervious cover. The cover was constructed, as described above, and the Order prohibits excavation or degradation of the cover without Ecology's prior written approval.

Following closure of the Chlor-Alkali plant in 1999, planned remediation of the Chlor-Alkali site was to occur in two phases, each conducted under an Agreed Order with Ecology. The first phase was conducted under Agreed Order DE TC99 I035 (1999), which required the decommissioning and demolition of the Chlor-Alkali plant's processing machinery. That phase of the project was completed in 2000. The second phase, under Agreed Order DE 02 TCPIS-472 (2002), required completion of a RI/FS for the Chlor-Alkali site.

2.1.2 Former Pulp and Tissue Mill

The GP Mill manufactured bleached sulfite pulp for internal production of tissue and toweling, and for sale as market pulp. The facility contained six individual plants producing primary sulfite pulp, Permachem pulp, sulfuric acid, chlorine, sodium hydroxide, alcohol, and lignosulfonate products. Sulfite waste liquor, a byproduct of pulping, was converted into ethanol and salable lignin products. Lignin, a byproduct of pulping, was converted into salable products through various production steps.

The following sections summarize the development history, operations, and waste generation and handling at the former Pulp and Tissue Mill. This operational history of the former Pulp and Tissue Mill is taken from the Phase II Environmental Assessment for the Pulp and Tissue Mill property (Aspect, 2004b). It was developed based on review of GP's historical information and interviews with GP employees, and was reviewed by GP for accuracy.

2.1.2.1 Development History

In 1926, the San Juan Pulp Company opened the first pulp mill on 5 acres of tideland within the footprint of the current Mill property. The Mill was designed to make use of pulp logs and fiber leftovers from a local wood box plant and several lumber mills. Three years later, the business was reorganized as the Puget Sound Pulp and Timber Company. During the late 1930s, the Pulp Mill underwent significant expansion. In 1943, the Defense Plant Corporation constructed a chemical byproducts plant to produce ethyl alcohol from wood sugars present in sulphite waste liquor produced by the Pulp Mill. The Puget Sound Pulp and Timber Company later purchased this plant. In 1946 and 1947, the company added a log barking and chipping plant and a paperboard manufacturing plant to its operations. Also in 1947, a laboratory research group was established to determine ways of converting waste lignin materials into commercial products. Later that year, the

first facilities to extract such products were installed. Lignin products produced included chromium-containing oil well drilling mud thinners, vanilla flavoring, animal feeds, adhesives, pharmaceuticals, dust retardants, fuel pellets, solvents, ferromagnetic liquids, and many other products.

In the early 1950s, two bleaching stages were added to the pulping process. Two additional stages were added later to produce very bright and strong pulp. In 1958, Puget Sound Pulp and Timber Company acquired the adjacent tissue manufacturing operations of Pacific Coast Paper Mills. In 1963, the company merged with GP. In 1965, GP expanded the Mill operations by constructing the Chlor-Alkali plant as previously described in Section 2.1.1.

Throughout the 1970s and 1980s, GP continued to upgrade the facility by adding a pulp washer, additional digesters, power substations, wood-handling installations, warehousing, byproduct expansions, and chip plants. It also provided primary and secondary treatment of its wastewater. The Pulp Mill and associated chemical plants were closed in 2001, and the Tissue Mill was closed at the end of 2007.

2.1.2.2 Pulp and Tissue Mill Operations

During the 1980s, the Mill produced an average of 760 tons per day of bleached sulfite pulp and an average of 40 tons per day of Permachem pulp (for production of tissue paper). The Mill had nine batch digesters for pulping. According to Ecology records, the facility also produced some byproducts and chemicals, including concentrated lignin products in the Lignin Plant, ethyl alcohol in the Alcohol Plant, sulfuric acid for the pulping process (80 tons per day) in the Acid Plant, and, in the Chlor-Alkali plant described above, chlorine (220 tons per day) and caustic soda (250 tons per day). Approximately 15 percent of the chlorine and sodium hydroxide produced at the facility was used for internal plant consumption; the balance was sold commercially. Sulfite waste liquor, a byproduct of pulping, was converted into ethanol and salable lignin products. The products and waste products from the Lignin Plant were stored in seven of the eight Million Gallon Tanks (petroleum was stored in one of the tanks as described below).

