Remedial Investigation/Feasibility Study Report
Weldcraft Steel and Marine (Gate 2 Boatyard)
Bellingham, Washington

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Prepared for

Port of Bellingham
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LIST OF ABBREVIATIONS AND ACRONYMS

ARARs	applicable or relevant and appropriate requirements
BEHP	bis(2-ethylhexyl)phthalate
BGS	below ground surface
BMPs	best management practices
BOD	biological oxygen demand
BSL	bioaccumulative screening level
BSAF	biota-sediment accumulation factor
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Cleanup Action Plan
cm	centimeters
COCs	constituents of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbons
CSL	cleanup screening level
CSM	conceptual site model
CTED	Department of Community, Trade, and Economic Development
CY	cubic yards
DCA	disproportionate cost analysis
DEIS	draft environmental impact statement
DMMP	Dredged Material Management Program
DO	dissolved oxygen
ESA	Environmental Site Assessment
ft	feet
FEIS	final environmental impact statement
GAC	granular activated carbon
HBU	highest beneficial use
HPAH	heavy polycyclic aromatic hydrocarbon
LNAPL	light non-aqueous phase liquid
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
MLLW	mean lower low water
MNA	monitored natural attenuation
MTCA	Model Toxics Control Act
NAPL	non-aqueous phase liquid
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWTPH-Dx	northwest diesel-range total petroleum hydrocarbons extended
NWTPH-G	northwest gasoline-range total petroleum hydrocarbons
ORP	oxygen reduction potential
PAH	polycyclic aromatic hydrocarbon
PBT	potentially bioaccumulative toxin
PCB	polychlorinated biphenyl
PCL	preliminary cleanup level
PID	photoionization detector
Port	Port of Bellingham
PSDDA	Puget Sound Dredged Disposal Analysis
PQL	practical quantitation limit
RAOs	remedial action objectives

RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
SAP	Sampling and Analysis Plan
SCO	sediment cleanup objective
SCUM	Sediment Cleanup Users Manual
SHA	Site Hazard Assessment
SEPA	State Environmental Policy Act
Site	Weldcraft Steel and Marine Site
SMA	Shoreline Management Act
SMS	sediment management standard
SQS	sediment quality standard
SVOCs	semivolatile organic compounds
TBT	tributyltin
TCE	trichloroethene
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TPH-D	diesel-range total petroleum hydrocarbons
TPH-G	gasoline-range total petroleum hydrocarbons
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Services
UST	underground storage tank
VOCs	volatile organic compounds
WARM	Washington Ranking Method

1.0 INTRODUCTION

This document presents the results of the remedial investigation and feasibility study (RI/FS) for the Weldcraft Steel and Marine Site (Site), which was conducted in accordance with Agreed Order Number DE 03TCPBE-5623 (Agreed Order) between the Washington State Department of Ecology (Ecology) and the Port of Bellingham (Port). As the owner of the Site, the Port has conducted a number of investigations to characterize environmental conditions for soil, groundwater, surface water, and marine sediment. These investigations have confirmed that contamination conditions are present in Site media, which has been reported to Ecology, as required under the Washington State Model Toxics Control Act (MTCA), Washington Administrative Code (WAC) 173-340.

The Agreed Order also included an interim action to remediate Site contaminated marine sediment. The interim action was performed in conjunction with infrastructure improvements and marine habitat enhancements. The interim action removed almost 7,000 cubic yards (CYs) of contaminated marine sediment and an extensive amount of creosote-treated timbers from the marine environment, and concurrently created a habitat bench providing over 2 acres of shallow intertidal habitat adjacent to the outer slope of the Squalicum Outer Harbor breakwater. The interim action is discussed further in subsequent sections of this document.

The RI describes the environmental setting for the Site, and identifies the nature and extent of contamination for affected media. The FS develops and evaluates alternatives for cleanup of Site contamination, and presents a preferred cleanup alternative.

1.1 SITE DESCRIPTION AND BACKGROUND

The Site is located in the northern corner of Squalicum Outer Harbor, as shown on Figure 1. The preliminary Site boundary is defined as the limits of the Weldcraft historical operations area for the purposes of RI characterization, and is refined in the FS based on the results of the RI. Site features pre-dating the 2003 interim action and Site improvements are shown on Figure 2 and current Site features are shown on Figure 3. As shown on Figure 2, the limits of the Weldcraft historical operations area are approximately bounded by Roeder Avenue to the east, Squalicum Way to the north, Squalicum Harbor to the west, and a parking lot to the south.

The Site consists of several buildings, open storage areas, parking lots, and until 2003, a marine railway. North of Building 1 is the location of a former gasoline underground storage tank (UST) and a former dispenser island pad that was used to dispense gasoline. An underground tank that was apparently used as a septic holding tank was formerly located between the dispenser pad and the gasoline UST. The gasoline UST was removed from the Site by the previous tenant in 1993 and the septic holding tank was removed by the Port in 2001. Two active catch basins are located on the Site, labeled Catch Basin Nos. 1 and 2. These catch basins currently have concrete-closed bottoms, although Catch Basin No. 2 had an open soil bottom until it was replaced by a closed bottom, Type II catch basin in the fall of 2002. There is an inactive slot-drain type catch basin, Catch Basin No. 3, which is not currently active located to the south of Building 3. There are two former and four active outfalls on the Site that discharge to Squalicum Harbor.

It should be noted that Figure 2 represents features present during the Site's historical operations. Existing Site features vary somewhat from those shown on Figure 2 as a result of both the marine sediment interim action and associated Site redevelopment in 2003 and 2004. Current Site features, including property ownership information, are shown on Figure 3.

1.2 OBJECTIVES OF THE RI/FS

The objective of the RI/FS is to collect, develop, and evaluate sufficient information regarding the Site to enable the selection of a cleanup action. Specifically, the RI/FS:

- Characterizes the nature and extent of contamination for affected media (i.e., soil, groundwater, surface water, and marine sediment)
- Identifies preliminary cleanup levels (PCLs) for affected media
- Develops and evaluates cleanup action alternatives that protect human health and the environment
- Presents a preferred cleanup action alternative.

This document presents the information collected and the evaluations performed to achieve this purpose.

1.3 REPORT ORGANIZATION

This RI/FS report is organized as follows:

- Section 2.0 presents project background, including a summary of Site history, and a description of environmental investigations conducted prior to signing of the Agreed Order.
- Section 3.0 describes the activities conducted following the signing of the Agreed Order, including RI soil, groundwater, surface water, and marine sediment investigations and the sediment interim cleanup action.
- Section 4.0 describes the environmental setting for the Site, including its physical features, geology, hydrogeology, natural resources, and land use.
- Section 5.0 develops Site screening levels for affected media, which are used in Section 6.0 to characterize the nature and extent of contamination.
- Section 7.0 discusses Site contaminant fate and transport, including contaminant sources and the fate and transport processes for identified exposure processes.

- Section 8.0 presents the conceptual Site model, including contaminants and sources, and fate and transport processes.
- Section 9.0 presents the development of cleanup standards for the Site, identifies remedial action objectives (RAOs), and identifies potentially applicable laws.
- Section 10.0 identifies Site cleanup units; specific areas of the Site to be addressed in cleanup activities.
- Section 11.0 presents the screening of the remedial technologies.
- Section 12.0 describes the remedial alternatives.
- Section 13.0 evaluates the remedial alternatives, including a description of the evaluation criteria, the evaluation of the alternatives against the evaluation criteria, and the presentation of the disproportionate cost analysis.
- Section 14.0 presents the summary and conclusions, including a description of the preferred alternative.

2.0 PROJECT BACKGROUND

The Port entered into the Agreed Order with Ecology to complete a Final RI /FS for the entire Site in 2003. Prior to entering into the Agreed Order, the Port had conducted a number of environmental investigations. Based on this earlier work, the Agreed Order scope of work allowed for implementation of an interim action to address contaminated marine sediment followed by performance of an RI/FS of the entire Site, both of which are presented in this document. This section summarizes the Site history, environmental investigations, and independent actions conducted prior to signing of the Agreed Order. RI activities and the sediment interim action are summarized in Section 3.0, and the results of the RI, integrated with the results of previous investigations, are presented in Section 6.0 (Nature and Extent of Contamination).

2.1 SITE HISTORY

Historical fire insurance maps from 1904 and 1913 show the Site area was originally undeveloped tidelands of Bellingham Bay. The Port has owned the property since 1927. In the 1920s, the area was filled with material dredged during construction of the Squalicum Waterway and from other upland sources of fill. By the 1940s and 1950s, various large businesses began operation in the fill areas along the waterway (Landau Associates 1993).

Weldcraft Steel and Marine was established on the Site in 1946 and was initially involved in general boat repair activities. The company was known as Weldcraft Steel Works until 1961, Weldcraft Steel and Tank from 1961 to 1972, and Weldcraft Steel and Marine from 1972 forward. Weldcraft Steel and Marine primarily operated as a boatyard that conducted various activities, including boat construction, repair, and maintenance; wood and metal fabrication; marine pipefitting; electrical; sheet metal work; painting; machinery construction, installation, and repair; vessel haul-out and launching; lofting and pattern-making; canvas and plastic work; storage, brokerage, retail, and wholesale sales; and concrete work.

The Site was identified as one of several cleanup sites in the Bellingham Bay Comprehensive Strategy final environmental impact statement (FEIS; Anchor Environmental 2000) developed under the Bay-wide Demonstration Pilot. Ecology placed the Site on its Confirmed and Suspected Contaminated Sites List in 2001, and gave the Site a “1” ranking under the Washington Ranking Method (WARM) following completion of a Site Hazard Assessment (SHA) in 2002. WARM categorizes contaminated sites between 1 and 5, with 1 representing the highest priority for cleanup.

The Port's lease with Weldcraft Steel and Marine was terminated in February 2000 and the Port obtained full operational control of the Site in July 2000. The Port entered into an Agreed Order with Ecology in July 2003.

Since April 2004, the Site has been leased to and occupied by Seaview Marine, operating as Seaview Boatyard North, a company that performs general boat repair activities. A number of improvements to Site infrastructure and an interim action that primarily addressed marine sediment contamination conditions were implemented in 2003 and 2004. The Site improvements that were made in conjunction with and concurrent to the marine sediment interim action to support the operations of Seaview Boatyard North included:

- Removal of the marine railway system
- Installation of a new steel sheet pile bulkhead to enclose the former marine railway ramp and to facilitate removal of contaminated marine sediment (existing bulkhead left in place)
- Backfilling and paving of the upland portion of the former marine railway ramp to adjacent grades
- Repair of the existing timber bulkhead along the north shoreline
- Repair/replacement of damaged timber piles associated with the existing wharf and north timber bulkhead and the north travel lift float
- Marine sediment dredging to attain adequate drafts of -12 feet (ft) Mean Lower Low Water (MLLW) for vessels in the vicinity of the new 150-ton travel lift
- Repair/replacement of selected structural elements of the existing wharf
- Construction and installation of a new 150-ton travel lift pier to replace the marine railway.

A marine habitat bench was created in conjunction with the activities described above to mitigate for the impacts of the Site improvements on aquatic habitat and to provide additional marine habitat enhancement beyond that required for mitigation. The habitat bench is discussed further in Section 3.4.1. Current Site features are shown on Figure 3.

2.2 PRE-AGREED ORDER ENVIRONMENTAL ACTIVITIES

Assessment of a site is often implemented in multiple investigative phases, with each phase building on the understanding developed from the previous site investigations. A number of upland and marine sediment investigative efforts have been completed at the Site, starting with the Phase I Environmental Site Assessment (ESA) in 1993 (Landau Associates 1993) and progressing through upland remedial investigation activities initiated in 2003. In addition to environmental investigation activities, the Port conducted waste removal and decommissioning activities to prevent potential releases from hazardous materials left by its former tenant. Waste removal and decommissioning activities are discussed further in Section 2.2.2.

Prior to entering into the Agreed Order, the Port conducted Site investigation activities as independent actions under MTCA, including development of the Upland RI Work Plan (Landau Associates 2002). Ecology comments were considered prior to work plan implementation. Work conducted under the Upland RI Work Plan is presented as "remedial assessment" work in this report because the activities were conducted prior to the Agreed Order. Only environmental investigation activities conducted subsequent to signing of the Agreed Order are considered RI activities for the purposes of this report.

2.2.1 PREVIOUS INVESTIGATIONS

This section provides a description of Site environmental investigation activities conducted prior to signing the Agreed Order. The description of relevant previous Site investigation activities are integrated in this section by the nature of the investigation activity or the media of concern (e.g., soil, groundwater, or marine sediment investigations) to provide the reader a comprehensive understanding of the scope of investigation activities that were implemented prior to conducting the RI.

The results of the previous investigations are presented with the RI data in Section 6.0. However, a brief description of the conclusions for each investigation phase that preceded the RI (e.g., Phase II ESA and Phase III ESA) is presented in this section to provide the reader an understanding of the basis for the subsequent RI activities.

A number of environmental investigations were conducted at the Site that provided data used in this RI. Prior to implementation of the RI, investigations at the Site included:

- Phase I ESA (Landau Associates 1993)
- Phase II ESA (Landau Associates 1998)
- Phase III ESA (Landau Associates 2001c)
- Supplemental Marine Sediment Investigation (Landau Associates 2001d)
- Upland remedial assessment in 2002 (results not previously reported).

A total of 37 soil borings, 8 soil grab samples, 9 monitoring wells, and 1 hand auger were completed during these pre-RI investigations. Groundwater samples were collected from seven of the borings, in addition to samples collected from the nine monitoring wells. Also, a total of 15 surface marine sediment samples and 7 sediment cores, including 10 discrete samples, were collected during these pre-RI investigations. Boring logs and well construction details are presented in Appendix A.

Site drainage was evaluated based on visual observations of drainage features, catch basins, and outfalls made during the Phase I ESA, and the remedial assessment. The evaluations were focused on general Site drainage characteristics, and on evaluating stormwater controls at the Site related to the management of stormwater.

Table 1 summarizes the scope of explorations associated with pre-Agreed Order investigation activities and post-Agreed Order activities. A summary of the upland and marine sediment sampling activities and the associated sample analyses are presented in Table 2. Upland sampling locations, including those related to pre-Agreed Order activities, are shown on Figure 4. Pre-interim action and Agreed Order marine sediment sampling locations are shown on Figure 5.

The results of these investigations are summarized below. Where referenced in this section, screening levels refer to the criteria developed in Section 5.0 for affected media, as presented on Tables 6 and 7. The individual investigation reports for the Phase I, II, and III ESAs provide more complete information on the activities associated with these investigations.

2.2.1.1 Phase I ESA

The 1993 Phase I ESA identified various areas of potential environmental concern, primarily related to poor housekeeping practices during Site operations. Specific items of concern that were identified in 1993 included:

- Potential impacts to soil and groundwater from one or more USTs. One former gasoline UST had been removed from the north side of Building 1, but there were no records documenting the removal procedures or whether the tank had leaked. A second UST was suspected to be present on the north side of Building 1 based on the presence of a vent pipe. There was no information regarding the type of UST, if present, or whether the tank had ever leaked. The suspected second UST was subsequently determined to be a former septic holding tank during its removal (see Section 2.2.2).
- Extensive oil staining in the outside paved storage areas and unpaved yard that may extend beyond the surface due to prolonged operations at the Site.
- Historical sandblasting activities in the yard and buildings and near the marine railway could be a source of heavy metal impact to soil, groundwater, and marine sediment.
- Potential impacts to marine sediment due to an outfall located in the bulkhead west of the Site buildings; the origin and use of the outfall was not determined.

2.2.1.2 Phase II ESA

The 1998 Phase II ESA evaluated conditions of potential concern identified in the Phase I ESA, including the location of a former gasoline UST, location of the former septic holding tank, the catch basins, oil stained areas, and boat maintenance work yards. Based on the results of the investigation, the findings include the following:

- The former gasoline UST had locally affected Site soil and groundwater with primarily gasoline-range petroleum hydrocarbons at concentrations greater than the screening levels. Groundwater did not exceed screening levels, except for gasoline-related constituents in the vicinity of the former gasoline UST.

- Localized areas of oil-range petroleum hydrocarbon contamination were identified at three locations, although revisions to the MTCA regulations implemented in 2001 resulted in the concentrations being below the screening levels in all but one location (SB-8).
- Lead concentrations above the soil screening level was identified in shallow soil in the northeast work yard to the east of Building 1 at one location (SB-20).
- Marine sediment containing concentrations of a number of metals and organic constituents above the screening levels was encountered in surface sediment collected from the marine railway well area.

2.2.1.3 Phase III ESA

- The 2001 Phase III ESA further evaluated soil and groundwater quality conditions in the vicinity of the oil-range petroleum hydrocarbon soil contamination and gasoline-range petroleum hydrocarbon contamination identified during the Phase II ESA. No constituents were detected above the screening levels in soil samples collected during the Phase III ESA. No constituents exceeded the groundwater cleanup levels for gasoline-related constituents in the samples collected from wells located upgradient and downgradient of the former UST source area, although no groundwater samples were collected from the source area.

2.2.1.4 Supplemental Marine Sediment Investigations

Landau Associates conducted a supplemental marine sediment investigation in 2000 and a marine sediment remedial assessment in 2001. These investigations identified marine sediment contamination extending to a depth of 4 ft in the vicinity of the marine railway. Tributyltin (TBT) and mercury were the ubiquitous contaminants identified in Site marine sediment. TBT concentrations tended to decrease with depth, indicating it was a more recent contaminant. Mercury contamination tended to increase with depth, indicating that mercury was a historical contaminant. Other marine sediment screening level exceedances at the Site prior to implementation of the marine sediment interim action consisted of:

- Fluoranthene: Marine surface sediment organic carbon normalized concentration at SD-TL of 268 milligrams per kilogram (mg/kg), compared to the fluoranthene Sediment Management Standards (SMS; Chapter 173-204 WAC) sediment quality standard (SQS) of 160 mg/kg.
- Bis(2-ethylhexyl)phthalate (BEHP): Marine surface sediment organic carbon normalized concentrations of 63 mg/kg at RIFS-02 and 85 mg/kg at SD-MW, compared to the BEHP SQS of 47 mg/kg.
- Copper: Marine surface sediment concentration at RIFS-02 of 827 mg/kg, compared to the copper SQS of 390 mg/kg.

As discussed in the Interim Action Work Plan (Landau Associates 2003), Appendix C to the Agreed Order:

- The marine railway near its upland terminus appeared to be the primary source of marine sediment contamination from historical Site operations.
- To a lesser extent, the travel lift vicinity may have also contributed to marine sediment contamination in the past.

- Available data do not suggest that the outfalls were a significant source of Site marine sediment contamination.

2.2.1.5 Upland Remedial Assessment

The upland remedial assessment was conducted in 2002 to fill data gaps remaining from the previous Site investigations. The remedial assessment focused on further characterization of soil and groundwater conditions near the former gasoline UST and in the vicinity of Catch Basin No. 2, and the potential for impacts to Bellingham Bay. The results confirmed the presence of gasoline-range petroleum hydrocarbons exceeding the screening levels in the immediate vicinity of the former UST, and indicated that natural attenuation appeared to be occurring downgradient of the gasoline source area. The investigation also demonstrated that downgradient groundwater was not affected by diesel-range petroleum hydrocarbon contamination that had been detected in Catch Basin No. 2 sediment.

2.2.2 WASTE REMOVAL AND DECOMMISSIONING

As an independent action, the Port performed waste removal and decommissioning activities at the Site in preparation for use by its new tenant, Seaview Boatyard North in January 2001. The Port cleaned out the three catch basins and removed a septic holding tank from the northwest side of Building 1. During its removal, the underground tank was determined to most likely be a septic holding tank based on the fact that the exit line was vitrified clay pipe that drained toward Squalicum Way. The materials of construction (i.e., vitrified clay), and the direction of discharge indicated that the tank was most likely used to hold septage that was then discharged to the sanitary sewer along Squalicum Way. The Port also removed the concrete dispenser island pad from the northwest side of Building 1, which was associated with the former gasoline UST, whose undocumented removal was conducted by the former tenant.

As part of that independent action, samples of soil from the septic holding tank excavation, beneath the open bottomed catch basin (Catch Basin No. 2), and beneath the removed dispenser island pad were collected and tested to further document and evaluate Site conditions. The locations of the former septic holding tank, dispenser island pad, and Catch Basin No. 2 are shown on Figure 2. The results of the waste removal and decommissioning activities are documented in a technical memorandum (Landau Associates 2001b), which includes a more complete description of the activities. The analytical results for the soil samples collected during the independent action indicated that:

- The soil sample collected from below the base of open-bottom Catch Basin No. 2 following removal of accumulated stormwater sediment and soil contained total petroleum hydrocarbons (TPH) in the diesel range at a concentration of 2,500 mg/kg, which exceeds the screening level of 2,000 mg/kg.

- The soil sample collected from the septic holding tank excavation bottom contained TPH in the gasoline range at a concentration of 470 mg/kg, which exceeds the screening level of 30 mg/kg [based on the presence of benzene (see Section 5.0)]. [There is no evidence that gasoline was stored in or discharged to the septic holding tank. The former gasoline UST, associated fuel lines, and/or dispenser island are the probable source(s) of the gasoline TPH levels detected at this location.]
- The soil sample collected from beneath the former dispenser island pad indicated the presence of gasoline-range TPH at a concentration above the screening level.

The analytical results for these interim action activities are presented in Section 6.0.

3.0 AGREED ORDER FIELD ACTIVITIES

This section describes activities conducted under the Agreed Order, including RI activities and the marine sediment interim action. RI field methods are described in Appendix B. The description of relevant Site characterization activities are integrated in this section by media of concern (i.e., soil, groundwater, marine sediment, and surface water) to provide the reader a comprehensive understanding of the scope of activities that were conducted under the Agreed Order. Upland RI data are presented in conjunction with upland pre-RI data in Sections 4.0 (Environmental Setting) and 6.0 (Nature and Extent of Contamination) to provide an integrated evaluation of upland data relevant to the nature and extent of Site contamination. Pre-Agreed Order and interim action performance and confirmational monitoring marine sediment quality data are discussed in this Section and in Section 6.0 to provide the reader an understanding of sediment quality conditions prior to and following implementing the marine sediment interim action.

3.1 SOIL INVESTIGATION

In spring 2006, 21 soil borings (SB-34 through SB-43, SB-53, SB-54, SB-55, SB-57, SB-59, SB-61 through SB-65, and SB-67) were installed to better delineate the extent of soil contamination associated with the former gasoline UST. The explorations were advanced using direct-push drilling methods, in accordance with the Supplemental RI Work Plan (Landau Associates 2006a). The soil borings were installed in and around Buildings 1 and 2, as shown on Figure 4. Soil samples were screened with a photoionization detector (PID) and the sample with the highest PID reading from each boring was tested for gasoline-range petroleum hydrocarbons using Method NWTPH-G. Selected samples were also analyzed for benzene, toluene, ethylbenzene, and xylene (BTEX).

In spring 2006, eight soil borings (SB-44 through SB-51) were also advanced in the vicinity of the former Northeast Work Yard sandblast area located east of Building 1, as shown on Figure 4. The soil borings were drilled using a combination of direct-push drilling methods and hand-auger techniques due to access limitations. Soil samples were collected from three discrete intervals [0 to 1 ft below the ground surface (BGS), 1 to 2 ft BGS, and 2 to 3 ft BGS]. Soil samples from each 0- to 1-ft interval were analyzed for arsenic, copper, lead, mercury, nickel, and zinc. Soil samples from deeper intervals were analyzed for those constituents that exceeded the screening levels in the overlying interval.

In fall 2007, two soil borings (SB-68 and SB-69) were advanced in the vicinity of Catch Basin Nos. 1 and 3, respectively. Soil samples were collected immediately below the bottom depth of each catch basin. Soil samples were analyzed for NWTPH-G and total metals (copper, lead, mercury, nickel, and zinc). Soil boring logs are presented in Appendix B.

3.2 GROUNDWATER INVESTIGATION

RI groundwater investigation activities included construction of additional monitoring wells and groundwater monitoring at both the new wells and existing wells (Figure 4). Groundwater samples were also collected from soil borings and a weep hole present in the bulkhead located between the 150-ton travel lift piers.

Weep holes are installed in sheet pile bulkheads to allow groundwater to discharge through the wall and prevent the buildup of hydrostatic pressure. Weep holes are spaced about every 10 ft along the wall at an elevation of about 6 ft MLLW. Although there are a number of weep holes in the galvanized steel bulkhead, the weep hole located just south of the northern 150-ton travel lift pier is the only one that exhibits sufficient discharge of groundwater for sampling. The weep hole discharges groundwater at a high rate, likely because it is in direct hydraulic connection with coarse sand and gravel backfill placed between the old and new bulkheads and in the former marine railway well located immediately upgradient of the weep hole. The flows from the weep hole are sufficient to cause a large stream of water from weep hole to project a significant distance into the marina, and as a result, a steel drop tube was installed at the weep hole to direct groundwater discharge downward to avoid discharging groundwater on boats using the travel lift. The two other weep holes between the 150-ton travel lift piers also exhibit minor seepage, but insufficient flow for groundwater sampling.

Groundwater monitoring of wells installed prior to the RI was conducted during summer 2004 to determine whether groundwater quality conditions had changed since the previous round of sampling in 2002, and to collect supplemental data on groundwater metals concentrations near the downgradient, western end, of the Site. Monitoring wells MW-3, MW-4, MW-7, and MW-8 were sampled and tested for NWTPH-G and BTEX to evaluate conditions downgradient of the former gasoline UST. Monitoring wells MW-1, MW-3, MW-4, and MW-7 were sampled and tested for selected dissolved metals (arsenic, copper, lead, mercury, nickel, and zinc) based on previously detected elevated concentrations for these metals in shallow soil. Additionally, monitoring well MW-9, located downgradient of Catch Basin No. 2, was sampled and tested for diesel- and oil-range organics using Method NWTPH-Dx.

Three additional groundwater monitoring wells, MW-10, MW-11, and MW-12, were installed in spring 2006 adjacent to the shoreline to characterize groundwater metals concentrations as close as practicable to the point of groundwater discharge to surface water. Drilling and construction of the monitoring wells were conducted in accordance with the Supplemental RI Work Plan (Landau Associates 2006a). Boring and well construction logs for the monitoring wells constructed during the RI are presented in Appendix B.

Monitoring well water levels were gauged and groundwater samples collected from selected wells in June and December 2006 to provide additional data for evaluating groundwater quality, flow direction, and gradient. The samples were analyzed for dissolved metals (copper, lead, mercury, nickel, and zinc). Two groundwater samples were collected from each of the selected wells during the December sampling round to evaluate the extent to which groundwater quality was affected by high and low tidal stages; these samples were analyzed for dissolved metals (copper, nickel, and zinc) and geochemical parameters.

Additional groundwater quality samples were collected in October 2007 from soil borings SB-68 and SB-69, located immediately downgradient of Catch Basins Nos. 1 and 3, respectively, for analysis of volatile organic compounds (VOCs), NWTPH-G, and dissolved metals (copper, lead, mercury, nickel, and zinc) to evaluate whether leakage from the catch basins may have impacted groundwater quality. Also in October 2007, a groundwater sample was collected from well MW-9 and analyzed for VOCs, NWTPH-G, and NWTPH-Dx to confirm earlier groundwater monitoring that indicated groundwater was not affected by releases from Catch Basin No. 2.

In February and November 2007, groundwater samples were collected from the bulkhead weep hole present immediately south of the northern 150-ton travel lift pier to evaluate groundwater quality at its point-of-discharge to surface water. Other weep holes were evaluated for potential sampling, but insufficient discharge was occurring for sample collection. The weep hole groundwater samples were analyzed for NWTPH-G, BTEX, VOCs, dissolved metals (copper, nickel, and zinc), and conventional parameters.

3.3 SURFACE WATER INVESTIGATION

Surface water samples were collected from a nearby dock extending into Bellingham Bay in December 2006 and February 2007 to evaluate background surface water quality conditions in the Site's vicinity. The surface water samples were analyzed for dissolved metals (copper, nickel, and zinc) and conventional parameters.

3.4 MARINE SEDIMENT INTERIM ACTION AND COMPLIANCE MONITORING

This section summarizes the marine sediment interim action conducted at the Site between September 2003 and March 2004 to fulfill one of the Agreed Order requirements. The interim action was conducted to address the marine sediment contamination identified during the 2000 and 2001 marine sediment remedial assessment described in Section 2.2.1.4. A more detailed description of the interim action is provided in the Interim Action Completion Report (Landau Associates 2006b), which is provided on a compact disk in Appendix C of this RI/FS report. Compliance monitoring activities associated with the interim action are also described in this Section.

3.4.1 INTERIM ACTION

As discussed in Section 2.2.1.4, marine sediment contamination associated with historical boatyard activities existed in the vicinity of the former marine railway and the existing 30-ton travel lift, and consisted primarily of TBT and mercury contamination with less extensive, co-located, marine sediment contamination consisting of other metals and organic constituents. The nature and extent of pre-interim action marine sediment contamination is presented on Figures 6 and 7 as exceedance ratios relative to the sediment screening criteria used at the time of the interim action, which consist of the SQS and the Cleanup Screening Level (CSL). An exceedance ratio is the ratio of the measured concentration to the applicable criterion and provides a representation of the degree to which a concentration exceeds the criteria (i.e., an exceedance ratio of two indicates that the concentration is two times the criterion). The pre-interim action marine sediment quality data and the SQS and CSL criteria are presented in tabular format in Appendix D.

The marine sediment interim action consisted of dredging about 6,800 CYs of contaminated marine sediment and, in areas dredged to below elevation -13 ft MLLW, backfilling with clean, imported gravelly sand. Marine sediment dredging was conducted in conjunction with removal of the marine railway, construction of a new bulkhead, and other Site improvements. The extent of the marine sediment dredging is shown on Figure 8.

A marine habitat bench was constructed concurrent with the sediment interim action. The habitat bench was constructed to mitigate for impacts associated with Site redevelopment, and as such, is not related to Site environmental conditions or Agreed Order activities. The performance of the habitat bench is being tracked by the U.S. Army Corps of Engineers (USACE) and state and federal resource services under the conditions associated with the permits issued for in-water construction. As a result, the construction and performance of the habitat bench is not addressed in this document.

3.4.2 DEVELOPMENT OF SEDIMENT CLEANUP LEVELS

Sediment cleanup levels were developed for the interim action based on potential exposure pathways and receptors of contaminants in sediment. The potential exposure pathways and receptors include the following:

- **Marine sediment uptake by benthic organisms.** There is a potential pathway for benthic organisms to uptake contaminated marine sediment.
- **Ingestion of benthic organisms (Food Chain) – potential pathway.** There is a potential for humans to be exposed to Site contaminants through ingestion of benthic organism and/or fish that have been exposed to Site contaminants that are bioaccumulative. The commercial use of the Site marine area and limited public access largely prevents the direct harvesting of benthic or epibenthic organisms from the Site. However, the Site is likely frequented by forage fish and migratory salmon that may consume benthic organisms present at the Site,

potentially resulting in direct impacts to the fish and food chain affects to higher order aquatic species and humans that consume the affected fish.

Incidental contact by humans with contaminated marine sediment was not considered a potential pathway due to the inaccessibility of the sediment to humans at this Site. To address the potential exposure pathway to benthic organisms, marine sediment cleanup levels were developed using the SMS cleanup standards for each constituent of concern (except TBT which does not have promulgated SMS values). The SMS rule was recently updated and went into effect on September 1, 2013. The SMS cleanup standards are protective of the benthic organisms and range from the SQS [the level below which is expected to cause no adverse effects to biological resources nor pose a significant health threat to humans; now referred to as the Sediment Cleanup Objective (SCO)] to the CSL (the level expected to cause only minor adverse effects to biological resources).

Based on WAC 173-333, the only potentially bioaccumulative toxins (PBTs) in marine sediment are mercury and certain polycyclic aromatic hydrocarbons (PAHs). Although no site-specific mercury cleanup level was developed to address the potential exposure pathway through the food chain, a bioaccumulative screening level (BSL) for mercury has been developed for the Whatcom Waterway Site (Whatcom County Superior Court 2007). This BSL (1.2 mg/kg) is greater than the SMS numeric benthic criterion.

Some PAHs in the heavy PAH (HPAH) range are also considered PBTs, which can affect humans and other higher trophic-level species. The new SMS rule requires the development of screening levels that consider bioaccumulative effects if PBT compounds are present at concentrations greater than the natural background concentrations. Guidance for addressing PBTs in marine sediment is provided in the draft Sediment Cleanup Users Manual (SCUM) II (Ecology 2013).

Under the draft of SCUM II, the SCO for PBTs is the highest of the following:

- Natural background concentrations
- Practical quantitation limit (PQL)
- Risk-based concentration.

The CSL is based on the highest of the:

- Regional background concentration
- PQL
- Risk-based concentration.

The revised draft SCUM II guidance presents calculated Puget Sound natural background values for PBTs, however Ecology has not yet calculated regional background concentrations for Bellingham Bay. The PQLs are established for analytes based on laboratory reporting limits. Risk-based concentrations have not been developed as it was assumed that these would be lower than the PQL and background levels.

PAHs are ubiquitous in the marine environment and are typically elevated above natural background in marinas and other working waterfront areas due to the presence of creosoted pilings, bulkheads, and other marine structures. Site PAH concentrations, specifically carcinogenic polycyclic aromatic hydrocarbons (cPAH) TEQ values, range between14.6 µg/kg and 78.5 µg/kg, as presented in Table 10. Values for cPAH TEQs detected elsewhere in Squalicum Harbor ranged between 18.2 µg/kg and 126.5 µg/kg in samples collected during a 2007 sediment quality investigation for the Port's Gate 3 project, as presented in Table 11. Since Site cPAHs are less than or equal to values found within the Squalicum Harbor area, the cPAHs present in Site marine sediment do not appear to be related to Site releases.

Ecology has not yet calculated a regional background concentration for cPAHs, but cPAH concentrations within Squalicum Harbor, including the Site, may be consistent with regional background concentrations. Because the cPAHs do not appear to be related to Site releases and Ecology has not yet calculated regional background, no screening level is established for the Site at this time. Ecology will revisit this as part of developing the cleanup action plan for the Site, at which time the source of cPAHs in Site marine sediment may be further evaluated and regional background concentrations may be available.

Although no promulgated SMS values are available for TBT, the Dredged Material Management Program (DMMP) evaluation criteria for open water disposal identifies a no effects TBT marine sediment porewater criteria of 0.05 micrograms per liter (µg/L) and a potential adverse affects marine sediment porewater criteria of 0.15 µg/L for open water disposal of dredged material. These Puget Sound Dredge Disposal Analysis (PSDDA) criteria provide a reasonable basis for assessing the potential effects of TBT on marine biota. For the purposes of this RI, a TBT porewater concentration of 0.05 µg/L is considered analogous to the SQS and a TBT porewater concentration of 0.15 µg/L is considered analogous to the CSL.

Because significantly more bulk TBT data are available than porewater TBT data, a correlation between bulk and porewater TBT concentrations was developed to allow a more comprehensive evaluation of the extent of TBT contamination based on bulk TBT data. A linear regression analysis was performed for co-located porewater and bulk TBT data. A strong correlation with an R^2 of 0.96 was obtained for the six available data points, as shown on Figure 9. Based on this linear regression, the preliminary Site-specific bulk TBT SQS and CSL criteria are 79 micrograms per kilogram (µg/kg) and 156 µg/kg, based on the PSDDA TBT porewater evaluation criteria of 0.05 and 0.15 µg/L, respectively. These values were developed with the review and concurrence of Ecology. Because the SQS was selected as the basis for the preliminary marine sediment cleanup levels, the TBT concentration of 79 µg/kg was identified as the marine sediment screening level for TBT.

The marine sediment cleanup levels are presented in Table 3.

3.4.3 COMPLIANCE MONITORING

Compliance monitoring for the interim action consisted of the following:

- Protection monitoring to confirm that human health and the environment are adequately protected during construction of the interim action
- Performance monitoring to confirm that the interim action attained the sediment screening levels within the predominantly biologically-active zone [the upper 12 centimeters (cm)] established for the project
- Confirmational monitoring to confirm the long-term effectiveness of the interim action once the cleanup standards and other performance standards have been attained.

This section summarizes the performance and confirmational monitoring and the development on the cleanup standards used in the monitoring program. Further details of the interim action compliance monitoring are provided in the Interim Action Completion Report (Appendix C; Landau Associates 2006b) and the 2009 Sediment Data Report (Appendix E; Landau Associates 2009a).

3.4.3.1 Performance Monitoring

Performance monitoring was first conducted in January 2004, immediately following the interim action dredging in the Marine Area. Twelve surface marine sediment samples (SPM-1 through SPM-12) were collected at the locations shown on Figure 10, to determine if the dredging associated with the interim action had removed sediment with chemical concentrations above the project sediment quality standards (i.e., the SQS and the CSL). The samples were tested for semivolatile organic compounds (SVOCs), metals (i.e., arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc), bulk organotins (including TBT), and total organic carbon (TOC). Two samples collected from the marine railway well area (SPM-7 and SPM-11) also underwent analysis for TPH using methods NWTPH-Gx and NWTPH-Dx. The analytical results are summarized in tabular format in Appendix F.

The analytical results from this round of performance monitoring indicated that surface marine sediment at each of the nine sampling locations within the marine dredge area still exceeded the SMS SQS or CSL numeric benthic criteria for mercury, zinc, TBT and/or individual PAHs, as shown on Figure 10. Only analytical results for two sediment samples collected outside the dredge prism, SPM-10 and SPM-11, did not exceed the SMS SQS and the CSL numeric benthic criteria. Based on these initial results, additional dredging was performed in front of the former marine railway well area, which included sample locations SPM-3 and SPM-5, in February 2004.

In July 2004, supplemental marine sediment performance monitoring was implemented to evaluate the vertical extent of the marine sediment cleanup level exceedances where additional dredging did not occur (i.e., at sample locations SPM-2, SPM-4, and SPM-6) and to evaluate whether the additional dredging conducted in front of the former marine railway well area at sample locations SPM-3 and SPM-5 achieved the sediment interim action cleanup levels. The marine sediment samples collected in July 2004 were labeled SPM-2A, SPM-3A, SPM-4A, SPM-5A, and SPM-6A and were located as shown on Figure 10. At locations SPM-3A and SPM-5A surface samples were collected. At locations SPM-2A, SPM-4A, and SPM-6A, core samples were collected. Subsamples were collected from each core from the following intervals (based on zero being the top of the post-dredging surface or the base of the backfill): 0 to 4 inches (0 to 10 cm), 12 to 16 inches (30 to 40 cm), and 24 to 28 inches (61 to 71 cm). Backfill material, if present, was not sampled. Note that the 2004 compliance monitoring activities were conducted based on the standard SMS definition of the upper 10 cm representing the predominantly biologically-active zone, prior to the upper 12 cm being established as the more applicable surface sediment sampling interval for Bellingham Bay (RETEC 2006).

The additional marine sediment samples were analyzed for mercury (all samples) and TBT (SPM-3A and SPM-5A). SVOCs and metals, other than mercury, were not tested because the number and level of exceedances for these parameters were low relative to the number and level of mercury and TBT exceedances. None of the sediment samples analyzed during the July 2004 performance monitoring event exhibited exceedances of the SQS or CSL numeric benthic criteria, except for mercury in SPM-4A (0 to 4 inches), which was detected at a concentration above the CSL. July 2004 mercury results are presented on Figure 10 and the July 2004 analytical results are presented in tabular format in Appendix F.

3.4.3.2 2009 Confirmational Sampling

Confirmational monitoring to determine the long-term effectiveness of the interim action was conducted in October 2009, approximately five years after completion of the interim action. Marine sediment samples were collected at nine locations within the Marine Area. Six samples were collected from the location of the interim action dredge prism. Five of these samples were co-located with the 2004 post-interim action performance monitoring locations that exhibited the highest concentrations of sediment constituents of concern (COCs) in the post-interim action sediment compliance monitoring. The remaining three samples were collected immediately outside the former dredge prism and were also co-located with previous confirmational sampling locations. Where applicable, the sample identifications included the post-interim action compliance monitoring sample identifications and the year 2009. The 2009 confirmation sampling locations are shown on Figure 11. Each sediment sample consisted of sediment collected from the upper 12 cm, which is considered the biologically-active zone for Bellingham Bay (RETEC 2006), as indicated above.

The sediment was retrieved at each sampling station using a 36-ft vessel with a pneumatic power grab sampler. In accordance with the Sampling and Analysis Plan (SAP) prepared for the 2009 confirmational sampling event (Landau Associates 2009b), samples for laboratory analysis were collected from the upper 12 cm using a stainless-steel spoon, homogenized in a stainless-steel bowl, and placed in the appropriate sample container. The sediment samples were analyzed for the COCs (i.e., mercury, zinc, acenaphthene, flourene, fluoranthene, phenanthrene, and dibenzofuran). TOC in each sediment sample was also measured.

For data validation purposes, a blind field duplicate sample was collected at station SPM-4-09 (duplicate sample identified as SPM-0-09). Matrix spike and matrix spike duplicate samples were also collected at station SPM-10-09. The blind field duplicate and the matrix spike and matrix spike duplicates were analyzed for all of the COCs. None of the concentrations exceeded the SQS or CSL numeric benthic criteria. Reporting limits for the non-detected constituents were also below the SQS and CSL numeric benthic criteria. The analytical results for the 2009 confirmational sampling are discussed further in Section 6.4; the 2009 Sediment Data Report (Landau Associates 2009a) is included in Appendix E.

4.0 ENVIRONMENTAL SETTING

This section describes the Site environmental setting. The results of previous investigations relevant to the Site environmental setting are integrated with RI data in this section to provide the reader a comprehensive understanding of Site conditions. The environmental setting includes physical conditions, geology, hydrogeology, natural resources, and land and navigational uses. Laboratory analytical results and associated evaluation of the nature and extent of contamination are presented in Section 6.0.

4.1 PHYSICAL CONDITIONS

Site physical conditions are relevant because they have the potential to affect the fate and transport of contaminants. Physical conditions discussed below include Site shoreline features, topography, bathymetry, surface cover, stormwater management, and utilities.

4.1.1 SHORELINE FEATURES

Historical shoreline features are shown on Figure 2 and current shoreline features are shown on Figure 3. As previously discussed in Section 2.1, shoreline features were significantly altered during Site redevelopment in 2003. Site improvements were installed concurrent with sediment interim action activities. The primary changes that occurred to shoreline features included removal of the marine railway and construction of a new galvanized steel bulkhead along the shoreline. Removal of the marine railway eliminated the primary source of Site marine sediment contamination. The new significantly modified groundwater flow by restricting groundwater discharge at the bulkhead and redirecting it to the northern bulkhead weep hole located between the 150-ton travel lift piers; minor groundwater seepage has also been observed from two other weep holes located between the 150-ton travel lift piers, but at flow rates too low to quantify or sample. Wetting has also been observed at some bulkhead sheet pile seams, but not visible flow. The bulkhead extends a significant distance into the underlying glacial marine drift aquitard, providing a vertical barrier to groundwater migration, with the primary point of groundwater discharge being the bulkhead weep hole located between the newly installed 150-ton travel lift piers, as shown on Figure 3.

4.1.2 TOPOGRAPHY AND BATHYMETRY

The upland portion of the Site is relatively flat with a surface elevation ranging between 14 ft to 15 ft MLLW. Because of the limited topographic relief, a Site topographic map was not prepared for this report.

The post-interim action bathymetry for the Site is shown on Figure 12. A depression exists within the dredge prism where contaminated marine sediment was removed. However, clean granular backfill was placed in the western portion of the dredge prism where post-dredge bottom elevations were below -13 ft MLLW. The area over which at least 0.5 ft of cleanup backfill was placed within the dredge prism is shown on Figure 12.

Squalicum Harbor was originally dredged in 1958 to elevation -13 ft MLLW, based on an authorized dredge depth of -12 ft MLLW and a 1 ft allowable over-dredge. Subsequent dredging has not been conducted in the harbor except for the 2003-2004 marine sediment interim action, which only addressed the Site. Based on a 2007 condition survey conducted by the Port for its Gate 3 project (Reid Middleton 2007), mud line elevations in the Site vicinity are generally -10 ft MLLW, with elevations as shallow as -8 ft MLLW in the vicinity of the north harbor entrance adjacent to Squalicum Channel. Based on the increase in mud line elevation from -13 ft MLLW in 1958 to -10 ft MLLW in 2007, there has been a 3 ft (91 cm) accumulation of sediment in the Site vicinity over the 49 years between 1958 and the 2007 bathymetric survey. This represents an average accumulation rate of about 1.9 cm/yr in the Site vicinity. Harbor-wide, sedimentation rates are anticipated to be similar to historical rates, except that sedimentation rates within the Site's marine sediment interim action dredging footprint will likely be greater until the depression resulting from dredging for the interim action is filled to the mud line elevation of the adjacent sediment surface.

4.1.3 SEA LEVEL RISE

Several studies have been conducted to predict sea level rise in the Pacific Northwest due to climate change (global warming). The results of these studies have been summarized in the Port's draft environmental impact statement (DEIS) for the Port's New Whatcom Redevelopment Project (Blumen 2008**)** which is located immediately south of the Site on Bellingham Bay. According to the DEIS, a January 2006 study issued by Ecology and the Department of Community, Trade, and Economic Development (CTED) estimates that sea level rise in the Puget Sound Basin may range between 6 and 50 inches, with a medium estimate of 13 inches by 2100. To analyze impacts of the New Whatcom Redevelopment Project on the environment, the DEIS is using a sea level rise of 2.4 ft by 2100. Forecasted sea level rise is not expected to impact this cleanup. The land surface elevation of the Site is approximately 14 to 15 ft MLLW and the height of the new steel bulkhead is approximately 15 ft MLLW.

4.1.4 SURFACE COVER

The Site upland is almost entirely covered by low permeability surfaces consisting of either asphaltic pavement or buildings with slab foundations. The paved areas are in generally good condition and have been replaced/repaired as needed, including the recent stormwater drainage and treatment upgrades discussed in Section 4.1.5. Cracked and areas of damaged pavement along the shoreline were repaired at the start of the current tenant's occupancy in 2004. Aside from a grassy bioswale at the southwest corner and the vegetative are at the northwest corner, the only unpaved areas of the Site are the North Work Yard area to the west of Building 1 and the eastern edge of the Dry Storage Yard, as shown on Figure 3.

4.1.5 STORMWATER MANAGEMENT

Stormwater has a significant potential to convey and release contaminants to the subsurface. Contaminants in stormwater can move to groundwater, or be discharged in dissolved or particulate form to surface water or other downstream receptors. Based on the nature of boat maintenance wastes associated with historical Site operations, the primary contaminant release mechanism for Site stormwater is discharge of both soluble and particulate contaminants to surface water.

Historically, the former tenant applied poor housekeeping and limited stormwater treatment and management practices, which resulted in the release of contamination to Site surface water and marine sediment. The distribution of pre-interim action Site marine sediment contamination, as shown on Figures 6 and 7, indicate that stormwater and/or pressure wash water, as well as direct release of boat maintenance wastes in the vicinity of the former marine railway and 30-ton travel lift, were the primary sources of Site marine sediment contamination. The impacts marine sediment that resulted from these releases were addressed by the marine sediment interim action, which is discussed in Section 3.4.

The Site improvements made in conjunction with redevelopment for the Port's new tenant, Seaview Boatyard North, included significant improvements to the Site stormwater system including recent upgrades to infrastructure and stormwater treatment. The evaluation of Site stormwater management conducted during the RI focused on current Site conditions because historical impacts resulting from poor stormwater management were remedied by the marine sediment interim action. Additionally, stormwater infrastructure and management practices were significantly modified as part of Site redevelopment and current tenant management, both minimizing the potential for stormwater to be a future source of contaminant releases to the environment.

4.1.5.1 Stormwater Management Improvements and Current Management

The current tenant, Seaview Boatyard North, has improved Site stormwater management and treatment practices since its tenancy started in 2004. Stormwater improvements that have been constructed since the start of Seaview Boatyard North's tenancy included:

- Construction of a closed-loop boatyard pressure wash water treatment system in the vicinity of the 30-ton travel lifts (2004). The closed-loop treatment system supports management and treatment of stormwater and wash water volumes at the western edge of the Site.
- Installation of a bioswale, to treat Site stormwater runoff from the South Work Yard outside the area managed by the close-loop boatyard pressure wash facility. The bioswale is located at the southwest corner of the Site. The bioswale consists of a dual-compartment engineered swale planted with native grasses and vegetation. The stormwater volumes treated by the swale ultimately either infiltrates into the subsurface or discharges at Outfall D (see Figure 3). The vegetation in the swale is replaced, as needed, but yearly at a minimum.
- Re-pavement of areas of cracked and distressed pavement near the bulkhead.
- Stormwater diversion features to ensure that pressure wash water is captured within the closed-loop treatment system that supports the western end of the Site.

In July 2010, the Port and the Seaview Boatyard North conducted a dye test of the Site's stormwater system in association with Seaview Boatyard North's boatyard general permit. The results of the dye test, and the actions taken by Seaview Boatyard North and the Port in response to the dye test results, were documented in a technical memorandum to Ecology dated November 9, 2010 (Landau Associates 2010). Based upon the result of the 2010 dye test, it was determined that Catch Basin No. 1 (located east of Building 2), discharged at that time via Squalicum Way to Outfall C located in the northeast corner of bulkhead, and that not all stormwater was being captured by the boatyard's existing close-looped treatment system. In addition, the dye test determined that Catch Basin No. 2 was discharging to the south of the Site, into the larger stormwater network supporting the paved parking lot areas adjacent to the Yacht Club.

This information resulted in a number of changes to the management and treatment of Site stormwater, including upgrades to the Site's grading and drainage infrastructure and its stormwater treatment system. The changes implemented in response to the results of the dye test included:

- An additional stormwater treatment system that utilizes Aquip® enhanced stormwater filtration system technology to treat stormwater was installed to manage stormwater flows originating in the northeast, east, and central portions of the Site (this system is discussed in further detail in Section 4.1.5.2.
- Stormwater infrastructure associated with Catch Basin Nos. 1 and 2 was rerouted to direct stormwater into the newly-installed Aquip® enhanced stormwater filtration system in 2012 (see Section 4.1.5.2).

Figure 3 presents the location of each treatment system and the approximate stormwater flow drainage break at the Site.

Site stormwater discharge associated with current boatyard activities is regulated by Ecology under the National Pollutant Discharge Elimination System (NPDES). Seaview Boatyard North is covered under the Ecology boatyard general permit, which requires the implementation of best management practices (BMPs) and periodic water quality monitoring of stormwater discharges for oil and grease, copper, zinc, nitrite, nitrate, biological oxygen demand (BOD), and total suspended solids. Tenant boatyard operations are conducted both indoors and outdoors. Outdoor activities can include engine, shaft, and rudder related repairs; hull repair, welding, and grinding; and buffing and waxing; all of these outdoor operations are conducted on tarped areas and within containment tents, as appropriate to the activity. After upgrades to stormwater infrastructure and treatment at the Site, Seaview Boatyard North currently operates in compliance with this permit and stormwater associated with current boatyard activities is not considered a potential source of contamination to surface water.

4.1.5.2 Catch Basins, Site Drainage, and Stormwater Treatment

Two functioning stormwater catch basins exist on the Site, Catch Basins Nos. 1 and 2. The catch basins are located east of Building 2 (Catch Basin No. 1), and east of Building 3 (Catch Basin No. 2), as shown on Figure 3. Catch Basin No. 1 is approximately five ft deep with a concrete bottom constructed with an approximate four-inch sediment trap. Catch Basin No. 2 was originally constructed of a concrete cistern approximately three ft deep with an open bottom, but was replaced with a closed bottom Type II catch basin in the fall of 2002. A third catch basin located south of Building 3 (Catch Basin No. 3 shown on Figure 3) was determined to no longer function during the 2010 dye test (Landau Associates 2010).

The two functioning catch basins collect stormwater from areas in the eastern and central portions of the Site that are removed from primary boatyard maintenance activities. Activities in this area include engine, prop, shaft, and rudder repair; hull welding, repair, joinery, and grinding; and buffing and waxing. Although do-it-yourself boat maintenance is conducted by boat owners in the areas serviced by these catch basins, the current tenant (Seaview Boatyard North) requires that users comply with applicable boatyard BMPs to minimize releases from these activities. This entire area of activity is currently supported by the tenant's Aquip® stormwater treatment system.

The catch basins were cleaned out in 2001 and 2010 as discussed in Section 2.2.2. Catch Basin Nos. 1 and 2 currently discharge into the Site's Aquip® stormwater treatment system located at the northeast corner of Building 1, as presented on Figure 3. Stormwater on the paved area at the eastern end of the Site (i.e., Dry Storage Yard) flows northward via sheet flow into a below-grade piping network and is subsequently conveyed to the Site's Aquip® stormwater treatment system prior to discharge via Squalicum Way infrastructure at Outfall C. The easternmost portion of the Dry Storage Yard is unpaved (gravel); stormwater volumes in this area are managed via infiltration (see Figure 3).

The Site's stormwater treatment system uses a combination of high quality sorptive and inert filtration including media layers comprising granular calcium-, aluminum/iron-, and organic-based materials. The system utilizes Aquip® enhanced stormwater filtration system technology specifically configured for boatyards and other facilities where dissolved metals are of primary concern (StormwateRx 2012). The Engineering Evaluation prepared for the Aquip® stormwater treatment system was approved by Ecology in June 2012 (Ecology 2012). Boatyard general permit benchmark violations were reported in late 2011 and early 2012 sampling rounds for copper and zinc, with maximum concentrations of 160 µg/L and 1,100 µg/L, respectively. However, quarterly sampling results for samples collected after Site infrastructure and stormwater treatment improvements were implemented in mid 2012 have been below benchmark standards.

Stormwater drainage on the paved western extent of the Site sheet flows into the bioswale at the southwest corner of the Site or is intercepted and processed by the closed-loop boatyard wash water treatment system located adjacent to the 30-ton travel lift pier. Boat pressure washing is conducted within this bermed, closed-loop system area to capture and treat pressure wash water. The North Work Yard, located west of Building 1, is unpaved (i.e., gravel) and stormwater predominately infiltrates in this area. The surface of the North Work Yard is sloped to the south, so during heavier precipitation stormwater from this area can sheet flow to the south where it is collected and treated either by the closed-loop boatyard wash water treatment system or the bioswale. Localized stormwater volumes in the North Work Yard can drain westward into the grass and vegetated strip along the bulkhead, but this discharge pathway occurs rarely and only under severe weather conditions.

4.1.5.3 Best Management Practices

The current tenant at the Site applies various mandatory boatyard BMPs, as outlined in the boatyard general permit, in addition to general good housekeeping practices during the course of managing daily operations. Use of vacuum sanders is mandated for all employees and customers of Seaview Boatyard North; customers must sign agreement to comply with this requirement and all other BMP requirements initiated at the Site. In addition to use of vacuum sanders, use of containment tents, ground tarps, and standard cleaning regimens are required to minimize any potential contaminated runoff. In-water boat work is prohibited, with the exception of cleaning of the boat interiors.

Any particles, grits, dusts, flakes, and/or chips are collected regularly and properly disposed through the proper waste stream, including support from offsite waste disposal management companies. All painting activities are conducted indoors (with the exception of bottom painting which is conducted using ground tarps and containment trays). Materials that have the potential to pollute stormwater flows (e.g., oil and bilge water, paints, etc.) are stored indoors within secondary containment and spent materials are removed by a licensed transporter, as necessary. The wash pad is pressure washed daily and any water volume is contained and treated within the closed-loop boatyard wash water treatment system.

Any potential sewage volumes brought onto the Site in boats requiring maintenance are properly disposed by a mobile off-site contractor; however, the occurrence of vessel sewage management is rare. Gray water in boats brought to the Site is treated through the Site's closed-loop boatyard wash water treatment system. A toilet and washroom facility, located in the northwest corner of Building No. 1, was formerly used at the Site. The facility was connected to the City's sanitary sewer system via the sewer main line beneath Squalicum Way. The facility has not been used in at least 20 years; however, the original plumbing remains-in-place (Riise 2014).

Meetings by the tenant's staff are held regularly to review BMP implementation, management, and monitoring requirements/procedures. BMP features are monitored regularly, based on the particular BMP, and staff is trained on BMP management and spill prevention on a yearly basis. In addition, inspections of the yard are performed daily, pavement is swept on a weekly basis, filter socks are replaced and catch basin sediment is removed and properly disposed, as needed. Filter sock replacement and catch basin sediment removal is dependent on the season and the presence of accumulated sediment volumes but occurs quarterly on average (Seaview North Boatyard 2012).

4.1.5.4 Outfalls

Six outfalls were present on the Site prior to the marine sediment interim action at the locations shown on Figure 2. For the purposes of this report, these outfalls have been given letter designations A, B, C, D, E and F, as shown on Figure 2. The status (active or inactive) and discharge sources to the outfalls were evaluated by the Port during the marine sediment interim action. Outfalls identified as E and F on Figure 2, were determined to be inactive and were abandoned in place prior to construction of the new bulkhead. Outfall C was extended through the new bulkhead and discharges stormwater from neighboring Squalicum Way and the Site's upgradient Aquip® stormwater treatment system. Outfalls A and B discharge stormwater from paved areas between buildings on Bellingham Cold Storage property to the north of the Site. The outfall at the southwest corner of the Site (Outfall D on Figure 3) discharges stormwater from the bioswale that collects and treats stormwater in the South Yard, as discussed in the previous section.

Only two outfalls, identified as outfalls C and D on Figure 3, discharge Site-related stormwater. Required quarterly monitoring is conducted at the outfall pipe from the bioswale (i.e., Outfall D) and from the outfall pipe of the Aquip® treatment system prior to discharge into the stormwater network serving Squalicum Way. As described above, two inactive outfalls (i.e., Outfalls E and F) were abandoned in place during the marine sediment interim action and currently four stormwater outfalls actively discharge in the vicinity of the Site, as presented on Figure 3. Previous sediment investigations at the Site, prior to the sediment interim action, did identify minor sediment quality impacts in the vicinity of these now former outfalls; however, the contaminant distribution did not indicate that these outfalls (including currently active Outfall C) were the primary sources of contamination in this area.

4.1.5.5 Stormwater Recontamination Considerations

Current stormwater dynamics and management at the Site are not considered a potential source of surface water and/or sediment contamination for various reasons, including but not limited to the following considerations:

- Effective stormwater infrastructure upgrades and treatment system management at the Site, as indicated by current compliance with required discharge benchmarks since completion of the upgrades,
- Recent and multiple cleaning of catch basin sediment and stormwater conveyance infrastructure,
- Catch basin sediment and the stormwater conveyance system are required to be inspected and cleaned per NPDES Permit requirements. The catch basins and stormwater infrastructure are inspected daily and their current condition is recorded on the inspection forms. Filter socks are replaced and catch basin sediment removed and properly disposed as needed when sediment volumes are identified. Although sediment accumulation varies seasonally, on average filter socks are replaced and sediment is properly disposed on a quarterly frequency (Seaview Boatyard North 2012).
- The removal of accumulated catchment basin sediment from previous Site activities, and
- Effective implementation and management of boatyard BMPs, including tarping and containment of outdoor activities and use/management of the closed-loop pressure wash water treatment system.

In addition, the Site's tenant is currently completing the permitting process for the planned demolition and removal of the three 1940s-era buildings located at the Site. Although the building's roofs are currently coated to limit potential impact to stormwater runoff from metals contaminants (i.e., zinc), removal of the buildings is anticipated to improve overall Site stormwater quality.

4.1.6 UTILITIES

Subsurface utilities have the potential to affect contaminant migration. Coarse backfill is often used for bedding and in subsurface utilities and can create preferred pathways for groundwater migration. However, Site groundwater is 7 to 10 ft BGS, which is deeper than typical utilities, except for some utilities that convey water by gravity flow, such as sanitary and stormwater systems. However, at this Site the stormwater systems are completed at elevations higher than groundwater and not considered potential preferred pathways for groundwater migration.

A number of utilities are present in Squalicum Way off site to the north, including sanitary sewer and local stormwater conveyance systems. The depth of these systems is not known, but given that the Site is near the upgradient terminus of any gravity flow utilities it is unlikely that they extend to significant depth.

Building No. 1 contains a toilet and washroom facility that was historically used at the Site. The facility is connected into the sanitary sewer network beneath Squalicum Way. The facility has not been used in at least 20 years but the subsurface piping remains-in-place. Currently, active sanitary sewer facilities are within the main administrative and storefront building operated by Seaview North, located off Site to the south of the Dry Storage Yard. Connections to domestic water were also formerly available within Building Nos. 1 through 3; however, these utilities were disconnected at least 20 years ago and have not been used since the current tenant's occupancy (Riise 2014).

4.2 GEOLOGY

General geologic information for the project Site was obtained from the *Geologic Map of Western Whatcom County, Washington* (USGS 1976) and from Site soil borings. The two geologic units observed on the Site, from youngest to oldest, are fill and glacial marine drift. The upland portion of the Site was created by filling marine aquatic land with dredge material and other fill in the 1920s through the early 1950s.

The fill material consists of an upper mixed fill unit up to about 14 ft BGS underlain by dredged fill. The upper mixed fill consists of gray-brown to brown, gravelly, fine to coarse sand with varying amounts of shiny, black, angular sand to gravel-sized apparent coal fragments, as well as fragments of wood and brick. In some areas, such as the vicinity of the former gasoline UST, lenses consisting entirely of coarse sand to gravel-sized coal material are present that function as high permeability zones when in contact with groundwater. One of these lenses of coarse coal material is present at and below the water table to the south of the former gasoline UST and appears to have affected the distribution of gasoline-range petroleum hydrocarbon contamination in this area, as discussed in Section 6.2.1.1. The estimated aerial extent of the apparent coal lens in the former UST vicinity is shown on Figure 4.

