Remedial Investigation Report for Interim Action Work Plan Custom Plywood Site Anacortes, Washington

Prepared by AMEC under Agreement between the Washington State Department of Ecology and GBH Investments, LLC

September 2011
17330-27

STATE OF WASHINGTON DEPARTMENT OF ECOLOGY

HARTCROWSER

September 14, 2011

Project SE11160350

Mr. Steven Hoffman
Hart Crowser, Inc.
1700 Westlake Avenue North, Suite 200
Seattle, Washington 98109-6212

Subject: **Remediation Investigation Report**
Former Custom Plywood Mill
Anacortes, Washington

Dear Mr. Hoffman:

AMEC Geomatrix, Inc. (AMEC), has completed the Remedial Investigation (RI) Report for the Former Custom Plywood Site in Anacortes, Washington as a subconsultant to Hart Crowser, Inc., under the Washington State Department of Ecology (Ecology) agreement. The final RI report is enclosed.

AMEC produced the First Draft RI Report in June 2010, and Ecology approved this First Draft RI with no changes required to the content. In minor cases, clarifications have been made to the text where there are references to recent activities conducted in 2010 and 2011, including the Draft Feasibility Study and Draft Cleanup Action Plan for the 2011 interim actions, and the interim action debris removal and excavation activities that occurred in recent months.

This RI Report does not describe the 2011 interim action activities in detail, nor does it provide a timeline for future activities. Moreover, because the Draft Feasibility Study discussed a phase of supplemental sediment sampling and analysis activities conducted in 2010, AMEC did not incorporate those findings in the final RI Report. The public should refer to Ecology's website for updates on the project schedule and links to additional documents. The Ecology website URL is cited in Section 1.2 of the enclosed report.

This cover letter is intended to accompany the enclosed document and serve as a brief update on the RI activities. ***AMEC strongly recommends keeping the cover letter together with the RI Report***.

We appreciate the opportunity to provide this RI Report to you and Ecology. Please let us know if we can assist with anything in the future.

Sincerely yours,
AMEC Geomatrix, Inc.

Kathleen Goodman

Kathleen Goodman, LG, LHg
Principal Hydrogeologist

KG/ajs
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Enclosure: Remedial Investigation Report

cc: Project File

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REMEDIAL INVESTIGATION REPORT

Former Custom Plywood Mill

Anacortes, Washington

Prepared for:

GBH Investments, LLC
Anacortes, Washington

And

Washington State Department of Ecology
Lacey, Washington

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September 2011

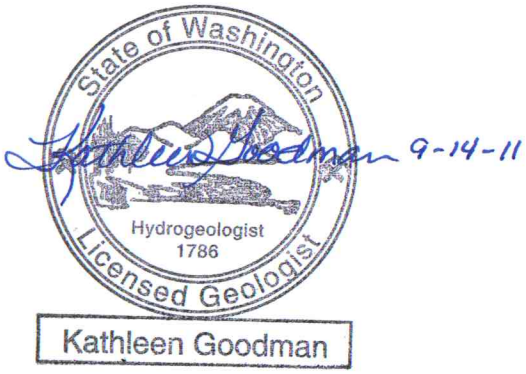
Project No. SE11160350

REMEDIAL INVESTIGATION REPORT
Former Custom Plywood Mill
Anacortes, Washington

September 14, 2011
Project SE11160350

This report was prepared by the staff of AMEC Geomatrix, Inc., under the supervision of the Geologist whose seal and signature appears hereon.

The findings, recommendations, specifications, or professional opinions are presented within the limits described by the client, in accordance with generally accepted professional engineering and geologic practice. No warranty is expressed or implied.



Kathleen Goodman, LG, LHg
Principal Hydrogeologist

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ACRONYMS AND ABBREVIATIONS

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
2LAET	second lowest apparent effects threshold
Agreed Order	Agreed Order DE 5235
AMEC	AMEC Geomatrix, Inc.
ARARs	applicable or relevant and appropriate regulations
ARL	acceptable risk level
AST	aboveground storage tanks
AUF	area use fraction
bgs	below ground surface
BMPs	best management practices
BNAs	base/neutral/acid compounds
BNSF	Burlington Northern Santa Fe
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Cleanup Action Plan
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLARC	Cleanup Levels and Risk Calculation
cm	centimeters
COPCs	constituents of potential concern
Corps	U.S. Army Corps of Engineers
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CSL	cleanup screening level
CSM	conceptual site model
DE	Document number
DGPS	differential global positioning system
DLCs	dioxin-like compounds
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
EE/CA	Engineering evaluation/cost analysis
EIM	Environmental Information Management
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
ERT	Environmental Response Team
°F	degrees Fahrenheit
FS	feasibility study
ft^2	square foot
ft^3	cubic feet
g	gram
GBH	GBH Investments, LLC
Geomatrix	Geomatrix Consultants, Inc.
HASP	Health and Safety Plan
kg	kilogram
LAET	lowest apparent effects threshold
m	meter

ACRONYMS AND ABBREVIATIONS
(Continued)

m^2	square meter
MCL	maximum contaminant level
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MHHW	mean higher high water
Mill	Former Custom Plywood Mill facility
MLLW	mean lower low water
µm	micrometer
mph	miles per hour
msl	mean sea level
MTCA	Model Toxics Control Act
NAD83	North American Datum of 1983
NAS	National Academy of Sciences
NAVD88	North American Vertical Datum of 1988
ng/kg	nanograms per kilogram or parts per trillion
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWRO	Ecology Northwest Regional Office
OHWM	ordinary high water mark
OnSite	OnSite Environmental Laboratories, Inc.
PA	preliminary assessment
PA/SI	Preliminary Assessment/Site Inspection
PAHs	polycyclic aromatic hydrocarbons
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCBs	polychlorinated biphenyls
PCP	pentachlorophenol
PDA	City of Anacortes Public Development Authority
pg	picogram (10^{-12} gram)
pg/g	picograms per gram
PID	photoionization detector
PLP	potentially liable parties
POC	point of compliance
POD	point of departure
pptr	parts per trillion
PQL	practical quantitation limit
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
PSI	Puget Sound Initiative
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act

ACRONYMS AND ABBREVIATIONS
(Continued)

RI	remedial investigation
RI/FS	remedial investigation/feasibility study
SAP	Sampling and Analysis Plan
SI	site inspection
SIM	selected ion monitoring
Site	Area of contamination caused by releases from former Custom Plywood Mill, 35th Street and V Place, Anacortes, Washington
SMS	Sediment Management Standards
SPCS	State Plane Coordinate System
SPOC	standard point of compliance
SQS	sediment quality standards
START	Superfund Technical Assessment Response Team
SVOCs	semivolatile organic compounds
TDL	target distance limit
TDS	total dissolved solids
TEE	terrestrial ecological evaluation
TEFs	toxicity equivalent factors
TEQ	toxicity equivalent quotient (equivalent to "TEC" – Toxic Equivalent Concentration [WAC 173-340-708(8)(d)] [Ecology, 2007])
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TPH-D	total petroleum hydrocarbons, diesel range
TPH-G	total petroleum hydrocarbons, gasoline range
TPH-Oil	total petroleum hydrocarbons, heavy oil range
TVS	total volatile solids
U&A	usual and accustomed
USCS	Unified Soil Classification System
VCP	Voluntary Cleanup Program
VOCs	volatile organic compounds
VPH	volatile petroleum hydrocarbons
WAC	Washington Administrative Code
WDFW	Washington Department of Fish & Wildlife
Work Plan	Final Remedial Investigation/Feasibility Study Work Plan, Former Custom Plywood Mill, Anacortes, Washington

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REMEDIAL INVESTIGATION REPORT
Former Custom Plywood Mill
Anacortes, Washington

EXECUTIVE SUMMARY

On behalf of GBH Investments, LLC (GBH), and in accordance with Agreed Order DE 5235 (the Agreed Order), AMEC Geomatrix, Inc. (AMEC), prepared this Remedial Investigation (RI) Report for the former Custom Plywood Mill (the Mill) located on Fidalgo Bay in Anacortes, Washington. The purpose of this RI is to identify the nature and extent of contaminated soil and groundwater in the upland, and sediments in the intertidal and submerged lands. This RI report was prepared under the direction of the Washington State Department of Ecology (Ecology) and the Puget Sound Initiative in accordance with the Agreed Order.

The former Mill site has remained mostly undeveloped since 1992, when the majority of the buildings were destroyed by fire. The area occupied by the former plywood plant was once greater than the property currently owned by GBH, and several parcels on the periphery of the former plant have been sold and redeveloped. Parcels owned by GBH constitute the largest land and marine portions of the former plywood mill operation and remain impacted by contaminants. The GBH parcels are the primary subject of this RI. Other owners of parcels formerly occupied by the Mill include the City of Anacortes, North Harbor Diesel, John and Jennifer Andrews, and Cimarron Trucking.

The GBH parcels, and the other former Custom Plywood parcels not owned by GBH, are zoned for industrial use. Along the southern boundary of the GBH parcels is an undeveloped embankment leading uphill to Fidalgo Bay Road. Across from Fidalgo Bay Road and up the steep embankment from the southwest portion of the GBH parcels are several residential properties zoned R2 (residential low density) and R3 (residential medium density).

Until 2007, successive limited site investigations and interim actions were conducted independently or under the Voluntary Cleanup Program (VCP) program without the benefit of formal Ecology involvement or oversight. Environmental studies at the site were initiated in 1993. Phase I and limited Phase II site assessment studies were conducted in 1995 that included soil sampling from areas with the highest likelihood of contamination. Significant concentrations of hydrocarbons, particularly heavy oils, were found in shallow soils around the press pits and the compressor house in the central part of the property. Studies from 1995 to 2003 found localized occurrences of polychlorinated biphenyl compounds (PCBs), and inorganics (arsenic, cadmium, chromium, lead, and mercury) around the former boiler house,

and petroleum hydrocarbons in the former hog fuel area. In 1997 the City of Anacortes undertook a soil remediation project on their former upland property on Tract 4, next to what was the Hardboard Plant and is now a yacht manufacturing building. In 2007, 1,500 tons of soil were removed within the upland areas of Tracts 5 and 6, while remediation of the southern portion of the upland area was being planned to coincide with redevelopment. This 2007 soil cleanup was conducted as an independent interim action and was implemented where contaminants were known to exceed Method A cleanup levels on the northern part of the site. After the interim action in 2007, Ecology required the subsequent work to be conducted within the Puget Sound Initiative (PSI) program under an Agreed Order to be consistent with the approach at other PSI-lead sites in Fidalgo Bay.

Formalized cooperation between Ecology and GBH began in early 2008 with the signing of the Agreed Order (DE 5235). Since that time, the remedial investigation planning and implementation occurred from the early summer of 2008 to late summer of 2009. This phase of remedial investigation included the following multimedia sampling and analysis.

- Soil samples were collected from 58 push-probe borings and nine groundwater monitoring wells.
- Groundwater samples were collected from nine newly installed and two pre-existing monitoring wells, one temporary well, and four seeps.
- Nine test pits were dug in the intertidal zone for characterization of fill material and for archaeological monitoring.
- Five test pits were dug on the western property boundary for an assessment of archaeological resources.
- Marine sediments were sampled at 32 locations and analyzed using a tiered approach, which included several bioassay tests and chemical analyses.
- Two soil samples were collected for a terrestrial ecological evaluation by soil bioassay.

Based on the remedial investigation work through 2009, soils at the site are primarily fill materials from about 5 to over 20 feet in thickness. These fill materials overlie a layer of gray clayey sediment that is highly compacted and dense. This clayey unit is the native material that formed the tidal flats on which the Mill was built around 1900. The fill material on the GBH property appears to consist of two types, which have been designated the Upper Fill Unit and the Lower Fill Unit. The Upper Fill Unit consists of silty sand with gravel, brick, concrete fragments and burned building debris; the Lower Fill Unit is composed of predominantly fine-grained wood (sawdust to bark chip-sized) with scattered logs.

A shallow groundwater zone occurs in the fill units and was sampled as part of this investigation. Monitoring wells were installed within the fill units to evaluate the tidal influence on the groundwater. Results indicated that the groundwater is more impacted by marine water in the nearshore wells, with an attenuated impact with increased distance from the shoreline. The groundwater flow direction is affected by the tidal cycle, but at low tide the flow direction is toward the east-northeast. Due to high concentrations of total dissolved solids in the groundwater at the site, the groundwater does not meet the criteria for use as a potable water supply.

Results of the 2008 to 2009 investigations indicate that detectable concentrations of inorganic constituents (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc) are present in the fill units above preliminary screening levels. The inorganic constituents are generally not distributed or concentrated such that it would point to a widespread use of metals in the historical industrial processes. Rather, the distribution and relatively low concentrations are more indicative of typical historic uses of paints (historically containing lead and other metals), use of metal equipment, and natural occurrences in wood and in the area's geologic units.

Organic constituents that were detected in the soils above screening levels included numerous areas of petroleum in the diesel and oil ranges, but only localized occurrences of PCBs (one occurrence), pentachlorophenol (PCP) (one occurrence), and dioxins and furans. The dioxins and furans likely originated due to combustion, probably related to the burning of salt-water-affected wood. In addition, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), constituents of creosote, are present at the site due to the widespread use of fill of poor structural quality, which resulted in the construction of many structures on pilings, many of which were made with creosote-treated wood.

Concentrations of inorganic constituents in groundwater were generally below screening levels, except arsenic, copper, and nickel were frequently above screening levels. One well yielded a single exceedance of zinc above the screening level.

Very few organic constituents were found in groundwater. Only one groundwater sample exhibited detectable levels of total petroleum hydrocarbons (TPH) as diesel, however, it was below the screening level of 0.5 milligrams per liter (mg/L). None of the wells or recent groundwater grab samples had any TPH as lube oil in excess of the screening level, with the exception of one 2008 seep sample. Volatile organic compounds (VOCs), PCBs, and PCP were generally not detected or were below screening levels.

Chemical analysis of the sediment indicated no exceedances of Sediment Management Standards (SMS) standards and no clear chemical explanation for the bioassay failures. Portions of the aquatic area with little or no eelgrass development can likely be attributed to the presence of surface debris from the collapsed structures. There are also areas of elevated dioxin/furan concentrations in the sediments that are likely associated with combustion of building materials and wood.

Current potential upland receptors are terrestrial biota and human workers engaged in excavation activities at the GBH property or exposed to surface water through ingestion, inhalation, or direct contact. The GBH property is restricted from public use by a fence, and only personnel trained in health and safety procedures are allowed on the property by the owner. Terrestrial biota cannot be restricted from trespassing; however, future land uses will restrict the exposed surface area of the property to only those areas that meet terrestrial ecological cleanup levels.

Marine receptors are fish and shellfish, birds, amphibians, and upper tropic level predators, such as humans and aquatic species. Currently, the intertidal zone is too cluttered with coarse building debris for any human or marine predator to forage for shellfish or other burrowing biota. Below the surface layer of debris is a layer of wood ranging in size from sawdust to large pieces of logs.

Soil, groundwater, and sediments that are impacted with the identified constituents of potential concern (COPCs) and with debris and wood fill materials will be evaluated in the feasibility study (FS) within a range of remedial alternatives. The remedial alternatives to be considered include excavation and off-site disposal, capping, containment, and monitored natural attenuation. A detailed analysis of each remedial alternative will be conducted according to the requirements of Washington Administrative Code (WAC) 173-340-350, and further evaluated under the requirements of WAC 173-340-360.

Remediation of the GBH property uplands will impact the small wetlands identified on the property; and mitigation to offset any wetland impacts will be conducted. Mitigation could involve the creation of a new wetland area equal in size to the impacted area. The newly created wetland would be designed to immediately provide higher functions and values than the function and values of the current wetlands.

REMEDIAL INVESTIGATION REPORT
Former Custom Plywood Mill
Anacortes, Washington

1.0 INTRODUCTION

On behalf of GBH Investments, LLC (GBH), and in accordance with Agreed Order DE 5235 (the Agreed Order), AMEC Geomatrix, Inc. (AMEC), has prepared this Remedial Investigation (RI) Report for the former Custom Plywood Mill (the Mill) located on Fidalgo Bay in Anacortes, Washington (Figure 1). The Mill is listed on the Washington State Department of Ecology (Ecology) Hazardous Sites List as Facility Site ID 2685 (the Site). The purpose of this RI is to identify the nature and extent of contaminated soil and groundwater in the upland and contaminated sediments in the submerged lands.

This RI report was prepared under the direction of Ecology and the Puget Sound Initiative (PSI) in accordance with the Agreed Order. A portion of the funding for this study was contributed by the U.S. Environmental Protection Agency (EPA) through a grant to Ecology.

The former Custom Plywood Mill is one site of about a dozen sites within Fidalgo Bay and nearby Padilla Bay that are being investigated and cleaned up with oversight by PSI.

1.1 DEFINITION OF THE SITE

Primarily because of environmental concerns, a large portion of the former Custom Plywood Mill has remained undeveloped since 1992, when the majority of the buildings were destroyed by fire. The area occupied by the former plywood plant was once greater than the property currently owned by GBH, and several parcels on the periphery of the former plant have been sold and redeveloped. Parcels owned by GBH constitute the largest land and marine portions of the former plywood mill operation and remain impacted by contaminants. The GBH parcels are the primary subject of this RI. However, properties not owned by GBH that were formerly part of the original plywood mill will be discussed within this RI Report to the extent that environmental information is known about those properties. For purposes of this RI Report, the “Site” is defined by the extent of contamination caused by the release of hazardous substances from the former Mill, and includes areas encompassing the footprint of the former plywood mill operation at its maximum extent during operation, offshore areas used for log storage, and locations to which contaminants have migrated.

The historical activities, including 1992 inferno at the facility, resulted in a release of hazardous substances that impacted the current GBH-owned property and adjacent properties, and

natural features in the area such as the shore of Fidalgo Bay. The affected areas subject to potential cleanup action, whether GBH property or otherwise, are collectively referred to as "the site" in this RI report. GBH's property is referred to as "the facility" and Figure 2 shows the general layout and boundaries of the facility. The facility covers approximately 6.6 acres of upland and 34 acres of tidal areas.

For purposes of this RI report, the site is defined by contamination detected in soil, sediment, surface water or groundwater samples exceeding the cleanup levels defined by both Model Toxics Control Act (MTCA) cleanup regulation (Chapter 173-340 WAC) and Sediment Management Standards (Chapter 173-204 WAC). The boundaries of the site will be adjusted based on RI field sampling results and be readjusted based on additional sampling that might occur during remedial design and compliance monitoring, after a final cleanup action is selected. Boundaries of the site will be adjusted to avoid cutting through property lines, as possible.

1.2 OBJECTIVES AND SCOPE OF WORK

The goals of this RI Report are to:

- Demonstrate that the data collected for this investigation are in compliance with the sampling protocols and approaches outlined in the Final Remedial Investigation/Feasibility Study (RI/FS) Work Plan (AMEC, 2008) (Work Plan) and subsequent supplemental sampling plan (AMEC Geomatrix, April 2009);

- Define the nature and extent of contamination at the site such that a feasibility study (FS) can be developed to evaluate remedial options on the impacted areas of uplands and sediments; and

- Summarize information from the RI and previous interim remedial actions that were conducted independently and under Voluntary Cleanup Program (VCP).

The MTCA regulations (WAC Chapter 173-340) require potentially liable parties (PLPs) to characterize the nature and extent of hazardous substances as defined in WAC 173-340-200. In addition, the Washington State Sediment Management Standards (SMS; WAC 173-204) require PLPs to characterize the nature and extent of any toxic effects or other deleterious substances in sediment. PLPs are required to compile this information into an RI for Ecology review. For portions of this site that exceed applicable MTCA and/or SMS cleanup levels, Ecology has developed and evaluated cleanup alternatives and identifies a preferred alternative in the FS under the Ecology-lead Interim Action Work Plan.

Documents relating to this project that are released to the public will be available for review in the following repositories and will be posted in electronic form on Ecology's website:

http://www.ecy.wa.gov/programs/tcp/sites/custom_ply/custom_ply_hp.htm

Anacortes Public Library
1220 10th Street
Anacortes, Washington 98221

Washington State Department of Ecology
300 Desmond Drive SE
Lacey, Washington 98503

The Ecology website can be searched using the Facility ID #2685 or the Cleanup ID #4533. The work that has been conducted since the Work Plan was finalized in 2008 was done in accordance with detailed plans that can be found in the appendices of the Final RI/FS Work Plan (AMEC, 2008). These Appendices include Appendix A (Uplands Sampling and Analysis Plan), Appendix B (Sampling and Analysis Plan for Sediment Characterization), and Appendix C (Site-Specific Health and Safety Plan [HASP]).

1.3 PROJECT COMMUNICATIONS

The site representative for the project and one of the owners of the GBH property is Mr. Richard (Bud) LeMieux of GBH. Mr. LeMieux may be contacted at:

GBH Investments, LLC
Richard "Bud" Lemieux
13941 Gibralter Road
Anacortes, WA 98221
(360) 630-6015
nmibud@wavecable.com

AMEC assisted GBH with the environmental science and engineering aspects of the RI. The project manager for AMEC is Kathleen Goodman and the project engineer is Dr. Larry McGaughey; they may be contacted at:

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Communications from the public regarding the project can be directed to Ecology's project personnel as follows:

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1.4 REPORT ORGANIZATION

This RI report is organized as follows:

- **Section 2.0:** a description of the Site, history, background, and an overview of findings of the previous investigations and interim remedial actions conducted independently and under the VCP at the Site;
- **Section 3.0:** a description of the environmental setting, including the geologic and hydrogeologic conditions, the aquatic areas, and the ecologic setting;
- **Section 4.0:** a description of the current land use, potential contaminant transport mechanisms, and potential exposure pathways;
- **Section 5.0 :** a discussion of the approaches used in the investigations, sample collection techniques and data quality assessment;
- **Section 6.0:** an overview and evaluation/findings of the previous investigations, interim remedial actions, and the 2008-2009 investigation activities culminating in a discussion of the nature and extent of contamination, including a list of COPCs;
- **Section 7.0:** an outline of data quality objectives for the RI; a discussion of indicator hazardous substances;
- **Section 8.0:** a conceptual site model and release/transport mechanisms;
- **Section 9.0:** a discussion of terrestrial and human health risks, including populations, exposure pathways, and quantification of exposure;
- **Section 10.0:** proposed preliminary screening levels and a discussion of points of compliance;
- **Section 11.0:** a summary of locations and media to be addressed in the FS;
- **Section 12.0:** a description of the extent of the Site covered by concrete blocks/debris and sawdust;
- **Section 13.0:** Report limitations; and
- **Section 14.0:** A list of references cited in this report.

2.0 SITE DESCRIPTION AND HISTORY

This section presents a description of the property, the Mill's operational history, Site regulatory and compliance history, and a summary of previous investigations and cleanup actions that have been conducted at the Site.

2.1 LOCATION

The former Custom Plywood Mill is a former sawmill and plywood manufacturing plant that was largely destroyed by fire in November 1992. The property is located at 3311 V Place on the western shore of Fidalgo Bay, within the city limits of Anacortes, Washington (Figures 1 and 2). The former Custom Plywood Mill is situated at latitude 48°29'40" North, longitude 122°36'04" West (approximate location of the former boiler house), in Section 30, Township 34 North, Range 2 East, in Skagit County, Washington. The portion of the former plant owned by GBH comprises an irregularly shaped parcel that covers approximately 6.6 acres of upland and 34 acres of tidal areas. According to the Skagit County Assessor's records, portions of the former Custom Plywood plant that are currently owned by other parties comprise roughly 7 upland acres and 1.3 tideland acres.

The elevation of upland parcels of the site is approximately 10 to 30 feet above mean sea level (msl). Each parcel is relatively flat or slopes slightly downward toward Fidalgo Bay. Breaks in slope between the various parcels are evidenced by low retaining walls or steepened vegetated slopes.

Fidalgo Bay is an ancient delta of the Skagit River that was abandoned by the river and currently has no significant fresh water stream input. Water depths in Fidalgo Bay are shallow, and generally less than 12 feet below mean lower low water (MLLW). Tidal fluctuation within Fidalgo Bay can vary from -3 feet to +12 feet msl.

Historically, tracts have been defined to identify different portions of the uplands and nearshore areas of the site and vicinity (Figure 2). Marine areas owned by GBH within Tracts No. 5 through 10 extend out to the Inner Harbor Line. Intertidal and subtidal lands within Tract No. 4 out to the Inner Harbor Line are owned by the City of Anacortes. Submerged lands between the Inner Harbor and Outer Harbor Lines are owned by the State of Washington and managed by the Department of Natural Resources (DNR). Historically, some of these DNR-managed marine areas were leased by the plywood mill for rafted log storage.

2.2 HISTORICAL SITE USE

This section presents a brief history of site operation and ownership, and the history and characteristics of surrounding properties. The current layout of the Site vicinity is shown in

Figure 3. Historical features discussed in this document are shown in Figure 4. The main historical features of the former Mill plant are visible on an aerial photograph taken in 1966 (Figure 4).

2.2.1 Site Ownership

The property was originally developed as a saw and planing mill operated by Fidalgo Mill Company from around 1900 until it burned down sometime after 1925 and prior to 1937. Bill Morrison acquired the property in 1913 and owned it until it was purchased around 1937 by Anacortes Plywood Company. The newly incorporated plywood company failed early on, but was able to reorganize as the Anacortes Veneer Company on April 4, 1939 (Plywood Pioneers Association, 1978). Anacortes Veneer Company operated on the property until it was sold to Publisher's Forest Products in 1969. In 1984, Anacortes Plywood assumed control of the plant. Brent Homes assumed title out of bankruptcy proceedings in January 1991. Custom Plywood became the operating entity sometime prior to 1991 and continued to use the facility until 1992. Most of the wooden structures in the main plant area, many of which were built in the 1940s, were consumed in a fire that occurred on November 28, 1992.

In February 1999, Brent Homes granted a quit claim to Anacortes Joint Venture. Anacortes Joint Venture owned the remaining portion of the Site until May 2006, when it was purchased by Concorde, Inc. In December 2007, Concorde sold the main portion of the former Mill property to GBH. Following cleanup, GBH intends to use the property for yacht storage and sales, and long-term plans are for yacht repair and renovations. Except for the parcels that have been sold and redeveloped, the main portion of the former plant property has been unused since 1992. The Skagit County Assessor's records show the parcels owned by GBH as P33196, P33197, P33198, P33199, P33208, P33209, and P33210. GBH was not involved in any of the activities that contributed to contamination of the Site, having purchased former Mill property parcels in December 2007, 15 years after industrial activities ceased.

At its maximum size, the plywood plant included several parcels not currently owned by GBH (Figures 2 and 4) that are located north and west of the main plant area that was acquired by GBH in 2007. One large piece of the original property was sold in 1984 when the City of Anacortes purchased the northernmost parcel (currently Parcels P33189, P199600, P199601, P199602, and a portion of P33211) located within Tract No. 4. After the 1992 fire, other portions of the former Mill property that had not sustained fire damage were sold to different owners, including the former hardboard plant (currently in use by Northern Marine), the former office building (currently in use by Cimarron Trucking), and the former machine shop with the attached former resin/caustic aboveground storage tank (AST) shed (also currently in use by Cimarron Trucking).

The City of Anacortes conducted remediation of the Tract No. 4 uplands, north of the main plant area, in September 1998. Remediation and confirmation groundwater monitoring occurred on what is currently depicted as parcels P119602, P33211, and P33189. After conducting the required long-term groundwater monitoring, the City obtained a "no further action" status through Ecology's Voluntary Cleanup Program (VCP). In October 2002, the City broke up the property into the current parcel layout and sold parcels P119602 and P33189. Parcel P33189 was sold to North Harbor Diesel LLC. Howard and Pamela Bean of Anacortes currently own a portion of the Tract No. 4 uplands (Parcel P33189; purchased in May 2005) and operate dry boat storage under the name North Harbor Diesel. Ownership of the riprap bulkhead and marine area of Tract No. 4 out to the Inner Harbor Line was retained by the City of Anacortes (Parcels P119600 and P119601), and the City of Anacortes owns the V Place right-of-way (Parcel 33211). The V Place roadway was constructed in about 2003.

The Skagit County Assessor's records show parcels P33056, P33194, and P119602 belonging to Joseph and Jennifer Andrews of Santee, California. The former hardboard plant was sold in July 1999 and ownership transferred from Anacortes Hardboard Investments, Inc., to the Andrews. Up until 2009, it was leased by Northern Marine for the manufacture of luxury yachts. Parcel P119602 was previously a portion of the former City of Anacortes-owned Tract No. 4 and the location of the majority of the remediation activities that were conducted in 1998. Parcel P119602 was sold to the Andrews in 2004, and is currently used as a parking lot for Northern Marine. Documents available on Skagit County's iMap website indicate that parcel P33056 (the former Credit Union building) was purchased in 2009 by the Grimm Living Trust, with trustees Joseph and Carolyn Grimm, a nearby property owner.

A third portion of the former plywood mill encompassing the former mill office, machine shop, and the resin/caustic storage tank buildings was sold in August 1998 and ownership transferred from Brent Homes, Inc., to Ray Sizemore of Cimarron Trucking (Parcel P33055). Cimarron Trucking has extensively refurbished the buildings, including removing the resin/caustic tanks, and added facilities for truck storage.

Along the west boundary of the current GBH property lies the Tommy Thompson Trail, a public multi-use trail. The trail occupies the former right-of-way (Parcel P112899) for the Burlington Northern Santa Fe (BNSF) rail line that historically connected downtown Anacortes with the petroleum refineries to the east and the main track to Burlington. The City of Anacortes purchased a 4-mile portion of the rail line in August 1997 from the BNSF railroad (formerly Great Northern Railway Co.). To construct the trail, the City's contractor removed the tracks, cross ties, and unsuitable ballast to approximately 15 inches below ground surface (bgs), but to a depth of approximately 30 inches in the vicinity of the former machine shop. The trail was excavated at least 16 feet wide. A geofabric was laid, new subbase ballast placed on top, and

a minimum 2-inch asphalt pavement was laid above the new ballast to form the trail (City of Anacortes, 2008).

2.2.2 Site Operations

The manufacturing process used at the plant involved drying veneer (purchased in Canada, Oregon, Montana, and eastern Washington) in one of two kiln dryers heated by hog-fuel boiler steam (EPA, 2000). The graded veneers were glued together and then pressed by three large, hot-plate hydraulic presses (identified as Press Pits #1 to #3 on Figure 3). Glue rollers were coated with wax prior to rolling to minimize the use of cleaning solvents. Toluene was used to clean the glue application nozzles and tips. There is no indication, historical or chemical, that wood preservatives, such as pentachlorophenol (PCP), were used in the manufacturing process at the plant; the only wood preservative that exists on the Site is creosote that was used on wood piles and timbers to support the plant structures. The manufacturing operations reached their highest capacity in about the late 1960s, when the annual production capacity was about 150 million square feet (Plywood Pioneers Association, 1978). A steep decline in the locally available timber supply led to an increase in raw materials costs, and to the eventual failure of the company.

The main plant area (currently owned by GBH) was the location of the portion of the plywood mill that contained three hot plate hydraulic presses, a hog-fueled boiler house, a compressor house, a glue tank surrounded by a concrete pad, a propane tank, a paint storage area, a pitch collection tank, and piers (Figure 4). According to a historic map cited in the 1995 Phase I site reconnaissance (Enviros, 1995a), two aboveground fuel oil (18,000 gallon and12,000 gallon) and one 300-gallon diesel tank were located in the compressor area, but facility personnel interviewed at the time did not recall any ASTs since 1969. Prior to the fire in November 1992, much of the plant was built on piles over the intertidal marine area. Currently, the only visible structures remaining in the tideland area are concrete structures, wood pilings, roof remnants, and a large, L-shaped concrete platform that supported the former hardboard plant building (Figure 2). Concrete foundations for the compressor building, boiler house, and hydraulic presses (labeled press pits #1, #2, and #3 in figures) remained in the uplands portion of the site until 2011 (Figure 3). Three outfalls were used by the plywood mill, although only the northern outfall (Outfall #003) can still be seen at low tide; the other two outfalls have not been found and may have been buried or destroyed during the collapse of the building during the fire in 1992.

The three press pits formerly contained hydraulic presses that glued and pressed thin wood sheets (or plys). This area contains the concrete remnants of three separate concrete pits that housed 1,000-gallon hydraulic pumps. The press pits were designed to contain the hydraulic equipment and collect hydraulic leaks during operations. The press pits are numbered 1, 2,

and 3 from north to south. Press pit #1 was essentially a concrete foundation with no catchment basin remaining. Press pit #2 had an opening at the top and an approximate capacity of 3,000 cubic feet (ft^3). Press pit #3 had the largest aboveground area, was also open at the top, and had an approximate capacity of 6,000 ft^3.

According to an Ecology inspection report (Ecology, 1992), the glue-making process used phenolic resin and caustic that was shipped in by truck and stored in ASTs that were located in the shed adjoining the former machine shop. Three tanks were used in the glue-making process: one mixing tank, one intermediate process tank, and one finished product tank. The finished product tank was connected to a pump to supply the glue to the mill. Approximately 20,000 gallons of phenolic resins and caustic were used each month in the glue-making process in the main plant building. The caustic and resin ASTs were located on the property now owned by Ray Sizemore of Cimarron Trucking. Mr. Sizemore had the ASTs removed, and remodeled the former machine shop building several years ago. He also extensively remodeled the former office building and currently uses it as the headquarters for Cimarron Trucking. The City of Anacortes removed soil in this area during the preparation of the sub-base for the Tommy Thompson Trail. More information regarding the sample results from the area between the former ASTs and the trail can be found in Sections 2.5.1 and 6.1.1.2.

A mixed glue tank was located near the southern edge of the uplands area. During mill operations, this tank contained 10,000 gallons of glue wash water, which was separated from the sediments in the tank and recycled back into the process. The resulting tank sediments were transferred by truck to the hog-fuel pile and burned. In 1989, Ecology expressed concern about surface staining around the mixed glue tank (see discussion in Section 2.4.1).

Tract 4 (historic Parcel P33189) was an area of tidal flats (see Figure 4) and was used for floating log storage by the plywood mill until the early 1970s, when a new bulkhead was installed and the parcel was filled with dredged sediments from the nearby shipping channel maintained by the U.S. Army Corps of Engineers (Corps). From 1984 to 2002 the parcel was owned by the City of Anacortes. In September 1998 the City of Anacortes successfully removed and disposed of 1,939 tons of soil contaminated with petroleum hydrocarbons from the site under Ecology's VCP (see Section 2.6.1). Subsequent to the cleanup, the City of Anacortes built the V Place roadway and split the parcel into multiple parcels. Joe and Jennifer Andrews own the newly created parcel P119602, where the majority of the remedial excavation occurred. North Harbor Diesel is currently operating the other upland portion of historic parcel P33189 (currently P33189) for small yacht and equipment storage.