One of the lignin byproducts produced at the site was a drilling mud containing chromium as an additive. Most of the chromium was supplied to the Mill as chromium dioxide. The chromium dioxide product was supplemented with chromic acid wastes from plating facilities. According to EPA 1987 records, the facility was receiving approximately 5,000 gallons per month of hexavalent chromium-containing acid wastes, which were stored in a 30,000-gallon tank east of the Lignin Plant Mill A Warehouse. This source of chromium was discontinued in the late 1980s. Prior to the 1980s, liquid chromium (sodium bichromate) was brought in by barge and stored in 100,000-gallon and 150,000-gallon tanks located behind Warehouse Number 2. The liquid chromium in these tanks was transported to the Lignin Plant via an underground pipeline (dashed line on Figure 2-1).

Steam heat was supplied to the Mill by burning fuel oil (e.g., Bunker C oil) in the Steam Plant. The fuel oil was stored in a 375,000-gallon tank located east of the Steam Plant and, later, in one of the Million Gallon Tanks (Tank 2) located immediately north of the BNSF main line and west of the Pulp and Tissue Mill. Because of Bunker C fuel oil's

high viscosity, it was heated to allow its being pumped through pipelines from the storage tanks to the Steam Plant.

2.1.2.3 Pulp and Tissue Mill Waste Generation and Handling

According to a 1992 EPA RCRA Facility Assessment report, the GP facility generated 750 tons per year of listed mercury-containing wastes associated with Chlor-Alkali plant operations and ignitable wastes in the form of waste oils, solvents, and degreasers. The facility generated large volumes of non-hazardous solid wastes including primary clarifier sludge (mostly fiber), log-sorting debris (mostly sand and dirt), general mill waste (e.g., paper, wood), and process waste (primarily hog fuel boiler grate ash and limestone spalls). Ecology and facility records indicate that solid wastes were disposed of at off-site facilities.

Before installation of primary and secondary treatment systems, process wastewaters were discharged through various outfalls directly into the Whatcom Waterway. In the early 1970s, the sewer lines from hydraulic barking, Permachem pulp and sulfuric acid production, pulp digesters and screening, tissue paper making and converting, and pulp drying operations were rerouted to the newly constructed primary clarifier to receive primary treatment (solids settling). When the ASB, located across the Whatcom Waterway, was completed in 1979, the rest of the facility process sewers were rerouted to it, and these wastewaters, along with effluent from the primary clarifier, received secondary (biological) treatment.

2.2 Listing of Previous Environmental Studies and Independent Cleanup Actions

Considerable environmental cleanup-related work has been accomplished at the Site, prior to the Port and Ecology executing the current Agreed Order No. 6834 to conduct the Site-wide RI/FS. The previous studies and independent cleanup actions conducted at the Site are listed below.

- Whatcom Waterway dredging and creation of upland Confined Nearshore Fill (1974);
- Removal and Chemfix-stabilization of sludge from Wastewater Settling Basin (1976-77);
- Preliminary site assessment for the Chlorine-Alkali Plant area (Law Environmental, 1992);
- Assessment and soil removal at Laurel Street Pipe Rack (Law/Crandall, 1993);
- Investigation and soil removal at 72 Catch Basin (ENSR, 1993);
- RI/FS for Chlor-Alkali plant (ENSR, 1994a and 1994b);
- A series of independent remedial actions conducted to support infrastructure improvements (1999-2002);
- Groundwater monitoring in support of design of interim remedial action for the Log Pond (Anchor Environmental, 2000 and 2001b);

- Addendum to 1994 RI for Chlor-Alkali plant (Anchor Environmental, 2003b);
- Updated FS for Chlor-Alkali plant (Aspect, 2004a);
- Phase II Environmental Site Assessment for Pulp and Tissue Mill area (Aspect, 2004b);
- Independent cleanup of petroleum-contaminated soil at Million Gallon Tanks (RETEC, 2007a); and
- Geotechnical explorations to support potential relocation of the BNSF railroad traversing the Site (GeoEngineers, 2007).

The RI/FS Work Plan (Aspect, 2009a) summarizes the activities and results from the prior remedial actions.