Coal is ubiquitous and was historically mined in the Bellingham area. Coal is compressed organic matter, and while the combustion residues of coal can contain PAHs and other hazardous substances, coal itself does not contain constituents of environmental concern. The observed coal lenses at the Site varied in thickness from two inches to about four feet in Site explorations, and exhibited angular, shiny surfaces characteristic of fractured coal.

The underlying dredge fill is more uniform in composition than the mixed fill and generally consists of loose, brown to gray fine to coarse sand with gravel and organic stringers, and was encountered to depths of between about 18 and 25 ft BGS in the limited number of borings that have been extended to the base of the fill unit.

The native soil underlying the dredge fill encountered in the borings that extended through the fill unit consists of a gray-green medium stiff to very stiff silty clay to sandy silt, interpreted to be glacial marine drift. Glacial marine drift was deposited as rising sea levels floated and melted Pleistocene glacial ice (Stasney 1997). The upper surface of the glacial marine drift dips downward from east to west.

An east-west geologic cross section is presented on Figure 13, and the cross section alignment is shown on Figure 4.

4.3 HYDROGEOLOGY

Based on available boring and groundwater data, the uppermost hydrostratigraphic unit at the Site consists of the fill unit that overlies the finer-grained glacial marine drift. The underlying glacial marine drift deposit forms the uppermost aquitard throughout the Site. Hydrogeologic properties for the uppermost hydrogeologic unit are discussed in the following sections.

4.3.1 SATURATED THICKNESS, FLOW DIRECTION, AND TIDAL INFLUENCE

Groundwater elevation data collected during the remedial assessment and RI are presented in Table 4. The depth to groundwater ranged from approximately 6 to 10 ft BGS based on these data, and is shallower during the wet season than the dry season. The saturated thickness of the uppermost hydrostratigraphic unit increases from the eastern edge of the Site toward Bellingham Bay, but is generally about 17 ft thick within 350 ft of the shoreline, based on available geologic data and water level measurements.

Tidal influence on groundwater was evaluated based on three days of semi-continuous data collected from Bellingham Bay, MW-1, MW-3, and MW-6 between June 24 and 28, 2002 using an electronic data logger. Data for this monitoring period are shown on Figure 14. Groundwater elevation changes of up to 2.9 ft, 1.1 ft, and 0.4 ft, corresponding with tidal fluctuations were observed in monitoring wells MW-3, MW-6, and MW-1, respectively. These data also indicate groundwater gradient reversals extending to the vicinity of MW-1 during high tide. Based on these data, it is estimated that tidal influence does not extend significantly farther inland from the shoreline than MW-1, or about 260 ft, which is consistent with tidal influences observed in other unconfined aquifers adjacent to Puget Sound.

The direction of groundwater flow and gradient was estimated based on water levels measured from a surveyed reference point at each well using a hand-held water level indicator and converting these data to elevations. Groundwater levels measured at low tide in July 2002 and December 2006 were contoured to show groundwater flow direction and gradient during dry and wet season conditions and are presented on Figures 15 and 16. As shown on these figures, groundwater flow is to the west-southwest at low tide during both the dry and wet seasons. Groundwater flow measured in December 2006 during high tide is shown on Figure 17, and illustrates the extent of gradient reversal during high tide.

Figure 18 presents a hydrograph of groundwater elevations measured at low tide in 2002 prior to installation of the steel sheetpile bulkhead and in 2004 and 2006 following installation of the sheetpile bulkhead. As shown on this figure, groundwater levels at all of the wells increased following installation of the bulkhead, but the direction of groundwater flow and relative response of the wells did not change significantly. This change is consistent with the less permeable nature of the new bulkhead.

4.3.2 HYDRAULIC CONDUCTIVITY

Hydraulic conductivity of the uppermost hydrostratigraphic unit was estimated using a technique for estimating transmissivity in tidally influenced aquifers from the following equation (Ferris 1951):

$$T = (x^2 S t_0)/(4 \pi t_1^2)$$

where:

- T = transmissivity (L^2/t)
- S = storativity (dimensionless)
- x = distance from well to subaqueous outcrop (L)
- t_0 = time between tidal maxima or minima in Bellingham Bay (t)
- t_1 = time lag between the occurrence of the maxima or minima in Bellingham Bay and in the monitoring well (t).

Data for this evaluation were obtained by using the electronic data collected during the remedial assessment for MW-3, MW-6, and Squalicum Harbor, as presented on Figure 14. The time (t_0) between tidal maximum and minimum in Bellingham Bay was computed based on water elevation data from June 24 through 28, 2002, as presented in Table 5. The time lag (t_1), or difference, between the maxima or minima of a cyclical tidal fluctuation from Squalicum Harbor to MW-3 and MW-6 was also computed based on the data logger record for this same time period and is listed in Table 5. The time lag for tidal minimum was used for estimating t_1 because it was more consistent than the lag time for tidal maximum. The distance from MW-3 and MW-6 to Squalicum Harbor adjacent to the Site is about 29 and 90 ft, respectively. Aquifer storativity/specific yield was assumed to be 0.10. Based on the borehole drilling information and groundwater levels in this area, the aquifer saturated thickness (b) is estimated to be 17 ft.

Based on the data and assumptions described above, the transmissivity (T) is estimated to be about 3,400 ft^2/day based on the average of the estimated input parameters for monitoring wells MW-3 and MW-6, as follows:

t_0 = 24.7 hr
t_1 = 2.25 hr
x = 60 ft

$$T = [(60ft)^2(0.10)(24.7\ hr)]/[(4\pi)(2.25\ hr)^2] = 140\ ft^2/hr = 3,400\ ft^2/day$$

The hydraulic conductivity (K), based on the relationship K = T/b, is estimated to be about 200 ft/day ($7.0x10^{-2}$ cm/s).

Grain size data collected during the Phase III ESA were also used to estimate hydraulic conductivity of shallow saturated fill based on the Hazen Method (Fetter 1994). The estimated hydraulic conductivity values for the four samples ranged from about 10 ft/day to 250 ft/day, which is consistent with the hydraulic conductivity estimated using the Ferris method. As a result, a hydraulic conductivity of 200 ft/day will be used for the uppermost hydrostratigraphic unit for the purposes of this RI/FS.

4.3.3 Groundwater Velocity and Flow

Groundwater average linear velocity (v) is estimated from the equation:

$$v = Ki/n$$

where:

K = hydraulic conductivity (L/t)

i = hydraulic gradient (dimensionless)

n = effective porosity (dimensionless).

The groundwater hydraulic gradient for the Site was calculated using a three-point method incorporating information from monitoring wells MW-5, MW-7 and MW-9. An equipotential line (dashed) is estimated with an equivalent hydraulic head as that at MW-5, as presented on Figures 15 and 16. The equipotential line intersects the line between MW-7 and MW-9 at a point equal in hydraulic head to that at MW-5, based on a linear interpolation. Hydraulic gradient is then calculated as the dividend of the difference in hydraulic head between the equipotential line and MW-7 divided by the lateral distance between the equipotential line and MW-7.

The current hydraulic gradient for the Site is estimated to be about 0.0030 based on the groundwater elevation data for monitoring wells MW-5, MW-7, and MW-9 presented on Figure 16. The hydraulic gradient prior to installation of the galvanized bulkhead was estimated to be 0.0054 based on the elevation data for monitoring wells MW-5, MW-7, and MW-9 presented on Figure 15. These data indicate that the hydraulic gradient following the installation of the new bulkhead is flatter than the hydraulic gradient prior to bulkhead replacement. Based on the estimated hydraulic conductivity of 200 ft/day and an assumed effective porosity of 0.30, the estimated average linear velocity is about 2.0 ft/day (730 ft/yr) based on the estimated hydraulic gradient for current conditions (0.0030).

Based on Darcy's Law, groundwater flow is estimated by the equation:

$Q = KiA$

where:

Q = Groundwater flow (L^3/t)

A = Cross sectional area perpendicular to flow (L^2).

Based on an estimated width of the Site perpendicular to groundwater flow of 250 ft, an estimated saturated thickness of 17 ft, and the previous estimates for hydraulic conductivity and gradient, the estimated groundwater flow from the Site to Bellingham Bay is about 2,600 ft^3/day (13 gpm).

4.4 NATURAL RESOURCES

This section summarizes information on natural resources at the Site and for Bellingham Bay. Included is a discussion of the types and functions of habitats, and plants and animal species. Because it has been used for commercial and industrial purposes since its creation, there is limited natural resources value and function to Site uplands and the discussion primarily focuses on marine natural resources.

4.4.1 TYPES AND FUNCTIONS OF HABITATS

4.4.1.1 Upland Habitat

The upland portion of the Site was created by filling and has been used for heavy commercial and industrial purposes since its creation, and consequently has no substantive natural resource value. Except for grass and small shrubs located within the bioswale at the southwest corner and a vegetative strip at the northwest corner of the Site, the upland portion of the Site is devoid of vegetation.

4.4.1.2 Marine Habitat

The marine portion of the Site (Marine Unit) is dominated by numerous marine structures, including a bulkhead along its entire shoreline and two sets of travel lift piers, as shown on Figure 3. The Marine Unit is defined by the extent of pre-interim action marine sediment contamination, as shown on Figures 6 and 7. It consists of about 0.6 acres, including almost no intertidal habitat (elevation 0 to 10 ft MLLW), about 0.1 acre shallow subtidal habitat (elevation -4 to 0 ft MLLW), and about 0.5 acres of deep subtidal habitat (below elevation -10 ft MLLW).

An intertidal habitat survey was conducted in 2002 as part of the biological evaluation for the Site redevelopment and marine sediment interim action (Landau Associates 2002). The habitat survey found that live animals and plants were scarce, with low abundance and diversity. It was concluded that the low productivity of Site intertidal habitat was the result of a number of factors, including significant shading resulting from the bulkhead and over-water structures, the coarse nature of the substrate, the extensive creosote-treated wood present in in-water structures, and the presence of marine sediment contamination.

The removal of contaminated marine sediment and creosote-treated wood from the aquatic environment during Site redevelopment has improved the aquatic environment and should promote greater abundance and diversity of aquatic organisms, although Site aquatic natural resources will remain of limited value due to physical conditions present in the marine portion of the Site.

Due to the limited potential for improvement of the Site marine resources, habitat mitigation and enhancement associated with marine sediment dredging and related Site improvements was conducted off-Site, by construction of the marine habitat bench described in Section 3.4.1. The marine habitat bench provides improved habitat for benthic and epibenthic biota, as well as juvenile salmonids and other fish species, by significantly increasing the amount of shallow subtidal habitat. Oversight of the habitat bench performance is being provided by the USACE and resource services consistent with the conditions associated with the in-water permits issued for the marine sediment interim action and concurrent redevelopment activities. Although the marine resources associated with the marine habitat bench are not present on the Site, they are a direct result of Site actions and should be considered when evaluating Site marine resources.

4.4.2 PLANT AND ANIMAL SPECIES

As documented in the Whatcom Waterway Site RI/FS and the FEIS (Port of Bellingham 2010), the Bellingham Bay area is utilized by a wide range of plant and animal species. The significant plant and animal species are summarized below.

4.4.2.1 Plants

As previously mentioned the Site is devoid of vegetation except for grasses and small shrubbery that are present in the bioswale and in the vegetative strip located in the southwest and northwest corners of the Site, respectively.

4.4.2.2 Terrestrial Wildlife

Wildlife that may be present is on the Site and in the vicinity is limited to those species typically observed in the City of Bellingham urban environment, including various songbirds, gulls, crows, ravens, and possibly raccoon (*Procyon lotor*) and opossum (*Didelphis virginiana*).

4.4.2.3 Aquatic Wildlife

As previously mentioned, a habitat survey found that aquatic life at the Site was scarce; therefore, aquatic life is discussed in broader terms for all of Bellingham Bay.

Fisheries and Invertebrate Resources

As reported in the Whatcom Waterway RI/FS, documented fisheries resources for Bellingham Bay include the following:

- **Surf Smelt and Sand Lance:** Surf smelt and Pacific sand lance are common fish that spawn in the high intertidal portions of coarse sand and gravel beaches. Surveys by Washington Department of Fish and Wildlife have documented spawning beaches in Bellingham Bay.
- **Pacific Herring:** Pacific herring spawn in inland marine waters of Puget Sound between January and June in specific locations. There is typically a two-month peak within the overall spawning season. Herring, which deposit their eggs on marine vegetation such as eelgrass and algae in the shallow subtidal and intertidal zones between one foot above and five ft below MLLW, are known to congregate in the deeper water of Bellingham Bay. However, only relatively low-density spawning deposition occurs in the Bay.
- **Salmonids:** Bellingham Bay is used extensively by anadromous salmon species. Each of the streams flowing into Bellingham Bay is used by one or more of the following species: Coho, chum, Chinook, pink, sockeye, steelhead, cutthroat, and bull trout. The Nooksack River has the largest salmon runs in Bellingham Bay, followed by Squalicum and Whatcom creeks. Concentrations of chum, Coho, and Chinook salmon along the shoreline and in offshore waters in Bellingham Bay peak annually about mid-May. Juvenile Coho and Chinook salmon appear to have different migration habits. Coho remain in the bay for approximately 30 to 35 days, while Chinooks remain about 20 days. More recent studies on the distribution of Chinook salmon (Ballinger and Vanderhorst 1995) indicate relatively high numbers of juvenile Chinook salmon and average numbers of Coho salmon use the area in the vicinity of the Whatcom Waterway.
- **Groundfish:** Several species of groundfish occur in both shallow and deep waters in Bellingham Bay for part or all of their life. Detailed information on groundfish species and their timing and use of Bellingham Bay is not available. Key characteristics of groundfish occurring in northern Puget Sound are generally applicable to Bellingham Bay.

Bellingham Bay supports a variety of marine invertebrates, ranging from infauna (worms, clams, and small ghost shrimp that penetrate benthic sediments) to epibenthic plankters (organisms such as very small crustaceans that move off the substrate surface) to larger invertebrates such as oysters, crabs, and shrimp.

- **Clams, Geoduck and Oysters:** The predominant bivalves in Bellingham Bay are intertidal and subtidal hard-shell clams. Intertidal shell clam types include butter, littleneck, horse, and soft-shell clams and cockles. Subtidal clam resources consist of butter, littleneck, and horse clams. Native oyster and Pacific geoduck are also known to occur in Bellingham Bay. Shellfish densities are relatively low along the eastern shore of Bellingham Bay. Geoduck is only present in a handful of locations in the Bay.
- **Shrimp:** Seven species of pandalid shrimp, including, pink, coonstripe, dock, and spot shrimp, occur in nearshore and deeper waters of Bellingham Bay. Coonstripe shrimp have

been observed in intertidal areas immediately offshore of the Site, and this species is common around piers and floats.

- **Crab:** Crab trawls conducted for the PSDDA investigations indicate that the predominate crab resources in Bellingham Bay are the non-edible purple or graceful crab, the edible red rock crab, and the edible Dungeness crab. The highest densities of rock crab occur in relatively shallow water (30 to 45 ft below MLLW) in areas extending from the Lummi Peninsula to inner Bellingham Bay. Rock and Dungeness crab are likely to occur in shallower waters of Bellingham Bay not sampled as part of the PSDDA investigations. Dungeness crab is generally abundant in most areas of Bellingham Bay. The northern and eastern shorelines of Bellingham Bay serve as nursery/rearing areas for juvenile Dungeness crab. A shell substrate is a preferred habitat for the first eight to ten weeks after larvae settle. However, other substrates, such as small cobbles and gravel, algae, and eelgrass, are also recognized as important rearing habitat for juvenile crab.

Sea Birds and Marine Mammals

The greater Bellingham Bay area and its shallow estuarine habitats support a number of birds in all seasons. Although Bellingham Bay is not used extensively by large populations of waterfowl, wintering populations tend to be 10 to 15 times larger than summer populations for migratory species. Bellingham Bay is located on the flight path between the Fraser River estuary and Skagit Bay, and is used as a stopover for seabirds and waterfowl migrating between these two areas. Waterfowl sited in Bellingham Bay include brant, snow geese, mallard, widgeon, green-winged teal, and pintail. Bellingham Bay is also used as an over-wintering area for diving birds such as scoter and golden eye. A variety of both natural and man-made habitats provide protection from winter storms habitat to migrant and wintering birds. Glaucous-winged gulls use inner Bellingham Bay for resting and foraging. Pigeon guillemonts use the shoreline area in and around the Whatcom Waterway for nesting and foraging.

Limited information is available on the presence and residence time of marine mammals in Bellingham Bay. Bay-wide, several species have been reported: the harbor seal, sea lions, Orca whale, gray whale, and harbor porpoise. As described below, the local population of Orca whale is being listed as endangered under the Endangered Species Act. The other marine mammals are not threatened or endangered species under the Endangered Species Act, but they are protected from hunting under the Marine Mammal Protection Act. Seals and sea lions have been noted using the Site shoreline for resting areas. Migrating gray whales have been noted to enter Bellingham Bay and to feed in subtidal areas of Puget Sound. Orca whales are occasionally observed in and near Bellingham Bay, though they are more typically observed in Rosario Strait and near the San Juan Islands.

Threatened, Endangered, Sensitive, and Candidate Species

Under the Endangered Species Act, a species likely to become extinct is categorized as "endangered." A species likely to become endangered within the foreseeable future is categorized as "threatened." This section provides information on the occurrence of threatened and endangered bird, fish, and marine mammal species in Bellingham Bay.

- **Bald Eagle:** The majority of bald eagle nest sites occur in the eastern portion of Bellingham Bay, primarily in the Nooksack River delta along the shoreline and in inland areas of the Lummi Peninsula. There are also some nests along the shoreline of Portage Island and Chuckanut Bay. Nest trees in the Pacific Northwest are typically tall conifers located in forested or semi-forested areas within about 1 mile of large bodies of water with adequate food supplies. Marine and freshwater fish are eagles' preferred prey; birds contribute a smaller proportion of the eagle diet. Prey may also include small mammals. Nesting eagles generally forage within ten square miles of their nest site. Thus, while the Site does not appear to provide eagle habitat, it may serve as a food source. The bald eagle was proposed for delisting as of July 6, 1999 due to apparent recovery of the species in the U.S. (Federal Register 50 CFR Part 17). The bird is still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The United States Fish and Wildlife Service (USFWS) also works with state wildlife agencies to monitor the status of the species as required by the ESA.

- **Peregrine Falcon:** Peregrine falcons are also found in the vicinity of Bellingham Bay. They feed almost exclusively on birds captured in flight, particularly waterfowl, shorebirds, and game birds. Peregrine falcons typically nest on cliff ledges greater than 150 ft in height that are close to the water. The Site has no Peregrine falcon nests.

- **Marbled Murrelet:** Open water concentrations of marbled murrelets have been recorded in the central portion of Bellingham Bay. Murrelets forage in the marine environment typically up to 2 miles near a coastline. The species forages year round in waters generally less than 90 ft deep, sometimes congregating in well-defined areas where food is abundant. These birds generally do not utilize shallower waters less than 30 ft deep. Marbled murrelets reportedly feed on a wide variety of prey, including sand lance, Pacific herring, and other marine taxa such as crustaceans. Murrelets require old growth or mature forest composed of conifers, including Douglas fir, western red cedar, Sitka spruce, and western hemlock. There are no known nest sites along the shoreline of Bellingham Bay, and no clear association between these birds and the Site.

- **Salmon:** On March 16, 1999, the National Marine Fisheries Service (NMFS) added nine West Coast salmon to the Endangered Species List. Of the nine listed species, one occurs within the vicinity of the Site; Puget Sound Chinook salmon was listed as a threatened species. Two races of Chinook salmon (spring and fall) are found in Bellingham Bay. The timing of adult migration to freshwater differs between these two races, but the timing of the return of adult fish, spawning, and emigration of juveniles overlap. Fall Chinook is the most common run of Chinook salmon observed in Puget Sound. Juvenile fall Chinook generally emigrate to the estuary between February and August as sub-yearlings (within the first year after being spawned) or as yearlings. Individual fish may only use Bellingham Bay for a period of days to a few weeks before heading into the greater Puget Sound estuary. They may use the estuaries and intertidal areas between April and November for further rearing and growth. As juvenile fish move into neritic habitats, they preferentially consume emergent insects and epibenthic crustaceans in salt marsh habitat or decapod larvae, larvae, and other prey.

- **Bull Trout:** Bull trout, listed as a threatened species under the Endangered Species Act by the USFWS, are a member of the North American salmon family. Bull trout occur in the Nooksack River, and presumably spend some time in Bellingham Bay. Many are resident to a single stream; others migrate on a fluvial (i.e., spawn in headwaters streams and live downstream in larger rivers) or adfluvial basis (spawn in streams but live in lakes). Bull trout tend to prefer cold, clear waters (no more than 64 °F).

- **Orca Whales:** On November 15, 2005, the National Oceanic and Atmospheric Administration (NOAA) Fisheries announced its decision to list the North Pacific Southern Resident Orca whale (Orcinus orca) population as endangered under the ESA. The listing was effective on February 6, 2006 (50 CFR 223/224). The listing is specific to the three resident whale pods (J, K, and L pod) with spring through fall ranges in Puget Sound and the Straits of Georgia and Juan de Fuca. This population was previously (December 16, 2004) proposed for listing as threatened. NOAA Fisheries has announced that they are preparing language for proposed Orca whale critical habitat for this population. A number of factors have been identified by NOAA Fisheries as having resulted in the listing of these Orca whales as endangered. Sound and disturbance from vessel traffic, toxic chemicals which accumulate in top predators, and uncertain prey availability (primarily salmon) all have been identified as concerns for the continued survival of this population. The small number of whales in this group, and relatively slow rate of population recovery since a 20 percent population decline during the 1990s, also puts this historically small group at risk of extinction during a catastrophic event such as an oil spill or disease outbreak.

4.5 HISTORICAL AND CULTURAL RESOURCES

No known archaeologically-significant cultural or historical resources are present at the Site. As discussed in Section 2.1, prior to ownership of the Site by the Port, the property was undeveloped subtidal aquatic lands of Bellingham Bay. In the 1920s, the area was filled with material dredged during construction of the Squalicum Waterway. In 1946, Weldcraft Steel and Marine was established on the Site, and the Site has since been used continuously since that time for boatyard activities. Although a cultural and historical survey of the Site has not been conducted, the existing structures are largely metal-sided buildings with no apparent architectural significance. Because the native ground surface was originally subtidal and located at distance from the original shoreline, the potential for Native American archeological material to be present at the Site beneath the approximately 15 ft to 25 ft of fill is low.

4.6 LAND AND NAVIGATION USES

The Site is currently used as a commercial boatyard, and is zoned for commercial use with surrounding properties zoned for commercial or industrial use. The Site, adjacent properties to the north and south, and adjacent aquatic lands, are owned by the Port. The Port also owns Squalicum Way and the historical Harbor Loop Drive. Roeder Avenue is a public right-of-way. Ownership information is provided on Figure 3. No changes to local zoning or land use are planned or anticipated. The Marine Unit is situated within Squalicum Outer Harbor, which is owned by the Port and includes a large marina and a number of commercial businesses with limited public access. No changes to navigation and marine uses are planned or anticipated.

5.0 SITE SCREENING LEVELS

This section develops Site screening levels for use in evaluating the nature and extent of contamination discussed in Section 6.0. Site screening levels are used to delineate the nature and extent of contamination in Section 6.0 based on those constituents that exceed Site screening levels in affected media. PCLs are developed for those constituents that exceed these screening levels in Section 9.0 for use in evaluating Site cleanup alternatives. However, final Site cleanup levels will be established by Ecology in the Cleanup Action Plan (CAP) following completion of the RI/FS.

Site screening levels were developed for soil and groundwater based on MTCA, for those constituents that were detected during Site investigation activities. The following sections identify potential exposure pathways and receptors, which are used as a basis for developing Site screening levels. Screening levels were not developed for marine sediment because cleanup levels for marine sediment were developed for the interim action. Development of the sediment cleanup levels are presented in Section 3.4.2 and in the Interim Action Work Plan (Landau Associates 2002).

5.1 POTENTIAL EXPOSURE PATHWAYS

Potential exposure pathways must be identified for both human and environmental impacts. The potential exposure pathways (i.e., current and/or potential future) are:

- **Ingestion of groundwater.** Site groundwater is not considered a potable water source and is therefore not considered a current or potential future pathway, as discussed below.
- **Groundwater discharge to surface water and sediment.** Discharge of contaminated groundwater to surface water could affect receptors in surface water or marine sediment, including marine organisms and human consumption of marine organisms, and is therefore considered a current and potential future pathway.
- **Direct contact with and ingestion of soil.** Potential pathways include contact with surface soil and exposure to subsurface soil during construction that involves intrusive activities; therefore this is considered a current and potential future pathway.
- **Soil runoff to sediment and surface water.** Contaminated surface soil runoff via stormwater flow to sediment or surface water can introduce contaminants that could affect receptors and is considered a current and potential future pathway.
- **Soil and groundwater vapors.** VOCs in soil and groundwater within the former UST Area have the potential to volatilize into the air and migrate into Site structures, and therefore is considered a current and potential future pathway.
- **Leaching from soil to groundwater.** Soil contaminants can leach to groundwater in unpaved areas where stormwater can infiltrate through shallow contaminated soil or at locations where soil contamination is in direct contact with groundwater. Although the Site is predominately paved, two unpaved areas (i.e., North Work Yard and eastern edge of the Dry Storage Yard) do exist and therefore this is considered a current and potential future pathway.

MTCA allows for application of groundwater cleanup criteria based on the protection of adjacent surface water if groundwater has an extremely low probability for use as a future drinking water source [WAC 173-340-720(2)]. It is necessary that the following conditions be demonstrated to treat groundwater as non-potable, as referenced in WAC 173-340-720(2):

- (2)(a) *The ground water does not serve as a current source of drinking water.*

  Drinking water is currently supplied by the City of Bellingham. Water supply wells are not known to exist at or near the Site.

- (2)(c) *The department determines it is unlikely that hazardous substances will be transported from the contaminated groundwater to groundwater that is a current or potential future source of drinking water, as defined in (a) and (b) of this subsection* [i.e., WAC 173-340-720(2)], *at concentrations which exceed groundwater quality criteria published in chapter 173-200 WAC.*

  Remedial investigation work at the site indicates that contaminated groundwater occurs primarily in the uppermost water-bearing zone. This water-bearing zone occurs in manmade fill placed into Bellingham Bay and in the upper part of the underlying native sediments ("shallow aquifer"). The shallow aquifer discharges directly into Bellingham Bay. Contaminated groundwater in the shallow aquifer will not flow laterally inland toward other aquifers that may be a current or potential future source of drinking water, because the inland aquifers are hydraulically upgradient of the shallow aquifer. Similarly, contaminated water in the shallow aquifer will not flow vertically downward into deeper aquifers that may be a current or potential future source of drinking water, because groundwater flow between aquifers at the shoreline is upward, reflecting increasing hydraulic heads with depth.

- (2)(d) *Even if groundwater is classified as a potential future source of drinking water, the department (Ecology) recognizes that there may be sites where there is an extremely low probability that the groundwater will be used for that purpose because of the site's proximity to surface water that is not suitable as a domestic water supply. An example of this situation would be shallow groundwaters in close proximity to marine waters such as on Harbor Island in Seattle. At such sites, the department may allow groundwater to be classified as non-potable if each of the following conditions can be demonstrated. These determinations must be for reasons other than that the groundwater or surface water has been contaminated by a release of a hazardous substance at the site.*

  - <u>(2)(d)(i)</u> *There are known or projected points of entry of the groundwater into the surface water.*

    Remedial investigation work at the site demonstrates that groundwater in the shallow aquifer discharges directly into Bellingham Bay.

- o (2)(d)(ii) *The surface water is not classified as a suitable domestic water supply source under chapter 173-201A WAC.*

  Bellingham Bay is a marine surface water body, and is not suitable as a domestic water supply under chapter 173-201A WAC.

- o (2)(d)(iii) *The groundwater is sufficiently hydraulically connected to the surface water that the groundwater is not practicable to use as a drinking water source.*

  Remedial investigation work at the site indicates that the shallow aquifer is directly connected with and discharges into Bellingham Bay. It is not practicable to utilize the shallow aquifer for water supply due to the potential for drawing saline water into the aquifer (saltwater intrusion).

5.2 POTENTIAL RECEPTORS

The potential exists for human and ecological receptors to be exposed to affected media at the Site. Potential human receptors that may be exposed to affected groundwater and soil are identified below. Potential human receptors that may be exposed to affected sediment are not included because these were identified in the Interim Action Completion Report (Appendix C), except as related to potential recontamination of marine sediment by contaminated Site groundwater:

- **Site visitor/do-it-yourselfer.** Potential exposure of Site visitors or individuals conducting do-it-yourself boat repair to contaminants in surface soil can occur through ingestion, dermal contact, or inhalation of particulates, although potential exposure is limited by the presence of pavement and buildings throughout most of the Site. Inhalation of soil vapors migrating into buildings is also a potential exposure pathway.
- **Site commercial/industrial workers.** Potential exposure of Site workers to contaminants in surface soil can occur through ingestion, dermal contact, or inhalation of particulates, although potential exposure is limited by the presence of pavement and buildings throughout most of the Site. Inhalation of soil vapors migrating into buildings is also a potential exposure pathway.
- **Site construction workers.** Potential exposure of Site construction workers to contaminants in surface and subsurface soil can occur through ingestion, dermal contact, or inhalation of particulates; through dermal contact with groundwater; and through inhalation of soil vapors. The Port maintains internal controls to ensure that workers conducting excavations at the Site receive appropriate training and monitoring. Potential exposure to contaminants in marine sediment can occur through ingestion and dermal contact during sediment dredging.
- **Site aquatic seafood gatherer/fisher.** Potential exposure of Site seafood gatherers/fishers to contaminants in fish organisms containing hazardous substances originating from Site groundwater discharged to marine surface water, and potentially through the gathering of benthic/epibenthic organisms affected by Site sediment, if recontaminated by groundwater discharge through sediment. Potential exposure is limited due to lack of public access to Site aquatic area for fishing or shellfish gathering.

- **Residential use exposure.** The Site is not planned for residential use, although unrestricted site use would not preclude future use for this potential exposure pathway. If residential use were to occur, potential exposure could occur through dermal contact, ingestion, or inhalation of soil vapors migrating into buildings.

Ecological receptors may also be exposed to affected Site media. Potential ecological receptors include:

- **Benthic/epibenthic organisms.** Benthic or epibenthic organisms affected by sediment recontamination resulting from groundwater discharge to sediment.
- **Aquatic species.** Fish species potentially use marine surface water that is potentially affected by Site groundwater discharge.
- **Terrestrial plants and animals.** Future land use at the Site is anticipated to be limited to industrial and commercial uses. Existing and future development will cover the Site's ground surface with buildings and pavement, which preclude contact of terrestrial plants and animals with contaminated soil. As a result, the Site qualifies for an exclusion under WAC 173-340-7491(1)(c)(i) because there is less than 1.5 acres of contiguous undeveloped land within 500 ft of the Site. Therefore a terrestrial ecological evaluation is not required and terrestrial plants and animals are not considered potential receptors for the Site.

5.3 SCREENING LEVELS

Site screening levels were developed for groundwater and soil based on the preceding evaluation of potential exposure pathways and receptors, and MTCA regulations. Site screening levels are presented below by media. As previously mentioned, sediment cleanup levels were developed for the interim action and are discussed in Section 3.4.1.

5.3.1 SURFACE WATER

Surface water screening levels were not developed for the Site because surface water is not considered an affected media for the Site, and because the groundwater screening levels developed in Section 5.3.2 are protective of surface water. As such, the groundwater screening levels can be applied to surface water for the evaluation of RI surface water quality data, as necessary.

5.3.2 GROUNDWATER

As discussed in Section 5.1, Site groundwater is considered non-potable. As a result, groundwater screening levels were developed based on groundwater discharge to adjacent marine surface water using the applicable surface water cleanup levels identified in WAC 173-340-730(3), or calculated porewater concentrations protective of marine sediment utilizing the SQSs (WAC 173-204-320). MTCA Method B standard formula values protective of consumption of shellfish and fish by humans were used unless more stringent cleanup level criteria protective of human consumption of fish or aquatic life were available under the following state and federal laws: National Toxics Rule (40 CFR 131.36), National Recommended Water Quality Criteria (EPA 2006), and Chapter 173-201A WAC. The applicable regulatory criteria and the selected Site surface water screening levels are presented in Table 6. Because surface water quality criteria for TPH has not been developed, MTCA Method A cleanup levels for groundwater were used for these constituents, as provided for in WAC 173-340-730(3)(b)(iii)(C).

The groundwater screening levels developed above consider protection of sediment recontamination by applying the SMS SQS criteria, the most stringent standards protective of benthic organisms. Ecology has identified three additional potential sediment exposure pathways that should be considered regarding sediment recontamination potential: (1) human seafood consumption, (2) human direct contact with sediment, and (3) higher trophic level organism (seals, birds) consuming seafood. The first and third additional pathways are associated with hazardous substances that have the potential to bioaccumulate. The only PBT that has been detected in Site groundwater is arsenic. As presented in Table 6, the state-wide natural background concentration of arsenic is identified as the applicable groundwater screening level, which is an appropriate screening level for PBTs, including arsenic.

The most stringent criteria protective of surface water and/or sediment, adjusted to the PQL or background concentrations, if appropriate, were identified as the groundwater screening levels. The potentially applicable regulatory criteria and the selected Site groundwater screening level are presented in Table 6.

5.3.3 SOIL

MTCA Method B standard formula values protective of direct human contact developed in accordance with WAC 173-340-740(3) and MTCA soil concentrations protective of groundwater quality calculated using the fixed parameter three-phase partitioning model in accordance with WAC 13-340-747(4), were identified as potential screening levels for soil. In the event that a particular constituent did not have an associated MTCA Method B screening value, MTCA Method A soil cleanup levels for unrestricted site use were used as soil screening levels for these constituents. MTCA Method A unrestricted land use criteria were used to establish screening levels for TPH compounds, and to evaluate the most stringent screening level for arsenic, lead, and mercury.

The most stringent of the above criteria applicable to soil cleanup levels, adjusted for soil background concentrations or the PQL, as appropriate, were identified as soil screening levels for the Site. The potentially applicable criteria and selected soil screening levels are presented in Table 7.

6.0 NATURE AND EXTENT OF CONTAMINATION

This section describes Site environmental conditions including soil, groundwater, marine sediment, surface water, and air quality. Site upland environmental conditions were evaluated based on analytical results for soil and groundwater samples generated during the RI and pre-RI investigations. Site sediment environmental conditions are based on analytical results from the 2009 interim action compliance monitoring event because the data collected during this monitoring event represents current Site sediment quality.

Soil and groundwater screening levels for VOCs, including gasoline-range petroleum hydrocarbons, address the vapor migration pathway. So, although the vapor migration pathway is not addressed as a separate media, the potential threat to human health and the environment associated with the vapor migration pathway is adequately addressed for the Site.

Analytical data were evaluated for data quality prior to use. Data validation for pre-RI investigations are described in those documents (Landau Associates 1993, 1998, 2001b, 2001c, 2001d). Data quality evaluations for the upland remedial assessment and the RI upland investigations were conducted in accordance with the procedures identified in the Upland RI Work Plan (Landau Associates 2002) and the Supplemental RI Work Plan (Landau Associates 2006a), respectively. Data quality evaluations for the marine sediment compliance monitoring were conducted in accordance with the procedures identified in the Interim Action Compliance Monitoring Plan (Landau Associates 2003) and the 2009 Sampling and Analysis Plan (Landau Associates 2009b).

Environmental conditions for soil are presented using base maps that show Site features at the time of sample collection. As a result, the base maps for soil conditions predate the improvements made as part of the redevelopment for the Port's current tenant. However, current Site features (as presented on Figure 3) are illustrated on the base maps presenting groundwater and marine sediment conditions.

6.1 CONSTITUENTS OF POTENTIAL CONCERN

Investigation activities have identified six areas of the Site where one or more samples exceeded Site soil, groundwater, and/or marine sediment screening levels. These affected areas, the media that contained the exceedance, and the COCs in each affected area are summarized below:

Affected Area	Impacted Media	COC
Former Gasoline UST Area	Soil and Groundwater	Gasoline-Range Petroleum Hydrocarbons, BTEX
Catch Basin No. 2 Area	Soil	Diesel-Range Petroleum Hydrocarbons
North and South Work Yards	Soil	Metals (Copper, Mercury, Nickel, and Zinc)
	Groundwater	Metals (Copper, Nickel, and Zinc)
Northeast Work Yard (Former Sandblast Area)	Soil	Metals (Copper, Lead, Mercury, Zinc)
DA-101/102 Area	Soil	VOCs (Trichloroethene)
Marine Area	Marine sediment	Metals (Mercury and Zinc), Acenaphthene, Flourene, Phenanthrene, Fluoranthene, and Dibenzofuran

It should be noted that TBT and other hazardous substances were marine sediment COCs prior to implementation of the marine sediment interim action. However, the constituents listed above were the only COCs remaining based on sediment compliance monitoring data collected following completion of the interim action. No sediment COCs were detected above the sediment screening levels in the most recent (i.e., 2009) round of sediment quality monitoring (see Section 3.4).

6.2 SOIL QUALITY

Soil quality data for constituents detected in soil during pre-RI and RI investigations are presented and compared to the soil screening levels in Table 8. Analytical results for the constituents tested for are presented in Appendix G. Analytical laboratory reports are maintained in Landau Associates' project files.

The soil analytical program included the following:

- 10 soil samples were tested for TPH-HCID
- 33 samples for NWTPH-G
- 18 samples for BTEX
- 13 samples for NWTPH-Dx
- 6 samples for VOCs
- 3 samples for PAHs
- 30 samples for priority pollutant metals.

Of the 30 samples tested for priority pollutant metals, 4 were composite samples that included soil from a total of 14 locations. The distribution of soil testing is shown on Figure 19, including sample locations that were composited.

Based on the analytical results for these tests, one or more samples exceeded the soil screening levels for gasoline-range TPH (TPH-G), BTEX, diesel-range TPH (TPH-D), trichloroethene (TCE), copper, lead, mercury, nickel, and zinc. The analytical results for TPH-G are shown on Figure 20; TPH-G concentration contours are based on orders-of-magnitude of the 30 mg/kg screening level. The analytical results for benzene are shown on Figure 21, the analytical results for TPH-D and cPAHs are shown on Figure 22, and the analytical results for metals are presented on Figures 23 and 24.

Based on these data, soil quality at the Site was impacted by Site activities in five locations: the Former Gasoline UST Area, Catch Basin No. 2, the Northeast Work Yard (former sandblast area) east of Building 1, the DA-101 and DA-102 Area in the northwest corner of the Dry Storage Yard, and the North and the South Work Yards. These affected soil areas are discussed below.

6.2.1 FORMER GASOLINE UST AREA

Soil quality in the vicinity of the former gasoline UST was impacted as a result of leaking or overfilling from the gasoline UST, and probably from the piping between the tank and the dispenser island. The following sections discuss exceedances of the soil screening levels for gasoline-range petroleum hydrocarbons, BTEX, and metals. Based on the use of paint and paint-related solvents in the construction, repair, and maintenance of boats, VOCs were likely used at the Site during historical operations. Potential former use of VOCs in the building is supported by the presence of chlorinated solvents at the DA-101/102 Area due to the former accumulation of wastes at that location. VOCs can be transported through the subsurface via soil vapor or groundwater migration similar to petroleum hydrocarbons. VOC soil vapor and groundwater contamination and migration could occur if significant releases of VOCs associated with historical boatyard activities occurred. Only low concentrations of a limited number of VOCs unrelated to gasoline-range petroleum hydrocarbons have been detected in Site soil and/or groundwater sampled away from the buildings, but VOCs have not been sampled beneath the building.

6.2.1.1 Gasoline-Range Petroleum Hydrocarbons

Concentrations of gasoline-range petroleum hydrocarbons were above soil screening levels in soil samples from SB-8, SB-25, MW-5, UST B, DI-1, SB-35 through SB-40, SB-42, SB-43, SB-53 through SB-55, SB-57, SB-59, SB-61, SB-63, SB-65, SB-66 (a duplicate of sample SB-65), and SB-67, as shown on Figure 20. Additionally, field observations indicated gasoline-range petroleum hydrocarbon contamination in Borings SB-25 though SB-29, SB-31, SB-32, SB-35 through SB-39, SB-42, SB-43, and SB-61. The highest concentration of gasoline-range petroleum hydrocarbons was detected at boring SB-55 (15,000 mg/kg). This boring is located along the southern side of Building 1.

The gasoline-range petroleum hydrocarbon contamination was generally limited to the capillary zone and associated smear zone resulting from groundwater level fluctuations, and a layer of loose, black apparent coal material observed beneath Building 1 at a depth of about 8 to 10 ft BGS. As shown on Figure 20, the distribution of gasoline-range petroleum hydrocarbon contamination to the south of the former UST largely mirrors the areal distribution of the apparent coal lens underlying the Buildings 1 and 2. The coal lens in the petroleum-affected area consists primarily of coarse sand and gravel-sized material, and represents a higher permeability zone that appears to influence the distribution of petroleum hydrocarbon contamination in this area. Gasoline-range petroleum hydrocarbon contamination was also present in shallow soil at the dispenser island.

The extent of gasoline-range petroleum hydrocarbon soil contamination is best illustrated by the extent of TPH-G contamination and the area over which gasoline-like odors were observed during drilling, both shown on Figure 20. The extent of gasoline-range petroleum hydrocarbon contamination is not closely bounded to the north, south, and east, so contamination could extend to the eastern limits of Building 1, beneath Squalicum Way and underneath at least the western portion of Building 3.

As illustrated by these data, the extent of TPH-G soil contamination extends a significant distance upgradient and cross gradient to the location of the former UST. This distribution of TPH-G soil contamination is interpreted to result from the following factors:

- Leakage from the gasoline conveyance lines and the pump island likely released gasoline-range petroleum hydrocarbons upgradient of the former UST location.
- A higher hydraulic conductivity zone containing apparent coal media was encountered at locations where gasoline-range petroleum hydrocarbon contamination was encountered to the south and east of the former UST location, providing a migration pathway in directions other than downgradient from the source.
- Gradient reversals caused by high tides likely caused gasoline free product to migrate laterally and upgradient to the direction of average groundwater flow, particularly within higher permeability zones such as the lens containing apparent coal media present in the affected area.

6.2.1.2 BTEX

Fifteen samples [SB-25, SB-30, SB-32, SB-53, SB-54, SB-55, SB-57, SB-59, SB-61, SB-63, SB-64, SB-65, SB-66 (a duplicate of sample SB-65), SB-67, and MW-5] contained benzene, ethylbenzene, o-xylene, and/or total xylenes at concentrations above the soil screening levels. Benzene soil quality results are shown on Figure 21. Benzene was not tested for as extensively as gasoline-range petroleum hydrocarbons, and as a result, the extent of benzene soil contamination is not as well delineated. However, it is likely that the extent of benzene soil contamination is similar to the extent of gasoline-range petroleum hydrocarbon contamination because both COPCs have relatively low screening levels and benzene is directly associated with the gasoline release.

6.2.1.3 Metals

The only exceedances of the soil screening level for metals in the former UST area were copper exceedances at locations UST-A and UST-B, as shown on Figure 23. The UST-B sample was collected from the septic holding tank excavation bottom, which was originally thought to be a second petroleum UST. The copper concentrations at these locations were 41.2 and 55.6 mg/kg, respectively, which slightly exceed the copper screening level of 36 mg/kg.

6.2.2 CATCH BASIN NO. 2 AREA

Soil quality in the vicinity of Catch Basin No. 2 is impacted as a result of the releases from the catch basin prior to the Port replacing the open-bottom catch basin with a Type II catch basin, as discussed in Section 4.1.5. A soil sample (i.e., CB-2) collected from the base of the former catch basin following sediment removal was tested for diesel- and oil-range petroleum hydrocarbons, heavy metals, and VOCs. A soil sample was also collected from the boring for monitoring well MW-9, located about 10 ft downgradient from Catch Basin No. 2, and was tested for petroleum hydrocarbons in the diesel- and oil-ranges, and PAHs. The samples did not exceed the soil screening levels for any VOC or PAH compounds. The results for petroleum hydrocarbon and metals analyses are discussed below.

6.2.2.1 Petroleum Hydrocarbons

The total petroleum hydrocarbon (combined diesel-range and residual-range) concentration in the soil sample collected from the base of Catch Basin No. 2 (i.e., sample CB-2) of 4,100 mg/kg exceeded the soil screening level of 2,000 mg/kg, as shown on Figure 22. Soil collected from the boring for MW-9, located about 10 ft downgradient of Catch Basin No. 2, contained petroleum hydrocarbons in the diesel- and oil-ranges, although the total concentration was below the soil screening level.

Based on these results, affected soil above the soil screening level for diesel-range petroleum hydrocarbons is limited to the immediate vicinity of Catch Basin No. 2.

6.2.2.2 Metals

The soil sample collected from Catch Basin No. 2 contained copper at a concentration of 186 mg/kg and mercury at a concentration of 0.29 mg/kg, which exceeded the soil screening levels of 36 mg/kg and 0.07 mg/kg, respectively, as shown on Figure 23. No other metals exceeded their soil screening levels in sample CB-2.

6.2.3 NORTHEAST WORK YARD

Of the nine sample locations in the Northeast Work Yard, soil samples collected from SB-20, SB-44, SB-45, SB-47, SB-48, SB-50, and SB-51 contained copper, lead, mercury, and/or zinc above the soil screening levels, as shown on Figure 24. Elevated metals concentrations at this location likely result from boat maintenance activities, including sand blasting, that occurred prior to the area being paved.

Samples were collected in one foot depth increments in the borings in this area to a maximum depth of 3 ft, except SB-20 (collected between 0.4 and 1.7 ft BGS). The soil sample from SB-20 was collected during the Phase II ESA and surface soil was the only sampling interval planned for this location. Boring SB-51 could only be advanced to a depth of 1 ft due to encountering refusal at that depth.

Soil metals concentrations generally decreased with depth and soil screening levels for the constituents were achieved within the 3 ft BGS, except at borings SB-44 and SB-47. At boring SB-44 copper, lead, mercury, and zinc exceeded the soil screening levels in the 0- to 1-ft interval and only copper exceeded the soil screening level in the 1- to 2-ft interval. At SB-47 the copper screening level was exceeded down to the 2- to 3-ft interval.

6.2.4 NORTH AND SOUTH WORK YARDS

Soil quality in shallow soil samples collected in the North and South Work Yards exhibited concentrations of copper, mercury, nickel, and/or zinc above the soil screening levels, as shown on Figure 23. The soil screening levels are based on protection of surface water; however, no soil concentrations exceeded the Method B cleanup level for unrestricted Site use for these metals based on direct contact. Concentrations for these metals were the highest in the vicinity of the former marine railway well area and travel lift, which is consistent with where the heaviest boat maintenance activities occurred during the previous tenant's operations. It should be noted that soil quality on the North and South Work Yards relied heavily on analysis of composite samples, so concentrations at some of the individual boring locations used to create the composite samples could be higher than indicated by the composite sample results.

6.2.5 DA-101/102 AREA

Soil quality in shallow soil samples collected in the northwest corner of the Dry Storage Yard exhibited concentrations of TCE that exceeded the soil screening level. The soil samples from DA-101 and DA-102 were collected from 0.75 ft BGS from an area where a number of drums containing waste fluids from boat maintenance activities were stored by the former tenant prior to being disposed of by the Port. The soil samples were tested for VOCs, SVOCs, petroleum hydrocarbons, and polychlorinated biphenyls (PCBs). TCE was the only analyte that exceeded its screening level, combined diesel and oil-range petroleum hydrocarbons were detected at low concentrations (less than 100 mg/kg), and neither PCBs or SVOCs were detected above the laboratory reporting limits.

The detected TCE soil concentrations were 0.0094 mg/kg and 0.015 mg/kg at DA-101 and DA-102, respectively, compared to a screening level of 0.005 mg/kg based on protection of groundwater. The screening level based on direct contact is 11 mg/kg, which is over 700 times greater than the highest detected concentration. However, deeper samples often contain greater concentrations of VOCs due to their volatile nature and the greater potential for air exchange in soil near the surface. Deeper soil samples were not tested for VOCs because the detected concentrations were well below the screening levels being used at the time of the investigation (2000). However, deeper samples were tested for petroleum hydrocarbons in the diesel-extended range and concentrations were either less than or similar to the shallower soil results.

VOCs were tested for in groundwater samples collected from 13 locations, including locations downgradient from the DA-101/102 area, and TCE or potential TCE daughter products [i.e., 1,1-dichloroethene (DCE), vinyl chloride] were not detected in any of the samples tested, including samples collected from MW-1 and MW-9, which are located in the vicinity of the DA-101/102 area.

6.3 GROUNDWATER QUALITY

Groundwater quality data and screening levels for constituents detected in groundwater are presented in Table 9. Analytical results for the constituents tested for are presented in Appendix H. Analytical laboratory reports are maintained in Landau Associates' project files.

Groundwater quality was evaluated based on samples collected from 9 temporary direct-push locations (SB-5, SB-8, SB-10, SB-16, SB-19, SB-24, SB-30, SB-68, and SB-69), 12 monitoring wells, and 2 samples collected from the weep hole discharge from the bulkhead. The groundwater analytical program included the following:

- 1 groundwater sample (SB-24) was tested for petroleum hydrocarbon identification using Method TPH-HCID
- 23 samples from 13 locations were tested for gasoline-range petroleum hydrocarbons using method NWTPH-G
- 15 samples from 10 locations were tested for BTEX
- 3 samples from 1 location (MW-9) were tested for diesel- and oil-range petroleum hydrocarbons using Method NWTPH-Dx
- 12 samples from 12 locations were tested for VOCs
- 1 sample (MW-9) was tested for PAHs
- 32 samples from 14 locations were tested for dissolved metals, and

- 13 samples from 9 locations were tested for lead only.

Additionally, 16 samples from 9 locations were tested for conventional parameters to evaluate the extent to which natural attenuation is occurring in the vicinity of the former gasoline UST. The distribution of groundwater sample testing is illustrated on Figure 25.

Groundwater screening levels were exceeded in the vicinity of the former UST and in the vicinity of the bulkhead, as discussed in the following sections. The only other constituents detected in groundwater were:

- Arsenic, antimony, lead, selenium, and zinc were detected below the groundwater screening levels at multiple locations
- A single detection of 1,1,1-trichloroethane at SB-19 at a concentration of 5 µg/l, which is well below the groundwater screening level of 11,000 µg/l
- A single detection of naphthalene, 2,-methylnapthalene, and 1-methynapthalene at MW-9 at a combined total concentration of 1.02 µg/l, well below the naphthalene groundwater screening level of 83 µg/l.

The groundwater quality results are discussed in the following sections.

6.3.1 FORMER GASOLINE UST AREA

Groundwater quality in the vicinity of the former gasoline UST is impacted by releases from the former UST, the associated piping, and the pump dispenser. Source area groundwater quality samples were collected from monitoring well MW-5 and soil boring SB-8. Concentrations of gasoline-range petroleum hydrocarbons, benzene, and o-xylene in the groundwater sample from MW-5 were above the groundwater screening levels. The analytical results for TPH-G and BTEX are shown on Figure 26. As noted previously, VOCs were likely used at the Site during historical operations, but VOCs have not been sampled for in soil or groundwater beneath the building. In addition, gasoline often contained lead in mixtures commonly used in the past; however potential lead concentrations have not been fully evaluated within the former gasoline UST area. Potential lead and VOC concentrations in groundwater will be further evaluated during remedial design for the final cleanup action.

Groundwater quality data collected downgradient of the former gasoline UST indicate that the release to groundwater is limited to the vicinity of the former gasoline UST. Gasoline-range petroleum hydrocarbons and BTEX were not detected in groundwater samples collected from SB-30, MW-3, MW-4, MW-6, MW-7, and MW-8, and BTEX were not detected in the sample collected from boring SB-5, all of which are hydraulically downgradient of the former gasoline UST. Groundwater data from the Site indicates that gasoline-impacted groundwater is not migrating a significant distance from the former UST location toward Bellingham Bay.

A measurable thickness of floating gasoline free product was not observed in any Site wells although sheens were observed below the water table in SB-8, MW-5, and MW-6 during drilling. The available data do not indicate the presence of free-phase non-aqueous phase liquid (NAPL); however, wells are not present within the portion of the source area underlying the buildings to evaluate its potential presence. The potential presence, and if present, the extent of free-phase NAPL at the Site will be further evaluated during remedial design of the selected remedy.

A number of conventional parameters, including dissolved oxygen (DO), ferrous iron, and nitrate were tested for in groundwater samples collected from MW-1 (upgradient well), MW-5 (source area well), and MW-3 and MW-6 (downgradient wells) to evaluate the extent to which natural attenuation was occurring in the vicinity of the former gasoline UST release. Natural attenuation parameter results are shown on Figure 27 for the former UST area and North and South Work Yards. Analytical results indicate that background concentrations for these parameters measured at MW-1 are characterized by low concentrations of ferrous iron, and low to moderate concentrations of DO and nitrate. In the source area evaluated at MW-5, the concentration of ferrous iron is about 50 times greater than the background concentration, and DO and nitrate are below reporting limits. At the first downgradient well (MW-6), the ferrous iron concentration has declined, nitrate has increased, and DO is still below reporting limits. In the furthest downgradient well (MW-3), ferrous iron is below reporting limits, and nitrate and DO have increased to background concentrations.

These results indicate that natural attenuation is occurring through biological processes, which utilize the available DO and nitrate as electron acceptors in the process of aerobic degradation of petroleum hydrocarbons in the vicinity of the gasoline release. However, Ecology guidance (Ecology 2005) requires four quarters of monitoring for natural attenuation parameters to confirm that natural attenuation is occurring, so additional groundwater quality monitoring will be required during remedial design to confirm that these preliminary results of monitored natural attenuation (MNA) is considered as part of the cleanup action for the Site.

6.3.2 NORTH AND SOUTH WORK YARD AREA

Copper, nickel, and zinc exceeded the groundwater screening level in samples collected from monitoring wells MW-3, MW-4, MW-10, MW-11, and MW-12 located within the North and South Work Yard Area, as shown on Figure 28. Only copper exceeded the preliminary groundwater cleanup level in samples collected from monitoring well MW-7, and only nickel exceeded its preliminary groundwater cleanup level in the groundwater sample collected from SB-5. Except for the exceedance of nickel in SB-5, located about 90 ft from the galvanized steel bulkhead, copper, nickel, and zinc were not exceeded in any of the monitoring wells located more than about 45 ft from the shoreline.

The probable primary source of the elevated metals concentrations in groundwater near the shoreline is dissolution (corrosion) of the galvanized coating on the bulkhead and tieback anchors that were installed during redevelopment of the Site in 2003/2004. Dissolution of the galvanized coating is considered the most probable source of elevated metals concentrations, with the possible exception of copper (as discussed below), for the following reasons:

- Zinc, which exhibits the highest concentrations of the metals present in Site groundwater, is the primary constituent of galvanized coatings.
- Nickel is often added to the galvanized coating to suppress the reactivity of silicon and phosphorus in the steel.
- Groundwater specific conductance data indicate groundwater in the vicinity of the bulkhead and associated tie back anchors is a mixture of groundwater and marine water, and is highly corrosive.
- The ground surface over the majority of the metals-affected groundwater area is paved, reducing surface water infiltration through affected shallow soil, and reducing the potential pathway for groundwater to be impacted by historical releases associated with boat maintenance activities to the ground surface.

Groundwater quality in the bulkhead vicinity is discussed further in the following sections, by constituent.

The amount of groundwater quality data in the Northeast and South Work Yards is limited and relies heavily on groundwater samples collected from temporary borings rather than monitoring wells. As a result, there is some potential that available data are not fully representative of groundwater quality, and groundwater could be affected by dissolved metals that leached from affected shallow soil.

6.3.2.1 Copper

The concentrations of copper in groundwater samples that exceeded the groundwater screening level ranged between 3 µg/l to a maximum of 35 µg/l in MW-11, which is about 14 times the screening level for copper of 2.4 µg/l. The copper concentration in the two groundwater samples collected from the bulkhead weep hole that is the only known location of significant groundwater discharge to surface water ranged between 4.1 µg/l to 6 µg/l, which is above the screening level of 2.4 µg/l. The copper concentration measured in the two surface water samples collected from Bellingham Bay ranged from undetected (less than 2 µg/l) to 6 µg/l, which is in the same range as the weep hole groundwater concentrations.

The results of the surface water sampling indicate that surface water quality could be affecting copper groundwater quality in the vicinity of the shoreline. The detected concentrations of dissolved copper in surface water do not appear to be attributable to Site releases because surface water and groundwater concentrations are similar, and may be the result of anti-fouling paints present on boat hulls in the marina. A 2007 study conducted by Ecology documented similar to higher levels of dissolved copper at two Puget Sound marinas located in the Anacortes, Washington area resulting from anti-fouling paint. Inner marina concentrations for dissolved copper ranged between 3.3 µg/L to 12 µg/L at Cap Sante Marina and ranged from 4.7 µg/L to 7.2 µg/L at Skyline Marina as compared to a background concentration of 0.42 µg/L (Ecology 2007). Dissolved copper concentrations were generally progressively lower moving from the inner marina toward the marina entrance.

The detected concentrations of dissolved copper within the Anacortes marinas were attributed by the Ecology report to anti-fouling paints commonly applied to boat hulls (Ecology 2007). Senate Bill 5436, which was signed into law in May 2011 and became effective in July 2011, prohibits the sale of new recreational water vessels with antifouling paint containing copper after January 1, 2018. The bill also prohibits the sale of copper antifouling paint intended for use on recreational water vessels after January 1, 2020. These measures are expected to reduce concentrations of dissolved copper and improve surface water quality in Washington State marinas over time.

Based on these considerations, the elevated copper concentrations in the weep hole sample may be the result of background conditions in surface water intermixing with groundwater near the shoreline. However, based on the proximity of the copper groundwater exceedances to the bulkhead and its associated galvanized tie back anchors, it is also possible that elevated copper groundwater concentrations partially result from corrosion of the galvanized coating on the bulkhead.

6.3.2.2 Nickel

The concentrations of nickel in groundwater samples that exceeded the groundwater screening level ranged from 9.1 µg/l to a maximum of 37 µg/l in MW-10, which is about 4 times the screening level of 8.2 µg/l. The nickel concentration in the two groundwater samples collected from the bulkhead weep hole ranged from 4.8 µg/l. to 7.0 µg/l, and the nickel concentration in the two surface water samples ranged from 6.0 µg/l. to 10 µg/l, indicating that the nickel concentration discharging to surface water is consistent with background surface water nickel concentrations.

6.3.2.3 Zinc

The concentration of zinc in groundwater samples that exceeded the groundwater screening level ranged from 82 µg/l to a maximum of 280 µg/l in MW-12, which is about 3 times the screening level of 81 µg/l. The zinc concentrations in the two groundwater samples collected from the bulkhead weep hole ranged from 49 µg/l to 60 µg/l, and the zinc concentrations in the two surface water samples ranged from undetected (less than 10 µg/l) to 9.0 µg/l. Zinc concentrations in groundwater upgradient and more distant from the bulkhead were significantly lower, as is reflected in Figure 29, which presents dissolved zinc concentrations in groundwater with distance from the shoreline. Similar concentration trends with distance from the shoreline were also observed in nickel and copper data.

6.3.2.4 Summary

The groundwater results for nickel and zinc are consistent with the conceptual model of significant groundwater/surface water mixing immediately prior to groundwater discharge to surface water, which results in significant reductions in zinc and nickel concentrations at the point of groundwater discharge to surface water. The copper results are consistent with this conceptual model if the copper concentration measured in the weep hole sample primarily results from background surface water quality conditions, which is supported by the surface water quality data and the Anacortes marina study conducted by Ecology (Ecology 2007).

Based on these conditions, elevated metals concentrations in the vicinity of the shoreline may result from a combination of corrosion of the bulkhead structure and surface water background concentrations of copper. However, the amount of groundwater quality data in the Northeast and South Work Yards is limited and relies on groundwater samples collected from temporary borings rather than monitoring wells. As a result, the potential exists that available data are not fully representative of groundwater quality and groundwater could be affected by dissolved metals that leached from affected shallow soil. Groundwater quality will be further evaluated during remedial design, as necessary, to support design of the selected remedy.

6.4 MARINE SEDIMENT QUALITY

Site marine sediment quality within the Marine Area is evaluated based on the analytical results from the 2009 compliance monitoring event. The 2009 marine sediment quality data in conjunction with the marine sediment cleanup levels are presented in Table 10.

Analytical results for the 2004 post-interim action performance monitoring event are not presented because they do not represent current sediment quality conditions. Tabulated analytical results for the 2004 performance monitoring event are provided in Appendix F. Results for pre-interim action marine sediment samples are also summarized in tabular format in Appendix D. Analytical laboratory reports are maintained in Landau Associates' project files.

As discussed in Section 3.4.2, the purpose for collecting and analyzing the 2009 sediment confirmational samples was to evaluate surface sediment quality in the Marine Area following five years of natural recovery after completion of the sediment interim action. The nine marine surface sediment samples were analyzed for the COCs identified following completion of the marine sediment interim action (i.e., mercury, zinc, acenaphthene, flourene, phenanthrene, fluoranthene, and dibenzofuran). The analytical results were compared to the SQS numeric benthic criteria (see Table 10). The concentrations for acenaphthene, flourene, phenanthrene, fluoranthene, and dibenzofuran were organic carbon normalized for comparison to the SQS criteria. As shown in Table 10, mercury, zinc, and two or more of the SVOCs were detected in each sample. However, none of the concentrations exceeded the SQS numeric benthic criteria. Reporting limits for the non-detected constituents were also below the SQS numeric benthic criteria.