According to the Skagit County tax records, the original hardboard plant was built in 1951. It was built to manufacture a trademarked product called "Armorbord" (Plywood Pioneers

Association, 1978). A 15,500-square foot (ft^2) addition to the former hardboard plant was constructed on the south side of the former hardboard building in about 2001. This addition was placed in the area of the former location of a large group of transformers that had been used by the plywood plant. The transformers were removed from this location in early 1997 without using appropriate decommissioning procedures. In May 1997, the EPA oversaw an investigation to determine whether transformer oil containing polychlorinated biphenyls (PCBs) had been released during removal of the transformers. Details of this investigation are provided in Section 2.5.8.

Following the cleanup and sale of the uplands portion of Tract No. 4 in 2002, the City of Anacortes constructed the V Place roadway that now forms the northwestern boundary of the GBH parcels. In 2004 the City constructed the Tommy Thompson Trail over the former rail right-of-way.

2.3 CURRENT LAND USE AND FUTURE REDEVELOPMENT PLAN

The former Custom Plywood plant includes a number of parcels outside of those that are currently owned by GBH (Figure 2) that are located north and west of the main plant area. The northern piece of the original plant property was sold in 1984, when the City of Anacortes purchased the parcel located within Tract No. 4. Upland portions of the City of Anacortes' property are now owned by North Harbor Diesel and used for dry boat storage. Other portions of the former mill area were sold to different owners, including the former hardboard plant (in use by Northern Marine for yacht building), the former office building and former machine shop (currently in use by Cimarron Trucking).

2.3.1 Current Land Use

The site, which includes the GBH-owned parcels and the other former Custom Plywood parcels not owned by GBH, is zoned for industrial use. Maintaining the current industrial zoning is a priority for the City and is part of the City of Anacortes Comprehensive Plan. Industrial zoning extends from the former Custom Plywood property on 34th Street as far north as 29th Street.

Along the southern boundary of the GBH parcels is an undeveloped embankment leading up to Fidalgo Bay Road. Across from Fidalgo Bay Road and up the steep embankment from the southwest portion of the GBH parcels are several residential properties zoned R2 (residential low density) and R3 (residential medium density).

Upland areas of the site, with the exception of the GBH property, are developed. Currently, the neighboring industrial properties on the north and northwestern sides of the GBH parcels are used for yacht building and storage, and are therefore compatible with the future intended

use of the GBH parcel as a marine-dependent industrial facility. Cimarron Trucking, on the west side of the GBH parcel, houses an office and dispatch facilities for large trucks. On the western and southwestern edge (Tracts No. 6-8) of the GBH parcels is an asphalt-paved multi-use trail built on a former rail line easement historically used by the Custom Plywood plant.

2.3.2 Future Redevelopment Plan

The Shoreline Management Act (Act; RCW 90.58) was enacted to provide for the management and protection of the state's shoreline area resources by planning for reasonable and appropriate uses. The law provides a planning and regulatory program by the state and local government. By law, the City of Anacortes (City) is responsible for the preparation of a "Master Program" in accordance with the policies and requirements of the Act and the State Shoreline Guidelines (WAC 173-26) and development of a permit system in accordance with the requirements of the Act. The City is in the process of revising its Shoreline Master Program, which regulates all development projects. The future development of the GBH property will need to be compliant with the Shoreline Master Program. Future development of the property is likely to require a shoreline Substantial Development Permit (SDP), although, depending on the scope, a Shoreline Conditional Use Permit or a Shoreline Variance from the provisions of the Master Program may be required. Review under the State Environmental Policy Act (SEPA) may also be required.

Current use of the GBH property as a boat storage and sales facility is temporary until the soil cleanup work is complete and permitting is approved for the redevelopment. Future redevelopment planning is underway and will include activities consistent with how the Shoreline Master Program defines “industry”, which includes businesses or uses involved in the production, processing, manufacturing, or fabrication of goods; and warehousing and storage of materials or products. The future redevelopment will be some type of water-dependent use that requires a location adjacent to the shoreline. GBH is planning to develop the main portion of the former Custom Plywood plant area to be the future Anacortes Yacht Center. The tentative long-term plans include services for yacht repairs and renovations, and possibly yacht manufacturing. These plans may include construction of a pier or piers, launch ramp and/or travel-lift, and a building to house the repair operations. All development planning and permitting will be compliant with the City’s Shoreline Master Program and will be closely coordinated with the City.

Tracts 5, 6, and 7 will be working waterfront for the industrial portion of the GBH property. Tract 8 will be a transitional area between the industrial activities and mitigation areas for future habitat restoration. South of Tract 8, in Tracts 9 and 10 where no usable upland exists, there will be no industrial activities, and the shoreline and aquatic areas in Tracts 9 and 10 are not intended to be used by GBH for commercial purposes.

2.4 SITE REGULATORY AND COMPLIANCE HISTORY

This section presents available information from regulatory agencies regarding regulatory and compliance history of the former Custom Plywood Mill. A summary of previous environmental investigations and interim remedial actions conducted are presented in Section 2.5 and Section 2.6, respectively.

2.4.1 Washington State Department of Ecology Memos and Inspection Reports

Ecology personnel visited the Custom Plywood Mill site several times since 1974 in the course of the plant's operations. A brief summary of regulatory and compliance information about the former Mill obtained from Ecology's files is presented below.

- **National Pollutant Discharge Elimination System (NPDES) 1974 Permit Application** – The NPDES permit provided for weekly discharge of 32,000 gallons of plywood dryer discharge water through Outfall 001. Constituents in the discharge water included phosphorus, sodium, oil, grease, and phenols. The discharge went into Fidalgo Bay at a location just south of the L-shaped concrete platform (Figure 4).

- **January 25, 1979, Ecology Memorandum** – A memorandum dated January 25, 1979, described an incident involving discharge of boiler blowdown water to a drainfield.

- **March 14, 1988, Letter From Anacortes Plywood, Inc.** – Anacortes Plywood reported a cracked hydraulic line that resulted in a release behind Press Pit #2 in March 1988.

- **April 5, 1989, Ecology Memorandum** – An Ecology memorandum dated April 1989 reported the dumping of approximately 60 gallons of light lubricating oil in the hog fuel storage area on the north end of the yard. Also, several 5-gallon containers of glue were observed to have overflowed in the offloading area at the south end of the mill.

- **October 10, 1989, Ecology Inspection Report** – Ecology conducted an inspection of the Mill on October 10, 1989. Results from that inspection are summarized below.

    - Ecology found problems with the glue wastewater and dried resin solids from the raw material holding tank. There was a stain on the ground coming from the containment around the glue machine wash water holding tank.

    - Ecology noticed that solids that are cleaned out of the raw phenolic resin glue tank were removed from the tank and some were left outside the building. Rain dissolved some of the chunks, resulting in purple puddles.

- There were multiple discharge points for the non-contact cooling water. Some of these discharges were from the boiler area that discharged across the ground and into the bay, while other points in the plant discharged wherever the machinery was located, usually to the intertidal area.

- **November 27, 1989, Ecology Notice of Violation** – Ecology issues a violation notice indicating that Custom Plywood, Inc., had discharged phenolic formaldehyde resin glue wastewater into the waters of Fidalgo Bay.

- **September 26, 1990, Ecology Inspection Report** – The Ecology inspector found that the means for discharging non-contact cooling water from the hog-fueled boiler was unsatisfactory. The cooling water combines with a sheet-flow of boiler blowdown water. Several of the press pits were observed to be discharging cooling water directly to the Fidalgo Bay tidal flats (Ecology, 1990). The distance from the press pits to the tidal flats is approximately 75 to 100 feet (EPA, 2000). Ecology noted that outside of the discharges of non-contact cooling waters and boiler blowdown, there was little to no generation of process wastewater and no apparent discharge into the Anacortes sanitary system of process wastewaters. Ecology also noted that the facility had apparently achieved a "zero" discharge of process wastewater, and that best management practices (BMPs) would need to be put in place in the company's NPDES permit to maintain a "zero" discharge (Ecology, 1990).

- **March 24, 1992, Ecology Inspection Report** – During the March 24, 1992, site visit, Ecology noted inconsistencies in the discharge rate reported on the facility's NPDES application. Ecology also observed caustic spillage on the boiler room floor and noted that the spillage was being washed away by boiler blowdown water and subsequently discharged to Fidalgo Bay. Ecology recommended that the facility improve its BMPs to prevent caustic spills from contacting blowdown water and encouraged the facility to recycle the noncontact cooling water (Ecology, 1992).

- **July 10, 1992, Ecology Inspection Report** – Ecology performed an unannounced inspection of the facility on July 10, 1992, to verify that the facility had closed for business. Ecology informed the assistant manager that the facility had not completed its NPDES permit and that a notice of violation would be issued.

- **November 30, 1992, Ecology Environmental Response Team (ERT) Report** – A caller stated that there was a fire at the Custom Plywood Mill Site and noticed oil pools under the main building where machinery had leaked over the years. The caller described it as deep pools of heavy oil.

- **December 2, 1992, Ecology Inspection** – Ecology visited the site to inspect barrels for substances of concern. Ecology reported that all barrels were blown out by the heat of the fire and either had only ash residue or glass-like substances remaining.

- **June 10, 1993, Ecology Environmental Response Team (ERT) Report** – Ecology received a call indicating that contractors working at the Custom Plywood Mill property were dumping chemicals onto the ground, including the oil out of old electrical transformers.

- **December 9, 1994, Site Visit** – Ecology noted that soil in the vicinity of the former presses was noted to be very oily in places. It was also noted that a yellow hopper-like structure (identified as the Pitch Collection Tank on Figure 4) was situated on a concrete pad near the area on the south end of the property. Material similar to hardened resin was noted on the concrete pad at this location. This resin-like substance was similar to the material at the base of the former glue tanks stored in the southeastern-most building.

Ecology added the site to the Confirmed and Suspected Contaminated Site List on March 5, 1993. The site was listed as having confirmed contamination of soil with petroleum products; suspected soil contamination by PCBs, and suspected contamination of soil, groundwater, surface water, and sediment by metals, phenolic compounds, and polycyclic aromatic hydrocarbons (PAHs).

2.4.2 Skagit County Health Department Site Hazard Assessment

The Skagit County Health Department completed a Site Hazard Assessment for the site in 2001 resulting in a hazard ranking of 1, which represents the highest level of risk. Contaminants identified in the Site Hazard Assessment as exceeding MTCA cleanup levels included various metals, methylene chloride, dioxin, and PAHs in soil, and metals in groundwater. Contaminants identified as a concern in sediment included PAHs, metals, and dioxin.

2.5 PREVIOUS (PRE-2008) ENVIRONMENTAL CHARACTERIZATION/SAMPLING INVESTIGATIONS

This section presents a brief summary of site characterization and sampling investigations that were conducted at the former Custom Plywood property prior to the Agreed Order process that started in 2008. Since 1993, the previous owners of the site have funded site investigations to define the extent of contamination. Each successive investigation targeted the data gaps identified in the previous investigation. In addition to investigations funded by the former owners, the EPA conducted a combined Preliminary Assessment/Site Inspection (PA/SI) to characterize potential sources of contamination, determine off-site migration of contaminants, and to document any threat or potential threat to public health or the environment posed by the site. Based on available Ecology records, this section provides a summary of investigations conducted since 1993 in the vicinity of the site to evaluate the conditions of the soil, groundwater, and offshore sediments. Sampling locations for upland and sediment samples from several of these historical investigations are shown in Figure 5. In this section, concentrations of potential soil and groundwater contaminants are cited, but these concentrations are not compared to historic or current cleanup levels in this section.

Section 6 of this document will discuss the historic and recent data in the context of current screening levels.

Environmental studies at the site were initiated in 1993 with a very limited soil and surface water sampling study (Pinner, 1993). A Phase I and limited Phase II study was conducted in 1995 that included soil sampling from areas with the highest likelihood of contamination (Enviros, 1995a). Significant concentrations of hydrocarbons, particularly heavy oils, were found in shallow soils around the press pits and the compressor house in the central part of the property (Figure 3). Subsequent studies found isolated occurrences of PCBs, and inorganics (arsenic, cadmium, chromium, lead, and mercury) around the former boiler house, and petroleum hydrocarbons in the former hog fuel area.

Sample results from the investigations that occurred between 1995 and 2003 culminated in the development of an interim action plan for removal of soil within the upland areas of Tracts 5 and 6 (Geomatrix, 2006a). The interim action plan intended to conduct the cleanup work under the VCP with excavation and disposal of the soil in the northern tracts first, followed by excavation and disposal of the soil in the southern tracts (Tracts 7 and 8) a year later. The first phase of the interim action work on the northern tracts was conducted in July 2007 to remove soils from four areas where COPCs exceeded Method A cleanup levels. A more complete description of the northern interim cleanup action is provided in Section 2.6.2. After the interim action in 2007, Ecology required the subsequent work to be conducted within the PSI program under an Agreed Order to be consistent with the approach at other PSI-led sites in Fidalgo Bay. Consequently, the VCP was not entered and negotiations for an RI/FS and Agreed Order commenced. The subsections of 2.5 further discuss the individual investigations and findings between 1993 and 2007.

2.5.1 John A. Pinner and Associates 1993 Preliminary Environmental Evaluation

Pinner and Associates (1993) performed a preliminary environmental evaluation of the Mill property for Brent Homes in November 1993. Two surface water samples (one sample from press pit #2 and one from a depression north of press pit #2), and one soil sample (northeast of press pit #3) were collected and analyzed. The soil sample was tested for heavy metals (cadmium, chromium, copper, lead, mercury, and zinc), total petroleum hydrocarbons (TPH) in the heavy oil range (TPH-Oil) (by Method TPH 418.1), phenolic compounds, and PAHs. TPH-Oil was found in the soil sample at a concentration of 4,200 milligrams per kilogram (mg/kg); the other results were unremarkable. The two water samples were analyzed for TPH-Oil (Method TPH 418.1) resulting in concentrations of 80 micrograms per liter (µg/L) and 380 µg/L. The report did not provide precise sample locations (John A. Pinner and Associates, 1993).

2.5.2 Enviros 1995 Phase I and Limited Phase II Environmental Site Assessment

The owners of the site in 1995, Brent Homes, initiated environmental studies by conducting a phase I and limited phase II environmental site assessment. The study included collection and analysis of hand-auger and grab soil samples from areas with the highest likelihood of contamination (Enviros, 1995a). Sampling locations are shown on Figure 5. TPH-Oil concentrations in near-surface soils (depths ranging from 1.5 to 3 feet bgs) varied from not detectable to 164,000 mg/kg, with the highest concentrations observed around the press pits and the compressor house. TPH-Oil was also found at a concentration of 11,500 mg/kg in a sampled collected at HA3 near the hog fuel area and at a concentration of 4,900 mg/kg in a sample from HA7 located near the reported location of the former 300-gallon diesel tank in the central part of the site (Figure 5). Sample HA11-1.5 contained a TPH-Oil concentration of 112,000 mg/kg, and that sample was analyzed for PAHs. Benzo(a)anthracene was the only carcinogenic PAH (cPAH) detected (0.95 mg/kg). Diesel-range hydrocarbons (TPH-D) were generally associated with the higher TPH-Oil concentrations. However the lab sheets reported that the chromatograms did not appear to represent diesel but rather the lighter range of the heavy oil range. Gasoline-range hydrocarbons (TPH-G) were analyzed but not detected above reporting limits of 25 mg/kg.

Soil samples HA17-0.5 and HA18-2 were collected in areas where the phenolic resins were stored or used. These samples were analyzed for phenols and formaldehyde, but these compounds were not present above the detection limit. Sample HA4-1.5 was collected in soil directly adjacent to the concrete pavement on which the large bank of transformers were located. This sample was analyzed for PCBs, which were not detected at the reporting limit of 50 micrograms per kilogram (µg/kg). Arsenic, cadmium, chromium, and lead were analyzed in three samples (HA5-1.5, G15-S, and HA17-0.5). The only sample returning metals at significant concentrations was sample G15-S, which was collected from a small pile (less than 1 ft^3) of blue-green sand located just south of press pit #3, with cadmium at 9.5 mg/kg, chromium at 450 mg/kg, and lead at 1,600 mg/kg.

2.5.3 Enviros 1995 Sediment Sampling Report

In September 1995, a preliminary characterization study of sediment chemistry was conducted offshore of the former Custom Plywood Mill (Enviros 1995b). A total of 12 samples (S1–S12) were collected and analyzed (Figure 5). Seven of the samples were analyzed for base/neutral/acid compounds (BNAs) and PAHs, 9 samples were analyzed for PCBs, and 12 samples were analyzed for metals. Analytes were selected based on known or suspected areas of impact in the upland and offshore. The only exceedances of the SMS Sediment Quality Standards (SQS) or the dry-weight lowest apparent effects threshold (LAET) were for total PCBs in samples S-5 and S-7. Total PCBs were above the SMS Cleanup Screening Level (CSL) or the second lowest apparent effects threshold (2LAET) at sample S-1. Because

these samples were analyzed more than 10 years ago, these results are not included in the sediment evaluation.

2.5.4 URS Greiner 1997 City of Anacortes and Anacortes-Brent Homes Joint Venture Marine Habitat and Resources Survey

In November 1996, a marine habitat and resources survey was conducted offshore of both the City of Anacortes and Custom Plywood properties (URS Greiner, 1997). The objective of this survey was to map the distribution of vegetation and surficial sediment types, and the bathymetric contours, in the area from the shoreline to the outer harbor line. Video data were compiled on the distribution of eelgrass and macroalgae, sediment grain size, wood content, and fauna present. Wood debris was present in the surficial sediment from the shoreline to approximately 300 feet from shore in the area adjacent to the main plant.

2.5.5 Woodward-Clyde March 1997 Phase I and Limited Phase II Environmental Site Assessment, City of Anacortes, 3205 V Place (lot 3)

Woodward-Clyde was retained by the City of Anacortes to conduct a phase I and limited phase II environmental site assessment on the upland portion of the V Place property owned by the City (current parcels P119602, P33211, P33189, and P119600, Figure 2), in anticipation of sale and subsequent redevelopment of the upland (Woodward-Clyde, 1997a). The phase I investigation identified potential conditions that indicated a phase II investigation was warranted. Thirteen test pits (AN1 through AN13, Figure 5) were dug and sampled during the limited phase II site assessment (Woodward-Clyde, 1997a). On January 22, 1997, 16 soil samples were collected and delivered to the lab for analysis of TPH-D and TPH-Oil. Four samples, two collected near the hardboard plant building (AN1-1 and AN6-2) and two from locations midway between the building and the shoreline (AN8-4 and AN13-1), were analyzed for arsenic, barium, cadmium, chromium, lead, selenium, mercury, and silver. Four samples (AN1-1, AN3-1, AN6-2, and AN8-4) were analyzed for PAHs by EPA Method 8310-selected ion monitoring (SIM).

TPH-D and TPH-Oil at concentrations in excess of 10,000 mg/kg were discovered in samples from test pits AN1, AN2, AN4, AN6, and AN7 in the area near the hardboard plant on the west side of the property. The samples in this western group that were also analyzed for metals and PAHs yielded no detectable arsenic, cadmium, lead, selenium, or silver; PAHs were also not detected, but the PAH reporting limits were elevated due to TPH interference. Detectable concentrations of barium (highest concentration 235 mg/kg in AN1-1), chromium (highest concentration 57.6 mg/kg in AN1-1), and mercury (highest concentration 0.114 mg/kg in AN1-1) were found in the samples analyzed. The report recommended remediation of this TPH-impacted soil. The areas including and surrounding test pits AN1, AN2, AN3, AN4, AN6, and AN7 were excavated in 1998 and disposed at a controlled landfill (see Section 2.6.1).

Test pit samples from AN5 yielded concentrations as high as 1,260 mg/kg TPH-D and 600 mg/kg TPH-Oil, and the 1998 remediation activities did not include the immediate area of this test pit.

Of the remaining test pits (AN8 through AN13) that were away from the TPH-impacted building area and closer to the shoreline, the highest detected analyte concentrations were TPH-D at 64 mg/kg (AN10-4), TPH-Oil at 183 mg/kg (AN12-5), barium at 81.4 mg/kg (AN8-4), chromium at 23.7 mg/kg (AN8-4), lead at 27.4 mg/kg (AN8-4), and mercury at 0.0624 mg/kg (AN8-4). Sample AN8-4 contained no detectable PAHs, with the exception of pyrene at 0.0562 mg/kg. The central and eastern portions of the site did not require excavation during the 1998 remediation.

2.5.6 Ecology 1997 Survey for Petroleum and Other Chemical Contaminants in the Sediments of Fidalgo Bay

In April 1997, Ecology conducted a sediment survey to investigate the extent of oil and chemical contamination in Fidalgo Bay (Ecology, 1997b). Three of the sampling locations were located offshore from the project site (Outer_26, Outer_17, and Inner_8). The sediments were analyzed for conventionals (i.e., total organic carbon), metals, semivolatile organic compounds (SVOCs), and PCBs. There were no exceedances of the SMS SQS or CSL criteria.

2.5.7 Woodward-Clyde April 1997 Soil Sampling, 3205 V Place Property

On April 11, 1997, Woodward-Clyde (1997b) collected three soil samples from the area that was described in Section 2.5.5 as having the highest concentrations of TPH. Previous test pits AN1, AN2, and AN4 had been staked in the field during the initial sampling. Additional samples from these soils were collected for analysis of PCBs and volatile organic compounds (VOCs) (by EPA Method 8260) to further evaluate remediation or treatment options. Samples were labeled ANX1-1, ANX2-2, and ANX4-2, noting the location of each of the corresponding previous test pits. Samples were collected immediately adjacent to the corresponding test pit from undisturbed soil. Results indicated all PCBs and VOCs were undetected, with the exception of methylene chloride, a common laboratory solvent.

2.5.8 Woodward-Clyde June 1997 Custom Plywood Soil Sampling

Soil sampling was performed in May 1997 (Woodward-Clyde, 1997c) to investigate the presence of PCBs in the upland soils on the property then owned by Brent Homes (Parcel No. 33194). This investigation was conducted at the direction of the EPA after transformers located on the south side of the hardboard plant had been improperly removed from the site. Sampling locations were selected under the direction of Mike Burnett of EPA's Criminal Investigation Division. Samples in the vicinity of the south end of the hardboard plant were

collected in the unpaved area just beyond (and downslope of) the concrete pavement on which the transformers had been located. Soil samples were collected from four borings advanced using push-probe techniques to a depth of 10 feet; soil samples were collected using a hand-auger/shovel from 15 additional locations (Figure 5). A total of 22 soil samples were analyzed for PCBs (by individual Aroclors) using EPA Method 8080.

PCBs in the form of Aroclors 1016, 1221, 1242, 1246, and 1260 were not detected in any of the 22 soil samples. Aroclor 1254 was detected in 6 of the 22 samples at concentrations ranging from 0.082 mg/kg (CP-HA20-1) to 13.0 mg/kg (CP-HA31-0.5). The four highest PCB detections were identified in samples collected near the foundations of the boiler house and compressor building, which were former locations of transformers at the time of plant operation. These PCB-impacted soils in the boiler house and compressor building areas were later excavated and disposed during the interim remedial action in 2007 (Section 2.6.2). Two soil samples collected near the southwest end of the hardboard plant contained detectable levels of PCBs at concentrations ranging from 0.082 mg/kg (CP-HA20-1) to 0.14 mg/kg (CP-HA21-1).

In addition to PCBs, this investigation characterized the contents of three of four ASTs located in the former resin/caustic tank shed; one tank could not be opened. This shed is now located on the property owned by Ray Sizemore of Cimarron Trucking. Samples of the contents of the two resin storage tanks (CP-Tank2 and CP-Tank3) were analyzed for phenols, formaldehyde, flash point, and pH. Laboratory results from these samples indicated the presence of formaldehyde in both of the resin tanks and a low concentration of phenols in one of the tanks; pH was 11.2 and 9.8, respectively. Residue from AST CP-Tank4, which was a sodium hydroxide tank, was analyzed for metals (cadmium, chromium, and sodium) and pH. Cadmium was not detected, and chromium was detected at a very low level (0.19 mg/kg); whereas sodium was at a concentration of 210,000 mg/kg. The pH was 11.7. Mr. Sizemore subsequently removed the tanks from the building and remodeled the shed and adjoining former maintenance shop. The final disposal location of the ASTs has not been confirmed.

A third task of this study was to confirm for the EPA that nine drums of liquid waste, temporarily stored in the drum storage area, were characterized and removed. Brent Homes, the property owners at the time, contracted with Philip Environmental to profile and remove the drums of oil, grease, water, and latex paint. All the drums were removed from the property on May 28, 1997, by Burlington Environmental (former affiliate of Philip Environmental).

2.5.9 EPA 1997 EMAP Program

In June 1997, two sampling locations in Fidalgo Bay (Stations WA000007 and WA000008) were surveyed during the EPA's Environmental Monitoring and Assessment Program (EMAP)

that were in the general vicinity of the site (EPA, 1997a). Sediment samples were analyzed for conventionals (i.e., total organic carbon [TOC]), metals, SVOCs, and PCBs. Analytical results showed concentrations above the SMS CSL criteria for 4-methylphenol and the SMS SQS for phenol. There were also exceedances for several chlorinated benzenes, benzoic acid, and hexachlorobutadiene due to elevated reporting limits.

2.5.10 Woodward-Clyde September 1997 Limited Phase II Site Assessment

On August 6, 1997, Woodward-Clyde collected soil samples from test pits excavated on both sides of the line separating Tracts No. 4 and 5, which forms the approximate northern property boundary of the parcels currently owned by GBH (Woodward-Clyde, 1997d). The purpose of this investigation was to determine the extent of contamination by heavy petroleum hydrocarbons in the area immediately east of the hardboard plant that had been covered by a ponded water (due to a buried asphalt slab) during the sampling conducted in January 1997 (Section 2.5.5; Woodward-Clyde 1997a). This heavy oil contamination was thought to be related to a waste oil AST that had been suspected to have once been located in this area, and to the discharge of oil from piping emanating from the hardboard plant. No evidence of ASTs or USTs was found during the follow-up soil excavation under the VCP program in 1998 (see Section 2.6.1).

A total of 11 test pits were dug: eight on the City of Anacortes' property (ANA-TP1 through ANA-TP6, ANA-TP10, and ANA-TP11) and three (ANA-TP7, ANA-TP8, and ANA-TP9) on the Brent Homes property (Figure 5). Analytical results for samples collected from three test pits (ANA-TP1 through ANA-TP3) on the north side of the Tract No. 4 line indicated a potential need for remediation of the soils impacted by TPH-Oil and TPH-D, with concentrations between 700 mg/kg and 6,800 mg/kg (ANA-TP1-03A). PCBs were analyzed by Aroclors using EPA Method 8081 in two samples (ANA-TP1-03B and ANA-TP2-04B) and were not detected at practical quantitation limits (PQLs) of 0.093 mg/kg and 0.059 mg/kg, in the respective samples. Samples from test pits ANA-TP4 though ANA-TP11 all returned TPH concentrations below 200 mg/kg, including the test pits on the former Brent Homes property (current GBH property) on the south side of the Tract No. 4 boundary. Test pit ANA-TP7 was located just south of the property boundary between the former City of Anacortes property and the Brent Homes property, and near the hardboard plant. This test pit hit a large concrete slab, and no sample could be collected.

2.5.11 Woodward-Clyde February 1998 Site Investigation and Remedial Options Evaluation

An additional upland investigation was conducted in October 1997 to (1) delineate the extent of petroleum-impacted soil and groundwater in the press pit area, (2) identify potentially impacted soil in the vicinity of the resin/caustic storage shed and the former mixed glue tank,

and (3) assess the quality of surface water contained in the press pits for disposal purposes (Woodward-Clyde, 1998b). A preliminary evaluation of remedial options was also developed for the site.

Seven push-probe borings were drilled (CP-GP4 through CP-GP10), five hand-auger soil samples were collected in the vicinity of the press pits (CP-HA36 through CP-HA40), two shallow soil samples were collected adjacent to the resin/caustic AST shed (HARC-1.5A and HARC-1.5B), and one shallow soil sample was collected next to the concrete pad for the mixed glue tank (HAGT-1.5). Grab groundwater samples collected from three push-probe borings (CP-GP5, CP-GP7, and CP-GP8) were analyzed for pH; TPH-G; TPH-D; TPH-Oil; benzene, toluene, ethylbenzene, and xylenes (BTEX); and SVOCs. In addition, water samples from the open press pits #2 and #3 were analyzed for TPH-D, TPH-Oil, and PCBs.

Ten shallow (1-2 feet bgs) soil samples were analyzed to better define the extent of the hydraulic oil impacts in the vicinity of the press pits. Concentrations of TPH-D and TPH-Oil ranged from not detected to 12,000 mg/kg for diesel (C12-C24) and not detected to 91,000 mg/kg for oil (C24-C34). The 10 soil samples were also analyzed for TPH-G and BTEX, with nondetectable concentrations of all analytes, except one sample (CP-HA37-1.5) contained benzene at a concentration of 0.43 mg/kg, one sample (CP-HA40-1.5) contained m,p-xylene at a concentration of 0.62 mg/kg, and one sample (CP-GP9-2.5) contained TPH-G at a concentration of 17 mg/kg. The two soil samples with the highest TPH-D and TPH-Oil concentrations were additionally analyzed for volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH), PCBs, VOCs, and SVOCs. All PCBs, VPHs, and VOCs (except methylene chloride, a common laboratory solvent) were below the respective reporting limit. Analyses for SVOCs produced detections of pyrene and several additional SVOC compounds. cPAHs were not detected, although the PQLs were elevated in CP-GP6-2 due to interference.

The three soil samples in the vicinity of the resin/caustic AST shed and the glue tank were analyzed for formaldehyde, phenols, pH, TPH-D, and TPH-Oil. Phenols and formaldehyde were not detected in these samples; pH ranged from 8.47 to 11; TPH-D ranged from 45 mg/kg (CP-HAGT-1.5) to 1,500 mg/kg (CP-HARC-1.5A); TPH-Oil ranged from 130 mg/kg (CP-HAGT-1.5) to 6,800 mg/kg (CP-HARC-1.5A).

Three grab groundwater samples were analyzed for pH, TPH-G, TPH-D, TPH-Oil, BTEX, and SVOCs. The groundwater sample from CP-GP5-HP returned all compounds at nondetectable concentrations. Sample CP-GP7-HP returned all nondetectable results except for TPH-D at 610 µg/L. Groundwater sample CP-GP8-HP had no detectable BTEX, but detectable

concentrations of TPH-G (2.5 mg/L), TPH-D (9.0 mg/L), TPH-Oil (1.5 mg/L), and six SVOCs. Free product was noted in this groundwater sample.

A preliminary evaluation of remedial options was developed for the site based on the areal extent of the petroleum impacts in the vicinity of the press pits, boiler house, and resin/caustic AST shed, as well as the extent of PCBs in shallow soils in the vicinity of the compressor and boiler houses (based on earlier studies). Given the generally high molecular weight of the petroleum, and the shallow extent of the contamination, excavation and off-site disposal was the preferred option.

2.5.12 EPA Region 10 December 2000 START Preliminary Assessment/Site Inspection

In July 2000, EPA conducted a combined PA/SI of the former Custom Plywood Mill (EPA ID No. WASFN1002212) under EPA's Superfund Technical Assessment and Response Team (START) Contract (EPA, 2000). The purpose of the PA/SI was to document the nature and extent of contamination that may be present. As part of this investigation 61 soil samples and 10 sediment samples were collected and analyzed. EPA uplands and sediment sampling locations are shown on Figure 5. Results of the investigation confirmed the findings of previous studies that identified:

- localized upland areas of near-surface soils containing metals and PCBs, and
- larger areas affected by releases of petroleum hydrocarbons, as indicated by the presence of SVOCs, particularly PAHs.

EPA did not analyze for TPH because of EPA's petroleum exclusion policy under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In addition to the upland sampling, 10 sediment samples (FB01-FB10 on Figure 5) were collected and analyzed for a range of priority pollutants.

While some soil analytes were found at detectable concentrations, no VOCs or pesticides were detected at elevated concentrations in any of the samples. Two samples contained PCBs at concentrations up to 2.6 mg/kg total PCBs. SVOCs were detected at concentrations ranging from 480 µg/kg (fluoranthene) to 5,100 µg/kg (pyrene). A total of 11 inorganic elements were detected. Dioxins were also detected, but no tetrachlorinated (four chlorine) or pentachlorinated (five chlorine) congeners were detected. The detected dioxins indicate a signature typical of combustion-generated dioxin where the seven and eight chlorine congeners are typically dominant, and the most toxic four-chlorine congeners are less than 1 percent of the total (Cleverly, et al, 1997). The profile for combustion sources is different from the profile typically seen in effluent from pulp and paper mills where the four-chlorine

congeners dominate. Combustion sources of dioxin can include burning of wood, coal, and flammable materials, but also emissions from diesel trucks and gasoline-powered vehicles.

Six groundwater samples (including one background) were collected from the temporary push probe boreholes and analyzed for SVOCs, VOCs, and 23 inorganic analytes. Water samples were described in the report as turbid or very turbid, sometimes with suspended peaty material or organic matter. Only two of the six groundwater sample descriptions (PP07 and CB01) mentioned that a sheen was observed. No VOCs were detected with the exception of one low concentration (13 µg/L) of methylene chloride, a likely lab-introduced contaminant; and the background sample contained 1,2-dichloroethane detected at the contract-required quantitation limit of 10 µg/L.

Water was collected from one shoreline seep that was located approximately 60 feet east of the compressor building, although the report did not provide a latitude/longitude for the sample location. The sample was analyzed for SVOCs, VOCs, and inorganic constituents. None of the SVOC or VOC analytes was detected, with the exception of caprolactum at 0.8 µg/L, which was an estimated concentration below the contract-required quantitation limits. Of the 23 inorganics analyzed, antimony, arsenic, beryllium, cadmium, cobalt, lead, selenium, silver, and thallium were not detected. Calcium, magnesium, potassium, and sodium were detected at percentage concentrations, which is common with the influx of marine water. The other 10 inorganic analytes (aluminum, barium, chromium, copper, iron, manganese, mercury, nickel, vanadium, and zinc) were detected at estimated concentrations ranging from 0.11 µg/L (mercury) to 672 µg/L (iron).

EPA designated the site as "Other Cleanup Activity-State Lead" as it was agreed by the agencies that this was the most appropriate approach.