2.3 Objectives of the RI/FS

In accordance with Agreed Order No. 6834, the RI/FS is intended to provide sufficient data, analysis, and evaluations to enable Ecology to select a cleanup action for the Site. To that end, specific objectives of the RI/FS are to:

- Obtain data of sufficient quality and quantity to describe the physical setting and physical properties of site soil, groundwater, and soil vapor (air);
- Determine the nature and extent of contamination in soil, water, and 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 and groundwater to air);
- Use the information collected to assess potential human health and ecological health concerns under current and planned land uses;
- Determine the need for cleanup actions for specific areas of the Site, and define and evaluate alternatives for doing so based on specific contaminants, environmental conditions, and land use plans for different areas of the Site; and
- Report the methods and findings of the RI/FS to Ecology and the local community.

The RI/FS is to be completed in accordance with WAC 173-340-350 and pursuant to the Scope of Work and Schedule in Agreed Order No. 6834, and the August 2011 Amendment to the Agreed Order.

This RI represents Volume 1 of the RI/FS, and describes the Site's physical setting, contaminant nature, extent, and transport, and potential for human and ecological exposure to the contaminants. The FS, Volume 2 of the RI/FS, defines the need for cleanup actions and evaluates the alternatives for achieving Site cleanup.

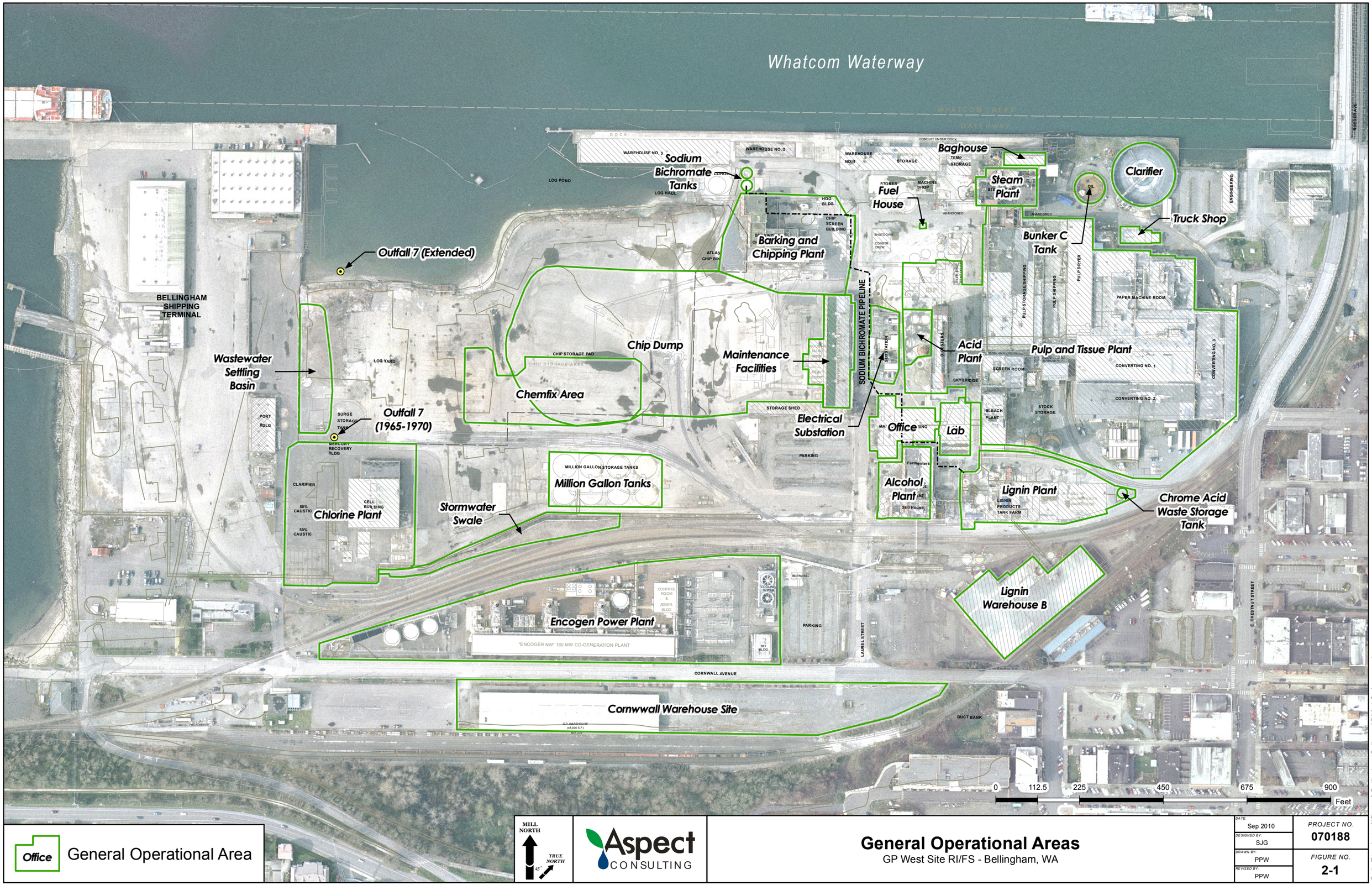
2.4 Relationship of RI/FS to Other Documents