Based on the results of the 2009 marine sediment compliance monitoring, it is concluded that the sediment screening levels (see Section 3.4) have been achieved by the marine sediment interim action in conjunction with subsequent natural recovery. Natural recovery processes are discussed in Section 7.2.3.

6.5 SURFACE WATER

As discussed in Section 3.3, surface water quality samples were collected from Bellingham Bay during December 2006 and February 2007 RI sampling events and tested for dissolved metals and conventional parameters. Surface water quality data are presented in Table 12. Copper and nickel exceeded the groundwater screening levels in the December 2006 surface water sample. The concentrations of copper and nickel measured in the surface water samples were similar to the concentrations measured in bulkhead weep hole samples. The zinc concentrations measured in the surface water samples were significantly lower than the weep hole samples, although zinc concentrations were below the screening level in both weep hole and surface water samples. The surface water quality samples were collected at distance from the Site and other upland areas, and as such, the measured concentrations of copper and nickel appear to represent background surface water quality conditions, as discussed in Section 6.3.2.

7.0 CONTAMINANT FATE AND TRANSPORT

This section addresses contaminant fate and transport processes, including source control and transport/attenuation processes. The discussion in this section is focused on general fate and transport processes associated with affected media. Discussion of Site-specific contaminants and sources, and contaminant fate and transport are presented in Section 8.0.

7.1 SOURCE CONTROL

Source control addresses the elimination of releases from Site operations that resulted in contamination of affected media. Source control for each affected area identified in Section 6.1 is discussed in the following sections.

7.1.1 FORMER GASOLINE UST AREA

The UST, associated piping, and dispenser island that represent the original source of the gasoline-range petroleum hydrocarbon contamination present at the Site was removed in 1993. As a result, an ongoing release of gasoline contamination to the Site is not occurring.

Although free-phase NAPL has not been detected in Site monitoring wells, residual NAPL and elevated soil concentrations remain within the smear zone located near the water table. Residual NAPL can release gasoline-range petroleum hydrocarbon contamination to groundwater and soil gas for many years, and as such, represents an ongoing source of contamination.

7.1.2 CATCH BASIN NO. 2 AREA

Source control for the Catch Basin No. 2 Area was implemented in 2001 and 2002. Accumulated sediment was removed from the open-bottom catch basin in 2001. Analytical results for a soil sample collected from the base of the catch basin following removal of the accumulated sediment indicated that diesel-range petroleum hydrocarbons, copper, and mercury were present in the soil at concentrations exceeding the soil screening levels. In 2002, the open-bottom catch basin was removed and replace with a closed-bottom Type II catch basin to prevent further releases to the subsurface.

7.1.3 NORTH AND SOUTH WORK YARD AREA

The only known contaminant source in the North and South Work Yard Area was surface releases of heavy metals related to historical boat maintenance activities. The South Yard is currently paved and stormwater is actively managed and treated by Seaview Boatyard North under its NPDES permit. The smaller North Work Yard is not paved, but boat maintenance activities conducted in this area use BMPs, including the use of tarps to catch hull scrapings and paint, and vacuum sanders to limit particulate emissions; sheet flow during large storm events from this area flows south in the direction of the closed-loop boatyard waste water treatment system and the bioswale. Based on the extent of paving, active stormwater management/treatment, and application of boatyard BMPs, adequate source control is being applied and ongoing releases that caused existing contamination in this area are no longer occurring.

7.1.4 NORTHEAST WORK YARD AREA

Similar to the South Work Yard, contamination in the Northeast Work Yard likely resulted from historical boat maintenance activities, including sand blasting activities. The area is currently paved, and stormwater is being actively managed. As a result, it is concluded that ongoing releases that caused existing contamination in this area are no longer occurring.

7.1.5 DA-101/102 AREA

Low level TCE soil contamination in the DA-101/102 Area appears to have resulted from releases associated with drums of liquid boat maintenance wastes that were temporarily stored near this location. The drums and associated wastes were removed by the Port in 2001. As a result, ongoing releases in this area are not occurring.

7.1.6 MARINE AREA

The primary source of contamination in the Marine Area was the release of boat maintenance waste and associated stormwater to the former marine railway well. A secondary source appeared to be uncontrolled stormwater and hull cleaning water released in the vicinity of the 30-ton travel lift piers. The marine railway was removed and contaminated soil and marine sediment present in the marine railway well was remediated, during the sediment interim action and Site redevelopment. The current tenant also installed curbing and other stormwater controls to prevent the release of stormwater and hull cleaning water from being discharged to surface water. As previously discussed, the current tenant also installed a zero discharge, closed-loop boatyard wash water treatment system to treat contact water associated with boat hull cleaning and a bioswale to treat stormwater from the South Work Yard. Based on these actions, the releases to the Marina Area that caused Site marine sediment contamination are no longer occurring.

7.2 TRANSPORT AND ATTENUATION PROCESSES

Attenuation and transport processes are generally media and contaminant specific. Site contaminants are limited to heavy metals, VOCs, and petroleum hydrocarbons. Attenuation and transport processes associated with these contaminants are discussed for each affected media in the following section.

7.2.1 SOIL

The transport of heavy metals in soil is limited for most metals. The primary transport mechanism is dissolution from solid to liquid phase through either direct contact with groundwater or via stormwater infiltration through affected soil and unsaturated flow transport to the uppermost groundwater unit. The heavy metals often associated with boat maintenance activities, such as copper, lead, nickel, and zinc, are often in a low solubility form, and when limited to shallow soil above the groundwater table, do not typically result in sufficient dissolution and transport to cause groundwater contamination. Additional transport can occur through anthropogenic activities, such as excavation or grading, which have the potential to relocate contamination to greater depths, unaffected areas, or to offsite locations.

Metals typically attenuate very rapidly in soil. Metals tend to strongly partition to soil, so metal concentrations in soil typically decrease rapidly with distance from the source. This characteristic is evident in Site data which indicate a rapid decrease in concentrations with depth at locations where vertically discrete samples were analyzed.

The transport of petroleum hydrocarbon contamination in soil can occur through multiple mechanisms and multiple phases. The most direct transport mechanism is the migration of NAPL downward through the unsaturated zone until the groundwater table is intersected. Because petroleum hydrocarbon NAPL products are primarily lighter that water [(light non-aqueous phase liquid (LNAPL)], the NAPL tends to migrate on top of the water table surface in the downgradient direction until the driving force for migration (the release) is eliminated. Once in the subsurface, petroleum hydrocarbon NAPL often releases dissolved-phase contamination to groundwater either through direct contact with groundwater or as the result of stormwater infiltration through the affected soil. Petroleum hydrocarbon NAPL and residual petroleum hydrocarbons in groundwater and soil that contain VOCs, such as gasoline and diesel, also release contaminants to soil vapor. The transport of petroleum hydrocarbon soil contamination from soil to soil gas and groundwater can continue for many years if the NAPL source material is not removed.

Petroleum hydrocarbon soil contamination typically attenuates rapidly with distance from the source. The rate of attenuation is typically more rapid for heavier petroleum hydrocarbon products, such as oil, and the least rapid for the lighter fraction products such as gasoline. The difference in attenuation rates results from a combination of factors, including viscosity, solubility, volatility, biological activity, and the cleanup levels that must be achieved. In general, soil cleanup levels are achieved immediately outside an area affected by diesel- or oil-range NAPL contamination, while gasoline-range petroleum hydrocarbon soil contamination can extend further beyond the extent of NAPL, in part because of the physical properties of the petroleum product (e.g., gasoline can migrate farther in the vapor phase), and partially because the screening level for gasoline-range petroleum hydrocarbons is much lower so exceedances extend farther from the source.

7.2.2 GROUNDWATER

The transport of heavy metals in groundwater typically occurs in an aqueous, ionic form, although metals can also migrate in colloidal form. Metals transported in groundwater attenuate with distance from the source, primarily through dispersion and absorption. The rate of metals absorption is affected by pH, oxidation reduction potential (ORP), and in some cases salinity. The factors affecting absorption, and the degree to which absorption occurs, vary greatly with the specific metal.

The transport of petroleum hydrocarbons in groundwater is affected by various processes, including absorption, dispersion, and biological decomposition. These attenuation factors are collectively referred to as natural attenuation, and are most effective in an aerobic (oxygen-rich) environment.

The attenuation of heavy metals and petroleum hydrocarbons is heavily influenced by hydrodynamic dispersion in a tidally-influenced groundwater regime such as that present at the Site. Hydrodynamic dispersion in groundwater subjected to tidal fluctuations is greatly increased due to the mixing of surface water and groundwater in the vicinity of the shoreline. In addition to the direct mixing of groundwater and surface water, the fluctuation of groundwater elevations can cause “tidal pumping” of soil gas in the unsaturated zone. Tidal pumping results in greater air/soil gas exchange and a more oxygen-rich subsurface environment, which in turn supports greater absorption for most metals and greater aerobic decomposition of petroleum hydrocarbons. These enhanced aerobic conditions are evidenced by the natural attenuation data collected in the vicinity of the former UST and presented in Section 6.3.1.

In general, BTEX and VOC compounds possess unique chemical properties that create some variability in fate and transport for of each VOC once released into the environment, particularly to groundwater. However, VOCs are highly susceptible to volatilization and dissolution. As VOC compounds are generally soluble and do not exhibit the tendency for sorption to soil matrices, they can be relatively mobile in groundwater (Patrick 1987). However, naturally-occurring bacteria often degrade BTEX compounds relatively rapidly, and to a lesser degree other VOCs such as chlorinated solvents (EPA 1999).

7.2.3 MARINE SEDIMENT

Transport mechanisms for contaminants in sediment include suspension and redistribution through wave action and bioturbation. Because the Site is located in a quiescent marina protected by a breakwater, there is no exposure to wind-generated wave action. As a result, marine sediment contaminant transport is largely limited to boat wake and prop wash transport disturbance. The limited area over which contaminants were distributed during historical boatyard activities supports the conclusion that suspension and redistribution of marine sediment contamination from boat wake and prop wash disturbance is not a significant transport mechanism.

Vertical redistribution of marine sediment contamination occurs through bioturbation by benthic organisms in conjunction with accumulation of new sediment. Physical observations of the marine sediment in the Marine Area during the 2009 compliance monitoring event show that at least 10 cm of sediment has been deposited within the dredge prism following the interim action. The observations are based on visible contrast between the gravelly sand used to backfill the western portion of the dredge prism during the interim action and the overlying fine-grained sediment at three compliance monitoring locations. Three 2009 compliance monitoring samples, SPM-1-09, SPM-2-09, and SPM-13-09 were collected from the backfill area. At sample locations SPM-1-09 and SPM-2-09, only fine-grained sediment (silt) was encountered in the 12 cm surface sediment samples. At sample location SPM-13-09, silt was observed to a depth of 10 cm and a medium to coarse sand (interim action backfill) was observed below 10 cm.

8.0 CONCEPTUAL SITE MODEL

Historical Site activities, environmental data, and the physical processes that control the fate and transport of contaminants were used to develop the conceptual Site model (CSM). The CSM describes the Site contaminant sources, fate and transport processes, migration pathways, and potential receptors. The CSM includes elements that address releases associated with historical boatyard activities, the former gasoline UST, the marine area (marine sediments), and the bulkhead area discussed below.

8.1 HISTORICAL BOATYARD ACTIVITIES

As discussed in Section 7.1, contamination in the North, South, and Northeast Work Yards; the DA-101/102 Area; and the Catch Basin No. 2 Area, are associated with historical boatyard activities. In shallow soil, contamination is mostly heavy metals and oil-range petroleum hydrocarbons, and available data appear to support the conclusion that surface soil contamination is not causing groundwater contamination. However, the amount of groundwater quality data in the Northeast and South Work Yards is limited. As a result, some potential exists that available data are not fully representative of groundwater quality, and groundwater could be affected by dissolved metals that leached from affected shallow soil.

Because only shallow soil is affected by historical boatyard activities, the primary transport mechanism is stormwater transport via overland flow. However, the Site is entirely paved except for the North Work Yard, so the majority of soil potentially affected from historical boatyard activities is not exposed to stormwater transport. Although the surface of the North Work Yard is unpaved, stormwater rapidly infiltrates and stormwater runoff from this area only occurs during extreme rainfall events; runoff from this area reportedly flows to the south, toward the bioswale. As a result, there is very limited potential for transport of contamination resulting from historical boatyard activities to occur as the result of stormwater transmission. Additionally, heavy metal contamination is not significantly affected by physical, chemical, or biological degradation processes, and will likely remain relatively unchanged from its current form. Oil-range petroleum hydrocarbon contamination can be affected by these degradation processes over an extended period of time, so some reduction in concentrations may occur over a long period of time.

Based on the use of paint and paint-related solvents in the construction, repair, and maintenance of boats, VOCs were likely used at the Site during historical operations. VOCs can be transported through the subsurface via soil vapor or groundwater migration. VOC soil vapor and groundwater contamination and migration could occur if significant releases of VOCs associated with historical boatyard activities occurred, as is discussed on the following section for gasoline-range petroleum hydrocarbons.

Only low concentrations of a limited number of VOCs not related to gasoline-range petroleum hydrocarbons have been detected in Site soil and/or groundwater sampled away from the buildings, but VOCs have not been sampled within the building. VOCs that may have been released within the buildings have similar physical properties as benzene, and as such, have similar transport mechanisms. Therefore, discussion of pathways for benzene in the following paragraphs would apply to other VOCs released in the building, if identified.

Potential receptors that could be exposed to contamination associated with historical boatyard activities include Site workers or public users of the current boatyard that contact contaminated soil, or construction workers that come into contact with contaminated soil during intrusive activities.

Figure 30 illustrates the CSM for upland contaminant releases associated with historical boatyard activities.

8.2 FORMER GASOLINE UST

Contamination associated with releases from the former gasoline UST has affected soil, groundwater, and soil vapor. Residual LNAPL is likely present in the vicinity of the former tank, and is an ongoing source of groundwater and soil vapor contamination. Contamination consists of gasoline-range petroleum hydrocarbons and associated BTEX compounds.

Because only residual LNAPL remains, the extent of LNAPL is not expected to migrate further. Groundwater contamination originating from soil containing residual LNAPL migrates with groundwater flow toward the shoreline to the west. However, natural attenuation, primarily through biodegradation, appears to be occurring and gasoline-range petroleum hydrocarbons, including BTEX, are not above reporting limits within 60 ft of visual and olfactory evidence of contamination. Biodegradation is likely enhanced in the shoreline vicinity by the frequent recharge of atmospheric oxygen to the unsaturated zone caused by “tidal pumping”; tidal pumping results in the displacement and replacement of soil gas in the unsaturated zone through alternating high and low tides.

Due to the volatile nature of gasoline-range petroleum hydrocarbons and associated VOCs, contamination will also migrate via the soil vapor pathway. Soil vapor generally migrates upward, but will also move laterally if it encounters a low permeability barrier to upward migration. Soil vapor ultimately discharges to the atmosphere.

Potential receptors for contamination originating from the former gasoline UST include construction workers that contact contaminated soil, groundwater, or soil vapor during intrusive activities; Site workers or the general public exposed to soil vapors that intrude into Site buildings; and, aquatic organisms that are exposed to affected groundwater that discharges to surface water, although Site data indicate that gasoline-affected groundwater is not reaching surface water.

Figure 30 illustrates the CSM for releases associated with the former gasoline UST.

8.3 MARINE SEDIMENT

Marine sediment Site screening levels based on the SMS SQS were achieved as a result of the sediment interim action conducted for the Site (Table 10). The upland source of marine sediment contamination was eliminated when the marine railway was removed and the new tenant installed a closed-loop wash water collection and treatment system near the shoreline for hull washing operations. Additionally, the sheet pile bulkhead reduces groundwater discharge through marine sediment, which minimizes the potential for groundwater quality to affect sediment quality. Additionally, no hazardous substances were detected in groundwater in the bulkhead vicinity at concentrations that exceed groundwater screening levels protective of marine sediment (Table 6). Based on these considerations, sediment is not considered a media of concern for the Site.

Figure 30 illustrates the CSM for Site marine sediment.

8.4 BULKHEAD AREA

As previously discussed in Section 6.3.2, elevated nickel, zinc, and possibly copper groundwater concentrations in the vicinity of the shoreline appear to result primarily from dissolution (corrosion) of the galvanized protective coating for the steel sheet pile bulkhead and associated tieback anchors rather than from historical boatyard operations. Although they appear to be largely unrelated to Site releases, elevated metal concentrations in groundwater are addressed as constituents of concern for the Site and are shown in the CSM.

The bulkhead galvanized coating contains high concentrations of zinc and lesser concentrations of nickel and possibly copper. The galvanized coating is added to marine steel structures to provide protection against the highly corrosive properties of sea water. The galvanized coating protects the underlying steel and also preferentially corrodes relative to steel, acting as a sacrificial anode. This corrosion process results in metals from the galvanized coating solubilizing into adjacent groundwater, resulting in elevated groundwater concentrations. Corrosion will continue through the life of the bulkhead system, although the concentration of zinc released (as well as nickel and possibly copper) will likely decrease after a number of years as the galvanized coating is depleted.

Groundwater flows from the inland direction to its point-of-discharge to surface water at the shoreline. The galvanized steel bulkhead inhibits and focuses groundwater discharge to surface water. The only known point of measurable Site groundwater discharge to surface water is through a bulkhead weep hole located between the two 30-ton travel lift piers, although minor seepage through other weep holes and wetting at some bulkhead sheet pile joints have also been observed; discharge around the ends of the bulkhead is also possible. Significant mixing of marine surface water and groundwater water occurs within the shallow groundwater unit in the vicinity of the shoreline due to tidally induced hydrodynamic dispersion. Based on available data, hydrodynamic dispersion reduces groundwater concentrations of zinc and nickel to below the screening levels prior to groundwater discharge to surface water; the copper groundwater concentrations are similar to the surface water background concentrations of copper in the marina, so marine surface water appears to be, at least in part, the source of elevated copper concentrations detected in groundwater.

Potential receptors for groundwater are aquatic organisms exposed to groundwater discharged from the bulkhead weep hole(s) and benthic organisms in sediment through which impacted groundwater moves. Because the subject metals do not tend to bioaccumulate at concentrations that would affect higher order aquatic organisms, food chain affects from affected organisms would not be anticipated. Additionally, because the metals concentrations are at or below the screening levels or background concentration (for copper), contact with potential receptors at concentrations of concern would be limited to the immediate vicinity of the location(s) where groundwater discharges to surface water.

8.5 CURRENT SITE ACTIVITIES

The Site is currently occupied by Seaview Marine, operating as Seaview Boatyard North, a company that performs general boat repair activities. Seaview Boatyard North has occupied the Site since 2004 and operates under a NPDES general boatyard permit, as described in Section 4.1.5. Based on available NPDES monitoring data, the primary potential contaminants associated with current operations are copper and zinc, which are problematic for all boatyards and urban stormwater in general. The primary potential transport mechanism is stormwater runoff and discharge to surface water via the current stormwater system. As discussed in Section 4.1.5, Seaview Boatyard North has implemented a number of BMP and stormwater treatment system improvements to address current operations, and current operations will continue to be regulated under the NPDES regulations administered by Ecology.

8.6 RI CONCLUSIONS

In summary, major data gaps that were identified prior to implementation of the RI have been filled and sufficient data are available to develop and evaluate remedial alternatives for the Site. Additional data will be collected during the remedial design process, as necessary, based on the final cleanup action selected by Ecology. Additional investigation will likely include further evaluation of the presence of LNAPL in the vicinity of the Former Gasoline UST Area, evaluation of potential VOC and lead concentrations in groundwater, and assessment of VOC soil gas concentrations, as discussed in subsequent sections of this report.

9.0 CLEANUP REQUIREMENTS

This section identifies regulatory cleanup requirements through the development of preliminary Site cleanup standards and RAOs, and the identification of other potentially applicable laws and regulations.

9.1 CLEANUP STANDARDS

This section develops preliminary Site cleanup standards for chemical constituents that were detected in affected Site media. Cleanup standards consist of 1) cleanup levels defined by regulatory criteria that are adequately protective of human health and the environment and, 2) the point of compliance at which the cleanup levels must be met. The cleanup standards developed in this section are used as the basis for developing media-specific RAOs for the cleanup action.

9.1.1 DEVELOPMENT OF CLEANUP LEVELS

The cleanup levels for affected media will be selected by Ecology and presented in the Site CAP. However, it is necessary to identify PCLs to develop, and evaluate the effectiveness of, cleanup action alternatives for the FS.

Cleanup levels for affected media developed under MTCA represent the concentration of COC that are protective of human health and the environment for identified potential exposure pathways, based on the highest beneficial use (HBU) and the reasonable maximum exposure (RME) for each affected media. The process for developing cleanup levels consists of identifying the HBU and RME for affected media, determining those that represent the greatest risk to human health or the environment, and determining the cleanup levels for the COC in affected media.

PCLs are only developed for Site soil, groundwater, and marine sediment because these are the only media that have been affected by Site releases. However, other media are discussed in this section to provide the reader an understanding of the media considered.

9.1.1.1 Groundwater

Based on the potential exposure pathways established and receptors discussed in Sections 5.1 and 5.2, the HBU for groundwater is considered discharge to surface water (i.e., Bellingham Bay). Based on a groundwater HBU of discharge to Bellingham Bay, the RME for groundwater is the more conservative of 1) uptake by aquatic organisms based on aquatic water quality criteria, or 2) ingestion of affected aquatic organisms by humans. As a result, federal [National Toxics Rule (40 CFR 131.36) and National Recommended Water Quality Criteria (EPA 2006)] and state (MTCA Method B formula values and Chapter 173-201A) surface water criteria, based on human consumption of fish, and federal [National Recommended Water Quality Criteria (EPA 2006)] and state (MTCA Method B formula values and Chapter 173-201A) surface water quality criteria protective of aquatic life, were evaluated as potential cleanup levels for groundwater.

Since TPH do not have surface water criteria and because existing data shows that TPH in groundwater does not extend to surface water, MTCA Method A groundwater cleanup levels were used for these constituents. The groundwater to vapor pathway was also considered for VOCs due to the potential intrusion of soil vapor into Site buildings, as discussed in Section 5.3.1. Potential gasoline-range petroleum hydrocarbon vapor migration was evaluated using equations provided in MTCA and in Ecology's recently issued draft guidance (Ecology 2009). The most stringent of the applicable criteria, adjusted to the PQL or background concentrations, if appropriate, is identified as the Site groundwater PCL.

As shown in Table 13, at least one groundwater sample exceeded the PCL for gasoline-range petroleum hydrocarbons, benzene, o-xylene, copper, nickel, and zinc. As discussed in Section 6.3.2, exceedances of the PCLs for copper, nickel, and zinc occurred within 45 ft of the shoreline and the elevated zinc and nickel concentrations appear to be primarily related to the dissolution (corrosion) of the galvanized steel bulkhead system rather than releases associated with Site activities. The elevated copper concentrations near the shoreline appear to primarily result from copper background concentrations in surface water, but may partially originate from elevated concentrations in groundwater near the shoreline. Regardless of source, copper, nickel, and zinc are carried forward as COCs for Site groundwater, which are summarized in Table 14.

9.1.1.2 Soil

Based on the potential exposure pathways established and receptors discussed in Sections 5.1 and 5.2, the HBU for soil is considered unrestricted site use. Although the Site may meet the criteria for industrial use, the Port does not want to restrict its future options for Site use. Based on a soil HBU of unrestricted site use, the RME for soil is the more conservative of 1) direct ingestion of soil or inhalation of soil vapors, or 2) impacts to surface water and the associated exposures described in the preceding section. The exception to this HBU determination is for soil cleanup levels based on the vapor migration pathway, which is discussed in the following section.

Uptake of constituents in Site soil or groundwater by terrestrial plants and animals is not considered a potential exposure pathway for Site soil. The Site qualifies for an exclusion under 173-340-7491(1)(c)(i) because there is less than 1.5 acres of contiguous undeveloped land within 500 ft of the Site, so a terrestrial ecological evaluation is not required.

Based on an HBU of unrestricted Site use, MTCA Method B standard formula values for direct contact and MTCA soil concentrations for surface water protection, calculated using the 3-phase partitioning model (equation 747-1), were evaluated as potential cleanup values for soil. In the event that a particular constituent did not have an associated MTCA Method B screening value, MTCA Method A soil cleanup levels for unrestricted site use were used as soil screening levels for these constituents. The most stringent of the applicable criteria, adjusted for soil background concentrations or the PQL, as appropriate, is identified as the Site soil PCL.

The soil cleanup value based on protection of surface water was not identified as the soil PCL for constituents that were not detected in any groundwater samples at concentrations exceeding the groundwater PCL as provided for in WAC 173-340-747(3)(f). In these circumstances, direct contact was used as the basis for the soil PCL. This adjustment to the PCL eliminated mercury and TCE as COCs for soil.

As shown in Table 15, at least one sample exceeded one or more applicable criteria for gasoline-range petroleum hydrocarbons, diesel-range petroleum hydrocarbons, BTEX, copper, nickel, lead, and zinc. The identification of diesel-range petroleum hydrocarbons and lead as COCs is based on exceedance of MTCA Method A soil cleanup levels for unrestricted land use. The identification of the remaining constituents as COCs is based on protection of surface water, or on the protection of indoor air quality as discussed in the following section. These constituents are carried forward as COCs for Site soil as summarized in Table 14.

9.1.1.3 Soil Vapor

The soil vapor migration pathway is a pathway of concern whenever VOCs are present in subsurface soil. This pathway is of primary concern at the Site if the current buildings remain. Under current redevelopment scenarios, new buildings would be located at a distance from the source area, which would significantly lessen the threat for this exposure pathway. However, even if the buildings are relocated, soil vapors could migrate significant distances laterally under a low permeability cap and potentially intrude into either the new buildings or other structures located at moderate distances from the source area. As a result, cleanup levels protective of the soil migration pathway must be developed for VOCs present in Site soil regardless of the future development scenario.

The Site is zoned commercial, although the property to the north and east are zoned industrial. As specified in WAC 173-340-745(1)(i), industrial cleanup levels may be appropriate for properties not specifically zoned industrial if the Site use is consistent with "traditional industrial use," and identifies the following characteristics as indicative of industrial use:

- People do not live on the property

- Access to the property by the general public is not generally allowed
- Food is not grown/raised on the property
- Operations are often characterized by use and storage of chemicals, noise, odors, and truck traffic
- The land surface is mostly covered by buildings and paved surfaces, minimizing potential exposure to soil
- Commercial support facilities such as offices and restaurants are primarily intended to serve the industrial facility and not the general public.

Operations at the Site exhibit the characteristics listed above. Nevertheless, the Port does not want to restrict potential future use of the property to industrial activities only, therefore unrestricted site use criteria will be used to address the soil vapor pathway.

9.1.1.4 Marine Sediment

As previously discussed, marine sediment is not considered a Site media of concern because no hazardous substances exceeded the Site screening levels following the interim action and subsequent natural recovery. However, screening levels for sediment COCs identified in Section 6.4 (mercury, zinc, acenaphthene, flourene, phenanthrene, fluoranthene, and dibenzofuran) are carried forward as PCLs for Site marine sediment to document the basis for cleanup of Site sediment, and to provide criteria for comparison of sediment quality data if sediment quality is evaluated during future five year reviews for the Site.

9.1.1.5 Surface Water

Site surface water is not considered a media of concern under present Site conditions, provided cleanup actions developed in Section 10.0 adequately address the discharge of affected groundwater to surface water.

9.1.1.6 Air

Gasoline-affected soil and groundwater in the vicinity of the former UST represent the only Site release with the potential for affecting air quality. As a result, vapor intrusion through building floor slabs is considered the only potential air exposure pathway for the Site. The vapor migration pathway is addressed in the evaluation of appropriate Site soil and groundwater PCLs in Sections 9.1.1.1 and 9.1.1.2 above, and further evaluation of the vapor migration pathway is not needed for the RI/FS. However, additional characterization of soil vapor will be conducted during the remedial design for the final cleanup action.

9.1.2 POINTS OF COMPLIANCE

Under MTCA, the point of compliance is the point or location on the Site where the cleanup levels must be attained. The point(s) of compliance for affected media will be selected by Ecology and presented in the Site CAP. However, it is necessary to identify proposed point(s) of compliance to develop, and evaluate the effectiveness of, cleanup action alternatives in the FS. As a result, the proposed points of compliance for soil, groundwater, air, and marine sediment are identified in this section. The point of compliance for surface water is not discussed because it is not a media of concern based on existing Site conditions.

9.1.2.1 Soil

The point of compliance for soil, as established in WAC 173-340-740(6), is throughout the Site. MTCA recognizes that for those cleanup actions that involve containment of hazardous substances, the soil cleanup levels will typically not be met throughout the Site [WAC 173-340-740(6)(f)]. However, MTCA also recognizes that such cleanup actions may still comply with cleanup standards. The determination of the adequacy of soil cleanup will be based on the remedial action alternative's ability to comply with groundwater cleanup standards for the Site, to meet performance standards designed to minimize human or environmental exposure to affected soil, and to provide practicable treatment of affected soil. Performance standards to minimize human and environmental exposure to affected soil may include institutional controls that limit activities that interfere with the protectiveness of the remedial action. Specific actions are described in the FS, which is presented in subsequent sections of this report.

9.1.2.2 Groundwater

A proposed point of compliance needs to be identified for one of the two areas of the Site exhibiting groundwater concentrations above the proposed cleanup levels. A proposed point of compliance is established below for the former gasoline UST area, which is identified as a Site Unit in Section 10.0 for use in developing and evaluating remedial action alternatives. A point of compliance is also required for metals contamination in groundwater related to the boat maintenance work yards, which is also identified as a Site Unit in Section 10.0. The proposed point of compliance, or monitoring point, for these areas, as applicable, are discussed below.

Former Gasoline UST Area

The point of compliance for groundwater is typically throughout the Site when the HBU is drinking water. However, Ecology may approve a conditional point of compliance as close as practicable to the source, not to exceed the property boundary, if it can be demonstrated that it is not practicable to meet the cleanup level throughout the Site within a reasonable restoration timeframe [WAC 173-340-720(8)(c)]. As such, the point of compliance for groundwater in the former gasoline UST area can vary from throughout the Site to the downgradient property boundary at the bulkhead, depending on the elements of the remedial alternative identified as the most practicable for the area. If the most practicable remedial alternative for the subject area includes removal or treatment of the source area such that groundwater cleanup levels are achieved throughout the affected area within a reasonable restoration timeframe, the groundwater point of compliance will be throughout the Site. However, if the most practicable remedial alternative includes containment/treatment of the source area, a conditional point of compliance may be established as close as practicable to the source area.

Work Yard Area

As discussed in Section 6.3.2, the probable primary source of the elevated zinc and nickel concentrations in groundwater near the shoreline is dissolution (corrosion) of the galvanized coating on the bulkhead and associated tieback anchors that were installed during redevelopment of the Site in 2003/2004, although it is possible that leaching of metals from soil contaminated by boat maintenance activities in the Site work yards may also have contributed to elevated metals concentrations in groundwater. Elevated copper concentrations appear to be related to background surface water concentrations of copper in the marina. Copper is the only metal that has exceeded the groundwater screening levels at the point of groundwater discharge to surface water (the bulkhead weep hole). Based on these considerations, it appears that groundwater cleanup standards for copper, nickel, and zinc can be achieved for the work yard area using a conditional point of compliance at the shoreline, provided background surface water quality for metals is taken into consideration.

9.1.2.3 Air

The point of compliance for air, based on WAC 173-340-750 (6), is ambient air throughout the Site.

9.2 REMEDIAL ACTION OBJECTIVES

RAOs define the goals of the cleanup that must be achieved to adequately protect human health and the environment. RAOs must address all affected media, and a cleanup alternative must achieve all RAOs to be considered a viable cleanup action. RAOs can be either action-specific or media-specific. Action-specific RAOs are based on actions required for environmental protection that are not intended to achieve a specific chemical criterion. Media-specific RAOs incorporate the PCLs developed in Section 9.1. Based on the characterization of Site conditions presented in Section 6.0 and the cleanup standards developed in Section 9.1, the action-specific and media-specific RAOs identified for the Site consist of:

- RAO-1: Prevent direct human contact with soil containing hazardous substances above the direct contact soil cleanup level. .
- RAO-2: Prevent human ingestion of and direct contact with Site groundwater containing COCs above groundwater cleanup levels based on human consumption.
- RAO-3: Prevent the exposure of marine aquatic organisms to hazardous substances at concentrations above the groundwater cleanup levels based on protection of marine surface water.
- RAO-4: Prevent human inhalation of petroleum hydrocarbons and other VOCs.
- RAO-5: Protect marine sediment and associated marine benthic organisms from exposure to hazardous substances above the sediment cleanup levels through sediment recontamination by groundwater or entrained materials in stormwater.

Each of these RAOs can be achieved through treatment (including active treatment and natural attenuation) or removal of the contaminated media (soil and/or groundwater), or by preventing exposure to the contaminated media through containment. Each of the cleanup action alternatives described in Section 12.0 achieves these RAOs and meets all of the MTCA threshold requirements (described in Section 12.3); each alternative is therefore a viable cleanup alternative under MTCA. The degree to which each cleanup action alternative meets the threshold requirements and other requirements listed in WAC 173-340-360(2) will be determined by applying the specific evaluation criteria identified in MTCA (Section 13.1).

9.3 POTENTIALLY APPLICABLE LAWS

In accordance with MTCA, cleanup actions conducted under MTCA shall comply with applicable state and federal laws (WAC 173-340-710(1)). MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements that are relevant and appropriate. Collectively, these requirements are referred to as applicable or relevant and appropriate requirements (ARARs). This section provides a brief overview of potential ARARs for the Site cleanup. The MTCA cleanup regulations (WAC 173-340) and the SMS regulation (WAC 173-204) are considered the governing regulations under which Site cleanup will be conducted, and as such are not considered ARARs. The primary ARARs that may be applicable to the cleanup action include the following:

- Washington Water Pollution Control Act (RCW 90.48) and Water Quality Standards for Surface Waters (Chapter 173-201A WAC)
- Washington Hazardous Waste Management Act (RCW 70.105) and Dangerous Waste Regulations (Chapter 173-303 WAC)

- Federal Clean Water Act (CWA: 33 U.S.C. § 1251) and surface water quality criteria (40 CFR 131, CWA Section 304)
- Shoreline Management Act (SMA; RCW 90.58)
- Washington Clean Air Act, Chapter 70.94 RCW
- State Environmental Policy Act (SEPA; RCW 43.21C and Chapter 197-11 WAC).

State and federal surface water quality criteria are considered in the development of cleanup levels. State Dangerous Waste Regulations may be applicable to contaminated soil removed from the Site during cleanup activities due to contamination characteristics. The SMA may apply to implementation of a particular cleanup action, but does not directly influence the evaluation of the cleanup alternatives. Substantive SEPA requirements will be addressed concurrent with the Site CAP to the degree applicable for the selected cleanup action.

10.0 DESIGNATION OF SITE UNITS

Where physical Site features, contaminant source or nature, or other relevant distinguishing factors apply, the definition of Site Units may be required. Cleanup action alternatives are then independently developed and evaluated for each Site Unit for the FS. A preferred alternative is developed by combining the most practicable alternative for each Site Unit into a Site-wide cleanup alternative.

The Site contains three distinct areas that were affected by historical Site releases and warrant consideration as potential Site Units. These three areas were identified during the RI as containing soil, groundwater, and/or marine sediment with constituent concentrations above PCLs. These areas are designated as Site Units for the purposes of this FS, and the remedial alternatives developed and evaluated for Site cleanup will address each Site Unit, as applicable. The identified Site Units are shown on Figure 31, along with the estimated Site boundary based on the extent of Site contamination identified in the RI. The three applicable Site Units and associated affected media are:

- The UST Site Unit, consisting of the former gasoline UST area (soil, soil vapor, and groundwater)
- The Work Yard Site Unit, consisting of the North, South, and Northeast Work Yards (soil and groundwater)
- The Marine Site Unit, consisting of the Marine Area (marine sediment).

The Catch Basin No. 2 (CB-2) area also contained soil concentrations that exceeded the proposed cleanup levels. However, the exceedances appear to be limited in both concentration and areal extent, and as such this area does not warrant designation as an independent site unit and is addressed as part of the Work Yard Site Unit. However, the manner in which this area will be addressed as part of the cleanup action is addressed in Section 10.3.

As noted on Figure 31, the UST and Work Yard Site Units overlap in a couple of locations. Although the Site Units overlap, the contamination associated with each Site Unit is separate and distinct. Contamination associated with the UST Site Unit is generally located at least 7 ft BGS and contamination associated with the Work Yard Site Unit is generally located within the upper 2 ft of soil. As a result, the use of different technologies to address overlapping contamination between the Site Units for a given alternative does not cause conflict with implementation, although contamination conditions for both Site Units would need to be considered during design to effectively integrate the treatment technologies.

10.1 INTEGRATION OF CLEANUP ACTION WITH FUTURE SITE REDEVELOPMENT

Future Site redevelopment will include the demolition of existing Buildings 1, 2 and 3, and construction of a new building in the current Dry Storage Yard to create better access for maneuvering vessels in the vicinity of the travel lift piers. As of March 2014, the majority of Building 3's above-grade structure has been removed. The remains of the Building 3 and all of Building 2 will be removed by fall 2014; the building's floor slab will remain-in-place. The timing of construction for the new building is uncertain; however, the approximate location and size of the planned building are provided on Figure 3 (Riise 2014).

Although the buildings will be demolished, the intent is for the building floor slabs to be retained for use in boatyard operations. The preference for retaining the building floor slabs will be considered during the development, evaluation, and selection of remedial alternatives for the UST Site Unit and Work Yard Site Unit.

10.2 FORMER GASOLINE UST AREA (UST SITE UNIT)

Releases from the former gasoline UST formerly located on the north side of Building 1 impacted subsurface soil, groundwater, and soil vapor. The former gasoline UST area (UST Site Unit) is defined as the area of subsurface gasoline-range petroleum hydrocarbon impacted soil and groundwater resulting from the UST releases, but may also include VOCs previously released in the building. The UST Site Unit within the property boundary includes the area north of Building 1 and south of Squalicum Way, the area beneath the majority of Buildings 1 and 2, and likely some of the area beneath Building 3. Soil contamination is generally limited to the water table smear zone located at a depth of 10 to 12 ft BGS. The approximate boundary of the UST Site Unit is shown on Figure 31. Current and anticipated future use of the area of the UST Site Unit is commercial and light-industrial boat maintenance operations.

10.3 NORTH, SOUTH, AND NORTHEAST WORK YARDS (WORK YARD SITE UNIT)

The Work Yard Site Unit consists of the North, South, and Northeast Work Yards. The North and South Work Yards consists of paved and unpaved boat maintenance areas west, southwest, and south of the Building 1, 2, and 3 complex. The Northeast Work Yard is a formerly unpaved boat maintenance and sandblast area generally located to the east of Building 1. The approximate limits of the Work Yard Site Unit are shown on Figure 31.

Soil contamination in this area includes concentrations of copper, lead, nickel, and/or zinc above the PCLs. Detected concentrations of these metals were highest in the Northeast Work Yard, which is the only area where soil concentrations (for lead) exceeded cleanup criteria based on direct contact. Preliminary soil cleanup level exceedances for copper, nickel, and zinc occurred at lower concentrations in the South and North Work Yards, although many of the samples tested from these areas were composited, so soil metals concentrations at some individual locations could be higher than indicated by the analytical results.

Diesel- and oil-range petroleum hydrocarbons and copper concentrations exceeded the PCLs in soil samples collected from the CB-2 location prior to replacement of the open-bottom catch basin with closed-bottom catch basin. However, petroleum hydrocarbons were not detected in groundwater samples collected from monitoring well MW-9, located immediately downgradient from CB-2, and dissolved copper was detected at a concentration well below the proposed groundwater cleanup level. Since the proposed soil cleanup levels for diesel- and oil-range petroleum hydrocarbons and copper are based on protection of groundwater, these results indicate that soil concentrations at the CB-2 location do not pose an unacceptable threat to human health or the environment. As a result, the CB-2 area will not be specifically considered when evaluating remedial alternatives, but will be addressed with respect to soil management associated with any future intrusive activities that disturb soil in the CB-2 area.

Copper, nickel, and zinc exceeded the groundwater screening level in samples collected from monitoring wells and borings located within about 100 ft of the shoreline in the Work Yard Site Unit. Groundwater quality farther inland partially relies on groundwater samples collected from temporary wells installed in borings rather than permanent groundwater monitoring wells, which may not represent the most reliable data. As a result, it is assumed for the purposes of the FS that groundwater metals concentrations could be more elevated than indicated by available data throughout the Work Yard Site Unit. However, because available data indicate that groundwater metals concentrations are not highly elevated in the Work Yard Site Unit, this assumption is addressed in the context of groundwater management related to future Site activities and not active remediation as part of one or more remedial alternatives.

10.4 MARINE AREA (MARINE SITE UNIT)

The Marine Area (Marine Site Unit) was delineated by the area of surficial marine sediment (upper 12 cm) containing mercury, and to a lesser extent residual PAHs and zinc, at concentrations exceeding the marine sediment PCLs immediately following implementation of the interim action. However, following natural recovery of residual contamination after the 2003/2004 interim action was completed the Marine Site Unit now meets SMS numeric benthic criteria. However, it is still part of the Site and is addressed, where applicable, in the following sections.

The Marine Area includes the area of Bellingham Bay west of the former Weldcraft facility uplands, bounded approximately by the shoreline to the north and east, the westerly extension of the southern upland Site boundary to the south, and extending about 200 ft to the west of the bulkhead, as shown on Figure 31. Current and anticipated future use in the Marine Site Unit includes commercial and recreational maritime activities associated with a large marina and a number of commercial businesses.

11.0 SCREENING OF REMEDIAL TECHNOLOGIES

The purpose of the FS is to develop and evaluate cleanup action alternatives to enable an appropriate cleanup action to be selected for the Site. Cleanup action alternatives are an assemblage of one or more cleanup activities that, taken as a whole, will achieve the RAOs for the entire Site or a Site Unit. This section discusses the breadth of remedial technologies considered for implementation at the Site with discussion of whether they would be applicable to each Site Unit, and identifies the remedial technologies that are carried forward for development of the remedial alternatives in Section 12.0. Table 16 includes a description of the various technologies retained for each remedial alternative.

As presented in Section 3.4, under the terms of the Agreed Order, an interim action removing contaminated sediment exceeding cleanup levels was implemented in the Marine Site Unit in 2003/04. The combination of the removal and the subsequent natural recovery of the minor post-interim action residual contamination achieved the sediment cleanup standards throughout the Marine Site Unit. As a result, no additional technologies are considered for the Marine Site Unit and it is not discussed further in the FS.

The following remedial technologies or response actions were screened for consideration in development of cleanup action alternatives for the UST and/or Work Yard Site Units, and were compared to the applicable RAOs. Note that the RAOs are applicable to the UST and the Work Yard Site Units, except that RAO-4 is applicable only to the UST Site Unit.

11.1 SOIL CONTAINMENT

Soil containment would be achieved by maintaining pavement and/or building slab cover to limit potential future human exposure to residual contaminated soil and groundwater and minimize stormwater infiltration and recharge in the affected area. Soil containment would achieve RAO-1 for both the UST and Work Yard Site Units. It would also assist in achieving RAO-3, RAO-4, and RAO-5 by reducing the potential for leaching of contaminants from soil to groundwater, by inhibiting vapor migration to ambient air, and by reducing the amount of Site groundwater discharge to surface water. This remedial technology is an effective remedy for preventing direct contact with contaminated soil and reducing infiltration when implemented in conjunction with institutional controls. As the Site currently exists, an asphalt layer and building slabs cover most of the UST and Work Yard Site Units. Though neither the asphalt pavement nor the building slabs are considered engineered caps, they provide adequate soil containment by limiting human exposure to contaminated soil and groundwater. The existing asphalt pavement and slabs also minimize infiltration, and accordingly minimize the rate of groundwater recharge, by acting as low permeability layers. Though some infiltration occurs through the asphalt layer, this layer significantly reduces infiltration from what would occur if the Site were not paved or covered by concrete building slabs. Considering these attributes of the existing pavement and concrete slabs, this technology is carried forward for further consideration.

11.2 GROUNDWATER CONTAINMENT

Groundwater containment would be achieved by installing a barrier to groundwater flow around the affected area in conjunction with a low permeability containment layer. Groundwater extraction might also be required to maintain hydraulic containment. The hydraulic barrier could be constructed using different technologies, such as sheet pile or bentonite slurry cutoff walls. Containment would partially achieve RAO-1 and RAO-5, and would achieve RAO-3. However, existing data indicate that gasoline-range petroleum hydrocarbon groundwater contamination does not extend a significant distance downgradient from the UST Site Unit source area and metals groundwater contamination associated with the Work Yard Site Unit achieves groundwater cleanup standards at the proposed conditional point of compliance at the shoreline. As a result, groundwater containment does not appear necessary to protect downgradient receptors (i.e., aquatic organisms). Additionally, the implementability for a cutoff wall would be very low due to utilities and other obstructions. As a result, physical containment of groundwater was not carried forward as a viable technology in the FS.

11.3 INSTITUTIONAL CONTROLS

This technology would utilize restrictive covenants to achieve RAO-1 and RAO-2 site wide, in conjunction with maintaining a containment layer, by preventing Site activities that could lead to direct contact with contaminated soil or groundwater, or the ingestion of contaminated groundwater. Institutional controls could also be used to partially address RAO-4 by limiting uses at the Site. Institutional controls would include a soil and groundwater management plan that would identify the procedures for the management of potentially-contaminated soil and groundwater contained at the Site during post-cleanup action redevelopment or other activities that compromise the containment of these materials. It should be stated that institutional controls alone cannot address the potential presence of LNAPL in the UST Site Unit.

11.4 MONITORED NATURAL ATTENUATION (MNA)

This technology would limit the UST Site Unit petroleum plume extent through natural processes to achieve RAO-2 (and RAO-3 and RAO-5, as applicable), and groundwater quality would be monitored to confirm its effectiveness. This remedial technology is not impacted by the presence of surface impediments and is typically a cost-effective remedy. Although historical Site monitoring indicates that the gasoline petroleum hydrocarbon plume is stable, additional data would need to be collected during remedial design to confirm the effectiveness of natural attenuation processes at the Site. If the source area is not removed as part of the cleanup action, this technology would not be used as a primary remedial technology, as MNA cannot provide a timely solution to high concentrations of hydrocarbons/VOC or address the existing presence of LNAPL. However, it may be used as a supplemental technology in conjunction with a containment alternative. If the source area is removed, MNA could be used as a supplemental technology to address residual contamination. This technology is carried forward for further consideration.

11.5 BIOREMEDIATION/ENHANCED MNA

This technology expands on the MNA technology above by enhancing natural biological degradation of petroleum to more rapidly achieve RAO-3, RAO-5, and to a lesser degree RAO-4. Bioremediation can be used to enhance or stimulate the naturally-occurring aerobic or anaerobic biological processes through the introduction of oxidizing reagents, oxygen sources, nitrates, sulfates, and/or macro/micro nutrients into the source area to increase the rate of degradation of the petroleum constituents in groundwater. Reagent or oxygen introduction can be accomplished by a direct-push injection program or through injection wells. This technology is carried forward for further consideration related to the UST Site Unit; though it would not be able to address the potential presence of LNAPL in a timely manner.

11.6 AIR SPARGE/SOIL VAPOR EXTRACTION (AS/SVE)

AS/SVE is a proven technology combination for remediation of hydrocarbons and VOCs in groundwater and vadose zone soils, both in the dissolved phase and as LNAPL, by injecting compressed air below the groundwater table to strip volatile constituents out of groundwater followed by extraction of the volatilized gasoline constituents. These technologies take advantage of the inherently volatile nature of VOCs and provide an avenue for phase change and thus product removal. However, they have only shown limited success at treating sites with large quantities of free product. AS can also help stimulate biological degradation by increasing DO levels in groundwater. AS/SVE would address RAO-1, RAO-2, RAO-3, and RAO-5 (if applicable), and RAO-4 for the UST Site Unit (and is not applicable for the other Site Units). Implementation would be limited only by the presence of surface or subsurface features (e.g., utilities, concrete slabs, etc.). SVE would achieve RAO-4 for this area if the source is not removed to control indoor accumulation or offsite migration of soil vapor. AS/SVE is carried forward for further consideration related to the UST Site Unit.

11.7 SOIL VAPOR CONTROL/MANAGEMENT

If source removal or SVE treatment are not selected for cleanup of the UST Site Unit, other technologies would need to be employed to prevent indoor intrusion or offsite migration of soil vapor (i.e., achieve RAO-4). There are several active and passive sub-grade vapor control technologies that may be appropriate for this application, such as sub-grade depressurization or passive venting. Soil vapor control technologies are carried forward for further consideration related to the UST Site Unit.

11.8 BIOSPARGING/BIOVENTING

Biosparging/bioventing involves the slow introduction of air into groundwater and/or soil to stimulate aerobic microbial degradation of contaminants. SVE would also be necessary to ensure that indoor air concentrations do not exceed applicable criteria, so the amount of equipment and infrastructure (and consequently cost) required for biosparging/bioventing is similar to that of AS /SVE. Because biosparging/bioventing is a less aggressive technology than AS/SVE, the benefits of biosparging/bioventing are less than those for AS/SVE and the cost savings would be negligible. Consequently, this technology was not carried forward for further consideration in the FS.

11.9 EXCAVATION

Excavation and offsite disposal or treatment of hydrocarbons, VOCs, or metals contaminated soil is a viable and permanent remedial technology that would achieve RAO-1, RAO-2, RAO-3, RAO-4, and RAO-5 site wide. This technology would be the most permanent solution for impacted soil and groundwater and would remove the potentially LNAPL present in the UST Site Unit. However, it can only be implemented if Site buildings and associated building slabs are removed. Excavation could be supplemented by MNA if residual groundwater impacts were identified after completion of excavation. Excavation and offsite disposal or treatment is carried forward for further consideration in the FS related to both the UST and Work Yard Site Units.

11.10 DUAL-PHASE EXTRACTION (DPE)

DPE would extract soil gas, groundwater, and free-phase product to treat the saturated and unsaturated zones in the UST Site Unit. Due to the need for long-term treatment of significant quantities of groundwater generated through DPE and other pump and treat technologies, and for treatment of the exhaust air stream, more equipment and infrastructure (and consequently greater cost) is associated with this technology than for AS/SVE with no incremental increase in benefit. Consequently, this technology was not carried forward in the FS as an ongoing technology option.

Though traditional DPE is not being considered, it is possible to implement DPE as an intermittent LNAPL recovery technology. Under this scenario, a vactor truck periodically extracts soil gas, groundwater, and free-phase product from designated wells. As the time between extraction sessions allows the potential LNAPL thickness in the well to rebound, this solution is both economical and labor-efficient, since each extraction session removes the maximum LNAPL thickness possible. It also only requires minimal infrastructure, as only a well and vactor truck are necessary for implementation. Intermittent DPE is carried forward in the FS as an option to remove LNAPL in the UST Site Unit, if present.

11.11 STABILIZATION

Chemical stabilization of soil to inhibit leaching of metals to groundwater could be utilized to achieve RAO-2, RAO-3, RAO-4, and RAO-5 in the Work Yard Site Unit. Chemical stabilization would not address LNAPL in the UST Site Unit, if present. Available groundwater quality data do not indicate extensive leaching of metals soil contamination to groundwater is occurring, if at all, and the source area appears to be very diffuse throughout shallow Site soil. As a result, stabilization is not considered an applicable technology for the Site and was not carried forward in the FS.

12.0 DESCRIPTION OF REMEDIAL ALTERNATIVES

This section describes the cleanup alternatives selected for detailed evaluation. Sufficient detail is included for each alternative to provide the reader a conceptual understanding of the design intent, which portion of the alternative is applicable for each Site Unit, and to provide an adequate basis for developing the associated cost estimates.

Cleanup alternatives are developed for each Site Unit using one or more of the technologies described in Section 11.0. The four remedial alternatives evaluated include:

- Remedial Alternative 1 – Containment with Source Recovery
  - Recovery of LNAPL with intermittent DPE methods, if LNAPL is present in recoverable quantities (UST Site Unit)
  - Containment of gasoline-range petroleum hydrocarbon and VOC contaminated soil (i.e., BTEX), with soil vapor control if needed to manage affected soil vapor (UST Site Unit)
  - Containment of metals-contaminated soil (Work Yard Site Unit)
  - Soil, groundwater (potentially including porewater analysis), and soil vapor compliance monitoring (Site Wide[1])
  - Institutional controls to maintain containment layer, restrict groundwater use, and manage potentially contaminated soil and groundwater disturbed during future intrusive activities (Site Wide).
- Remedial Alternative 2 – Containment with *In Situ* Treatment and Source Recovery
  - *In situ* treatment of gasoline-range petroleum hydrocarbon and VOC contaminated soil (i.e., BTEX) and groundwater using AS/SVE (UST Site Unit).
  - Recovery of LNAPL with intermittent DPE methods, if LNAPL is present in recoverable quantities (UST Site Unit)
  - Containment of metals-contaminated soil (Work Yard Site Unit)
  - Soil, groundwater (potentially including porewater analysis), and soil vapor compliance monitoring (Site Wide)
  - Institutional controls to maintain containment layer and the AS/SVE treatment system, restrict groundwater use, and manage potentially-contaminated soil and groundwater disturbed during future intrusive activities (Site Wide).
- Remedial Alternative 3 – Containment with Focused Source Removal
  - Excavation and offsite disposal of gasoline-range petroleum hydrocarbon and VOC (i.e., BTEX) contaminated soil (UST Site Unit) within the area identified for the potential presence of LNAPL
  - Placement of ORC within excavation backfill to enhance treatment of any remaining contaminated soil or groundwater

[1] Note: use of the term "Site Wide" from this point forward describes the UST Site Unit and Work Yard Site Unit, and does not include the Marine Site Unit.

- Backfill excavations with clean fill, grading, and paving consistent with Site use (UST Site Unit).
- Containment of residual gasoline-range petroleum hydrocarbon/VOC (i.e., BTEX) contaminated soil, if needed (UST Site Unit)
- MNA of residual gasoline-range petroleum hydrocarbon contaminated groundwater, if needed (UST Site Unit)
- Containment of metals-contaminated soil (Work Yard Site Unit)
- Soil, groundwater (potentially including porewater analysis), and soil vapor compliance monitoring (Site Wide)
- Institutional controls to maintain containment layer, restrict groundwater use, and manage potentially contaminated soil and groundwater during future intrusive activities (Site Wide).

- Remedial Alternative 4 –Site-wide Source Removal
  - Excavation and offsite disposal of soil contaminated with metals, gasoline-range petroleum hydrocarbons, and VOCs (Site Wide)
  - Backfill excavations with clean fill, grading, and paving consistent with Site use (Site Wide)
  - Soil, groundwater (potentially including porewater analysis), and soil vapor compliance monitoring (Site Wide)
  - Institutional controls to restrict groundwater use (Site-Wide, or as needed).

A summary of the various components of each alternative is presented in Table 16.

As discussed in Section 11.1, soil containment for Alternatives 1, 2, and 3 will largely consist of utilizing the existing asphalt pavement layer and building slabs, in addition to paving the currently unpaved areas (i.e., North Work Yard) and repairing/replacing existing pavement, as necessary. An engineered cap underlain by a liner will not be installed, as the existing asphalt and building slabs already provide a barrier to human contact and adequately reduce stormwater infiltration. As is further discussed in Section 12.0, institutional controls will be implemented to maintain these surface layers to preserve their capacity as a barrier to human contact and to maintain the existing reduction in infiltration.

In addition, all four Alternatives take into consideration that the existing buildings on the Site will be removed to the slab prior to implementation of the final cleanup action. Alternatives 1 and 2 could be implemented with the buildings remaining in place; however, additional costs would be incurred from those presented in this section and disruption to tenant activities would be a consideration. Presently, the main structure of Building 3 has been removed, with the remaining walls to be removed by the tenant by fall 2014. Permits have been obtained by the tenant for removal of Buildings 1 and 2; removal of Building 2 is scheduled by fall 2014 (Riise 2014).

A description of these alternatives is presented below. Alternative descriptions are organized by: 1) alternative; 2) Site Unit; and 3) the media (e.g., soil and/or groundwater) that the alternative addresses within that area; 4) a discussion of the conceptual approach and how the alternative meets the RAOs for the Site; and 5) presentation of a cost estimate for each alternative.

The cost estimates presented in this FS are considered order-of-magnitude with a relative accuracy within the range of -30 to +50 percent. Detailed cost estimates for each alternative are provided in Appendix I and a summary of alternative costs are provided in Table 17. These cost estimates are intended solely for use as a basis for comparison of costs between alternatives. A more accurate cost estimate will be developed for the selected cleanup action during the remedial design phase.

12.1 ALTERNATIVE 1 –CONTAINMENT WITH SOURCE RECOVERY

Alternative 1 consists of utilizing and maintaining the existing asphalt layer and building slabs on Site, installing new asphalt pavement in the North Work Yard, and installing and/or repairing/replacing additional asphalt, where needed, to inhibit human contact with contaminated soil, and to reduce the potential for infiltration. If a practicably recoverable quantity of LNAPL is identified during additional investigation in support of the remedial design within the UST Site Unit, intermittent DPE will be implemented to recover free-phase product. In addition, pending the results of the soil vapor survey to be conducted during the remedial design phase, this alternative includes installation of a vapor capture/control trench to help manage potential vapor migration from the area of the UST Site Unit. The costs for implementation of the intermittent DPE recovery program and installation and management of the vapor capture/control trench are included in the cost estimate provided in Table 17 and the cost detail provided in Appendix I. The following sections describe how Alternative 1 would be implemented and how the RAOs are achieved, as applicable.

12.1.1 UST SITE UNIT

This alternative consists of addressing the potential presence of recoverable LNAPL using intermittent DPE methods, and containing gasoline-range petroleum hydrocarbon and VOC-impacted soil in the former gasoline UST area, with soil vapor control, compliance monitoring, and institutional controls.

- Soil
  - Containment by repairing/replacing existing asphalt pavement (as needed), and maintaining existing pavement cover to limit potential human exposure to contaminated soil and to reduce infiltration to minimize leaching of contaminants in the unsaturated zone.
  - LNAPL recovery using intermittent DPE, if LNAPL is established to be present in practicably recoverable quantities during additional investigation to support remedial design.

- Institutional controls (restrictive covenants) on the property to 1) require maintenance of the Site's containment layer discussed above, and 2) ensure the proper management of excavated soil and appropriate worker safety associated with any future intrusive activities through implementation of a soil and groundwater management plan.
- Compliance monitoring to ensure that the Site's containment layer is adequately maintained and functioning properly.

- Groundwater
  - LNAPL recovery using intermittent DPE, if LNAPL is established to be present in practicably recoverable quantities during additional investigation to support remedial design.
  - Repairing/replacing existing asphalt pavement (as needed), and maintaining existing pavement containment layer to reduce infiltration, minimize leaching of contaminants in the unsaturated zone to groundwater, and reduce the rate of groundwater flow.
  - Institutional controls (restrictive covenants) on the property to 1) prevent the use of Site groundwater for drinking water, and 2) properly manage groundwater extracted for other uses such as construction dewatering through implementation of a soil and groundwater management plan.
  - Groundwater compliance monitoring to demonstrate that groundwater cleanup standards are achieved and maintained.
- Indoor/Outdoor Air
  - If determined necessary during remedial design, installation of a soil vapor control (active or passive) system to control potential offsite migration of soil vapor.
  - Compliance monitoring to ensure that offsite migration of soil vapors at concentrations that could impact indoor air quality at neighboring property buildings does not occur.

For Alternative 1, the existing pavement surface and Site building slabs would be utilized as the soil containment layer, as shown on Figure 32. The purpose of the soil containment layer would be to provide a physical barrier to human contact with contaminated soil and to minimize stormwater infiltration and leaching of petroleum hydrocarbon contamination and VOCs from unsaturated soil. Reducing groundwater recharge, via the installation and maintenance/repair of a low-permeability pavement layer would also help maintain the stability or potentially reduce the size of the affected groundwater plume.

During the remedial design, an investigation will be conducted to determine if LNAPL is present within the UST Site Unit in practicably recoverable quantities. If the presence of recoverable LNAPL is confirmed, intermittent DPE will be included in the final cleanup action to remove recoverable free-phase product. The number and location of wells necessary, and the frequency between DPE sessions, will be determined during the remedial design. However, for costing purposes, it was assumed that recoverable free product is present within the area defined by the 300 mg/kg gasoline contour and in areas that exhibited a gasoline-like odor during boring investigations (sees Figures 20 and 32). It was also assumed that LNAPL recovery would require eight wells and monthly DPE sessions for up to two years. A two year time frame is established for this Alternative so that the potential period of treatment is comparable to the period of treatment considered in Alternative 2.

If soil vapor characterization monitoring conducted during remedial design indicates that vapor control is needed to prevent benzene and other VOCs from migrating north to buildings across Squalicum Way, a vapor control and capture system/trench would be installed along the north side of the UST Site Unit. The specific configuration of the vapor control system would be developed during remedial design. For the purposes of the FS, it was assumed that the vapor control system would consist of a 150-ft long trench excavated to about 7 ft BGS and backfilled with pea gravel or similar material. A perforated pipe installed in the trench would be connected to a low-flow vacuum system to intercept soil vapor. For the purposes of the FS, it is assumed that off-gas treatment of the extracted soil vapor would not be required prior to discharge to the atmosphere, but the need for air emission treatment would be further evaluated during remedial design. Although the necessity for soil vapor management under this alternative will be evaluated during remedial design, costs for the vapor control system have been included as part of this Alternative's evaluation.