2.5.13 URS October 2003 Draft Engineering Evaluation/Cost Analysis and Cleanup Action Plan

A draft engineering evaluation/cost analysis (EE/CA) and CAP was prepared for the City of Anacortes and the Anacortes Public Development Authority (PDA) to evaluate soil and groundwater cleanup alternatives in the upland portion of the Custom Plywood Site (URS, 2003). This draft document was intended to summarize the information developed in previous investigations, evaluate remedial technologies, and provide a conceptual plan for the preferred remedial action. Areas that were previously targeted for remediation (Section 2.5.11) were expanded due to additional areas of inorganics that were found during the EPA study in 2000, although the general areas remained similar. The document was not finalized and the work was not performed because of complications during negotiations between the PDA and the

former owners during purchase of the property, and because the PDA could not obtain a prospective purchaser agreement/consent decree from the State of Washington.

2.5.14 Ecology and NOAA 2003 Chemical Contamination, Acute Toxicity in Laboratory Tests, and Benthic Impacts in Sediments of Puget Sound

Between 1997 and 1999, sediment samples were collected for analysis at 300 locations within the Puget Sound as part of a joint survey between Ecology and the National Oceanic and Atmospheric Administration (NOAA) (Ecology and NOAA, 2003). Three of the 12 stations (Stations 17-1-50, 17-2-51, and 17-3-52) located within Fidalgo Bay were close enough to the subject site to provide potential background information about the vicinity (Figure 6). The sediments were analyzed for conventionals (i.e., TOC), metals, SVOCs, and PCBs. There were no exceedances for metals, PAHs, or PCBs. Exceedances of SMS SQS and CSL occurred for various phenolic compounds and benzoic acid. Analytical reporting limits for di- and trichlorinated benzenes exceeded the SMS SQS or CSL levels.

While the sample stations are outside of the potential boundary of Custom Plywood site vicinity and are not useful for defining the cleanup areas, the data provide information on possible contaminants in the vicinity of the project area and a rationale for selection of the COPCs.

2.5.15 Geomatrix 2006 Wetlands Delineation Study

A Wetlands Delineation Study (Geomatrix, 2006) was conducted in the Custom Plywood Uplands area in July 2006. In that study, several small areas were identified (Figure 5) as wetlands that met all three jurisdictional wetland criteria used by the Corps of Engineers and Ecology to define a wetland. (Criteria are: 50% of the dominant vegetation was hydrophytic, the presence of at least one primary or at least two secondary indicators of wetlands hydrology, and the presence of hydric soils within the top 12 inches of the soil surface.) One larger area (Area D) was identified on the western boundary of the GBH property that did not meet all criteria and was not determined to be a wetland at the time of the Geomatrix delineation study. The Department of Ecology (Shorelands & Environmental Assistance Program) conducted a wetlands assessment in April 2008 after a wet winter and found evidence that Area D should be classified as a wetland (henceforth referred to as Wetland D).

2.5.16 Geomatrix 2007 Underwater Habitat Survey

Geomatrix Consultants, Inc. (Geomatrix) was contracted by the Washington General Services Administration on behalf of the Washington Department of Community, Trade and Economic Development to conduct an underwater survey of the extent of eelgrass, macroalgae, and debris in the marine areas near the site (Geomatrix, 2007b). The field survey was conducted in late July 2007 (Geomatrix, 2007b).

Results of the survey are discussed more thoroughly in Section 3.3 and Section 5.1.3.2. Results are shown schematically in Figure 6. Three primary patches of exceptionally tall (up to 6 feet) eelgrass were found during the survey. Construction debris and wood debris present near the shoreline of the main plant area and along the length of the collapsed finger pier appeared to impair the growth of eelgrass in those areas. Large quantities of macroalgae were mixed with eelgrass in the northern part of the survey area, but only limited quantities of macroalgae occurred in the southern portion of the survey area.

2.6 PREVIOUS LIMITED CLEANUP ACTIONS

This section presents a summary of previous limited cleanup actions that have been conducted at the former Custom Plywood Mill site.

2.6.1 Woodward-Clyde November 1998 Soil Remediation Report for 3205 V Place

Previous investigations on the City of Anacortes' V Place property had indicated that an area of soil heavily impacted with hydraulic oil was located near the hardboard plant (Woodward-Clyde, 1997a,b,c,d). Using EPH/VPH sample results, results of other analyses, and calculations from the interim TPH policy (Ecology, 1997a), site-specific cleanup levels of 15,000 mg/kg total aliphatic hydrocarbons and 1,500 mg/kg total aromatic hydrocarbons were established as a guideline for removal of soils. Three areas of soil with documented exceedances of 15,000 mg/kg TPH (Areas #1, #2, and #3, south to north) had been found at the site.

Remediation was conducted in August 1998 in accordance with the Remedial Options Evaluation and Cleanup Action Plan (Woodward Clyde, 1998a), which was approved by Norm Peck of Ecology's Northwest Regional Office (NWRO) (April 22, 1998). A mobile laboratory supplied by OnSite Environmental Laboratories, Inc. (OnSite), provided gas chromatographic analysis with rapid turnaround time to guide the excavation of contaminated soils. The locations of the 1998 excavation areas are shown on Figure 5.

During soil excavation, Areas 1 and 2 coalesced into one large excavation. The rumored UST was never found in the excavation area. One large excavation just east of the former hardboard plant extended approximately 50 feet by 100 feet at its maximum extent and to a depth just below the water table at approximately 5.5 feet bgs. Small blebs of free oil were noticed floating in the excavation during the work. Soils were excavated until confirmation samples returned results below 15,000 mg/kg TPH, which occurred in all cases on the northern and eastern sidewalls, where all samples were at or below 8,400 mg/kg. Sidewall samples were collected from the most likely location of high TPH concentration—at the top of the water table. Excavation on the western and southern sidewalls continued until reaching either (1) a line 5 feet from the building (excavation was limited by concern over structural

integrity of the building), (2) concrete foundations, or (3) the property line. The site-specific cleanup level was not attained at all confirmation sample locations on the west or south sidewalls, and impacted soil appeared to extend under the building that could not be removed without compromising the structure. Plastic sheeting was placed on the edges of the excavation to minimize recontamination of the clean backfill material.

Area 3 remained a smaller, discrete excavation area in the northern portion of the property. At its maximum extent Area 3 excavation was approximately 25 feet by 25 feet by 6 feet in depth. All sidewalls around the perimeter of Area 3 attained nondetectable concentrations of TPH.

A total of 1,939 tons of soil impacted with hydraulic oil was excavated and disposed in August through September 1998 (Woodward-Clyde, 1998c). The soil was trucked to Olympic View Sanitary Landfill in Bremerton. Locations of confirmation soil sampling and groundwater monitoring wells are shown on Figure 5.

Three groundwater monitoring wells were installed on January 21, 1999, downgradient (east) of the soil excavation areas. Each well was drilled to 17 feet deep and screened from 5 to 15 feet bgs. MW-1 and MW-2 were located midway between the excavation areas and the shoreline (about 160 feet upland of the shoreline). MW-3 was located near the shoreline. Groundwater samples were collected semiannually on a wet season/dry season basis on January 27, 1999; September 2, 1999; January 7, 2000; July 12, 2000; and January 15, 2001. Water elevations were obtained in three sampling events. Water elevations measured during the events fluctuated 1.96 feet in MW-1, 1.52 feet in MW-2, and 5.06 feet in MW-3. Water samples were analyzed for TPH-D and TPH-Oil by method NWTPH-Dx. Of the 15 water sampled collected (5 events and 3 wells), only three samples had detectable TPH, with one detection in each well. The detection in MW-1 was from the sample collected on January 27, 1999, and the concentration was 0.92 mg/L in the oil range. The detection in MW-2 was from the sample collected on January 15, 2001, and the concentration was 0.27 mg/L in the diesel range (although the laboratory flagged the analyses as not similar to a diesel fuel chromatogram). The detection in MW-3 was from the sample collected on January 7, 2000, and the concentration was 1.1 mg/L in the oil range. Analytes for all other analyses were not detected below the standard reporting limits of 0.25 mg/L for TPH-D and 0.5 mg/L for TPH-Oil.

Following the three years of groundwater monitoring in the three wells, the City of Anacortes received a “No Further Action” letter under the VCP through Ecology’s NWRO. The City placed a restrictive covenant on the deed of the property. In 2002, the monitoring wells were decommissioned, more fill material was brought into the central and eastern portions of the property, and additional construction occurred on the west side of the property. The area that

was excavated in 1998 is currently covered by the asphalt-paved parking lot for Northern Marine employees and the asphalt paved V Place roadway.

2.6.2 Geomatrix 2007 Interim Remedial Action Areas 2 through 5

Previous studies had identified five primary areas where concentrations of COPCs exceeded unrestricted MTCA Method A soil cleanup levels. Four of the five areas (Areas 2–5) were small and located on the northern half of the property. An interim remedial action was conducted in July 2007 to remove and dispose the soils from these four small areas. Locations of the four excavated areas are shown on Figure 5. Figure 7 shows the extent of the four excavation areas and the locations of final confirmation samples. About 1,500 tons of contaminated soil was disposed of at Rabanco's Subtitle D landfill in Klickitat County. Backfill material was obtained from Lakeside Industrial in Anacortes. The details for each individual excavation are discussed below.

Area 2. Area 2 is located on the north side of the former boiler house (Figure 5), and the COPCs included metals (arsenic, cadmium, chromium, lead, and mercury); TPH-G, TPH-D, and TPH-Oil; BTEX; and PCBs. The excavation area measured approximately 40 feet by 53 feet and extended to a depth of approximately 4.5 feet bgs. Approximately 360 cubic yards of soil was removed from Area 2, which consisted of brown silty sand and poorly graded gravel with intermingled layers of brown wood waste overlaying poorly graded clean sand with bricks. Once the excavation was complete, soil confirmation samples were collected on the north, south, east, and west sidewalls, and four samples were collected from the base of the excavation (Figure 7). Analyses of the final confirmation samples for metals revealed arsenic concentrations less than 17 mg/kg, cadmium less than 1.7 mg/kg, chromium less than 130 mg/kg, lead less than 100 mg/kg, and mercury less than 1.2 mg/kg. Results of analyses for TPH-G, TPH-D, and TPH-Oil yielded concentrations less than 27 mg/kg, less than 83 mg/kg, and less than 1,400 mg/kg, respectively. Total PCBs were found in confirmation samples at concentrations less than 0.17 mg/kg. All BTEX compounds were found at concentrations less than 0.54 mg/kg. The excavation was backfilled with bank run to within 3 inches of surrounding ground surface and then covered with approximately 3 inches of road ballast to prevent stormwater runoff.

Area 3. Area 3 covers a relatively small area located on the south side of the former boiler house (Figure 5). The COPCs in this area were metals and PCBs. The final excavation was approximately 8 by 39 feet in area and extended to approximately 2.5 feet bgs. Approximately 30 cubic yards of soil was removed from Area 3, which consisted mainly of several layers of asphalt and subgrade overlying brown silty sand and wood waste. Once the excavation was complete, soil confirmation samples were collected on the east and west sidewalls, and one bottom sample was collected from the base of the excavation (Figure 7). Concrete footings

extended the length and depth of the excavation on the north and south sides, so confirmation samples could not be collected from those sidewalls. The final confirmation samples had arsenic concentrations of less than 18.1 mg/kg, cadmium less than 1.1 mg/kg, chromium less than 46 mg/kg, lead less than 140 mg/kg, and mercury less than 0.76 mg/kg. In addition, total PCBs were analyzed at less than 0.21 mg/kg. The excavation was backfilled to the surface with bank run and then covered with a thin layer of road ballast to prevent stormwater runoff.

Area 4. Area 4 is located over the former compressor building, upland of the mean higher high water (MHHW) mark (Figure 5). It is the largest of the four excavations, covering an area approximately 75 by 40 feet and extending to a depth of 9 feet bgs. The COPCs in this area were metals and PCBs. Approximately 950 cubic yards of soil was removed from Area 4, which consisted mainly of silty sand with wood waste, wood, and other miscellaneous debris. Once the excavation was complete, soil confirmation samples were collected from one location on each of the north, south, and east sidewalls; two locations on the west sidewall; and six locations at the base of the excavation (Figure 7). The final confirmation samples did not contain COPC concentrations above the applicable MTCA Method A cleanup criteria, with the following exceptions: sample Area4-B3 had a total PCBs concentration of 1 mg/kg, which is equal to the MTCA Method A cleanup level for PCBs; and sample Area4-B4 exceeded the MTCA Method A cleanup level for mercury (2 mg/kg) with a concentration of 2.7 mg/kg. Samples Area4-B3 and Area4-B4 were collected at a depth of 9 feet bgs. Each was adjacent to a different concrete pile cap that could not be removed due to logistical constraints. Sample Area4-W7 was collected beneath a concrete footing (3.5 feet bgs) at the north side of the Area 4 western sidewall. The concentration of cadmium in this sample (4.6 mg/kg) exceeded the MTCA Method A criterion of 2 mg/kg for cadmium. Further excavation could not be completed in this area because of difficulties associated with removing the concrete footing and the attached concrete slab. The excavation was backfilled with bank run to within 6 inches of the surrounding ground surface and then covered with 6 inches of road ballast to protect against wave erosion.

Area 5. Area 5 is located at the north end of the GBH property, approximately 50 feet west of the MHHW (Figure 5). This area was originally delineated from a single sample and the COC was TPH-D. The excavation area measured approximately 27 by 40 feet and extended to a depth ranging from 2 to 4.5 feet bgs. Approximately 145 cubic yards of soil was removed from Area 5, which consisted mainly of a layer of fine-grained wood waste over a gray silty, sandy gravel and gray to black silty sand. Once the excavation was complete, soil confirmation samples were collected from the north, south, east, and west sidewalls, and two samples were collected from the base of the excavation (Figure 7). The final confirmation samples had TPH-D concentrations less than 60 mg/kg and TPH-Oil concentrations less than 900 mg/kg. The excavation was backfilled with bank run and graded to match the surrounding ground

surface, removing the low spot present in that area prior to excavation. This excavation area was not covered with road ballast because it is generally surrounded by thick vegetation and/or concrete structures and is sloped away from the water, which leads to a graveled road and/or more thick vegetation. The surface finish was monitored for the duration of the excavation activities, and no obvious signs of erosion were observed.

2.7 EVALUATION OF BUILDING MATERIALS ACTIVITIES

On April 18, 2008, AMEC personnel collected samples of stained concrete at various locations on the GBH property. The sampling was conducted in preparation for removal of some of the concrete because of the potential for physical hazards or obstructions to further sampling. In addition, on June 3, 2008, AMEC personnel collected samples of existing stockpiles of soil that were imported from a North Harbor Diesel property about 0.5 mile away during a construction project. One pile of the imported soil was placed on the western part of the GBH property just south of the access gate, and another pile was placed just north of the access gate. All samples were delivered to OnSite Environmental for analysis. Samples were selectively analyzed for TPH-D, PCBs, and/or total metals, and the data are presented in Appendix C.

There were no exceedances of MTCA A cleanup levels for unrestricted land use for either the concrete or the soil stockpile south of the access gate. However, analyses of the single soil sample from the stockpile north of the access gate yielded a TPH-Oil concentration of 2,100 mg/kg and copper, nickel, and zinc concentrations of 240, 50, and 100 mg/kg, respectively. The four soil samples from the southern stockpile yielded mostly non-detected analytes, except for the following metals at their maximum concentrations: copper at 63 mg/kg; chromium at 45 mg/kg; lead at 20 mg/kg; nickel at 44 mg/kg; and zinc at 84 mg/kg.

Ecology gave approval to GBH to demolish selective existing concrete features at the northern part of site only and to have the concrete crushed and reused on the ground surface within Tract 5. Ecology also gave approval to GBH to use the southern stockpile of soil in the area west of the GBH access gate. GBH placed the soil on top of the ground surface in the western corner of the GBH property. The northern stockpile was removed and disposed off site by North Harbor Diesel.

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3.0 ENVIRONMENTAL SETTING

In this section we present a discussion of the current site conditions, including surface features, subsurface soil and geology, surface water and groundwater, and meteorology. Also included is a discussion of the terrestrial and aquatic ecological setting comprising ecological receptors and potential threatened or endangered species.

3.1 SITE GEOLOGY

This section summarizes geologic characteristics of the Site and vicinity, including the general geologic conditions of the surrounding area, and specific stratigraphy of the site based on observations from recent investigations.

3.1.1 General Site Geology

Less than 0.5 mile south of the site is an outcrop of the bedrock that dominates the Anacortes area. This bedrock is late Jurassic (possibly to early Cretaceous) marine sedimentary and volcanic rocks of the Fidalgo Complex. The Fidalgo Complex is an ophiolitic sequence that was thought to have formed in a back-arc basin and obducted during the Tertiary collision of tectonic plates. The complex ranges from gabbroic to serpentinitic sequences of chemically mafic rocks with naturally elevated concentrations of common and trace metals,(including iron, magnesium, and chromium) to more felsic keratophyre and plagiogranite (Brown et al., 1979). Localized mineralization occurs in an area about 1.25 miles west of the site, where Jurassic granodiorite intruded the Fidalgo Complex. This mineralization was considered of sufficiently high grade in the early 1900s to be mined for copper, gold, and silver. The economic depression in the 1930s and later urban development curtailed further mining. Given the close proximity of significant surface exposures of the Jurassic bedrock, it is likely that this bedrock lies directly below the Site at a relatively shallow, but as yet unknown, depth.

Overlying the Jurassic bedrock is a layer of gray clayey sediment that is highly compacted and dense. This unit is the native material that formed the tidal flats on which the Mill was built and has been found in drilled borings and cored sediments throughout the study area and the western portions of Fidalgo Bay, during studies that AMEC employees have conducted over the last 14 years in the Anacortes area. Moreover, this compacted clayey unit was found as far north as the former Scott Paper Mill site near Cap Sante Boat Haven marina approximately 1 mile north of the former Custom Plywood Mill. Heterogeneous fill material in varying thicknesses was placed above the dense clay around the Custom Plywood Mill. Test pits dug along the western property boundary of the GBH property have revealed the dense clay layer at 5 to 7 feet bgs. In contrast, a test pit dug near sample location GMX-S42 (Figure 8) during the July 2007 excavations reached the top of the native layer at a depth of 22 feet bgs.

Fill soils in the area near the shoreline are generally composed of brown to gray silty clayey sand and gravel with a thickness of approximately 6 feet, although fill thickness depends partly on the thickness of debris that remains from collapsed buildings within the GBH parcels. According to the Soil Survey of the Skagit County Area, Washington (Klungland, 1989), the upland soils are mapped as Xerothents, 0 to 5 percent slopes. The Xerothents soil unit consists of areas where the surface layer and subsoil have been highly disturbed and can contain sawdust and other wood wastes. Within the property that is owned by GBH, uplands exist only in Tracts No. 5, 6, 7, and the northern part of Tract No. 8. Although the GBH property boundaries continue south and include Tracts No. 9 and 10, areas south of Tract No. 8 owned by GBH have no upland, except for the shoreline riprap that supports the hiking trail (former rail line).

The uplands portion of the site that was used for industrial purposes was created by placement of fill on top of former shallow tidelands that slope very gradually beyond the MLLW line shown on Figure 2. Inner portions of Fidalgo Bay beyond the Outer Harbor Line remain quite shallow (less than 12 feet below MLLW). Sanborn Maps from 1903, 1907, and 1925 indicate that the early sawmill was built on piles over the tidelands. The sequence of fill placement on top of the intertidal areas could not be ascertained from early records. Observations of the fill in test pits and borings indicate that the fill is highly heterogeneous, and a pattern of placement was not discernable. Much of the fill seen during test pits and excavations in Tracts No. 5 and 6 consisted of wood waste, ranging from sawdust to logs. Construction debris from the former structures is also present in the fill, and includes concrete, rebar, piping, brick, and pile-supported concrete foundations. The wood waste content of the fill material averages 30 to 40 percent across the site, but varies significantly. Hand augering west of the press pits encountered 2 to 3 feet of saturated fine wood material overlying sand and gravel. In contrast, fill soil in some northwestern portions of the site contained little wood and consisted of poorly graded, clean sand to a depth of 6 feet bgs.

Much of the large construction and wood debris in the upland that was left from the fire has been cleared since initial investigations in 1995; several concrete structures and concrete building foundations remained as of the end of 2010. Smaller debris, such as brick and remnants of wooden pilings, are present on the surface of the uplands, and brick, concrete pieces, roof remnants, and rafted-in logs are still present in the intertidal area below the MHHW. The MHHW was used instead of the Ordinary High Water Mark (OHWM) due to the lack of an identifiable elevation that could be reliably correlated to the OHWM as defined in 220-110-020 WAC. The MHHW will be used in this document.

3.1.2 Geological Observations from the Recent Investigations

This section presents an overview of the stratigraphy in the vicinity of the Mill based on geological observations during field investigations conducted in July 2008, April 2009, and July-August 2009.

A total of 58 push probe borings, nine monitoring wells, and nine test pits were installed during these three field investigation events in 2008-2009. Most of the push-probe sampling locations extended to depths of 8 feet bgs; however, a few push-probe sampling locations were advanced to refusal to provide information on the depth of the fill layer and the depth to underlying native units. All monitoring wells were advanced through the fill unit until native material was encountered to total depths ranging from 13.5 feet to 21.5 feet below grade. In addition to the environmental sample locations, five test pits were dug along the western boundary of the GBH property as part of the archaeological and cultural resources survey. The archaeological test pits next to the fence on the western boundary of the property were dug to depths below the thin clay layer (5 to 7 feet bgs) until the hard clay layer was reached.

Figure 9 and Figure 10 show the thickness of the fill layer, and the elevation of the top of the clay layer, based on findings of the 2008-2009 field investigations and other available lithologic data from previous investigations and interim actions. Figure 11 illustrates the topographic elevations in the upland and bathymetric contours.

In general, the upper 12 feet to 18 feet of material at the site consists of fill material, including sandy silts, silts, sandy gravels with various amounts of wood material, and concrete and brick debris. Based on observations made during test pit digging and drilling, wood content can locally range from 10 percent to 100 percent in the upland and nearshore sediments. Only a few of the push-probe sampling locations did potentially penetrate through the fill-like material. However, when compared to the thickness of fill observed in the monitoring wells, it is unclear if these push-probe borings actually did fully penetrate the fill-like material. All monitoring wells except GMX-MW-05 terminated in a clay layer which was encountered at depths ranging from 12 feet to 18 feet below grade. Based on the depth of fill (Figure 9), the contour map of the top of clay layer (Figure 10), and the known total depth of GMX-MW-05, the reason for the missing clay layer could be that GMX-MW-05 was not extended far enough below grade to encounter this clay layer.

The fill material on the site appears to consist of two distinct types, which have been designated the Upper Fill Unit and the Lower Fill Unit. The Upper Fill Unit consists of silty sand with gravel, brick, and concrete fragments and burned building debris; the Lower Fill Unit is composed of predominantly fine-grained wood (sawdust to bark chip-sized) with scattered logs.

Along the GBH west fenceline, the archaeological survey test pits showed approximately 4 to 6 feet of fine-grained wood material, underlain by about a 1-foot-thick, highly plastic clay layer. Below the thin unit of clay was a compacted dense clay layer that was not easily penetrated by the backhoe.

A few of the push-probe borings were advanced to refusal at depths ranging from 16 feet to 35 feet below grade. Refusal at a depth of 16 feet was encountered at GMX-S30 near the western boundary of the property, while the other refusals occurred near the northwest corner and the eastern boundary. This depth-to-refusal information confirms that the hard native clay unit exists, sloping downward toward the northeast (Figure 10).

3.2 SITE HYDROGEOLOGY

The shallow subsurface of the former Custom Plywood Mill is tidally influenced. A perched groundwater zone has previously been encountered within the fill layer at depths of about 5 to 6 feet bgs during low tide and within 2 feet of the ground surface at high tide in some nearshore locations. With increased distance from the shoreline, it is probable that the tidally influenced fluctuation of the groundwater is increasingly dampened; however, monitoring the degree of fluctuation of the water table elevation has not been conducted. At low tide, seepage of water has been observed in the intertidal zone. Samples were collected from these seeps during the field investigation in July and August 2008.

Three shallow perched groundwater wells were monitored from 1999 to 2001 on the Tract No. 4 property to the north of the GBH property that had been sold to the City of Anacortes (Section 2.6.1). Results of groundwater monitoring indicated that the groundwater gradient had consistently been toward the east southeast, toward the shoreline. The three monitoring wells were decommissioned on October 2, 2002, prior to regrading and filling the property for redevelopment.

Two wells (ANCP-MW-01 and ANCP-MW-02) were installed in June 2004 by Aspect Consulting under contract to Anchor, for a previous owner on the main plant parcels currently owned by GBH (Figure 5). AMEC collected water samples and measured groundwater elevations in these wells starting with the groundwater monitoring event in July 2008. Construction details of these two wells are unknown, but water levels measured during the 2008-2009 groundwater monitoring events indicate that they are both screened in the same shallow water-bearing zone as the groundwater monitoring wells installed by AMEC in 2008 and 2009.

Six additional monitoring wells (GMX-MW-01 through GMX-MW-06) were installed during the July 2008 field investigation (Figure 8), and three more wells (GMX-MW-07 through

GMX-MW-09) were installed in August 2009. These wells were all screened in the shallow water-bearing zone above the deeper native units at the site. Five of the new monitoring wells (GMX-MW-01, GMX-MW-04, GMX-MW-05, GMX-MW-06, and GMX-MW-09) were installed in proximity to the shoreline on the eastern part of the property downgradient from areas of known contaminated fill material. Two other wells (GMX-MW-02, GMX-MW-03) were installed upgradient from known contaminated areas along the western boundary of the property to evaluate the shallow groundwater coming onto the property from areas to the west. The final two wells (GMX-MW-07 and GMX-MW-08) were installed on the northwestern portion of the GBH property where petroleum hydrocarbons had been detected in earlier push-probe borings.

The native clay layer was encountered at all well locations, except GMX-MW-05, which was not drilled to the depth of the layer. Nowhere on site was the native clay layer fully penetrated, and so the thickness of this unit is not known. Based on the presence of the localized perched shallow water zone above the native clay layer, the clay acts as an effective aquitard, making it difficult for contaminants to migrate downward through the clay layer.

Depth to the perched groundwater was measured in all wells (existing and newly installed) in July 2008, April 2009, and August 2009 at the time of groundwater sampling. The depth to groundwater data were converted into groundwater elevations (in feet relative to the North American Vertical Datum of 1988 [NAVD 88]), and potentiometric maps were created to evaluate groundwater flow directions at the site. The individual potentiometric maps are discussed in more detail below.

- The July 2008 potentiometric map (Figure 12) indicates that the groundwater elevation ranged from approximately 4.5 feet NAVD88 at the western property boundary to less than 2.5 feet NAVD88 in the northeast corner of the GBH property near the shoreline. Based on these data, the overall groundwater flow direction is toward the east-northeast.

- The April 2009 potentiometric map (Figure 13) shows a similar pattern to the July 2008 potentiometric map. The highest groundwater elevation is approximately 5.5 feet NAVD88 along the western property boundary and the lowest elevation is approximately 3 feet NAVD88 in the northeast corner of the property near the shoreline.

- The August 2009 potentiometric map (Figure 14) shows a similar pattern to the two previous potentiometric maps from July 2008 and April 2009. The groundwater elevation ranged from a high of 7.19 feet NAVD88 at GMX-MW-07 located along western property boundary to a low of about 5.4 feet NAVD88 GMX-MW-06 along the northern property boundary and at ANCP-MW-02 along the shoreline in the central part of the property. The groundwater elevations collected during the August 2009 event were all collected within a period of 1.5 hours, and thus the August 2009 potentiometric map provides a more representative snapshot in time

of the potentiometric surface at the site during low tide than the July 2008 and April 2009 potentiometric maps. The groundwater elevations were collected during the time of water sampling during those two earlier events, resulting in the groundwater elevation measurements being collected over a 2-day time period during both rising and falling tides.

Overall the groundwater elevations were higher in April 2009 compared to July 2008 and August 2009. This relationship is to be expected as the April event was conducted toward the end of the rainy season and the July and August events were conducted during the drier summer season.

The parcels to the north and west of the GBH parcels that have been sold and redeveloped are predominantly paved or have buildings in place. The GBH-owned parcels are mostly unsurfaced, except for remnants of concrete foundations. Natural drainage of surface water trends to the east toward Fidalgo Bay. Under present conditions, most surface water infiltrates, with the exception of large storm wave surges, which tend to pond on the site.

Four small areas of wetlands were identified in the wetlands delineation conducted by Geomatrix (2006a) (Figure 5) as described in more detail in Section 2.5.15. A fifth area, termed Area D, did not meet all three of the criteria for a wetland at the time of the study. (Area D is intermittently wet because it is the discharge point for a stormwater pipe that drains the off-site roads and upland areas west of the GBH property.) A wetlands delineation report was sent to the U.S. Army Corps of Engineers for a jurisdictional determination. The Corps determined that three of the four wetlands (Wetlands A, B, and C) are isolated and not regulated (Corps, 2006). The Corps retained jurisdiction over one wetland, Wetland E. The Department of Ecology conducted a wetlands assessment in April 2008, after a wet winter, and found new evidence that Area D should be classified as a wetland. Remediation activities that are done in Wetlands D and E will be coordinated with the Corps and Ecology's Shorelands and Environmental Assistance Program.

3.3 MARINE AREAS AND DISCHARGE AREAS TO FIDALGO BAY

The site, specifically the parcels owned by GBH and City of Anacortes, include aquatic lands. Because "the site" is defined broadly as those areas that may have been affected by the contaminants, state-owned aquatic lands beyond those aquatic lands owned by GBH and the City may also be part of the site.

Historical photographs show that the plywood mill was constructed on pilings over what is currently the intertidal zone. When the 1992 fire occurred, the debris from the buildings collapsed into this zone. Consequently, the area between the L-shaped platform visible in Figure 2 and the MHHW line contains building debris.

The marine areas at the Site can be divided into the intertidal sections of the shoreline and the offshore, shallow subtidal zone. Accumulations of wood and wood waste from the former mill operations are visible in the intertidal areas at the north end of the Site during low tides. Building debris, pilings, concrete rubble, and foundations are present on or protruding from the surface of the sediments. An underwater video survey conducted in 2007 (Geomatrix, 2007b) revealed accumulations of wood and building debris in the lower intertidal and shallow subtidal zones (Figure 6). Test pits excavated in the intertidal area above the MLLW line showed accumulations of sediment, wood debris, sawdust deposits, and building debris of 8 feet or more. Pilings and concrete rubble in the lower intertidal zone have developed a diverse community of marine encrusting organisms. Portions of the lower intertidal zone have also developed an attached green algal community.

The shoreline at the south end of the GBH property is armored with riprap to protect the walking path. A narrow intertidal beach composed of coarse sand and gravel with scattered cobbles and riprap pieces is present along the toe of the riprap. Surf smelt spawning was documented along this portion of the shoreline during surveys conducted in the 1980s and early 1990s by the Washington Department of Fish and Wildlife (WDFW, 2003a) (Figure 15).

The lower intertidal/shallow subtidal portions of the Site are characterized by sediments consisting of silts and fine-grained sands. Portions of the Site are covered by well-established eelgrass and algal beds that serve as herring spawning areas (WDFW, 2003b) (Figure 15). The eelgrass beds were mapped during the Skagit County DNR Puget Sound Nearshore Survey conducted in 1996 and 1997 (Ritter et al., 1997) (Figure 16) and during the 2007 underwater video habitat survey completed by Geomatrix (2007b) (Figure 6). Emergent and submerged aquatic vegetation were mapped in Fidalgo Bay using multispectral imagery and ground surveys during the 1996 and 1997 Skagit County survey (Ritter et al., 1997) (Figure 16). A majority of the area mapped as eelgrass during the 1996/1997 survey also had eelgrass present during the 2007 video survey (Geomatrix, 2007b) (Figure 6). Some changes in the inshore limits of the beds adjacent to the study area have occurred, and the eelgrass bed offshore of Fidalgo Marina (immediately north of the former Mill) identified during the 2007 video survey (Geomatrix, 2007b) (Figure 6) was not identified as an eelgrass bed during the 1996/1997 DNR survey (Figure 16). The full offshore extent of the eelgrass beds was not mapped during the 2007 video survey.

Additional changes in the distribution of eelgrass and submerged aquatic vegetation are evident when comparing the distribution of eelgrass mapped in 1996/1997 with the 2007 video survey results. The 1996/1997 survey information shows submerged aquatic vegetation (either eelgrass or attached brown algae) extending further offshore than was documented

during the 2007 survey. Patchy dark areas that may represent submerged aquatic vegetation are also visible in the 2006 aerial image used in Figure 6 and Figure 16.

The video survey report (Geomatrix, 2007b) proposed that accumulations of wood and building debris in some areas were responsible for the absence of eelgrass; however, the report identified no clear explanation for the apparent absence of eelgrass in the nearshore area in the vicinity of Tract 4 and Tract 5 (Figure 6). The elevation of the vicinity of the bottom in this area is slightly lower than in adjacent areas to the south, and the area may have been dredged while the Mill was in operation. Eelgrass is sparse or absent over most of the Tract 4 and 5 area. Colonization of the area by eelgrass may have been slowed by unfavorable sediment conditions, or the deeper water depths may limit light penetration and growth.

A bathymetric survey was conducted on the site (discussed further in Section 5.1.3.1) and is depicted on Figure 11. There have been significant changes to the bathymetry from the late 1800s to 1992 while the historical companies were operating and filling the tideflat areas over time. There has been no specific historical information found regarding dredging activities on the site. Water depths on the site are shallow, and generally less than 6 feet below mean lower low water (MLLW). Tidal fluctuation within Fidalgo Bay can vary from -3 feet to +12 feet msl.

There were three known historic outfalls from the facility into Fidalgo Bay. Outfall 003 is currently located on the City of Anacortes' property on Tract No. 4. A metal pipe can still be observed at the shoreline, and is presumed to be this outfall. It is likely that the metal conduit runs along the property boundary easement between Tracts No. 4 and 5. It is not known how the conduit connects farther upland. Outfalls 001 and 002 discharged from the plywood plant when the building extended over the intertidal zone. Current evidence of these two outfalls has not been observed during recent underwater surveys, and it may be that they were destroyed or covered when the building collapsed during the fire. Figure 3 depicts the approximate locations of the historic outfalls.

AMEC has not found evidence to document what may have been discharged from those outfalls. There appears to have been an NPDES permit application filed in 1974 for Outfall 001. The effluent was to be monitored for phosphorus, sodium, oil, grease, and phenol, but no data associated with the NPDES permit have been found.