This RI is the synthesis/culmination of previous Site characterization work and independent cleanup actions at the Site as well as current findings undertaken to fill data gaps. This RI incorporates all relevant information contained in those documents, and provides a current description of environmental conditions within the Site.

The RI/FS activities at the Site are being performed in close coordination with remediation and land use planning activities associated with the Site and vicinity. The relationship between these other activities is described below:

- **Cleanup of Whatcom Waterway Sediments:** Immediately north of the Site, the Port is initiating the cleanup of sediments in the Whatcom Waterway site under a Consent Decree (No. 07 2 02257 7). The cleanup of the Whatcom Waterway sediments is being performed jointly by the Port, the City of Bellingham (City), the Department of Natural Resources, and Meridian Pacific Highway LLC, under Ecology oversight. The Whatcom Waterway Consent Decree addresses the cleanup and monitoring of mercury and associated contaminants currently located in the Whatcom Waterway site sediments, including contamination associated with historical wastewater discharges from the Chlor-Alkali plant. The current RI/FS for the GP West Site addresses contaminants located in upland areas immediately south of the Whatcom Waterway. The Site RI/FS includes evaluation of those measures necessary to ensure that upland Site conditions are protective of sediment and water quality within the Whatcom Waterway site, including prevention of potential recontamination of Whatcom Waterway sediments (e.g., through groundwater discharge to sediment).

- **Waterfront District Land Use Planning:** The Port and City are currently conducting land use planning associated with the redevelopment of The Waterfront District, which includes the footprint of the Site. That planning process included development of a Final Environmental Impact Statement (FEIS) in accordance with State Environmental Policy Act (SEPA) requirements. The FEIS, and its addenda, herein collectively referred to as the Waterfront District EIS documents, summarized environmental conditions within the Waterfront District, including current environmental conditions and the status of ongoing investigation/cleanup actions within the Site. Potential environmental impacts and mitigation measures associated with Site redevelopment were described in that document. Section 4.6 of this RI describes anticipated future land uses consistent with The Waterfront District EIS documents.