Institutional controls would be established to require that the soil containment layer be maintained on the property. The institutional controls would also prohibit the use of Site groundwater as a potable water supply and require, through the implementation of a soil and groundwater management plan, that proper safety measures and soil and groundwater management practices be implemented as part of any project involving intrusive activities within the UST Site Unit, in accordance with WAC 173-340-440. The institutional controls would be conveyed as a restrictive covenant on the property.

The conditional point of compliance for petroleum hydrocarbons would be established at existing and new monitoring wells. For costing, six wells would be monitored for compliance, and three monitoring wells would be monitored to evaluate the effectiveness of vapor containment. The locations of compliance monitoring wells will be determined during remedial design.

Alternative 1 achieves the RAOs presented in Section 9.2 for the UST Site Unit through soil containment, reduction of stormwater infiltration, intermittent DPE LNAPL recovery, soil vapor control (if necessary), institutional controls, and compliance monitoring. RAO-1, RAO-3, and RAO-5 would be achieved through maintaining the containment layer over the source area to prevent human contact with contaminated soil/groundwater and to reduce stormwater infiltration through contaminated soil. Restrictive covenants placed on the property would ensure that these RAOs continue to be met in the long-term by requiring that the containment layer be maintained and by implementing a soil and groundwater management plan that specifies the requirements for worker health and safety and the proper management of any contaminated soil or groundwater generated during future projects involving intrusive activities at the Site. Compliance monitoring would ensure that the containment layer is adequately maintained to prevent direct human contact, and that concentrations of gasoline range petroleum hydrocarbons and VOCs do not exceed Site cleanup levels protective of marine surface water and sediment.

RAO-2 would be achieved through maintenance of the containment layer to prevent direct contact and application of institutional controls that would prohibit the use of Site groundwater as a potable water supply. RAO-3 and RAO-5 would be achieved through groundwater compliance monitoring to confirm that concentrations of gasoline-range petroleum hydrocarbons do not exceed Site cleanup levels protective of marine surface water and sediment at the conditional point of compliance.

RAO-4 would be achieved through maintaining the containment layer at the Site and active or passive capture or control of vapors (if necessary) to prevent vapor migration and potential vapor intrusion to neighboring buildings. With respect to RAO-4, compliance monitoring would include soil vapor monitoring with a point of compliance throughout the Site.

12.1.2 WORK YARD SITE UNIT

Alternative 1 for the Work Yard Site Unit consists of containment of heavy metals impacted soil. Due to the limited available groundwater quality data, groundwater is assumed to be potentially contaminated with metals throughout the Work Yard Site Unit, although available data indicate that heavy metal groundwater contamination is limited to the vicinity of the galvanized steel bulkhead at the shoreline. Containment would be achieved by installing new asphalt pavement in the North Work Yard, repairing/replacing existing asphalt pavement (as needed), and maintaining the existing pavement cover and building slabs to prevent direct contact with and to limit stormwater infiltration through soil contaminated, or potentially contaminated, with heavy metals. Institutional controls would be implemented to ensure the containment layer is properly maintained and repaired as needed to prevent exposure to Site construction workers. The containment areas for Alternative 1 are shown on Figure 32.

In addition to the physical remediation elements, groundwater compliance monitoring would be conducted and institutional controls in the form of a restrictive covenant would be established. Groundwater compliance monitoring would likely be conducted at a conditional point of compliance at the bulkhead, but could include porewater sampling from marine sediment adjacent to the bulkhead. The restrictive covenant would require that an asphalt containment layer be maintained or replaced by an equivalent low permeability surface, and would prohibit extraction of groundwater for use as a potable water supply. The restrictive covenant would also require the implementation of a soil and groundwater management plan, as described in the previous section. Additionally, the containment layer would be inspected on an annual basis to ensure its integrity, and would be repaired, as necessary.

For the purposes of FS cost estimating, it is assumed that groundwater compliance monitoring would be conducted quarterly for the first year and once every 5 years for an additional 30 years at up to three compliance monitoring wells.

Alternative 1 achieves the applicable RAOs for the Work Yard Unit through a combination of soil containment, reduction of stormwater infiltration, groundwater compliance monitoring, and institutional controls. RAO-1 would be achieved through containment to prevent human contact with contaminated soil and reduce stormwater infiltration, compliance monitoring, and restrictive covenants. RAO-2 would be achieved through the restrictive covenant. RAO-3 and RAO-5 would be achieved through compliance monitoring to confirm that concentrations of heavy metals in groundwater do not exceed Site cleanup levels protective of marine surface water and sediment at the conditional point of compliance (i.e., the shoreline). Given the COCs within the Work Yard Unit, RAO-4 would not apply.

12.1.3 COST

The estimated cost to implement Alternative 1 is approximately $610,000 (for all Site Units); this cost includes $53,000 for a low flow vapor capture/trench system (as needed). Costs include installation of asphalt in the North Work Yard and repair/replacement of existing asphalt across an estimated 20 percent area of the Site. The costs associated with the LNAPL recovery program assume installation and management of eight recovery wells and monthly DPE sessions for two years, with passive recovery (i.e., oil socks) in between these sessions. For cost estimating purposes, it is assumed that groundwater and soil vapor monitoring would be required for 30 years. Estimated costs are summarized in Table 17 and detailed cost estimates are provided in Appendix I.

12.2 ALTERNATIVE 2: CONTAINMENT WITH *IN SITU* TREATMENT AND SOURCE RECOVERY

Alternative 2 is similar to Alternative 1, with the use of Site-wide soil containment and intermittent DPE LNAPL recovery for the UST Site Unit. However, Alternative 2 also uses *in situ* treatment of gasoline-range petroleum hydrocarbon and VOC-contaminated soil and groundwater in the UST Site Unit. The *in situ* treatment could use either bioremediation to stimulate or enhance the natural biological degradation and attenuation processes in the saturated soil and groundwater zones in the area of the former gasoline UST or AS/SVE to use physical processes to extract volatile compounds from both soil and groundwater. Preliminary evaluation of the likely difference in cost between the two technologies is negligible. Because AS/SVE would address both vadose zone soil and groundwater contamination and manage soil vapor, whereas bioremediation would only effectively address groundwater contamination, AS/SVE is the preferred *in situ* treatment technology for the FS evaluation.

12.2.1 UST SITE UNIT

Alternative 2 for the UST Site Unit consists of the following major components:

- Soil
  - Conducting AS/SVE within the boundaries of the gasoline-impacted soil area to aid in the volatilization, capture, and treatment of the volatile COCs present in LNAPL-form and sorbed to soil.
  - Implementing intermittent DPE recovery to further aid in addressing LNAPL, if present in practicably recoverable quantities.
  - Institutional controls (restrictive covenants) on the property to 1) require maintenance of the Site's containment layer discussed above, and 2) ensure the proper management of excavated soil and appropriate worker safety associated with any future intrusive activities through implementation of a soil and groundwater management plan.
  - Compliance monitoring to ensure that the Site's containment layer is adequately maintained and functioning properly.
- Groundwater
  - Conducting AS/SVE within the groundwater contamination plume to promote volatilization and aerobic biodegradation of the volatile constituents dissolved in groundwater or present as residual LNAPL.
  - Implementing intermittent DPE recovery to further aid in addressing LNAPL, if present in practicably recoverable quantities.
  - Institutional controls (restrictive covenants) on the property to 1) prevent the use of Site groundwater for drinking water, and 2) properly manage groundwater extracted for other uses such as construction dewatering through implementation of a soil and groundwater management plan.
  - Groundwater compliance monitoring to demonstrate that groundwater cleanup standards are achieved and maintained.
- Indoor/Outdoor Air
  - Conducting SVE, an aggressive subsurface soil gas recovery, capture, and management system, to prevent indoor intrusion or offsite migration of soil vapor.

Institutional controls are not anticipated to be necessary for the UST Site Unit under Alternative 2, beyond maintenance of existing/repaired pavement in the vicinity of the treatment system, but would be evaluated following completion of AS/SVE treatment and the evaluation of its effectiveness.

AS/SVE would consist of continuously (or pulse) injecting compressed air below the water table through a series of sparge wells to promote aerobic biodegradation and volatilization of the dissolved volatile constituents in groundwater and the volatile constituents sorbed to soil. An SVE system would be installed in the unsaturated zone above the sparge wells to collect the sparged air and soil vapor, and assist in the aerobic degradation of contaminated soil above the water table. Vapor-phase granular activated carbon (GAC) or a catalytic oxidation system would be used to treat the extracted soil vapor prior to discharge to the atmosphere. Intermittent DPE recovery will be implemented as described in Alternative 1, pending further evaluation of the presence of recoverable LNAPL during investigations to support the remedial design. However, DPE recovery will only be implemented for a six month period under Alternative 2, as discussed below.

For cost estimating purposes it is assumed that the area of known soil contamination approximates the extent of the groundwater plume, and that the final design of the AS/SVE system would consist of 13 vertical sparge wells and 4 horizontal SVE wells, as presented on Figure 33. Intermittent DPE recovery will be implemented for the first 6 months in 8 of the 13 sparge wells, with the wells being permanently used for AS after that 6 month period (i.e., SVE system components will begin operation upon setup, active AS will be implemented along with SVE at the 6-month period; the total period of treatment will be 2 years). Residual petroleum hydrocarbon contamination remaining in Site groundwater following this two-year period would be addressed through natural attenuation processes. This alternative includes conducting quarterly groundwater monitoring over a three-year period, including one year of monitoring following shutdown of the AS/SVE system.

The application of air sparging to the subsurface would promote volatilization (and aerobic biodegradation) of petroleum constituents and any other VOCs dissolved in Site groundwater. As a result, it would also help volatilize residual LNAPL and accelerate the rate of dissolution of petroleum constituents and VOCs sorbed to Site soil. Air sparging has shown to have limited success in treating heavily-contaminated release areas because of limitations in driving a sufficient mass of sorbed hydrocarbons from the soil into the dissolved phase where it can be treated through biological and volatilization processes. These limitations result from air channeling that reduces the effective treatment area and slow, diffusion limited processes that limit the dissolution rate. Air sparging is typically more successful at sites where most of the contaminant source material has been previously removed. The lack of observed free-phase NAPL at the Site indicates that air sparging should be effective in treating the UST Site Unit. However, if LNAPL is found to be present in recoverable quantities during the investigations to support remedial design, the intermittent DPE recovery methods are anticipated to provide adequate treatment/recovery to make AS/SVE effective.

Alternative 2 achieves the RAOs presented in Section 9.2 through *in situ* treatment of gasoline-range petroleum hydrocarbon contaminated soil, management of soil vapor, and compliance monitoring. The RAOs would be achieved through removal or destruction of gasoline-range petroleum hydrocarbons and any other VOC contamination present in Site soil and groundwater. If AS/SVE (with intermittent DPE recovery methods, as necessary) is successful in treating the petroleum hydrocarbon release area, it is expected that groundwater cleanup levels would be achieved within and downgradient of the former gasoline UST area within a two-year operational period, and institutional controls would not be required to achieve RAO-2. Once treatment is completed, no additional vapor extraction or monitoring should be necessary following a post-shutdown confirmational monitoring period (i.e., one year). Regular monitoring of the SVE system intake air stream would identify trends in subsurface vapor concentrations and provide an indicator for when active extraction could be terminated.

12.2.2 WORK YARD SITE UNIT

Implementation of Alternative 2 at the Work Yard Site Unit and achieving the respective RAOs would be the same containment, compliance monitoring, and institutional control strategy as the as described Alternative 1 in Section 12.1.2 above.

12.2.3 COST

The estimated cost to implement Alternative 2 is $950,000 for all Site Units. Costs include installation, operation, and management of the AS/SVE system (including off-gas treatment with GAC units); intermittent DPE for LNAPL recovery (if necessary); and compliance monitoring. Costs also include installation of asphalt in the North Work Yard and repair/replacement of existing asphalt across an estimated 20 percent area of the Work Yard Unit. Cost estimates are summarized on Table 17 and detailed cost estimates are provided in Appendix I.

12.3 ALTERNATIVE 3: CONTAINMENT WITH FOCUSED SOURCE REMOVAL

Alternative 3 includes the removal of contaminated soil from the source area for the UST Site Unit, containment, and institutional controls to manage metals-contaminated soil in the Work Yard Site Unit, along with compliance monitoring.

12.3.1 UST SITE UNIT

Alternative 3 incorporates the following major components to address contamination in the UST Site Unit:

- Soil:
  - Excavating gasoline-range petroleum hydrocarbon-/VOC-contaminated soil (dissolved and free-phase) from the source area of the UST Site Unit and disposal/treatment of this soil offsite.
  - Soil compliance monitoring post excavation to confirm that the soil cleanup levels have been achieved.
  - Institutional controls (restrictive covenants) to address the management of residual soil and groundwater contamination, including restoration of site pavement and containment features.

- Groundwater:
  - Removal of impacted soil, groundwater, and residual LNAPL from the saturated zone and overlying vadose smear zone within the UST Site Unit source area.
  - Addition of an oxidant and/or ORC to the excavation following contaminated soil and groundwater removal to enhance natural biodegradation processes.
  - Groundwater compliance monitoring following excavation to determine whether soil excavation also achieved groundwater cleanup levels, and if not, to monitor groundwater quality until cleanup levels are achieved.
  - Institutional controls (restrictive covenants) to prevent the use of Site groundwater for drinking water, and to manage residual contaminated groundwater, if needed.
  - Contingent MNA to address residual impacts if post-excavation groundwater compliance monitoring indicates residual petroleum hydrocarbon groundwater contamination is not rapidly attenuating.

For the purposes of this alternative, the source area is assumed to be the area identified for potential LNAPL recovery, as presented on Figure 34. The actual extent of excavation would be based on additional investigation during remedial design, and the results of field screening and soil compliance monitoring conducted during implementation of the cleanup action.

It is assumed that limited dewatering would be conducted to excavate the entire smear zone. The excavation is assumed to extend to a depth of 10 ft BGS, which is approximately 1 to 2 ft below the water table. As an alternative to dewatering, soil below the water table could be agitated using excavation equipment to release residual LNAPL that would then be recovered from the groundwater surface. The approach to removing residual LNAPL from below the groundwater table would be further evaluated during remedial design. Approximately 5 ft of clean over-burden would be removed from above the contaminated soil and later re-used to fill the excavation, with the possible exception of soil directly beneath the former dispenser island and distribution lines, which may have been contaminated by previous releases associated with these features.

Based on the excavation limits shown on Figure 34, approximately 3,000 CY of soil would be excavated and of this volume, approximately 1,700 CY (2,600 tons) would be contaminated soil requiring treatment or disposal at a facility licensed to accept petroleum-contaminated soil. The excavation would be backfilled with clean, granular soil and the reserved clean overburden to current grades and the surface repaved. The estimated cost for Alternative 3 also includes the application and mixing of an oxidant and/or an ORC into soil and groundwater at the bottom of excavation. This would enhance the attenuation of any residual petroleum hydrocarbon contamination not removed through excavation.

Alternative 3 also includes the construction of up to five new monitoring wells and four quarters of groundwater compliance monitoring following completion of excavation activities to assess whether groundwater cleanup levels are achieved through excavation.

Implementation of an MNA program and/or placing institutional controls on the property would be performed only if post-excavation residual soil or groundwater contamination was identified at concentrations that would not be expected to attenuate in a relatively short time frame of two to five years. There is a high probability that soil and groundwater cleanup levels would be achieved either immediately following excavation, or within five years, so MNA is not included in the cost estimate for the UST Site Unit portion of Alternative 3.

Alternative 3 achieves the RAOs through excavation and offsite treatment or disposal of petroleum hydrocarbon contaminated soil, site restoration (i.e., repaving), compliance monitoring, institutional controls, and MNA, if necessary. Alternative 3 would achieve RAO-1 and RAO-2 through source removal and oxidant or ORC addition, and institutional controls and MNA (if applicable). RAO-3, RAO-4, and RAO-5 would be achieved by removing the petroleum hydrocarbon source area and the addition of oxidant or ORC to address the potential presence of residual contamination within the UST Site Unit.

12.3.2 WORK YARD SITE UNIT

Implementation of Alternative 3 at the Work Yard Site Unit and achieving the respective RAOs would be the same containment, compliance monitoring, and institutional control strategy as that described for Alternative 1 in Section 12.1.1 above.

12.3.3 COST

The estimated cost to implement Alternative 3 is $1,100,000 for all Site Units. The cost estimate assumes removal of the existing buildings through planned tenant improvements prior to implementation of the remedial alternative; costs for building removal are not included in the cost estimate Costs include implementation of the excavation program, including management of excavated and overburden soil as necessary, dewatering activities, and transport and disposal of the excavated contaminated material. Costs for asphalt and slab removal prior to excavation, and surface repair upon completion of the excavation program are included. Materials costs for the ORC additive are included, along with the cost for installing, developing, and sampling of the additional groundwater monitoring wells for long-term compliance monitoring. Costs also include installation of asphalt in the North Work Yard and repair/replacement of existing asphalt across an estimated 20 percent the Work Yard Unit area. Cost estimates for Alternative 3 are summarized in Table 17 and presented in detail in Appendix I.

12.4 ALTERNATIVE 4: SITE-WIDE SOURCE REMOVAL

Alternative 4 consists of excavation and offsite disposal of the petroleum- and VOC-contaminated soil in the UST Site Unit and metals-contaminated soil in the Work Yard Site Unit. The estimated limits of excavation are shown on Figure 35. Excavation of the UST Site Unit would be defined to include the petroleum-contaminated soil with concentrations above the PCL for TPH-G in soil (i.e., 30 mg/kg).

Based on an average smear zone thickness of 5 feet starting at a depth of approximately 5 ft BGS, approximately 2,500 CY of clean overburden soil and 3,200 CY of petroleum-contaminated soil would be excavated from the UST Site Unit, and the petroleum-contaminated soil would either be disposed of at a licensed solid waste facility or treated at a facility licensed to treat petroleum-contaminated soil. Assuming an estimated average excavation depth of 2 ft BGS for the Work Yard Site Unit, approximately 4,600 CY of heavy metals-contaminated soil would be excavated from the Work Yard Site Unit and disposed of at a licensed solid waste facility. The excavations would be backfilled with clean structural fill and the surface repaved.

Alternative 4 also includes the construction of up to five groundwater monitoring wells and four quarters of groundwater monitoring to confirm that groundwater cleanup standards have been achieved. Compliance monitoring may also include surface water and/or porewater sampling at the conditional point of compliance (i.e., the shoreline).

Alternative 4 achieves the Site RAOs through site-wide removal and offsite disposal of contaminated soil and compliance monitoring.

The estimated cost to implement Alternative 4 is about $2,900,000 as summarized in Table 17 and detailed in Appendix I. The cost estimate assumes removal of the existing buildings through planned tenant improvements prior to implementation of the remedial alternative, although removal of asphalt and building slabs would be included as part of the cleanup action. Costs include managing excavated volumes, dewatering (as necessary), new backfill, and transport/disposal of the excavated contaminated soils. Installation of new compliance monitoring points (e.g., monitoring wells) and soil and groundwater compliance monitoring. For the purposes of this FS, it is assumed that concentrations of petroleum-related hydrocarbons (specifically benzene), lead, and other metals would not be sufficiently elevated to require disposal at a hazardous waste disposal facility.

12.5 MARINE SITE UNIT

The Marine Site Unit currently meets cleanup standards, as discussed in Section 3.4. As a result, no additional remedial actions are required for this area of the Site. However, when remedial action goals have been achieved for the upland units and bulkhead area, a final round of confirmation sampling may be required for the Marine Site Unit. The determination will be made based on both analytical results from the monitoring of those cleanup units and the eventual duration of the monitoring process.

13.0 DETAILED EVALUATION OF ALTERNATIVES

This section evaluates each alternative using criteria specified in MTCA. Section 13.1 presents a description of the evaluation criteria against which the alternatives are evaluated. Section 13.2 presents an evaluation of the alternatives against these criteria. Section 13.3 presents the disproportionate cost analysis (DCA) conducted to determine which alternative is permanent to the maximum extent practicable.

13.1 MTCA EVALUATION CRITERIA

MTCA specifies criteria for the evaluation and selection of cleanup actions. This section provides an overview of these regulatory criteria. An evaluation of the cleanup action alternatives against these criteria is then presented in sections 13.2 and 13.3.

13.1.1 MTCA THRESHOLD REQUIREMENTS

As specified in WAC 173-340-360(2), cleanup actions are required to meet the following threshold requirements:

- Protect human health and the environment,
- Comply with cleanup standards specified under MTCA,
- Comply with ARARs,
- Provide for compliance monitoring.

13.1.2 REQUIREMENT FOR PERMANENT SOLUTION TO THE MAXIMUM EXTENT PRACTICABLE

WAC 173-340-200 defines a permanent solution as one in which cleanup standards of WAC 173-340-700 through 173-340-760 can be met without further action being required at the original site or any other site involved with the cleanup action, other than the approved disposal site of any residue from the treatment of hazardous substances. MTCA recognizes that permanent solutions may not be practicable for all sites and provides criteria for determining whether a cleanup action is permanent to the "maximum extent practicable" in WAC 173-340-360(3)(f). These criteria include:

- ***Protectiveness.*** Overall protectiveness of human health and the environment, including the degree to which Site risks are reduced, time required to reduce risk at the facility and attain cleanup standards, risks during implementation, and improvement of overall environmental quality.
- ***Permanence.*** The degree of reduction in toxicity, mobility, and volume of hazardous substances, including the reduction or elimination of hazardous substance releases and sources of releases.
- ***Cost*** to implement the remedy including capital costs and operation and maintenance costs.

- ***Effectiveness over the long-term.*** Long-term effectiveness, including the degree of certainty that the alternative will be successful, long-term reliability, the magnitude of residual risk, and the effectiveness of controls required to manage treatment residues and remaining waste. The following types of cleanup action components may be used as a guide, in descending order, when assessing the relative degree of long-term effectiveness: Reuse or recycling; destruction or detoxification; immobilization or solidification; on-site or offsite disposal in an engineered, lined, and monitored facility; on-site isolation or containment with attendant engineering controls; and institutional controls and monitoring.
- ***Management of short-term risks***. The risk to human health and the environment during construction and implementation, and the effectiveness of measures to manage the risk.
- ***Technical and administrative implementability.*** Implementability, including consideration of whether the alternative is technically possible; the availability of necessary offsite facilities, services, and materials; administrative and regulatory requirements; scheduling, size, and complexity of construction; monitoring requirements; access for construction, operations, and monitoring; and integration with existing facility operations.
- ***Consideration of public concerns.*** Whether the community has concerns and the extent to which those concerns are addressed.

Free product (e.g., LNAPL) must be removed to the maximum extent practicable for releases from petroleum USTs [WAC 173-340-450(4)(a)]. As a result, LNAPL recovery to the degree practicable is considered a requirement for an alternative to be considered permanent to the maximum extent practicable.

The DCA [WAC 173-340-360(3)(e)] is used to determine whether a cleanup action is permanent to the maximum extent practicable. The purpose of the DCA is to determine if the incremental increase in cost of a cleanup alternative over that of a lower cost alternative is justified by the incremental increase in benefits to human health and the environment. If the incremental increase in costs is determined to be disproportionate to the benefits, the more expensive alternative is considered impracticable and the lower cost alternative is determined to be permanent to the maximum extent practicable. This process provides a mechanism for balancing the permanence of the cleanup action with its costs, while ensuring that human health and the environment are protected.

13.1.3 REQUIREMENT FOR A REASONABLE RESTORATION TIME FRAME

WAC 173-340-360(4)(b) specifies that the following factors be considered when determining whether a cleanup action provides for a reasonable restoration time frame:

- Potential risks to human health and the environment
- Practicability of achieving a shorter restoration time frame
- Current use of the Site, surrounding areas, and associated resources that are, or may be affected by releases from the Site

- Potential future use of the Site, surrounding areas, and associated resources that are, or may be affected by releases from the Site
- Availability of alternate water supplies
- Likely effectiveness and reliability of institutional controls
- Ability to control and monitor migration of hazardous substances from the Site
- Toxicity of the hazardous substances at the Site
- Natural processes that reduce concentrations of hazardous substances and have been documented to occur at the Site or under similar Site conditions.

13.1.4 REQUIREMENT FOR CONSIDERATION OF PUBLIC CONCERNS

Consideration of public concerns is an inherent part of the Site cleanup process under MTCA (see WAC 173-340-600). This RI/FS report will be issued for public review and comment, and Ecology will determine whether changes to the RI/FS report are needed in response to public comment. A similar process will occur for the CAP, prior to implementation of the final cleanup action, as specified in WAC 173-340-380. Consideration of public concerns will not be discussed further in this document (except as part of the DCA), in recognition of the public participation process that will be conducted for the RI/FS report and the CAP to comply with MTCA requirements.

13.2 EVALUATION OF ALTERNATIVES

This section provides an evaluation of the cleanup alternatives with respect to the MTCA criteria discussed in Section 13.1 (Evaluation Criteria). The evaluation of each cleanup alternative against the MTCA criteria is summarized in Table 18 and presented in the following sections.

13.2.1 THRESHOLD REQUIREMENTS

Under the MTCA, a cleanup action shall meet the threshold requirements outlined in Section 13.1.1. Compliance with the threshold requirements for a cleanup action under the MTCA is presumed by definition to be protective of human health and the environment once the cleanup action meets the cleanup standards for the affected media. Also, any cleanup action performed in accordance with the requirements of MTCA is assumed to be in compliance with cleanup standards and applicable state and federal laws. The following sections identify how the cleanup alternatives comply with the threshold requirements.

The potential exists for human health or the environment to be impacted under current conditions at the Site through direct contact with gasoline-affected soil or soil vapors, direct contact with metals-contaminated soil, human consumption of and direct contact with groundwater, or through discharge of contaminated groundwater to surface water and the resulting impact to sediment, aquatic organisms, and humans consuming those organisms. The four alternatives comply with the threshold requirements as described in the following sections.

13.2.1.1 Protection of Human Health and the Environment

Alternative 1 protects human health and the environment through containment and institutional controls to prevent exposure to contaminated Site soil, to prevent potential leaching to groundwater, and to prevent discharge of contaminated groundwater to marine surface water and sediment. Alternative 1 also provides further protection through intermittent DPE removal of LNAPL, if determined to be present in practicably recoverable quantities. Long-term groundwater and soil gas compliance monitoring is also included to confirm that cleanup standards are achieved and maintained, and soil vapor control is included as a contingent action if soil vapor monitoring indicates that gasoline-range petroleum hydrocarbon contamination in soil vapor could migrate at concentrations of concern to nearby structures.

Alternative 2 protects human health and the environment through *in situ* treatment (i.e., AS/SVE) to remove source area contamination in the UST Site Unit, including intermittent DPE LNAPL removal if LNAPL is determined to be present in practicably recoverable quantities at the Site, and through containment and institutional controls for the other Site Unit. Alternative 2 also includes compliance monitoring to confirm that cleanup standards have been achieved and are maintained.

Alternative 3 protects human health and the environment through physical removal of source area contamination in the UST Site Unit and through containment, compliance monitoring, and institutional controls as previously described for Alternative 2. Alternative 4 protects human health and the environment through complete removal of contaminated soil across the Site and disposal at an offsite licensed facility, and compliance monitoring to confirm that cleanup standards have been achieved.

Alternatives 2, 3, and 4 also include provisions for contingent MNA if groundwater cleanup levels are not achieved by the primary cleanup technology.

13.2.1.2 Compliance with Cleanup Standards

Through the various cleanup technologies and administrative controls employed, and achievement of the applicable RAOs (Section 9.2), Alternatives 1 through 4 each comply with MTCA soil and groundwater cleanup standards by achieving cleanup levels at the proposed points-of-compliance.

13.2.1.3 Compliance with State and Federal Laws

Alternatives 1 through 4 each comply with state and federal laws through compliance with identified ARARs (Section 9.3) and compliance with the MTCA regulations.

13.2.1.4 Provisions for Compliance Monitoring

Protection monitoring would be provided for Alternatives 1 through 4 through health and safety protocols outlined under a Site-specific health and safety plan, and the administration of institutional controls for Alternatives 1, 2, and 3. Alternative 1 would include long-term compliance monitoring for groundwater, surface water, and soil vapor, and includes containment layer inspections and maintenance to provide both performance and confirmational monitoring. Alternative 2 would include performance monitoring via effluent air sampling and confirmation monitoring through long-term groundwater compliance monitoring after completion of AS/SVE treatment in the UST Site Unit, and long-term groundwater and surface water compliance monitoring, and containment layer inspection/maintenance, for the Work Yard Site Unit. Alternatives 3 and 4 would include soil compliance monitoring for excavation performance, and confirmation monitoring via groundwater monitoring after completion of the excavation. Long-term groundwater and surface water monitoring, and containment layer inspection/maintenance would still be necessary for the Work Yard Site Unit under Alternative 3.

13.2.2 REQUIREMENT FOR A REASONABLE RESTORATION TIME FRAME

The MTCA identifies a number of factors to be considered when establishing a reasonable restoration time frame, as described in Section 13.1.3 (Requirement for a Reasonable Restoration Time Frame). A cleanup action is considered to have achieved restoration once cleanup standards have been met. An evaluation of the cleanup alternatives with regard to achieving a reasonable restoration time frame is presented in Table 18 and is discussed below for each Site Unit; the practicability of achieving a shorter restoration time frame is addressed as part of the DCA evaluation presented in Section 13.3.

All four cleanup alternatives achieve restoration in a reasonable time frame. Alternative 1 would achieve cleanup standards following implementation of containment in all areas of the Site after demolition of existing Site buildings and a restrictive covenant is placed on the property to maintain the integrity of the containment layer. The intermittent DPE and passive LNAPL recovery included as part of Alternative 1 (if practicable) would also aid in achieving cleanup levels at the Site in a reasonable time frame.

Alternative 2 would achieve cleanup standards following treatment of soil and groundwater in the UST Site Unit with AS/SVE, and LNAPL recovery (if practicable), which is anticipated to require up to two years of treatment followed by one year of compliance monitoring, for a three year restoration time frame. Alternative 2 also requires the implementation of containment and institutional controls for soil in the Work Yard Site Unit, although it is anticipated to take less time to implement than the AS/SVE treatment.

Alternative 3 would achieve cleanup standards following implementation of containment and institutional controls as well as excavation of petroleum-contaminated soil from the UST Site Unit and compliance monitoring to demonstrate that soil and groundwater cleanup levels have been achieved, which is expected to require one year following completion of excavation. Alternative 4 would achieve cleanup standards following excavation and compliance monitoring to demonstrate that soil and groundwater cleanup levels have been achieved throughout the Site, which is expected to require one year following completion of excavation.

13.2.3 PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE

As described in Section 13.1.2 (Requirement for Permanent Solution to the Maximum Extent Practicable), the MTCA requires that cleanup actions be permanent to the maximum extent practicable, and identifies a number of criteria to evaluate whether this requirement is achieved. Evaluation of a given alternative is based on the comparison of whether the incremental increase in cost associated with increasingly permanent cleanup actions is substantial and disproportionate to the incremental increase in environmental benefit. The remainder of this section evaluates the cleanup alternatives against the MTCA permanence criteria. The benefits of the alternatives are then compared against cost and each other in Section 13.3 (Disproportionate Cost Analysis).

13.2.3.1 Protectiveness

As indicated in Section 13.1.2, overall protectiveness is a measure of the degree to which Site risks are reduced, the time required to reduce risk at the facility and attain cleanup standards, risks during implementation, and improvement of overall environmental quality. The overall protectiveness and associated considerations for each alternative are as follows:

- Alternative 1: Medium

  While Site risks are reduced through the elimination of potential exposure to contaminated Site soil, groundwater, and soil vapor, and LNAPL recovery (if practicable), some volume of petroleum hydrocarbon source material remains at the Site. The improvement in overall environmental quality is moderate because the current paved surfaces (with the addition of new pavement and repair/replacement of existing pavement) already limit human contact with underlying soils and groundwater.

- Alternative 2: Medium High

  Alternative 2 significantly reduces long-term risk relatively rapidly and provide a significant improvement in overall environmental quality through the reduction in petroleum contaminant mass by treatment and LNAPL recovery (if practicable). Alternative 2 has limited risk during implementation because treatment will occur *in situ*, which will minimize the potential exposure of workers.

- Alternative 3: Medium High

Alternative 3 also significantly reduces long-term risk relatively rapidly and provide a significant improvement in overall environmental quality through the reduction in petroleum contaminant mass by focused removal and offsite treatment/disposal. Alternative 3 has a moderate risk during excavation and transport of contaminated soil, although these risks can be managed through appropriate design and health and safety procedures.

- Alternative 4: High

Alternative 4 is high because it reduces long-term risk rapidly and provides even greater improvement in overall environmental quality than Alternatives 1, 2, and 3 through the reduction in both petroleum and metals contaminant mass through excavation and offsite treatment or disposal. Alternative 4 has a higher risk than Alternative 3 due to the increase amount and volume of excavation and transport of contaminated soil, although these risks can also be managed through appropriate design and health and safety procedures.

13.2.3.2 Permanence

As indicated in Section 13.1.2, permanence is the degree of reduction in toxicity, mobility, and volume of hazardous substances, including the reduction or elimination of hazardous substance releases and sources of releases. The overall permanence and associated considerations for each alternative are as follows:

- Alternative 1: Medium

Alternative 1 provides a moderate level of permanence because it results in a limited reduction in contaminant mass and mobility through intermittent LNAPL recovery (if practicable), and by preventing stormwater from infiltrating and leaching contaminants to groundwater through the expansion, repair, and maintenance of the low permeability cover.

- Alternative 2: Medium High

Alternative 2 provides *in situ* treatment of petroleum contaminated soil by AS/SVE, combined with LNAPL recovery (if practicable), provides a medium high level of permanence through the permanent reduction in contaminant mass and thereby reduction of toxicity and mobility.

- Alternative 3: Medium High

Alternative 3 provides *in situ* treatment of petroleum contaminated soil by AS/SVE provides a medium high level of permanence through the permanent reduction in contaminant mass and thereby reduction of toxicity and mobility.

- Alternative 4: High

Alternative 4 provides a high level of permanence by greatly reducing the volume of hazardous substances at the Site through removal of contaminated soil and either treatment or disposal at an engineered landfill. However, relocation of contaminated soil to a licensed solid waste landfill does not reduce the toxicity, mobility, or volume of the hazardous substances in the affected media.

13.2.3.3 Effectiveness over the Long-term

As indicated in Section 13.1.2, effectiveness over the long-term includes the degree of certainty that the alternative will be successful, long-term reliability, the magnitude of residual risk, and the effectiveness of controls required to manage treatment residues and remaining waste. All four cleanup alternatives would be effective in the long-term. The overall effectiveness over the long term and associated considerations for each alternative are as follows:

- Alternative 1: Medium High

  Alternative 1 includes surface containment in both Site Units, along with LNAPL recovery (if practicable). However, some volume of petroleum contamination will remain in the source area and VOCs have the potential to migrate in soil vapor.

- Alternative 2: High

  Alternative 2 has a high level of certainty for long-term effectiveness because it will remove petroleum contaminant mass from the UST Site Unit through *in situ* treatment and LNAPL recovery (if practicable), and maintain the containment of the metals contaminated soil.

- Alternative 3: High

  Petroleum contaminated soil in the UST Site Unit will be removed through focused source removal and metals contaminated soil in the other Site Unit will be contained through installation and repair/replacements of the containment layer and institutional controls which will minimize risks of exposure.

- Alternative 4: High

  Alternative 4 has a very high degree of certainty for long-term effectiveness because most, if not all, residual risk will be eliminated through removal and offsite disposal or treatment of contaminated soil, including LNAPL, Site-wide.

13.2.3.4 Management of Short-term Risks

As indicated in Section 13.1.2, management of short-term risk includes the risk to human health and the environment during construction and implementation, and the effectiveness of measures to manage the risk. The management of short-term risks and associated considerations for each alternative are as follows:

- Alternative 1: High

  The management of short-term risks associated with Alternative 1 is high because short term risks primarily relate to installation of dual-phase LNAPL removal wells, new long-term compliance monitoring wells, and a soil vapor trench (if needed). Alternative 1 includes minimal construction activities associated with installation of the containment layer in the North Work Yard and general containment layer replacement/repair throughout the Site.

- Alternative 2: High

  The management of short-term risks associated Alternative 2 is also high because short term risks are primarily associated with worker safety during well drilling and the installation, operation and maintenance of the AS/SVE system, and containment cover installation in the North Work Yard and replacement/repair elsewhere on the Site.

- Alternative 3: Medium High

  Management of short term risks for Alternative 3 is medium high because of the greater potential worker exposure to hazardous substances during excavation of contaminated soil and the transport of contaminated soil for treatment or disposal.

- Alternative 4: Medium

  Management of short term risks for Alternative 4 is medium because of the progressively greater potential worker exposure to hazardous substances during excavation of contaminated soil and the transport of contaminated soil for treatment or disposal compared to Alternative 3.

The short-term risks associated with each alternative can be effectively managed through appropriate design and construction controls, including implementation of a Site-specific health and safety plan during construction.

13.2.3.5 Technical and Administrative Implementability

As indicated in Section 13.1.2, technical and administrative implementability includes consideration of whether the alternative is technically possible; the availability of necessary offsite facilities, services, and materials; administrative and regulatory requirements; scheduling, size, and complexity of construction; monitoring requirements; access for construction, operations, and monitoring; and integration with existing facility operations.

Alternatives 1 through 4 would be implemented using common construction techniques and equipment employed for drilling, plumbing/mechanical, and/or earthwork. The cleanup technologies addressed by these alternatives have been demonstrated to be successful at many other cleanup sites. However, Alternatives 2, 3, and 4 result in progressively increasing levels of disruption to Site use for the current tenant, which affects the implementability of the Alternatives to varying degrees.

None of the alternatives present significant permitting or other administrative implementability issues. Filing for restrictive covenants under Alternatives 1, 2, and 3 should be relatively routine. Because the cleanup action is being conducted under a formal agreement with Ecology, no state or local permits need to be obtained, although substantive permit requirements would still need to be met. No federal permits are anticipated to be required.

The tenant reviewed the potential historical significance of the Site buildings as part of the permitting process for building demolition; the buildings were not determined to be historically significant so this is not anticipated to affect the administrative implementability of any of the alternatives. Cultural resources are not anticipated to be present because the Site uplands were created by filling former aquatic lands with dredge spoils and the original ground surface was aquatic, located below an elevation of 0 ft MLLW. Additionally, any drilling or excavation activities that would be associated with Site cleanup would not extend to the underlying native ground surface where cultural resources could be encountered, if present.

Evaluation of technical and administrative implementability and associated considerations for each alternative are as follows:

- Alternative 1: High

  Alternative 1 is highly implementable because it would not require significant construction to implement. Permitting and administrative issues, including filing for restrictive covenants, will be routine.

- Alternative 2: Medium High

  The implementability of Alternative 2 is medium high because it results in a short-term, moderate level of operational disruption that could be accommodated without severely affecting Port tenant operations. Permitting and administrative-related issues, including filing for restrictive covenants, will be routine.

- Alternative 3: Medium Low

  The implementability of Alternative 3 is considered medium low because it would cause significant disruption to tenant operations and could require the suspension of travel lift operations during excavation. Permitting and administrative-related issues, including filing for restrictive covenants, will be routine.

- Alternative 4: Low

  The implementability of Alternative 4 is considered low because it would require the tenant to cease most operations for a number of months during excavation, backfilling, and Site restoration, and may not be implementable without permanently displacing the tenant.

13.2.3.6 Consideration of Public Concerns

As indicated in Section 13.1.2, the criteria for consideration of public concerns includes whether the community has concerns and the extent to which those concerns are addressed. Public concerns will be identified and addressed through the public participation process that is an integral part of the MTCA. The public will be provided the opportunity to review and comment on this RI/FS report and the CAP developed by Ecology that selects the final cleanup action for the Site. For the purposes of the DCA, consideration of public concerns in considered high for all alternatives.

13.2.3.7 Cost

Itemized cost estimates for each of the cleanup alternatives are provided in Appendix I and are summarized in Table 17. Estimated present-worth costs are as follows:

- 1 - $ 610,000 (including costs for vapor control measures of $53,000, which may not be needed)
- 2 - $ 950,000
- 3 - $ 1,100,000

- 4 - $ 2,900,000

These estimated cleanup costs are consistent with an order-of-magnitude cost estimate and are based on an assumed present worth discount factor of three percent. The costs estimates are used as the cost basis for the DCA (Disproportionate Cost Analysis) presented in Section 13.3.

13.3 MTCA DISPROPORIONATE COST ANALYSIS

As discussed in Section 13.1.2, MTCA requirements for remedy selection include the requirement to use permanent solutions to the maximum extent practicable. MTCA defines permanent cleanup actions as those in which cleanup standards are met without further action being required. MTCA specifies that the evaluation of whether or not a cleanup action uses permanent solutions to the maximum extent practicable be based on a DCA consistent with the requirements of WAC 173-340-360(3)(e). In that analysis, cleanup alternatives are arranged from least to most permanent based on the criteria specified in WAC 173-340-360(3)(f).

The DCA then compares the relative environmental benefits of each alternative against those provided by the most permanent alternative evaluated. Costs are disproportionate to benefits if the incremental cost of an alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the lower cost alternative [WAC 173-340-360(3)(e)(i)]. Where the benefits of two alternatives are equivalent, MTCA specifies that Ecology select the least costly alternative [WAC 173-340-360(e)(ii)(c)].

The DCA is performed below, using the information presented in Section 13.2 and in Table 18. The alternatives are first compared to the most permanent cleanup alternative, and the benefits of each alternative are ranked under the criteria of the disproportionate cost analysis [WAC 173-340-360(f)] in Section 13.3.1. The costs are then compared against these benefits and the relationship between the benefits and costs evaluated in Section 13.3.2. This analysis then defines which alternative is permanent to the maximum extent practicable.

Relative rankings for the alternatives within each Site Unit were determined by assigning a value on a scale from 1 to 10, where 10 is the highest benefit/value, for each criterion, multiplying each value by a weighting factor, and summing the weighted values to determine an overall alternative-benefits-ranking score. Weighting factors are the same as those used by Ecology in the CAP for the Whatcom Waterway Site. The six evaluation criteria and associated weighting factors are:

- Protectiveness: 30%
- Permanence: 20%
- Long-term effectiveness: 20%
- Short-term risk management: 10%

- Implementability: 10%
- Considerations of public concerns: 10%

Relative rankings of each alternative for the benefits criteria are discussed below and summarized in Table 18.

13.3.1 COMPARATIVE EVALUATION OF ALTERNATIVES

The DCA is based on a comparative analysis of the alternatives against the six evaluation criteria. Relative rankings of each alternative for the six criteria are discussed below and summarized in Table 18 for each Alternative. The following provides the comparative evaluation of the alternatives and compares Alternatives 1 through 3 to the most permanent alternative, Alternative 4.

13.3.1.1 Protectiveness

All four alternatives are protective of human health and the environment. The differences lie within the technologies used to achieve that protectiveness. Alternative 4 achieves protection through the removal of contaminated soil Site wide, Alternative 3 achieves protection through removal of petroleum contaminated soil and /containment of metals contaminated soil and institutional controls. Alternative 2 is similar to Alternative 3, but achieves protection through *in situ* treatment of petroleum contaminated soils with the intermittent LNAPL removal (if practicable), and Alternative 1 achieves cleanup through containment, intermittent LNAPL removal (if practicable), compliance monitoring, and institutional controls. Although removal is not more protective than the other technologies, it does provide a higher level of certainty that protectiveness will be achieved quickly and maintained in the long-term. Similarly, *in situ* treatment provides greater certainty regarding long-term protectiveness than alternatives that rely only on physical barriers and institutional controls for protection.

Alternative 4 was ranked the highest for protectiveness with a ranking of 9 based on the complete removal of contaminated soil; this alternative was not given a ranking of 10 because there is some potential that cleanup levels will not be achieved in groundwater through excavation alone and supplemental cleanup and/or monitoring could be required. Alternatives 2 was given a ranking of 8 based on the expectation that *in situ* treatment of petroleum contaminated soil combined with intermittent LNAPL removal in the UST Site Unit will achieve soil and groundwater cleanup levels, or only minimal contamination would remain if cleanup levels are not achieved. Alternative 3 is also given a protectiveness ranking of 8 because it addresses the same area of petroleum contamination as Alternative 2. Alternatives 1 is given a ranking of 6 because containment with intermittent LNAPL removal in conjunction with institutional controls effectively limits human contact and reduces stormwater infiltration through contaminated soils.

13.3.1.2 Permanence

As indicated previously, Alternative 4 is considered the most permanent alternative because it removes the contaminated material from the Site and provides a reduction in contaminant mobility through placement of contaminated soil in a certified landfill. Alternative 3 provides a reduction in contaminant mobility through removal of petroleum contamination source area soil and either treatment or placement of the excavated soil in a certified landfill. Alternative 3 would also include onsite containment of residual petroleum- and metals-contaminated soil. Alternative 2 permanently reduces the volume of hazardous materials at the Site through *in situ* treatment of petroleum-contaminated soil and groundwater with intermittent LNAPL recovery (if practicable), and containment of metals contaminated soil. Alternative 1 reduces the mobility of contaminants through containment measures, and reduces mass and mobility through intermittent LNAPL recovery (if practicable), but does not greatly reduce the contaminant mass present on the Site so is considered less permanent than Alternatives 2 through 4.

Alternative 4 was ranked highest for permanence (9) because it removes contaminated soil Site-wide and reduces its mobility. Alternative 3 is given a permanence ranking of 8 because while it does not reduce the volume of contamination on the Site as much as Alternative 4, it does remove the most highly contaminated soil from the Site. Alternative 2 was given a ranking of 8 because it reduces the total onsite volume of contamination to about the same extent as Alternative 2. Alternative 1 was given permanence rankings of 6 because of the lack of extensive removal or treatment of contaminated media.

13.3.1.3 Effectiveness over the Long-Term

Alternative 4 is considered the most effective in the long-term because it removes most, if not all, contamination from the Site. Alternatives 2 and 3 are considered moderately effective because a significant portion of the contamination is removed and/or treated. Alternative 1 is considered somewhat less effective in the long-term because it does not greatly reduce the contaminant mass. Because Alternatives 1, 2 and 3 rely on containment and institutional controls to varying degrees, they each retain the risk of losing effectiveness if the containment layer is not adequately maintained or the institutional controls are not properly followed.

Alternative 4 is ranked the highest for long-term effectiveness (10) because most, if not all Site soil contamination would be removed by excavation and only minimal potential risk would remain for human or environmental receptors. Alternatives 2 and 3 are ranked slightly lower (9), because there is greater uncertainty in maintaining long-term effectiveness through containment and institutional controls. Alternatives 1 is given a rankings of 8 because, it does not significantly reduce contaminant mass, and relies on containment and institutional controls for a larger area than for Alternatives 2 and 3.

13.3.1.4 Management of Short-Term Risks

Alternative 1 is ranked the highest (10) with respect to management of short-term risk because construction activity is limited to minor containment layer construction activities and drilling wells for long-term monitoring and LNAPL recovery (if practicable) Alternative 1 also includes the possible installation and operation of a soil vapor control system, pending the results of additional investigations to be conducted during remedial design. Alternative 2 is ranked slightly lower (9) because of the additional construction associated with the AS/SVE treatment system. Alternatives 3 and 4 are given rankings of 7 and 6, respectively, due to the quantity of excavation for each alternative.

13.3.1.5 Technical and Administrative Implementability

Alternative 1 is ranked the highest (9) for implementability because it requires the least amount of construction and poses only minor administrative implementation issues related to filing and implementing the institutional controls. Alternative 2 is given a ranking of 8 due to the challenges associated with constructing and integrating the relatively intensive AS/SVE system operation and maintenance activities with an active boatyard. Alternative 3 is given a ranking of 4 because of the significant disruption excavation will have on current tenant operations. Alternative 4 is given a ranking of 1 because it would require the closure of the boatyard for a number of months during construction of the cleanup action. Alternatives 3 and 4 also present difficulties associated with excavating contaminated soil from below the water table, and protecting extensive utilities along Squalicum Way.

As indicated in Section 13.2.3.5, no historic or cultural resources are known to be present on the Site, and if any cultural resources were present, they would be located well below any excavation or other intrusive activities that would occur in conjunction with Alternatives 1 through 4. Therefore, none of these factors modified the implementability rankings.

13.3.1.6 Consideration of Public Concerns

Specific public concerns regarding the cleanup alternatives are not yet known, however it is assumed that the greatest public concern would be protection of human health and the environment. This concern is reflected in the other criterion above such as Protectiveness and Permanence. The other concerns described in Section 13.2.3.6 are readily managed and do not necessarily favor one Alternative over another. Therefore, for the purposes of completing this RI/FS for public review all alternatives are given a ranking of 10 for consideration of public concerns. Evaluation of alternatives against the Consideration of Public Concerns criterion is subject to change based on public comments received on this document.

13.3.2 COMPARISON OF OVERALL BENEFITS (RELATIVE BENEFIT SCORES)

Based on higher overall scores in the areas of protectiveness, permanence, and long-term effectiveness, Alternative 2 has the highest weighted score. The rank and relative benefit scores for each alternative are presented in Table 17, and are as follows:

- Alternative 4 Relative Benefit Score: 8.2
- Alternative 3 Relative Benefit Score: 7.9
- Alternative 2 Relative Benefit Score: 8.5
- Alternative 1 Relative Benefit Score: 7.5

13.3.3 DISPROPORTIONATE COST ANALYSIS

The estimated costs, and the benefits presented in Section 13.3.1, are summarized for each alternative in Table 18. Table 18 also summarizes the overall benefits and costs for each alternative using the relative benefit score developed for each alternative in Section 13.3.1.

Figure 36 provides a graphical comparison between the costs of each alternative and the relative benefits, using the costs developed in Appendix I and benefit rankings developed in Table 18. A comparison of the relative benefit- to-cost ratios between the alternatives is also depicted on the figure. The relative benefit versus cost ratios have been escalated by a scaling factor of 300,000 so that the ratios can be presented in comparison to the ranges-of-scale provided by the relative benefit ranking axis.

The DCA indicates that Alternative 2 (Containment with *In Situ* Treatment and Source Recovery) yields the greatest overall benefit of the four alternatives evaluated, as indicated in the previous section. Because Alternatives 3 and 4 received lower overall benefit scores and both cost more than Alternative 2, they are both considered impracticable and eliminated from further consideration.

Alternative 1 has a 13 percent lower overall benefits ranking than Alternative 2 (7.5 compared to 8.5), but costs about 37 percent ($340,000) less. This results in a correspondingly higher benefit/cost ratio (3.7 compared to 2.7), based on the benefit divided by the cost adjusted using the 300,000 scaling factor [i.e., $\text{Benefit/Cost}_{\text{Alternative 1}} = (7.5/610{,}000)*300{,}000 = 3.7$]. Because the incremental increase in cost of Alternative 2 compared to Alternative 1 is large, and the incremental increase in benefit is small, the incremental cost of Alternative 2 is considered substantial and disproportionate to its incremental benefits. As a result, Alternative 1 is the alternative considered permanent to the maximum extent practicable for the Site.

14.0 SUMMARY AND CONCLUSIONS

The Site RI defined physical characteristics, source areas, the nature and extent of impacted media, and the migration pathways and potential receptors for contaminants. Data from the RI and previous investigations were used in the FS process to develop and evaluate remedial alternatives for the Site.

The FS developed remedial alternatives for the UST and Work Yard Site Units for cleanup of contaminated media defined in the RI, evaluated the alternatives against criteria defined by MTCA, provided a comparative analysis of the alternatives to determine the relative environmental benefits of each, and compared the relative benefits of each against their costs to determine the alternative that uses permanent solutions to the maximum extent practicable.

14.1 PREFERRED ALTERNATIVE

The preferred alternative for the Site is an integrated cleanup action that addresses contamination in the UST and Work Yard Site Units. The preferred alternative is Alternative 1, and was selected based on the DCA presented in Section 13.3. The preferred alternative consists of the following elements:

- Containment of gasoline-range petroleum hydrocarbon and VOC-contaminated soil (i.e., BTEX), with soil vapor control if needed to contain affected soil vapor (UST Site Unit)
- Recovery of LNAPL, if practicable, using intermittent DPE recovery methods (UST Site Unit)
- Containment of metals-contaminated soil, including paving the North Work Yard (Work Yard Site Unit)
- Reduction of the vapor migration potential through LNAPL recovery and a vapor control system (if needed)
- Soil, groundwater (potentially including porewater analysis), and soil vapor compliance monitoring (Site Wide/point of compliance)
- Institutional controls to maintain the soil containment layer (i.e., pavement and building slabs), restrict groundwater use, and manage potentially-contaminated soil and groundwater disturbed during future intrusive activities (Site Wide).

Because a permanent cleanup action has already been implemented at the Marine Site Unit, this area of the Site complies with Site cleanup requirements and no further remedial action is required. However, the need for future sediment compliance monitoring will be determined during development of the Site CAP.

Containment would be fully implemented following demolition of the existing buildings during Site redevelopment and pavement of the North Work Yard. Existing buildings would be demolished to their floor slabs and the floor slabs would be used as part of the Site containment system; Building 3 has been partially removed as of December 2013 with the remaining structure to be removed by spring 2014.

Floor slabs would be patched/repaired as necessary to support the containment strategy. Currently unpaved areas (i.e., the North Work Yard), or areas where demolition leaves exposed soil, would be paved for use as a work yard for the current tenant and would also serve as the Site containment. Areas of existing cracked or otherwise degraded pavement would be repaired and/or replaced as necessary to provide effective containment and minimize stormwater infiltration at the Site.

A soil vapor control system would be constructed and operated at the Site as part of the containment system, if additional soil vapor investigation to be conducted during remedial design indicates that soil vapor concentrations could represent an unacceptable risk to air quality. An LNAPL recovery system using DPE will be constructed and intermittently operated in the UST Site Unit area, if additional LNAPL evaluation in the source area to be conducted during remedial design indicates that LNAPL recovery is practicable.

A restrictive covenant would be applied to the Site that prohibits use of Site groundwater as potable water. The restrictive covenant would also specify the procedures required for future intrusive activities that could encounter affected media, including worker health and safety requirements and procedures for managing potentially contaminated soil and groundwater. The procedures would be established in a soil and groundwater management plan reviewed and approved by Ecology.

Long-term compliance monitoring would be implemented to ensure that cleanup standards are achieved and maintained. Compliance monitoring would evaluate groundwater quality at the proposed conditional point of compliance at the shoreline and surface water in the marina in proximity to the groundwater conditional point of compliance; groundwater compliance monitoring may include porewater sampling within the marine sediment near the bulkhead, depending on evaluations conducted during remedial design. Surface water sampling would also be conducted elsewhere in the marina to establish area background concentrations for copper, and possibly other COCs monitored for groundwater compliance. Soil vapor compliance monitoring would be conducted along the north Site boundary adjacent to Squalicum Way, as necessary, and could also be conducted elsewhere on the Site if new buildings are constructed within 100 ft of the UST Site Unit.

14.2 IMPLEMENTATION OF SITE CLEANUP

After considering public comment, the RI/FS will be finalized and a cleanup action alternative for the Site units will be selected by Ecology. The selected cleanup action will be presented in the Site CAP, which will be an exhibit to a legal agreement called a consent decree. The Site CAP will describe the cleanup action and specify cleanup standards and compliance monitoring requirements. Following public review of the consent decree and CAP, the cleanup will progress into a series of implementation phases, including engineering and design, permitting, construction, and compliance monitoring.

Remedial design will include additional investigation and evaluation to address data gaps that need to be filled to finalize the design of the final cleanup action, including evaluation of the:

- Presence of, and the practicability of recovering, LNAPL free product in the UST Site Unit,
- Distribution of VOCs in soil vapor, and the need for a soil vapor recovery system as part of the cleanup action in the UST Site Unit area,
- Concentrations of lead and VOCs in Site groundwater in the UST Site Unit area, and
- Effectiveness and practicability of porewater monitoring in marine sediment near the bulkhead as an element of groundwater compliance monitoring

15.0 USE OF THIS REPORT

This report was prepared for the exclusive use of the Port of Bellingham, the Washington State Department of Ecology, and applicable regulatory agencies, for specific application to the Weldcraft Steel and Marine Site. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of the Port and Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied. This document was prepared under the supervision and direction of the undersigned.

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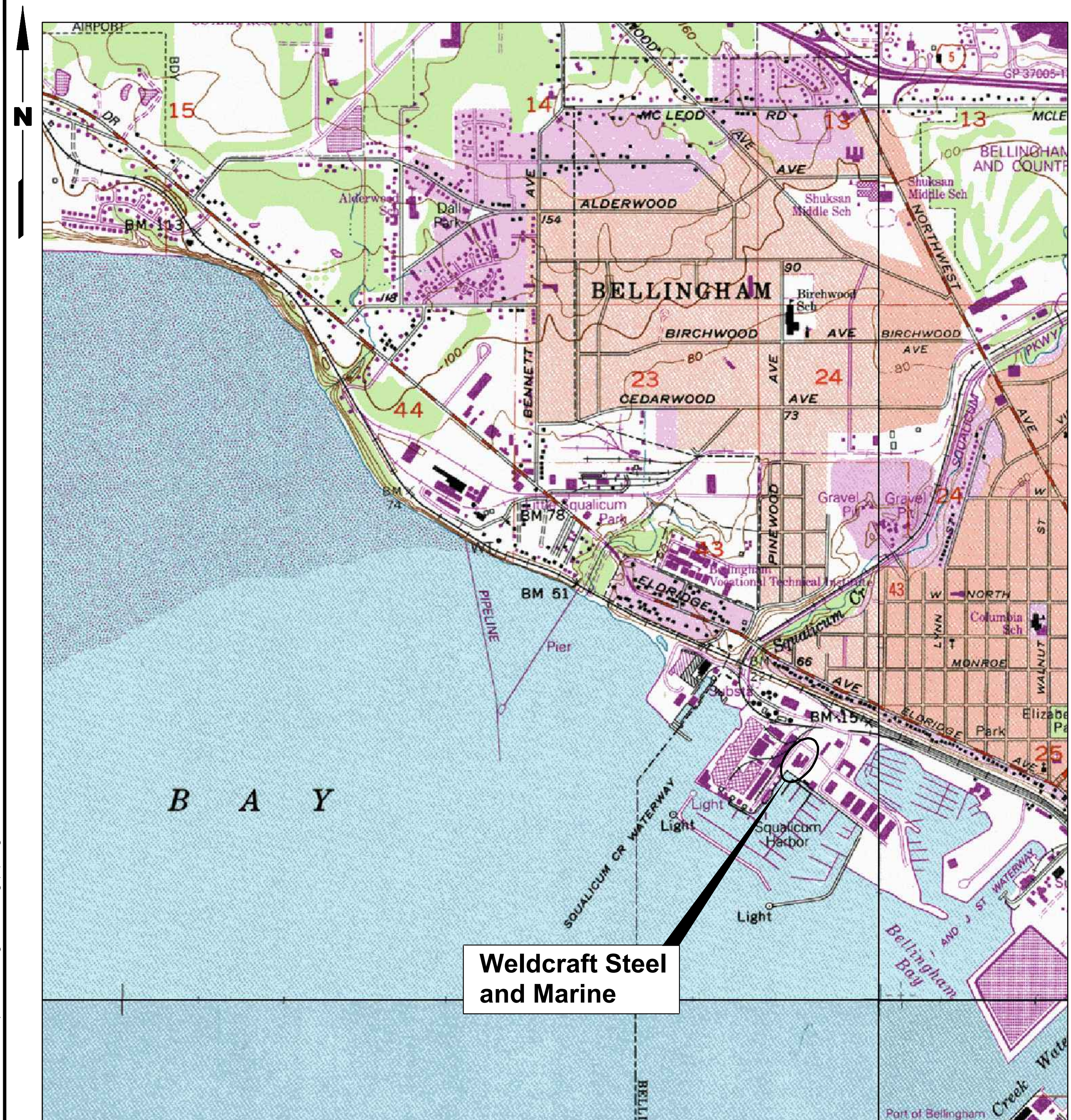

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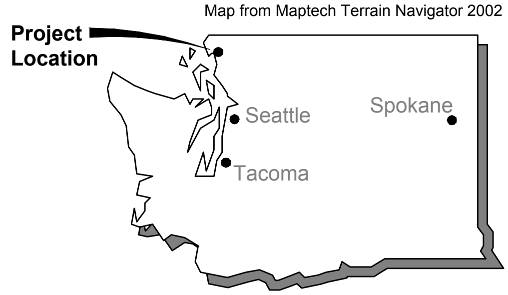

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Scale in Feet

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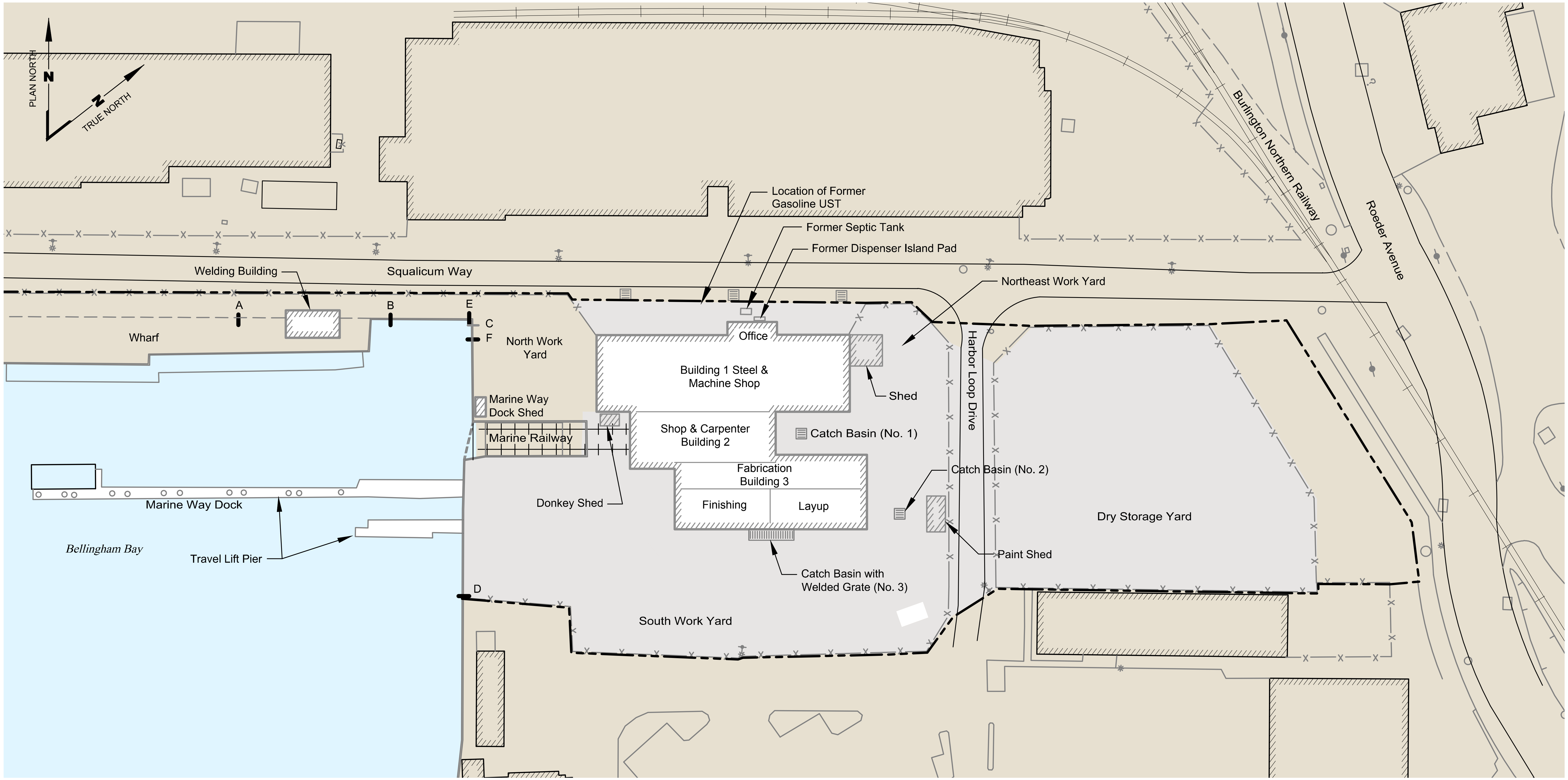
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Vicinity Map

Figure
1



Legend

- Catch Basin
- Pilings
- A — Approximate Location of Outfall and Identification
- Fence
- Railroad
- Former Weldcraft Steel and Marine Operations Area
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces

Ownership Information

The Site, adjacent properties to the north and south, and adjacent aquatic lands, are owned by the Port of Bellingham (Port). The Port also owns Squalicum Way and the historical Harbor Loop Drive. Roeder Avenue is a public right-of-way.