3.4 METEOROLOGY

The maritime climate in Anacortes, Washington, is characterized by mild winters and cool summers. Mean monthly temperature varies from an average minimum of 34.9 degrees Fahrenheit (^{o}F) in January to an average maximum of 71.9^{o}F in July and August. The highest

recorded temperature in Anacortes was 95°F in August 1931, and the lowest recorded temperature was 4°F in December 1964.

Average monthly wind velocity ranges from 4.0 miles per hour (mph) in September to 9.4 mph in February, with gusts in excess of 50 mph during winter storms. The prevailing wind direction is from the southwest.

Mean annual precipitation for Anacortes is 26.2 inches, most of which falls as rain. Average monthly precipitation varies from a low of 0.93 inch in July to a high of 3.79 inches in December.

In late January 2010, a confluence of events occurred that caused the upland portion of the GBH property to be unusually wet. There was a normal high tide that occurred during an exceptionally low barometric pressure, creating a tide that was perhaps 1 to 2 feet higher than the predicted tide. Low barometric pressure was related to a large storm that reportedly brought in up to 60 mph winds from the southeast. In addition, significant rainfall generated large volumes of stormwater from the stormwater discharge pipe that exists onto Wetland D on the GBH property. The combined rainfall and stormwater discharge created an abnormally high water table with standing water on the surface in areas where infiltration was delayed. The confluence of a high water table due to rain/stormwater, higher tides than normal, and storm surges, caused the GBH property to be exceptionally wet for several days. Erosional effects of the storm surge were apparent on the beach.

On February 9, 2010, AMEC met with Ecology to discuss emergency efforts that could be implemented to mitigate further erosion of the shoreline and minimize storm surge water from topping the bank. On February 10, GBH, Ecology and AMEC met on the property to discuss alternatives for erosion mitigation. A plan was submitted on February 11 to Ecology for the emergency mitigation. The plan consisted of laying a geotextile on the eroding bank within Tracts 5 and 6, and constructing a berm adjacent to the bank in Tract 7. The mitigation measures were granted a Nationwide 38 permit by the Army Corps of Engineers on February 23 and were implemented on February 25.

During the February 10, 2010, site visit, two samples of surface water were collected from puddles near Press Pit #1 (SW01) and GMX-S9 (SW02) and analyzed for TPH-HCID, TPH-DX, and for salinity (using a portable instrument). The salinity readings indicated that water in the surface puddles was brackish with concentrations of 20‰ and 21‰ compared to 34‰ for the marine water that was also tested at that time.

3.5 ECOLOGICAL SETTING

This section describes ecological and habitat conditions in the vicinity of the former Mill, including a description of habitats in the vicinity and wetlands occurring on the GBH parcels, as discussed in Section 2.5.15. EPA (2000) defined a 15-mile-diameter area around the site as a target distance limit (TDL) for ecological receptors. Habitat occurs for all federally listed threatened or endangered species (NOAA, 2009a,b; USFWS, 2007) inside this TDL. These threatened or endangered species include:

- Chinook salmon (*Oncorhynchus tshawytscha*),
- Steelhead trout (*Oncorhynchus mykiss*),
- Bull trout (*Salvelinus confluentus*),
- Bocaccio (*Sebastes paucispinis*),
- Canary rockfish (*Sebastes pinniger*),
- Yelloweye rockfish (*Sebastes ruberrimus*),
- Eulachon (*Thaleichthys pacificus*),
- Steller sea lion, (*Eumetopias jubatus*),
- Southern resident killer whale (*Orcinus orca*),
- Humpback whale (*Megaptera novaeangliae*), and
- Marbled murelet (*Brachyramphus marmoratus*).

Critical habitat has been designated inside the TDL for Chinook salmon and resident orca whales (NOAA, 2000; NOAA, 2009c). In addition, the bald eagle (*Haliaeetus leococephalus*), a recently delisted species, has several breeding habitats within the TDL. The closest bald eagle habitat is approximately 1.5 miles south of the site. The state-listed endangered species the peregrine falcon (*Falco peregrinus anatum*) has several habitats within the TDL; its closest habitat is 2 miles northwest of the site. It is estimated that 3.25 miles of wetland frontage exist within the 15-mile TDL (EPA, 2000). Padilla Bay National Estuarine Reserve and the San Juan National Wildlife Refuge are located 6 miles and 4 miles from the site, respectively (EPA, 2000).

4.0 BASIS OF CONCERN AND PRIMARY RELEASE AND TRANSPORT MECHANISMS

This section presents a summary of current conditions, water and groundwater beneficial uses, source areas, release and transport mechanisms, potential exposure pathways, and public access.

4.1 SURROUNDING LAND USE AND POPULATIONS

This subsection describes the current conditions in Section 4.1.1 and future planned land use of the site and the immediate area in 4.1.2.

4.1.1 Current Conditions

Land uses on properties immediately adjacent to the site include the following.

- The Eastern boundary is Fidalgo Bay, a shallow marine embayment.
- The northern parcel of the former Custom Plywood property is used by North Harbor Diesel for dry dock boat storage, and north of this parcel is a stuffed animal manufacturing facility.
- On the western and southwestern edge of the Site is an asphalt-paved multi-use trail built on a former rail line easement.
- Beyond the multi-use trail to the west is Cimarron Trucking, a trucking company that hauls municipal waste to disposal facilities. The northwest parcel of the former Mill property is V Place road, and adjacent to the road is Northern Marine, a yacht manufacturing company that leases the completely renovated former hardboard plant associated with the former plywood mill. A number of transformers that were moved to the south end of the hardboard plant prior to the fire were undamaged in the fire and later moved off site and disposed. A new addition to the hardboard plant building was placed in the location of the former transformers and is a covered construction area for the yacht manufacturing facility.
- Along the southern boundary is an undeveloped embankment leading up to Fidalgo Bay Road. Across from Fidalgo Bay Road and up the steep embankment from the southwestern portion of the former Mill are several residential properties.
- The site is zoned for industrial use. Maintaining the current industrial zoning is a priority for the City and is part of the City of Anacortes Comprehensive Plan.

Principal land uses in the area surrounding the former Custom Plywood Mill are industrial/commercial businesses. Fidalgo Bay is primarily used for recreational boating and fishing. No commercial fishing is documented to occur within 15 miles of the site (EPA, 2000). Tidal areas of the site may be used by the public for recreational fishing and shellfish collection; however, the heavy debris in the intertidal zone precludes digging. From 1992 until the excavations of Areas 2 through 5 in 2007, the GBH property had not been disturbed

except to clear debris and weeds, and to temporarily store some equipment and boat parts. Since late 2007 when GBH bought the site to early 2011, GBH cleared the northern portion of their property and stored boats on the land. However, as of early 2011, the southern portion of the GBH property had not been modified except where it was necessary to build firm surfaces to enable access for drilling and sampling equipment and to stabilize the shoreline. The land surrounding the site is moderately populated; as of 2000, 3,961 residents live within 1 mile of the GBH property and a total of 13,316 residents live within 4 miles of the property.

4.1.2 Future Developed Conditions

Future development of the GBH parcels will incorporate stormwater runoff controls in areas with hard surfaces. Stormwater will be routed to catchment basins for settling, and to a swale prior to discharge. Areas planned for landscaping will be sampled prior to construction and planting to confirm the absence of contaminants in excess of cleanup levels. If such areas contain residual contamination and the soil cannot be readily removed, those landscaped areas will be engineered and controlled to eliminate exposure; however, every effort will be made to avoid landscape plantings in areas with residual contamination, if any such areas remain.

The City of Anacortes may construct a public access pathway on the southernmost portion of the GBH property to provide access from the multi-use trail to Fidalgo Bay. If public access becomes the land use for this small area, it will be fenced from industrial portions of the property such that no access to the industrial portion of the site will be allowed.

The GBH property was fenced with temporary fencing during the July 2007 excavation activities, and permanent fencing was installed in May 2008. The fencing will be maintained during the proposed remedial activities.

With the exception of the GBH parcel and small strips of unsurfaced land on either side of the Tommy Thompson Trail, the various parcels within the footprint of the former Custom Plywood plant have been extensively redeveloped. Redevelopment of those parcels has generally involved construction of buildings and pavement that preclude infiltration of surface water and prevents exposure of humans and terrestrial biota to affected soils. Consequently, exposure of the public to any impacted soils or groundwater is precluded throughout most of the Site, except for the narrow landscaped trail corridor.

Following remedial activities, future development of the GBH-owned upland areas will be consistent with the applicable City of Anacortes industrial zoning (Zone I). Currently, GBH envisions the short-term use as a boat storage yard. Longer term use could include boat launch facilities with ramp and pier structures, and structures for dry storage of boats. Based

on current conceptual plans, redevelopment will include adding several feet of fill over the ground surface to a relatively consistent height (final elevation yet to be determined). Where necessary, structural fill, followed by asphalt or concrete, will be placed on the surface to control settlement and to function as an engineering control, if needed. Areas that are used for creation of habitat for mitigation will be designed to minimize ecological exposure.

Granting the City of Anacortes the right to use a small part of the southern portion of the property for public access to Fidalgo Bay has been discussed, but no specific location for this public access area has been defined. If the City is interested in the use of a small part of the property for public access, an exposure evaluation of that specific portion of the area would be conducted separately based on the intended use.

4.2 HIGHEST BENEFICIAL USE OF SITE GROUNDWATER AND SURFACE WATER (MARINE AND FRESH)

Sections (2)(b)(i) and (ii) of WAC 173-340-720 state that groundwater can be considered nonpotable if it contains natural background concentrations of organic or inorganic constituents that make use of the water not practicable. An example of inorganic constituents that would make groundwater nonpotable under this definition is levels of total dissolved solids (TDS) greater than 10,000 mg/L. The former Custom Plywood Mill abuts Fidalgo Bay, and groundwater is shallow and perched above the clayey native material that is present at about 6 to 22 feet bgs. Thus, groundwater at the Site is most likely tidally influenced (hydraulically connected) by Fidalgo Bay. Seawater in the adjacent Fidalgo Bay typically contains a minimum of 30,000 mg/L TDS. TDS concentrations greater than 10,000 mg/L would be expected in groundwater in a nearshore area with tidal influx of seawater. Thus, based on the definition in Sections (2)(b)(ii) and (d) of WAC 173-340-720, groundwater at the site would be considered a nonpotable water source because some of the wells have exhibited TDS greater than 10,000 mg/L or salinity greater than 1 percent. Indeed, groundwater samples from the site monitoring wells were analyzed for salinity as part of this RI, and results ranged from 0.1 percent (1,000 mg/L) from a well near the hiking trail to 2.1 percent (21,000 mg/L) in a nearshore well; seep samples were 2.9 percent to 3.3 percent.

Aside from the groundwater on the site qualifying as a non-potable water source, City-supplied domestic water is available for the surrounding area. Thus, groundwater at the Site cannot and will not be used for potable purposes.

Ecology's well log database was searched for domestic water supply wells within a 1 mile radius of the site. AMEC did not independently verify the data or determine whether the wells are still in use.

The site is located in the eastern portion of Section 30, T35N, R2E. Five domestic supply wells are listed in the database that are within 0.75 mile of the site, and all within in Section 30. The five well logs yielded the following information:

Well ID	Owner	Address	Date Drilled	Total Depth (feet)	Section 30 Subsections
A	Aaron Strickert	4207 O Avenue	1-13-03	12	SE, NW
B	Elizabeth Kuehnoel	NA	NA	119	NW, SE
C	Blaine Moffitt	802 Haddon Road	8-20-86	215	SE, SE
D	David Hammons	1410 19th Street	10-13-76	212	NW, NE
E	Donald Daniels	4114 R Avenue	11-13-98	224	SW, SW

Notes
1. NA = Information is not available.

Well D (1410 19th Street) is located with the City of Anacortes water service area and is unlikely to continue to be used since water service is available. All the other wells lie outside the Anacortes water service area. The water service boundary in the vicinity of wells A, B, C, and E is at the intersection of O Avenue and 41st to the north and Haddon Road and Happy Valley Lane to the east. All four wells are located on a topographic high and the city cannot supply water to this area without installing a pump house. According to the City (Bob Clumpner, 2010), all residences in that area have domestic wells and it is likely Wells A, B, C and E are still in use.

Between 0.75 to 1.0 mile radius of the site, seven additional domestic wells were listed in Section 25 to the west, and 17 wells were listed in Section 31 to the south. Based on the groundwater gradient established during the RI, none of the domestic wells present within one mile is at risk from the groundwater at the site as all the domestic wells are either up gradient or cross gradient from the site. Furthermore, because the contamination present is predominantly petroleum hydrocarbons that are less dense than water or other low mobility contaminants, and because there is a widespread clay unit below the site that acts as an aquitard, there is extremely low risk for downward migration of the contaminants at the site.

4.3 PRIMARY RELEASE AND TRANSPORT MECHANISMS

Potentially impacted groundwater and soil particles could be released and transported through various mechanisms, such as surface water runoff, groundwater migration to Fidalgo Bay, direct discharge, and fugitive dust. Each transport mechanism is discussed in more detail below.

- Surface water runoff: Surface water (originating as overland flow from upgradient areas or from rain events) could potentially entrain soil particles and/or dissolved

fractions of COPCs. Surface water with entrained COPCs may potentially be transported via overland flow to Fidalgo Bay.

- Groundwater migration to Fidalgo Bay: COPCs in soil may leach into groundwater due to infiltration of precipitation into COPC-impacted soil. Leaching may also occur due to the daily tidal cycle, lowering and raising the water table elevation, and thereby flushing residual contamination in soil into groundwater. This impacted water may potentially discharge to marine surface water via groundwater to sediment pore water transport. COPCs in groundwater may have the potential to migrate to surface water, based on the historical presence of seeps along the shoreline.

- Direct Discharge: Direct discharge either to soil or groundwater, or marine environment might have occurred until 1992 when the facility was razed. No industrial activity is currently occurring on the site; however, boat building activities were occurring on the Andrews properties (former Hardboard plant) until recently.

- Fugitive Dust: COPCs in soil may mobilize in fugitive dust throughout the unpaved portions of the former Mill property. The fugitive dust could potentially be transported either to other uplands areas or to Fidalgo Bay.

- Direct contact by aquatic or terrestrial ecological receptors: Wood waste in the upland and aquatic areas have the potential to cause deleterious effects on ecological receptors due to physical obstructions and breakdown compounds generated during wood decay.

4.4 EXPOSURE PATHWAYS

Terrestrial ecological and human receptors can be exposed to contamination via the transport mechanisms discussed in the previous subsection. More specific information is provided below regarding potential exposure pathways. Section 8.0 discusses the conceptual site model, potential contaminant release & transport mechanisms and exposure pathways specific to the site COPCs that are identified in Section 6 and Section 7. An overview of potential exposure pathways are outlined below by medium:

- **Soil and wood debris:**
  - Human direct contact (i.e., ingestion and dermal exposure and inhalation) with soil by construction and site maintenance workers, visitors and future industrial workers;
  - Direct contact with soil or wood decay products by terrestrial ecological receptors (e.g., mammals, birds, vegetation, etc.);
  - Uptake of soil contaminants into terrestrial ecological species (i.e., terrestrial plant and animal bioaccumulation) who then would be consumed as prey by upper trophic-level terrestrial ecological receptors;
  - Cross-media transfer pathway associated with hazardous substances in upland soil leaching to adjacent groundwater; and

- Upland soils from 0 to 6 feet bgs are within the biologically active zone and terrestrial ecological receptors are of concern, as well as the human health exposure risk. Soils between 6 to 15 feet bgs are below the biologically active zone and terrestrial ecological exposure pathways are not complete, unless changes to land use were to occur.

- **Air**

  - Exposure through inhalation of soil contaminants that have migrated to air either as windblown dust or as vapor: Receptors may include site trespassers, construction and site maintenance workers, future industrial workers, and terrestrial ecological receptors. This pathway should include future indoor air exposure to industrial workers who may occupy future on-site buildings.

  - Exposure through inhalation of groundwater contaminants that have migrated to air as vapor: Receptors may include site trespassers, construction and site maintenance workers, future industrial workers, and terrestrial ecological receptors. This pathway may include future indoor air exposure to industrial workers who may occupy future on-site buildings.

- **Groundwater**

  - Human direct contact with shallow groundwater by construction and site maintenance workers and site visitors; and

  - Media transfer pathway associated with hazardous substances in shallow groundwater migrating to surface water and nearby marine sediment.

- **Surface Water and Sediment**

  - Human direct contact with Fidalgo Bay surface water and sediment by recreational users and subsistence fishers;

  - Direct contact with Fidalgo Bay surface water and sediment by aquatic ecological receptors (e.g., fish, invertebrates such as shellfish, birds, amphibians);

  - Uptake of surface water/sediment contaminants into aquatic ecological species such as fish and shellfish (i.e., aquatic organism bioaccumulation), which then would be consumed as prey by humans;

  - Uptake of surface water/sediment contaminants into aquatic ecological species, which then would be consumed as prey by upper-tropic-level aquatic ecological receptors; and

  - Direct contact with significant accumulations of wood debris by aquatic ecological receptors. Physical effects may include smothering of infauna organisms or changes in the benthic community structure. Chemical effects may include the buildup and release of toxic contaminants from the decay of the wood and the development of reduced oxygen (anoxic) sediment conditions.

5.0 REMEDIAL SITE INVESTIGATIONS AND LIMITED INTERIM ACTION ACTIVITIES CONDUCTED PREVIOUSLY

An independent limited Interim Action was carried out for Areas 2 through 5 in July 2007 (Section 2.6.2). Following the Interim Action, a remedial investigation was carried out in July 2008 with supplemental investigations in April 2009 and August 2009. These activities are discussed in more detail below. A supplemental sediment study was conducted in 2010 and is discussed in the FS report (Hart Crowser, 2011).

5.1 INVESTIGATION AND INTERIM ACTIONS

The methods and procedures used during the 2007 Interim Action and the 2008 and 2009 remedial investigation are discussed in more detail below. Sampling locations are shown on Figure 8, and complete coordinates are presented in Table 1.

5.1.1 Soil Sampling Activities and Results

This section describes the methods used for soil sampling, post-interim action confirmation sampling, and soil bioassay sampling during the remedial investigation process.

The horizontal positions of all the 2008-2009 soil and groundwater sample locations were surveyed following the sampling events by a professional surveyor (Schemmer Engineering, Inc.). Survey data were based on the horizontal Washington State Plane North American Datum of 1983 (NAD83) coordinate system, which is compatible with Environmental Information Management (EIM) submission requirements. The survey used such practices that resulted in horizontal errors no greater than 0.10 foot. Monitoring wells were also surveyed by a licensed surveyor after completion.

5.1.1.1 Soil Investigation Sampling

Soil samples were collected from approximately 57 locations plus from nine monitoring well boreholes in 2008 and 2009 during the final phases of the remedial investigation.

The majority of the samples were shallow samples collected from depth intervals of 0 to 1 feet, 2 to 4 feet, and 4 to 6 feet bgs. Sample collection proceeded as follows.

- A push-probe rig, a hollow-stem auger rig, or an excavator was used to perform soil sampling to the maximum desired depth at each soil sample location. Drilling was completed by Cascade Drilling, a driller licensed in Washington State. The drilling and soil sampling was supervised by a geologist licensed in Washington State.

- For each sample (except for volatile analyses), a portion of soil was collected from the designated sample depth interval and placed directly into a labeled, precleaned sample jar using a stainless steel spoon. Each sample jar was sealed and retained on ice until transported to the contract laboratory.

- If refusal was encountered at a sample location prior to reaching the target depth, the sample location was moved approximately 1 foot away, as directed by the project geologist in consultation with Ecology staff, and the boring was repeated.

- The sampling equipment was decontaminated between each sampling location using the decontamination procedures outlined in Section 4.1 of the Sampling and Analysis Plan attached as Appendix A to the Work Plan (Geomatrix, 2008).

The sampling equipment was cleaned prior to conducting borings at the site, and decontaminated before sampling began at each sample location. A survey flag was placed at each sampling location, and all locations were subsequently surveyed at the end of the investigation.

All subsurface borings completed during well installation were logged continuously by a field geologist to the boring's total depth. The lithologic log for each boring was based on visual observation and description of the corresponding soil samples in accordance with American Society for Testing and Materials (ASTM) standard D2488. Each sample lithologic description contained the following information:

- Boring identifier;
- Sample depth interval, in feet bgs;
- Color (based on Munsell® color chart);
- Signs of weathering (e.g., rust-colored stains or coatings);
- Texture (particle size, angularity/roundness, and degree of sorting);
- Soil type, based on the Unified Soil Classification System (USCS) (ASTM D2487-98);
- Estimated moisture content (qualitative);
- Organic matter (e.g., plant detritus, woody or fibrous vegetative matter, shell fragments), if any;
- Photoionization detector (PID) reading;
- Noticeable odor, if any; and
- Sheen test results and observations regarding heaviness of the sheen or free product.

The soil samples were delivered to OnSite in Redmond, Washington, for analysis. Standard procedures were followed using chain-of-custody forms for all samples sent to the laboratory.

5.1.1.2 Post-Interim Action Confirmation Sampling

An interim action was completed in July 2007 in Area 2 through Area 5 as described in the Work Plan (Geomatrix, 2008) (Section 2.6.2). Soil confirmation samples were collected from the bottom and side walls of each excavated area once the proposed depth had been reached and when field screening indicated that all impacted soil has been removed. At least one excavation bottom sample for every 500 square feet of area and two side wall samples were collected from each excavated area.

Depending on the excavation depth, soil samples were collected directly from the excavation bottom or side wall, or from the bucket of a backhoe. Soil samples were collected using stainless steel spoons and the material was placed directly into precleaned glass jars supplied by the analytical laboratory. Soils collected from the bucket of the backhoe were taken in the center of the bucket to minimize the risk of cross-contamination. All sampling equipment was properly decontaminated between each confirmation sample location as discussed in Section 5.1 of the Uplands Remedial Action Sampling and Analysis Plan (Geomatrix, 2007a).

Samples were analyzed in accordance with the methods described in the Quality Assurance Project Plan (QAPP) attached as Appendix B to the Uplands Remedial Action Sampling and Analysis Plan (SAP).

5.1.1.3 Soil Bioassay Testing

A terrestrial ecological work plan was developed and approved by email from David Sternberg of Ecology to AMEC on July 16, 2009. Soil samples were collected and analyzed for bioassay purposes in accordance with the work plan. Soil bioassay samples were collected near press pit #1 on August 4, 2009. Samples were stored in a chest freezer at 4°C until transport to the laboratory. During transport to Nautilus laboratory, samples were maintained at 4°C by shipping them in a cooler with blue ice. The lettuce and earthworm bioassay tests were started on August 11 and 13, respectively. Twelve soil samples (5 treatment concentrations and the 2 artificial soils used for dilutions) were delivered to OnSite for TPH analysis on August 14th. Samples were analyzed for TPH-Dx, TOC, PAHs, and metals.

5.1.2 Groundwater Sampling and Water Level Measurements

This section describes the methods used for well installation and development, groundwater sampling, and evaluation of the groundwater gradient during the remedial investigation process.

5.1.2.1 Well Installation and Development

During the first phase of the RI field work conducted in July 2008, a total of six new monitoring wells (MW-01 through MW-06) were installed (see Table 2 for a summary of monitoring well

construction details). These wells, in addition to the two existing wells (ANCP-MW-01 and ANCP-MW-02), were subsequently developed in accordance with Section 3.2.3 of the Uplands SAP included as an appendix with the Work Plan (Geomatrix, 2008). The two previously existing wells were installed on July 12, 2004, by a different contractor as part of an earlier investigation at the site. The well completion data included in Table 2 for these two previously existing wells were compiled from Ecology's online well database. AMEC redeveloped ANCP-MW-01 and ANCP-MW-02 during the July 2008 RI field work so that all wells sampled were properly developed and acceptable to be used for collecting groundwater samples. Three more monitoring wells (MW-07 through MW-09) were installed in August 2009 during the second phase of RI field work. Well construction information for these wells is included in Table 2. These three wells, like the wells installed during the first phase of the RI field work, were developed in accordance with Section 3.2.3 of the Uplands SAP.

The monitoring wells installed in July 2008, GMX-MW-01 through GMX-MW-06, were installed with the screen completely submerged below the groundwater table, based on instructions from Ecology. The wells installed in August 2009 (GMX-MW-07 through GMX-MW-09), however, were screened so that the screened interval straddled the water table at the time of installation.

These nine new wells were used to fill remaining data gaps in the groundwater investigation. The wells were located as follows (see also Figure 8).

- **GMX-MW-01** was installed southeast of the press pits. This well was installed to monitor water quality of groundwater downgradient of the TPH-impacted press pits and to detect potentially impacted groundwater migrating toward the intertidal zone.

- **GMX-MW-02** was installed east of the Tommy Thompson Trail (former railroad right-of-way), downgradient of the suspected location of a former 7,500-gallon fuel tank and Custom Plywood's former office building. The land occupied by the former office building is currently owned by Ray Sizemore of Cimarron Trucking. This well was installed to monitor groundwater quality downgradient of the potential former fuel tank and to detect potentially impacted groundwater migrating toward the GBH property from upgradient locations.

- **GMX-MW-03** was installed southeast of the former hardboard plant, where the transformers were located. This hardboard plant and former transformer storage area is currently owned by Joseph and Jennifer Andrews of Santee, California. This well was installed to monitor water quality in groundwater downgradient of the former transformer storage area and to detect potentially impacted groundwater migrating toward the GBH property from parcels upgradient.

- **GMX-MW-04** was installed east of the hog fuel area. This well was installed to monitor water quality of groundwater downgradient of the hog fuel area and to detect potentially impacted groundwater migrating toward the intertidal zone.

- **GMX-MW-05** was installed in a new borehole located at the location of soil sampling point GMX-S21 to monitor groundwater at the suspected location of a former 18,000-gallon fuel tank. This well was installed based on field observations and in consultation with Ecology.

- **GMX-MW-06** was installed in a new borehole located at the location of soil sampling location GMX-S27 to monitor water quality of groundwater in the vicinity of the suspected location of a former 990-gallon fuel tank. This well was installed based on field observations and in consultation with Ecology.

- **GMX-MW-07** was installed along the western property line near the entrance to the GBH property. This well was installed to monitor water quality of groundwater in the vicinity of soil with elevated TPH concentration and to detect potentially impacted groundwater migrating toward the GBH property from upgradient locations.

- **GMX-MW-08** was installed in the northwestern part of the GBH property near the property entrance. This well was installed to monitor water quality of groundwater in the vicinity of soil containing elevated TPH concentrations and to detect potentially impacted groundwater migrating toward the GBH property from upgradient locations.

- **GMX-MW-09** was installed east of the press pits. This well was installed to monitor water quality of groundwater downgradient of the TPH-impacted press pits and to detect potentially impacted groundwater migrating toward the intertidal zone.

Two existing wells were also used as part of the groundwater monitoring network. The existing wells are located as follows (see also Figure 8).

- **ANCP-MW-01** is located south of the boiler house and compressor building. This well was used to assess the groundwater quality in the vicinity of the boiler house and to detect potentially impacted groundwater migrating toward the intertidal zone.

- **ANCP-MW-02** is located east of the press pits. This well, along with GMX-MW-01, was used to assess the groundwater quality downgradient of the press pits and to detect potentially impacted groundwater migrating toward the intertidal zone.

5.1.2.2 Well Monitoring and Sampling Procedures

Starting on July 31, 2008, and continuing through August 1, 2008, AMEC personnel sampled all eight existent monitoring wells and four surface water seep locations (Figure 8) at the site. Two additional rounds of groundwater sampling were conducted in April and August 2009. No seep samples were collected during the 2009 groundwater monitoring events. The August 2009 groundwater monitoring event included sampling of the three new monitoring wells (GMX-MW-07 through GMX-MW-09) installed during August 2009. Groundwater and seep sampling was conducted in accordance with Sections 3.4.1 and 3.5.1 of the Uplands SAP (Geomatrix, 2008). Prior to collecting groundwater samples, physical parameters were

allowed to stabilize so that groundwater sampled met water quality criteria set forth in Section 3.4.1 of the Uplands SAP. A summary of the final recorded physical parameters is included in Table 3.

Samples were collected in pre-cleaned containers provided by OnSite and properly labeled and handled as outlined in Sections 3.4.2 and 3.5.2 of the Uplands SAP. Groundwater samples collected for dissolved metals analysis during the July/August 2008 groundwater monitoring event were field filtered using a GeoTech in-line 0.45 micron single use filter. The filter was fitted to the end of the sampling tubing and was allowed to fill with water. Once the filter was filled with water, a dissolved metals sample was collected from the outgoing port of the filter. The samples were hand delivered, shipped, or couriered to OnSite in Redmond, Washington, for subsequent analysis.

5.1.2.3 Groundwater Grab Sampling

One grab groundwater sample (S9-W) at GMX-S9 was collected during a concurrent push probe investigation in July 2008 at the request of Ecology. This sample was collected using a pull-back stainless steel screen in a push probe hole. The hole was sealed after sampling. The sample was analyzed for total metals, TPH, and VOCs, in accordance with Section 3.4.1 of the Uplands SAP (Geomatrix, 2008).

5.1.2.4 Groundwater Gradient

Water levels were measured prior to sampling during each groundwater monitoring event. The recorded depth to water measurements was converted to groundwater elevations using the surveyed elevations of the top of casing for each monitoring well. Groundwater elevation contour maps were generated using these data, and the resulting potentiometric surface maps are presented in Figures 12 through 14.

Based on these groundwater contour maps, a groundwater gradient between GMX-MW-02 (western part of the GBH property) and GMX-MW-04 (along shoreline) was calculated for the three monitoring events. The general groundwater flow direction is to the northeast at low or falling tide, and the groundwater gradient ranges from a high of 0.00653 during the April 2009 event to a low of 0.00361 during the July 2008 event. The gradient for the August 2009 event was 0.00418, and this value might represent the most representative estimate of the groundwater gradient since all groundwater elevation measurements during this event were taken within 1 hour of each other, reducing the tidal impact on the measured elevations.

5.1.3 Nearby In-Water Area Sediment Sampling Activities and Results

The primary objective of the nearby in-water area sediment sampling activities was to determine whether sediments adjacent to the former mill exceeded the SMS (WAC 173-204)

SQS (WAC 173-204-320) or CSL (WAC 173-204-520) biological, chemical, and/or deleterious substances criteria. Another objective was to determine if sediments adjacent to the former mill pose and unacceptable risk to human health due to bioaccumulative constituents of potential concern identified by Ecology (i.e., dioxins and PCBs).

The sediment sample locations were established in a systemic grid layout with a random start point (see Figure 17) Proposed sampling locations in the inshore area were moved after consultation with Ecology to provide improved coverage of the intertidal portion of the shoreline. The intertidal samples at the north end of the study area (i.e., Stations ST-5, ST-9, ST-13, and ST-17) were sampled by hand during a low tide on September 8, 2008. Sampling locations were chosen to avoid visible surface debris. Intertidal stations at the south end of the project area (i.e., ST-21, ST-25, and ST-29) were moved offshore from the original sample locations because gravel and cobble substrates prevented sample collection at the proposed locations. The sampling locations were moved offshore of the proposed sampling locations perpendicular to the shoreline until a satisfactory sampling was obtained using a powered grab sampler.

5.1.3.1 Bathymetric Survey

A multi-beam (swath) hydrographic survey was conducted January 26 and January 27, 2006, in the shallow intertidal and subtidal areas adjacent to the Former Custom Plywood Mill. Bathymetric soundings were converted to elevations referenced to MLLW using a surveyed benchmark and an electronic water elevation recorder. The topographic (land) survey data collected in the uplands and extending into the upper intertidal zone were merged with the bathymetric survey data set to form an integrated data set covering the project area. A contour map with elevation contours referenced to MLLW vertical datum was generated and is included as Figure 17.

5.1.3.2 Benthic Survey

A benthic habitat survey (Geomatrix 2007b) was conducted on July 28 and 29, 2007, using a video camera suspended from a boat moving slowly along transects established within the study area (Figure 6; Section 2.6.16). The survey area was divided into two subareas with transects spaced about 25 feet apart in the north area, and 75 feet apart in the southern portion.

A video file was created for each transect. The video files were reviewed to identify the presence of eelgrass, macroalgae, and visible debris (wood, metal, construction debris). A data file was created for each transect that logged the location of the survey vessel using a differential global positioning system (DGPS) with a position accuracy of <1 meter (m). Data files with the logged coordinates and the visible attributes (e.g., eelgrass, algae, or debris)

were created and plotted. Eelgrass coverage was visually estimated as none (0 percent coverage), low (1 to 25 percent coverage), medium (25 to 75 percent coverage), or high (>75 percent coverage), and the results are presented in Figure 6.

The survey identified the following features.

- Three eelgrass beds (covering approximately 7.6 acres north of the project area; 0.6 acres at the north end of the project area; and 23.3 acres at the south end of the project area) were found.
- Visually estimated eelgrass coverage varied from 52 percent in the north end to 75 percent in the south end.
- Scattered areas of visible debris were present, concentrated in the vicinity just offshore from the former Custom Plywood Mill and in the vicinity of the abandoned pier.
- Large amounts of macroalgae occurred in the north end of the study area, primarily *Laminaria* sp. with *Ulva* sp. in the nearshore areas.
- Only very limited amounts of macroalgae occurred in the south end of the study area.

The presence of large pieces of surficial wood debris in the nearshore area appeared to limit the shoreward extent of eelgrass in some areas (Figure 6); however, poor visibility during the summer survey limited direct observation of the sediment surface in areas with higher eelgrass density. Frequent fouling of the towed video camera occurred in the eelgrass beds if the camera elevation was adjusted deep enough to clearly see the bottom. Because eelgrass generally does not colonize areas with extensive wood debris, it is likely that the amount of wood debris within the eelgrass beds is low.

5.1.3.3 Grab Sampling and Grain Size Analysis

A total of 34 sediment samples were collected at 32 sampling stations between September 3 and September 8, 2008. The 32 sediment sampling locations are shown on Figure 16, and detailed coordinates area presented in Table 4. All but one (i.e., ST-8) of the offshore sample locations were within 3 m of the proposed location (Figure 16). Sample location ST-8 was collected 5 m from the proposed location. Qualitative sample characteristic logs describing the sediment types, stratigraphic contacts, and sample IDs for each station are provided in Appendix A.

Grab samples were collected from all but four stations (Table 4) using the procedures specified in the work plan (Geomatrix, 2008) Appendix B, Sampling and Analysis Plan for Sediments, with the exceptions noted above. Grab sample locations were determined using a

DGPS, with coordinates in the Washington State Plane Coordinate System (SPCS), North Zone, referenced to the NAD83, survey feet.