Office General Operational Area

MILL NORTH
45°
TRUE NORTH

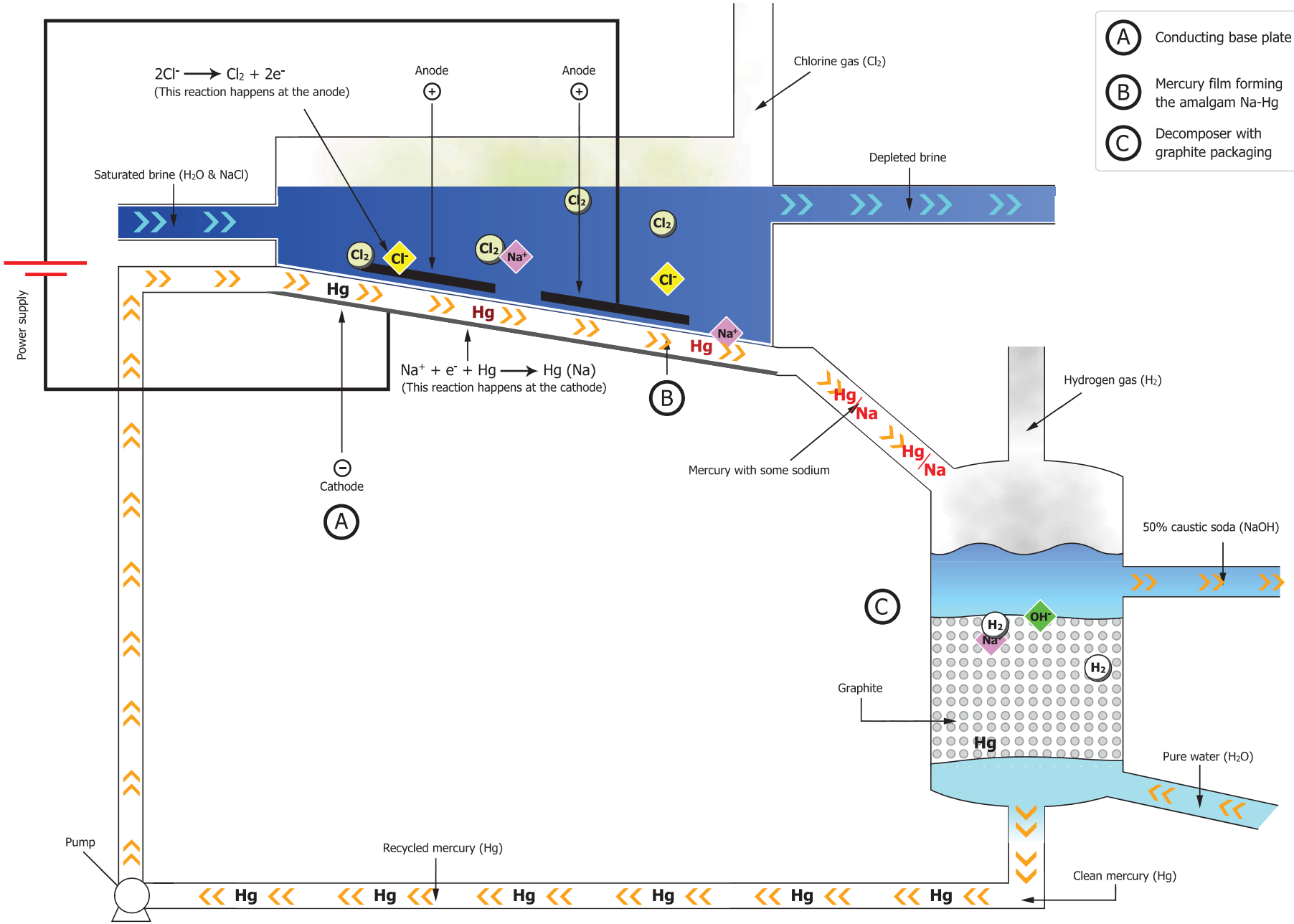
Aspect CONSULTING

General Operational Areas

GP West Site RI/FS - Bellingham, WA

DATE: Sep 2010	PROJECT NO. 070188
DESIGNED BY: SJG	
DRAWN BY: PPW	FIGURE NO. 2-1
REVISED BY: PPW	

Path: T:\projects_8\Port_of_Bellingham\Delivered\RI\2-1 OpAreas.mxd



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Mercury Cell Chlor-Alkali Process Diagram

GP West Site RI/FS
Bellingham, WA

DATE: Sep 2010	PROJECT NO.: 070188
DESIGNED BY: EUROCHLOR	
DRAWN BY: ---	FIGURE NO.: 2-2
REVISED BY: ---	

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3 RI Methods

This section provides a brief overview of the investigation methods employed during this RI. Appendix A provides details on the various field methods and includes logs for the explorations completed during the current RI.

In accordance with the Statement of Work under Agreed Order No. 6834, and described further in the RI/FS Work Plan, the primary tasks of the Site-wide RI/FS are as follows:

- Prepare RI/FS Work Plan (Aspect, 2009a);
- Conduct field data collection program;
- Evaluate new data and prepare RI Report (Volume 1 of RI/FS);
- Prepare FS Report (Volume 2 of RI/FS);
- Prepare RI/FS for Public Review; and
- Prepare Final RI/FS.