Note

1. Site plan is based on conditions prior to to the 2003/2004 Sediment Interim Action.

2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160

Scale in Feet

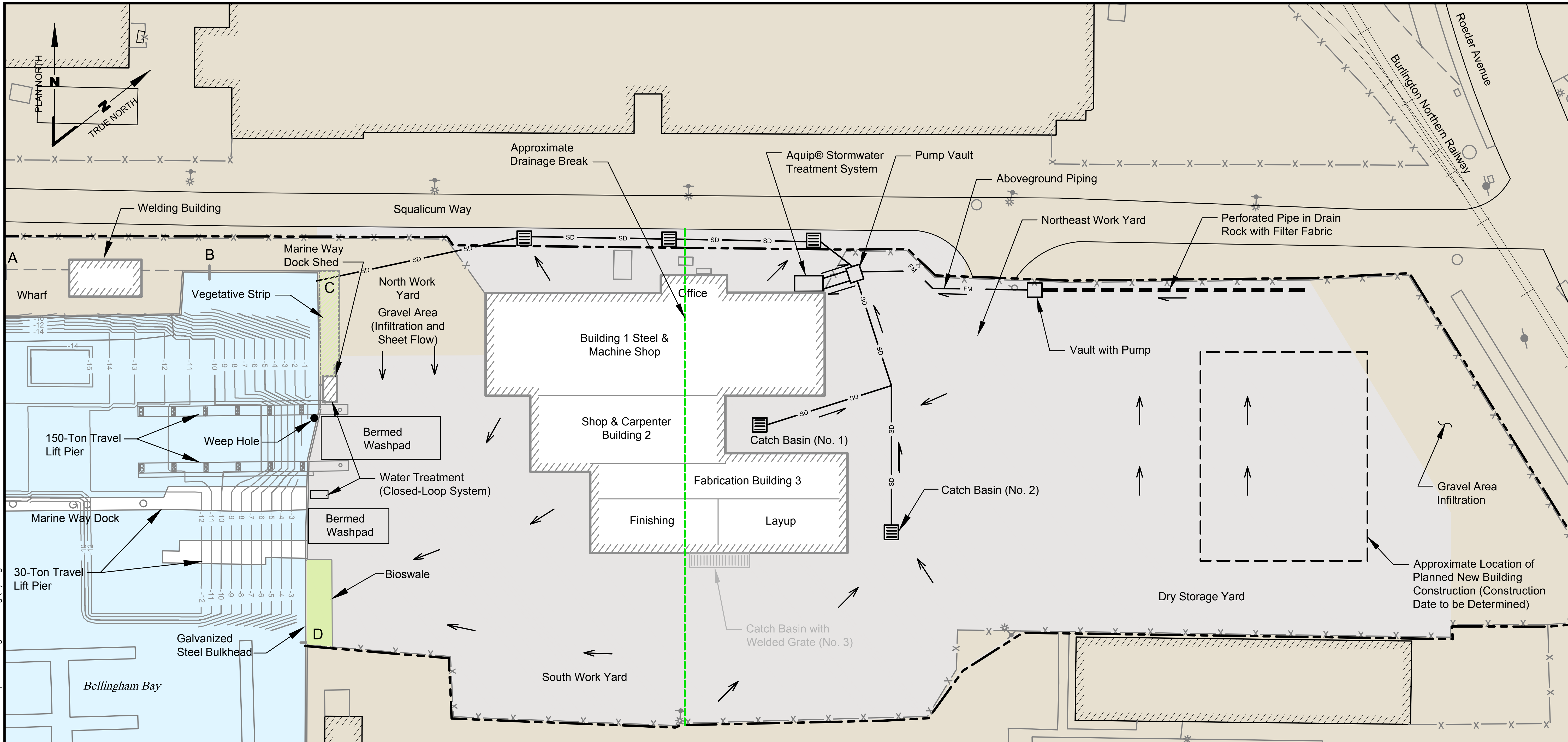
Landau Associates

Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Pre-Interim Action Site Plan

Figure 2

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 02.dwg (A) "Figure 2" 1/8/2014



Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 03.dwg (A) "Figure 3" 3/27/2014

Legend

	Catch Basin
	Pilings
—A	Approximate Location of Outfall and Identification
	Stormdrain Flow Direction
	Surface Water Sheet Flow Direction
	4" Perforated Pipe in Drain Rock and Filter Fabric
FM	4" PVC
SD	12" PVC Stormdrain
X	Fence
	Railroad
	Former Weldcraft Steel and Marine Operations Area
	Structure
	Upland Area
	Bellingham Bay
	On-site Paved Surfaces

Ownership Information

The Site, adjacent properties to the north and south, and adjacent aquatic lands, are owned by the Port of Bellingham (Port). The Port also owns Squalicum Way and the historical Harbor Loop Drive. Roeder Avenue is a public right-of-way.

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 60 120
Scale in Feet

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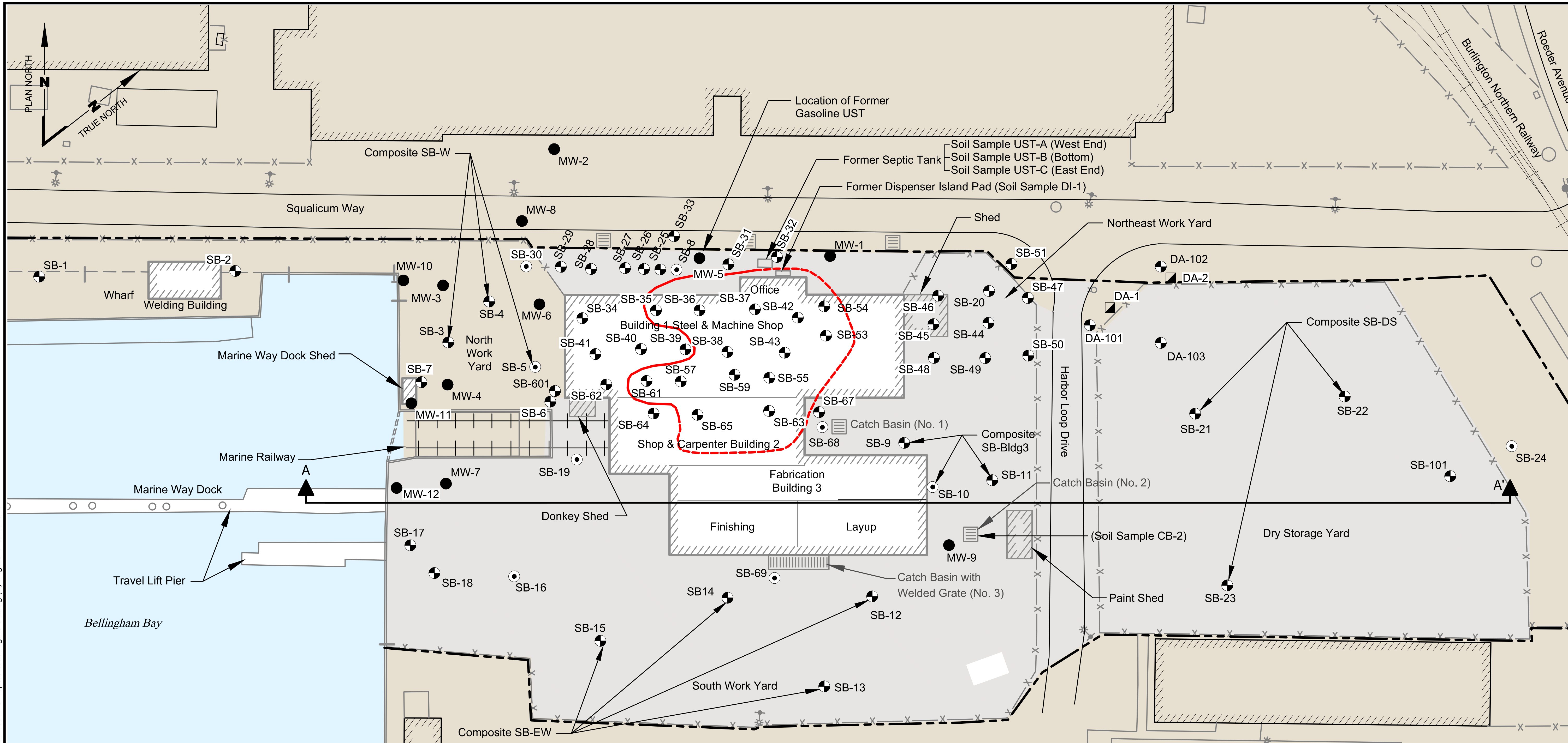
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Post Interim Action Site Plan and Current Site Features

Figure 3



Legend

- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Estimated Area of Apparent Coal Material in UST Vicinity (dashed where inferred)
- Former Weldcraft Steel & Marine Operations Area
- Fence
- Railroad
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Structure
- A A' Geologic Cross Section Alignment (See Figure 13)
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces

0 60 120
Scale in Feet

Notes

1. Site plan is based on conditions prior to to the 2003/2004 Sediment Interim Action.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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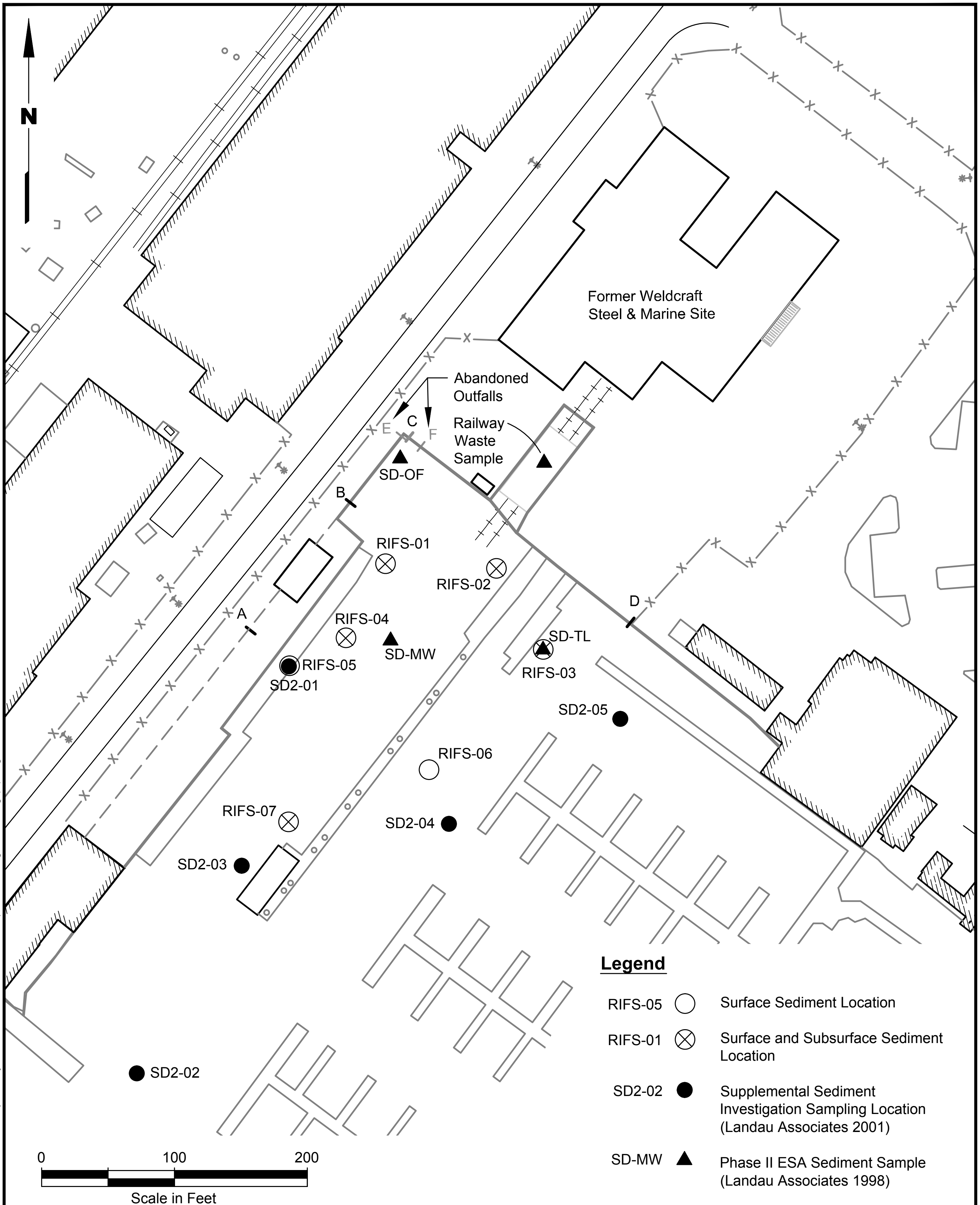
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Upland Sample Locations

Figure
4



Source: Port of Bellingham

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 05.dwg (A) "Figure 5" 12/18/2013

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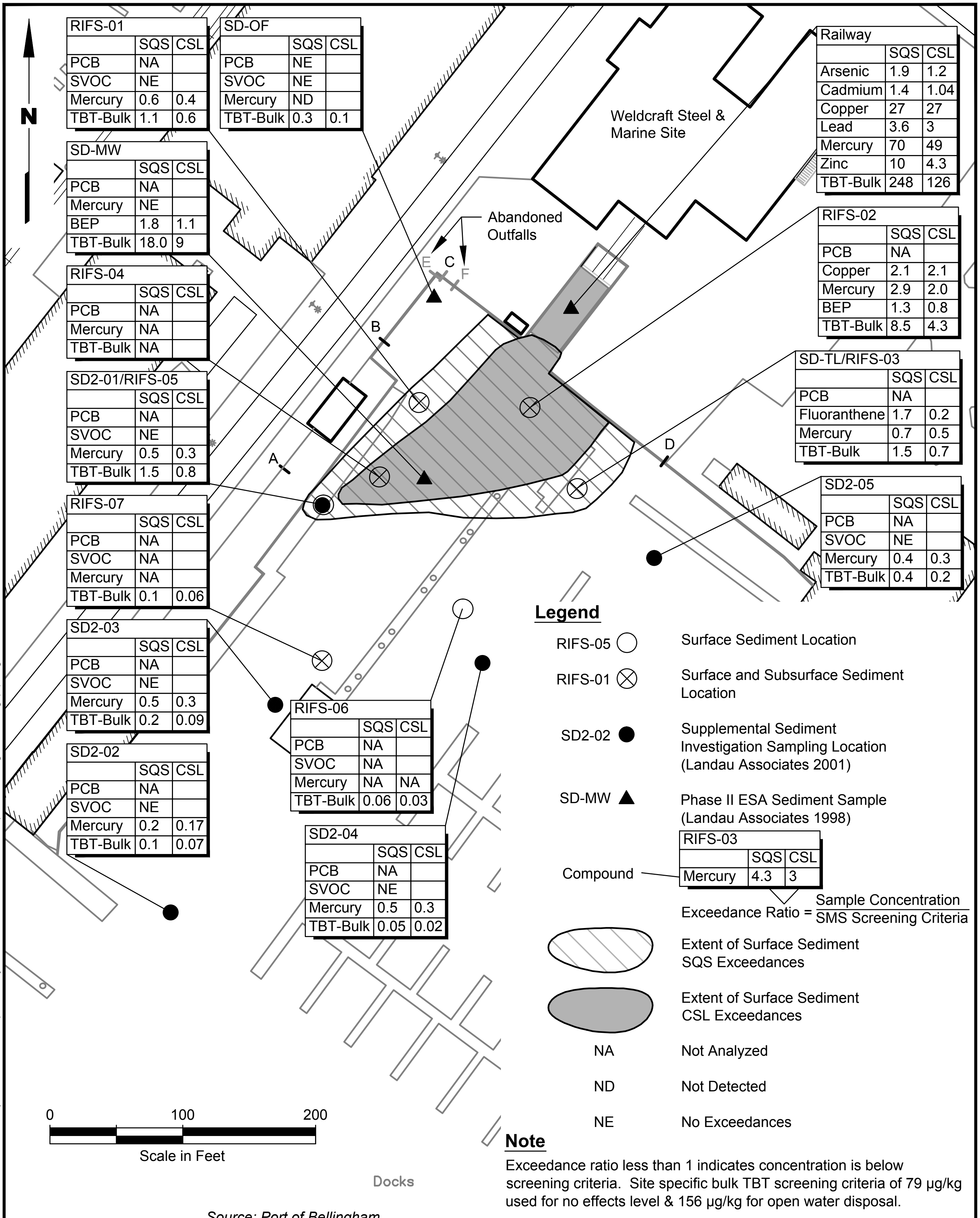
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Pre-Interim Action Sediment Sampling Locations

Figure 5



RIFS-01	SQS	CSL
PCB	NA	
SVOC	NE	
Mercury	0.6	0.4
TBT-Bulk	1.1	0.6

SD-OF	SQS	CSL
PCB	NE	
SVOC	NE	
Mercury	ND	
TBT-Bulk	0.3	0.1

Railway	SQS	CSL
Arsenic	1.9	1.2
Cadmium	1.4	1.04
Copper	27	27
Lead	3.6	3
Mercury	70	49
Zinc	10	4.3
TBT-Bulk	248	126

SD-MW	SQS	CSL
PCB	NA	
Mercury	NE	
BEP	1.8	1.1
TBT-Bulk	18.0	9

RIFS-02	SQS	CSL
PCB	NA	
Copper	2.1	2.1
Mercury	2.9	2.0
BEP	1.3	0.8
TBT-Bulk	8.5	4.3

RIFS-04	SQS	CSL
PCB	NA	
Mercury	NA	
TBT-Bulk	NA	

SD-TL/RIFS-03	SQS	CSL
PCB	NA	
Fluoranthene	1.7	0.2
Mercury	0.7	0.5
TBT-Bulk	1.5	0.7

SD2-01/RIFS-05	SQS	CSL
PCB	NA	
SVOC	NE	
Mercury	0.5	0.3
TBT-Bulk	1.5	0.8

SD2-05	SQS	CSL
PCB	NA	
SVOC	NE	
Mercury	0.4	0.3
TBT-Bulk	0.4	0.2

RIFS-07	SQS	CSL
PCB	NA	
SVOC	NA	
Mercury	NA	
TBT-Bulk	0.1	0.06

SD2-03	SQS	CSL
PCB	NA	
SVOC	NE	
Mercury	0.5	0.3
TBT-Bulk	0.2	0.09

RIFS-06	SQS	CSL
PCB	NA	
SVOC	NA	
Mercury	NA	NA
TBT-Bulk	0.06	0.03

SD2-02	SQS	CSL
PCB	NA	
SVOC	NE	
Mercury	0.2	0.17
TBT-Bulk	0.1	0.07

SD2-04	SQS	CSL
PCB	NA	
SVOC	NE	
Mercury	0.5	0.3
TBT-Bulk	0.05	0.02

RIFS-03	SQS	CSL
Mercury	4.3	3

Note

Exceedance ratio less than 1 indicates concentration is below screening criteria. Site specific bulk TBT screening criteria of 79 µg/kg used for no effects level & 156 µg/kg for open water disposal.

Source: Port of Bellingham

Weldcraft Steel and Marine | \\EDMGIS03\Graphics\Projects\001\024\200\240\RIFS Report 2013\Figure 06.dwg (A) "Figure 6" 1/20/2014

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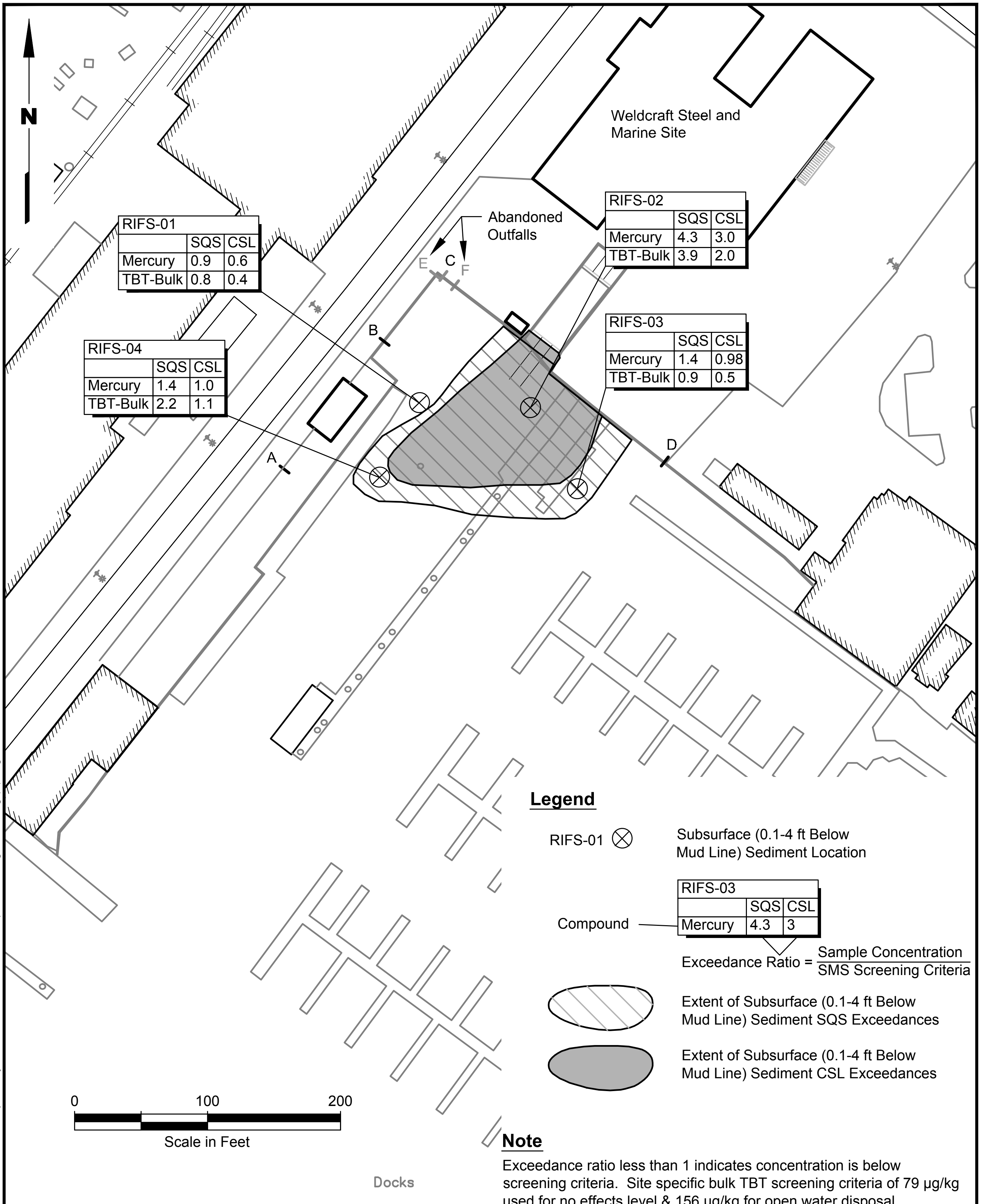
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Pre-Interim Action Surface Sediment Exceedance Ratios

Figure 6



Source: Port of Bellingham

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 07.dwg (A) "Figure 7" 12/18/2013

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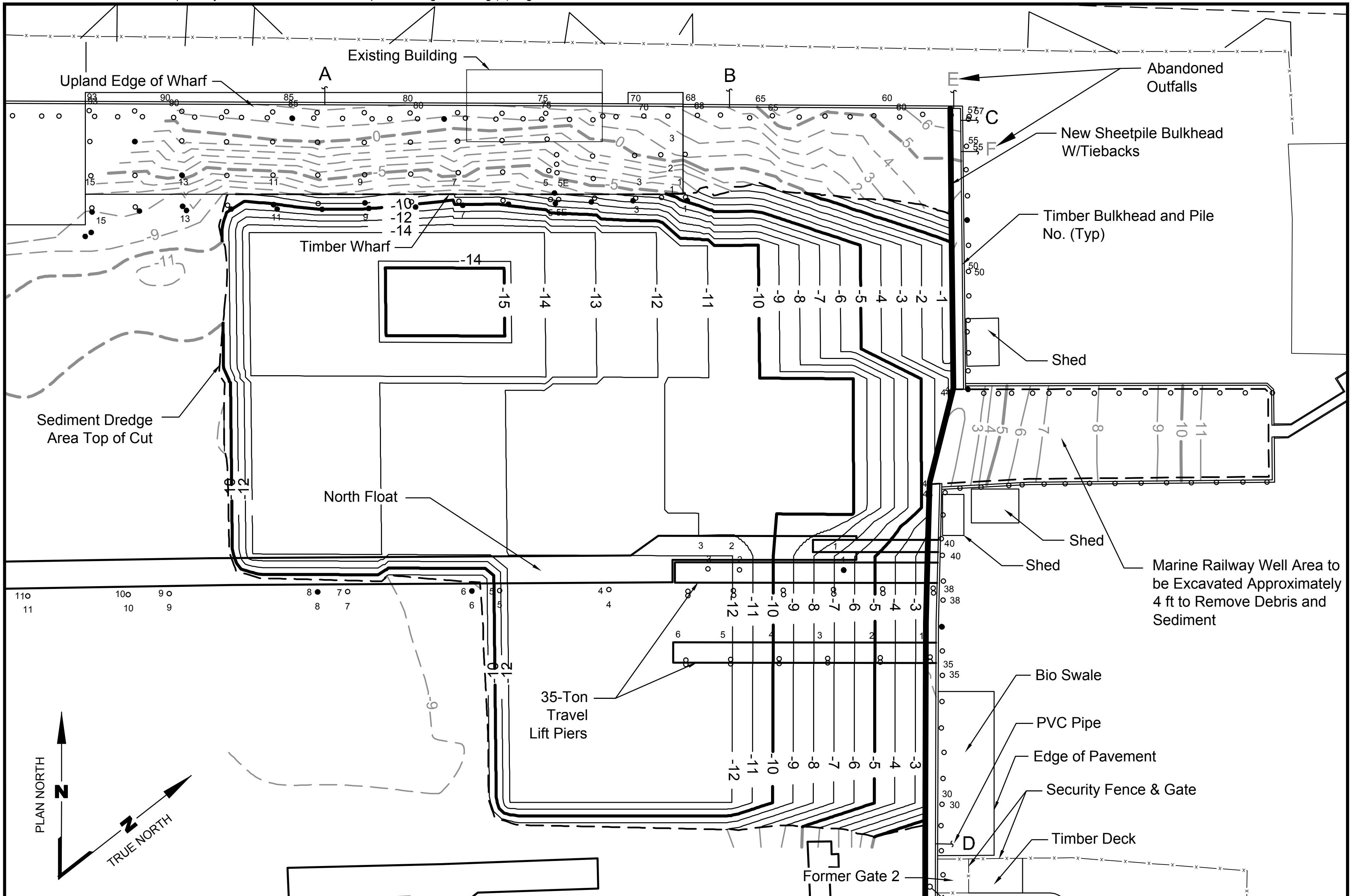
Port of Bellingham Weldcraft Steel and Marine Bellingham, Washington	**Pre-Interim Action Subsurface Sediment Exceedance Ratios**	Figure 7



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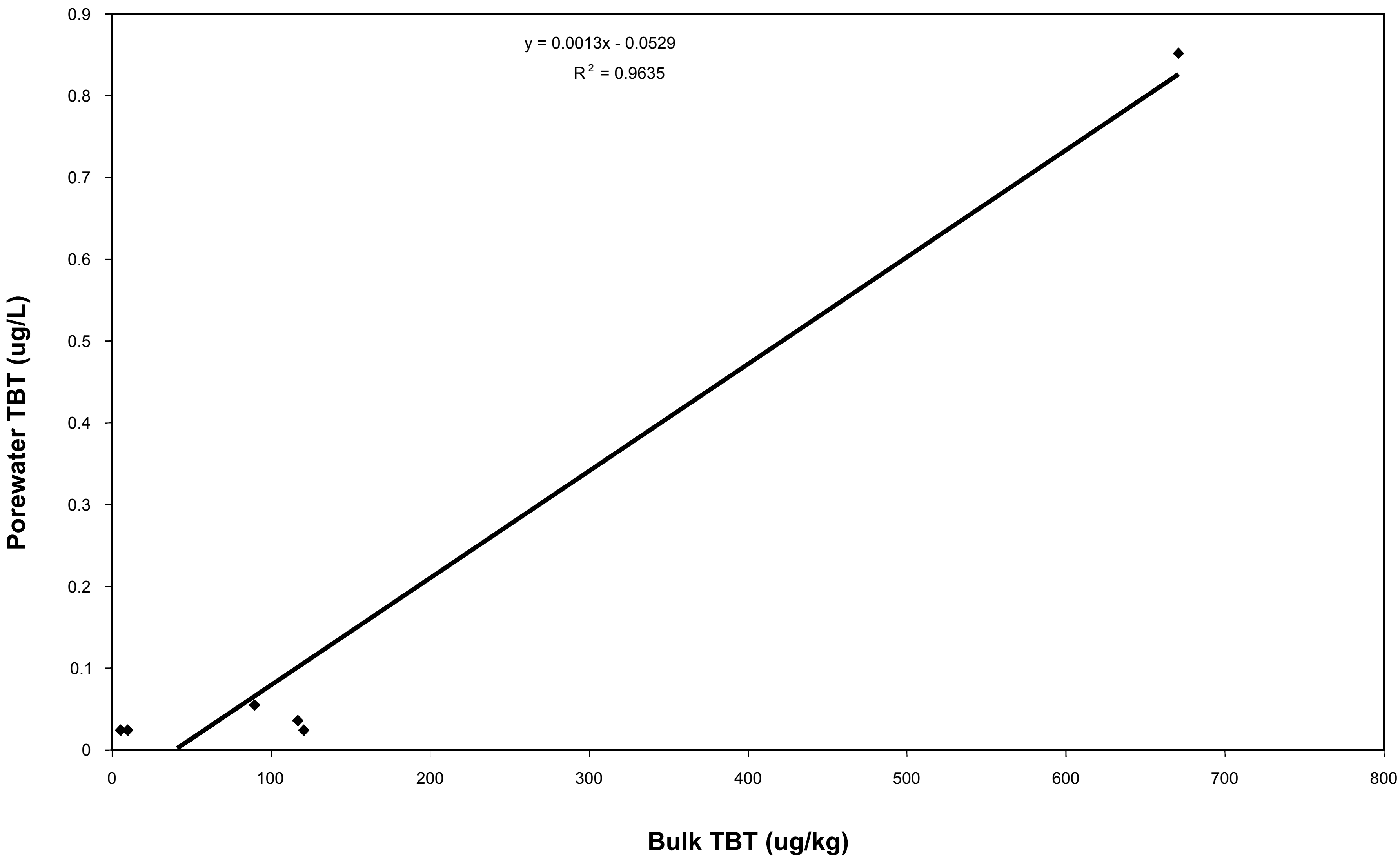
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Interim Action
Dredging Design Contours

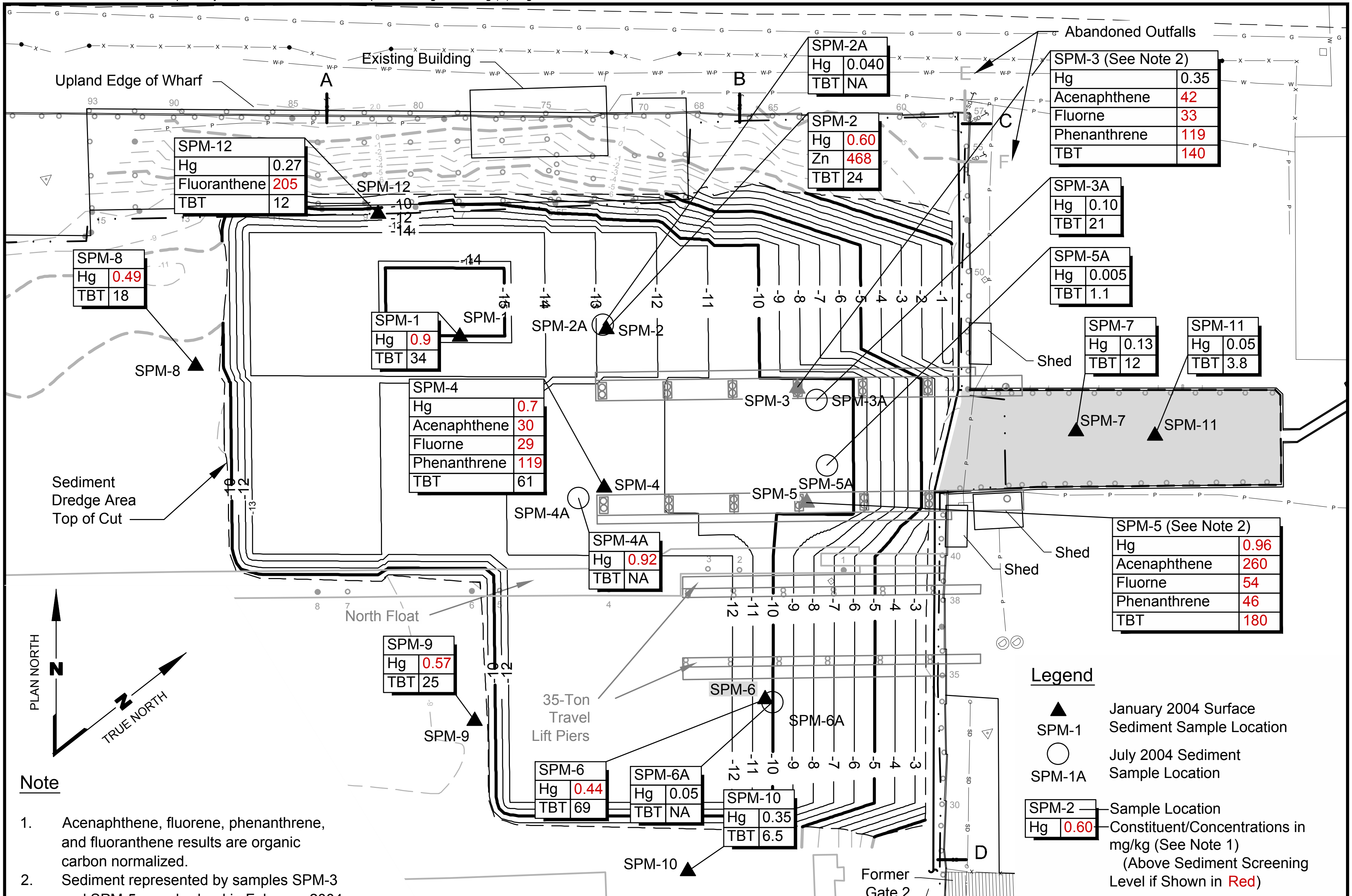
Figure 8



LANDAU ASSOCIATES

Port of Bellingham Weldcraft Steel and Marine Bellingham, Washington	**Comparison of Bulk TBT and Porewater TBT**	Figure 9

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 10.dwg (A) "Figure 10" 12/18/2013



Note

1. Acenaphthene, fluorene, phenanthrene, and fluoranthene results are organic carbon normalized.
2. Sediment represented by samples SPM-3 and SPM-5 was dredged in February 2004.

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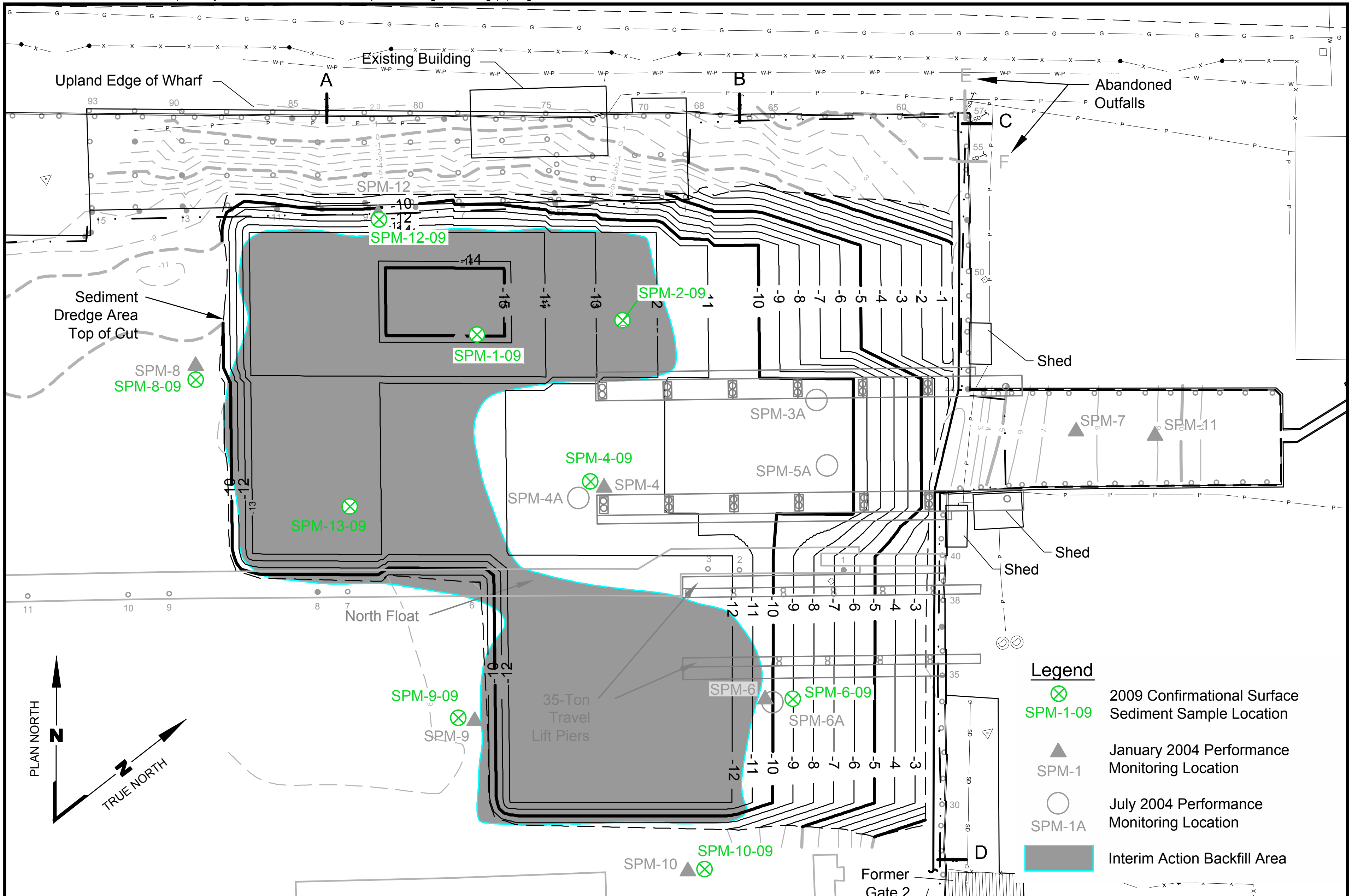
Weldcraft Steel and Marine
Bellingham, Washington

2004 Performance Monitoring Sediment Sample Locations and Results

Figure 10

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 11.dwg (A) "Figure 11" 12/18/2013



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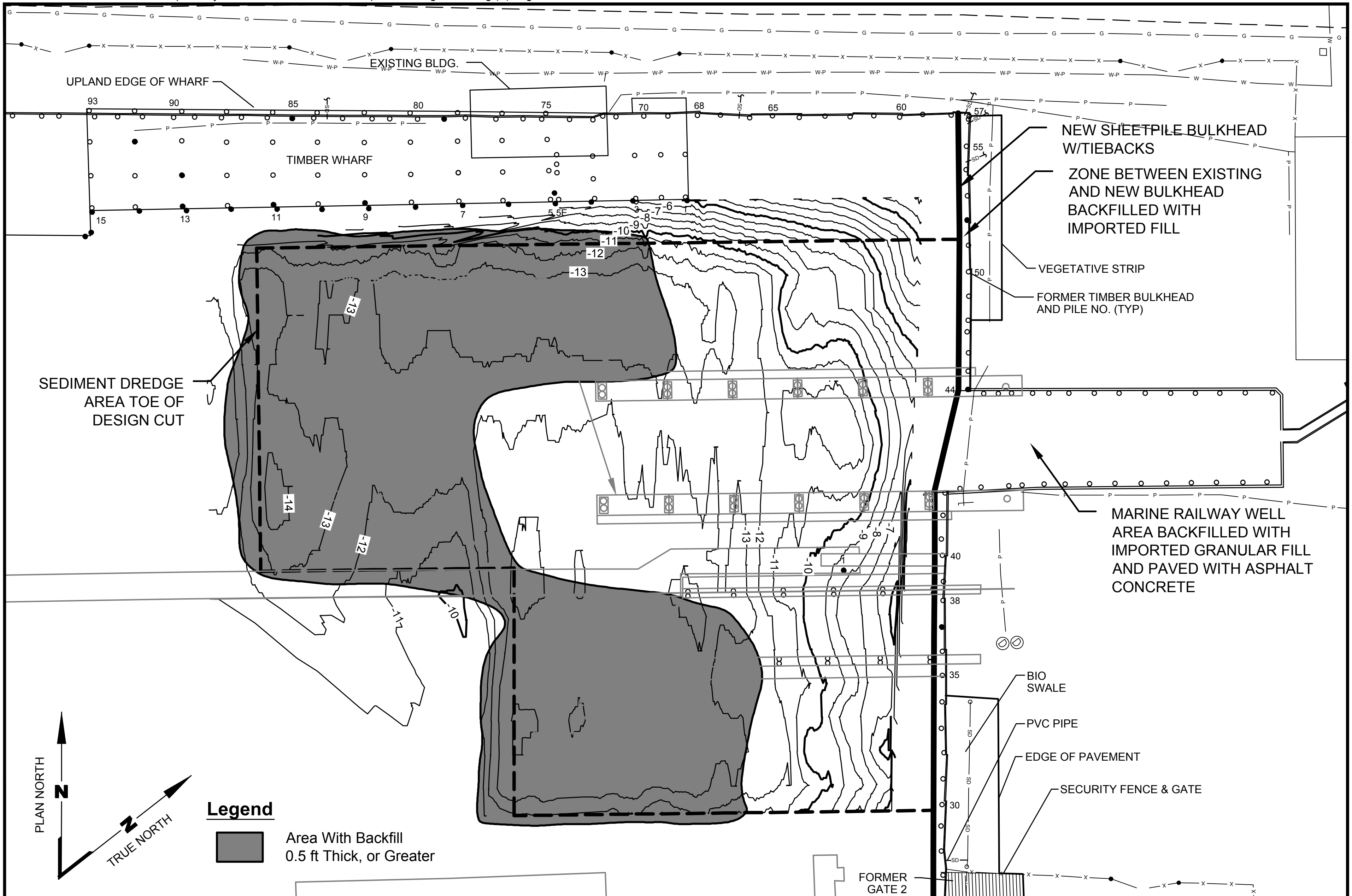
0 40 80
Scale in Feet

Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

2009 Confirmational Monitoring Sediment Sample Locations

Figure 11

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 12.dwg (A) "Figure 12" 12/18/2013



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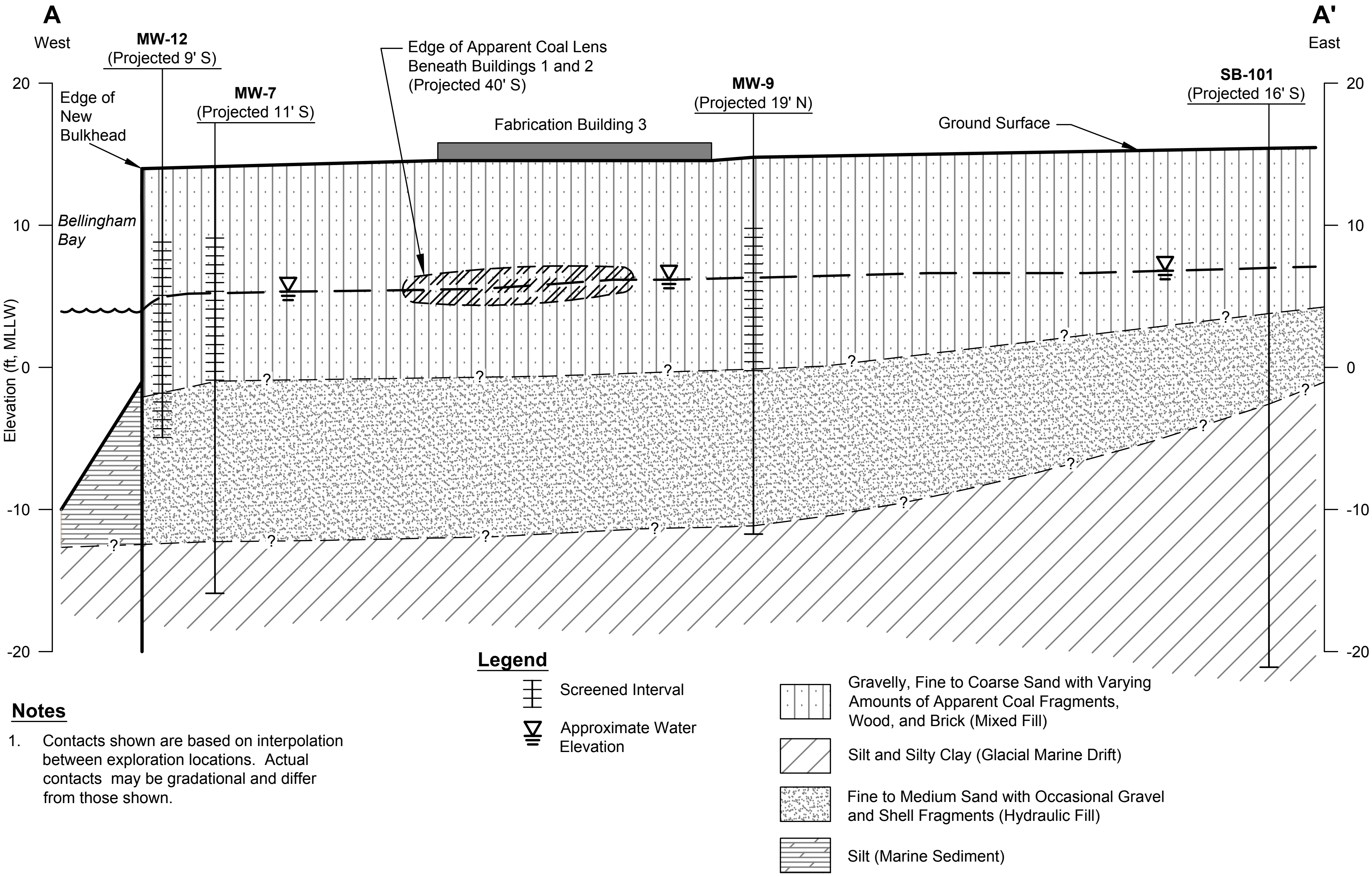
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Sediment Backfill Areas

Figure 12



Notes

1. Contacts shown are based on interpolation between exploration locations. Actual contacts may be gradational and differ from those shown.

0 80 160
Scale in Feet
Vertical 1"=10'

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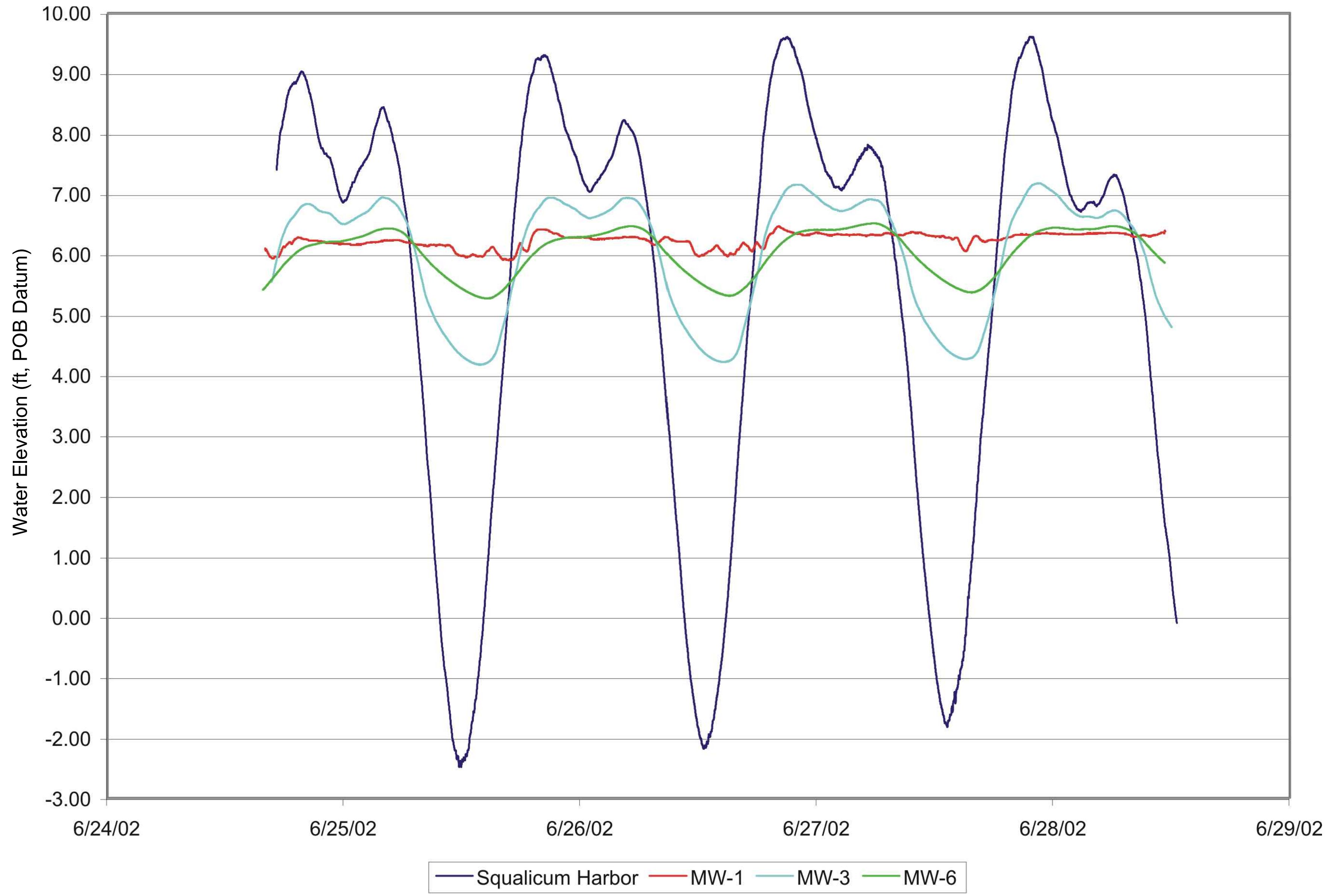
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Geologic Cross-Section A-A'

Figure 13



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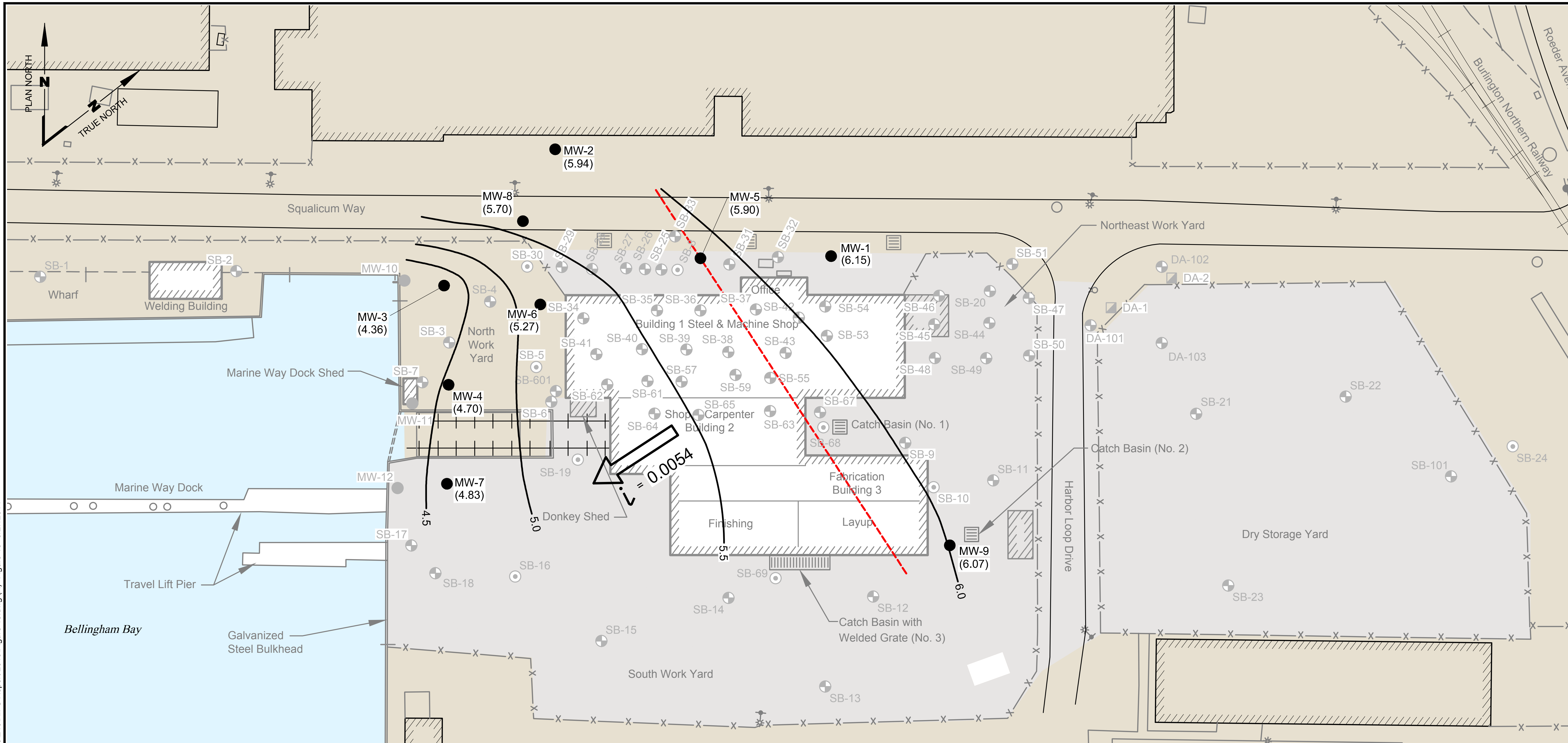
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Elevations for MW-1, MW-3, MW-6, and Squalicum Harbor, June 24-28, 2002

Figure 14



Legend

- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces
- (4.83) Measured Groundwater Elevation (ft MLLW)
- 5.5 Estimated Groundwater Contour (ft MLLW)
- Inferred Equipotential Line used for Gradient Evaluation
- Direction of Groundwater Flow
- i = Horizontal Hydraulic Gradient Based on Monitoring Wells MW-5, MW-7, and MW-9

Notes

1. Site plan is based on conditions prior to to the 2003/2004 Sediment Interim Action.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 60 120
Scale in Feet

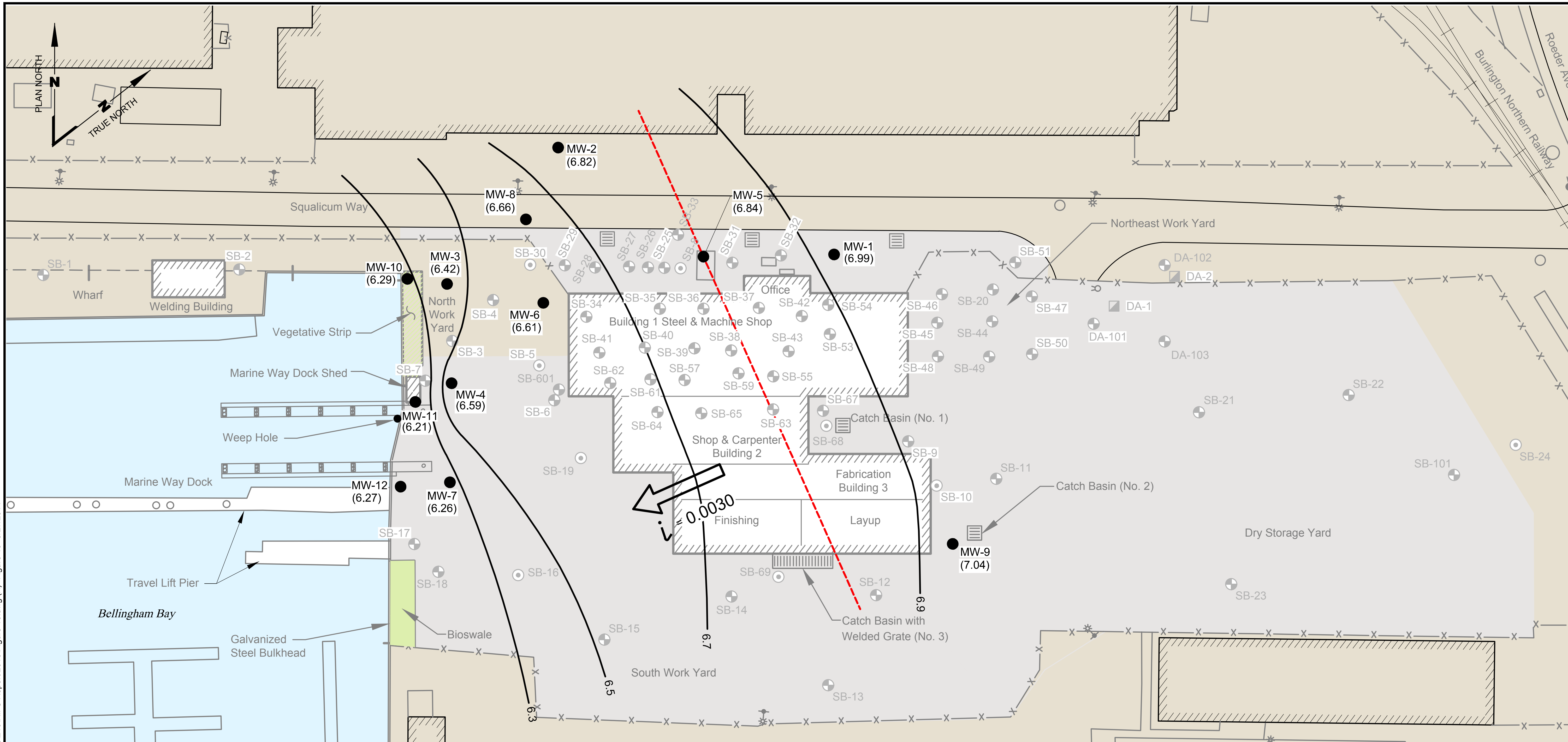
Landau Associates

Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Groundwater Elevation Contours for July 2002, Low Tide

Figure 15

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 15.dwg (A) "Figure 15" 3/27/2014



Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 16.dwg (A) "Figure 16" 3/27/2014

Legend

- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces
- (6.73) Measured Groundwater Elevation (ft MLLW)
- 7.0 Estimated Groundwater Contour (ft MLLW)
- Inferred Equipotential Line used for Gradient Evaluation
- Direction of Groundwater Flow
- i = Horizontal Hydraulic Gradient Based on Monitoring Wells MW-5, MW-7, and MW-9

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 60 120
Scale in Feet

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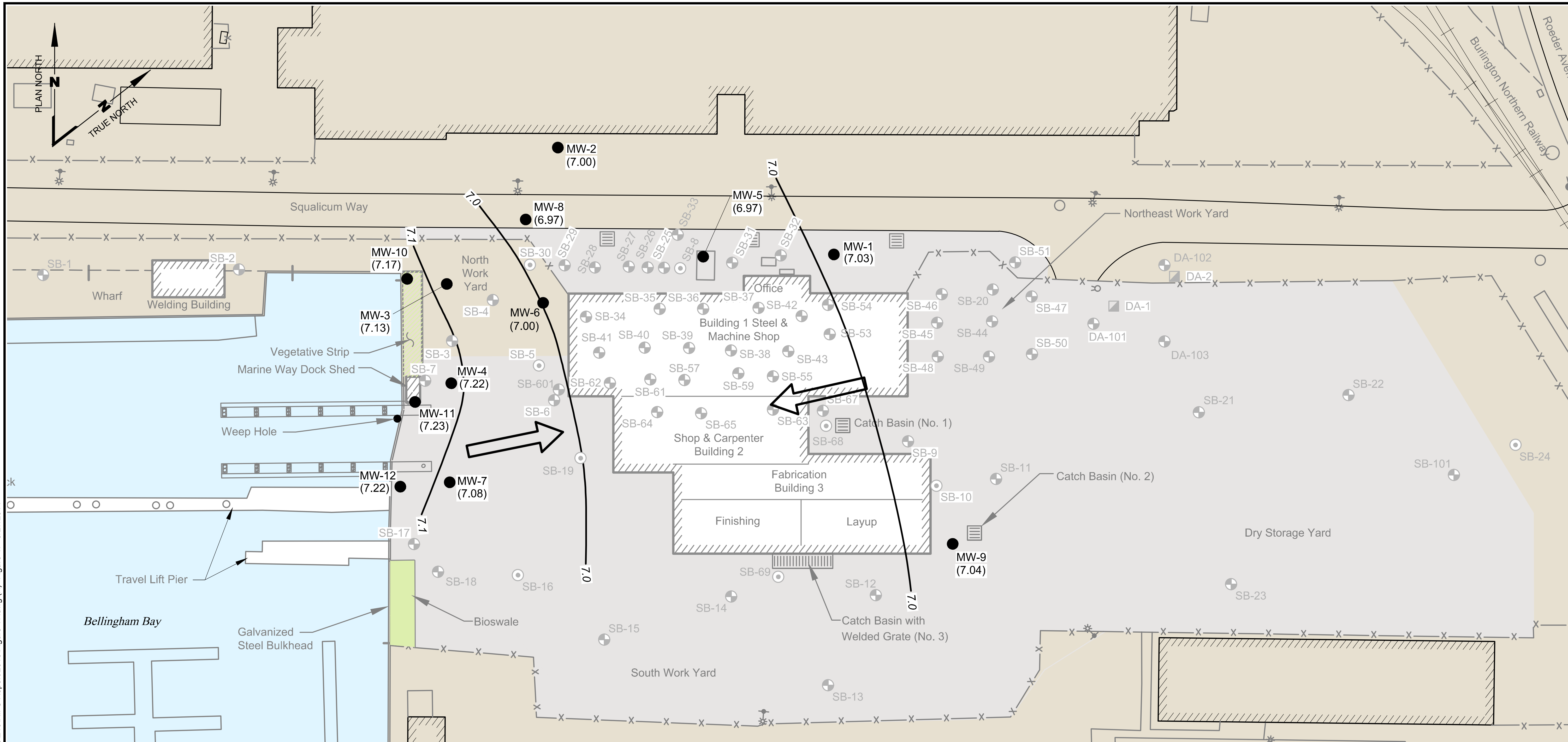
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Groundwater Elevation Contours for December 2006, Low Tide

Figure 16



Legend

- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces
- (7.52) Measured Groundwater Elevation (ft MLLW)
- 7.5 Estimated Groundwater Contour (ft MLLW)
- Direction of Groundwater Flow

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 60 120
Scale in Feet

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 17.dwg (A) "Figure 17" 3/27/2014

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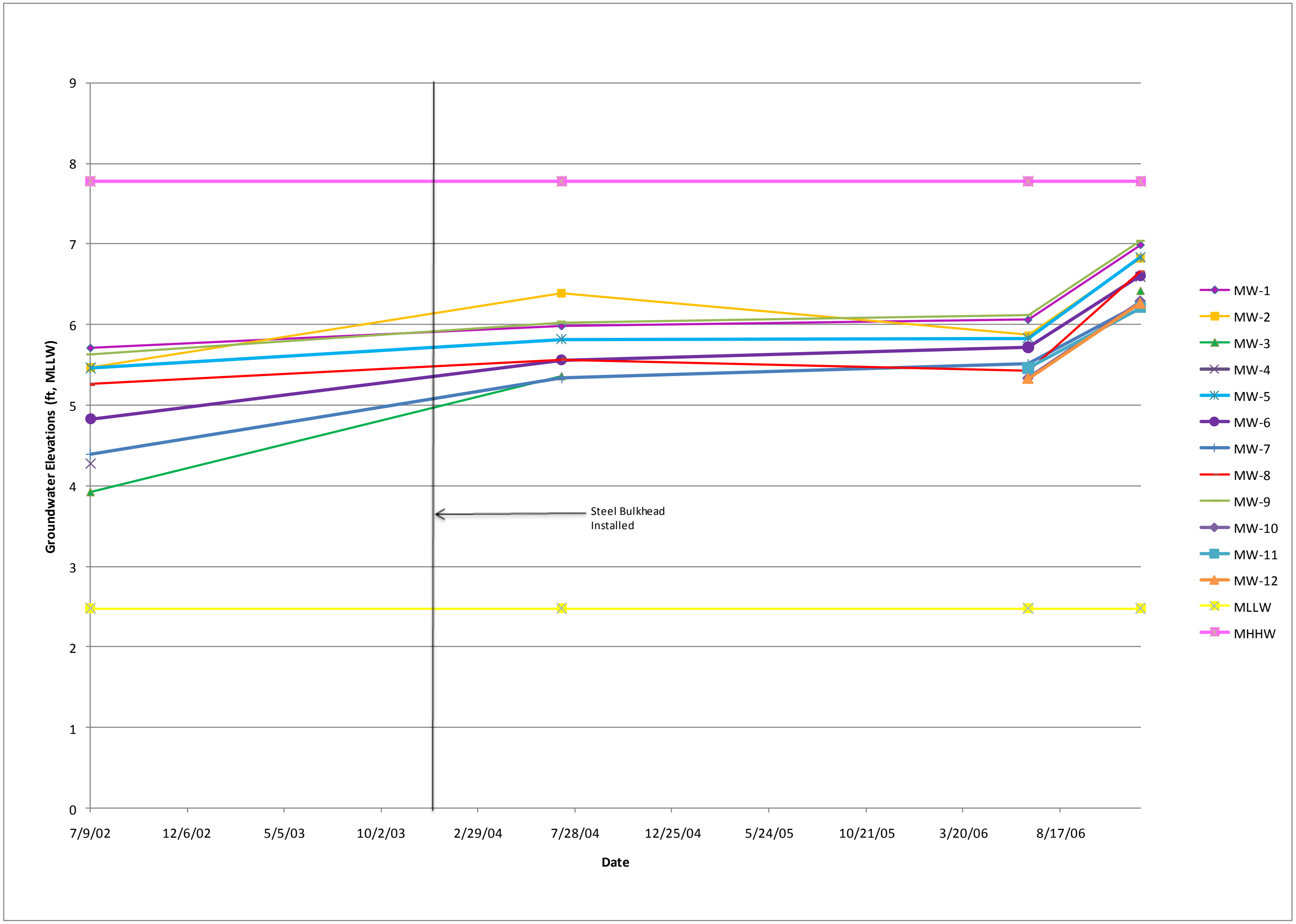
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Groundwater Elevation Contours for December 2006, High Tide

Figure 17



Note: All water levels presented on figure collected at or near low tide.