A stainless-steel, 0.2 square-meter (m^2) pneumatically operated grab sampler was used to collect an undisturbed sample of the bottom sediments at 28 of the sample stations (plus one duplicate at ST-20 for a total of 29 samples). The surface of the sediment was photographed, visually inspected, and logged. Porewater was collected for sulfide and ammonia analysis from the top 10 centimeters (cm) of sediment. Sediment for Microtox® porewater extraction was placed directly into 16-ounce glass jars. The top 10 cm of sediment was collected, homogenized, and archived for future chemical analysis and biological testing. Sediments touching the sides of the grab sampler were not collected.

Sediments were collected by hand from four intertidal stations (plus one duplicate for a total of five samples) (ST-5, ST-9, ST-13, and ST-17) at the north end of the project area using a stainless steel spoon from the top 10 cm. The coarse–grained sediments at these intertidal stations did not retain sufficient pore water for sulfide or ammonia analysis or Microtox testing.

Sediments were analyzed for grain size distribution using the Puget Sound Estuary Program protocols. The percentage of fines (< 63 micrometer [µm]) in the test sediment was matched to an appropriate reference sediment for the bioassay testing.

5.1.3.4 Tiered Analytical Approach

This project uses a tiered testing approach to identify potential areas to be addressed in the FS. The tiered testing approach is shown schematically in Figure 18. Results of the tiered testing are presented in Table 5 and illustrated schematically in Figure 19. The initial tier of testing involved assessment of wood content in sediments using visual and analytical methods. In addition, sediments were tested for adverse biological responses. Surficial wood debris coverage was assessed in each sediment grab sample using a visual point contact method. Total volatile solids (TVS) and TOC were measured with a large-sized sample (≈300 grams) and used as a surrogate for wood debris within the biologically active zone. A Microtox bioassay was used as a screening test for adverse biological impacts. Porewater ammonia and sulfide (from the top 10 cm) were also measured in each grab.

Results of tiered testing are presented in Table 5. Surficial wood coverage in the 29 grab samples collected ranged from 0 percent to 20 percent. TVS values in sediment from the 29 grabs and from the 5 hand-collected sediment samples ranged from 2.14 percent to 23.5 percent. Fourteen samples from 13 stations exceeded the Tier 1 criterion of 9.7 percent TVS. TOC values exceeded the Tier 1 criterion of 10 percent in three samples from two

stations. Microtox testing was conducted on sediments from 28 locations (plus 1 duplicate sample). Eighteen of the Microtox tests failed the SMS SQS biological criterion (Table 5).

Additional biological testing was conducted on sediment samples from 16 of these stations using amphipod bioassay and a sediment larval test. All of the sediment samples passed the amphipod test, but four sediment samples failed to meet the sediment larval test SQS biological criterion and two failed to meet the CSL criterion (Table 5). The four stations that did not exceed the CSL criterion for the sediment larval test were considered CSL station failures because there were SQS failures for the Microtox test at those stations.

5.1.3.5 Sediment Chemistry Studies

Archived sediment samples from the six stations with exceedances of the CSL biological criteria in the sediment larval tests were analyzed for the SMS list of chemicals of concern (Table 6). There were no exceedances of the SMS SQS chemical criteria.

Bioaccumulative COPCs (PCBs and dioxins/furans) were analyzed at selected locations and/or composites of locations. PCBs were not detected in any of the discrete or composite samples selected for PCB analysis (Table 6). Dioxins and furans were also measured in selected samples and in composite samples. Results are presented in Table 7. Toxicity equivalency quotients (TEQ) were calculated using the World Health Organization 2005 toxicity equivalency factors (Van den Berg et al., 2006). Calculated TEQs ranged from 2.74 to 19.6 parts per trillion (pptr) (Table 7) using one-half of the reporting limit for nondetected values (Figure 19).

A human health risk assessment is presented in Section 9.2 for dioxin and furans in sediments.

5.2 DATA QUALITY ASSESSMENT

This section describes the criteria used to evaluate existing available data and determine if data meet project quality assurance (QA) and quality control (QC) criteria for input into the project database.

5.2.1 Recency

Data used to evaluate conditions should be representative of current environmental conditions. Therefore, for Uplands, only data collected since 1995 were included in the project database. Uplands data collected prior to 1995 may be of historical interest, but are less likely to be representative of current conditions due to the potential for physical, chemical, and biological transformations and transport. Sediment data from the EPA 2000 report and earlier were not input into the EIM database because of the age of the data.

5.2.2 Data Validation/Suitability Review

Non-detect results may be good quality data, but introduce uncertainty depending on reporting limits. To assess this potential uncertainty, non-detect values were evaluated to determine how detection limits compared to screening levels. Older analytical methods may not have been capable of detecting constituents at the low levels that are currently achievable by the project laboratory. Detection limits may also be higher than expected due to interference caused by detections of other constituents present in the sample, general laboratory dilution, or matrix issues. For this data evaluation, historic data were conservatively considered to exceed screening levels if the reporting limits were higher than the screening levels.

The soil, groundwater, and sediment data collected since 2001 have been subjected to a Level 1 data review, which includes evaluation of package completeness; reviewing the chain-of-custody, sample preservation, and holding times; and evaluating the associated laboratory quality control samples, including blanks, matrix spikes, and laboratory spikes. Reporting limits were also assessed to evaluate whether project-specific screening levels were achieved. Any qualifiers added to the data as a result of the review were inserted in the project database and added to excel tables. Additionally, any uncertainty associated with the qualifiers is considered in evaluating the data. None of the analytical data collected since 2001 have been rejected due to quality control issues.

5.2.3 Sample Collection Methods

Soil data entered into the project database were collected using standard, acceptable methods of sample collection, ensuring that sample integrity was not compromised during sample collection. The soil and sediment samples collected in 2007 and 2008 were obtained using standardized methods as described in Sections 5.1.1 and 5.1.3.

Groundwater analyses from push-probe grab sampling conducted prior to 2007 were not entered, since they were not collected using standard collection methods. Groundwater samples collected in 2008 and 2009 were collected using standardized low-flow sampling techniques as described in Section 5.1.2.

5.2.4 Analytical Methods

Data entered into the database originate from analyses performed using the EPA's SW-846 Methods and Ecology TPH Methods, ensuring that the results were based on analyses performed using standard and acceptable methods.

5.2.5 Locations

The samples in the database all have existing location information (northings and eastings), and no samples were rejected due to lack of location information. Historical sampling points

were located relative to existing site features by taping. The distance between at least two existing site features and the actual sample point was measured, and this information was then used to locate the sampling point based on the 1997 surveyed map by Larry Steele and Associates.

Locations of soil and groundwater samples collected since 2007 were all surveyed by Schemmer Engineering, Inc., from Anacortes.

5.3 DATABASE DEVELOPMENT

Data were compiled by hard copy, entered or received in electronic format, and entered into a Microsoft Access relational database. Historical data, representing sample results from 1995 through 2000, were entered from Microsoft Excel tables; however, these were not electronic data compiled by the laboratories. The recent data collected in 2007, 2008, and 2009 were imported directly into the database in electronic format using laboratory electronic data deliverables. The information in the database includes:

- sample identifications and locations;
- sample types;
- sample locations, including depth; and
- analytical chemistry results.

Data tables submitted to Ecology's EIM database are also stored in the project database.

The database was queried to compare the data to the applicable and relevant screening criteria for soils, groundwater, and sediments presented in Section 10.1.

6.0 NATURE AND EXTENT OF CONTAMINATION

This section identifies areas of contamination based on available information from all of the previous investigations. Known or suspected source areas are summarized in Section 6.1. Sections 6.2 to 6.5 describe the nature and extent of COPCs for soil, groundwater, and sediments, respectively, individually and in the context of the known and potential source areas. Constituents identified in one or more samples at concentrations greater than the screening levels presented in Section 10.1 are retained as COPCs.

6.1 HISTORIC AND CURRENT SOURCE AREAS

This section presents a discussion of known or suspected historic source areas based on a review of available information for the site. All the sources discussed are historic, because the main plant area has been unused since the 1992 fire, and current operations on other portions of the site appear to be environmentally compliant (although AMEC has not conducted an audit of the facilities to verify their compliance status).

Previous investigations have compiled information about the history and manufacturing processes used at the plant (Section 2.2.2). Following the evaluation of the data conclusions can be made regarding known or potential historic sources of contamination associated with the site. These historic sources are listed below and labeled on an historical aerial photograph of the former Mill in Figure 4:

- Boiler house,
- Compressor house,
- Hog fuel storage area,
- Northwest gate,
- Northern portion of Tract 5
- Paint storage and spraying areas,
- Press pits,
- Mixed glue tank,
- Former hardboard plant (including 1998 Excavation Area),
- Transformer yard, and
- Resin/Caustic storage tanks.

6.1.1 Uplands Areas

Areas within the uplands portion of the former Custom Plywood Mill generally exhibit localized and limited contamination, with the exception of the press pit area.

6.1.1.1 GBH Parcels

Boiler House, Compressor House, Hog Fuel Area: Several areas in the vicinity of the boiler house, the compressor house, and the hog fuel area were excavated in 2007 to remove soils with elevated concentrations of metals, PCBs, and TPH (Geomatrix, 2007a). Excavations were conducted iteratively, with excavation pit confirmation samples analyzed and excavation continuing until MTCA Method A unrestricted use cleanup levels were attained (Section 2.6.2). Some of the sidewall excavation was halted by the presence of concrete pile caps (e.g., the northwestern portion of the compressor house, Excavation Area #4).

Northwest Gate of the GBH Parcel (also includes former Paint Storage and Spraying Areas): Areas in the vicinity of the northwest access gate of the GBH parcel were investigated during early investigations, during the 2007 soil removal activities (Section 2.6.2), and as part of the 2008-2009 investigations. Relatively high concentrations of diesel and lube oil were found to occur in localized areas, separated by areas of low concentrations. Inorganic constituents, including arsenic, copper, mercury, nickel, and zinc, were also found but at relatively lower concentrations. One soil sample (GMX-S30, 2 to 4 feet) contained PCP.

Northern Portion of Tract 5: Three isolated areas of petroleum hydrocarbons in the form of lubricating oil were found in sample locations along the northern portion of Tract 5 on the GBH property. In the northwest corner of the GBH property near the road, GMX-S18 yielded TPH above screening levels in the 4- to 6–foot-depth interval, but not in the shallower depth interval and not at all in the nearby borings GMX-S35 and GMX-S36. Another isolated, low concentration area of petroleum was in the north central portion of Tract 5 at GMX-S27 from 2 to 4 feet. A well was installed very near this boring (GMX-MW06) and the groundwater has not indicated any impacts from petroleum. A third isolated area of lubricating oil is located at the northeast portion of the site (GMX-S26) from 2 to 6 feet. Drilling was very difficult in this area due to buried concrete foundations, and so the extent of this petroleum-impacted soil could not be fully determined, except that the samples collected 50 feet west at GMX-S19 had no petroleum.

Press Pit Area: Press pits #2 and #3 contained water that might have a hydraulic connection to groundwater. Press pits #2 and #3 had been observed to contain approximately 1,000 feet^3 and 1,500 feet^3 of water, respectively. During the summers, press pit #2 was typically empty except for a wet scum on the concrete bottom. Press pit #3 generally contained water during all times of the year.

The water in press pits #2 and #3 have been found to contain hydrocarbons, based on analytical results and the intermittent presence of an oily sheen. High concentrations of hydrocarbons within the soil surrounding the press pits are presumed to be the source of the contamination. Water removal and disposal or treatment will be required prior to the demolition of the concrete in the press pits.

Soil in the press pit area has significant concentrations of TPH-D and TPH-Oil, presumably originating from leakage of the hydraulic lines. The soil also contains extensive amounts of decayed wood and organic material.

Glue Tank Area: A soil sample (HAGT) (Figure 5) collected from 5 feet north of the glue tank returned results of 45 mg/kg for TPH-D and 130 mg/kg for TPH-Oil. One soil sample (HAGT) from the glue tank area was further analyzed for phenols (EPA Method 8270) and formaldehyde (EPA Method 8315) and returned results below laboratory detection limits (Woodward-Clyde, 1998b).

Surface and subsurface soil samples were collected in this area and analyzed for SVOCs, VOCs, pesticides/PCBs, and inorganic constituents during the EPA (2000) study. No SVOCs, pesticides, or PCBs were detected above screening levels. Some inorganic constituents (copper, nickel, thallium, vanadium, and zinc) were detected above screening levels.

6.1.1.2 Andrews, Bean, and Sizemore Parcels, City of Anacortes Right-of-Way

The upland parcels on the west and north of the GBH parcels are not known to have contributed to contamination on the GBH upland parcels. Likewise, the nature of the known contamination on the GBH upland parcels is unlikely to have impacted the other properties that are all located presumably upgradient from the GBH parcels. High concentrations of TPH are suspected to remain under the building foundation of the former hardboard plant; however 3 years of post-excavation groundwater sampling did not indicate that migration of the residual TPH is a concern for the current Bean property.

Sources Associated with the Former Hardboard Building-Tract No. 4 Area (Currently Andrews' Parcels, Bean Parcel, and V Place Roadway): In 1997, oil-impacted soils were discovered in the area that is currently the asphalt-paved parking lot for Northern Marine employees on one of the Andrews' parcels (Sections 2.5.5, 2.5.7, and 2.5.10). The oil-impacted soil extended east onto the western part of what is now the V Place roadway. This contaminated soil was removed and disposed in 1998 by the City of Anacortes under an Ecology VCP agreement (Section 2.6.1; Woodward-Clyde, 1998c). Prior to the soil removal, Woodward-Clyde, the City's consultant, negotiated a site-specific soil cleanup level of 15,000 mg/kg for TPH-Oil with Ecology based on calculations made using prior chemical

results and Ecology's Interim TPH Guidance Document (Ecology, 1997a). Soil was removed until TPH concentrations in confirmation samples analyzed using a mobile laboratory on site were at or below 8,400 mg/kg. The only soils in excess of the site-specific cleanup level that could not be excavated were in areas under the building foundations where soil could not be removed so as not to undermine the structure, or in the case of one sidewall sample, at the property boundary.

Two soil borings (GMX-S56 and GMX-S57) were drilled in 2009 on the edge of the V Place roadway. One sample, GMX-S56 from 4-6 feet bgs exceeded TPH-Oil and PAH screening levels; however, it is possible that the sample contained asphalt from the roadway. In addition, GMX-S57 from a depth of 2-4 feet bgs yielded a nickel concentration of 55 mg/kg compared to the screening level of 54.2 mg/kg.

Sources Associated with the Sizemore Parcel and City of Anacortes Right-of-Way/Hiking Trail Area: The former plywood operation used a building located immediately west of the former railroad right-of-way (currently the Tommy Thompson Trail) as a machine shop. This building was not damaged in the fire in 1992. The southern portion of the machine shop building housed four caustic or resin ASTs that were connected via a pump to the former glue loft. According to Ecology files, these tanks held as much as 20,000 gallons of phenolic resin and caustic each month during plant operations. The building is currently owned by Ray Sizemore of Cimarron Trucking. Mr. Sizemore conducted an extensive renovation of the shop and AST shed, including the decommissioning, removal, and disposal of the ASTs in 2003.

Near-surface soil samples collected on October 29, 1997, from the area east and adjacent to the former machine shop building returned results as high as 1,500 mg/kg for TPH-D and 6,800 mg/kg for TPH-Oil in samples from 1.5 feet (sample CP-HARC-1.5A). These soil samples were also analyzed for phenols (EPA Method 8270) and formaldehyde (EPA Method 8315) and returned results below laboratory detection limits (Woodward-Clyde, 1998b).

Surface and subsurface soil samples and one groundwater sample were collected in this area and analyzed for SVOCs, VOCs, pesticides/PCBs, and inorganic constituents during the EPA (2000) study. Based on the EPA study (2000), no SVOCs, VOCs, pesticides, or PCBs were detected in any of the soil or groundwater samples at concentrations exceeding the screening levels used by EPA. Comparing the sample results to the screening levels in this study, the samples collected from 0 to 1 foot bgs contained exceedances of inorganics (arsenic, copper, mercury, silver, thallium, and zinc); the deeper samples exhibited exceedances of only thallium and silver. In 2008, additional soil borings were placed in this area (GMX-S31 through GMX-S33). No gasoline, BTEX compounds, diesel, or oil was detected in the samples, except

GMX-S33 from 4-6 feet bgs contained a low concentration of TPH-Oil at 110 mg/kg. All the inorganics were below screening levels.

The results from the Woodward-Clyde (1986) study suggest that the elevated TPH readings resulted from an apparently minor surface release of TPH adjacent to the former resin/caustic shed. No releases of phenols, formaldehyde, or other constituents were indicated. According to Kim McKinnon, the City's project manager during construction of the trail, the City removed the tracks and cross-ties, and excavated the railroad ballast and unsuitable soil to a depth of as much as 30 inches (below the depth at which the EPA samples were collected). The excavation was at least 16 feet wide along the former tracks. The City backfilled the excavation with 10 to 24 inches of structurally suitable materials and topped the trail with 2 inches of asphalt. A narrow unpaved area adjacent to the former shed that housed the ASTs may not have been disturbed during trail construction.

6.1.2 Aquatic Areas

The aquatic areas east of the GBH parcels are not known to have contributed to contamination on the GBH upland parcels. However, there is potential for contamination from uplands sources to migrate into aquatic areas via surface water runoff, erosion, groundwater migration, or air transport. Potential direct contamination sources in the aquatic areas are likely limited to building debris from the collapse of the over-water structure and the presence of hundreds of creosote-treated pilings. Sediment samples with dioxin/furan concentrations above background levels are likely to be related to the historical structural fires that occurred at the site and in the surrounding areas.

6.2 NATURE AND EXTENT OF SOIL COPCS

This section presents a discussion of soil COPCs. The evaluation presented in this section is based largely on results from field investigations conducted in 2008 and 2009, and on results from earlier investigations. Where applicable, concentrations of COPCs are compared with the screening levels developed in Section 10.0.

Analytical results for soil samples collected in 2008 and 2009 are presented in Tables 8 through 11. Table 12 presents a summary of the percentage of analytical results that exceed the screening level by analyte. An overview of results for TPH and metals in soil samples is presented in Figures 20 through 25. Analytical results for TPH constituents are presented in Figures 21 and 24 for soil samples collected in the depth ranges of 0–6 feet and 6–15 feet, respectively. Results for metals that exceed screening levels are shown in Figures 22 and 25 for the same depth ranges. Due to the large number of analytes, all result for metals are not shown schematically on a map of the Mill area.

The primary COPCs in soil are TPH-D, TPH-Oil, inorganic constituents (arsenic, cadmium, copper, chromium, lead, mercury, nickel, selenium, silver, and zinc), and select SVOCs (primarily cPAHs). PCBs and dioxins/furans each exceed its respective screening level at only one location. Of these, TPH-Oil has the most significant relative exceedance, with concentrations up to 164,000 mg/kg (or 82 times the MTCA Method A cleanup level of 2,000 mg/kg) found in the vicinity of the press pits. Where the concentrations of petroleum hydrocarbons are highest, some SVOCs were detected (e.g., phenanthrene, fluoranthene, pyrene). Due to analytical interference from the elevated oil concentrations, detection limits for SVOCs were often elevated and in some cases above current MTCA Method B cleanup levels. Dioxins/furans were detected in soil samples at low concentrations consistent with an origin by combustion. Combustion-generated dioxin and furans typically exhibit a profile with a very high percentage of the total dioxin and furan concentrations in the less toxic, seven and eight-chlorine congeners, and a very small (1% or less) of the more toxic, tetra-chlorine congeners, for example, 2,3 7,8-TCDD (Cleverly, et. al., 1997).

6.2.1 Inorganic Constituents

A total of 161 upland soil samples have been collected from the GBH parcels during various investigations and have been analyzed for various inorganic constituents. Table 12 indicates the number of samples that exceeded screening levels for each of the inorganic constituents (see also Figures 22 and 25).

An applicable screening level (included in Table 12) has been developed in Section 10.1.1 for 14 of the 24 inorganic constituents analyzed. Screening levels have not been exceeded for two of the analytes for which screening levels have been established, including beryllium, which was analyzed a total of 62 times and never detected in the samples. Barium was analyzed and detected a total of 55 times, but was not detected above the screening level of 1,250 mg/kg.

Constituents with an applicable screening level that have been detected at least 50 percent or more of the time include arsenic, chromium, copper, lead, mercury, nickel, and zinc. Many of these analytes also exceeded the applicable screening levels.

6.2.2 Semivolatile Organic Compounds

SVOCs or specific cPAHs have been analyzed up to a total of 90 times during the various investigations at the site. Of the 90 samples for which a toxicity equivalent concentration [relative to benzo(a)pyrene] was calculated, 50 had a concentration above 0.14 mg/kg for cPAHs.

As specified in the Work Plan, soil samples collected during the recent investigations in 2008 and 2009 that had TPH concentrations greater than 460 mg/kg were subsequently analyzed for PAHs. This resulted in 50 samples being analyzed for PAHs, with the maximum detected concentration of total TEQ cPAHs, of 92.19 mg/kg from the sample collected from 6-8 feet bgs at boring location GMX-S40 (Table 8). A total of 18 samples from the recent investigations contained total TEQ cPAHs at concentrations above 0.14 mg/kg. An additional five samples were also analyzed for the full suite of SVOC compounds (Table 9); four of these samples had concentrations of total TEQ cPAHs above 0.14 mg/kg.

Except for cPAH compounds, the only other SVOC compound detected at a concentration greater than the screening level was PCP in only one sample, from 2-4 feet bgs from boring location GMX-S30, which at a concentration of 1.5 mg/kg exceeded the screening level of 0.05 mg/kg.

Elevated concentrations of petroleum hydrocarbons in samples created analytical interferences that resulted in higher than normal detection limits for SVOCs. There are 11 compounds for which the minimum detection limit is greater than the screening level; however, these compounds have not been detected during any of the investigations completed at the site.

6.2.3 Polychlorinated Biphenyls

A total of up to 128 soil samples have been analyzed for PCBs during the course of investigations at the site. Of the recent samples collected, during 2008 and 2009, 21 samples were analyzed for PCBs (Table 8). None of the individual Aroclors exceeded its respective screening level. Total PCBs calculated by summing the detections of individual Aroclors exceed the screening level of 500 µg/kg in only one sample at a concentration of 3,900 µg/kg in the sample collected from 2-4 feet bgs at GMX-S16.

6.2.4 Total Petroleum Hydrocarbons and BTEX

A total of 29 samples were submitted for analysis of TPH-G as well as BTEX (Table 8). Results were below laboratory detection limits, except for one detection each of toluene, m,p-xylene, and ethylbenzene. These detections occurred in separate samples and were below the screening levels. TPH-G was not detected in any of the 29 samples submitted, and the reporting limit did not exceed the screening level of 100 mg/kg (when benzene is not present).

A total of 256 samples have been analyzed for TPH-D throughout the various investigations of the site. The maximum detection of 31,000 mg/kg occurred during the recent sampling in the sample from 2 to 4 feet bgs from boring location GMX-S7.

Accurate analysis of TPH in soils is confounded by the presence of wood debris. Natural oils in wood can dramatically affect analytical results for petroleum compounds, although results would be expected to vary depending on the type and age of the wood. Using gas chromatography, the analytical instrument used for the NWTPH method, compounds originating from wood are detected in the TPH-Oil range and can cause false positives of hundreds to thousands of parts per million. The NWTPH method designed by Ecology allows the use of silica gel/acid wash cleanup that is intended to remove the non-petroleum hydrocarbons prior to analysis. However, this cleanup technique is incomplete in removing non-petroleum hydrocarbons from samples with a matrix high in wood content. Consequently, samples collected during the RI that have a significant wood fraction, based on visual observation during sampling, may contain an artificially elevated apparent TPH-D concentration, which is not quantifiable.

In addition to the analyses for TPH discussed, two soil samples from the recent work were analyzed by the EPH/VPH method (Table 10) (see discussion in Section 6.4.2.)

6.2.5 Volatile Organic Compounds

A total of up to 75 soil samples collected over the years from the GBH parcels have been analyzed for VOCs. No samples exceeded screening levels except for typical laboratory solvents. Pre-2007 samples contained sporadic detections of BTEX components but no exceedances of screening levels occurred in the 2007–2009 samples. Recent samples submitted for analysis of VOCs include samples from 2-4 feet bgs from soil boring locations GMX-S6, GMX-S16, and GMX-S17. There were no detections of VOCs in these three samples, with the exception of acetone, carbon disulfide, and 2-butanone in the sample from GMX-S-6. These were all low-level detections and were orders of magnitude below the respective screening levels.

6.2.6 Dioxin/Furans

Prior to the 2008-2009 RI activities, five upland soil samples had been analyzed for dioxins and furans (EPA, 2000). One of the upland samples analyzed was the background sample, BG01SB01 (shown as BG01 on Figure 5), collected from a depth of 7.5 feet bgs. Total TEQ was calculated in parts per trillion (ng/kg) for the detected congeners per EPA and Ecology 2007 MTCA rule. The TEQs for the upland samples were 3.46 ng/kg (sample CB01SB01, CB01 on Figure 5) and 0.994 ng/kg (sample BH01SB01, BH01 on Figure 5). The background sample yielded a calculated TEQ of 0.069 ng/kg. The TEQ results for the samples are below the MTCA Method B soil cleanup level of 11 ng/kg, and below 4.1 ng/kg, which is the mean dioxin concentration for urban soils in Washington State (Yake et al., 2000).

As stated in the RI/FS work plan, samples were submitted for analysis of dioxins/furans if evidence of ash was discovered in the soil borings. One boring location, GMX-MW-1, exhibited such evidence, and the sample collected from 4.5 to 6.5 feet bgs was submitted for dioxin/furan analysis (Table 11). Total TEQ was calculated in parts per trillion (ng/kg) for the detected congeners per EPA and Ecology 2007 MTCA rule. The calculated TEQ for this sample was 17 ng/kg, greater than the screening level of 11 ng/kg.

6.3 NATURE AND EXTENT OF GROUNDWATER/SURFACE WATER COPCS

A total of 11 monitoring wells are currently located on the GBH property (Figure 26). These wells have been sampled a maximum of three times since 2008. In addition, four seeps were sampled within the intertidal zone in 2008.

6.3.1 Groundwater and Surface Water (Seeps)

Samples collected in 2008 and 2009 monitoring events were analyzed for the analytes shown in Table 1 of the SAP. Total and dissolved metals were only analyzed during the July/August 2008 sampling event. Analytical data from the July/August 2008 event indicated that, in general, dissolved metals concentrations detected above screening levels were also detected at similar or higher total metals concentrations. The only exceptions were arsenic at GMX-MW-02 (0.0035 mg/L dissolved vs. 0.0032 mg/L) and arsenic (0.0016 mg/L vs. 0.0015 mg/L), copper (0.0045 mg/L vs. 0.003 U mg/L), and nickel (0.0086 mg/L vs. 0.008 U mg/L) at GMX-MW-04. The differences in total versus dissolved concentrations between those samples is within the laboratory margin of error.

Only total metals were analyzed for during the two events in April and August 2009. This was performed with Ecology's approval obtained during a conference call with Hun Seak Park on November 17, 2008, where elimination of dissolved metals from the analysis list was discussed.

VOCs were analyzed only during the July/August 2008 groundwater monitoring event. Permission to exclude VOCs from the analyte list for the April and August 2009 monitoring events was granted by Ecology on November 19, 2008, in their response letter to AMEC's letter to Ecology dated November 11, 2008, regarding Preliminary Findings from July/August 2008 Groundwater Sampling Event.

The single grab groundwater sample (S9-W) was analyzed for metals, VOCs, and TPH, and the data are presented with the other groundwater and seep data in Table 13. The analytical results from S9-W are generally similar to those from the nearby monitoring wells.

Analytical results are tabulated and compared to preliminary screening levels in Table 13. Table 14 presents a summary by analyte of the results that exceed the respective screening level for groundwater. The data were validated as described in Section 11 of the QAPP included as an appendix with the RI/FS Work Plan (Geomatrix, 2008).

Results for each analyte group are discussed in more detail below.

6.3.1.1 Inorganic Constituents

All groundwater, seep, and grab samples were analyzed for both total (all three monitoring events) and dissolved (July/August 2008 event only) metals per the methods outlined in Table 2 of the QAPP. Results are presented in Table 13 and on Figure 27. The analytical findings are discussed in more detail below.

Total Metals

Detectable concentrations of total (unfiltered) metals were found for arsenic, barium, copper, lead, nickel, selenium, and zinc. Total arsenic was detected in samples from all boring locations except ANCP-MW-01, ANCP-MW-02, and the seep locations (SP-1 through SP-4) at concentrations ranging from 1.3 to 19 µg/L. Copper was found at concentrations ranging from 5.2 to 20 µg/L at seven locations (all four seeps, ANCP-MW-01, GMX-MW-01, and GMX-MW-05). Nickel was detected at six locations (all four seeps, ANCP-MW-01, and GMX-MW-05) at concentrations ranging from 8.7 to 24 µg/L. Lead was detected at S9-W and GMX-MW-05 at concentrations of 7.1 and 2.4 µg/L, respectively, both below the preliminary screening level. Barium was found in all but one of the samples analyzed from the July/August 2008 monitoring event, at concentrations ranging from 32 to 420 µg/L. No screening level has been developed for barium in Section 10.1.2 based on applicable or relevant and appropriate requirements (ARARs) for surface water; however, this range of concentrations falls below the Washington State and Federal Groundwater Maximum Contaminant Level (MCL) of 2,000 µg/L. Barium was not analyzed for during the subsequent April and August 2009 monitoring event based on Ecology's comments on November 19, 2008, in their response to AMEC's letter to Ecology dated November 11, 2008 (Preliminary Findings from July/August 2008 Groundwater Sampling Event). Ecology's letter clarified that only the Priority Pollutant Metals (13 analytes) list were to be analyzed for going forward.

Zinc was detected during the August 2009 monitoring event in GMX-MW-02 at a concentration of 130 µg/L, exceeding the screening level (81 µg/L) developed in Section 10.1.2. Selenium was detected at three locations (MW-05, MW-06, and MW-08) during the August 2009 monitoring event at concentrations ranging from 5.9 to 8 µg/L. The screening level for selenium is 71 µg/L, almost ten times greater than the highest concentration detected in groundwater.

No other metals were detected at the reporting limit; however, the reporting limits for mercury (0.125 µg/L), silver (8 µg/L), and thallium (5 µg/L) were all higher than the preliminary screening levels developed for the RI/FS Work Plan. The reporting limits for arsenic (1.8 to 3 µg/L) and copper (3 µg/L) were above the screening levels as well.

On July 10, 2008, Ecology wrote an email message to AMEC that approved a reporting limit of 1.0 µg/L for arsenic and 0.125 µg/L for mercury, even though those values are higher than the preliminary screening levels. Ecology based their approval on the fact that the MTCA Method A screening levels for arsenic and mercury are 2 and 5 µg/L, respectively, and that the laboratory could not attain reporting limits at or below the preliminary screening levels developed for the RI/FS Work Plan. In the same email message on July 10, 2008, Ecology approved reporting limits for copper at 3 µg/L, nickel at 8 µg/L, and silver at 8 µg/L, all above the preliminary screening levels developed for the RI/FS Work Plan.

The nickel and copper detections were co-located, except for the sample from GMX-MW-01, in which only copper was detected. Nickel and copper appear to be distributed relatively ubiquitously throughout the Site, including the seeps, indicating that the detected concentrations may represent background concentrations.

Arsenic was not detected in any seep samples. GMX-MW-02, located upgradient from the area of major industrial operations, had the second highest arsenic concentration at 3.2 µg/L, suggesting that the arsenic levels encountered in groundwater could be considered background concentrations and not attributed to historical operations of the plywood mill.

Dissolved Metals

Similar to the analytical data for total metals, arsenic, barium, copper, and nickel were found at detectable concentrations in groundwater samples. None of the seep samples (SP-1 through SP-4) was analyzed for dissolved metals; seep samples were analyzed only for total metals. Dissolved arsenic was detected in the same four wells where total arsenic was detected, and at similar concentrations. Dissolved copper and nickel were detected in ANCP-MW-01 and GMX-MW-04 at concentrations ranging from 4.5 to 7.4 µg/L and 8.6 to 15 µg/L, respectively.

The detected concentrations of dissolved copper were slightly lower than the detected concentrations of total copper, whereas detected concentrations of dissolved nickel were similar in magnitude to the detected concentrations of total nickel. Dissolved barium was detected in all samples analyzed at concentrations ranging from 54 to 170 µg/L, which is well below the MCL.

No other metal was detected at the reporting limit; however, the reporting limits for mercury (0.125 µg/L), silver (8 µg/L), and thallium (5 µg/L) were all higher than the preliminary screening levels developed for the RI/FS Work Plan. The reporting limits for arsenic (1.0 to 3 µg/L) and copper (3 µg/L) were above the screening levels as well. However, as discussed above in the total metals discussion, Ecology approved the use of these reporting limits in an email message dated July 10, 2008 due to the inability of the lab of achieving reporting limits below these preliminary screening levels.

Dissolved metals were only analyzed for during the July/August 2008 groundwater monitoring event.

6.3.1.2 Semivolatile Organic Compounds

All groundwater and seep samples were analyzed for SVOCs during all three groundwater monitoring events, as outlined in Table 2 of the QAPP. Analytical results are presented in Table 13 and on Figure 27, and discussed in more detail below.

Various individual PAH species were detected, as were several other SVOCs (Table 13). Individual PAH species exceeded the established preliminary screening levels (0.018 µg/L) at locations ANCP-MW-02, GMX-MW-04, GMX-MW-05, GMX-MW-08, and SP-4, at concentrations ranging from 0.018 to 0.19 µg/L. However, only the samples from ANCP-MW-02 (0.04496 µg/L), GMX-MW-08 (0.0552 µg/L), and SP-4 (0.05366 µg/L) exceeded the preliminary screening level for cPAHs (0.018 µg/L) on a TEQ basis. The duplicate sample collected during the August 2009 event from GMX-MW-07 had elevated detection limits due to matrix interference. The resulting calculated TEQ based on these detection limits exceeded the preliminary screening levels for cPAHs. Based on the matrix interference this data is considered to not be representative of site conditions.

6.3.1.3 Polychlorinated Biphenyls

All groundwater samples from all three groundwater monitoring events were analyzed for PCBs, as outlined in Table 2 of the QAPP. Results are presented in Table 13. No PCBs were detected in any samples. The reporting limits ranged from 0.048 to 0.051 µg/L, which is above the preliminary screening level of 0.03 µg/L for several individual Aroclors for the July/August 2008 and April 2009 monitoring events. The reporting limits for samples collected during the August 2009 event ranged from 0.052 to 0.11 µg/L. The elevated reporting limits for the August 2009 event were due to the analytical laboratory having to re-extract the sample after initial analysis.