3.1 Field Data Collection Program

The RI data collection program outlined in the RI/FS Work Plan included two general phases, covering the period September 2009 through May 2010. Subsequent phases of data collection were conducted in December 2010 and February 2011 to support decision making and design of potential interim actions, as previously reported in the Interim Action Pre-Design Investigation Report (Aspect, 2011b). Finally, additional data collection was conducted in June through October 2011 to support interim action design, and this information is incorporated into this RI. The results from completion of the interim action are not included in this RI, but will be incorporated into subsequent FS documents.

3.1.1 RI/FS Work Plan Data Collection

The first, and largest, data collection effort occurred in September and October 2009, representing dry season conditions. The 2009 dry season data collection effort included the following:

- Completion of 49 soil borings with field screening of soils and nine vapor probes. Thirty-three of the soil borings were advanced through the Fill Unit into the top of the Tidal Flat Aquitard, whereas two borings were advanced through the Aquitard into the underlying Lower Sand. Beyond visual and olfactory observations, field screening included measuring soil pH during drilling within areas of suspected mercury contamination, and monitoring for volatile organic compounds (VOCs) using a photoionization detector (PID) while drilling within areas with suspected VOC contamination.
- From the soil borings, collection of 168 soil samples and six grab groundwater samples for a range of laboratory analyses based on constituents of potential

concern for the specific subarea being investigated (subareas described in Section 6). In addition, petrography analysis was conducted on four samples of the Fill Unit aquifer matrix from different parts of the former Chlor-Alkali plant area, to assess differences in matrix mineralogic assemblages and thereby better understand fate/transport of dissolved mercury in that area.

- Construction and development of groundwater monitoring wells in 23 of the soil borings. Twenty-one of the monitoring wells were screened within the Fill Unit, and two were screened within the Lower Sand Unit.
- Collection and chemical analysis of groundwater samples from 51 monitoring wells: 47 screened in the Fill Unit and four screened in the Lower Sand Unit.
- Collection and chemical analysis (total mercury) of nine soil vapor samples from shallow soil probes located immediately adjacent to soil borings located within the former Chlor-Alkali plant area.
- Completion of hydraulic conductivity testing (slug testing) in nine newly installed Fill Unit monitoring wells and the two newly installed Lower Sand Unit monitoring wells in and around the former Chlor-Alkali plant area.
- Completion of a 72-hour tidal study, in which groundwater levels were continuously monitored in ten Fill Unit monitoring wells and four Lower Sand monitoring wells, during a period of large tidal fluctuations in Bellingham Bay (October 19-21, 2009). For correlation, Puget Sound tidal data for the period of study were obtained from the NOAA tide station 9449424 at Cherry Point (http://tidesandcurrents.noaa.gov), just north of Bellingham Bay. In addition, tidal predictions for Bellingham Bay from the WTides v.3.1.7 software (http://www.wtides.com/) were also used in analysis. Barometric pressure was continuously monitored on Site during the tidal study, and used to correct water level data from each well.

In Spring (March through May) 2010, a supplemental data collection effort, conducted in accordance with the RI/FS Work Plan Addendum (Aspect, 2010a) was completed with the wet season groundwater sampling event included in the RI/FS Work Plan. The Spring 2010 field data collection effort included the following:

- Completion of 13 soil borings with field screening of soils and four vapor probes. Eight of the soil borings were advanced through the Fill Unit into the top of the Tidal Flat Aquitard. Beyond visual and olfactory observations, field screening during drilling included measuring soil pH within areas of suspected mercury contamination.
- From the soil borings, collection of 47 soil samples for a range of laboratory analyses based on constituents of potential concern for the specific Site subarea being investigated (subareas described in Section 6).
- Construction and development of groundwater monitoring wells in nine of the soil borings. These monitoring wells were screened within the Fill Unit.