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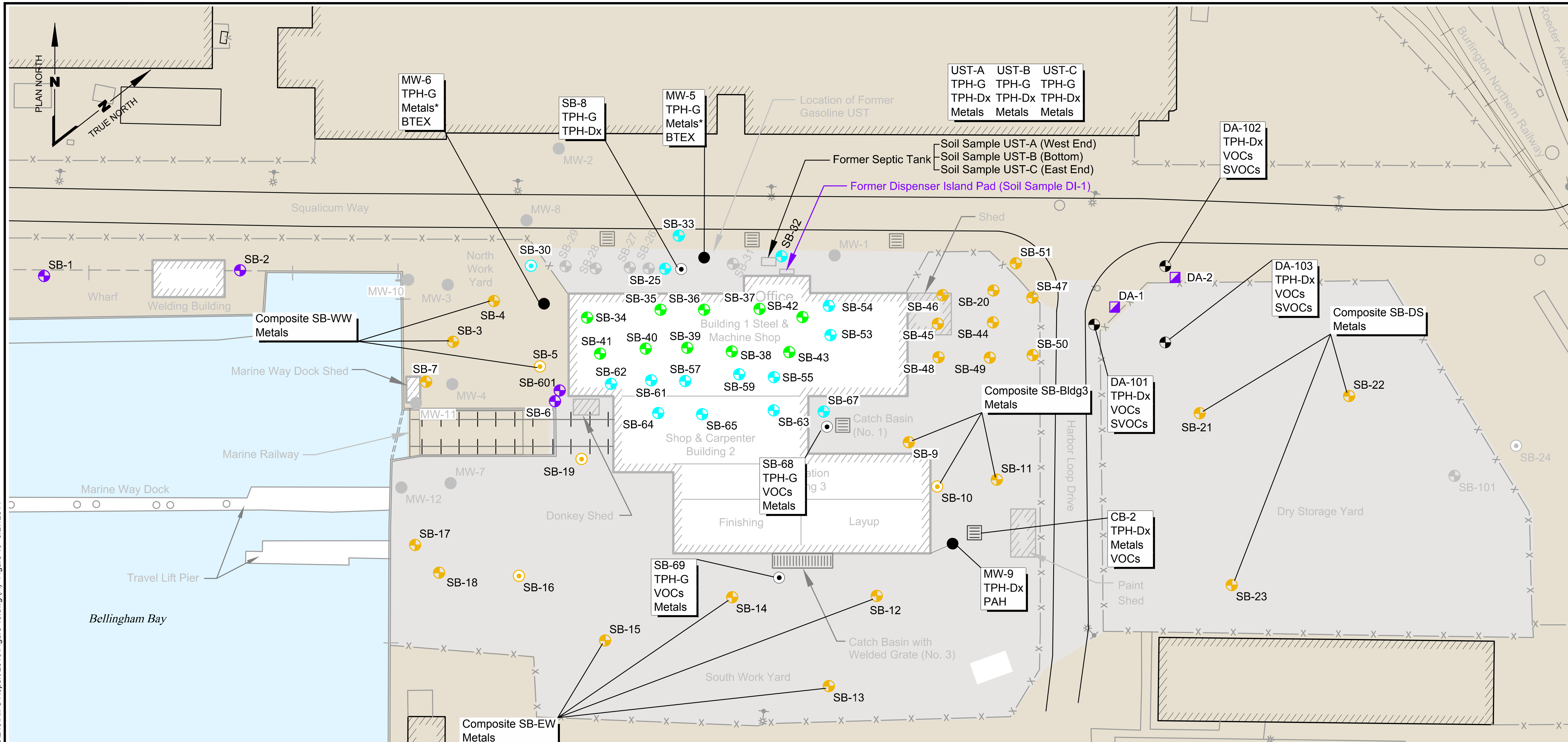
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Groundwater Elevations vs. Time

Figure
18



Legend

- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces

Analytical Testing Performed on Soil Samples

- Metals
- TPH-G and BTEX
- TPH-G
- TPH-G and TPH-Dx
- Not Tested
- SB-69 TPH-G VOCs Metals — Summary of analytical tests performed when soil samples were analyzed for more than one group of constituents.

0 60 120
Scale in Feet

Notes

1. * Tested for lead only.
2. Site plan is based on conditions prior to the 2003/2004 Sediment Interim Action.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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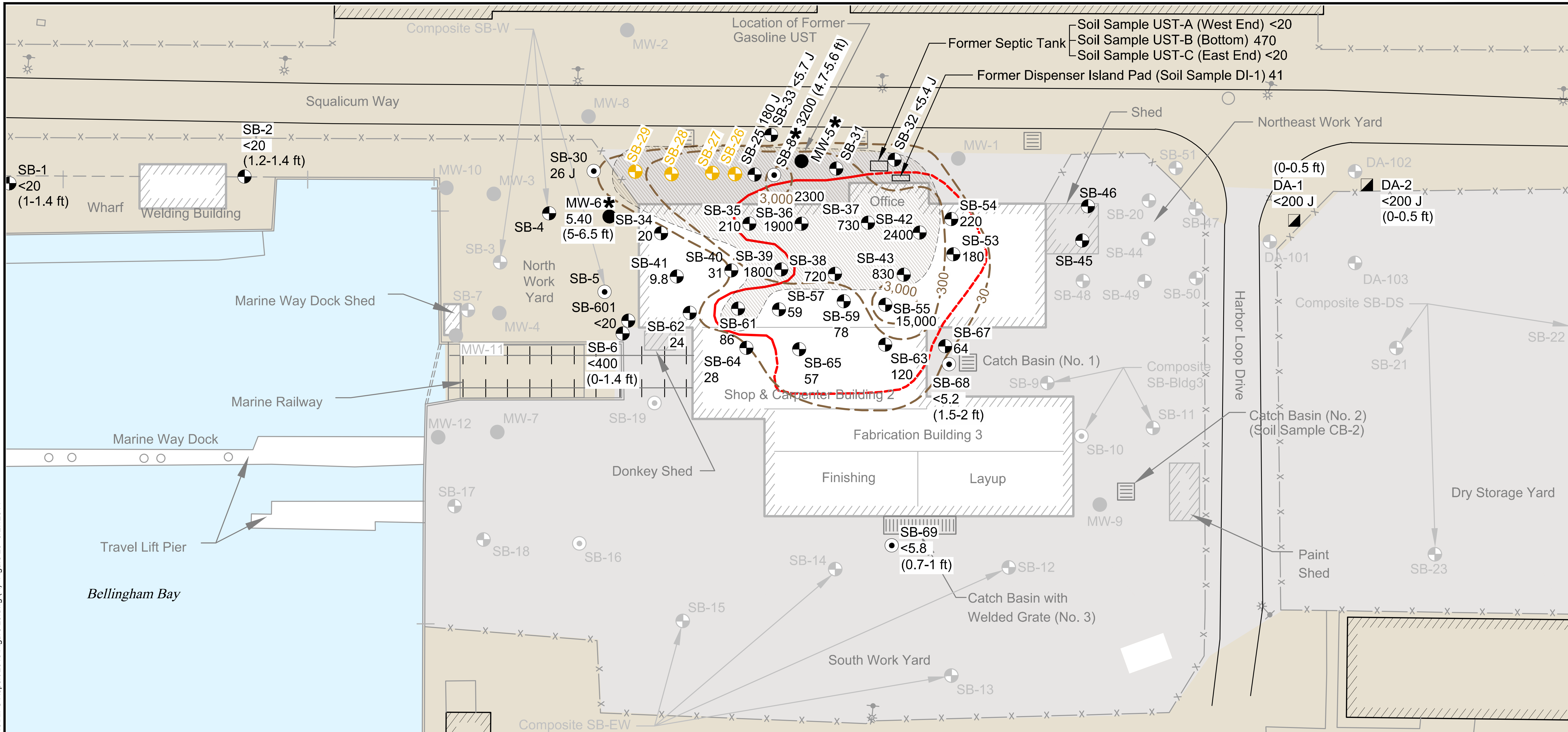
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Distribution of Soil Analytical Testing

Figure 19

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 19.dwg (A) "Figure 19" 3/27/2014



Legend

Boring Location	Fence	Soil Boring Location Where Gasoline-like Odor Was Noted During Drilling But No Soil Sample for Analyses Were Conducted	Area Where a Gasoline-like Odor Was Noted in Borings During Drilling
Monitoring Well	Railroad	Estimated Gasoline Concentration Contour (mg/kg) (See Note 1)	
Groundwater Geoprobe Sampling Location	Structure	Estimated Area of Apparent Coal Material in UST Vicinity (dashed where inferred)	
Surface Soil Grab Sample	Upland Area		
Catch Basin	Bellingham Bay		
Pilings	On-site Paved Surfaces		
Approximate Location of Outfall			

SB-64 — Sample Location
28 — Concentration in mg/kg
J — Indicates Estimated Concentration
(1-2 ft) — Depth of Sample (See Note 4)
MW-6✱ — Boring Location Where a Sheen was Observed at the Time of Drilling

0 50 100
Scale in Feet

Notes

1. Contour intervals selected based on soil screening level for gasoline (30.0 mg/kg).
2. Site plan is based on conditions prior to the 2003/2004 Sediment Interim Action.
3. Soil samples collected from 7-11 ft BGS, except when otherwise noted.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 20.dwg (A) "Figure 20" 3/27/2014

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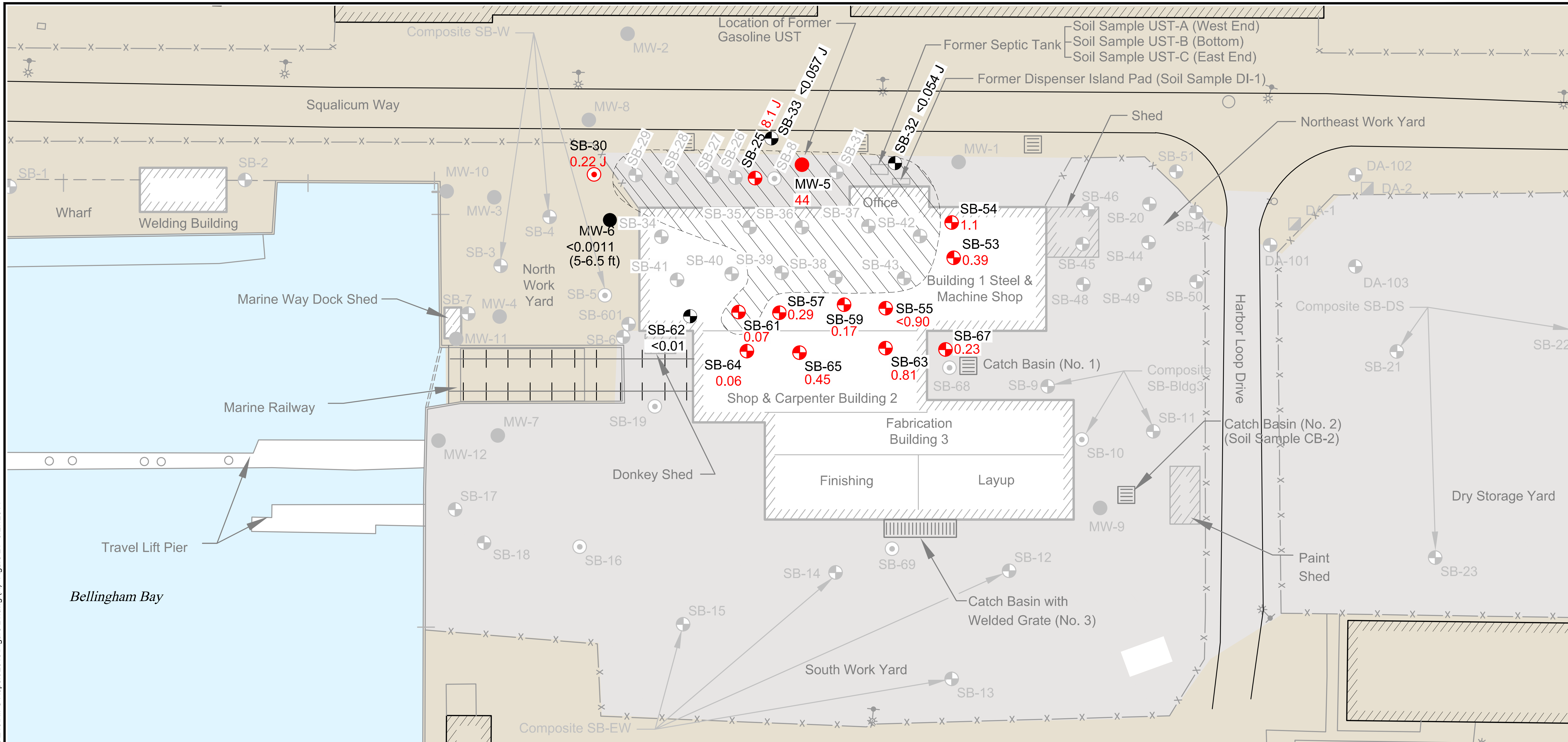
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Gasoline-Range Petroleum Hydrocarbons Concentrations in Soil

Figure
20



Legend

- Sample Location with >5x Screening Level Exceedance
- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces
- Area Where a Gasoline-like Odor Was Noted During Drilling
- SB-8 — Sample Location
- 0.06 — Concentration in mg/kg (Above Soil Screening Level of 0.005 mg/kg if Shown in Red)
- J — Indicates Estimated Concentration
- (5-6.5 ft) — Depth of Sample (See Note 3)

Notes

1. Site plan is based on conditions prior to the 2003/2004 Sediment Interim Action.
2. Soil samples collected from 7-11 ft BGS, except where noted otherwise.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 60 120
Scale in Feet

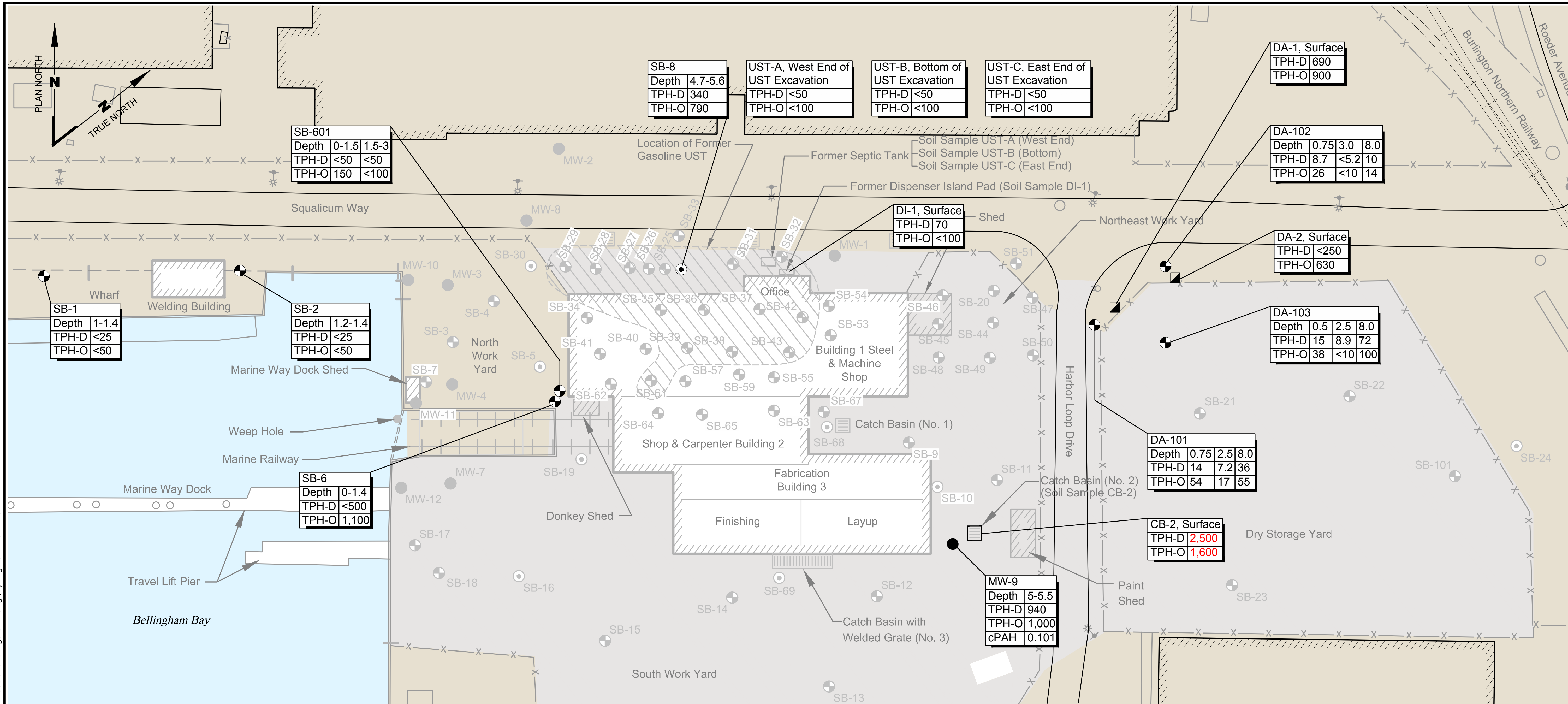
Landau Associates

Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Benzene Concentrations in Soil

Figure 21

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 21.dwg (A) "Figure 21" 3/27/2014



Legend

Symbol	Description
Boring Location	Fence
Monitoring Well	Railroad
Groundwater Geoprobe Sampling Location	Structure
Surface Soil Grab Sample	Upland Area
Catch Basin	Bellingham Bay
Pilings	On-site Paved Surfaces
Approximate Location of Outfall	
Catch Basin, Solids Sample Location	

Area Where a Gasoline-like Odor Was Noted During Drilling

TPH-D Diesel-Range Petroleum Hydrocarbons

TPH-O Oil-Range Petroleum Hydrocarbons

cPAH Carcinogenic Polycyclic Aromatic Hydrocarbons

MW-9		Sample Location
Depth	5-5.5	Depth, ft BGS
TPH-D	940	Concentration in mg/kg (Individual and/or Combined Concentration Above TPH Soil Screening Level of 2,000 mg/kg if Shown in Red)
TPH-O	1,000	
cPAH	0.101	

Notes

1. Site plan is based on conditions prior to the 2003/2004 Sediment Interim Action.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 60 120

Scale in Feet

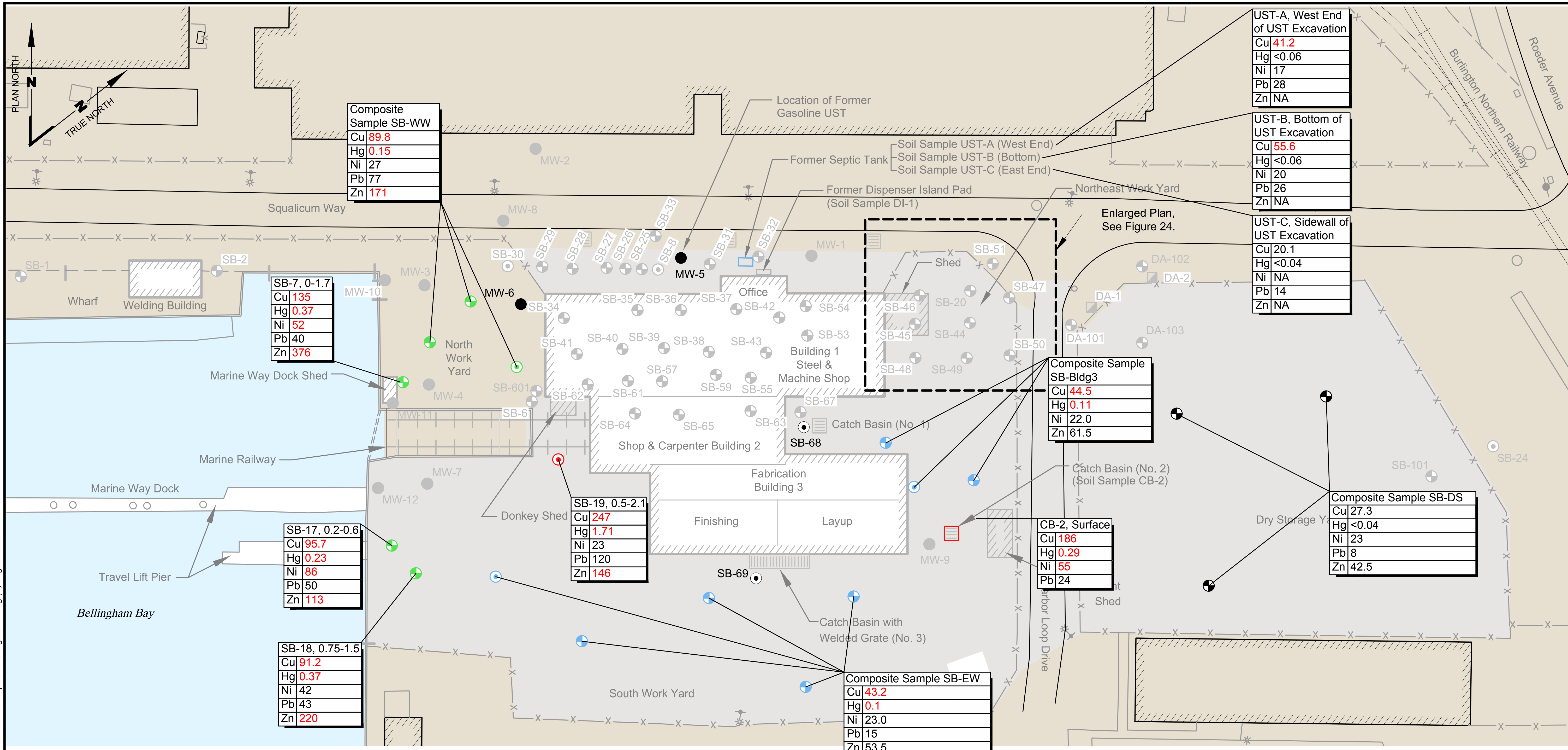
LANDAU ASSOCIATES

Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Diesel-Range and Oil-Range Petroleum Hydrocarbons and cPAH Concentrations in Soil

Figure 22

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 22.dwg (A) "Figure 22" 3/27/2014



Legend

- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces
- Sample Location with <2x Screening Level Exceedance
- Sample Location with >2x Screening Level Exceedance
- Sample Location with >5x Screening Level Exceedance

SB-19, 0.5-2.1		Sample Location and Sample Depth (ft, BGS)
Cu	247	Concentration in mg/kg (Above Soil Screening Level if Shown in Red)
Hg	0.1	
Zn	146	Compound

NA= Not Analyzed

Soil Screening Levels (mg/kg)	
Cu	36
Hg	0.07
Ni	48
Pb	250
Zn	100

0 60 120
Scale in Feet

Notes

1. Site plan is based on conditions prior to the 2003/2004 Sediment Interim Action.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

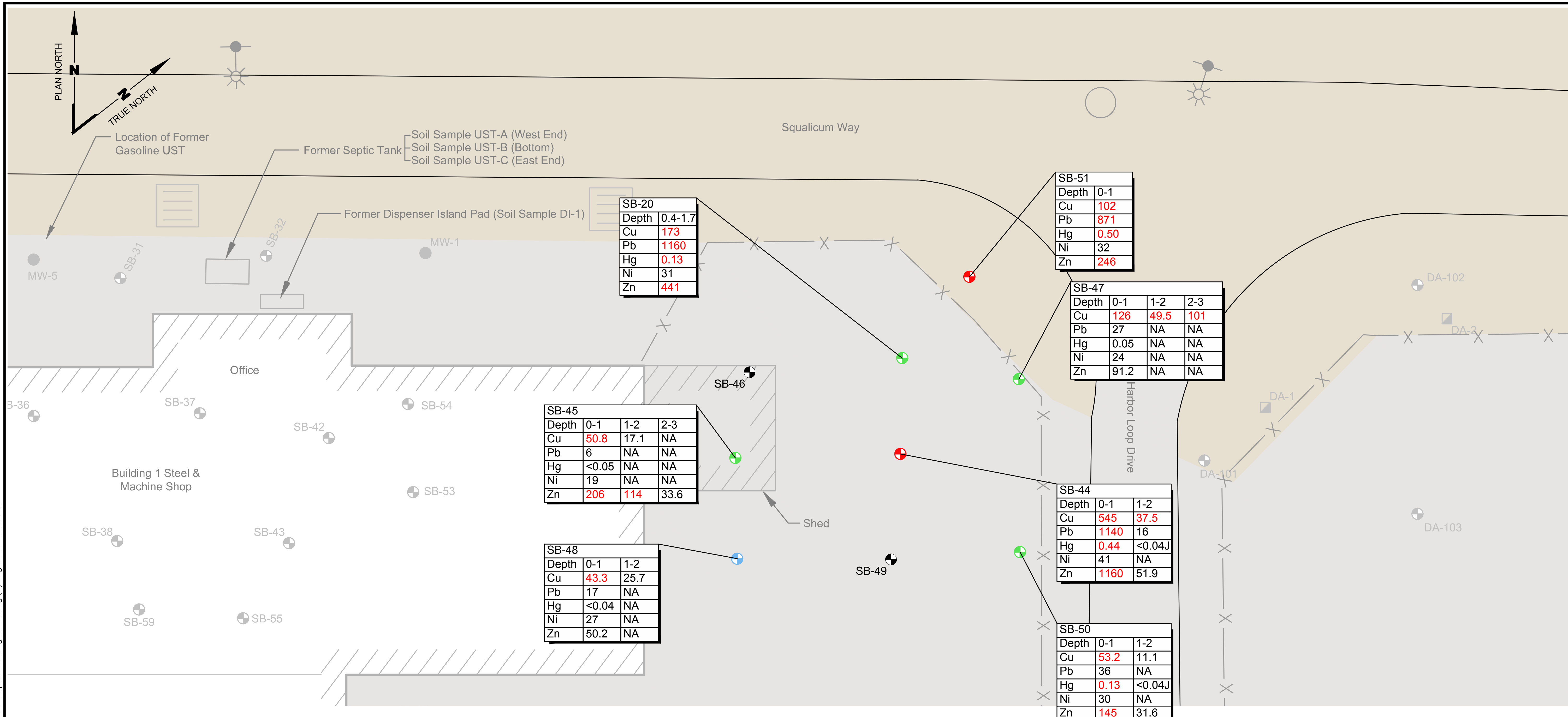
LANDAU ASSOCIATES

Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Metals Concentrations in Soil

Figure 23

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 23.dwg (A) "Figure 23" 3/27/2014



Legend

- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces
- Sample Location with <2x Screening Level Exceedance
- Sample Location with >2x Screening Level Exceedance
- Sample Location with >5x Screening Level Exceedance

SB-19, 0.5-2.1		Sample Location and Sample Depth (ft, BGS)
Cu	247	Concentration in mg/kg (Above Soil Screening Level if Shown in Red)
Pb	120	
Hg	NA	Not Analyzed
Ni	J	Compound
Zn	146	

Soil Screening Levels (mg/kg)	
Cu	36
Pb	250
Hg	0.07
Ni	48
Zn	100

0 20 40

Scale in Feet

Notes

1. Site plan is based on conditions prior to the 2003/2004 Sediment Interim Action.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 24.dwg (A) "Figure 24" 3/27/2014

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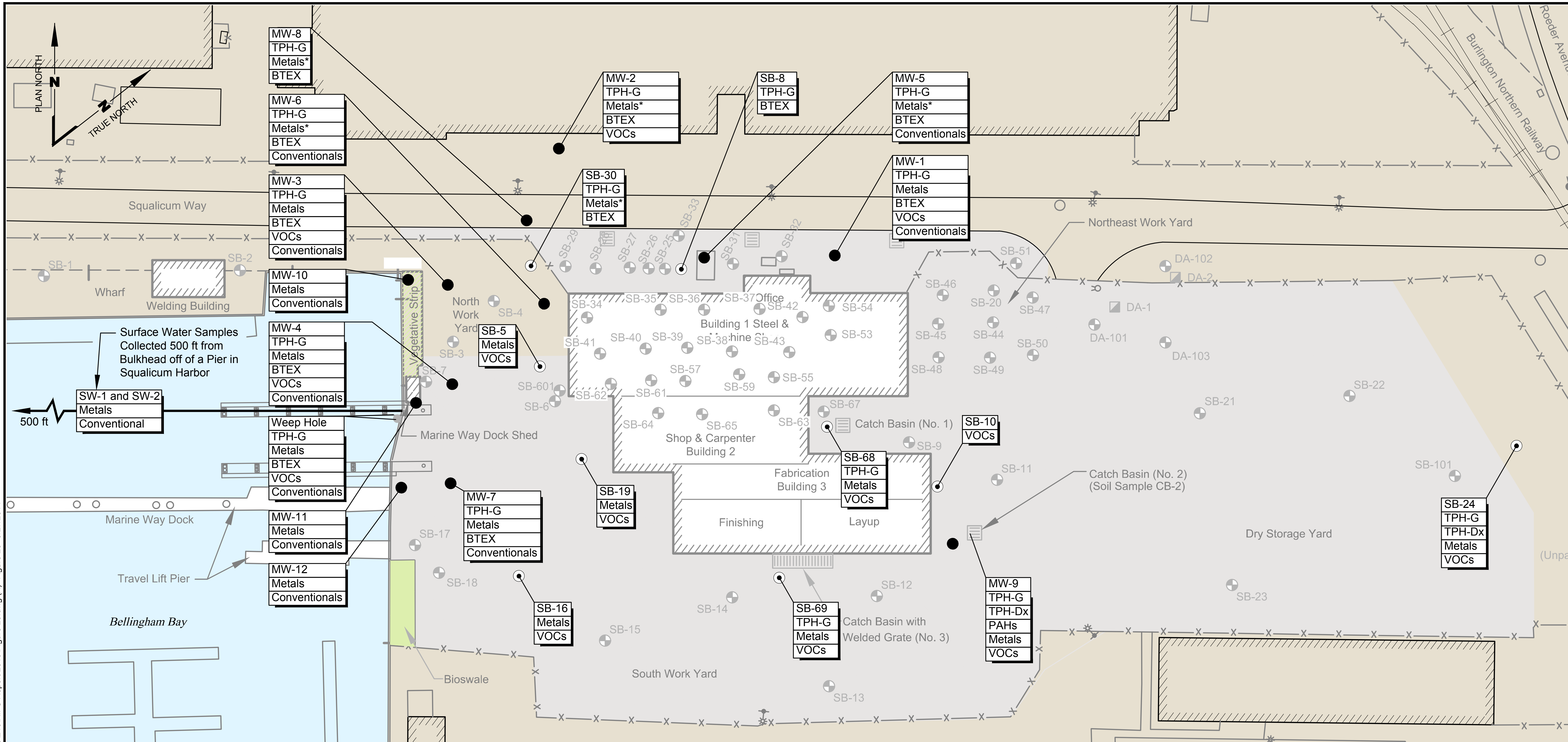
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Metals Concentrations in Soil
Northeast Work Yard

Figure
24



Legend

- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces

Notes

1. * Tested for lead only.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 60 120

Scale in Feet

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 25.dwg (A) "Figure 25" 3/27/2014

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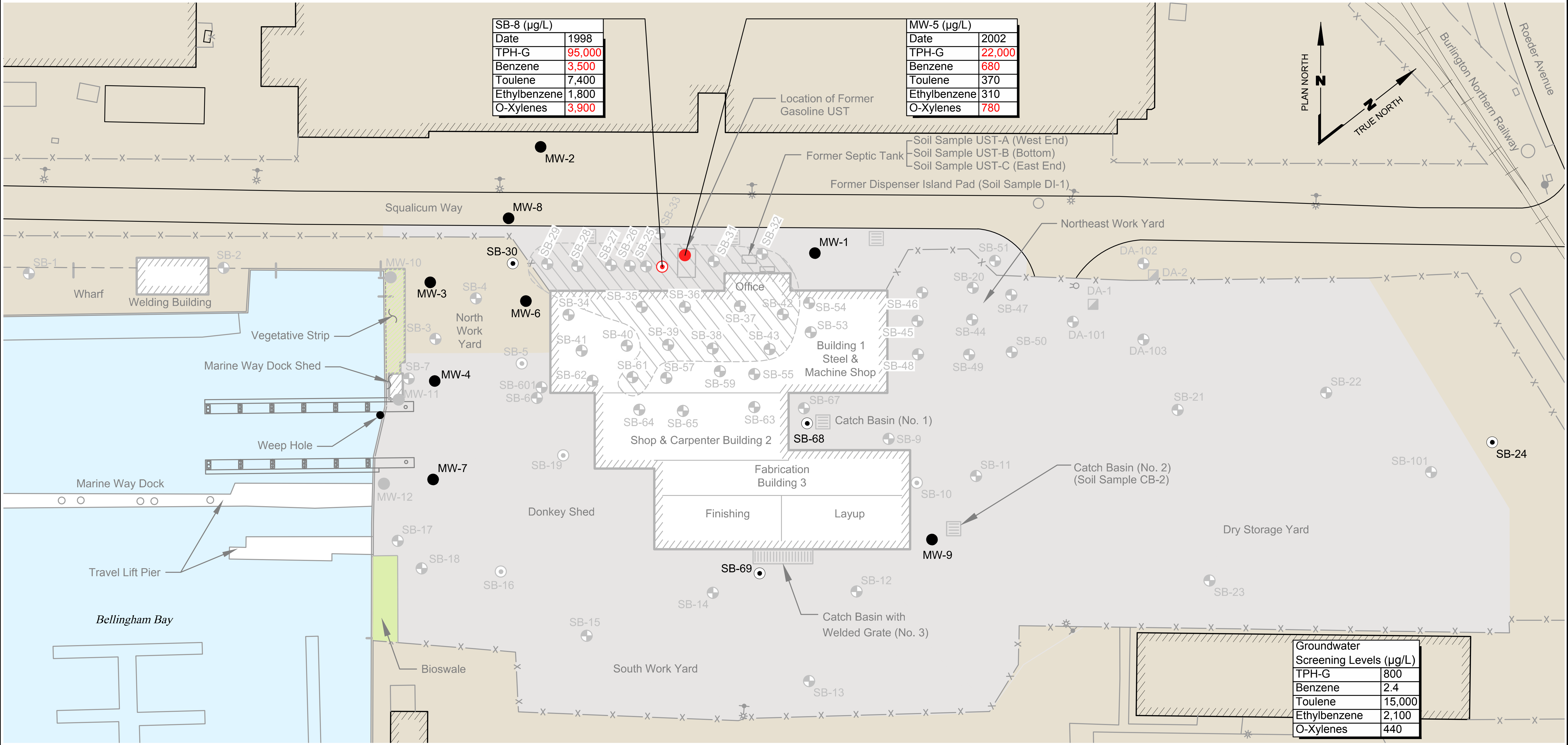
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Distribution of Groundwater and Surface Water Testing

Figure 25



SB-8 (µg/L)	
Date	1998
TPH-G	95,000
Benzene	3,500
Toulene	7,400
Ethylbenzene	1,800
O-Xylenes	3,900

MW-5 (µg/L)	
Date	2002
TPH-G	22,000
Benzene	680
Toulene	370
Ethylbenzene	310
O-Xylenes	780

Groundwater Screening Levels (µg/L)	
TPH-G	800
Benzene	2.4
Toulene	15,000
Ethylbenzene	2,100
O-Xylenes	440

Legend

- Boring Location
- Monitoring Well With No Screening Level Exceedances
- Groundwater Geoprobe Location With No Screening Level Exceedances
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces
- Area Where a Gasoline-like Odor Was Noted During Drilling
- THP-G — Gasoline-Range Petroleum Hydrocarbons
- Sample Location with >5x Screening Level Exceedance

MW-5	2002
TPH-G	22,000
Benzene	680
Toulene	370
Ethylbenzene	NA
Total Xylenes	

Sample Location and Year Sample Collected
Concentration in µg/L (Concentration Above Groundwater Screening Level if Shown in Red)
Not Analyzed Compound

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 60 120
Scale in Feet

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 26.dwg (A) "Figure 26" 3/27/2014

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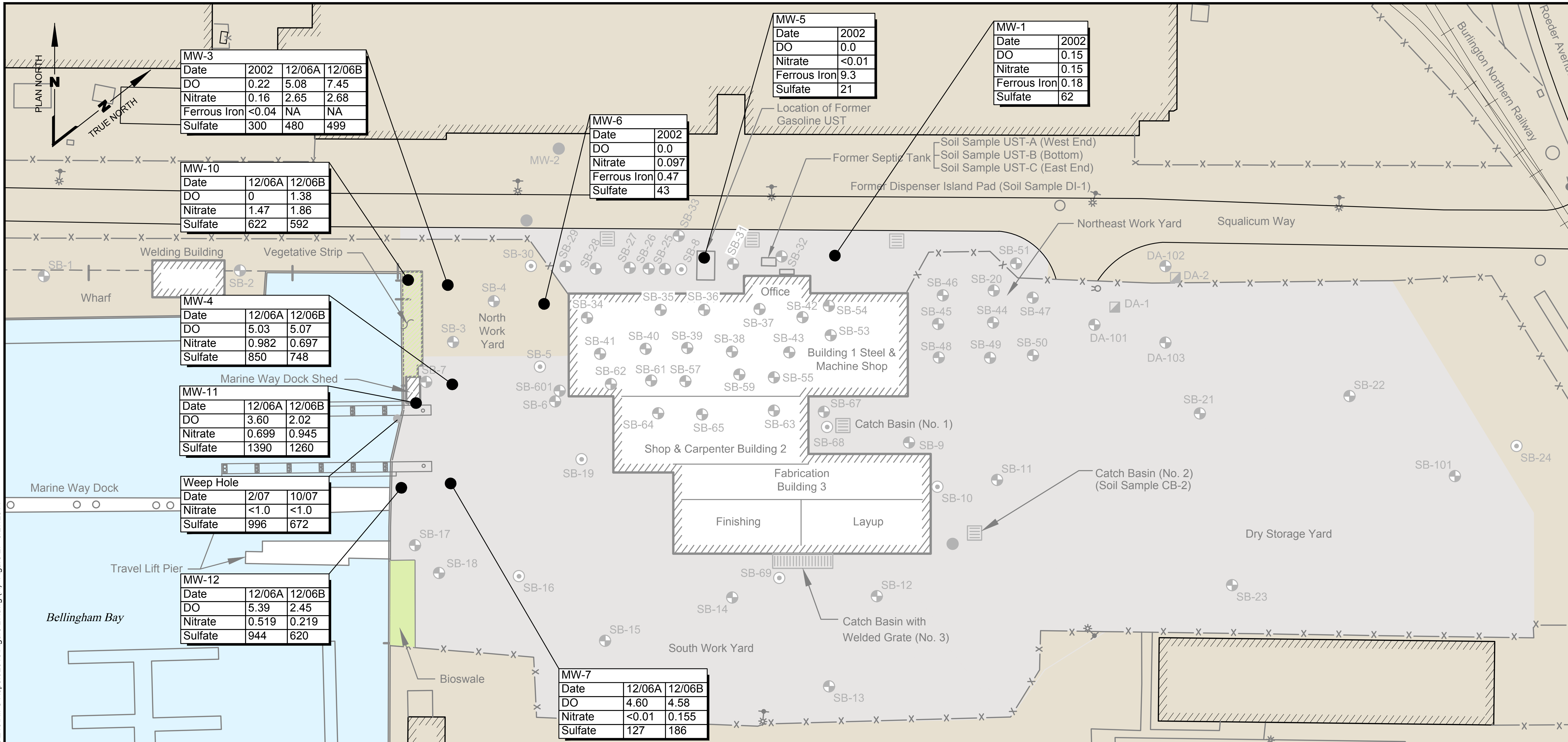
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Gasoline-Range Petroleum Hydrocarbons and BTEX Concentrations in Groundwater

Figure 26



Legend

- Boring Location
- Monitoring Well
- Groundwater Geoprobe Sampling Location
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces

MW-1		— Sample Location
Date	2002	— Year Sampled
DO	0.15	— Concentration in mg/L
Nitrate	0.15	
Ferrous Iron	0.18	

12/06A - Sampled at high tide.
12/06B - Sampled at low tide.

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 60 120
Scale in Feet

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 27.dwg (A) "Figure 27" 3/27/2014

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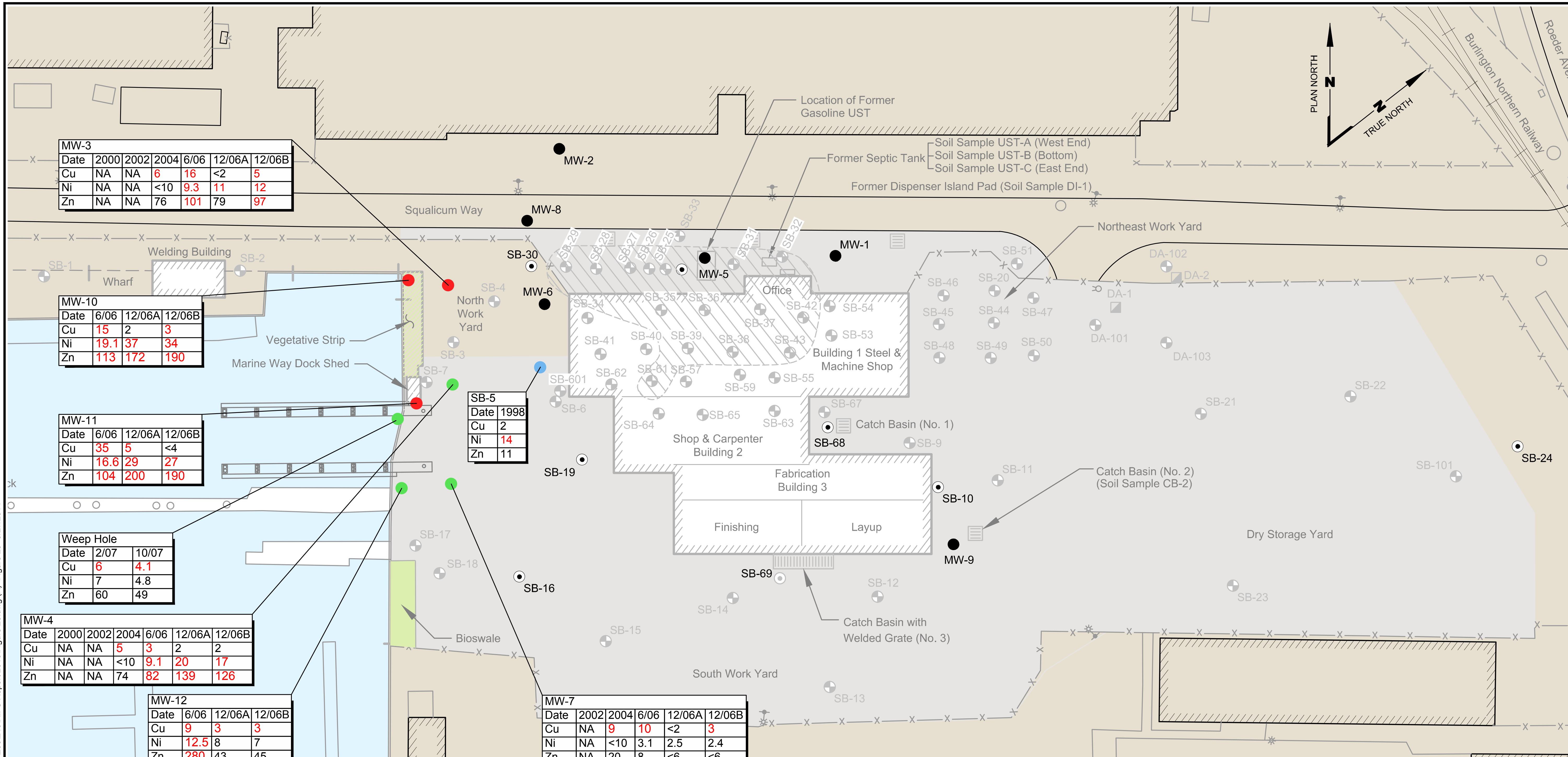
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Groundwater Natural Attenuation Parameters

Figure 27



MW-3						
Date	2000	2002	2004	6/06	12/06A	12/06B
Cu	NA	NA	6	16	<2	5
Ni	NA	NA	<10	9.3	11	12
Zn	NA	NA	76	101	79	97

MW-10			
Date	6/06	12/06A	12/06B
Cu	15	2	3
Ni	19.1	37	34
Zn	113	172	190

MW-11			
Date	6/06	12/06A	12/06B
Cu	35	5	<4
Ni	16.6	29	27
Zn	104	200	190

Weep Hole		
Date	2/07	10/07
Cu	6	4.1
Ni	7	4.8
Zn	60	49

MW-4						
Date	2000	2002	2004	6/06	12/06A	12/06B
Cu	NA	NA	5	3	2	2
Ni	NA	NA	<10	9.1	20	17
Zn	NA	NA	74	82	139	126

MW-12			
Date	6/06	12/06A	12/06B
Cu	9	3	3
Ni	12.5	8	7
Zn	280	43	45

SB-5	
Date	1998
Cu	2
Ni	14
Zn	11

MW-7					
Date	2002	2004	6/06	12/06A	12/06B
Cu	NA	9	10	<2	3
Ni	NA	<10	3.1	2.5	2.4
Zn	NA	20	8	<6	<6

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Boring Location
- Monitoring Well With No Screening Level Exceedances
- Groundwater Geoprobe Location With No Screening Level Exceedances
- Surface Soil Grab Sample
- Catch Basin
- Pilings
- Weep Hole
- Approximate Location of Outfall
- Fence
- Railroad
- Structure
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces
- Area Where a Gasoline-like Odor Was Noted During Drilling
- Groundwater Geoprobe Location With No Screening Level Exceedances
- Sample Location with <2x Screening Level Exceedance
- Sample Location with >2x Screening Level Exceedance
- Sample Location with >5x Screening Level Exceedance

SB-16	1998
Cu	NA
Ni	14
Zn	-

SB-16 1998 — Sample Location and Year Sampled
NA — Not Analyzed
14 — Concentration in µg/L (Above Groundwater Screening Level if Shown in Red)
Zn — Compound

12/06A - Sampled at high tide.
12/06B - Sampled at low tide.

Groundwater Screening Levels (µg/L)	
Cu	2.4
Ni	8.2
Zn	81

0 60 120
Scale in Feet

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 28.dwg (A) "Figure 28" 3/27/2014

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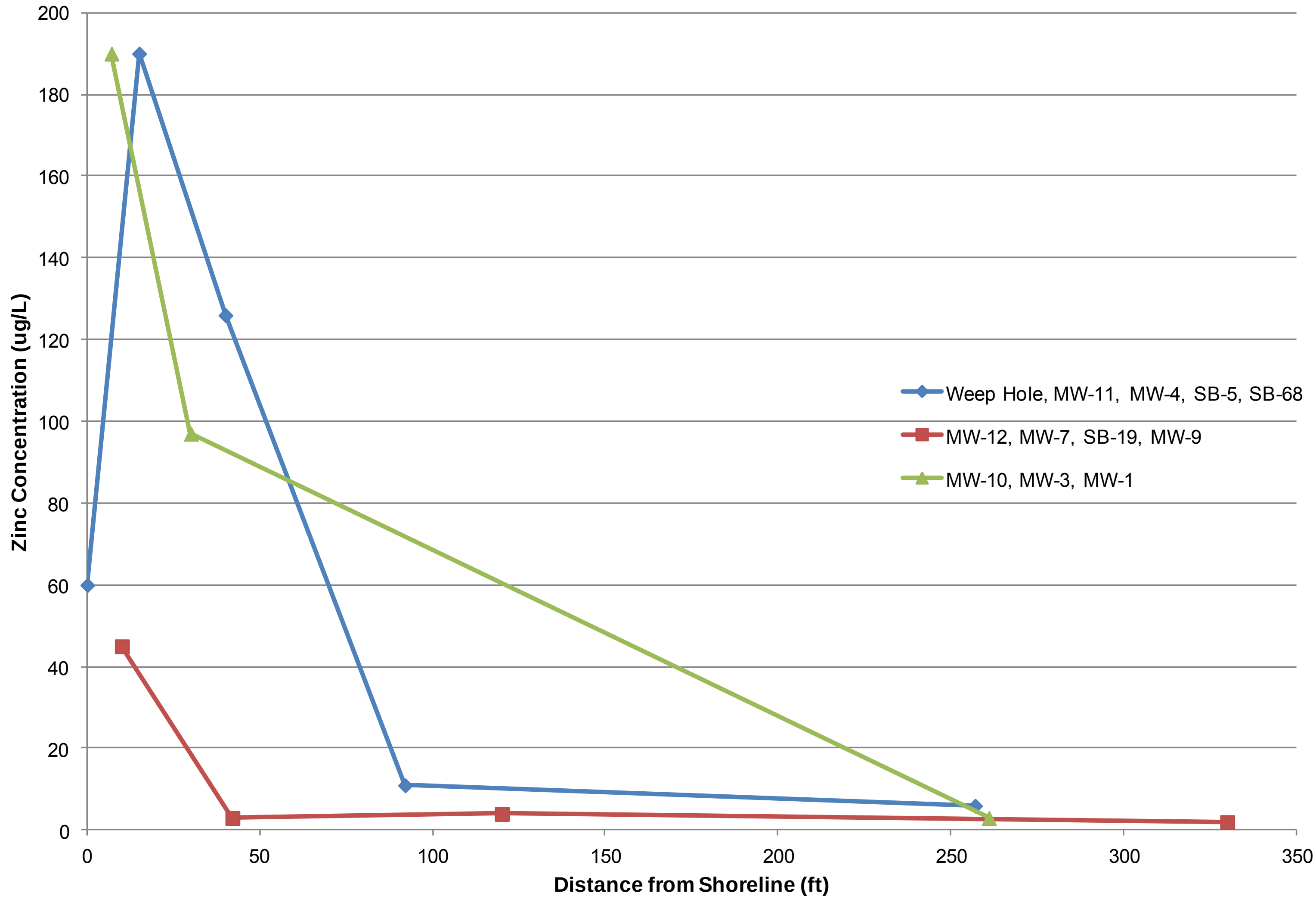
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Metals Concentrations in Groundwater

Figure 28



Not detected results are shown as one-half the reporting limit.