On July 10, 2008, Ecology acknowledged that achieving a reporting limit of 0.03 µg/L most likely would not be possible and informed AMEC that achieving a reporting limit of 0.05 µg/L would be sufficient, even though that number is higher than the preliminary screening level.

6.3.1.4 Total Petroleum Hydrocarbons and BTEX

All groundwater, seep, and grab samples were analyzed for TPH, as outlined in Table 2 of the QAPP. Results are presented in Table 13 and on Figure 27. The analytical findings are discussed in more detail below.

Gasoline Range

No gasoline-range hydrocarbons were detected in the groundwater or seep samples at reporting limits ranging from 100 to 400 µg/L. Preliminary screening levels for gasoline-range hydrocarbons are the MTCA Method A cleanup level of 1,000 µg/L (no detectable benzene) or 800 µg/L (if benzene is detected).

Diesel and Oil Range

Lube oil was detected in one seep sample (SP-4) at a concentration of 1,200 µg/L; lube oil was not detected in any other seep or groundwater well sample at reporting limits ranging from 360 to 470 µg/L. Diesel-range hydrocarbons were detected in one sample (GMX-MW-08) during the August 2009 monitoring event at a concentration of 490 µg/L. No other diesel-range hydrocarbons were detected in any groundwater or seep samples during the three monitoring events at reporting limits ranging from 220 to 290 µg/L.

Preliminary screening levels for diesel-range or heavy-oil-range hydrocarbons are the value of 500 µg/L established under MTCA Method A criteria for groundwater. The detected concentration of TPH-Oil in SP-4 may have a biogenic component, however, as previously explained, the analytical method used cannot resolve the relative contribution of petroleum and non-petroleum within these relatively high molecular weight compounds.

6.3.1.5 Volatile Organic Compounds

All groundwater, seep, and grab samples collected in 2008 were analyzed for VOCs, as outlined in Table 2 of the QAPP. Results are presented in Table 13. Analytical results are discussed in more detail below.

Naphthalene and 1,2,4-trimethylbenzene were detected in the groundwater sample from GMX-MW-03 at concentrations of 20 µg/L and 0.24 µg/L, respectively. Acetone was detected in the sample from GMX-MW-05 at 6.2 µg/L; however acetone is a known laboratory contaminant. Carbon disulfide was detected in 7 out of 13 samples at concentrations ranging

from 0.21 to 1.3 µg/L. 4-Isopropyltoluene (known also as p-isopropyltoluene) was detected in 5 out of 13 samples at concentrations ranging from 0.78 µg/L to 8.4 µg/L.

There is no established screening level for 1,2,4-trimethylbenzene, acetone, carbon disulfide, or 4-isopropyltoluene. The preliminary screening level for naphthalene is 4,900 µg/L, more than two orders of magnitude greater than the concentration of naphthalene detected in MW-03.

VOCs were analyzed only for samples collected during the July/August 2008 groundwater monitoring event, based on approval from Ecology as discussed above.

6.3.1.6 Dioxins/Furans

Dioxin and furans were not analyzed for in any groundwater or seep sample due to the lack of a defined burned horizon in the corresponding soil lithological boring logs from the monitoring well installation. Dioxins and furans are hydrophobic compounds, and would not be expected in groundwater, unless they are attached to the particle fractions.

6.3.1.7 Press Pit Surface Water

Water samples previously collected from press pits #2 and #3 were analyzed for TPH and PCBs to better evaluate costs of disposal of the water prior to demolition of the concrete pits (Woodward-Clyde, 1998b). Results indicated concentrations of TPH-D and TPH-Oil up to 3.7 mg/L, and no detectable concentrations of PCBs. Press pit #1 had no depression and was never observed to contain water. Press Pit #2 typically contained little or no water in the summer months and was likely intact and simply receiving rainfall.

6.4 NATURE AND EXTENT OF FREE PRODUCT AND VPH AND EPH ANALYSIS OF PETROLEUM

Free product was not observed in the water samples from the 2008-2009 investigation. Historical grab groundwater samples occasionally observed a sheen, and in the 1998 excavation on the Andrews' property there were minor quantities observed on the standing water. The following section provides a description of these occurrences.

6.4.1 Observations of Extent of Free Petroleum Product

A commonly interpreted indicator of free petroleum product is the observation of sheen or a separated layer of liquid on top of standing water or water in sample jars. These observations are frequently used to indicate petroleum saturation in soils when the water is extracted groundwater. Care must be taken that a sheen or thicker non-aqueous phase liquid (NAPL) is not of biogenic origin, rather than petroleum. Differentiation by chemical analysis can be inconclusive because the gas chromatographic methods used to analyze TPH cannot satisfactorily distinguish weathered heavy petroleum from liquid of biogenic origin.

Although there is risk in over-interpreting the results of grab groundwater samples (due to turbidity causing high bias), in the early investigations, the observation of sheen in the grab groundwater samples was interpreted to be indicative of petroleum saturation. These samples came from two areas on the GBH parcel: the former press pit area and the compressor building area.

In 1998, three grab groundwater samples were collected from temporary push probe borings and analyzed for all TPH ranges, BTEX, and SVOCs (Woodward-Clyde 1998b). One of the three samples (CP-GP8), located in the compressor building area, yielded detectable concentrations of TPH-G (2.5 mg/L), TPH-D (9.0 mg/L), TPH-Oil (1.5 mg/L), and six SVOCs; however, the sample had no detectable BTEX. Free product was noted in this groundwater sample.

In the EPA study (EPA, 2000), six groundwater grab samples were collected from the temporary push-probe boreholes and analyzed for SVOCs, VOCs, and 23 inorganic compounds; however, the samples were not analyzed for TPH components. Descriptions of two of the six groundwater samples (PP07 and CB01), located in the press pit and compressor building areas, mentioned that a sheen was observed.

High concentrations of hydraulic oil in soils in the press pit area have the potential to impact the shallow groundwater, as was seen in the groundwater grab sample from PP07 (EPA, 2000). However, free product has not been observed in the monitoring wells in that area (ANCP-MW-02 and GMX-MW-09).

Impacted soils in the compressor building area were excavated in 2007 (Excavation Area 4, Figure 7). The western portion of Excavation Area 4 included the location of CB01. In addition, the excavation was close to, and likely included, the location of sample CP-GP8, but that western wall of the excavation was stopped by a thick pile cap. Sheen was not observed in the water from Excavation Area 4 during digging. Soil borings GMX-S21, GMX-S22, and GMX-MW-05 were also drilled near the western extent of the Area 4 excavation and near the CP-GP8 location, and did not encounter petroleum-impacted soils.

On the Andrews property adjacent to the former Hardboard Plant, water observed in the bottom of the large remediation excavation conducted in 1998 (Woodward-Clyde, 1998a) showed small blebs of free product. The presence of product was expected because the excavation disturbed a significant volume of soil below the water table. Three post-excavation, downgradient monitoring wells were sampled for 3 years and none ever showed free product and only sporadic detections of dissolved TPH.

More recently, during the February 10, 2010, site visit for the preparation of the emergency shoreline stabilization work, two samples of surface water were collected from puddles near Press Pit #1 (SW01) and GMX-S9 (SW02) and analyzed for TPH-HCID, TPH-DX, and for salinity (using a portable instrument). The two surface water samples were sampled for TPH-HCID because of a sheen that was on the water, in an attempt to discern whether the sheen was natural organic material or petroleum. Heavily weathered oil has a signature on a gas chromatogram within the range of natural organic material, and the HCID result was equivocal. The samples were rerun to quantify the concentration of TPH before and after cleaning up the sample with silica gel that adsorbs polar compounds, such as the natural hydrocarbons. Concentrations of TPH in the sample SW01 before silica gel were 0.4 mg/L within the diesel range and 0.48 mg/L within the lube oil range; however, concentrations after the silica gel cleanup were below the reporting levels of 0.28 mg/L (diesel range) and 0.44 mg/L (lube oil range). Similar results occurred in SW02 where the pre-silica gel sample yielded concentrations of 0.44 mg/L within the diesel range and 0.60 within the lube oil range but the post-silica gel samples yielded concentrations below the reporting limits of 0.25 mg/L diesel range and 0.40 mg/L lube oil range. Assuming the silica gel removes only natural organic compounds, then the results indicate that while there may be components of both the natural organics and the petroleum hydrocarbons in the samples, the petroleum fraction, if present, is not significant enough to exceed the method reporting limit.

6.4.2 Physical/Chemical Properties and Equivalent Carbon Fraction of the Petroleum Product

A number of samples have been analyzed for Extractable Petroleum Hydrocarbons (EPH) and Volatile Petroleum Hydrocarbons (VPH) during the early investigations, and during the more recent RI. The most complete suite of analyses were run on two samples from the 2008-2009 investigations, which were analyzed for EPH and VPH, SVOCs, BTEX, and TOC (Table 10). The results from each sample were used to evaluate whether the sample concentrations met the Method B and Method C soil criteria based on the direct contact exposure pathway for human health. Ecology's Workbook Tools for Calculating Soil and Groundwater Cleanup Levels under the Model Toxics Control Act Cleanup Regulation (December, 2007) was used for the calculations. The TPH worksheets were also used to evaluate whether the samples met the criteria for the Method B soil cleanup levels for protection of groundwater based on leaching.

The analytical results used in the calculations are presented in Table 10 and in Appendix C. The results of the MTCA TPH worksheets indicate that the MTCA Method C human health direct contact cleanup levels would not be exceeded at the TPH and PAH concentrations present in the two most recent samples. Both samples also passed the criteria for protection

of groundwater. The summary pages from the MTCA TPH worksheets are provided in Appendix C.

6.5 NATURE AND EXTENT OF SEDIMENT COPCS

6.5.1 Bioassay Results

Microtox testing was conducted on sediments from 29 samples. Eighteen of the Microtox tests failed the Sediment Management Standards (SMS) Sediment Quality Standards (SQS) criteria (Table 5).

Sixteen of the stations were subjected to additional biological testing using amphipod and a sediment larval test. All of the sediments passed the amphipod test but six sediments failed to meet the sediment larval SQS criteria; two of the six sediments also failed to meet the Cleanup Screening Level (CSL) criteria for the sediment larval test (Table 5). Based on the failure of two of the three bioassays conducted, sediments at six locations (ST-1, ST-10, ST-11, ST-14, ST-22, and ST-25) failed to meet Puget Sound CSLs for biological testing.

6.5.2 Chemistry Results

Archived sediment samples from the six stations with CSL exceedances of the biological criteria were analyzed for the SMS list of chemicals of concern (Table 6). There were no exceedances of the SMS SQS.

6.5.2.1 Inorganic Constituents

There were no exceedances of the SMS SQS for inorganic constituents.

6.5.2.2 Semivolatile Organic Compounds

There were no exceedances of the SMS SQS for semivolatile organic compounds.

6.5.2.3 Polychlorinated Biphenyls

PCBs results selected samples and in composite samples were either undetected or below the SMS SQS levels.

6.5.2.4 Wood/Conventionals

The initial tier of testing assessed wood content in the sediments using visual, analytical, and biological criteria. Surficial wood debris coverage was assessed in each grab using a visual point contact method. Total volatile solids (TVS) measured with a large (≈300 gram) sample size and total organic carbon (TOC) were measured and used as a surrogate for wood debris within the biologically active zone. Porewater ammonia and sulfide (from the top 10-cm) were also measured in each grab.

Surficial wood coverage in the 29 grab samples collected ranged from 0 percent to 20 percent (Table 5). All grabs had less than 25 percent coverage of surficial wood. TVS values in sediment from the 29 grabs and from the 5 hand collected sediment samples ranged from 2.14 percent to 23.5 percent (Table 5). Fourteen of the samples from 13 stations exceeded the Tier 1 criteria of 9.7 percent (Table 5). TOC values exceeded the Tier 1 criteria of 10 percent in 3 samples from 2 stations (Table 5).

Test pits were excavated to depths of 4.0 to 8.0 feet in the intertidal area in July of 2009 (TP-1 through TP-9). Fine to coarse wood waste was present, frequently below a surface layer of building debris. Some of the test pits exhibited a wood layer more than 8 feet thick. In some locations, seeps in the sidewalls had a slight sheen on black-colored water and hydrogen sulfide-like odor to them. Test pits that contained these conditions were limited to TP-02 and TP-05. Observations made during the excavation of the two test pits showed a shiny substance on the sidewall that was interpreted by Ecology personnel to be petroleum but by AMEC personnel to be degraded wood in an anoxic condition. Samples of the sediment were not collected and analyzed.

6.5.2.5 Dioxins/Furans

Dioxins and furans were measured in selected samples and in composite samples. TEQs were calculated using the World Health Organization 2005 Toxicity Equivalency Factors. Calculated TEQs ranged from 2.74 to 19.6 pptr (Table 7) using one-half of the reporting limit for non-detected values (Figure 19). Additional dioxin/furan analyses were conducted in 2010; results are discussed in the FS (Hart Crowser, 2011).

7.0 PRELIMINARY INDICATOR HAZARDOUS SUBSTANCES

Indicator hazardous substances are those compounds that are included for further consideration during the development of the cleanup approach because of their frequency, mobility, persistence in the environment, or toxicity. Compounds can be eliminated from further consideration on a site specific basis using the following evaluation factors outlined in WAC 173-340-703:

- The toxicological characteristics of the hazardous substance relative to the concentration of the hazardous substance at the site;
- The chemical and physical characteristics of the hazardous substance which govern its tendency to persist in the environment;
- The chemical and physical characteristics of the hazardous substance which govern its tendency to move into and through environmental media;
- The natural background concentrations of the hazardous substance;
- The thoroughness of testing for the hazardous substance at the site;
- The frequency that the hazardous substance has been detected at the site; and
- Degradation by-products of the hazardous substance.

This section provides a preliminary list of indicator hazardous substances for soil, groundwater, and sediment that will be refined further in the RI/FS document.

7.1 SOIL

7.1.1 Preliminary Hazardous Substances in Soil

Compounds that were detected above screening levels and that are considered preliminary indicator hazardous substances because of their frequency, mobility, persistence in the environment, or toxicological characteristics include:

- TPH as diesel and oil;
- Carcinogenic PAHs; and
- Arsenic, cadmium, copper, lead, mercury, nickel, and zinc.

The following compounds have very few detections above screening levels and will be evaluated further for inclusion as indicator hazardous substances for specific localized areas:

- PCP: Of 35 samples analyzed, only three samples had detectable levels of PCP, one below the screening level. The highest sample was at GMX-S30 at a concentration of 1.5 mg/kg and the exceedances ratio was 6 percent.

- PCB: PCBs are included in the preliminary indicator substance because of two samples. One sample from the 2000 EPA study (BH06-surface sample) was close to the Area 4 excavation from 2007 but because the EPA 2000 sample locations were not surveyed to the current accuracy, BH06 may have been just outside of the excavated area. Other areas with pre-2007 sample results above 1.0 mg/kg (Method A Unrestricted level) were excavated in 2007. Of the 2007-2009 results, only GMX-S16 exceeded the screening level at 3.9 mg/kg for an exceedance ratio of 5 percent.

- Dioxins/Furans: One sample from a small ash deposit.

- Chromium: None of the 2008-2009 samples exceeded the screening level for chromium of 117 mg/kg. One sample (G-15-surface) from the pre-2007 data had a concentration of 450 mg/kg that was sampled in 1995 when a very small pile of blue-green sand was observed next to press pit #3. Due to the high concentrations of TPH in the press pit area, this area has to be mitigated for TPH, and the G-15S location will be included and is incidental to the TPH issue. Two of the final confirmation samples in the compressor building/boilerhouse area were just slightly above the screening level, but excavation could not be continued due to the presence of concrete. The exceedance ratio was 2 percent for the detected samples.

- Selenium, silver: Based on the 2008-2009 data, selenium and silver occur infrequently and generally where other indicator hazardous substances occur.

7.1.2 Hazardous Substances Excluded as Indicators in Soil

Analytes that are not under further consideration as indicator hazardous substances include the following substances and the rationale for exclusion.

- Antimony: Three samples out of 101 samples were found above the screening level, however, only one of the three was a detectable concentration, and the other two were non-detectable at reporting limits just above the screening level.

- Barium: No results were above the screening level.

- Beryllium: No results were above the screening level.

- TPH-Gas: Only one reported exceedance occurred out of 26 samples that were analyzed, but it was a non-detected reporting limit of 33 mg/kg, which is below the screening level of 100 mg/kg, if no benzene is present.

- BTEX: no samples exceeded the screening limit in the 2007-2009 sampling events.

- VOCs: no samples exceeded the screening limits, except for detections of compounds commonly used in the laboratory which are likely to have been introduced to the samples there.

7.2 GROUNDWATER/SURFACE WATER

7.2.1 Preliminary Indicator Hazardous Substances in Groundwater/Surface Water

Analytical results for groundwater samples collected in the monitoring wells during the 2008-2009 groundwater monitoring events were used to characterize groundwater within the GBH property. The results indicate that the following constituents or class of constituents have been detected during one or more of the three 2008-2009 groundwater monitoring events, and these are considered to be preliminary indicator hazardous substances:

- TPH as diesel (detected in only one well sample below the screening level);
- TPH as oil (detected in one seep sample only, and no well samples);
- Arsenic, copper, and nickel;
- Zinc (one well sample only); and
- Carcinogenic PAHs.

These preliminary indicator hazardous substances in groundwater will be further evaluated in the RI/FS document for exclusion based on the factors specified in WAC 173-340-703.

7.2.2 Hazardous Substances Excluded as Indicators in Groundwater/Surface Water

The following constituents were not detected in groundwater at any of the monitoring wells during any monitoring event and so will be excluded from the list of indicator hazardous substances in groundwater and surface water (some of the reporting limits were higher than screening levels due to laboratory methods, and those reporting limits were approved by Ecology):

- PCBs;
- Gasoline-range petroleum hydrocarbons/BTEX;
- Antimony, beryllium, cadmium, chromium, lead, mercury, selenium, silver, and thallium; and
- VOCs.

The following VOCs were detected but at concentrations below screening levels or they did not have a screening level based on the protection of marine surface water exposure pathway: naphthalene, 1,2,4-trimethylbenzene, acetone, carbon disulfide, and 4-isopropyltoluene. These VOCs will also be excluded from the list as indicator hazardous substances in groundwater/surface water.

7.3 SEDIMENT

Chemical analyses were conducted on the sample locations that exceeded the CSL (either one CSL exceedance or two or more SQS exceedances) biological criteria. At the six locations that were analyzed for the SMS chemicals of concern, there were no exceedances of the SQS chemical criteria. There was no obvious link between bioassay performance and chemical concentrations of the standard SMS chemical suite analyzed. Bioassay failures may be due to other contributing factors (e.g., sediment holding time). Dioxins/furans above Puget Sound background concentration may be of potential concern.

8.0 CONCEPTUAL SITE MODEL

This section presents a conceptual site model (CSM) for the Custom Plywood Site, which is a conceptual understanding of current conditions. The CSM will be used to make decisions on how to set Site-specific cleanup standards. A CSM summarizes:

- sources of the hazardous substances,
- nature and extent of hazardous substances,
- affected media,
- potential exposure pathways, and
- potential receptors.

Using the CSM developed in this RI, cleanup standards will be developed in the feasibility study. Cleanup standards are a combination of two components:

1. cleanup levels—the concentrations of COPCs in the affected media that are determined to be protective of human health and the environment under the specified exposure conditions, and
2. points of compliance—the location where the cleanup levels developed must be met.

8.1 SOURCE AREA CHARACTERIZATION

All the known sources of contamination from the former Custom Plywood Mill site are related to the historic operations that ceased in 1992, and there have been no known releases since that time. Historic source areas were investigated based on available diagrams of historical operations. Because the Mill had a long history of industrial use, there is a possibility that our knowledge of historic operations is incomplete. For that reason, samples were collected in broad areas within and beyond the GBH property boundary, rather than focusing on just the operations known from historical documents. With little evidence remaining of the operations except debris, we have strived to correlate the remaining concrete structures and debris observed on the Site with the chemical and physical evidence.

Outside of the current GBH property, the historic Custom Plywood buildings remain in place, although they have been extensively renovated for the current operations. Extensive modifications occurred within the past 8 years with the construction of V Place roadway, the Tommy Thompson Trail, and the parking lot and addition for the Northern Marine facility. Consequently, most of the former Custom Plywood Site outside of the GBH property has been upgraded with asphalt, concrete, or structures.

Based on the findings of this study, petroleum hydrocarbons were the most widely used and released hazardous substances at the site. Interim remedial actions to address localized areas of soils impacted by petroleum hydrocarbons (and to some extent by metals and PCBs) have occurred in several areas on the GBH and Andrews parcels. The largest volume of petroleum-impacted soil that remains (as of early 2011) is around the press pits on the GBH property. Smaller areas occur around the current gate off of V Place, on the northern portion of Tract 5, and likely under the former Hardboard Plant building.

Section 6.0 provides detailed descriptions of the nature of the hazardous substances contained in the soil, groundwater, and sediment at the former Custom Plywood Site. The following sections describe the nature of the hazardous substances in the context of potential exposure scenarios and potential receptors. Figure 28 depicts, in cross section, the interaction of hazardous substances, impacted media, exposure pathways, and receptors at the site. Geologic cross sectional views from uplands to tidelands are presented in:

- Figure 29 – for Tract 5,
- Figure 30 - for Tract 6, and
- Figure 31 – for Tracts 7 and 8.

8.2 INDICATOR HAZARDOUS SUBSTANCES, IMPACTED MEDIA, EXPOSURE PATHWAYS

8.2.1 Soil

Areas east of the former rail line (now Tommy Thompson Trail) were historically tideflat that was built up with fill to create upland. The surface of the former tideflat was a plastic clay unit underlain by a dense impermeable clay. Above the native clay units, fill material used on the GBH property has an upper sandy unit with a lower unit composed of mainly wood. Other parcels peripheral to the GBH property were filled with more sand and gravel mixtures, rather than woody fill, due to the later time of filling or the higher elevation of the clay layers. The fill units range from about 5 to 22 feet thick (total) on the GBH property (Figure 9).

Detectable concentrations of inorganic constituents (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc) are present in the fill units. The inorganic constituents are generally not distributed or concentrated such that it would point to a widespread use of metals in the historical industrial processes. Rather, the distribution and relatively low concentrations are more indicative of typical and limited historic uses of painted buildings (historically containing lead and other metals) and use of metal equipment. In addition, elevated concentrations of inorganics commonly occur in wood, after preferentially being taken up during the growth of trees.

Organic constituents that were detected included petroleum in the diesel and oil ranges, PCBs (one occurrence above the preliminary screening level), PCP (one occurrence above the preliminary screening level), and dioxin/furan. The presence of dioxin/furan is likely due to burning of salt-water affected wood. In addition, cPAHs are present at the site due to the widespread use of fill of poor structural quality, which resulted in many structures being placed on pilings made of creosote-treated wood.

Potential exposure pathways to the hazardous substances in soil are discussed in Section 4.4 and summarized below:

- Human direct contact (i.e., ingestion and dermal exposure) with soil by construction and site maintenance workers, and future industrial workers;
- Direct contact with soil by terrestrial ecological receptors (e.g., mammals, birds, vegetation, etc.), in those areas that have exposed surfaces;
- Uptake of soil contaminants into terrestrial ecological species (i.e., terrestrial plant and animal bioaccumulation) who then would be consumed as prey by upper trophic level terrestrial ecological receptors;
- Cross-media transfer pathway associated with hazardous substances in upland soil leaching to adjacent groundwater and resulting in nearby marine sediment;
- Exposure through inhalation of soil contaminants that have migrated to air either as windblown dust or as vapor. Receptors may include site trespassers, construction and site maintenance workers, future industrial workers, and terrestrial ecological receptors. This pathway includes future indoor air exposure to industrial workers who may occupy future on-site buildings.

8.2.2 Groundwater

Unconfined groundwater is present in the fill units that are perched above the plastic clay layer and dense clay unit. The native clay layers are sufficiently fine grained to be a vertical impediment to groundwater migration. Several soil borings penetrated the native clay unit to a depth of four feet below the top of the unit; therefore, the fill unit is known to be at least 4 feet thick.

The shallow groundwater is in hydraulic contact with the marine water, and is brackish in the nearshore areas. Depth to groundwater is tidally dependent, particularly near the shoreline, and can be close to the ground surface at high tide to a depth of 9 feet bgs at low tide. Groundwater flow direction is predominantly from west to east/southeast, although nearshore wells could show a reversal of the gradient at high tide.

Concentrations of inorganic constituents in groundwater were generally below screening levels, but concentrations of arsenic, copper, and nickel were frequently above screening levels. The screening level for arsenic is based on an ambient water quality criterion for protection of human health, because the human health criterion is well below criteria based on protection of aquatic life in marine surface water. None of the samples with arsenic detections exceeded the most stringent arsenic level for protection of aquatic life in marine surface water. Copper and nickel exceedances were based on comparisons to criteria for protection of aquatic life in marine surface water. One well yielded a one-time exceedance of zinc above the screening level. Only one well had detectable levels of TPH as diesel (GMX-MW-8 at 490 µg/L), which is below the screening level of 500 µg/L. None of the wells or recent groundwater grab samples had any TPH as lube oil in excess of the screening level, with the exception of one 2008 seep sample (SP-4) that showed a concentration of 1,200 µg/L. VOCs, PCBs, and PCP were generally not detected or were below screening levels.

Despite the high concentrations of TPH as lube oil present in the nearshore soils east of the press pits, the groundwater does not appear to be adversely affected by the oil, possibly due to the sorptive effect of the wood fill and partly due to the properties of the hydraulic oil itself exhibiting characteristics of weathering where the lighter (more soluble) fraction attenuated quickly and heaver fraction remained. The heavy residual oil also has a low solubility limit, calculated using the TPH Workbook (Appendix C) at 20 µg/L, well below the groundwater screening level. The single seep sample that showed a detectable concentration of oil was the southernmost sample collected and away from areas in the upland with the highest concentrations. This result may be due to the migration of oil globule detached from subsurface media (soil/saw dust, etc).

Despite the minimal apparent effects to groundwater, consideration must be given to the future potential for migration of the soil COPCs to groundwater and then to Fidalgo Bay, and other potential scenarios for exposure to COPCs in groundwater. Potential exposure pathways for groundwater are described in Section 4.4 and summarized below.

- Human direct contact with shallow groundwater by construction and site maintenance workers.
- Media transfer pathway associated with hazardous substances in shallow groundwater migrating to surface water and resulting in exposure to marine sediment.
- Exposure through inhalation of groundwater contaminants that have migrated to air as vapor. Receptors may include site trespassers, construction and site maintenance workers, future industrial workers, and terrestrial ecological receptors. This pathway may include future indoor air exposure to industrial workers who may occupy future on-site buildings.

Preliminary screening levels that are based on protection of marine surface water were used as a basis for comparison to analytical results for groundwater.

Exposure through the inhalation pathway was not considered to be a significant exposure pathway. There have been no soil gas samples collected on the site, and because there are currently no buildings on the GBH property, there is no possibility of collecting indoor air samples. As an alternative to soil gas or indoor air sampling, Ecology provided screening level concentrations in groundwater to use as an indicator for potential risk via air exposure. Table 14 provides a summary of groundwater screening level exceedances for all analyzed hazardous substances, including VOCs, SVOCs, TPH fractions and mercury. A comparison was made of the groundwater results with the Method B groundwater screening level (groundwater SL) concentration in Table B-1 (Indoor Air Cleanup Levels, Groundwater Screening Levels, and Soil Gas Screening Levels) from the Ecology publication "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action," publication number 09-09-047 (October 2009). The groundwater SL represents the concentration in the groundwater expected to not result in exceedance of the air cleanup level in an overlying structure under most circumstances.

This comparison was done as a conservative screening to identify whether any detected hazardous substances at the site could pose a threat to indoor air in future industrial development scenarios, or to site workers involved with excavation of the soil. The comparison is conservative because it assumes current conditions, not the conditions after cleanup actions have occurred. Based on current conditions, none of the VOCs in groundwater samples from the site exceeded the Method B groundwater SL. Of the detected SVOCs, only naphthalene was listed on Table B-1 of the Ecology publication. The highest concentration of naphthalene in groundwater on the site was detected in a groundwater sample from MW-8 at a concentration of 220 µg/L, slightly above the groundwater SL of 170 µg/L. Average groundwater concentration of naphthalene throughout the site is 7.6 µg/L. No other potential volatile substances listed on Table B-1 of Ecology's Vapor Intrusion Guidance, including mercury, were detected in any of the groundwater samples. Based on this site-specific information, further evaluation of vapor intrusion is not warranted.

8.2.3 Sediment

Chemical analysis of the sediment indicated no exceedances of SMS standards and no clear chemical explanation for the bioassay test failures. Portions of the aquatic area with little or no eelgrass development can likely be attributed to the presence of surface debris from the collapsed structures. There are also areas of elevated dioxin/furan concentrations in the

sediments that are likely associated with combustion of building materials and wood. Potential exposure pathways for sediments are summarized in Section 4.4.

8.3 POTENTIAL RECEPTORS

The various exposure pathways that are identified in the previous section do not constitute an equivalent risk to potential human and ecological receptors. Individual COPCs must be considered in the context of their locations, concentrations, mobility, and the probability of exposure of different receptors via the current land uses, and via proposed land uses upon redevelopment. The proposed redevelopment plan for the GBH property will be presented in more detail in the FS.

8.3.1 Current and Potential Land and Resource Uses

Upland properties that are peripheral to the GBH property are currently developed for industrial purposes, with the exception of the Tommy Thompson Trail that is used by the public. The privately owned parcels outside of GBH property are generally hard-surfaced and access-restricted.

Future development of the GBH-owned upland areas will be consistent with the applicable City of Anacortes industrial zoning (Zone I). Currently, GBH envisions the short-term site use as a boat storage yard; longer term site use could include boat launch facilities with ramp and pier structures, and structures for dry storage of boats. Redevelopment will include adding several feet of fill over the ground surface to a relatively consistent height (final elevation yet to be determined). Where necessary, structural fill topped by asphalt or concrete will be placed on the surface to control settlement and to function as an engineering control.

8.3.1.1 Current Potential Receptors

Current potential upland receptors are terrestrial biota and human workers engaged in excavation activities at the GBH property or exposed to surface water through ingestion, inhalation, or direct contact. The GBH property is restricted from public use by a fence, and only personnel trained in appropriate health and safety protocols are allowed on the property by the owner. Terrestrial biota cannot be restricted as easily from trespassing; however, future land uses will restrict the exposed surface area of the property to only those areas that meet terrestrial ecological cleanup levels.

Marine receptors are fish and shellfish, birds, amphibians, and upper tropic level predators, such as humans and aquatic species. Currently, the intertidal zone is too cluttered with coarse debris for any human or marine predator to forage for shellfish or other burrowing biota.

Assuming that most of the intertidal zone debris would be removed during redevelopment, then burrowing organisms and their predators would have exposure to the material below, most of which is sawdust, unless a capping material is placed on top.

8.3.1.2 Future Potential Receptors

Future upland development of the GBH property will further mitigate exposure of COPCs human and ecological receptors to COPCs by way of adding clean fill to raise the overall site elevation and constructing hard surfaces to restrict surface water exposure and direct contact. Areas of high concentrations of organic compounds will be remediated to eliminate risk of exposure through inhalation. Where receptors are exposed to hazardous constituents, either through development of habitat or establishment of public access areas, hazardous constituents will be mitigated to be consistent with allowable exposure concentrations for the receptors deemed to be at risk.

8.3.2 Transport Mechanisms

Chemical results from the groundwater monitoring program appear to indicate minimal solubility and transport of inorganic and organic constituents from the affected soil into the shallow groundwater. Low concentrations of arsenic, copper, and nickel (and sporadic occurrences of other metals) in groundwater may occur, because the natural degradation of the wood fill causes reducing conditions, which increases metal solubility in some cases (Deutsch 1997). Chemical analyses of the sediments indicate that the sediments are not affected by the elevated inorganic constituents in the groundwater.

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9.0 RISK EVALUATION FOR TERRESTRIAL ECOLOGICAL RECEPTORS IN UPLAND SOIL, AND FOR HUMAN HEALTH FROM DIOXINS/FURANS IN MARINE SEDIMENT

The MTCA cleanup regulations define the approach to be followed to establish cleanup requirements that will protect human health and the environment. For upland areas with soil contamination, cleanup levels for protection of human health are specified using MTCA Method B. Impacts to terrestrial ecological receptors from soil contamination are evaluated using the approach specified under WAC 173-340-7490 through 173-340-7494. This evaluation is provided in Section 9.1.

Potential human and ecological risk from sediment contaminants are evaluated by comparing measured concentrations to the Washington State Sediment Management Standards (see Section 5.1.3). For this RI, Ecology requested that a human health risk assessment be prepared to evaluate the potential risk of dioxin/furan compounds in sediment because no sediment standards exist for this group of compounds. This risk assessment is provided in Section 9.2.

9.1 TERRESTRIAL ECOLOGICAL EVALUATION

This section briefly describes the site-specific terrestrial ecological evaluation (TEE) completed for the Site. The complete TEE, including the bioassay results, is included in Appendix D.

9.1.1 Problem Formulation

The problem formulation step of a site-specific TEE discusses the following:

- Chemicals of Potential Ecological Concern (COPCs);
- Complete Exposure Pathways; and
- Terrestrial Ecological Receptors of Concern.

9.1.1.1 Chemicals of Potential Ecological Concern

COPCs were identified by comparing soil concentrations to MTCA ecological indicator soil concentrations for protection of terrestrial plant and animals (Ecology, 2007, Table 749-3). Eight metals (antimony, arsenic III, chromium (total), copper, lead, mercury, nickel, selenium, and zinc) and three categories of organic compounds (PCBs, TPH, and dioxins/furans) exceeded ecological soil indicator concentrations for plants, soil biota, or wildlife and are considered to be site COPCs of ecological concern.

9.1.1.2 Complete Exposure Pathways

An exposure pathway is defined by four elements:

- a source and mechanism of COPC release to the environment;
- an environmental medium of concern (e.g., soil) or transport mechanism (e.g., volatilization) for the released COPC;
- a point of potential contact with the medium of concern; and
- an exposure route (e.g., ingestion) at the contact point.

An exposure pathway is considered "complete" if all four of these elements are present.

Complete exposure pathways for COPCs in site soil under current conditions include:

- Wildlife ingestion of soil;
- Wildlife ingestion of on-site plants;
- Mammalian predator ingestion of on-site soil biota; and
- Avian predator ingestion of on-site soil biota.