- Collection and chemical analysis of groundwater samples from 65 monitoring wells: 61 screened in the Fill Unit and four screened in the Lower Sand Unit.
- Collection and chemical analysis (total mercury) of four soil vapor samples from shallow soil probes located within the former Chlor-Alkali plant area.
- Drilling, installation, and development of an additional monitoring well CP-MW12 based on field conditions observed within the former Chlor-Alkali plant area during the supplemental investigation, in accordance with a memorandum to Ecology (Aspect, 2010b);
- Completion of two 72-hour tidal studies, in which groundwater levels were continuously monitored in four Fill Unit monitoring wells from April 17-19, 2010, and eight Fill Unit monitoring wells from May 11-14, 2010. For correlation, Puget Sound tidal data for the period of study were obtained from NOAA tide station 9449424 at Cherry Point (http://tidesandcurrents.noaa.gov). In addition, tidal predictions for Bellingham Bay from the WTides v.3.1.7 software (http://www.wtides.com/) were used in analysis. Barometric pressure was continuously monitored on site during each tidal study and used to correct water level data from each well.

3.1.2 Interim Action Pre-Design Investigation

Based on the information from the RI work, additional investigation was conducted in the following four areas of the Site to evaluate the practicality and timing for conducting an interim action for one or more of the areas:

- Mercury source area of the Caustic Plume subarea;
- Law-1 area of the Confined Nearshore Fill/Chemfix subarea;
- Million Gallon Tanks subarea; and
- Bunker C Tank subarea.

The pre-design investigation scope was outlined in Addendum 2 to the RI/FS Work Plan (Addendum 2; Aspect, 2010c) and a follow-up memorandum to Ecology proposing a second phase of investigation (Aspect, 2011a). Ecology approved Addendum 2 and the proposed second phase investigation memorandum prior to the Port undertaking the respective phases of investigation.

The pre-design investigation included the following data collection activities:

- Caustic Plume Subarea: Installation and soil sampling of 16 soil borings, completion and groundwater sampling of three new Fill Unit monitoring wells, installation and soil gas sampling of six soil vapor probes, and collection of ambient air samples within the Mercury Cell Building (indoor air) and at an upwind location representing local background (outdoor air).
- Law-1 Area: Installation and soil sampling of five soil borings, completion of three new Fill Unit monitoring wells and three wellpoints along the intertidal shoreline, collection of groundwater samples from pre-existing and new locations

during two events, and collection of continuous water level data (tidal study) in three shoreline monitoring wells to refine understanding of local groundwater flow directions.

- Million Gallon Tanks subarea: Installation and soil sampling of eight soil borings, completion of two new Fill Unit monitoring wells, collection of groundwater samples from pre-existing and new wells, and installation and soil gas sampling of four soil vapor probes.
- Bunker C Tank subarea: Installation and soil sampling of twelve soil borings, completion of two new Fill Unit monitoring wells, collection of groundwater samples from pre-existing and new wells, and installation and soil gas sampling of four soil vapor probes.

3.1.3 Interim Action Design Investigation

Once the Port and Ecology agreed to conduct an interim action to include the Caustic Plume subarea and Bunker C Tank subarea, the following additional data collection was conducted to support interim action remedial design:

- In the Caustic Plume subarea, eight additional soil borings were conducted in the two locations where visible elemental mercury was targeted for removal in the interim action. The data were used to better delineate the extent of visible mercury and provide data to profile the contaminated soil for off-site disposal.
- A monitoring well was installed and hydraulically tested (pumping test) in each of the two interim action areas to provide aquifer parameter data for use in design of dewatering methods for the interim action soil excavation. Groundwater samples were also collected from each well during the pumping tests.
- Test pits were conducted within the footprint of the former Bunker C Tank to observe presence of subsurface concrete, pilings, and/or utilities that could affect the planned excavation.

The investigation approach was submitted to Ecology (Aspect, 2011c) for review and approval prior to start of work.

In October 2011, additional soil vapor sampling and analysis was conducted at the former Mercury Cell Building during the dry season (low water table conditions) to evaluate whether sub-slab soil mercury, in addition to known mercury on interior building materials, may be contributing to indoor air mercury concentrations measured within the Cell Building during the interim action pre-design investigation. The additional soil vapor sampling was requested by Ecology during review of the draft Interim Action Work Plan (Aspect, 2011d), and provided additional data for the RI/FS more so than the interim action. The vapor sampling approach was submitted to Ecology (Aspect, 2011e) for review and approval prior to start of work.