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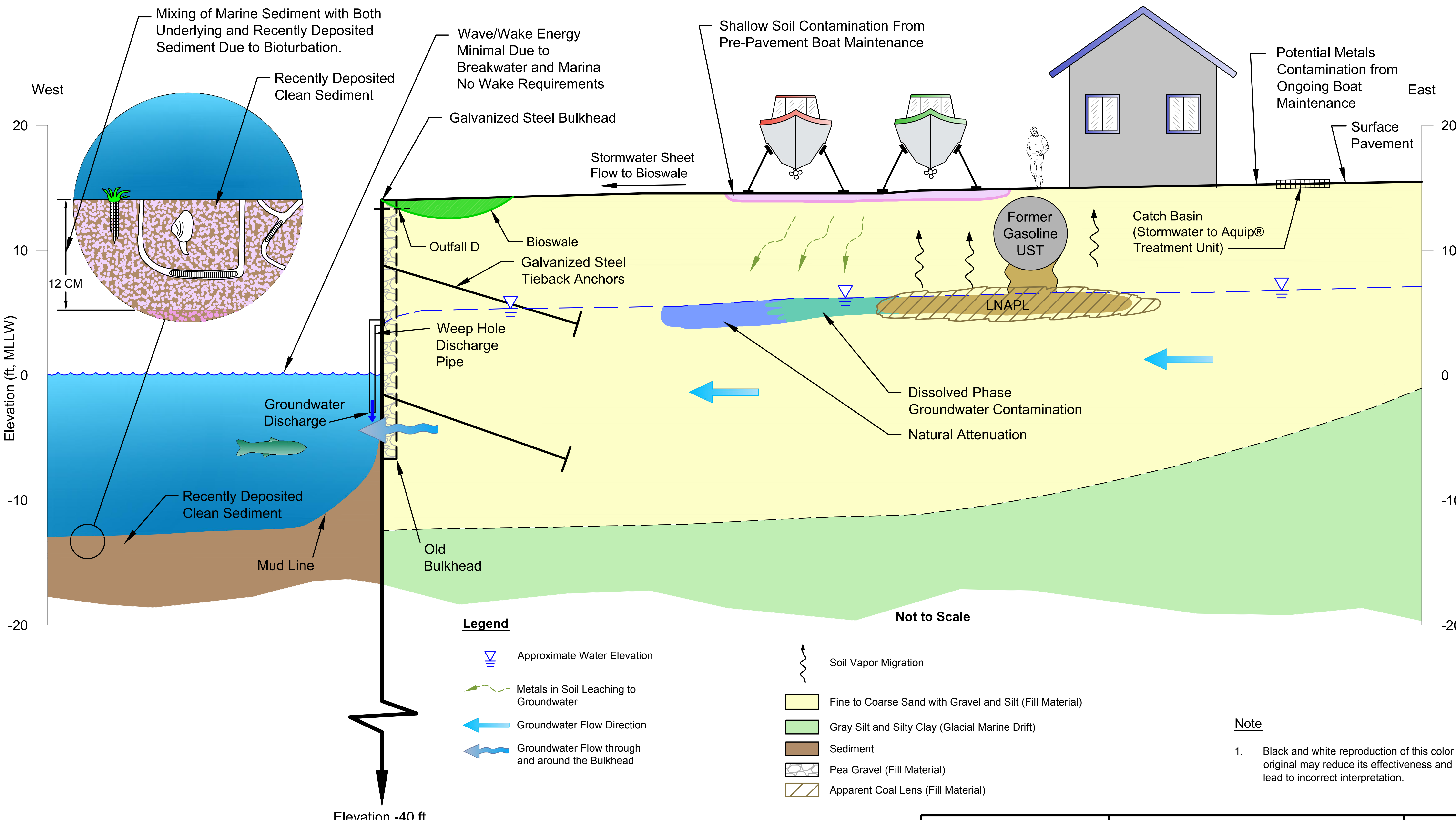
Port of Bellingham Weldcraft Steel and Marine Bellingham, Washington	**Zinc Concentrations in Groundwater vs. Distance Inland from Shoreline**	Figure 29



Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 30.dwg (A) "Figure 30" 3/27/2014

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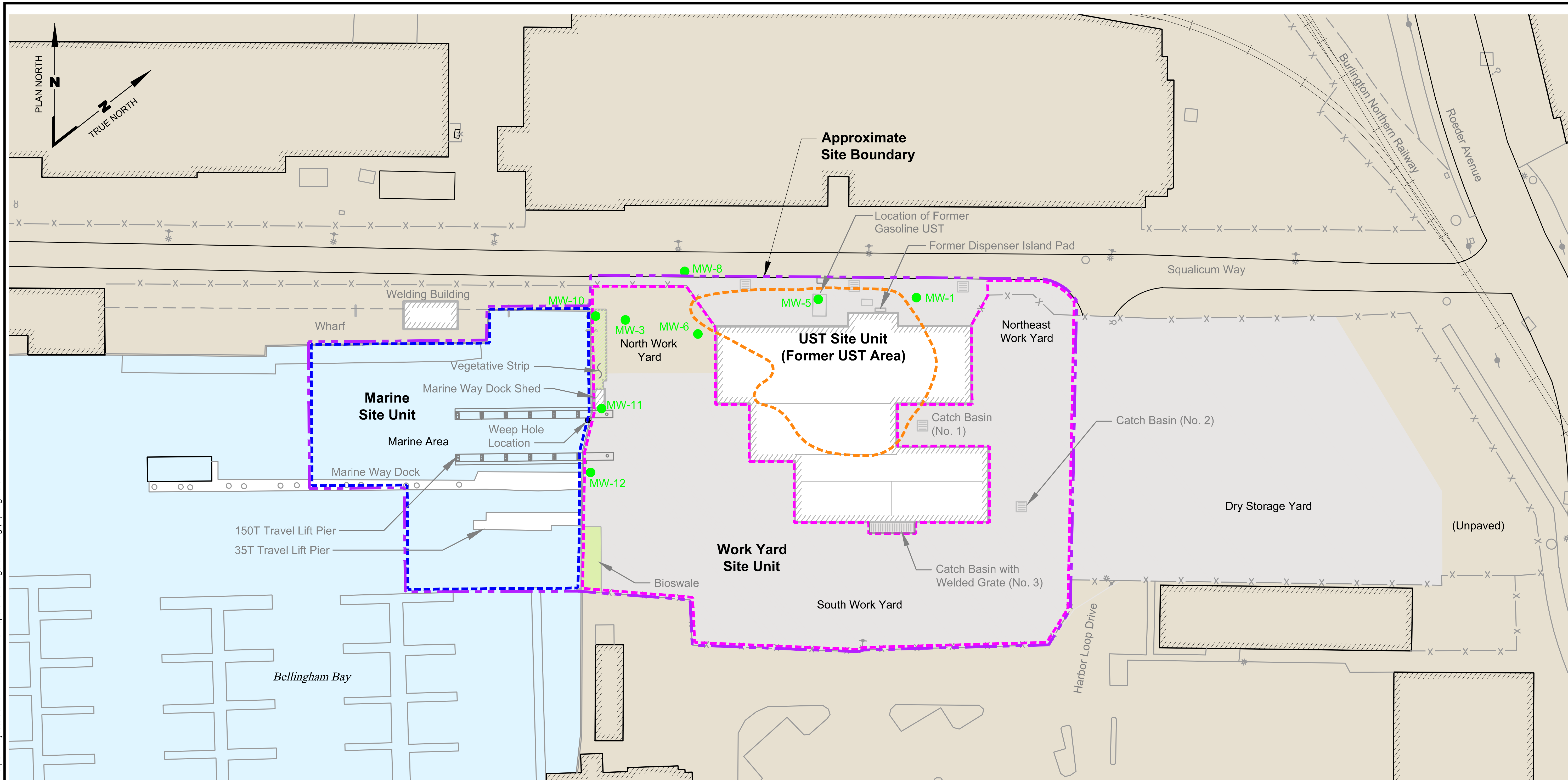
Port of Bellingham Weldcraft Steel and Marine Bellingham, Washington	**Conceptual Site Model**	Figure 30



Legend

- Catch Basin
- Pilings
- Monitoring Well (Existing)
- Fence
- Railroad
- Building Footprint
- Approximate Site Boundary
- Work Yard Site Unit Boundary
- UST Site Unit Boundary
- Marine Site Unit Boundary
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces

0 80 160
Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Port of Bellingham Weldcraft Steel and Marine Bellingham, Washington

Site Unit Designation Plan

Figure 31

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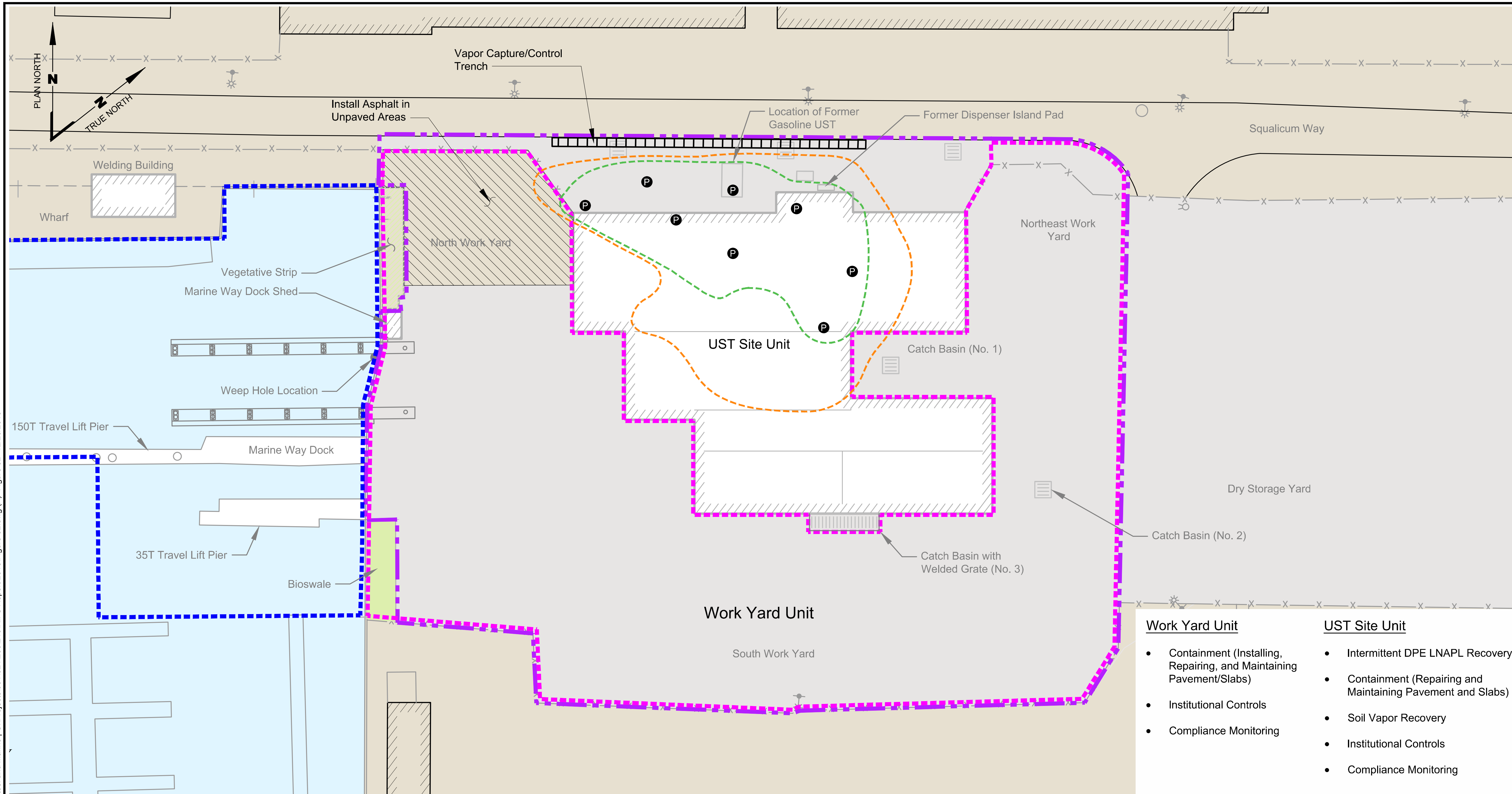
Port of Bellingham/Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 31.dwg (A) "Figure 31" 12/20/2013



Legend

- Catch Basin
- Pilings
- Product Recovery Well
- Fence
- Railroad
- Area Designated for Containment, Including Existing Pavement and Foundation Slabs
- Work Yard Site Unit Boundary
- UST Site Unit Boundary
- Marine Site Unit Boundary
- Potential LNAPL Treatment Zone
- Building Footprint
- Vapor Capture/Control Trench
- Area of New Containment
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces

0 50 100
Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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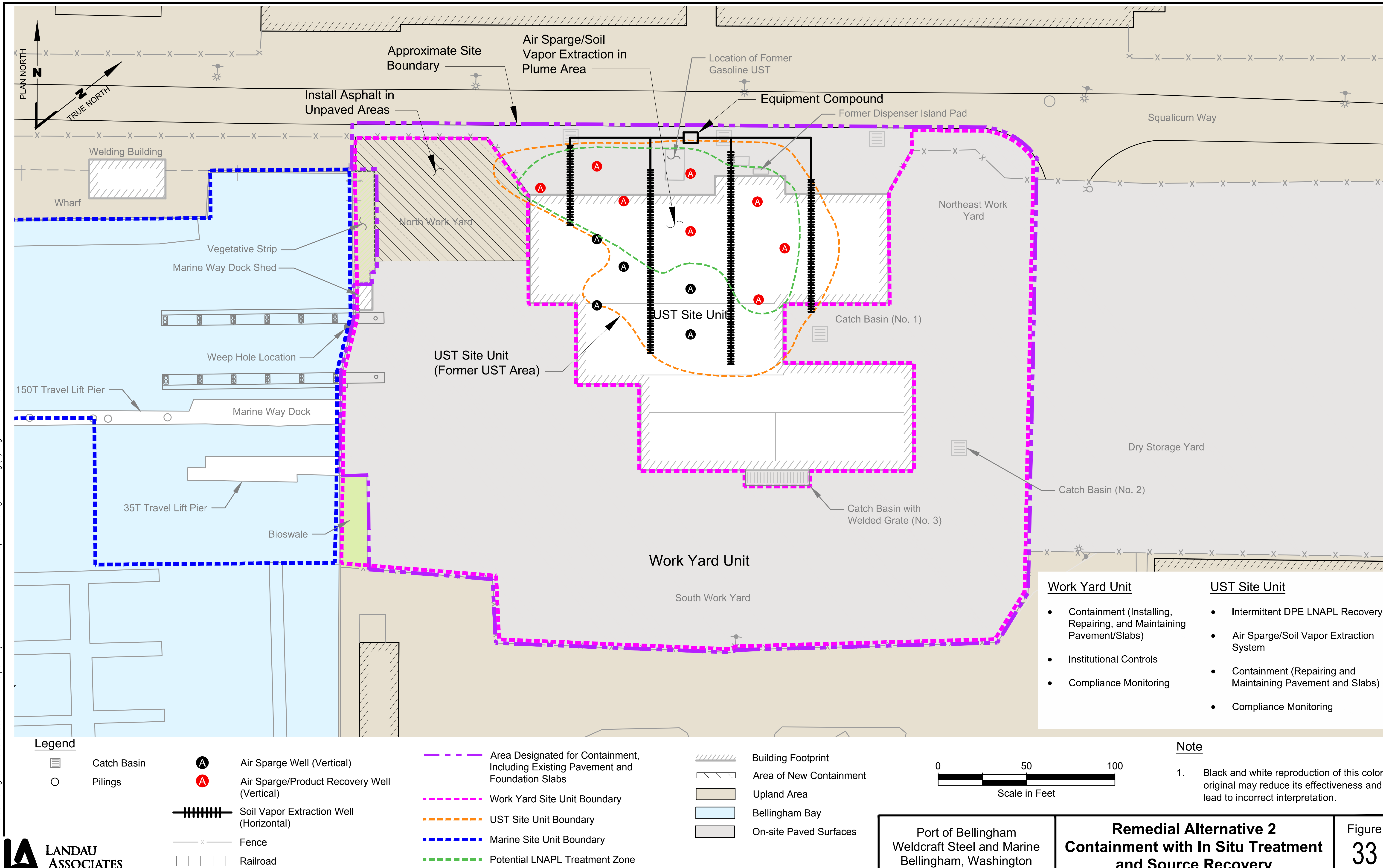
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Remedial Alternative 1
Containment with Source Recovery

Figure
32

Port of Bellingham\Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 32.dwg (A) "Figure 32" 12/20/2013



Port of Bellingham Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 33.dwg (A) "Figure 33" 3/27/2014

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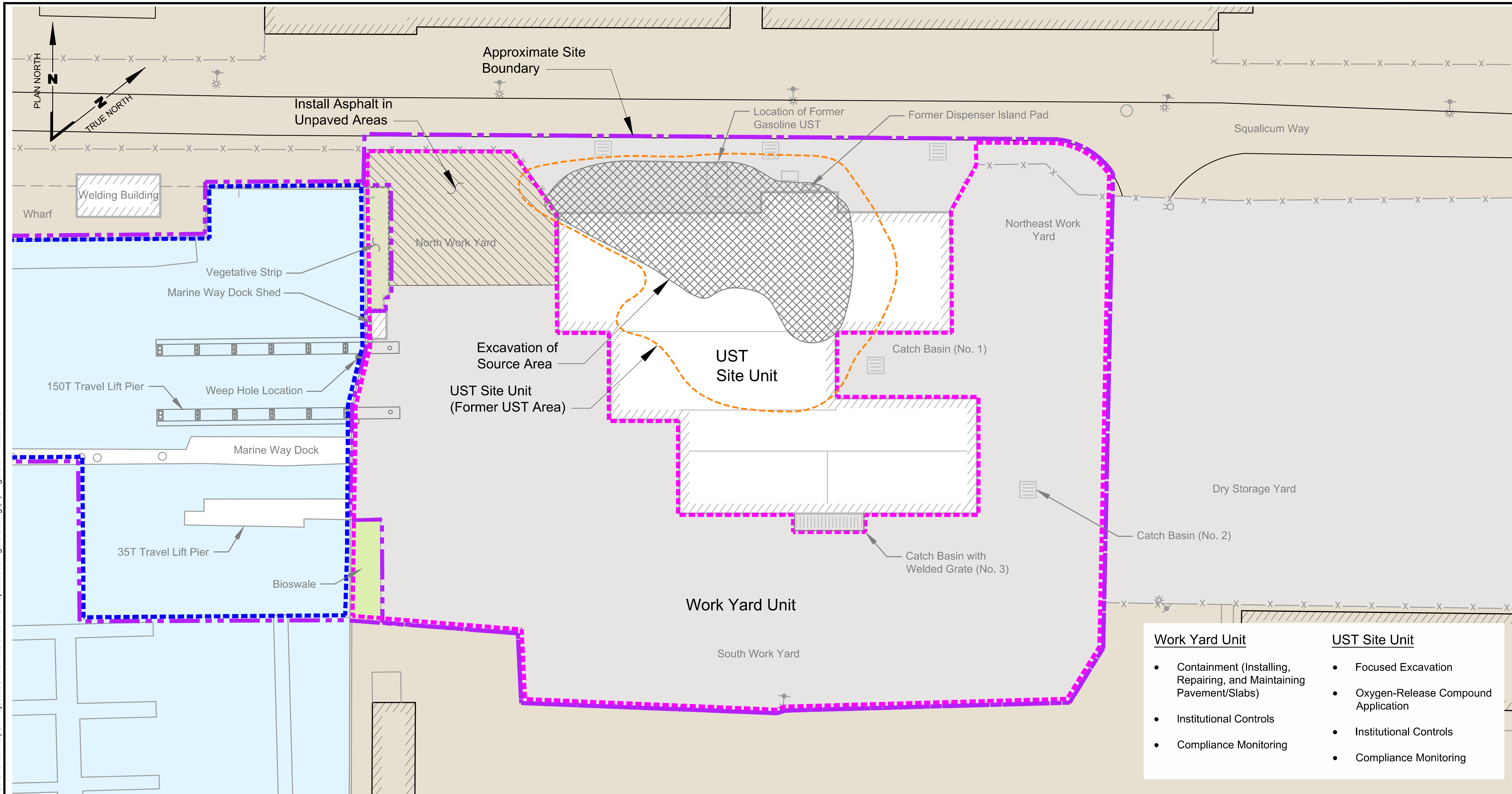
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Remedial Alternative 2 Containment with In Situ Treatment and Source Recovery

Figure 33



Legend

- Catch Basin
- Pilings
- Fence
- Railroad
- Area Designated for Containment, Including Existing Pavement and Foundation Slabs
- Work Yard Site Unit Boundary
- UST Site Unit Boundary
- Marine Site Unit Boundary
- Potential LNAPL Treatment Zone
- Assumed Area of Excavation (Petroleum Hydrocarbons)
- Building Footprint
- Area of New Containment
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces

0 50 100
Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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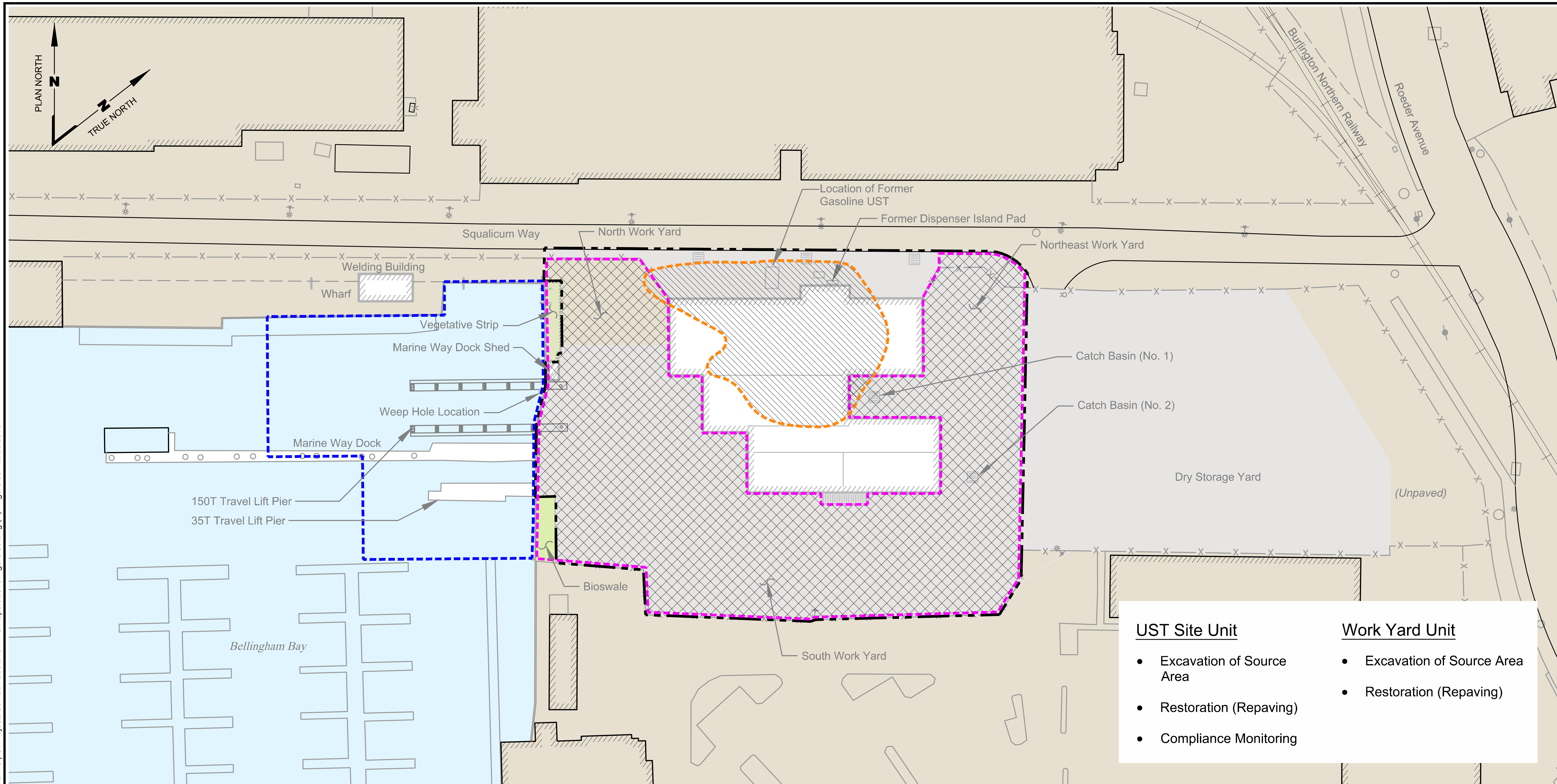
Port of Bellingham Weldcraft Steel and Marine Bellingham, Washington	**Remedial Alternative 3 Containment with Focused Source Removal**	Figure 34

Port of Bellingham/Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 34.dwg (A) "Figure 34" 12/26/2013



UST Site Unit

- Excavation of Source Area
- Restoration (Repaving)
- Compliance Monitoring

Work Yard Unit

- Excavation of Source Area
- Restoration (Repaving)

Legend

- Catch Basin
- Pilings
- Fence
- Railroad
- Area Designated for Excavation and Restoration (Repaving)
- Work Yard Site Unit Boundary
- UST Site Unit Boundary
- Marine Site Unit Boundary
- Assumed Area of Excavation (Petroleum Hydrocarbons)
- Assumed Area of Excavation (Metals)
- Building Footprint
- Upland Area
- Bellingham Bay
- On-site Paved Surfaces

0 80 160

Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Port of Bellingham\Weldcraft Steel and Marine | G:\Projects\001\024\200\240\RIFS Report 2013\Figure 35.dwg (A) "Figure 35" 12/26/2013

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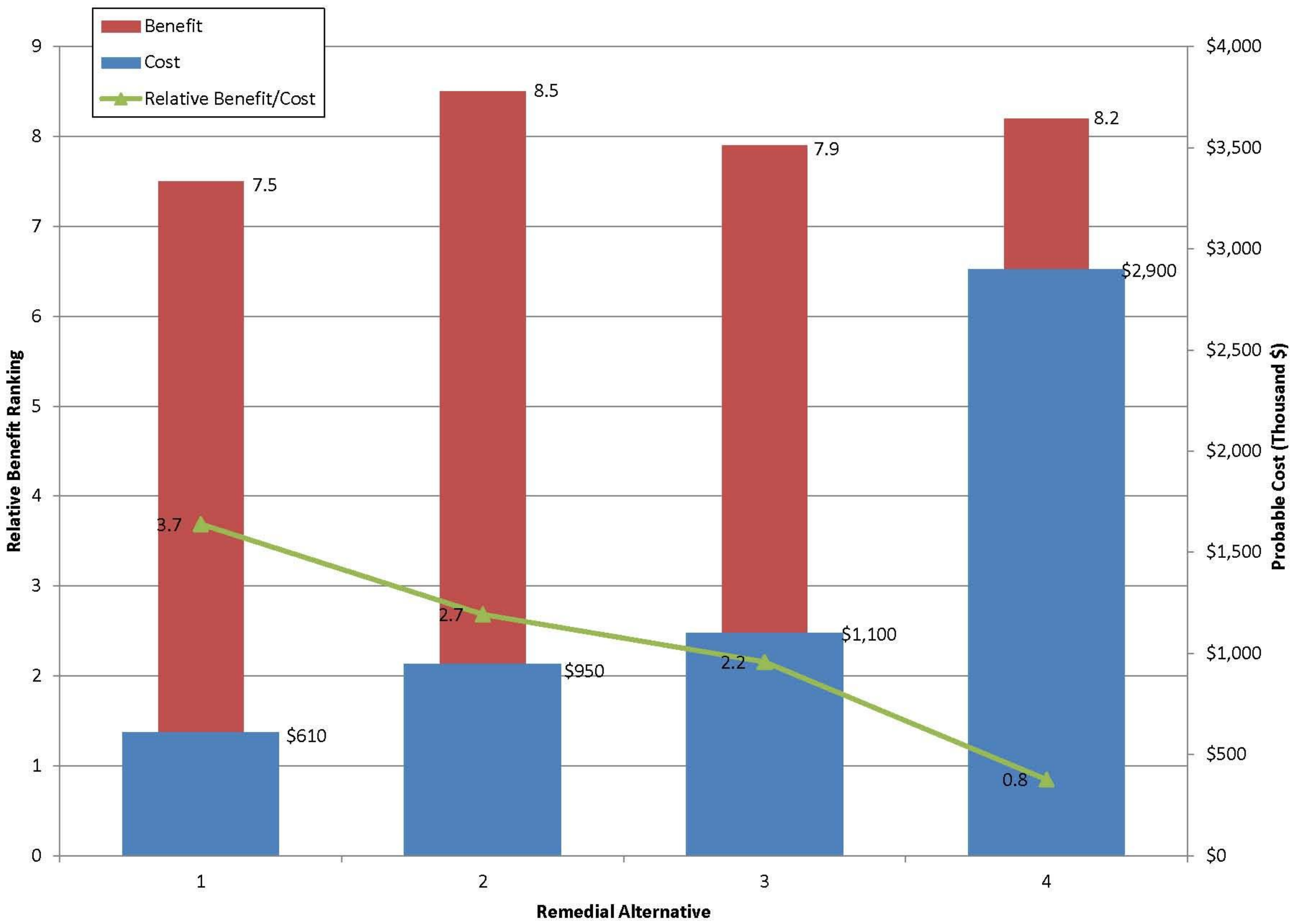
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Remedial Alternative 4
Site-Wide Source Removal

Figure
35



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Port of Bellingham Weldcraft Steel and Marine Bellingham, Washington	**Disproportionate Cost Analysis Rankings (Benefit/Cost Comparison)**	Figure 36

TABLE 1
CHRONOLOGY OF SITE INVESTIGATION ACTIVITIES
WELDCRAFT STEEL AND MARINE SITE

Activity	Year	Scope of Site Explorations
Pre-Agreed Order		
Phase I ESA	1993	None
Phase II ESA	1998	33 borings 2 surface soil grabs 3 surface sediment samples
Phase III ESA	2000	4 borings 1 hand auger 4 monitoring wells
Supplemental Sediment Investigation	2000	5 surface sediment samples
Sediment Remedial Assessment	2001	7 surface sediment samples 10 subsurface sediment samples
Waste Removal and Decommissioning - Independent Action	2001	5 soil samples
Upland Remedial Assessment	2002	5 monitoring wells
Agreed Order		
Interim Action Marine Sediment Cleanup	2004	17 performance monitoring samples
Remedial Investigation	2006 - 2007	31 borings 3 monitoring wells 2 surface water samples 2 weep samples
Interim Action Marine Sediment Confirmational Sampling	2009	9 surface sediment samples

TABLE 2
SUMMARY OF SAMPLES AND ANALYSES
WELDCRAFT STEEL AND MARINE SITE

Sample Type						Analysis and Depth of Sample in Feet (b)													
Sample ID	Soil	Groundwater	Sediment	Surface Water	Area	Depth Maximum (ft BGS)	PID	Metals	SVOCs	VOCs	PCBs	TPH	BTEX	cPAHs	TOC	TBT	Naphthalenes (e)	Conventionals (f)	Volatile Fuel Compounds (g)
PRE-AGREED ORDER																			
Phase II ESA																			
SB-1	X				Weld Shop	3	X					1							
SB-2	X				Weld Shop	3	X					1.2							
SB-3	X				West Work Yard	3	X												
SB-4	X				West Work Yard	3	X												
SB-5	X				West Work Yard	9	X												
SB-5-W		X			West Work Yard	9		X		X									
SB-6	X				Donkey Shed	3	X					0							
SB-7	X				Marine Way Dock Shed	3	X	0											
SB-8	X				Previously removed UST	10	X					5							
SB-8-W		X			Previously Removed UST	10						X	X						
SB-9	X				Marine Way	3	X												
SB-9	X				North of Building 3	3	X												
SB-10	X				North of Building 4	9	X												
SB-10-W		X			North of Building 4	9				X									
SB-11	X				North of Building 5	3	X												
SB-12	X				East Work Yard	3	X												
SB-13	X				East Work Yard	3	X												
SB-14	X				East Work Yard	3	X												
SB-15	X				East Work Yard	3	X												
SB-16	X				East Work Yard	9	X												
SB-16-W		X			East Work Yard	9		X		X									
SB-17	X				Tammi Lift Dock Shed	3	X	0											
SB-18	X				Tammi Lift	3	X	0.75											
SB-19	X				East Work Yard	9	X	0.5											
SB-19-W		X			East Work Yard	9		X		X									
SB-20	X				Former Sandblast	3	X	0.4											
SB-21	X				Dry Storage Yard	3	X												
SB-22	X				Dry Storage Yard	3	X												
SB-23	X				Dry Storage Yard	3	X												
SB-24-W		X			Dry Storage Yard	9		X		X									
SB-25	X				Former gasoline UST	8	X					7	7						
SB-26	X				Former gasoline UST	8	X												
SB-27	X				Former gasoline UST	8	X												
SB-28	X				Former gasoline UST	8	X												
SB-29	X				Former gasoline UST	8	X												
SB-30	X				Former gasoline UST	8	X					7	7						
SB-30-W		X			Former gasoline UST	8						X	X						
SB-31	X				Former gasoline UST	8	X												
SB-32	X				Former gasoline UST	8	X					1	1						
SB-33	X				Former gasoline UST	8	X					1	1						
SB-WW-comp(a)	X				West Work Yard	-	X	0.1											
SB-Bldg3-comp(a)	X				North of Building 3	-	X	0.1											
SB-EW-comp(a)	X				East Work Yard	-	X	0.1											
SB-DS-comp(a)	X				Dry Storage Yard	-	X	0.1											
DA-1	X				Drum Area, Outside the Fence Line	1						0							

TABLE 2
SUMMARY OF SAMPLES AND ANALYSES
WELDCRAFT STEEL AND MARINE SITE

Sample Type						Analysis and Depth of Sample in Feet (b)													
Sample ID	Soil	Groundwater	Sediment	Surface Water	Area	Depth Maximum (ft BGS)	PID	Metals	SVOCs	VOCs	PCBs	TPH	BTEX	cPAHs	TOC	TBT	Naphthalenes (e)	Conventionals (f)	Volatile Fuel Compounds (g)
DA-2	X				Drum Area, Outside the Fence Line	1						0							
SD-OF			X		Outfall	0.33		X	X		X				X	X			
SD-MW			X		Marine Way Dock	0.33		X	X						X	X			
SD-TL			X		Tammi Lift	0.33		X	X						X	X			
Railway			X		Marine Railway Upper Intertidal	0.5		X	X							X			
Supplemental Marine Sediment Investigation																			
SD2-01			X		West of Marine Way Dock	0.33		X	X						X	X			
SD2-02			X		Southwest of Marine Way Dock	0.33		X	X						X	X			
SD2-03			X		West end of Marine Way Dock	0.33		X	X						X	X			
SD2-04			X		East of Marine Way Dock	0.33		X	X						X	X			
SD2-05			X		Near bulkhead east of Marine Way Dock	0.33		X	X						X	X			
Phase III ESA																			
DA-101 (c)	X				Drum Area, Outside the Fence Line	9			0.75	0.75	0.75	0.75							
DA-102 (c)	X				Drum Area, Outside the Fence Line	9			0.75	0.75	0.75	0.75							
DA-103 (c)	X				Drum Area, Outside the Fence Line	9			0.5	0.5	0.5	0.5							
SB-601 (d)	X				Donkey Shed	3						0							
MW-1		X			Former septic tank	15		X		X		X							
MW-2		X			Former gasoline UST	15		X		X		X							
MW-3		X			Former gasoline UST	15		X		X		X							
MW-4		X			Former gasoline UST	15		X		X		X							
Sediment Remedial Assessment																			
RIFS-01			X		West of Marine Way Dock	0.33		X	X					X	X	X		X	
RIFS-01 (0-4)			X		West of Marine Way Dock	0.1-4		X								X			
RIFS-01 (4-8)			X		West of Marine Way Dock	4-8									X				
RIFS-02			X		West of Marine Way Dock	0.33		X	X					X		X		X	
RIFS-02 (0-4)			X		West of Marine Way Dock	0.1-4		X								X			
RIFS-02 (4-8)			X		West of Marine Way Dock	4-8		X								X			
RIFS-03			X		East of Marine Way Dock	0.33										X			
RIFS-03 (0-4)			X		East of Marine Way Dock	0.1-4		X								X			
RIFS-03 (4-8)			X		East of Marine Way Dock	4-8		X								X			
RIFS-04			X		West of Marine Way Dock	0.33										X			
RIFS-04 (0-4)			X		West of Marine Way Dock	0.1-4		X								X			
RIFS-04 (4-8)			X		West of Marine Way Dock	4-8		X								X			
RIFS-05			X		West of Marine Way Dock	0.33										X			
RIFS-06			X		East of Marine Way Dock	0.33										X			
RIFS-07			X		West of Marine Way Dock	0.33										X			
RIFS-07 (0-4)			X		West of Marine Way Dock	0.1-4													
RIFS-07 (4-8)			X		West of Marine Way Dock	4-8													
Waste Removal and Decommissioning - Independent Action																			
UST-A	X				West End of Former Septic Tank	-		2				2							
UST-B	X				Base of Septic Tank Excavation	-		4				4							
UST-C	X				East End of Former Septic Tank	-		2				2							
CB-2	X				Below Base of Catch Basin No. 2	4		4		4		4							
DI-1	X				Below Base of Former Dispenser Island	-						0							

TABLE 2
SUMMARY OF SAMPLES AND ANALYSES
WELDCRAFT STEEL AND MARINE SITE

	Sample Type					Analysis and Depth of Sample in Feet (b)													
Sample ID	Soil	Groundwater	Sediment	Surface Water	Area	Depth Maximum (ft BGS)	PID	Metals	SVOCs	VOCs	PCBs	TPH	BTEX	cPAHs	TOC	TBT	Naphthalenes (e)	Conventionals (f)	Volatile Fuel Compounds (g)
Upland Remedial Assessment																			
MW-5	X				Former gasoline UST	16	X	10				10	10						10
MW-6	X				Former gasoline UST	16	X	5				5	5						5
MW-9	X				Catch Basin No. 2	26.5	X	5				5		5					
MW-1		X			Former septic tank	15		X				X	X					X	
MW-2		X			Former gasoline UST	15		X				X	X						
MW-3		X			Former gasoline UST	15		X				X	X					X	
MW-4		X			Former gasoline UST	15		X				X	X						
MW-5		X			Former gasoline UST	16		X				X	X					X	X
MW-6		X			Former gasoline UST	16		X				X	X					X	
MW-7		X			Shoreline of Squalicum Harbor	30		X				X	X						
MW-8		X			Sanitary sewer along Squalicum Way	15.5		X				X	X						
MW-9		X			Catch Basin No. 2	26.5						X		X			X		
<u>AGREED ORDER</u>																			
Interim Action Marine Sediment Cleanup																			
SPM-1			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-2			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-3			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-4			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-5			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-6			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-7			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X			X				X			
SPM-8			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-9			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-10			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-11			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X			X				X			
SPM-12			X		Marine Area -- Initial Compliance Monitoring	0.33		X	X							X			
SPM-2A (0-4)			X		Marine Area - Supplemental Monitoring	7		0.33											
SPM-2A (12-16)			X		Marine Area - Supplemental Monitoring	7		1											
SPM-3A (0-4)			X		Marine Area - Supplemental Monitoring	7		0.33								0.33			
SPM_4A (0-4)			X		Marine Area - Supplemental Monitoring	7		0.33											
SPM-4A (12-16)			X		Marine Area - Supplemental Monitoring	7		1											
SPM-5A (0-4)			X		Marine Area - Supplemental Monitoring	7		0.33								0.33			
SPM-6A (0-4)			X		Marine Area - Supplemental Monitoring	7		0.33											
SPM-6A (12-16)			X		Marine Area - Supplemental Monitoring	7		0.33											
Remedial Investigation																			
SB-34	X				Former gasoline UST	12	X					8							
SB-35	X				Former gasoline UST	12	X					9.5							
SB-36	X				Former gasoline UST	12	X					8							
SB-37B	X				Former gasoline UST	12	X					---							
SB-37	X				Former gasoline UST	12	X					8.5							
SB-38	X				Former gasoline UST	12	X					8							

TABLE 2
SUMMARY OF SAMPLES AND ANALYSES
WELDCRAFT STEEL AND MARINE SITE

Sample Type						Analysis and Depth of Sample in Feet (b)													
Sample ID	Soil	Groundwater	Sediment	Surface Water	Area	Depth Maximum (ft BGS)	PID	Metals	SVOCs	VOCs	PCBs	TPH	BTEX	cPAHs	TOC	TBT	Naphthalenes (e)	Conventionals (f)	Volatile Fuel Compounds (g)
SB-39	X				Former gasoline UST	12	X					8							
SB-40	X				Former gasoline UST	12	X					8							
SB-41	X				Former gasoline UST	12	X					7.5							
SB-42	X				Former gasoline UST	12	X					8							
SB-43	X				Former gasoline UST	12	X					8							
SB-44	X				Former Sandblast	3	X	0											
SB-44	X				Former Sandblast	3	X	1											
SB-45	X				Former Sandblast	3	X	0											
SB-45	X				Former Sandblast	3	X	1											
SB-45	X				Former Sandblast	3	X	2											
SB-46	X				Former Sandblast	3	X	0											
SB-47	X				Former Sandblast	3	X	0											
SB-47	X				Former Sandblast	3	X	1											
SB-47	X				Former Sandblast	3	X	2											
SB-48	X				Former Sandblast	3.5	X	0											
SB-48	X				Former Sandblast	3.5	X	1											
SB-49	X				Former Sandblast	3.5	X	0											
SB-50	X				Former Sandblast	3.5	X	0											
SB-50	X				Former Sandblast	3.5	X	1											
SB-51	X				Former Sandblast	1.3	X	0											
SB-53	X				Former gasoline UST	12	X					9	9						
SB-54	X				Former gasoline UST	12	X					9	9						
SB-55	X				Former gasoline UST	12	X					10	10						
SB-57	X				Former gasoline UST	12	X					10	10						
SB-59	X				Former gasoline UST	12	X					10	10						
SB-61	X				Former gasoline UST	12	X					10	10						
SB-62	X				Former gasoline UST	12	X					10	10						
SB-63	X				Former gasoline UST	12	X					9	9						
SB-64	X				Former gasoline UST	12	X					9.5	9.5						
SB-65	X				Former gasoline UST	12	X					9	9						
SB-66	X				Former gasoline UST	12	X					9	9						
SB-67	X				Former gasoline UST	12	X					10.5	10.5						
SB-68	X				Catch Basin No. 1	12	X	1.5		1.5		1.5							
Remedial Investigation (cont.)																			
SB-68W		X			Catch Basin No. 1	12		X		X		X							
SB-69	X				Catch Basin No. 3	12	X	0.66		0.66		0.66							
SB-69W		X			Catch Basin No. 3	12		X		X		X							
MW-3		X			Former gasoline UST	15		X											
MW-3A		X			Former gasoline UST	15		X										X	
MW-3B		X			Former gasoline UST	15		X										X	
MW-4		X			Former gasoline UST	15		X											
MW-4A		X			Former gasoline UST	15		X										X	
MW-4B		X			Former gasoline UST	15		X										X	
MW-7		X			Shoreline of Squalicum Harbor	30		X											
MW-7A		X			Shoreline of Squalicum Harbor	30		X										X	
MW-7B		X			Shoreline of Squalicum Harbor	30		X										X	
MW-9		X			Catch Basin No. 2	26.5		X		X		X							
MW-10		X			Bulkhead	20.5		X											

TABLE 2
SUMMARY OF SAMPLES AND ANALYSES
WELDCRAFT STEEL AND MARINE SITE

Sample Type						Analysis and Depth of Sample in Feet (b)													
Sample ID	Soil	Groundwater	Sediment	Surface Water	Area	Depth Maximum (ft BGS)	PID	Metals	SVOCs	VOCs	PCBs	TPH	BTEX	cPAHs	TOC	TBT	Naphthalenes (e)	Conventionals (f)	Volatile Fuel Compounds (g)
MW-10A		X			Bulkhead	20.5		X										X	
MW-10B		X			Bulkhead	20.5		X										X	
MW-11		X			Bulkhead	20.5		X											
MW-11A		X			Bulkhead	20.5		X										X	
MW-11B		X			Bulkhead	20.5		X										X	
MW-111 (Dup 11B)		X			Bulkhead	20.5		X										X	
MW-12		X			Bulkhead	19.25		X											
MW-13 (Dup 12)		X			Bulkhead	19.25		X											
MW-12A		X			Bulkhead	19.25		X										X	
MW-12B		X			Bulkhead	19.25		X										X	
Weep - KP70A		X			Bulkhead Weep Pipe	-		X		X		X	X					X	
Weep - LU53A		X			Bulkhead Weep Pipe	-		X		X		X	X					X	
SW-1				X	Bellingham Bay	-		X										X	
SW-2				X	Bellingham Bay	-		X										X	
Interim Action Marine Sediment Confirmational Sampling																			
SPM-1-09			X		Marine Area - Compliance Monitoring	0.33		X	X										
SPM-2-09			X		Marine Area - Compliance Monitoring	0.33		X	X										
SPM-3-09			X		Marine Area - Compliance Monitoring	0.33		X	X										
SPM-4-09			X		Marine Area - Compliance Monitoring	0.33		X	X										
SPM-5-09			X		Marine Area - Compliance Monitoring	0.33		X	X										
SPM-6-09			X		Marine Area - Compliance Monitoring	0.33		X	X										
SPM-7-09			X		Marine Area - Compliance Monitoring	0.33		X	X										
SPM-8-09			X		Marine Area - Compliance Monitoring	0.33		X	X										
SPM-9-09			X		Marine Area - Compliance Monitoring	0.33		X	X										

(a) Represents a composite sample comprising individual samples from more than one location.
(b) Depth listed is top of soil sample interval.
(c) Additional samples were collected for TPH analysis at depths of 2.5 and 8 ft BGS at DA-101 and DA-103, and at depths of 3 and 8 ft BGS at DA-102.
(d) Additional sample collected at 1.5 ft BGS was also analyzed for TPH.
(e) Naphthalenes includes 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene.
(f) Conventionals includes alkalinity, carbonate, bicarbonate, ferrous iron, nitrate, nitrite, sulfate, and total organic carbon.
(g) Volatile fuel compounds includes 1,2-dichloroethane, ethylene dibromide, and methyl tert-butyl ether.

TABLE 3
SEDIMENT CLEANUP LEVELS
WELDCRAFT STEEL AND MARINE SITE

		APPLICABLE SEDIMENT VALUES			
		Sediment Protective of Benthic Toxicity			
		WAC 173-204 Sediment Management Standards (SMS)[b]		WAC 173-204 Dry Weight Equivalents of SMS Criteria	
ANALYTE (BY GROUP) [a]	CAS No.	SMS SQS[d]	SMS CSL/MCUL	Dry Weight SQS	Dry Weight CSL
Heavy Metals		**mg/kg-dry wt**	**mg/kg-dry wt**	**mg/kg-dry wt**	**mg/kg-dry wt**
Mercury	7439-97-6	0.41	0.59	0.41	0.59
Zinc	7440-66-6	410	960	410	960
Bulk Organotin				**µg/kg-dry wt**[e]	
Tributyltin (as TBT ion)				79	
Polycyclic Aromatic Hydrocarbons (PAHs)		**mg/kg OC**[c]	**mg/kg OC**[c]	**µg/kg dry wt**	**µg/kg dry wt**
Acenaphthylene	208-96-8	66	66	1,300	1,300
Fluoranthene	206-44-0	160	1,200	1,700	2,500
Fluorene	86-73-7	23	79	540	540
Phenanthrene	85-01-8	100	480	1,500	1,500
Other Carbon Normalized COCs		**mg/kg OC**[c]	**mg/kg OC**[c]	**µg/kg dry wt**	**µg/kg dry wt**
Dibenzofuran	132-64-9	15	58	540	540

Numerical Criteria Notes:

a Analytes listed are those detected in site sediment.

b SQS is no affects value. CSL is minor affects value.

c The listed values represent concentrations in parts per million "normalized" on a total organic carbon basis. To normalize to total organic carbon, the dry-weight concentration for each parameter is divided by the decimal fraction representing the percent total organic carbon content of the sediment.

d Sediment screening level determined based on most stringent applicable criteria.

e 79 mg/kg equals site-specific no effects TBT bulk sediment screening level.

Abbreviations:

CAS Chemical Abstracts Service.
CSL Cleanup screening level.
MCUL Maximum cleanup level.
OC Organic carbon.
SMS Sediment Management Standards.
SQS Sediment Quality Standards.
wt Weight.

TABLE 4
MONITORING WELL GROUNDWATER ELEVATIONS
WELDCRAFT STEEL AND MARINE SITE

Monitoring Well	Elevation of Top of PVC Casing (a)	Depth to Water (ft)					Groundwater Elevation (ft, MLLW)					
		7/9/02	7/7/04	6/29/06	12/20/06		7/9/02	7/7/04	6/29/06	12/20/06		ht-lt (f)
MW-1	14.38	8.23	7.96	7.88	6.91 (ht)	6.95 (lt)	5.71	5.98	6.06	7.03 (ht)	6.99 (lt)	0.04
MW-2	14.22	8.31	7.39	7.91	6.78 (ht)	6.96 (lt)	5.47	6.39	5.87	7.00 (ht)	6.82 (lt)	0.18
MW-3	14.18	9.82	8.38	NM	6.61 (ht)	7.32 (lt)	3.92	5.36	NM	7.13 (ht)	6.42 (lt)	0.71
MW-4	15.23 (b) 13.70 (c,d)	10.51	7.96	NM	6.04 (ht)	6.67 (lt)	4.28	NM	NM	7.22 (ht)	6.59 (lt)	0.63
MW-5	14.27	8.37	8.01	8.00	6.86 (ht)	6.99 (lt)	5.46	5.82	5.83	6.97 (ht)	6.84 (lt)	0.13
MW-6	14.46	9.19	8.46	8.30	7.02 (ht)	7.41 (lt)	4.83	5.56	5.72	7.00 (ht)	6.61 (lt)	0.39
MW-7	13.96	9.13	8.18	8.01	6.44 (ht)	7.26 (lt)	4.39	5.34	5.51	7.08 (ht)	6.26 (lt)	0.82
MW-8	14.09	8.39	8.08	8.22	6.68 (ht)	6.99 (lt)	5.26	5.57	5.43	6.97 (ht)	6.66 (lt)	0.31
MW-9	14.46	8.39	7.99	7.90	6.98 (ht)	6.98 (lt)	5.63	6.03	6.12	7.04 (ht)	7.04 (lt)	0.00
MW-10	14.14 (d)	(e)	(e)	8.36	6.53 (ht)	7.41 (lt)	(e)	(e)	5.34	7.17 (ht)	6.29 (lt)	0.88
MW-11	13.76 (d)	(e)	(e)	7.86	6.09 (ht)	7.11 (lt)	(e)	(e)	5.46	7.23 (ht)	6.21 (lt)	1.02
MW-12	13.86 (d)	(e)	(e)	8.09	6.20 (ht)	7.15 (lt)	(e)	(e)	5.33	7.22 (ht)	6.27 (lt)	0.95

Notes:
(a) POB datum in feet.
(b) Well casing elevation prior to sediment interim action.
(c) Well casing was modified (shortened) during the redevelopment activities associated with the sediment interim action.
(d) Top of casing elevation surveyed using MW-7 POB datum as reference.
(e) MW-10, MW-11, and MW-12 installed on 5/9/06.
(f) Elevation difference between low tide and high tide groundwater elevations measure 12/20/06.
(ht) Depth to water measurement collected during high tide.
(lt) Depth to water measurement collected during low tide.
(NM) Not measured.

TABLE 5
GROUNDWATER AND SURFACE WATER ELEVATION
TIDAL INFLUENCE DATA
WELDCRAFT STEEL AND MARINE SITE

Squalicum Harbor Tide Minimums

Date	Time	Seconds	Elevation (ft, MLLW)		Difference Hours
6/25/2002	11:52:36	67440	-2.45		
6/26/2002	12:27:36	155940	-2.19		24.6
6/27/2002	13:10:36	244920	-1.82		24.7
				Average =	24.7

MW-3 Minimums

Date	Time	Seconds	Elevation (ft, MLLW)		Lag Time for Minimum between MW-3 and Squalicum Harbor Total Hours
6/25/2002	13:49:26	76260	4.17		1.95
6/26/2002	14:29:26	165060	4.21		2.03
6/27/2002	15:00:26	253320	4.26		1.83
				Average =	1.94

MW-6 Minimums

Date	Time	Seconds	Elevation (ft, MLLW)		Lag Time for Minimum between MW-6 and Squalicum Harbor Total Hours
6/25/2002	14:29:04	81780	5.26		2.61
6/26/2002	15:07:04	170460	5.31		2.66
6/27/2002	15:36:04	258600	5.37		2.42
				Average =	2.56

MLLW = Mean Lower Low Water

TABLE 6
GROUNDWATER SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

ANALYTE (BY GROUP)	CAS No.	APPLICABLE GROUNDWATER VALUES — Groundwater Protective of Surface Water: Surface Water ARAR - Aquatic Life - Marine/Chronic - Ch. 173-201A WAC (ma-wac)	Surface Water ARAR - Aquatic Life - Marine/Chronic - Clean Water Act §304 (ma-cwa)	Surface Water ARAR - Aquatic Life - Marine/Chronic - National Toxics Rule, 40 CFR 131 (ma-ntr)	Surface Water ARAR - Human Health – Marine – Clean Water Act §304 (hh-cwa)	Surface Water ARAR - Human Health – Marine – National Toxics Rule, 40 CFR 131 (hh-ntr)	Surface Water, Method B, Most-Restrictive, Standard Formula[a] (sw-b)	Groundwater Protective of Sediment[1] — Partitioning/Distribution Coefficients[b]: Koc (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	Kd (Distribution Coefficient for metals) (L/kg)	Marine Sediment Quality Standards: WAC 173-204 Marine SQS (mg/kg organic carbon)	WAC 173-204 Marine SQS (mg/kg dry weight)	Calculated Porewater Concentration Protective of Marine Sediment[c] (sed)	Groundwater Protective of Vapor Intrusion[d,2]: Method B, Unrestricted Land Use (vi-b)	Method A, Groundwater (gw-a)	Applicable Practical Quantitation Level (PQL) for RI Analyses[f] (pql)	Most Stringent Groundwater Screening Level[g] (This value may vary by land use if most stringent value is associated with vapor intrusion.) Unrestricted Land Use	
Total Petroleum Hydrocarbons																	
Gasoline Range Hydrocarbons in ug/L	86290-81-5													800	250	800	*(gw-a)*
Diesel Range Hydrocarbons in ug/L	68334-30-5													500	250	500	*(gw-a)*
Oil Range Hydrocarbons in ug/L	TPH-Oil													500	500	500	*(gw-a)*
Heavy Metals																	
Antimony ug/L	7440-36-0				640	4300			*45*						0.2	640	*(hh-cwa)*
Arsenic in ug/L[e]	7440-38-2	36	36	36	0.14	0.14			*29*		57	2000		5	0.5	5	*(gw-a)*
Beryllium ug/L	7440-41-7						270								0.2	270	*(sw-b)*
Cadmium in ug/L	7440-43-9	9.3	8.8	9.3			41				5.1				0.1	8.8	*(ma-cwa)*
Chromium (III) in ug/L	1308-38-9														0.2		
Copper in ug/L	7440-50-8	3.1	3.1	2.4			2900		*22*		390	18000			0.5	2.4	*(ma-ntr)*
Lead in ug/L	7439-92-1	8.1	8.1	8.1					*10000*		450	45			0.1	8.1	*(ma-wac)*
Mercury in ug/L	7439-97-6	0.025	0.94	0.025		0.15			*52*		0.41	7.9	0.89		0.001	0.025	*(ma-wac)*
Nickel in ug/L	7440-02-0	8.2	8.2	8.2	4600	4600			*65*						0.5	8.2	*(ma-wac)*
Selenium in ug/L	7782-49-2	71	71	71	4200				*5*						1	71	*(ma-wac)*
Zinc in ug/L	7440-66-6	81	81	81	26000				*62*		410	6600			4	81	*(ma-wac)*
Volatile Organic Compounds																	
1,1,1-Trichloroethane in ug/L	71-55-6						930000	*140*					11000		0.5	11000	*(vi-b)*
1,2,4-Trimethylbenzene in ug/L	95-63-6												24		2	24	*(vi-b)*
1,3,5-Trimethylbenzene in ug/L	108-67-8												25		2	25	*(vi-b)*
Benzene in ug/L	71-43-2				51	71		*62*					2.4		0.5	2.4	*(vi-b)*
Carbon tetrachloride in ug/L	56-23-5				1.6	4.4		*150*					0.22		0.5	0.5	*(pql)*
Ethylbenzene in ug/L	100-41-4				2100	29000		*200*					2800		0.5	2100	*(hh-cwa)*
Isopropylbenzene in ug/L	98-82-8												720		2	720	*(vi-b)*
m,p-Xylenes in ug/L	179601-23-1														0.5		
n-Propylbenzene in ug/L	103-65-1														2		
o-Xylene in ug/L	95-47-6							*240*					440		0.5	440	*(vi-b)*
p-Isopropyltoluene in ug/L	99-87-6														2		
sec-Butylbenzene in ug/L	135-98-8														2		
Toluene in ug/L	108-88-3				15000	200000		*140*					15000		0.5	15000	*(hh-cwa)*
Trichloroethene (TCE) in ug/L	79-01-6				30	81		*94*					0.42		0.5	0.5	*(pql)*
Xylenes (total) in ug/L	1330-20-7							*230*							2		
Naphthalene in ug/L	91-20-3						4900	*1200*		99		83	170		0.2	83	*(sed)*
Polycyclic Aromatic Hydrocarbons (PAHs)																	
Naphthalene in ug/L	91-20-3						4900	*1200*		99		83	170		0.01	83	*(sed)*
1-Methylnaphthalene in ug/L	90-12-0														0.01		
2-Methylnaphthalene in ug/L	91-57-6									38					0.01		
Benz(a)anthracene in ug/L	56-55-3				0.018	0.031		*360000*		110		0.31			0.01	0.018	*(hh-cwa)*
Benzo(a)pyrene in ug/L	50-32-8				0.018	0.031		*970000*		99		0.1			0.01	0.018	*(hh-cwa)*
Benzo(b)fluoranthene in ug/L	205-99-2				0.018	0.031		*1200000*							0.01	0.018	*(hh-cwa)*
Benzo(k)fluoranthene in ug/L	207-08-9				0.018	0.031		*1200000*							0.01	0.018	*(hh-cwa)*
Benzofluoranthenes (total) (mg/L)	Total Benzo.							*1200000*		230		0.19				0.19	*(sed)*
Chrysene in ug/L	218-01-9				0.018	0.031		*400000*		110		0.28			0.01	0.018	*(hh-cwa)*
Dibenzo(a,h)anthracene in ug/L	53-70-3				0.018	0.031		*1800000*		12		0.0067			0.01	0.01	*(pql)*
Indeno(1,2,3-cd)pyrene in ug/L	193-39-5				0.018	0.031		*3500000*		34		0.0097			0.01	0.01	*(pql)*

Criteria Notes:

Blank cells are intentional.

a In accordance with WAC 173-340-730(3)(b)(iii), if sufficiently protective health-based criteria or standards have not been established under applicable state and federal laws, Method B values have been developed. Method B values are most restrictive of carcinogenic or non-carcinogenic values presented in Ecology's Cleanup Levels and Risk Calculation (CLARC) Database and pulled on May 15, 2012. A Method B value is not listed when it is either not available or an applicable surface water criteria meets the minimum 10-5 standard for carcinogens and HI-1 for non-carcinogens.

b Values from Ecology's CLARC Database May 15, 2012; except as noted.

c Calculated assuming equilibrium partitioning: Cw (porewater) = Sediment Quality Standard (SQS; WAC 173-204-320) / Kd.

d From Table B-1 (Appendix B) of Ecology's Guidance for Evaluation of Soil Vapor Intrusion (Ecology 2009).

e For arsenic, state-wide background arsenic concentration of 5 µg/L from WAC 173-340-900 Table 720-1 is considered applicable based on site-specific hydrogeology.

f PQL is the lowest concentration that can be reliably measured within specified limits of precision, accuracy, representativeness, completeness, and comparability during routine laboratory operating conditions, using department approved methods. Values are reported from Columbia Analytical Services, Inc. (Kelso, WA) and Analytical Resources, Inc. (Tukwila, WA).

g Most stringent of values protective of marine surface water, sediment, and vapor intrusion.

Process Notes:

1 Groundwater concentrations that are protective of sediments are calculated using an equilibration partitioning method. Site-specific data (e.g., distribution coefficient [Kd], soil organic carbon water partitioning coefficient [Koc], etc.) can be used to calculate if porewater is protective of sediments. In this table, the equilibrium partitioning equation is used with default parameters and is defined to achieve sediment concentrations protective of benthic toxicity.

2 Values protective of vapor intrusion from Table B-1 of Ecology's Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action, Draft 2009. Values vary based on site-specific land use (i.e., industrial or unrestricted).

Abbreviations:

ARAR Applicable or Relevant and Appropriate Requirement.
CAS Chemical Abstracts Service.
Ch Chapter.
CFR Code of Federal Regulations.
Ecology Washington State Department of Ecology.
Kd Distribution coefficient.
Koc Soil organic carbon water partitioning coefficient.
PQL Practical Quantitation Limit.
RI Remedial Investigation.
SQS Sediment quality standards.
WAC Washington Administrative Code.