Future developed conditions at the GBH property, as currently planned, will likely eliminate the exposure pathways for wildlife organisms through two means: (1) maintaining a thickness of clean fill material of at least 6 feet between the contaminated soil and the surface, and/or (2) capping the site with buildings, pavement, or other hard structures.

9.1.1.3 Terrestrial Ecological Receptors of Concern

Appendix D discusses ecological receptors of concern that may utilize the site based on the current site habitat. A review of existing information indicates that no threatened or endangered species listed pursuant to the Endangered Species Act are likely to utilize the Site. According to the Washington Natural Heritage Program, there are no known high quality ecosystems or rare plants on the Site. Based on the preferred habitat of priority species, candidate species, and species of concern listed for Skagit County by the Washington Department of Fish and Wildlife, two bird species of concern (Merlin and Purple Martin) and one State threatened plant species (California buttercup) could potentially utilize the Site. These species are discussed further in Appendix D.

9.1.2 TEE Methods

WAC 173-340-7493 (3) lists the various methods available for conducting a site-specific TEE:

- Literature surveys;
- Soil bioassays;
- Application of the wildlife exposure model in WAC-173-340-900 Tables 749-4 and 749-5;
- Biomarker methods;
- Site-specific empirical studies;
- Weight-of-evidence approach using multiple methods; and
- Other methods approved by Ecology.

Based on discussions with Ecology, the soil bioassay method was selected for this TEE. The following bioassays were performed on diluted aliquots of soil samples collected at the Site to establish soil concentrations protective of soil biota and plants:

- 14-Day Earthworm Bioassay Protocol for Soil Toxicity Testing (Ecology, 1996a), and
- 14-Day Early Seedling Growth Protocol for Soil Toxicity Screening (Ecology, 1996b).

The bioassays were conducted by Nautilus Environmental in Tacoma, Washington. The results of the bioassay tests are described in Appendix D. A brief description of the bioassay results is provided below.

9.1.2.1 Earthworm Bioassay Results

The earthworm bioassay tests the mean percentage survival of worms in artificial soil (the control) and the mean percentage survival in test soil after a 14-day exposure period. Survival in the two groups is then compared statistically using the Dunnett's Multiple Comparison test. Five replicates were tested for the control soil and five test groups were tested with TPH concentrations ranging from 590 to 8,500 mg/kg. The concentrations of TPH in the test soils were obtained by diluting soil samples collected at the Site of known TPH concentration with the artificial soil specified for the laboratory control soil. The concentrations of metals and PAHs in the test soil were all below MTCA ecological indicator soil concentrations for protection of terrestrial plant and animals (see Appendix D).

The percentage survival of earthworms in the test soils at all concentrations tested was not statistically different (based on significance criterion of $p < .05$) than in the control soil. The percentage survival of earthworms in the test soils was equal to or greater than in the laboratory control at the three highest TPH concentrations tested. These results suggest that TPH concentrations below the maximum concentration tested (8,500 mg/kg) in soils at the site are not likely to impact soil biota.

9.1.2.2 Lettuce Bioassay Results

The lettuce bioassay tests two different endpoints: percentage survival (seed germination) and aboveground growth (final aboveground, dry biomass) after the 14-day test period. Five replicates were tested for the artificial (control) soil and five test soils were tested with TPH concentrations ranging from 1,700 to 9,800 mg/kg. The concentrations of TPH in the test soils were obtained by diluting soil samples collected at the Site with the artificial soil specified for the laboratory control. The concentrations of metals and PAHs in the test soil were all below MTCA ecological indicator soil concentrations for protection of terrestrial plant and animals (see Appendix D).

The percentage survival of lettuce in the test soils at all concentrations tested was not statistically different (based on significance criterion of $p < .05$) than in the control soil. These results suggest that TPH concentrations below the maximum soil concentration tested (9,800 mg/kg) in soils at the site are not likely to impact plant survival.

The biomass of lettuce in the test soil at a TPH concentration of 1,700 mg/kg was not significantly different than the control (based on significance criterion of $p < .05$). At the other TPH concentrations tested (1,900 to 9,800 mg/kg), the biomass of lettuce in the test soils at the end of the test was lower than in the control, and the differences were statistically significant ($p < .05$). These results suggest that TPH concentrations above 1,700 mg/kg in soils at the Site may have an adverse chronic impact on plant growth.

9.2 HUMAN HEALTH RISK ASSESSMENT IN MARINE SEDIMENT

The RI Work Plan specified that a human health risk assessment would be conducted for bioaccumulative constituents (defined as PCBs and 2,3,7,8-chlorine-substituted dioxin and furan compounds) in sediments if there is a potential risk to human health. PCBs were not detected in sediment samples analyzed for the RI, although dioxins and furans were detected in sediment samples (Section 6.5.2.5); therefore, the human health risk assessment for the Site will be limited to dioxins and furans.

The methodology presented in this section to assess potential risk to humans from the consumption of fish and shellfish exposed to dioxins/furans in sediments adjacent to the Former Custom Plywood Mill is consistent with the approach recommended by EPA (1997b).

9.2.1 Exposure Assessment

The main steps of an exposure assessment are to:

- identify the populations that may be exposed to the chemicals being evaluated;
- determine how they may be exposed (the pathway); and
- select parameters for the exposure assessment that allow the chemical dose to be quantified.

Exposure assessments can focus on the individual or the population. For an individual exposure assessment, estimates of individuals' exposure to chemicals in fish and shellfish are calculated using data on the chemical concentrations in edible tissues of the species being consumed and human consumption patterns. Population exposure assessments are based on the distributions of exposure in a population (EPA, 1997b). The risk assessment presented in this section employs an exposure assessment focused on individuals.

9.2.1.1 Identification of Exposed Populations

No specific information is available on the rates of harvest and consumption of fish and shellfish from the marine waters within the study area. Three general target populations were selected for evaluation in this risk assessment:

Target Population 1: general public;

Target Population 2: a population that consumes fish/shellfish in a manner that is consistent with the Model Toxic Control Act (MTCA) default parameters for fish/shellfish consumption; and

Target Population 3: a high-consumption-rate subsistence scenario for Native Americans in Puget Sound.

Target Population 3 represents a very conservative approach based on the highest likely rate of consumption of fish and shellfish in the vicinity of the Site.

9.2.1.2 Exposure Pathway

An exposure pathway is the mechanism by which a chemical is transported from the source to the exposed individual. A complete description of an exposure pathway involves four elements (EPA, 1989).

1. a source and mechanism of chemical release;
2. a retention or transport medium;
3. a point of potential human contact with the chemical (referred to as the exposure point); and
4. an exposure route, such as ingestion, at the point of contact.

This risk assessment evaluates the exposure pathway resulting in human consumption of fish and shellfish (Section 8.2.3). A complete accounting of all sources that may have contributed to the dioxins/furans found in sediments adjacent to the site, and in fish/shellfish near the site, was not done for this study. Furthermore, the mechanisms by which dioxins/furans are mobilized in the environment, and the processes by which dioxins/furans accumulate in fish/shellfish near the site, were not evaluated.

9.2.1.3 Quantification of Exposure

The magnitude, frequency, and duration of exposure for exposed individuals must be quantified to allow an assessment of potential risk. The exposure evaluated in this risk assessment is the human ingestion of dioxins/furans in edible tissue of fish and shellfish. Because this exposure occurs over time, the total exposure is divided by a time period of interest to obtain an average exposure rate per unit time. When this average rate is expressed as function of body weight, the resulting exposure rate is referred to as the chronic daily intake (CDI). The CDI of dioxins/furans was calculated using Equation 1:

$$CDI = \left(\frac{C * CF * ABS * IR * FDF * ED * EF * AUF}{BW * AT} \right) \qquad \text{(Equation 1)}$$

where:

CDI = Chronic daily intake of dioxins and furans expressed as the TEQ of 2,3,7,8-tetrachlorodibenzo-p-dioxin [2,3,7,8-TCDD] measured in units of milligrams per kilogram of body weight per day (mg/kg-day)

C = 2,3,7,8-TCDD TEQ concentration in fish, crab, or clams in picograms (10^{-12} grams) per gram of body weight (pg/g)

CF = Conversion Factor (1.0^{-09} mg/pg)

ABS = Gastrointestinal absorption fraction (unitless)

IR = Exposed population ingestion rate of fish, crab, or clams in grams per day (g/day)

FDF = Fraction by weight of fish, crab, or clams in diet (unitless)

EF = Exposure frequency (days/year)

ED = Exposure duration (year)

AUF = Area use factor (fraction of consumed tissue obtained from area within the study area) (unitless)

BW = Body weight of exposed individuals in kilograms (kg)

AT = Averaging Time (days)

The default values used for the parameters in Equation (1) for the three general target populations evaluated in this risk assessment are shown in Table 18. A discussion of these parameters and the rationale for selecting the default values used to estimate risk is provided below.

Tissue Concentration

Fish and crab have relatively large home ranges that exceed the area of the Former Custom Plywood Site. Tracking studies of Dungeness crab have shown that most movements are less than 10 miles, but some individuals moved up to 100 miles (CDFG, 2009). Assuming a 10 mile radius of movement (a conservative assumption given the potential long-range movements of crab) yields a home range of 201,344 acres. The tissue concentration of dioxins/furans in these mobile organisms will correspond to their exposure over their home range. Large uncertainties arise in estimating a tissue dioxin concentration that results from exposure to sediments within the study area, Thus, dioxin concentrations in tissues of fish and crab at the Custom Plywood Site were calculated based on measured tissue concentrations from a nearby location; a biota–sediment accumulation factor (BSAF) calculated for the nearby location where the fish tissue samples were collected; and the measured concentrations of dioxins in sediment samples collected from within the Custom Plywood Site intertidal area.

Measured tissue dioxin concentrations in fish and crab were obtained from the SAIC (2008) study of Fidalgo Bay. SAIC's study area DUA3 included the marine waters adjacent to the Former Custom Plywood site. Dioxin concentrations in flatfish tissue in study area DUA3 in Fidalgo Bay ranged from 0.082 to 0.168 pg/g TEQ. Dioxin concentrations in Dungeness crab tissue in study area DUA3 ranged from 0.065 to 0.110 pg/g TEQ. As a conservative measure, the maximum concentration measured in fish and crab within study area DUA3 was used for the tissue concentrations in this risk assessment (Table 18).

A BSAF used to estimate the dioxin concentration in the tissue of clams in the intertidal region adjacent to the Former Custom Plywood Site was calculated using dioxin concentrations measured in horse clam (SAIC, 2008) and sediments (GeoEngineers et al., 2008) collected from study area DUA3. The BSAF calculation is shown Equation 2:

$$BSAF = \left[\frac{\frac{C_{clam}}{L_{clam}}}{\frac{C_{sed}}{S_{oc}}}\right] = \left[\frac{\frac{0.07}{0.0054}}{\frac{3.976}{0.0323}}\right] = 0.1053 \qquad \text{(Equation 2)}$$

where:

C_{clam} = 2,3,7,8-TCDD TEQ concentration (pg/g) in horse clam collected at Station A3R1 in Fidalgo Bay (SAIC, 2008)

L_{clam} = Fraction of lipid in horse clam collected at Station A3R1

C_{sed} = 2,3,7,8-TCDD TEQ (pg/g) in sediment collected near Station A3R1

S_{oc} = Fraction of organic carbon in sediment

The dioxin concentration (pg/g TEQ) of clams in the intertidal region adjacent to the Former Custom Plywood site (C_{CP_clams}) was calculated as shown in Equation 3:

$$C_{CP\_clams} = \left[\left(\frac{C_{CP\_sed}}{S_{CP\_oc}}\right) * BSAF * L_{clam}\right] = \left[\left(\frac{7.9325}{0.0197}\right) * 0.1053 * 0.0054\right] = 0.229 \qquad \text{(Equation 3)}$$

where:

C_{CP_sed} = Mean 2,3,7,8-TCDD sediment concentration (pg/g) at intertidal stations ST-1, ST-21, ST-25, and ST-29 (Table 7)

S_{CP_oc} = Mean fraction of sediment total organic carbon at intertidal stations ST-1, ST-21, ST-25, and ST-29 (Table 7)

BASF = biota–sediment accumulation factor calculated using Equation 2.

L_{clam} = Fraction of lipid in Horse clam collected at Station A3R1.

MTCA Default Exposure Parameters

The exposure parameters for fish/shellfish diet fraction, exposure duration, and averaging time (Equation 1) for target populations other than subsistence are the MTCA default values for calculating surface water cleanup levels for carcinogens in waters which support fish or

shellfish populations(Ecology, 2007, Equation 730-2). The dioxin gastrointestinal absorption factor (0.6) is the MTCA default value for developing soil cleanup levels containing mixtures of dioxins and furans (Ecology, 2007, Equation 740-2).

The exposure duration of 70 years used for the subsistence population is EPA's recommended lifetime assumption for estimating Native American risk from consuming fish and shellfish (EPA, 2007).

Ingestion Rate

Risk estimates were calculated for three different rates of fish/shellfish consumption: 17.5 g/day, 54.0 g/day, and 583 g/day. These rates are the values used by the EPA ambient water quality criteria for the protection of human health, the Washington State MTCA default value for fish/shellfish consumption, and the 95th percentile consumption value (excluding salmon) for the Suquamish Tribe, respectively (EPA, 2002b; Ecology, 2007; Duncan, 2000).

The total fish/shellfish ingestion rates for the EPA and MTCA default values were split into three categories: fish consumption, clam consumption, and crab consumption. The percentage of the diet in these three categories is based on the average U.S per capita consumption for adult males and females (EPA, 2002a). The percentage of crab and clams in the diet of the subsistence population was obtained from the Suquamish Tribe fish/shellfish consumption survey (Duncan, 2000).

Area Use Factor

The area use factor is the fraction of fish/shellfish consumed, over the period of exposure, that were obtained from the study area adjacent to the Former Custom Plywood Mill. The study area for fish and crab includes a 58-acre region extending 1,200 feet from the shoreline of the former Mill. The study area for clam harvesting is the 2.05-acre intertidal zone.

AUF values were applied to different scenarios for each target population (Table 18):

- Target Population 1: one scenario for fish, crab, and clams;
- Target Population 2: one scenario for crab and clams, and two scenarios for fish; and
- Target Population 3: three scenarios for fish, crab, and clams.

An AUF value of 1 assumes that all of the fish and shellfish consumed by an individual are harvested from within the study area. While this assumption is not realistic, this scenario (Scenario 1) was evaluated for all three target populations and each consumption category.

An additional scenario (Scenario #2) with an AUF of 0.4 for fish consumption was evaluated for Target Population 2 (the MTCA scenario).

Two additional AUF scenarios were evaluated for Target Population 3 (subsistence). AUFs for additional scenarios for Target Population 3 were calculated based on the usual and accustomed (U&A) fishing areas as defined by the Office of the Washington State Attorney General. The U&A fishing area for the Swinomish Tribe was used in these scenarios due to the proximity of the Custom Plywood Site to the Swinomish Reservation. The Former Custom Plywood Mill is approximately 5.5 miles northwest of the reservation. The U&A fishing area for the Swinomish Tribe can generally be described as the area from the Canadian border south to the southern end of Whidbey Island. This area is within about 60 miles of the reservation.

The AUF for clams and fish/crab were based on the area of the Custom Plywood study area as a percentage of the area within the overall Swinomish U&A fishing area. Since clams are non-motile and can only be harvested within the intertidal area, the intertidal area within the U&A fishing area was determined. The intertidal area was estimated from shoreline vector data of the MHHW and MLLW lines available from NOAA. The area between MHHW and MLLW was assumed to be the intertidal area within the U&A. The AUF for clam harvest under Scenario #2 (0.0000258) was calculated from the intertidal area within the study area (2.05 acres) and the intertidal area within the U&A fishing area (79,700 acres).

The AUF for fish and crab was based on the wetted area of the study area (from MHHW to approximately 1,200 feet offshore) as a percentage of the entire area within the U&A fishing area. The U&A fishing area was determined by calculating the area within 1,200 feet of the shoreline throughout the U&A fishing area. The AUF for fish and crab harvest under Scenario #2 (0.0005759) was calculated from the wetted area of the study area (58 acres) and the area within 1,200 feet of the shoreline throughout the U&A fishing area (100,700 acres).

Scenario 2 assumes that all of the area within the U&A fishing area would be used equally by Tribal fishers. However, it is reasonable to assume that areas nearer to the reservation would be used preferentially by Tribal members; therefore, site use factors under Scenario 3 were developed to account for the distance from the reservation. For this analysis, we assumed that areas closer to the reservation would be used more than areas further from the reservation. Thus, weighting factors were assigned to portions of the U&A fishing areas based on distance from the Reservation as follows: areas within 10 miles of the reservation were assigned a weighting factor of 1.0, areas 10 to 20 miles of the reservation were assigned a weighting factor of 0.8, areas 20 to 30 miles from the reservation a weighting factor of 0.6, 30 to 40 miles a weighting factor of 0.4, and more than 40 miles from the reservation a weighting factor of 0.2. These weighted areas were then used to determine the total weighted area for the intertidal and wetted areas (within 1,200 feet of the shoreline) within the U&A fishing areas.

This approach yielded AUF values of 0.0000373 and 0.0008396 for fish and crab, respectively, under Scenario #3.

9.2.2 Toxicity Assessment

The toxicity assessment evaluates each chemical's potential to cause health effects based on available toxicological information. Dioxins and dioxin-like compounds (DLCs) form as an unintentional by-product of incomplete combustion. The most toxic of these compounds is 2,3,7,8-TCDD, often simply called dioxin. EPA has classified TCDD as a probable human carcinogen (Group B2). Many other types of dioxins, other than TCDD, and DLCs share most, if not all, of the toxic characteristics of TCDD. The potential adverse effects of TCDD, other dioxins, and DLCs from long-term, low-level exposures to the general public are not directly observable and remain controversial. One major controversy is the issue of estimating risks at doses below the range of existing reliable data. Another controversy is the issue of appropriately assessing the toxicity of various mixtures of these compounds in the environment (NAS, 2006).

The National Research Council of the National Academy of Sciences (NAS) reviewed EPA's 2003 draft document titled *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds.* The key finding of the NAS report was: "*the committee said that compelling new animal data from the National Toxicology Program -- released after EPA completed its reassessment -- when combined with substantial evidence that dioxin does not directly damage DNA, is now adequate to justify the use of nonlinear methods for estimating cancer risk at relatively low levels of exposure*" (NAS, 2006) Currently, EPA assumes that exposure to any amount of dioxin can increase the risk of cancer and that risk increases linearly with increasing exposure concentration. The recent critique by NAS concludes that recent data supports a nonlinear model. This model would indicate that dioxin cancer risk does not increase substantially until a threshold concentration is reached. Thus, the current estimates of dioxin risk for concentrations below this threshold would be reduced using the nonlinear model.

Nearly all relevant cancer-risk data from human epidemiological studies and experimental animal bioassays reflect doses much higher than those typically experienced by humans from exposure to TCDD, other dioxins, and DLCs in the general environment. Consequently, analysts must extrapolate well below the doses observed in the studies to consider typical human exposure concentrations. This extrapolation involves two critical decisions: (1) selecting a "point of departure" (POD), which corresponds to the lowest dose associated with observable adverse effects within the range of data from a study, and (2) selecting the mathematical model used to extrapolate risk from typical human exposures that are well below the POD (NAS, 2006).

Estimating risks below the POD requires making assumptions about how TCDD, other dioxins, and DLCs might cause cancer at lower exposures. The NAS (2006) concluded that EPA's decision to rely solely on a default linear model lacked adequate scientific support. The NAS report recommends that EPA provide risk estimates using both nonlinear and linear methods to extrapolate below PODs. If background exposures to humans result in doses substantially less than the dose associated with the POD (the most likely case in most instances but perhaps not for occupational exposures), then an estimate of risk for typical human exposures to TCDD, other dioxins, and DLCs would be lower in a sublinear extrapolation model than in the linear model (NAS 2006).

At the present time, the only oral cancer slope factor available for TCDD is based on EPA's application of the linear model. This value, 1.5E05 mg/kg/day, was used to estimate potential excess cancer risk associated with fish and shellfish consumption.

The toxicity of dioxins/furan compounds was evaluated using toxicity equivalency factors (TEFs) recommended by the World Health Organization (Van den Berg et al., 2006). This procedure utilizes a set of TEFs to calculate the toxicity equivalent concentration of each dioxin/furan congener relative to 2,3,7,8-TCDD. The sum of all 17 dioxin/furan compounds is 2,3,7,8-TCDD TEQ (toxicity equivalent concentration).

9.2.3 Risk Characterization

Risk characterization integrates the results of the exposure assessment with chemical toxicity information to derive estimates of individual health risks potentially resulting from the exposure pathways.

9.2.3.1 Carcinogenic Risk

Risk for carcinogens is estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen (EPA, 1989). Under current risk assessment guidelines, EPA assumes that a threshold dose does not exist for carcinogens and that any dose can contribute to health risks. In other words, the risk of cancer is proportional to dose exposure and there is never a zero probability of cancer risk when exposed to carcinogenic chemicals. Carcinogenic risk probabilities were calculated by multiplying the estimated chronic daily intake of dioxin (2,3,7,8-TCDD TEQ) by EPA's oral cancer slope factor for 2,3,7,8-TCDD. This product represents the excess cancer risk, or the additional risk that an individual has of developing cancer in their lifetime due to the consumption of dioxin/furans in fish and shellfish.

$$Risk = CDI * SF \qquad \text{(Equation 4)}$$

where:

Risk = Estimated individual excess lifetime cancer risk (unitless)

CDI = Chronic daily intake (mg/kg-day)

SF = Oral cancer slope factor for 2,3,78-TCDD (1.5E05 kg-day/mg)

The excess cancer risk estimates are shown in scientific notation format. The values, for example 1.0E-06, should be interpreted as an increased risk of 1 in 1 million of developing cancer over a lifetime. The interpretation of cancer risk estimates requires that an individual, or regulatory agency, determine what increased risk is unacceptable. Under MTCA, a cancer risk below 1.0E-06 is used as the acceptable risk level (ARL) for protection of human health (Ecology, 2007).

9.2.3.2 Risk Characterization

Excess cancer risk estimates for the three target populations are shown in Table 19. Estimates are provided for the three types of seafood (fish, crab, and clams) and for total seafood consumption.

The general public scenario assumed a total fish/shellfish consumption rate of 17.5 g/day and an AUF of 1. The excess cancer risk estimate for total seafood consumption (7.8E-07) is below the ARL for protection of human health.

The MTCA fish consumption default Scenario #1, assumes a total fish/shellfish consumption rate of 54 g/day and an AUF of 1. The excess cancer risk estimate for total seafood consumption (2.4E-06) is above the ARL for protection of human health. This scenario assumes that all seafood consumed over a 30 year exposure period is harvested from the study area. This assumption is obviously overly conservative because current practices in the area, and modern social practices, in general, are such that a human is not currently and should not be solely dependent on a single food source at any specific location for 30 years. Moreover, the use of the study area for a sole source of seafood at the assumed rates of consumption would deplete the supply of seafood in the area and preclude continued harvesting at that rate. MTCA fish consumption default Scenario #2 shows that with an AUF for fish consumption of 0.4 (i.e., 40 percent of fish consumption from the site over a lifetime) the estimated excess cancer risk is equal to the ARL.

The Subsistence Scenario #1 assumes a total fish/shellfish consumption rate of 583 g/day and an AUF of 1. The excess cancer risk estimate for total seafood consumption (6.7E-05) is above the ARL for protection of human health. As noted above this scenario is obviously

overly conservative. The risk estimates for the AUF Scenarios #2 and #3 are approximately two orders of magnitude below the ARL.

10.0 DEVELOPMENT OF CLEANUP STANDARDS

Cleanup standards comprise (1) cleanup levels, or the concentrations that are protective of human health and the environment; and (2) points of compliance, or the locations where the cleanup levels must be attained. When evaluating cleanup standards, additional regulatory requirements may apply and must be considered, including policy-level changes within the state and federal environmental regulatory agencies regarding the determination of human health risk of dioxin and furans.

10.1 CLEANUP LEVELS

Cleanup levels under MTCA are categorized as Methods A, B, or C (WAC 173-340-700). Method A cleanup levels, which apply to soil, groundwater, and surface water media, are intended to be used for routine site cleanups. Cleanup levels under Method A are available for only about 25 of the more commonly found contaminants among the hundreds of potential hazardous substances. Tables of the MTCA Method A cleanup levels are available for potable groundwater, unrestricted land use (includes residential) soil, and industrial land use Method A cleanup levels for these media must be at least as stringent as concentrations established under applicable state and federal laws. In addition, Method A soil cleanup levels must also be protective of terrestrial ecological receptors. Method A groundwater concentrations must be protective of surface water beneficial uses (if the pathway for surface water–groundwater is complete). Unlike for groundwater and soil, MTCA does not provide a table of Method A cleanup levels for surface water. Surface water Method A cleanup levels must be at least as stringent as concentrations established under applicable state and federal laws and other requirements (See WAC 173-340-730[2]).

Method B may be used at any site and is the most common method for setting cleanup levels when sites are contaminated with substances not listed under Method A. Cleanup levels under Method B are established using applicable state and federal laws and the risk assessment equations and other requirements specified in the MTCA rule for each medium. In addition to accounting for human health impacts, Method B cleanup levels must account for any potential terrestrial or aquatic ecological impacts (unless it can be demonstrated that such impacts are not a concern at the site). Ecology's Cleanup Levels and Risk Calculations (CLARC) database contains hundreds of precalculated/established levels for hazardous substances in air, groundwater, surface water, and soil media (Ecology, 2008, 2010). The Method B cleanup levels in the CLARC database are provided as a service to the public. Also, the CLARC database does not contain cleanup levels for all exposure pathways, such as soil concentrations protective of groundwater and/or surface water.

In contrast to Method B, Method C cleanup levels are intended for industrial sites where exposure to potential contaminants is limited and controllable. As under Method B, potential terrestrial and aquatic ecological impacts must be accounted for in addition to human health impacts when establishing Method C cleanup levels.

In general, the text and tables in this document compare analytical results to the most rigorous cleanup levels, that is, MTCA Method A unrestricted and MTCA Method B, because Ecology recommends this approach as part of the early RI screening process. However, because future use of the GBH parcels, as well as the Sizemore, Bean, and Andrews parcels, is intended to remain industrial in accordance with the area zoning, less stringent industrial cleanup levels could apply to the site. However, public access areas and areas of restored habitat will require the more stringent, unrestricted land-use cleanup levels.

Preliminary screening levels for soil and groundwater are shown in Tables 20 and 21, respectively. Tables 20 and 21 include screening levels for all constituents detected during previous analyses based on screening levels available in the CLARC database. Final cleanup levels will be determined in the Final RI/FS.

10.1.1 Screening Levels for Soil

Either a MTCA Method A or MTCA Method B cleanup level for soil is established for many contaminants. However, Method A and Method B levels have been established for some contaminants. Method B is further broken down into cleanup levels for individual exposure pathways, such as a Method B cleanup level for protection of direct human contact versus a different Method B cleanup level for protection of terrestrial ecological receptors and for protection of groundwater as marine surface water. Preliminary soil screening levels are shown in Table 20. Method A and Method B levels will be used for the former Custom Plywood Mill, if they apply, although the lowest of the levels will be used for screening the existing data, unless regional background levels are higher.

Soil concentrations protective of groundwater were estimated using the fixed-parameter, three-phase partitioning model in accordance with WAC 174-340-747(4). Because groundwater at the Site is not a current or future source of drinking water, and because it migrates to marine surface water, marine surface water concentrations protective of human health and aquatic organisms developed in accordance with WAC 174-340-730 were used in the calculations. Accordingly, the three-phase model provides a conservative estimate of the concentration of a contaminant in soil that is protective of groundwater as marine surface water. Estimated soil concentrations protective of groundwater as marine surface water are listed in Table 20.

Soil cleanup levels for metals may be adjusted to no less than natural background concentrations, in accordance with WAC 173-340-740(5)(c). With the exception of chromium, statewide background metals concentrations were obtained from a state background soil metals study conducted by Ecology (1994) for comparison with Method A and Method B cleanup levels for the site. According to the Ecology study, background total chromium levels in Northern Skagit and Whatcom Counties are elevated compared to the rest of the state. Because elevated background levels of total chromium are expected, and because the Custom Plywood Mill is located outside of the four main regional areas selected by Ecology for the calculation of soil background concentrations, a site-specific total chromium background concentration for the Anacortes area was calculated.

Data for the calculation were obtained from the Ecology (1994) report for 10 sample locations closest to Anacortes. Ecology's MTCAStat program was used to calculate the 90th percentile concentration and four times the 50th percentile concentration for total chromium. Background is defined as the lower of the two values for lognormally distributed data sets, in accordance with WAC 173-340-709(3)(c). The lower value (four times the 50th percentile concentration) was selected as the Anacortes area background, yielding a background total chromium concentration of 117 mg/kg. The screening level for chromium was adjusted upward to this value to reflect elevated chromium background concentrations present in the area. The MTCAStat output for the background calculation of chromium was provided in Appendix E of the Work Plan (Geomatrix, 2008).

10.1.2 Screening Levels for Groundwater

Preliminary screening levels for groundwater based on protection of marine surface water are shown in Table 21. Groundwater results were compared to marine surface water criteria, rather than MTCA Method A or B drinking water criteria, because groundwater will not be used for drinking water, and the marine surface water criteria are more conservative for many of the constituents. Although Method C (industrial) cleanup levels for groundwater exist, Ecology places severe restrictions on their use for industrial sites. Given the proximity of the Custom Plywood Mill to Fidalgo Bay, it is unlikely that Method C cleanup levels for groundwater would ever apply to this Site. As discussed in Section 6.3, the analytical laboratory was unable to achieve quantitation limits below the screening levels for certain inorganic constituents, and thus reporting limits are sometimes higher than screening levels for arsenic, copper, mercury, nickel, silver, and thallium.

10.1.3 Screening Levels for Sediment

Screening levels were developed to determine whether surficial sediments adjacent to the former mill may have a potential adverse effect on human health and/or the environment. The chemical and biological screening criteria that were used are the SMS (WAC 173-204) SQS

(WAC 173-204-320) and CSLs (WAC 173-204-520). These standards contain both chemical and biological effects criteria. The SMS chemical screening levels are presented in Table 6 and the biological effects criteria for sediments are presented in Table 22. Additional site-specific screening criteria for potential deleterious substances (TOC, TVS, and surficial wood coverage were provided by Ecology. Sediment screening levels are not provided for dioxins/furans. Based on on-going discussions with Ecology, screening levels for dioxins and furans will likely be background concentrations established for Puget Sound rather than values based on unacceptable risk to human health ($>10^{-6}$) using the seafood ingestion pathway.

10.2 POINTS OF COMPLIANCE

Cleanup levels are applied at a specific location to assess compliance with MTCA regulations. The location where the cleanup level must be met is known as the point of compliance (POC). The POC can be defined independently for each medium (i.e., soil, groundwater, or sediment). Under the MTCA regulations, the POC may be a standard POC (SPOC) or a conditional POC. The SPOC for soil or groundwater is defined in the MTCA regulations as applying throughout the site (i.e., to all soil or groundwater present at a Site). A conditional POC is defined as a POC located at a specified distance from the source of the contamination. If it can be demonstrated in accordance with the MTCA regulations that it is not practicable to meet the cleanup level at the SPOC within a reasonable time frame, Ecology may approve a conditional POC. It should also be noted that different cleanup approaches may lead to different points of compliance for the same constituent and medium. As an example, the conditional POC that would be used for a cleanup action based upon a groundwater extraction and treatment system would likely be substantially different from the conditional POC that would apply to natural attenuation. The potential use of a conditional POC in the remedial alternatives will be evaluated in the FS. Under SMS, the POC for sediments is the upper 10 cm of sediment.

A conditional POC must be as close as practicable to the contaminant source and not to exceed outside the property boundary, except if the property is near to or abutting surface water or if there is an area-wide groundwater contamination problem per the provisions of WAC 173-340-720(8). Where the groundwater cleanup level is based on protection of surface water, Ecology may approve a conditional POC that is located within the surface water as close as technically possible to the point or points where groundwater flows into the surface water. The former Custom Plywood Mill site abuts Fidalgo Bay; therefore, conditional POCs may be proposed at locations between the source areas and the shoreline. A POC or conditional POC must be associated with each remedial alternative evaluated in detail in the FS.

The relevant regulatory provisions for establishing conditional POCs for affected groundwater at a site are presented in WAC 173-340-720(8). These provisions also provide for

establishment of a conditional POC beyond the site property lines. The specific requirements to establish a condition POC that are applicable to the Site, where groundwater discharges to surface water, are as follows.

- It must be demonstrated through the RI/FS and cleanup action selection/planning process conducted in accordance with WAC 173-340-350 through 173-340-390 that it is not practicable to attain the SPOC within a reasonable time frame.
- All practicable methods of treatment must be considered for cleanup of the affected groundwater before it discharges to surface water.
- Evidence must be presented showing affected groundwater will not continue to discharge to the surface water after implementation of the cleanup action.
- No mixing zone has been used to attain cleanup levels at the conditional POC.
- Evidence must be presented showing the groundwater discharge will not cause violations of sediment quality values specified in WAC 173-204.
- Groundwater and surface water monitoring must be conducted as appropriate to assess the long-term performance of the cleanup action, including the potential for bioaccumulation for constituents below detection limits.
- A public notice of the conditional POC must be provided to the natural resource trustees, Washington Department of Natural Resources, and the U.S. Army Corps of Engineers.
- If the conditional POC is on an off-site property, any property owners located between the source property and the surface water body must agree in writing to the conditional POC.
- If the conditional POC is on an off-site property and the extent of the plume exceeding the cleanup level is known and does not reach the surface water body, the conditional POC cannot be located beyond the extent of affected groundwater exceeding the cleanup level at the time the conditional POC is approved.

These requirements will be addressed as appropriate in the FS. For cleanup alternatives incorporating a conditional POC, the regulations at WAC 173-340-720(8)(e) provide for use of upland monitoring wells to demonstrate compliance at the groundwater conditional POC. Under these provisions, Ecology must consider that natural attenuation of groundwater constituents may occur between the monitoring wells and the surface water. An estimate of natural attenuation that considers the rate of attenuation, presence of preferential flow pathways, and any effects that changes in water chemistry due to natural attenuation processes may have on attaining surface water or sediment quality standards can be used to assess attainment of cleanup levels at the conditional POC.

The relevant provisions for establishing a POC for soil located on industrial sites are presented in WAC 173-340-740(6). These provisions are as follows.