3.2 Quality Control

The RI data collection program included quality control (QC) provisions for both the sampling methods used in the field, and the analytical laboratory's standard operating procedures for conducting the chemical analyses. As quality assurance (QA), results from

the field and analytical QC provisions are incorporated into the data quality validation for the program. An overview of field and laboratory QC is provided below.

3.2.1 Field QC

Quality control for the RI field data collection (including interim action pre-design efforts) was accomplished through use of standardized sampling procedures outlined in the Sampling and Analysis Plan (SAP), included as Appendix C to the RI/FS Work Plan (Aspect, 2009a).

To sample groundwater for ultra-low-level mercury analysis (EPA Method 1631), EPA Method 1669 field sampling methods were employed. This involved two-person sampling teams wearing new non-talc gloves for each well ("clean hands, dirty hands" protocols), sampling wells in order generally from inferred areas of lower contamination to higher contamination, using acid-washed teflon and silicone tubing prepared by the analytical laboratory (double-bagged when not in use) and analytical-grade 0.45 µm filters recommended by the lab, purging at least 1 liter of well water through the filter before sample collection, and double-bagging sample containers after collection. All sampling equipment that contacted the groundwater sample was dedicated to the well and was non-metallic. EPA Method 1669 is performance based, with the success of limiting sample cross contamination based on results from field filtration blanks described below. Contamination was not detected in the filtration blanks, indicating the field sampling did not introduce cross contamination.

In addition, the field program included preparation of controlled QC samples (blanks) that were submitted for chemical analysis with the rest of the Site samples, in accordance with the Quality Assurance Project Plan (QAPP; Appendix D to the RI/FS Work Plan). The field QC samples included:

- **Temperature blanks** were included in many of the coolers, and used for temperature measurement upon arrival at the laboratory to assess whether the samples in the cooler were adequately cooled during transport. Where temperature blanks were not included in the cooler, temperatures of the cooler interior were measured and recorded upon arrival at the lab.

- **An equipment rinsate blank** was collected during the soil sampling program to determine the potential for cross contamination introduced by reusable sampling equipment between samples. The rinsate blank was prepared by rinsing deionized water across the decontaminated stainless steel bowl/spoon used for homogenizing soil samples, and collecting the water into sample containers for analysis of dissolved metals and PAHs. Because the analytical laboratory supplied the analytical-grade deionized water used for equipment decontamination during the RI field program, and the lab's deionized water was analyzed as method blanks for QC of all analyses conducted in the program, separate field blanks using that water were not prepared and analyzed.

- **A filtration blank** was prepared during each groundwater sampling round to monitor whether target contaminants are introduced during filtering of groundwater samples (for dissolved metals analyses). The filtration blank was prepared in the field by filtering reagent-grade deionized water provided by the

analytical laboratory in the same manner as that done for the field samples. The blank was analyzed for dissolved metals, including ultra-low-level mercury as the target contaminant of primary interest for cross contamination.

- **Trip blanks** were used to monitor possible VOC cross contamination occurring during the transport of samples. Trip blank samples were prepared by the laboratory using organic-free reagent-grade water in a VOC vial prior to the collection of field samples. The trip blank sample was placed in each cooler containing samples for VOC analysis and accompanied the samples through the entire transporting process. The trip blank samples were analyzed only for VOCs.
- **Field duplicate samples** were used to check for sampling and analysis reproducibility. Field duplicate samples were collected at a frequency of 10 percent of the soil and groundwater samples and each analytical method.

3.2.2 Laboratory QC

Chemical analyses for soil, groundwater, and soil vapor samples collected during the 2009-2010 field data collection program were conducted by analytical laboratories accredited by the State of Washington for those analytical procedures, and by the National Environmental Laboratory Accreditation Program (NELAP) for a comprehensive analytical laboratory accreditation. The laboratories conducted analyses in accordance with the accreditation programs, laboratory quality assurance manual, individual analytical methods, and the project-specific QAPP. The laboratory QC specifics are outlined in the QAPP.

The analytical data underwent independent data quality validation by Pyron Environmental of Olympia, Washington, under subcontract to Aspect, in accordance with QAPP requirements. The data validation reports for the RI data are included in Appendix H.