- For soil cleanup levels based upon protection of groundwater, the soil POC shall be the SPOC.
- For soil cleanup levels based upon protection from vapors, the POC shall be all soils above the uppermost saturated zone.
- For soil cleanup levels based upon direct contact human exposure, the POC shall be the upper 15 feet of soil throughout the site.
- For soil cleanup levels based upon ecological considerations, the POC must be established in accordance with WAC 173-340-7490.
- For cleanup actions incorporating containment, Ecology recognizes that the cleanup levels specified in the regulation will typically not be met at the required POC, and that the cleanup action will be determined to be in compliance provided that the following conditions are met.
    - The cleanup action is demonstrated to be permanent to the extent practicable under the provisions of WAC 173-340-360.
    - The cleanup action is protective of human health.
    - The cleanup action is demonstrated to be protective of ecological receptors under WAC 173-340-7490 to 173-340-7494.
    - Institutional controls are implemented in accordance with WAC 173-340-440 that prohibit activities that may adversely affect the cleanup action.
    - Compliance monitoring under WAC 173-340-410 and periodic reviews under WAC 173-340-430 are conducted.
    - The types, levels, and amounts of hazardous substances remaining after implementation of the cleanup action and the measures to prevent migration of and contact with the hazardous substances are specified in the cleanup action plan.

These requirements will be addressed as appropriate in the FS.

10.3 REMEDIATION LEVELS

MTCA regulations provide for remediation levels in the development and evaluation of cleanup action alternatives. Remediation levels are constituent concentrations in affected media that differentiate between different cleanup action components of a comprehensive cleanup action. By definition, remediation levels exceed cleanup levels. Remediation levels may be identified by a constituent concentration or by some other means of identifying the hazardous

constituent, such as appearance. Remediation levels included in an approved CAP are enforceable under MTCA regulations, must incorporate plans for adequate monitoring, and must be protective of human health and the environment. Cleanup action alternatives to be developed for the FS may incorporate remediation levels. If remediation levels are used in a cleanup action alternative considered in the FS, the provisions of WAC 173-340-355 will be addressed.

Cleanup action alternatives considered in the FS that incorporate remediation levels will be evaluated in the same manner and using the same standards specified in WAC 173-340-360 as used for other cleanup action alternatives. The methods used to establish remediation levels may be qualitative or quantitative. If appropriate, a quantitative risk assessment performed in accordance with WAC 173-340-357 may be used to support remediation levels. Fate and transport considerations, including natural attenuation, biodegradation, and soil/groundwater partitioning, may also be used in developing and assessing remediation levels, as noted in WAC 173-340-355(4). The methods used for establishing remediation may be simple or complex, as appropriate.

10.4 OTHER POTENTIALLY APPLICABLE REQUIREMENTS

The FS report will discuss compliance of the preferred alternative with ARARs, including state and federal laws, in accordance with WAC 173-340-350, WAC 173-340-710, and the requirements of the Agreed Order. "Applicable" requirements mean those regulatory cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a COPC, remedial action, location, or other circumstance at the Site and that are applicable to the Site under law. "Relevant and appropriate" requirements are regulatory requirements or regulatory guidance that do not apply to the Site under law but have been determined to apply by Ecology. ARARs are often identified as chemical-specific, location-specific, or remedial action-specific. A number of regulations include requirements in more than one of these three categories.

Chemical-specific requirements are health- or risk-based numerical standards or methods that, when applied to the site-specific conditions, enable selection of the cleanup levels. If a COPC has more than one such requirement, the most stringent will generally be selected. This approach is consistent with Ecology's MTCA cleanup Regulations (Ecology, 2007).

Location-specific ARARs are restrictions on the concentrations of hazardous substances or on activities solely because they are in specific locations such as floodplains, wetlands, historic places and sensitive ecosystems or habitats. Remedial action-specific ARARs are technology- or remedial activities-based requirements or limitations that apply to particular

remedial activities. The list of ARARs that apply to the site and remedial actions selected are in Table 23.

Action- and location-specific requirements influence the character and nature of the cleanup standard, cleanup action, and/or remediation level. An example of location-specific requirements that may be included for consideration in the FS would be the state Shoreline Management Act developed under RCW 90.58.This state law may affect future remedial actions if such actions have the potential to affect areas within 200 feet of the shoreline. During initial FS development, location- and action-specific ARARs will be identified. When the detailed analysis of cleanup actions is completed, all location- and action-specific ARARs will be tailored to each alternative before a comparison of alternatives begins.

11.0 LOCATIONS AND MEDIA REQUIRING CLEANUP ACTION EVALUATION IN FEASIBILITY STUDY

Soil, groundwater and sediments that are impacted with the identified COPCs will be evaluated in the FS within a range of remedial alternatives. The remedial alternatives to be considered include excavation and off-site disposal, capping containment, and monitored natural attenuation. Depending on the location and depth of the affected media, a combination of remedial alternatives (e.g., excavation to a specified depth or concentration combined with capping) may be evaluated.

11.1 FEASIBILITY STUDY OBJECTIVES

A detailed analysis of each remedial alternative will be conducted according to the requirements of WAC 173-340-350, "Remedial Investigation and Feasibility Study." The remedial alternatives will be evaluated for compliance with the requirements of WAC 173-340-360, "Selection of Cleanup Actions," including a detailed evaluation of remedial alternatives relative to the following criteria:

1. Compliance with cleanup standards and applicable laws;
2. Provision for a reasonable restoration time frame; and
3. Use of permanent solutions to the maximum extent practicable by comparison of the following criteria:
    - Protectiveness
    - Permanence
    - Cost
    - Effectiveness over the long term;
    - Short-term risk management;
    - Net environmental benefit;
    - Technical and administrative Implementability;
    - Consideration of Public Concerns

The remedial alternative that is judged to best satisfy the evaluation criteria listed above will be identified. Rationale for the selection will be provided, and the recommended remedial alternative further developed in the FS report and in the Cleanup Action Plan.

11.2 LOCATIONS AND LIMITING CONDITIONS

Site-specific factors and potential future use can pose significant obstacles that may limit the practicability of some remedial technologies. The remedial technologies proposed in the FS will take into account technical considerations that could prevent successful use of a

technology, such as physical interferences or constraints, practical limitations of a technology, and soil properties. Administrative limitations will also be considered, including the ability to obtain permits and the availability of qualified contractors, equipment, and disposal services. Some of the site-specific technical and administrative difficulties are outlined below, and will be further discussed in the FS.

Complex Chemistry. The historical use of the GBH property as a sawmill and plywood production facility has left a significant amount of wood waste in soils. The wood waste ranges in size from boards and timbers to fine sawdust. In one area the wood waste was observed to a depth of 22 feet bgs. Wood naturally contains a complex mixture of chemicals, which may be falsely identified as petroleum contamination when analyzed using standard analytical methods for petroleum hydrocarbons (NWTPH-Dx). Some types of trees, notably cedar, have a significant concentration of natural oils. Special consideration must be given to the presence of this wood waste in order to accurately delineate the area of petroleum hydrocarbon contamination on site.

Debris on the GBH Property. A significant number of wooden piles, concrete foundations and pile caps, miscellaneous structures, and debris remain on the GBH property from the former mill and plywood facility, particularly in the marine area. Much of the aboveground debris (wooden piles, concrete foundations, and pile caps) in the uplands has been removed as part of interim measures. Further demolition prior to cleanup should enable further access to areas of contamination.

Non-GBH-owned Parcels. The area covered by the Agreed Order includes actively used areas outside of the property owned by GBH. A public hiking trail that was once a former rail line is adjacent to the western edge of the GBH parcels. A yacht manufacturing facility (the former Hardboard Plant) is present at the northwestern portion of the Agreed Order Area. Both of these areas have been previously investigated, and interim actions have been conducted. Most of the areas outside of the GBH property are developed with impervious surfaces and structures.

11.2.1 Extent and Magnitude of Soil Media Impacted

This RI has identified specific areas and volumes requiring further consideration during the FS process. These areas, including location, size, and volume, are described in more detail in this section.

The extent and magnitude of soil media containing COPCs at concentration exceeding preliminary screening levels were tentatively estimated based on the primary COPCs such as TPH and metals, and cPAHs.

Several small, localized areas of concern are found on the northern part of the GBH parcels on Tract 5 and Tract 6, and on one localized area of concern west of Tract 6 underneath V Place.

- **Tract 5:** Three areas of concern are found on Tract 5 (in the vicinity of GMX-S18, GMX-S26, and GMX-S27) ranging in areal extent from approximately 770 square feet to 1,810 square feet. The area localized around GMX-S26 is located approximately 50 feet east of the former 900-gallon fuel tank, and the area localized around GMX-S27 is located approximately 50 feet west of the same tank. The area of concern localized around GMX-S18 is located in an area where no potential historical sources have been observed. Based on the analytical results, an estimated volume of 115 cubic yards (GMX-S27) and 470 cubic yards (GMX-S18 and GMX-S26) of affected soils within these three areas require further consideration during the FS process.

- **Tract 6:** Five areas of concern occur on Tract 6 (localized around GMX-S23, GMX-S24, GMX-S28, GMX-S37, and GMX-MW-03). All areas of concern, except for the area localized to GMX-S37, are individually estimated to be 600 square feet. Based on analytical results an estimated volume of 100 cubic yards (GMX-S23, GMX-S28, and GMX-MW-03) and 150 cubic yards (GMX-S23) of affected soils are found within these four areas. The area localized around GMX-S37 is potentially larger than the other four areas within Tract 6, covering an area of approximately 1,150 square feet. This area, based on soil analytical data, contains approximately 335 cubic yards of affected soil requiring further consideration during the FS process. The area localized around GMX-S24 is located just south of the former compressor building, and the area localized around GMX-S23 is located just west of the former boiler house. The other three areas of concern within Tract 6 appear to be located in areas where no potential historical sources have been observed. After concrete is removed in the sidewalls of previous remediation excavation areas, COPCs from those excavation areas will need to be assessed for further mitigation.

- **V Place Roadway:** One area of concern is found underneath V Place, localized around sampling location GMX-S56. This area is approximately 1,150 square feet and contains an estimated 250 cubic yards of soil that will need further consideration during the FS process.

Three other larger areas of concern are found, stretching across several tract boundaries. Two of these areas (Smaller Gate Area and Larger Gate Area) are found just south of the entrance gate in the western part of the GBH property, and the other area (Press Pit Area) is found in the central to south-central part of the GBH property in the vicinity of the press pits.

- **Smaller Gate Area:** This area is approximately 2,700 square feet and contains an estimated 200 cubic yards of affected soil. Sampling locations GMX-S40 and GMX-S41 are located within this area. There are no apparent historical source areas in the vicinity of this area potentially indicating that this area is affected by upgradient off site conditions.

- **Larger Gate Area:** This area is approximately 15,000 square feet and consists of approximately 3,300 cubic yards of affected soil. This area is located in the vicinity of the former paint storage area and the former paint and oil spraying areas and includes sampling locations GMX-S18, GMX-S30, GMX-S39, GMX-S44, GMX-S45, GMX-S49, and GMX-S52. In addition, the southern part of this area is found within the perimeter of Wetlands D.

- **Press Pit Area:** This is the largest of all the areas of concern and spans approximately 36,000 square feet, and encompassing all three former press pits, the pitch collection tank area, and 11 sampling locations. Based on chemical analysis this area contains approximately 9,800 cubic yards of affected soil.

In summary, there is a total of approximately 60,000 square feet of affected upland area with an estimated volume of 15,000 cy of soil with contamination generally occurring in the upper 2 to 9 feet bgs.

11.2.2 Extent and Magnitude of Groundwater and Surface Water Media Impacted

The primary COPCs in groundwater and surface water are several metal compounds including arsenic, copper and nickel. Dissolved metals were only analyzed for during the July/August 2008 event (rationale discussed previously in this report) and thus the discussion below pertains to total metal concentrations only. Arsenic in groundwater and surface water is ubiquitous at the site but the detections are at or near the reporting limit for the analytical method used for analyzing for arsenic. Zinc was only detected at concentrations exceeding the screening level at one location (GMX-MW-02) outside the three main impacted areas discussed in more detail below.

Three localized areas of concern based on groundwater and surface water concentrations at the site. They are discussed in more detail below:

- **Tract 6:** Copper and nickel concentrations in groundwater and surface water are found exceeding screening levels in the eastern part of tract 6 outlined by sampling locations GMX-MW-05, ANCP-MW-01, SP-01, and SP-02. This area is located immediately north of the former boiler house and the compressor house where hog fuel used to be stored and extends to the east into the intertidal area. The remaining part of Tract 6, west of GMX-MW-05, including sampling locations GMX-MW-03, GMX-MW-07, and GMX-MW-08, does not have groundwater impacted by copper and nickel. The areal extent of this impacted region is approximately 40,000 square feet.

- **Tract 7:** The intertidal area just below the MHHW line has surface water concentrations of copper and nickel that exceed the screening levels. This area is east of press pits #1 and #2. The impacted appears to be localized to the area around SP-03 only as samples collected from the upgradient location (ANCP-MW-02) do not have detected concentrations of copper and nickel exceeding the screening level. The remaining part of Tract 7, west of

ANCP-MW-02, including location GMX-MW-02, appears to be not impacted as well. The aerial extent of this impacted area is approximately 8,000 square feet.

- **Tract 8:** Copper and nickel concentrations detected in samples collected from GMX-MW-01 and SP-04 exceed their respective screening levels. These two locations are situated in the central part of Tract 8 towards the southern edge of the uplands part of the site. Groundwater samples from GMX-MW-09, north of the impacted area still on Tract 8, are not impacted by copper and nickel indicating that the impacted zone is localized to the central part of Tract 8. The aerial extent of this impacted area is approximately 11,000 square feet.

11.2.3 Extent and Magnitude of Intertidal and in Water Sediment Media Impacted

As discussed in Section 6.5.1, six sediment sampling locations failed the Puget Sound sediment cleanup screening level (CSL) for biological testing. The area impacted was estimated by creating a Thiessen polygon around each location that failed the CSL. Thiessen polygons are polygons whose boundaries define the area that is closest to each point relative to all other points (Boots, 1987). Using this procedure, the impacted area defined by the six sampling locations is located within three polygons (Figure 33). The impacted area around ST-1 is estimated to be 12,000 square feet. The impacted area around locations ST-10, ST-11, and ST14 is estimated to be 322,706 square feet and the impacted area around ST-22 and ST-25 is estimated to be 163,575 square feet. The total impacted area of intertidal and in-water sediments is estimated to be 498,281 square feet.

11.3 HABITAT RESTORATION AND MITIGATION PLAN

Remediation of the GBH property uplands may be required in portions of Wetlands D and E; either because of the presence of contaminated soil or building debris, including creosoted pilings. Mitigation will be conducted for any impacts to the wetlands as a result of remediation. Mitigation will involve the creation of a new wetland area equal in size to the impacted area, with the mitigation area designed to immediately provide higher functions and values than the current function and values of Wetlands D and E. A potential on-site mitigation area is being planned in the southern portion of the Site.

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12.0 DESCRIPTION OF CONCRETE, CONSTRUCTION DEBRIS AND WOOD FILL

This section addresses the extent of the areas covered by concrete, construction debris, and wood debris at the former Mill site. The GBH property has remained undeveloped since the fire in 1992 and contains remnants of the former Mill site in the uplands and aquatic areas. Substantial debris cleanup has occurred on the GBH property since the fire. However, complete demolition and removal of the debris have been delayed because of the ongoing environmental investigations. Areas of the former Mill site that are beyond the GBH property boundaries have been fully redeveloped and do not contain observable debris.

12.1 UPLANDS AREA

Since acquisition of the property in late 2007, GBH has made significant progress toward debris removal on the property. Figure 34 illustrates the change in site elevations from March 2008 to April 2009, due to the GBH efforts. GBH has been working on removing some of the concrete structures on the upland portion of their property since the summer of 2008, as required by the Agreed Order. However, Ecology required certain concrete foundations and structures to remain until the site-wide remediation, notably the concrete in Tracts 7 and 8, and the concrete structures waterward of the MHHW line. From 2007 through 2010, approximately 1,000 cubic yards of concrete were tested, removed, crushed and reused as surface cover in the northern portion of the site. At the end of 2010, approximately 500 cubic yards of concrete remained in place in the upland, based on the observable material; although the estimate may not account for some concrete foundations that have not been observed because they remain buried. Tons of steel reinforcing bar and other metal pieces were segregated and sent to a metal recycling facility. GBH carefully segregated any treated timbers and pilings and sent them to the Kimberly-Clark facility in Everett for use as boiler fuel.

As of the end of 2010, a few small aboveground concrete structures still remained in the uplands on the GBH property, primarily around the former compressor/boiler house area, the press pits, the glue tank area, and a low retaining wall along the western property boundary. Some subsurface concrete pile caps and foundations were present in the former compressor/boiler house area and on the northeast corner of Tract 5. Demolition of the remaining structures will occur during phases of interim actions over the next several years. GBH is planning for the retaining wall to remain along the western property boundary during future development.

Although many have been removed, creosote-treated pilings occur throughout the central part of the uplands in the former location of the main buildings of the plywood plant. During previous RI activities, some of the excavated pilings were observed to be in poor condition and

many were partially burned. Pilings that are in poor condition are difficult to remove intact because of their fragility.

Wood debris, ranging in size from sawdust to logs and sawn timbers, was used as fill throughout the uplands. Thicknesses of the wood fill ranges from several feet to more than 17 feet above the native clay layers (Figure 9).

12.2 INTERTIDAL AREA

The intertidal area contains building debris, pilings, and concrete pieces ranging from about 2 to 4 feet in thickness in the center of the main plant area (Figure 35). This material overlies fill consisting of wood logs and finer grained wood from the former mill operations. Concrete structures and foundations are present on the surface of the intertidal area or protruding from it. Test pits excavated in the intertidal area above MLLW showed accumulations of fine sediment, wood debris, sawdust deposits, and building debris, totaling in some cases over 8 feet in thickness. A diverse community of marine encrusting organisms has developed on the pilings and concrete rubble in the lower intertidal zone.

In the aquatic areas there remains an additional estimated 300 cubic yards of platform structures, and 3,500 cubic yards of building debris (brick and concrete). Below the surface layer of debris in the intertidal zone, sawdust and larger wood pieces are present to a depth of 5 to 8 feet.

Approximately 600 pilings are present within the intertidal and subtidal zones. Similar to the upland pilings, many of the pilings in the intertidal zone are in poor condition, and partially burned. Intact removal of these pilings may be difficult. Future removal may be limited in some cases to cutting off the pilings at the mudline. Removal techniques will be evaluated further in the FS.

The shoreline at the south end of the site is armored with riprap to protect the former rail line and current walking trail. A narrow intertidal beach composed of coarse sand and gravel with scattered cobbles and riprap pieces is present along the toe of the riprap.

12.3 IN-WATER AREA

One large structural remnant and pilings from a former pier remain in the subtidal area on the GBH property. Hundreds of pilings support the large structural remnant, an L-shaped concrete platform. The pier remnants continue beyond the east boundary of the GBH property at the Inner Harbor line, well into the zone managed by DNR. Pilings do not appear to extend out to the Outer Harbor line.

Widespread wood deposits have not been observed in the subtidal areas, although observations during the benthic survey were limited in areas of dense eelgrass.

A tugboat that had been shipwrecked on the pilings between the Inner and Outer Harbor lines was removed and scrapped in the summer of 2008 by the Port of Anacortes with a grant from the State of Washington.

12.4 DEMOLITION PLANNING FOR DEBRIS/CONSTRUCTION MATERIALS

Details regarding the demolition and cleanup of debris and construction materials will be provided in the FS and the CAP. It is anticipated that an approach similar to the work conducted in 2008 and 2009 will be used to address the demolition of the remaining upland concrete foundations and structures, that is, breaking up the concrete, recycling metal materials, and reusing on site building materials that are not contaminated. Building materials that are found to be contaminated, including the creosote-treated pilings, will be segregated and disposed properly. Concrete structures and building materials in the intertidal and subtidal areas will be removed as part of the overall mitigation of the site.

Removal techniques will be evaluated in the FS for pilings present in both upland and aquatic areas. There are estimated to be over 600 pilings in the aquatic area and possibly hundreds of pilings remaining in the upland area. Based on previous excavations, the pilings are generally shorter than 15 feet, but many in poor condition such that they may not be removed intact. The FS will evaluate the technical feasibility of attempting to remove the entire length of the pilings or cutting off the pilings at the mudline.

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13.0 REPORT LIMITATIONS

Within the limitations of the agreed-upon scope of work, this assessment has been undertaken and performed in a professional manner in accordance with generally accepted practices, using the degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. Due to physical limitations inherent to this or any environmental assessment, AMEC expressly does not warrant that the site is free of pollutants or that all pollutants have been identified. No other warranties, express or implied, are made.

In preparing this report, AMEC has relied upon documents provided by the others. Except as discussed within the report, AMEC did not attempt to independently verify the accuracy or completeness of that information. To the extent that the conclusions in this report are based in whole or in part on such information, those conclusions are contingent on its accuracy and validity. AMEC assumes no responsibility for any consequence arising from any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to AMEC.

This report has been prepared for the express use of GBH Investments, LLC and the Department of Ecology. Third-party users of this report may rely on the RI provided that they agree, in writing, to be bound by the terms and limitations set forth in the Agreement for Professional Services dated March 18, 2008, between Geomatrix Consultants, Inc., and GBH and subject to the limitations and disclaimers described in the report. If this report is used by a third party, with or without written consent of AMEC, such third party in using this report agrees that it shall have no legal recourse against AMEC or its subsidiaries, and shall indemnify and defend AMEC or its subsidiaries from and against all claims arising out of or in conjunction with such use or reliance.

This report does not constitute legal advice. In addition, AMEC makes no determination or recommendation regarding the decision to purchase, sell, or provide financing for this property.

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14.0 REFERENCES

AMEC (AMEC Geomatrix, Inc.), 2009, Supplemental Soil Investigation Plan, Former Custom Plywood Mill, Anacortes, Washington: Prepared for GBH Investments, April.

Brown, E.H., J.Y. Bradshaw, G.E. Mustoe, 1979, Plagiogranite and Keratophyre in Ophiolite on Fidalgo Island, Washington, GSA Bulletin, Vol. 90, No. 5, pp. I493-I507, May.

CDFG (California Department Fish and Game), 2009, Dungeness Crab: http://www.dfg.ca.gov/response/crab.pdf.

City of Anacortes, 2008, Interoffice Memo from Kim McKinnon to Gary Robinson Re: NM200 Tommy Thompson Trail, Trail Construction in Area of Plywood Mill, March 12.

City of Anacortes, 2010, Telephone communication with Bob Clumpner, May 27.

Cleverly, David, John Schaum, Gregory Schweer, Jonathan Becker, Dwain Winters, 1997, The Congener Profiles of Anthropogenic Sources of Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans in the United States, Presentation at Dioxin '97, the 17th International Symposium on Chlorinated Dioxins and Related compounds, Short paper in Organohalogen Compounds, Volume 32:430-435.

Corps, (U.S. Army Corps of Engineers), 2006, Letter from Kathleen Kunz (Corps) to Concorde, Inc., Reference: 200600919, Concorde Inc., September 15.

Deutsch, William J., 1997, Groundwater Geochemistry: Fundamentals and Applications to Contamination. Lewis Publishers.

Duncan, M., 2000, Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region: Suquamish Tribe, Fisheries Department, Suquamish, WA.

Ecology (Washington State Department of Ecology), 2010, Cleanup Levels and Risk Calculations (CLARC) website, https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx.

Ecology, 2008, Cleanup Levels and Risk Calculations under the Model Toxics Control Act Cleanup Regulation (CLARC).

Ecology, 2007, Model Toxics Control Act Statute and Regulation: Publication No. 94-06, Washington State Department of Ecology, Toxics Cleanup Program, Olympia, WA.

Ecology, 2003, Sediment Sampling and Analysis Plan Appendix, Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards Chapter 173-204 WAC), Ecology Publication No. 03-09-043, revised April.

Ecology, 1997a, Interim Interpretive and Policy Statement, Cleanup of Total Petroleum Hydrocarbons (TPH).

Ecology, 1997b, Survey for Petroleum and Other Chemical Contaminants in the Sediments of Fidalgo Bay, Washington State Department of Ecology, Publication No. 97-338, November.

Ecology (Washington Department of Ecology), 1996a, “Earthworm Bioassay Protocol for Soil Toxicity Screening” Publication No. 96-327, Environmental Investigations and Laboratory Services Program, Olympia, WA.

Ecology (Washington Department of Ecology), 1996b, “Early Seedling Growth Protocol for Soil Toxicity Testing” Publication No. 96-324, Environmental Investigations and Laboratory Services Program, Olympia, WA.

Ecology, 1994, Natural Background Soil Metals Concentrations in Washington State, Ecology Publ. 94-115, October.

Ecology, 1992, Inspection Report, Custom Plywood Corporation, March 24.

Ecology, 1990, Inspection Report, Custom Plywood Corporation, September 26.

Ecology and NOAA, 2003, Chemical Contamination, Acute Toxicity in Laboratory Tests, and Benthic Impacts in Sediments of Puget Sound; a Summary of Results of the Joint 1997-1999 Ecology/NOAA Survey, Washington State Department of Ecology, Publication No. 03-03-049, October.

Ecology, 2007, Model Toxics Control Act Statute and Regulation: Washington State Department of Ecology, Publication 94-06, November.

Enviros, 1995a, Final Report Phase I and Limited Phase II ESA, Custom Plywood, 35th and V Streets, Anacortes, Washington, March 31.

Enviros, 1995b, Final Report: Sediment Sampling, Custom Plywood, 35th and V Streets, Anacortes, Washington, September 28.

EPA (U.S. Environmental Protection Agency), 2007, Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia: U.S. Environmental Protection Agency: U.S. Environmental Protection Agency Region 10, Seattle, WA.

EPA, 2002a, Estimated Per Capita Fish Consumption in the United States: EPA-821-C-02-003, U.S. Environmental Protection Agency, Office of Science and Technology, Office of Water, Washington, D.C.

EPA, 2002b, National Recommended Water Quality Criteria: 2002, Human Health Criteria Calculation Matrix: EPA-822-R-02-012, Office of Water, Washington, D.C.

EPA, 2000, Custom Plywood Mill Preliminary Assessment/Site Inspection, Anacortes, Washington: Prepared by Ecology and Environment for EPA Region 10, under START Contract No. 68-W6-0008, Seattle, Washington, December.

EPA, 1997a, Ecological Condition of the Estuaries of Oregon and Washington; an Environmental Monitoring and Assessment Program (EMAP) Report, EPA 910-R-06-001 US Environmental Protection Agency, Office of Environmental Assessment, Region 10, Seattle, Washington.

EPA, 1997b, Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2, Risk Assessment and Fish Consumption Limits, Second Edition: EPA 823-B-97-009, U.S. Environmental Protection Agency, Office of Science and Technology, Office of Water, Washington, D.C.

EPA, 1992, RCRA Ground-Water Monitoring: Draft Technical Guidance, Office of Solid Waste, U.S. Environmental Protection Agency, Washington, D.C.: November.

EPA, 1989, Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A): EPA/540/1-89/002, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

Foster, M.S., C. Harrold, and D.D. Hardin, 1991, Point vs Photo Quadrat Estimates of the Cover of Sessile Marine Organisms, Journal of Experimental Marine Biology and Ecology 146: 193-203.

GeoEngineers, Inc., AMEC Geomatrix, Inc., and Anchor Environmental, LLC, 2008, Remedial Investigation Report: Port Uplands Area, MJB North Area, and Marine Area, Former Scott Paper Company Mill Site, Anacortes, Washington: Prepared for Port of Anacortes, MJB Properties, and Kimberly-Clark Corporation, Anacortes, WA.

Geomatrix (Geomatrix Consultants, Inc.), 2008, Final Remedial Investigation/Feasibility Study Work Plan, Former Custom Plywood Mill, Anacortes: Prepared for GBH Investments, LLC, September.

Geomatrix, 2007a, Upland Area 1 Interim Remedial Action Plan, Former Custom Plywood Site, Anacortes, Washington: Prepared for Concorde, Inc., September.

Geomatrix, 2007b, Underwater Habitat Survey, Anacortes Custom Plywood Benthic Study, Anacortes, Washington: Prepared for Washington Department of Community, Trade, and Economic Development, November.

Geomatrix, 2006, Wetlands Delineation, Former Custom Plywood Site, Anacortes, Washington, August.

Hart Crowser, 2011, Feasibility Study Report for Interim Action Work Plan, Custom Plywood Site, Anacortes, Washington, Prepared under contract to the Washington State Department of Ecology, September.

Hartung, M., 1956, Inventory of Washington Minerals, Part II, Metallic Minerals, Vol. I.

John A. Pinner and Associates, 1993, Preliminary Environmental Evaluation, Custom Plywood Mill, November 29.

Klungland, Michael, 1989, Soil survey of Skagit County area, Washington, United States Department of Agriculture, Soil Conservation Service, in cooperation with Washington

State Department of Natural Resources and Washington State University, Agriculture Research Center.

Michelsen, Teresa, 1992, Organic Carbon Normalization of Sediment Data, Olympia; Washington Department of Ecology, Toxics Cleanup Program, Publication No. 05-09-050.

NAS (National Academy of Sciences), 2006, Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment, Committee on EPA's Exposure and Human Health Reassessment of TCDD and Related Compounds, Board on Environmental Studies and Toxicology, Division of Earth and Life Sciences, National Research Council of the National Academies, The National Academic Press, Washington, D.C., http://www.nap.edu/catalog.php?record_id=11688#toc (accessed on 10/09/09.

NOAA (National Oceanic Atmospheric Administration), 2009a, Endangered Species Act Status of West Coast Salmon & Steelhead, Seattle, WA: National Atmospheric Administration, National Marine Fisheries Service, Northwest Regional Office, http://www.nwr.noaa.gov/ESA-Salmon-Listings/upload/snapshot-7-09.pdf (accessed October 19, 2009).

NOAA, 2009b, ESA-Listed Marine Mammals, Seattle, WA: National Atmospheric Administration, National Marine Fisheries Service, Northwest Regional Office, http://www.nwr.noaa.gov/Marine-Mammals/ESA-MM-List.cfm (accessed October 19, 2009).

NOAA, 2009c, Southern Resident Killer Whale Critical Habitat Map & GID Data, Seattle, WA: National Atmospheric Administration, National Marine Fisheries Service, Northwest Regional Office, http://www.nwr.noaa.gov/Newsroom/images/SRKW-CH-Map.jpg (accessed October 19, 2009).

NOAA, 2000, Puget Sound Protected Resources, Chinook Salmon, May 8.

Plywood Pioneers Association, 1978, Anacortes Veneer Company, No. 18 in a series of monographs on the history of West Coast plywood plants, September.

PSDDA (Puget Sound Dredged Disposal Analysis), 2000, Dredge Material Evaluation and Disposal Procedures, A Users Manual for the Puget Sound Dredged Disposal Analysis (PSDDA) Program, February.

Ritter, R.A., H.D. Berry, B.E. Bookheim, and A.T. Sewell, 1997, Puget Sound Intertidal Habitat Inventory 1996: Vegetation and Shoreline Characteristics Classification Methods, Washington State Department of Natural Resources, Aquatic Resources Division, Nearshore Habitat Program, Olympia, Washington.

SAIC (Science Applications International Corporation), 2008, Fidalgo Bay Sediment Investigation, Fidalgo Bay, WA: Archived Sediment and Tissue Analytical Results Data Report Addendum: Prepared for Washington Department of Ecology, Toxics Cleanup Program, Lacey, WA.

SAIC, 2008, The Fidalgo Bay Sediment Investigation, Fidalgo Bay, Washington: Final Data Report, Prepared for the Washington State Department of Ecology Toxics Cleanup Program, Lacey, Washington: Prepared by Science Applications International Corporation (SAIC), March 31, 2008.

URS, 2003, Draft Engineering Evaluation/Cost Analysis and Cleanup Action Plan, January 10.

URS Greiner, 1997, City of Anacortes and Anacortes Joint Venture, Fidalgo Bay Shipyards Marine Habitat and Resources Survey: Prepared for the City of Anacortes, February 18.

USFWS (U.S. Fish and Wildlife Service), 2007, Listed and Proposed Endangered and Threatened Species and Critical Habitat; Candidate Species, and Species of Concern in Skagit County, Washington, Olympia, WA: US Fish and Wildlife Service, Washington Fish and Wildlife Office; http://www.fws.gov/westwafwo/speciesmap/SKAGIT.html (accessed October 19, 2009).

Van den Berg, M. et al., 2006, The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds, ToxSci advance access copy published 87, July 2006.

Van den Berg, M., Birnbaum, L.S., Denison, M., De Vito, M., Farland, W., Feeley, M., Fiedler, H., Hakansson, H., Hanberg, A., Haws, L., Rose, M., Safe, S., Schrenk, D., Tohyama, C., Tritscher, A., Toumisto, J., Tysklind, M., Walker, N., and Peterson, R.E., 2006, The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds: Toxicological Sciences, v. 93(2), p. 223-241.

WDFW (Washington Department of Fish and Wildlife), December 2003a, Polygons in Puget Sound showing locations of documented surf smelt (*Hypomesus pretiosus*) spawning beaches, Washington Department of Fish and Wildlife, Olympia and Mill Creek, Washington.

WDFW, December 2003b, Herring Spawning Areas in Washington: Washington Department of Fish and Wildlife, Olympia and Mill Creek, Washington.

Woodward Clyde, 1998a, 3205 “V” Place Property Remedial Options Evaluation and Cleanup Action Plan, March 4.

Woodward-Clyde, 1998b, Former Custom Plywood Site, Site Investigation and Remedial Options Evaluation: Prepared for Brent Homes, February 9.

Woodward-Clyde, 1998c, Soil Remediation Report for 3205 “V” Place, Anacortes, Washington: Prepared for City of Anacortes, November 4.

Woodward-Clyde, 1997a, Phase I and Limited Phase II Environmental Site Assessment, City of Anacortes, for City of Anacortes, 3205 “V” Place (Lot 3): Prepared for City of Anacortes, March 5.

Woodward-Clyde, 1997b, Analytical Results of Additional Soil Sampling—3205 “V” Place, Lot 3, Prepared for the City of Anacortes, April 24.

Woodward-Clyde, 1997c, Custom Plywood Soil Sampling: Letter Report, Prepared for City of Anacortes, June 27.

Woodward-Clyde, 1997d, Limited Phase II Site Assessment, 3205 “V” Place, Lot 3: Letter Report, September 22.

Yake, Bill, D. Rogowski, L. Goldstein, and G. Pelletier, 2000, Dioxins in Washington State Soils, Ecology Publication No. 00-03-045, Originally appeared in Dioxin 2000: 20th International Symposium on Halogenated Environmental Organic Pollutants and POPS, August 13–17, 2000, Monterey, California, Vol. 46, pp. 342–345.