TABLE 7
SOIL SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

			APPLICABLE SOIL VALUES									**Most Stringent Unrestricted Soil Screening Level (mg/kg)[i]** (This value may vary for saturated versus unsaturated soil if most stringent value is associated with groundwater intrusion.)	
			Soil Protective of Groundwater[2,3]					***Soil Protective of Direct Contact by Humans[d,1]***					
			Constants and Coefficients[a]			*Calculated Values*							
ANALYTE (BY GROUP)	CAS No.	Most Stringent Groundwater Screening Level (see Table 6) (refer to Table 6)	K_{oc} (Soil Organic Carbon-Water Partitioning Coefficient) (L/kg)	K_d (Distribution Coefficient for metals) (L/kg)	Henrys Law Constant (Hcc; unitless)	**Unsaturated Soil** Concentration Protective of Leachability to Groundwater (mg/kg)[b] *(gwl-u)*	**Saturated Soil** Concentration Protective of Leachability to Groundwater(mg/kg)[c] *(gwl-s)*	Soil, Method A, Unrestricted Land Use, Table Value (mg/kg)[a,e] *(mA)*	Soil, Method B, Most-Restrictive Standard Formula Value, Direct Contact (ingestion only), Unrestricted Land Use (mg/kg)[a,f] *(mB)*	Natural Background Concentration (mg/kg)[g] *(back)*	Applicable Practical Quantitation Level (PQL) for RI Analyses (mg/kg)[h] *(pql)*	**Unsaturated Soil**	**Saturated Soil**
Total Petroleum Hydrocarbons													
Gasoline Range Hydrocarbons	86290-81-5	800						30[j]	¥		5	30 *(mA)*	30 *(mA)*
Diesel Range Hydrocarbons	68334-30-5	500						2000	¥		25	2000 *(mA)*	2000 *(mA)*
Oil Range Hydrocarbons	TPH-Oil	500						2000	¥		100	2000 *(mA)*	2000 *(mA)*
Heavy Metals													
Antimony	7440-36-0	640		*45*	*0*	580	29		320		0.5	320 *(mB)*	29 *(gwl-s)*
Arsenic	7440-38-2	5		*29*	*0*	2.9	0.15	20	0.67	20[k]	0.5	20 *(back)*	20 *(back)*
Beryllium	7440-41-7	270		*790*	*0*	4300	210		160	0.6	0.5	160 *(mB)*	160 *(mB)*
Cadmium	7440-43-9	8.8			*0*				80	1	0.1	80 *(mB)*	80 *(mB)*
Chromium (III)	1308-38-9										0.2		
Copper	7440-50-8	2.4		*22*	*0*	1.1	0.053		3200	36	0.2	36 *(back)*	36 *(back)*
Lead	7439-92-1	8.1		*10000*	*0*	1600	81	250		24	0.1	250 *(mA)*	81 *(gwl-s)*
Mercury	7439-97-6	0.025		*52*	*0.47*	0.026	0.0013	24		0.07	0.025	0.07 *(back)*	0.07 *(back)*
Nickel	7440-02-0	8.2		*65*	*0*	11	0.54		1600	48	0.5	48 *(back)*	48 *(back)*
Selenium	7782-49-2	71		*5*	*0*	7.4	0.38		400		1	7.4 *(gwl-u)*	1 *(pql)*
Zinc	7440-66-6	81		*62*	*0*	100	5		24000	85	1	100 *(gwl-u)*	85 *(back)*
Volatile Organic Compounds													
1,1,1-Trichloroethane	71-55-6	11000	*140*		*0.71*	88	4.7		160000		0.005	88 *(gwl-u)*	4.7 *(gwl-s)*
1,2,4-Trimethylbenzene	95-63-6	24									0.02		
1,3,5-Trimethylbenzene	108-67-8	25							800		0.02	800 *(mB)*	800 *(mB)*
Benzene	71-43-2	2.4	*62*		*0.23*	0.014	0.00084		18		0.005	0.014 *(gwl-u)*	0.005 *(pql)*
Carbon tetrachloride	56-23-5	0.5	*150*		*1.3*	0.0046	0.00022		14		0.005	0.005 *(pql)*	0.005 *(pql)*
Ethylbenzene	100-41-4	2100	*200*		*0.32*	18	1		8000		0.005	18 *(gwl-u)*	1 *(gwl-s)*
Isopropylbenzene	98-82-8	720							8000		0.02	8000 *(mB)*	8000 *(mB)*
n-Propylbenzene	103-65-1								8000		0.02	8000 *(mB)*	8000 *(mB)*
p-Isopropyltoluene	99-87-6										0.02		
o-Xylene	95-47-6	440	*240*		*0.21*	4	0.23		16000		0.005	4 *(gwl-u)*	0.23 *(gwl-s)*
sec-Butylbenzene	135-98-8										0.02		
Toluene	108-88-3	15000	*140*		*0.27*	110	6.4		6400		0.005	110 *(gwl-u)*	6.4 *(gwl-s)*
Trichloroethene (TCE)	79-01-6	0.5	*94*		*0.42*	0.0033	0.00019		11		0.005	0.005 *(pql)*	0.005 *(pql)*
Xylenes (total)	1330-20-7		*230*		*0.28*				16000		0.02	16000 *(mB)*	16000 *(mB)*
Polycyclic Aromatic Hydrocarbons (PAHs)													
1-Methylnaphthalene	90-12-0	83							35		0.005	35 *(mB)*	35 *(mB)*
2-Methylnaphthalene	91-57-6								320		0.005	320 *(mB)*	320 *(mB)*
Naphthalene	91-20-3	83	*1200*		*0.02*	2.3	0.12		1600		0.005	2.3 *(gwl-u)*	0.12 *(gwl-s)*
Total Naphthalenes	Total Naph												
Benz(a)anthracene	56-55-3	0.018	*360000*		*0.00014*	0.13	0.0065		1.4		0.005	0.13 *(gwl-u)*	0.0065 *(gwl-s)*
Benzo(a)pyrene	50-32-8	0.018	*970000*		*0.000046*	0.35	0.017		0.14		0.005	0.14 *(mB)*	0.017 *(gwl-s)*
Benzo(b)fluoranthene	205-99-2	0.018	*1200000*		*0.0046*	0.43	0.022		1.4		0.005	0.43 *(gwl-u)*	0.022 *(gwl-s)*
Benzo(k)fluoranthene	207-08-9	0.018	*1200000*		*0.000034*	0.43	0.022		14		0.005	0.43 *(gwl-u)*	0.022 *(gwl-s)*
Chrysene	218-01-9	0.018	*400000*		*0.0039*	0.14	0.0072		140		0.005	0.14 *(gwl-u)*	0.0072 *(gwl-s)*
Dibenzo(a,h)anthracene	53-70-3	0.01	*1800000*		*0.0000006*	0.36	0.018		0.14		0.005	0.14 *(mB)*	0.018 *(gwl-s)*
Indeno(1,2,3-cd)pyrene	193-39-5	0.01	*3500000*		*0.000066*	0.7	0.035		1.4		0.005	0.7 *(gwl-u)*	0.035 *(gwl-s)*
Total cPAHs TEQ	Total cPAHs TEF								0.14			0.14 *(mB)*	0.14 *(mB)*

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES AND COMPARISON TO SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location:	Soil Screening Levels (a)		SB-1	SB-2	SB-6	SB-7	SB-8	SB-17	SB-18	SB-19	SB-20	SB-WW-	SB-Bldg3-	SB-EW-	SB-DS-	SB-25	SB-30	SB-32
Sample Depth (ft BGS)			1-1.4	1.2-1.4	0-1.4	0-1.7	4.7-5.6	0.2-0.6	0.75-1.5	0.5-2.1	0.4-1.7	Comp (b)	Comp (c)	Comp (d)	Comp (e)	7-8	7-7.5	5-6.8
Date Collected:	Unsaturated soil	Saturated soil	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																		
Method NWTPH-HCID																		
Gas Range	30	30	20 U	20 U	400 U		**3200**											
Diesel Range	2000 (h)	2000 (h)	25 U	25 U	500 U		**340**											
Oil Range	2000 (h)	2000 (h)	50 U	50 U	**1100**		**790**											
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																		
Method NWTPH-D																		
Diesel Range (f)	2000 (h)	2000 (h)																
Oil Range (f)	2000 (h)	2000 (h)																
Total petroleum hydrocarbons	2000 (h)	2000 (h)																
Method NWTPH-G																		
Gas Range	30	30														**180** J	**26** J	5.4 UJ
BTEX (mg/kg)																		
Method 8020																		
Benzene	0.014	0.005														**8.1** J	**0.22** J	0.054 UJ
Toluene	110	64														**3.2** J	**1.2** J	0.054 UJ
Ethylbenzene	18	1														**5** J	**0.56** J	**0.081** J
m,p-Xylene	--	--														**27** J	**2** J	**0.39** J
o-Xylene	4	0.23														**4.6** J	**0.96** J	0.054 UJ
Total Xylenes	16,000	16,000														**31.6**	**2.96**	**0.39** J
PRIORITY POLLUTANT METALS (mg/kg)																		
Antimony (6010)	320	29				**7**		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
Arsenic (6010)	20	20				5 U		**6**	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
Beryllium (6010)	160	160				**0.3**		**0.2**	**0.3**	**0.2**	**0.1**	**0.2**	**0.2**	**0.2**	**0.2**			
Cadmium (6010)	80	80				**0.6**		**0.3**	**0.6**	**0.4**	**0.9**	**0.4**	**0.3**	**0.2**	**0.2**			
Chromium (6010)	--	--				**38.5**		**28.4**	**51.7**	**29.9**	**35.4**	**36.5**	**26.5**	**27.6**	**23.4**			
Copper (6010)	36	36				**135**		**95.7**	**91.2**	**247**	**173**	**89.8**	**44.5**	**43.2**	**27.3**			
Lead (6010)	250	81				**40**		**50**	**43**	**120**	**1160**	**77**	**36**	**15**	**8**			
Mercury (7471)	0.07	0.07				**0.37**		**0.23**	**0.37**	**1.71**	**0.13**	**0.15**	**0.11**	**0.10**	0.04 U			
Nickel (6010)	48	48				**52**		**86**	**42**	**23**	**31**	**27**	**22**	**23**	**23**			
Selenium (6010)	7.4	1.0				5 U		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
Zinc (6010)	100	85				**376**		**113**	**220**	**146**	**441**	**171**	**61.5**	**53.5**	**42.5**			
VOLATILES (mg/kg)																		
EPA Method SW8260																		
1,1,1-Trichloroethane	88	4.7																
Carbon Tetrachloride	0.005	0.005																
Trichloroethene	0.005	0.005																
Benzene	0.014	0.005																
Toluene	110	64																
Ethylbenzene	18	1																
m,p-Xylene	--	--																
o-Xylene	4	0.23																
1,3,5-Trimethylbenzene	800	800																
1,2,4-Trimethylbenzene	--	--																
Isopropylbenzene	8000	8000																
n-Propylbenzene	8000	8000																
sec-Butylbenzene	--	--																
p-Isopropyltoluene	--	--																
Naphthalene	0.27	0.12																
SEMIVOLATILES (mg/kg)																		
EPA Method SW8270																		
Naphthalene	2.3	0.12																
2-Methylnaphthalene	320	320																
Benzo(a)anthracene	0.13	0.0065																
Chrysene	0.14	0.0072																
Benzo(b)fluoranthene	0.43	0.022																
Benzo(k)fluoranthene	0.43	0.022																
Benzo(a)pyrene	0.14	0.017																
Indeno(1,2,3-cd)pyrene	0.7	0.035																
Dibenz(a,h)anthracene	0.14	0.018																

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES
AND COMPARISON TO SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location:			SB-1	SB-2	SB-6	SB-7	SB-8	SB-17	SB-18	SB-19	SB-20	SB-WW-Comp (b)	SB-Bldg3-Comp (c)	SB-EW-Comp (d)	SB-DS-Comp (e)	SB-25	SB-30	SB-32
Sample Depth (ft BGS)	Soil Screening Levels (a)		1-1.4	1.2-1.4	0-1.4	0-1.7	4.7-5.6	0.2-0.6	0.75-1.5	0.5-2.1	0.4-1.7					7-8	7-7.5	5-6.8
Date Collected:	Unsaturated soil	Saturated soil	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998
PAHs (mg/kg)																		
SW8270-SIM																		
Naphthalene	2.3	0.12																
2-Methylnaphthalene	320	320																
1-Methylnaphthalene	35	35																
Total naphthalene	--	--																
Benzo(a)anthracene	0.13	0.0065																
Chrysene	0.14	0.0072																
Benzo(b)fluoranthene	0.43	0.022																
Benzo(k)fluoranthene	0.43	0.022																
Benzo(a)pyrene	0.14	0.017																
Indeno(1,2,3-cd)pyrene	0.7	0.035																
Dibenz(a,h)anthracene	0.14	0.018																
Total cPAH - benzo(a)pyrene TEQ (g)	0.14	0.14																

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES
AND COMPARISON TO SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location:	Soil Screening Levels (a)		SB-33	Drum Area 1	Drum Area 2	DA101	DA101	DA101	DA102	DA102	DA102	DA103	DA103	DA103	SB-601A	SB-601B	UST-A	UST-B
Sample Depth (ft BGS)			5-7.5	surface	surface	0.75	2.5	8	0.75	3	8	0.5	2.5	8	0.0-1.5	1.5-3.0	sidewall	base
Date Collected:	Unsaturated soil	Saturated soil	1/21/1998	1/23/1998	1/23/1998	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	8/17/2000	8/17/2000	1/4/2001	1/4/2001
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																		
Method NWTPH-HCID																		
Gas Range	30	30		200 UJ	200 UJ												20 U	**470**
Diesel Range	2000 (h)	2000 (h)		**690** J	250 UJ												50 U	50 U
Oil Range	2000 (h)	2000 (h)		**900** J	**630** J												100 U	100 U
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																		
Method NWTPH-D																		
Diesel Range (f)	2000 (h)	2000 (h)				**14**	**7.2**	**36**	**8.7**	5.2 U	**10**	**15**	**8.9**	**72**	50 U	50 U		
Oil Range (f)	2000 (h)	2000 (h)				**54**	**17**	**55**	**26**	10 U	**14**	**38**	10 U	**100**	**150**	100 U		
Total petroleum hydrocarbons	2000 (h)	2000 (h)				**68**	**24.2**	**91**	**34.7**	ND	**24**	**53**	**8.9**	**172**	**200**	ND		
Method NWTPH-G																		
Gas Range	30	30	5.7 UJ												20 U	20 U		
BTEX (mg/kg)																		
Method 8020																		
Benzene	0.014	0.005	0.057 UJ															
Toluene	110	64	0.057 UJ															
Ethylbenzene	18	1	0.057 UJ															
m,p-Xylene	--	--	**0.072** J															
o-Xylene	4	0.23	0.057 UJ															
Total Xylenes	16,000	16,000	**0.072** J															
PRIORITY POLLUTANT METALS (mg/kg)																		
Antimony (6010)	320	29																
Arsenic (6010)	20	20															6 U	6 U
Beryllium (6010)	160	160																
Cadmium (6010)	80	80															0.2 U	**0.3**
Chromium (6010)	--	--															**21.2**	**22.5**
Copper (6010)	36	36															**41.2**	**55.6**
Lead (6010)	250	81															**28**	**26**
Mercury (7471)	0.07	0.07															0.06 U	0.06 U
Nickel (6010)	48	48															**17**	**20**
Selenium (6010)	7.4	1.0																
Zinc (6010)	100	85																
VOLATILES (mg/kg)																		
EPA Method SW8260																		
1,1,1-Trichloroethane	88	4.7				0.0010 U			0.0011 U			0.0011 U						
Carbon Tetrachloride	0.005	0.005				**0.0019**			**0.0043**			**0.0013**						
Trichloroethene	0.005	0.005				**0.0094**			**0.015**			**0.0044**						
Benzene	0.014	0.005				0.0010 U			0.0011 U			0.0011 U						
Toluene	110	64				**0.0014**			**0.0022**			0.0011 U						
Ethylbenzene	18	1				0.0010 U			0.0011 U			0.0011 U						
m,p-Xylene	--	--				0.0010 U			0.0011 U			0.0011 U						
o-Xylene	4	0.23				0.0010 U			0.0011 U			0.0011 U						
1,3,5-Trimethylbenzene	800	800				0.0010 U			0.0011 U			0.0011 U						
1,2,4-Trimethylbenzene	--	--				0.0010 U			0.0011 U			0.0011 U						
Isopropylbenzene	8000	8000				0.0010 U			0.0011 U			0.0011 U						
n-Propylbenzene	8000	8000				0.0010 U			0.0011 U			0.0011 U						
sec-Butylbenzene	--	--				0.0010 U			0.0011 U			0.0011 U						
p-Isopropyltoluene	--	--				0.0010 U			0.0011 U			0.0011 U						
Naphthalene	0.27	0.12				0.0052 U			0.0054 U			0.0053 U						
SEMIVOLATILES (mg/kg)																		
EPA Method SW8270																		
Naphthalene	2.3	0.12				0.0690 U			0.071 U			0.069 U						
2-Methylnaphthalene	320	320				0.0690 U			0.071 U			0.069 U						
Benzo(a)anthracene	0.13	0.0065				0.0690 U			0.071 U			0.069 U						
Chrysene	0.14	0.0072				0.0690 U			0.071 U			0.069 U						
Benzo(b)fluoranthene	0.43	0.022				0.0690 U			0.071 U			0.069 U						
Benzo(k)fluoranthene	0.43	0.022				0.0690 U			0.071 U			0.069 U						
Benzo(a)pyrene	0.14	0.017				0.0690 U			0.071 U			0.069 U						
Indeno(1,2,3-cd)pyrene	0.7	0.035				0.0690 U			0.071 U			0.069 U						
Dibenz(a,h)anthracene	0.14	0.018				0.0690 U			0.071 U			0.069 U						

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES
AND COMPARISON TO SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location:			SB-33	Drum Area 1	Drum Area 2	DA101	DA101	DA101	DA102	DA102	DA102	DA103	DA103	DA103	SB-601A	SB-601B	UST-A	UST-B
Sample Depth (ft BGS)	Soil Screening Levels (a)		5-7.5	surface	surface	0.75	2.5	8	0.75	3	8	0.5	2.5	8	0.0-1.5	1.5-3.0	sidewall	base
Date Collected:	Unsaturated soil	Saturated soil	1/21/1998	1/23/1998	1/23/1998	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	8/17/2000	8/17/2000	1/4/2001	1/4/2001
PAHs (mg/kg)																		
SW8270-SIM																		
Naphthalene	2.3	0.12																
2-Methylnaphthalene	320	320																
1-Methylnaphthalene	35	35																
Total naphthalene	--	--																
Benzo(a)anthracene	0.13	0.0065																
Chrysene	0.14	0.0072																
Benzo(b)fluoranthene	0.43	0.022																
Benzo(k)fluoranthene	0.43	0.022																
Benzo(a)pyrene	0.14	0.017																
Indeno(1,2,3-cd)pyrene	0.7	0.035																
Dibenz(a,h)anthracene	0.14	0.018																
Total cPAH - benzo(a)pyrene TEQ (g)	0.14	0.14																

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES
AND COMPARISON TO SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location:	Soil Screening Levels (a)		UST-C	DI-1	CB-2	MW-5	MW-6	MW-9	SB-34	SB-35	SB-36	SB-37B	SB-37	SB-38	SB-39	SB-40	SB-41	SB-42
Sample Depth (ft BGS)			sidewall	surface	surface	10-11.5	5-6.5	5-5.5	8-9	9.5-10	8-8.5	8.5-9.5	8.5-9.5	8-9	8-8.5	8-8.5	7.5-8	8-8.5
Date Collected:	Unsaturated soil	Saturated soil	1/4/2001	1/4/2001	1/4/2001	5/22/2002	5/23/2002	5/22/2002	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																		
Method NWTPH-HCID																		
Gas Range	30	30	20 U	**41**														
Diesel Range	2000 (h)	2000 (h)	50 U	**70**														
Oil Range	2000 (h)	2000 (h)	100 U	100 U														
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																		
Method NWTPH-D																		
Diesel Range (f)	2000 (h)	2000 (h)			**2500**			**940**										
Oil Range (f)	2000 (h)	2000 (h)			**1600**			**1000**										
Total petroleum hydrocarbons	2000 (h)	2000 (h)			**4100**			**1940**										
Method NWTPH-G																		
Gas Range	30	30				**2300**	5.4 U		**20**	**210**	**1900**	**550**	**730**	**720**	**1800**	**31**	**9.8**	**2400**
BTEX (mg/kg)																		
Method 8020																		
Benzene	0.014	0.005				**44**	0.0011 U											
Toluene	110	64				**61**	**0.0015**											
Ethylbenzene	18	1				**63**	0.0011 U											
m,p-Xylene	--	--				**400**	0.0011 U											
o-Xylene	4	0.23				**130**	0.0011 U											
Total Xylenes	16,000	16,000				**530**	0.0011 U											
PRIORITY POLLUTANT METALS (mg/kg)																		
Antimony (6010)	320	29																
Arsenic (6010)	20	20	5 U		**8**													
Beryllium (6010)	160	160																
Cadmium (6010)	80	80	**0.3**		**0.8**													
Chromium (6010)	--	--	**16.5**		**24.7**													
Copper (6010)	36	36	**20.1**		**186**													
Lead (6010)	250	81	**14**		**55**	**32**	**3**											
Mercury (7471)	0.07	0.07	0.04 U		**0.29**													
Nickel (6010)	48	48	**16**		**24**													
Selenium (6010)	7.4	1.0																
Zinc (6010)	100	85																
VOLATILES (mg/kg)																		
EPA Method SW8260																		
1,1,1-Trichloroethane	88	4.7			0.0054 U													
Carbon Tetrachloride	0.005	0.005			0.0054 U													
Trichloroethene	0.005	0.005			0.0054 U													
Benzene	0.014	0.005			0.0054 U													
Toluene	110	64			**0.0092**													
Ethylbenzene	18	1			**0.810**													
m,p-Xylene	--	--			**0.070**													
o-Xylene	4	0.23			**0.037**													
1,3,5-Trimethylbenzene	800	800			**0.086**													
1,2,4-Trimethylbenzene	--	--			**0.220**													
Isopropylbenzene	8000	8000			**0.017**													
n-Propylbenzene	8000	8000			**0.018** M													
sec-Butylbenzene	--	--			**0.013** M													
p-Isopropyltoluene	--	--			**0.024**													
Naphthalene	0.27	0.12			**0.140**													
SEMIVOLATILES (mg/kg)																		
EPA Method SW8270																		
Naphthalene	2.3	0.12																
2-Methylnaphthalene	320	320																
Benzo(a)anthracene	0.13	0.0065																
Chrysene	0.14	0.0072																
Benzo(b)fluoranthene	0.43	0.022																
Benzo(k)fluoranthene	0.43	0.022																
Benzo(a)pyrene	0.14	0.017																
Indeno(1,2,3-cd)pyrene	0.7	0.035																
Dibenz(a,h)anthracene	0.14	0.018																

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES AND COMPARISON TO SCREENING LEVELS WELDCRAFT STEEL AND MARINE SITE

Location:	Soil Screening Levels (a)		UST-C	DI-1	CB-2	MW-5	MW-6	MW-9	SB-34	SB-35	SB-36	SB-37B	SB-37	SB-38	SB-39	SB-40	SB-41	SB-42
Sample Depth (ft BGS)			sidewall	surface	surface	10-11.5	5-6.5	5-5.5	8-9	9.5-10	8-8.5	8.5-9.5	8.5-9.5	8-9	8-8.5	8-8.5	7.5-8	8-8.5
Date Collected:	Unsaturated soil	Saturated soil	1/4/2001	1/4/2001	1/4/2001	5/22/2002	5/23/2002	5/22/2002	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006
PAHs (mg/kg)																		
SW8270-SIM																		
Naphthalene	2.3	0.12						**0.190**										
2-Methylnaphthalene	320	320						**0.330**										
1-Methylnaphthalene	35	35						**0.200**										
Total naphthalene	--	--						**0.720**										
Benzo(a)anthracene	0.13	0.0065						**0.084**										
Chrysene	0.14	0.0072						**0.140** J										
Benzo(b)fluoranthene	0.43	0.022						**0.097**										
Benzo(k)fluoranthene	0.43	0.022						**0.090**										
Benzo(a)pyrene	0.14	0.017						**0.069**										
Indeno(1,2,3-cd)pyrene	0.7	0.035						**0.030**										
Dibenz(a,h)anthracene	0.14	0.018						0.021 U										
Total cPAH - benzo(a)pyrene TEQ (g)	0.14	0.14						**0.101**										

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES
AND COMPARISON TO SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location:	Soil Screening Levels (a)		SB-43	SB-44-0-1	SB-44-1-2	SB-45-0-1	SB-45-1-2	SB-45-2-3	SB-46-0-1	SB-47-0-1	SB-47-1-2	SB-47-2-3	SB-48-0-1	SB-48-1-2	SB-49-0-1	SB-50-0-1	SB-50-1-2	SB-51-0-1
Sample Depth (ft BGS)			8-8.5	0-1	1-2	0-1	1-2	2-3	0-1	0-1	1-2	2-3	0-1	1-2	0-1	0-1	1-2	0-1
Date Collected:	Unsaturated soil	Saturated soil	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																		
Method NWTPH-HCID																		
Gas Range	30	30																
Diesel Range	2000 (h)	2000 (h)																
Oil Range	2000 (h)	2000 (h)																
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																		
Method NWTPH-D																		
Diesel Range (f)	2000 (h)	2000 (h)																
Oil Range (f)	2000 (h)	2000 (h)																
Total petroleum hydrocarbons	2000 (h)	2000 (h)																
Method NWTPH-G																		
Gas Range	30	30	**830**															
BTEX (mg/kg)																		
Method 8020																		
Benzene	0.014	0.005																
Toluene	110	64																
Ethylbenzene	18	1																
m,p-Xylene	--	--																
o-Xylene	4	0.23																
Total Xylenes	16,000	16,000																
PRIORITY POLLUTANT METALS (mg/kg)																		
Antimony (6010)	320	29																
Arsenic (6010)	20	20		10 U		5 U			5 U	**6**			5 U		5 U	6 U		10 U
Beryllium (6010)	160	160																
Cadmium (6010)	80	80																
Chromium (6010)	--	--																
Copper (6010)	36	36		**545**	**37.5**	**50.8**	**17.1**		**13.9**	**126**	**49.5**	**101**	**43.3**	**25.7**	**19.2**	**53.2**	**11.1**	**102**
Lead (6010)	250	81		**1140**	**16**	**6**			**9**	**27**			**17**		**4**	**36**		**871**
Mercury (7471)	0.07	0.07		**0.44**	0.04 UJ	0.05 U			0.04 U	**0.05**			0.04 U		**0.08**	**0.13**	0.04 UJ	**0.50**
Nickel (6010)	48	48		**41**		**19**			**22**	**24**			**27**		**24**	**30**		**32**
Selenium (6010)	7.4	1.0																
Zinc (6010)	100	85		**1160**	**51.9**	**206**	**114**	**33.6**	**39.6**	**91.2**			**50.2**		**61.7**	**145**	**31.6**	**246**
VOLATILES (mg/kg)																		
EPA Method SW8260																		
1,1,1-Trichloroethane	88	4.7																
Carbon Tetrachloride	0.005	0.005																
Trichloroethene	0.005	0.005																
Benzene	0.014	0.005																
Toluene	110	64																
Ethylbenzene	18	1																
m,p-Xylene	--	--																
o-Xylene	4	0.23																
1,3,5-Trimethylbenzene	800	800																
1,2,4-Trimethylbenzene	--	--																
Isopropylbenzene	8000	8000																
n-Propylbenzene	8000	8000																
sec-Butylbenzene	--	--																
p-Isopropyltoluene	--	--																
Naphthalene	0.27	0.12																
SEMIVOLATILES (mg/kg)																		
EPA Method SW8270																		
Naphthalene	2.3	0.12																
2-Methylnaphthalene	320	320																
Benzo(a)anthracene	0.13	0.0065																
Chrysene	0.14	0.0072																
Benzo(b)fluoranthene	0.43	0.022																
Benzo(k)fluoranthene	0.43	0.022																
Benzo(a)pyrene	0.14	0.017																
Indeno(1,2,3-cd)pyrene	0.7	0.035																
Dibenz(a,h)anthracene	0.14	0.018																

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES
AND COMPARISON TO SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location:			SB-43	SB-44-0-1	SB-44-1-2	SB-45-0-1	SB-45-1-2	SB-45-2-3	SB-46-0-1	SB-47-0-1	SB-47-1-2	SB-47-2-3	SB-48-0-1	SB-48-1-2	SB-49-0-1	SB-50-0-1	SB-50-1-2	SB-51-0-1
Sample Depth (ft BGS)	Soil Screening Levels (a)		8-8.5	0-1	1-2	0-1	1-2	2-3	0-1	0-1	1-2	2-3	0-1	1-2	0-1	0-1	1-2	0-1
Date Collected:	Unsaturated soil	Saturated soil	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/29/2006
PAHs (mg/kg)																		
SW8270-SIM																		
Naphthalene	2.3	0.12																
2-Methylnaphthalene	320	320																
1-Methylnaphthalene	35	35																
Total naphthalene	--	--																
Benzo(a)anthracene	0.13	0.0065																
Chrysene	0.14	0.0072																
Benzo(b)fluoranthene	0.43	0.022																
Benzo(k)fluoranthene	0.43	0.022																
Benzo(a)pyrene	0.14	0.017																
Indeno(1,2,3-cd)pyrene	0.7	0.035																
Dibenz(a,h)anthracene	0.14	0.018																
Total cPAH - benzo(a)pyrene TEQ (g)	0.14	0.14																

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES
AND COMPARISON TO SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location: Sample Depth (ft BGS) Date Collected:	Soil Screening Levels (a) Unsaturated soil	 Saturated soil	SB-53-9-10 9-10 6/30/2006	SB-54-9-10 9-10 6/30/2006	SB-55-10-11 10-11 6/30/2006	SB-57-10-11 10-11 6/30/2006	SB-59-10-11 10-11 6/30/2006	SB-61-10-11 10-11 6/30/2006	SB-62-10-11 10-11 6/30/2006	SB-63-9-10 9-10 6/30/2006	SB-64-9.5-10.5 9.5-10.5 6/30/2006	SB-65-9-10 9-10 6/30/2006	Dup of SB-65 SB-66-9-10 9-10 6/30/2006	SB-67-10.5-11.5 10.5-11.5 6/30/2006	SB-68-1.5-2 1.5-2 10/22/2007	SB-69-0.66-1 0.66-1 10/22/2007
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																
Method NWTPH-HCID																
Gas Range	30	30														
Diesel Range	2000 (h)	2000 (h)														
Oil Range	2000 (h)	2000 (h)														
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																
Method NWTPH-D																
Diesel Range (f)	2000 (h)	2000 (h)														
Oil Range (f)	2000 (h)	2000 (h)														
Total petroleum hydrocarbons	2000 (h)	2000 (h)														
Method NWTPH-G																
Gas Range	30	30	**180**	**220**	**15,000**	**59**	**78**	**86**	**24**	**120**	**28**	**57**	**66**	**64**	5.2 U	5.8 U
BTEX (mg/kg)																
Method 8020																
Benzene	0.014	0.005	**0.39**	**1.1**	0.90 U	**0.29**	**0.17**	**0.07**	0.01 U	**0.81**	**0.06**	**0.45**	**0.33**	**0.23**		
Toluene	110	64	**2.0**	**5.0**	**27.0**	**1.4**	**0.84**	**0.46**	**0.05**	**3.8**	**0.33**	**2.00**	**1.6**	**1.2**		
Ethylbenzene	18	1	**0.98**	**2.0**	**31.0**	**0.62**	**0.54**	**0.29**	**0.03**	**1.5**	**0.20**	**0.84**	**0.78**	**0.58**		
m,p-Xylene	--	--	**3.0**	**6.4**	**73.0**	**2.3**	**1.9**	**1.1**	**0.10**	**5.2**	**0.68**	**2.8**	**2.4**	**2.1**		
o-Xylene	4	0.23	**1.6**	**3.1**	**13.0**	**1.2**	**0.75**	**0.49**	**0.06**	**2.6**	**0.38**	**1.3**	**1.2**	**1.1**		
Total Xylenes	16,000	16,000	**4.5**	**9.5**	**85.0**	**3.4**	**2.6**	**1.6**	**0.15**	**7.8**	**1.1**	**4.1**	**3.6**	**3.2**		
PRIORITY POLLUTANT METALS (mg/kg)																
Antimony (6010)	320	29														
Arsenic (6010)	20	20														
Beryllium (6010)	160	160														
Cadmium (6010)	80	80														
Chromium (6010)	--	--														
Copper (6010)	36	36													**10.4**	**9.3**
Lead (6010)	250	81													2 U	2 U
Mercury (7471)	0.07	0.07													0.04 U	0.05 U
Nickel (6010)	48	48													**19**	**15**
Selenium (6010)	7.4	1.0														
Zinc (6010)	100	85													**26**	**27**
VOLATILES (mg/kg)																
EPA Method SW8260																
1,1,1-Trichloroethane	88	4.7													0.001 U	0.001 U
Carbon Tetrachloride	0.005	0.005													0.001 U	0.001 U
Trichloroethene	0.005	0.005													0.001 U	0.001 U
Benzene	0.014	0.005													0.001 U	0.001 U
Toluene	110	64													0.001 U	0.001 U
Ethylbenzene	18	1													0.001 U	0.001 U
m,p-Xylene	--	--													0.001 U	0.001 U
o-Xylene	4	0.23													0.001 U	0.001 U
1,3,5-Trimethylbenzene	800	800													0.001 U	0.001 U
1,2,4-Trimethylbenzene	--	--													0.001 U	0.001 U
Isopropylbenzene	8000	8000													0.001 U	0.001 U
n-Propylbenzene	8000	8000													0.001 U	0.001 U
sec-Butylbenzene	--	--													0.001 U	0.001 U
p-Isopropyltoluene	--	--													0.001 U	0.001 U
Naphthalene	0.27	0.12													0.052 U	0.049 U
SEMIVOLATILES (mg/kg)																
EPA Method SW8270																
Naphthalene	2.3	0.12														
2-Methylnaphthalene	320	320														
Benzo(a)anthracene	0.13	0.0065														
Chrysene	0.14	0.0072														
Benzo(b)fluoranthene	0.43	0.022														
Benzo(k)fluoranthene	0.43	0.022														
Benzo(a)pyrene	0.14	0.017														
Indeno(1,2,3-cd)pyrene	0.7	0.035														
Dibenz(a,h)anthracene	0.14	0.018														

TABLE 8
DETECTED CONSTITUENTS IN SOIL SAMPLES AND COMPARISON TO SCREENING LEVELS WELDCRAFT STEEL AND MARINE SITE

Location:	Soil Screening Levels (a)		SB-53-9-10	SB-54-9-10	SB-55-10-11	SB-57-10-11	SB-59-10-11	SB-61-10-11	SB-62-10-11	SB-63-9-10	SB-64-9.5-10.5	SB-65-9-10	Dup of SB-65 SB-66-9-10	SB-67-10.5-11.5	SB-68-1.5-2	SB-69-0.66-1
Sample Depth (ft BGS)			9-10	9-10	10-11	10-11	10-11	10-11	10-11	9-10	9.5-10.5	9-10	9-10	10.5-11.5	1.5-2	0.66-1
Date Collected:	Unsaturated soil	Saturated soil	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	10/22/2007	10/22/2007
PAHs (mg/kg)																
SW8270-SIM																
Naphthalene	2.3	0.12														
2-Methylnaphthalene	320	320														
1-Methylnaphthalene	35	35														
Total naphthalene	--	--														
Benzo(a)anthracene	0.13	0.0065														
Chrysene	0.14	0.0072														
Benzo(b)fluoranthene	0.43	0.022														
Benzo(k)fluoranthene	0.43	0.022														
Benzo(a)pyrene	0.14	0.017														
Indeno(1,2,3-cd)pyrene	0.7	0.035														
Dibenz(a,h)anthracene	0.14	0.018														
Total cPAH - benzo(a)pyrene TEQ (g)	0.14	0.14														

ND = Not Detected.
U = Indicates compound was analyzed for, but was not detected at the given detection limit.
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
J = Estimated concentration.
M = Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match.
Bold values indicate concentration detected above laboratory reporting limits.
Boxed value indicates concentration is above the screening level.
Blank indicates compound was not analyzed for.
(a) Soil screening levels based on lowest soil criteria adjusted up to PQL or background values (excluding MTCA Method A), except as indicated otherwise.
(b) Composite of samples from borings SB-3, SB-4, and SB-5.
(c) Composite of samples from borings SB-9, SB-10, and SB-11.
(d) Composite of samples from borings SB-12 through SB-16.
(e) Composite of samples from borings SB-21, SB-22, and SB-23.
(f) Beginning with May 2002 data, TPH samples were silica/acid cleaned.
(g) A toxicity equivalency quotient (TEQ) will be completed for each sample containing carcinogenic PAHs above reporting limits and the sum of the TEQS will be compared to the benzo(a)pyrene cleanup level in accordance with WAC 173-340-708(8)(e).
(h) Screening level based on MTCA Method A for unrestricted site use.

TABLE 9
DETECTED CONSTITUENTS IN GROUNDWATER AND SURFACE WATER SAMPLES
AND COMPARISON TO GROUNDWATER SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location: / Lab ID / Date Collected:	Groundwater Screening Level	SB-5-W V140D 1/20/1998	SB-8-W V140H 1/20/1998	SB-10-W V140J 1/20/1998	SB-16-W V140L 1/20/1998	SB-19-W V140P 1/21/1998	SB-24-W V140S 1/21/1998	SB-30-W V140V 1/21/1998	SB-68 LU53C 10/22/2007	SB-69 LU53E 10/22/2007	MW-1 BX90A 7/26/2000	MW-1-Dup BX90E 7/26/2000	MW-1 EK56A 5/30/2002	MW-1 GV31G 7/7/2004	MW-2 BX90B 7/26/2000	MW-2 EK56B 5/30/2002
TOTAL PETROLEUM HYDROCARBONS (mg/L)																
Method NWTPH-G																
Gas Range	0.8 (a)		**95**				10 (b) U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U		0.25 U	0.25 U
Si/Acid Cleaned NWTPH-D (mg/L)																
Diesel Range Hydrocarbons	0.5 (a)						10 (b) U									
Motor Oil	0.5 (a)						25 (b) U									
BTEX (µg/L)																
Method 8020																
Benzene	2.4		**3500** J					1.0 U					1.0 U			1.0 U
Toluene	15,000		**7400** J					1.0 U					1.0 U			1.0 U
Ethylbenzene	2,100		**1800** J					1.0 U					1.0 U			1.0 U
m,p-Xylene	--		**9400** J					1.0 U					1.0 U			1.0 U
o-Xylene	440		**3900** J					1.0 U					1.0 U			1.0 U
Total Xylenes	--		**13300**					1.0 U					1.0 U			1.0 U
DISSOLVED METALS (µg/L)																
Antimony (200.8)	640	0.2 U			0.2 U	0.2 U	**0.2**									
Arsenic (200.8)	5.0	**0.5**			**0.4**	**0.8**	**0.3**							1 U		
Beryllium (200.8)	270	0.2 U			0.2 U	0.2 U	0.2 U									
Cadmium (200.8)	8.8	0.2 U			0.2 U	0.2 U	0.2 U									
Chromium (200.8)	--	1 U			1 U	1 U	1 U									
Copper (200.8/6010B)	2.4	**2**			**1**	**1**	1 U		0.5 U	**1.8**				2 U		
Lead (200.8)	8.1	1 U			1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U		1 U	1 U	
Mercury (7470)	0.025	0.1 U			0.1 U	0.1 U	0.1 U		0.1 U	0.1 U				0.1 U		
Nickel (200.8)	8.2	**14**			**4**	**3**	**2**		**1.8**	**2.9**				10 U		
Selenium (200.8)	71	**2**			1 U	1 U	1 U									
Zinc (200.8/6010B)	81	**11**			**8**	**4**	**4**		**6**	**12**				6 U		
TOTAL METALS (µg/L)																
Lead (200.8)	8.1												1 U			1 U
VOLATILES (µg/L)																
EPA Method SW8260																
1,1,1-Trichloroethane	11,000	1.0 U		1.0 U	1.0 U	**5.0**	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
Carbon Tetrachloride	0.5	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
Trichloroethene	0.5	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
Benzene	2.4	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
Toluene	15,000	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
Ethylbenzene	2,100	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
m,p-Xylene	--	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.4 U	0.4 U	1.0 U	1.0 U			1.0 U	
o-Xylene	440	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
Total Xylenes	--	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U			1.0 U	
1,3,5-Trimethylbenzene	25	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
1,2,4-Trimethylbenzene	24	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
Isopropylbenzene	720	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
n-Propylbenzene	--	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
sec-Butylbenzene	--	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	
p-Isopropyltoluene	--	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U		0.2 U	0.2 U	1.0 U	1.0 U			1.0 U	

TABLE 9
DETECTED CONSTITUENTS IN GROUNDWATER AND SURFACE WATER SAMPLES AND COMPARISON TO GROUNDWATER SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location: Lab ID Date Collected:	Groundwater Screening Level	SB-5-W V140D 1/20/1998	SB-8-W V140H 1/20/1998	SB-10-W V140J 1/20/1998	SB-16-W V140L 1/20/1998	SB-19-W V140P 1/21/1998	SB-24-W V140S 1/21/1998	SB-30-W V140V 1/21/1998	SB-68 LU53C 10/22/2007	SB-69 LU53E 10/22/2007	MW-1 BX90A 7/26/2000	MW-1-Dup BX90E 7/26/2000	MW-1 EK56A 5/30/2002	MW-1 GV31G 7/7/2004	MW-2 BX90B 7/26/2000	MW-2 EK56B 5/30/2002
PAHs (µg/L)																
SW8270-SIM																
Naphthalene	83															
2-Methylnaphthalene	--															
1-Methylnaphthalene	--															
Benzo(a)anthracene	0.018															
Chrysene	0.018															
Benzo(b)fluoranthene	0.018															
Benzo(k)fluoranthene	0.018															
Benzo(a)pyrene	0.018															
Indeno(1,2,3-cd)pyrene	0.01															
Dibenz(a,h)anthracene	0.01															
CONVENTIONALS (mg/L)																
Alkalinity (SM 2320) (mg/L CaCO3)	--												**450**			
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	--												1.0 U			
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	--												**450**			
Ferrous Iron (SM3500 FeD)	--												**0.18**			
N-Nitrate (Calculated) (mg-N/L)	--												**0.15**			
N-Nitrite (EPA 353.2) (mg-N/L)	--												0.010 U			
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)	--												**0.15**			
Sulfate (EPA 375.2/300.0)	--												**62**			
Total Organic Carbon (EPA 415.1)	--												1.5 U			
FIELD PARAMETERS																
pH	6.2‡< pH <8.5												6.92	6.68		7.35
Temperature (deg C)	--												11.4	13.8		9.5
Conductivity (µS/cm)	--												675	410		0.5
Turbidity (NTU)	--												13	10		0
Dissolved Oxygen (mg/L)	--												0.15	0		0.28

TABLE 9
DETECTED CONSTITUENTS IN GROUNDWATER AND SURFACE WATER SAMPLES
AND COMPARISON TO GROUNDWATER SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location: Lab ID Date Collected:	Groundwater Screening Level	MW-3 BX90C 7/26/2000	MW-3 EK56C 5/30/2002	MW-3 GV31E 7/7/2004	MW-3 JO52G 6/29/2006	MW-3A KJ60A 12/20/2006	MW-3B KJ60G 12/20/2006	MW-4 BX90D 7/26/2000	MW-4 EK56D 5/30/2002	MW-4 GV31B 7/7/2004	MW-4 JO52H 6/29/2006	MW-4A KJ60E 12/20/2006	MW-4B KJ60I 12/20/2006	MW-5 EK56E 5/30/2002	MW-6 EK56F 5/30/2002	MW-6 GV31A 7/7/2004
TOTAL PETROLEUM HYDROCARBONS (mg/L)																
Method NWTPH-G																
Gas Range	0.8 (a)	0.25 U	0.25 U	0.25 U				0.25 U	0.25 U	0.25 U				**22**	0.25 U	0.25 U
Si/Acid Cleaned NWTPH-D (mg/L)																
Diesel Range Hydrocarbons	0.5 (a)															
Motor Oil	0.5 (a)															
BTEX (µg/L)																
Method 8020																
Benzene	2.4		1.0 U	1.0 U					1.0 U	1.0 U				**680**	1.0 U	1.0 U
Toluene	15,000		1.0 U	1.0 U					1.0 U	1.0 U				**370**	1.0 U	1.0 U
Ethylbenzene	2,100		1.0 U	1.0 U					1.0 U	1.0 U				**310**	1.0 U	1.0 U
m,p-Xylene	--		1.0 U	1.0 U					1.0 U	1.0 U				**1900**	1.0 U	1.0 U
o-Xylene	440		1.0 U	1.0 U					1.0 U	1.0 U				**780**	1.0 U	1.0 U
Total Xylenes	--		1.0 U	1.0 U					1.0 U	1.0 U				**2680**	1.0 U	1.0 U
DISSOLVED METALS (µg/L)																
Antimony (200.8)	640															
Arsenic (200.8)	5.0			**1**						**1**						
Beryllium (200.8)	270															
Cadmium (200.8)	8.8															
Chromium (200.8)	--															
Copper (200.8/6010B)	2.4			**6**	**16**	2 U	**5**			**5**	**3**	**2**	**2**			
Lead (200.8)	8.1	1 U		1 U	1 U					1 U	1 U					
Mercury (7470)	0.025			0.1 U	0.1 U					0.1 U	0.1 U					
Nickel (200.8)	8.2			10 U	**9.3**	**11**	**12**			10 U	**9.1**	**20**	**17**			
Selenium (200.8)	71															
Zinc (200.8/6010B)	81			**76**	**101**	**79**	**97**			**74**	**82**	**139**	**126**			
TOTAL METALS (µg/L)																
Lead (200.8)	8.1		1 U						1 U					1 U	1 U	
VOLATILES (µg/L)																
EPA Method SW8260																
1,1,1-Trichloroethane	11,000	1.0 U						1.0 U								
Carbon Tetrachloride	0.5	1.0 U						1.0 U								
Trichloroethene	0.5	1.0 U						1.0 U								
Benzene	2.4	1.0 U						1.0 U								
Toluene	15,000	1.0 U						1.0 U								
Ethylbenzene	2,100	1.0 U						1.0 U								
m,p-Xylene	--	1.0 U						1.0 U								
o-Xylene	440	1.0 U						1.0 U								
Total Xylenes	--	1.0 U						1.0 U								
1,3,5-Trimethylbenzene	25	1.0 U						1.0 U								
1,2,4-Trimethylbenzene	24	1.0 U						1.0 U								
Isopropylbenzene	720	1.0 U						1.0 U								
n-Propylbenzene	--	1.0 U						1.0 U								
sec-Butylbenzene	--	1.0 U						1.0 U								
p-Isopropyltoluene	--	1.0 U						1.0 U								

TABLE 9
DETECTED CONSTITUENTS IN GROUNDWATER AND SURFACE WATER SAMPLES AND COMPARISON TO GROUNDWATER SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location: Lab ID Date Collected:	Groundwater Screening Level	MW-3 BX90C 7/26/2000	MW-3 EK56C 5/30/2002	MW-3 GV31E 7/7/2004	MW-3 JO52G 6/29/2006	MW-3A KJ60A 12/20/2006	MW-3B KJ60G 12/20/2006	MW-4 BX90D 7/26/2000	MW-4 EK56D 5/30/2002	MW-4 GV31B 7/7/2004	MW-4 JO52H 6/29/2006	MW-4A KJ60E 12/20/2006	MW-4B KJ60I 12/20/2006	MW-5 EK56E 5/30/2002	MW-6 EK56F 5/30/2002	MW-6 GV31A 7/7/2004
PAHs (µg/L)																
SW8270-SIM																
Naphthalene	83															
2-Methylnaphthalene	--															
1-Methylnaphthalene	--															
Benzo(a)anthracene	0.018															
Chrysene	0.018															
Benzo(b)fluoranthene	0.018															
Benzo(k)fluoranthene	0.018															
Benzo(a)pyrene	0.018															
Indeno(1,2,3-cd)pyrene	0.01															
Dibenz(a,h)anthracene	0.01															
CONVENTIONALS (mg/L)																
Alkalinity (SM 2320) (mg/L CaCO3)	--		**160**											**360**	**360**	
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	--		1.0 U											1.0 U	1.0 U	
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	--		**160**											**360**	**360**	
Ferrous Iron (SM3500 FeD)	--		0.040 U											**9.3**	**0.47**	
N-Nitrate (Calculated) (mg-N/L)	--		**0.16**			**2.65**	**2.68**					**0.982**	**0.697**	0.010 U	**0.097**	
N-Nitrite (EPA 353.2) (mg-N/L)	--		0.010 U			**0.024**	**0.024**					**0.014**	**0.012**	0.010 U	0.010 U	
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)	--		**0.16**			**2.67**	**2.70**					**0.996**	**0.709**	0.010 U	0.097	
Sulfate (EPA 375.2/300.0)	--		**300**			**480**	**499**					**850**	**748**	**21**	**43**	
Total Organic Carbon (EPA 415.1)	--		1.5 U											1.5 U	1.5 U	
FIELD PARAMETERS																
pH	6.2‡< pH <8.5		6.77	6.46	6.46	6.43	6.42		6.61	6.46	6.60	6.61	6.63	6.98	7.06	6.37
Temperature (deg C)	--		9.7	17.6	15.8	10.8	11.0		11.4	18.7	15.1	10.3	10.3	8.1	10.1	13.3
Conductivity (µS/cm)	--		6340	11900	9,283	12,500	12,925		9500	16600	10,083	22,267	19,167	532	542	160
Turbidity (NTU)	--		21	12		10.8	27.3		0	9	0.001	2.1	24.7	9	12	0
Dissolved Oxygen (mg/L)	--		0.22	1.97	0.52	5.08	7.45		1.44	2.26	0.34	50.3	5.07	0.00	0.00	0.54

TABLE 9
DETECTED CONSTITUENTS IN GROUNDWATER AND SURFACE WATER SAMPLES AND COMPARISON TO GROUNDWATER SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location: Lab ID Date Collected:	Groundwater Screening Level	MW-7 EK56G 5/30/2002	MW-7 GV31D 7/7/2004	MW-7-Dup GV31H 7/7/2004	MW-7 JO52I 6/29/2006	MW-7A KJ60C 12/20/2006	MW-7B KJ60M 12/21/2006	MW-8 EK56H 5/30/2002	MW-8 GV31F 7/7/2004	MW-9 EK56I 5/30/2002	MW-9 GV31C 7/7/2004	MW-9 LU53F 10/22/2007	MW-10 JO52M 6/29/2006	MW-10A KJ60B 12/20/2006	MW-10B KJ60H 12/20/2006	MW-11 JO52L 6/29/2006
TOTAL PETROLEUM HYDROCARBONS (mg/L)																
Method NWTPH-G																
Gas Range	0.8 (a)	0.25 U	0.25 U	0.25 U				0.25 U	0.25 U	0.25 U		0.25 U				
Si/Acid Cleaned NWTPH-D (mg/L)																
Diesel Range Hydrocarbons	0.5 (a)									0.25 U	0.25 U	0.25 U				
Motor Oil	0.5 (a)									0.50 U	0.50 U	0.50 U				
BTEX (µg/L)																
Method 8020																
Benzene	2.4	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U							
Toluene	15,000	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U							
Ethylbenzene	2,100	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U							
m,p-Xylene	--	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U							
o-Xylene	440	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U							
Total Xylenes	--	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U							
DISSOLVED METALS (µg/L)																
Antimony (200.8)	640															
Arsenic (200.8)	5.0		**2**	**1**												
Beryllium (200.8)	270															
Cadmium (200.8)	8.8															
Chromium (200.8)	--															
Copper (200.8/6010B)	2.4		**9**	**8**	**10**	2 U	**3**					**0.7**	**15**	**2**	**3**	**35**
Lead (200.8)	8.1		1 U	1 U	1 U							1 U	1 U			1 U
Mercury (7470)	0.025		0.1 U	0.1 U	0.1 U							0.1 U	0.1 U			0.1 U
Nickel (200.8)	8.2		10 U	10 U	**3.1**	**2.5**	**2.4**					**2.1**	**19.1**	**37**	**34.0**	**16.6**
Selenium (200.8)	71															
Zinc (200.8/6010B)	81		**20**	**21**	**8**	6 U	6 U					4 U	**113**	**172**	**190**	**104**
TOTAL METALS (µg/L)																
Lead (200.8)	8.1	**3**						1 U								
VOLATILES (µg/L)																
EPA Method SW8260																
1,1,1-Trichloroethane	11,000											0.2 U				
Carbon Tetrachloride	0.5											0.2 U				
Trichloroethene	0.5											0.2 U				
Benzene	2.4											0.2 U				
Toluene	15,000											0.2 U				
Ethylbenzene	2,100											0.2 U				
m,p-Xylene	--											0.4 U				
o-Xylene	440											0.2 U				
Total Xylenes	--															
1,3,5-Trimethylbenzene	25											0.2 U				
1,2,4-Trimethylbenzene	24											0.2 U				
Isopropylbenzene	720											0.2 U				
n-Propylbenzene	--											0.2 U				
sec-Butylbenzene	--											0.2 U				
p-Isopropyltoluene	--											0.2 U				

TABLE 9
DETECTED CONSTITUENTS IN GROUNDWATER AND SURFACE WATER SAMPLES AND COMPARISON TO GROUNDWATER SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location: Lab ID Date Collected:	Groundwater Screening Level	MW-7 EK56G 5/30/2002	MW-7 GV31D 7/7/2004	MW-7-Dup GV31H 7/7/2004	MW-7 JO52I 6/29/2006	MW-7A KJ60C 12/20/2006	MW-7B KJ60M 12/21/2006	MW-8 EK56H 5/30/2002	MW-8 GV31F 7/7/2004	MW-9 EK56I 5/30/2002	MW-9 GV31C 7/7/2004	MW-9 LU53F 10/22/2007	MW-10 JO52M 6/29/2006	MW-10A KJ60B 12/20/2006	MW-10B KJ60H 12/20/2006	MW-11 JO52L 6/29/2006
PAHs (µg/L)																
SW8270-SIM																
Naphthalene	83									**0.64**						
2-Methylnaphthalene	--									**0.27**						
1-Methylnaphthalene	--									**0.11**						
Benzo(a)anthracene	0.018									0.10 U						
Chrysene	0.018									0.10 U						
Benzo(b)fluoranthene	0.018									0.10 U						
Benzo(k)fluoranthene	0.018									0.10 U						
Benzo(a)pyrene	0.018									0.10 U						
Indeno(1,2,3-cd)pyrene	0.01									0.10 U						
Dibenz(a,h)anthracene	0.01									0.10 U						
CONVENTIONALS (mg/L)																
Alkalinity (SM 2320) (mg/L CaCO3)	--															
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	--															
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	--															
Ferrous Iron (SM3500 FeD)	--															
N-Nitrate (Calculated) (mg-N/L)	--					0.010 U	**0.155**							**1.47**	**1.86**	
N-Nitrite (EPA 353.2) (mg-N/L)	--					0.010 U	0.010 U							**0.016**	**0.020**	
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)	--					0.010 U	**0.155**							**1.49**	**1.88**	
Sulfate (EPA 375.2/300.0)	--					**127**	**186**							**622**	**592**	
Total Organic Carbon (EPA 415.1)	--															
FIELD PARAMETERS																
pH	6.2‡< pH <8.5	7.08	6.34	6.34	6.76	6.96	6.87	7.36	6.74	7.13	6.78		6.41	6.03	5.90	6.66
Temperature (deg C)	--	12.5	17.0	17.0	15.9	12.2	12.3	10.6	14.7	13	15.3		15.7	10.4	10.3	16.5
Conductivity (µS/cm)	--	3042	13100	13100	4,526	4,528	5,815	449	684	512	675		10,871	15,700	15,700	17,512
Turbidity (NTU)	--	42	10	10	0.001	114.5	52.2	6	285	9	138		0.001	367.0	0.0	0.001
Dissolved Oxygen (mg/L)	--	0.29	0.90	0.90	1.79	4.60	4.58	1.50	1.70	0.78	0.45		1.98	0.00	1.38	0.88

TABLE 9
DETECTED CONSTITUENTS IN GROUNDWATER AND SURFACE WATER SAMPLES
AND COMPARISON TO GROUNDWATER SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

				Dup of MW-11B				Dup of MW-12	Weep hole and surface water results			
Location:	Groundwater	MW-11A	MW-11B	MW-111	MW-12	MW-12A	MW-12B	MW-13	SW-1	SW-2	Weep	Weep
Lab ID	Screening	KJ60F	KJ60J	KJ60K	JO52J	KJ60D	KJ60L	JO52K	KJ60N	KP70B	KP70A	LU53A
Date Collected:	Level	12/20/2006	12/20/2006	12/20/2006	6/29/2006	12/20/2006	12/21/2006	6/29/2006	12/21/06	02/26/07	02/26/07	10/22/07
TOTAL PETROLEUM HYDROCARBONS (mg/L)												
Method NWTPH-G												
Gas Range	0.8 (a)										0.25 U	0.25 U
Si/Acid Cleaned NWTPH-D (mg/L)												
Diesel Range Hydrocarbons	0.5 (a)											
Motor Oil	0.5 (a)											
BTEX (µg/L)												
Method 8020												
Benzene	2.4										1.0 U	0.2 U
Toluene	15,000										1.0 U	0.2 U
Ethylbenzene	2,100										1.0 U	0.2 U
m,p-Xylene	--										1.0 U	0.4 U
o-Xylene	440										1.0 U	0.2 U
Total Xylenes	--										2.0 U	0.6 U
DISSOLVED METALS (µg/L)												
Antimony (200.8)	640											
Arsenic (200.8)	5.0											
Beryllium (200.8)	270											
Cadmium (200.8)	8.8											
Chromium (200.8)	--											
Copper (200.8/6010B)	2.4	**5**	4 U	4 U	**9**	**3**	**3**	**9**	**4**	2 U	**6**	**4.1**
Lead (200.8)	8.1				5 U			5 U	NA			
Mercury (7470)	0.025				0.1 U			0.1 U	NA			
Nickel (200.8)	8.2	**29**	**27**	**28**	**12.5**	**8**	**7**	**13**	**10**	**6**	**7**	**4.8**
Selenium (200.8)	71											
Zinc (200.8/6010B)	81	**200**	**190**	**180**	**280**	**43**	**45**	**280**	10 U	**9**	**60**	**49**
TOTAL METALS (µg/L)												
Lead (200.8)	8.1											
VOLATILES (µg/L)												
EPA Method SW8260												
1,1,1-Trichloroethane	11,000											
Carbon Tetrachloride	0.5											
Trichloroethene	0.5											
Benzene	2.4											
Toluene	15,000											
Ethylbenzene	2,100											
m,p-Xylene	--											
o-Xylene	440											
Total Xylenes	--											
1,3,5-Trimethylbenzene	25										0.2 U	0.2 U
1,2,4-Trimethylbenzene	24										0.2 U	0.2 U
Isopropylbenzene	720											
n-Propylbenzene	--											
sec-Butylbenzene	--											
p-Isopropyltoluene	--											

TABLE 9
DETECTED CONSTITUENTS IN GROUNDWATER AND SURFACE WATER SAMPLES AND COMPARISON TO GROUNDWATER SCREENING LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location: / Lab ID / Date Collected:	Groundwater Screening Level	MW-11A KJ60F 12/20/2006	MW-11B KJ60J 12/20/2006	Dup of MW-11B MW-111 KJ60K 12/20/2006	MW-12 JO52J 6/29/2006	MW-12A KJ60D 12/20/2006	MW-12B KJ60L 12/21/2006	Dup of MW-12 MW-13 JO52K 6/29/2006	Weep hole and surface water results: SW-1 KJ60N 12/21/06	SW-2 KP70B 02/26/07	Weep KP70A 02/26/07	Weep LU53A 10/22/07
PAHs (µg/L)												
SW8270-SIM												
Naphthalene	83											
2-Methylnaphthalene	--											
1-Methylnaphthalene	--											
Benzo(a)anthracene	0.018											
Chrysene	0.018											
Benzo(b)fluoranthene	0.018											
Benzo(k)fluoranthene	0.018											
Benzo(a)pyrene	0.018											
Indeno(1,2,3-cd)pyrene	0.01											
Dibenz(a,h)anthracene	0.01											
CONVENTIONALS (mg/L)												
Alkalinity (SM 2320) (mg/L CaCO3)	--											
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	--											
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	--											
Ferrous Iron (SM3500 FeD)	--											
N-Nitrate (Calculated) (mg-N/L)	--	**0.699**	**0.945**	**0.968**		**0.519**	**0.219**		**0.512**	**1.2**	1.0 U	1.0 U
N-Nitrite (EPA 353.2) (mg-N/L)	--	0.010 U	**0.023 J**	0.010 UJ		0.010 U	0.010 U		**0.018**			
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)	--	**0.699**	**0.968**	**0.968**		**0.519**	**0.219**		**0.530**			
Sulfate (EPA 375.2/300.0)	--	**1390**	**1260**	**1270**		**944**	**620**		**1190**	**634**	**996**	**672**
Total Organic Carbon (EPA 415.1)	--											
FIELD PARAMETERS												
pH	6.2‡< pH <8.5	6.17	6.12	6.12	6.63	6.33	6.58					
Temperature (deg C)	--	7.3	7.6	7.6	15.6	9.3	11.0					
Conductivity (µS/cm)	--	33,800	31,900	31,900	25,982	24,300	18,800					
Turbidity (NTU)	--	44.8	69.9	69.9	0.001	74.6	68.7					
Dissolved Oxygen (mg/L)	--	3.60	2.02	2.01	0.70	5.39	2.45					

-- = Indicates no criteria provided.
U = Indicates compound was analyzed for, but was not detected at the given detection limit.
J = Estimated value.
Bold values indicate concentration detected above laboratory reporting limits.
Boxed value indicates concentration above preliminary screening level.
Blank indicates compound was not analyzed for.
Only detected compounds are presented in this table.
(a) Screening level based on MTCA Method A groundwater cleanup level because surface water quality criteria for this constituent does not exist.
(b) These samples were analyzed by method NWTPH-HCID.
‡ pH 6.2 is the lower-end of natural background groundwater pH range, calculated from Whatcom County background data, in accordance with WAC 173-340-709(3).

TABLE 10
2009 SEDIMENT COMPLIANCE MONITORING RESULTS - CARBON NORMALIZED
WELDCRAFT STEEL AND MARINE
PORT OF BELLINGHAM

	Sediment Management Standards SQS (a)	SPM-1-09 (0-12cm) PU05I 10/22/2009	SPM-2-09 (0-12cm) PU05H 10/22/2009	SPM-4-09 (0-12cm) PU05D 10/22/2009	Dup of SPM-4-09 (0-12cm) SPM-0-09 (0-12cm) PU05E 10/22/2009	SPM-6-09 (0-12cm) PU05G 10/22/2009	SPM-8-09 (0-12cm) PU05B 10/22/2009	SPM-9-09 (0-12cm) PU05A 10/22/2009	SPM-10-09 (0-12cm) PU05J 10/22/2009	SPM-12-09 (0-12cm) PU05C 10/22/2009	SPM-13-09 (0-12cm) PU05F 10/22/2009
TOTAL METALS (mg/kg-dry wt)											
Methods SW6010B/SW7471A											
Mercury	0.41	**0.12**	**0.11**	**0.14**	**0.12**	**0.27**	**0.19**	**0.18**	**0.17**	**0.14**	**0.12**
Zinc	410	**145**	**159**	**160**	**161**	**148**	**144**	**157**	**167**	**176**	**121**
SEMIVOLATILES (mg/kg OC) (b)											
Method SW8270D											
Acenaphthylene	66	1.35 U	1.52 U	1.21 U	**0.73** J	0.88 U	**0.69** J	1.32 U	1.41 U	**0.56** J	1.32 U
Fluorene	23	1.35 U	1.52 U	**0.73** J	**1.50**	0.88 U	**1.51**	**1.38**	**0.85** J	**1.18**	**0.86** J
Phenanthrene	100	**2.43**	**3.48**	**3.15** J1	**16.58** J1	**1.85**	**4.28**	**4.54**	**4.58**	**3.31**	**4.24**
Fluoranthene	160	**4.05**	**5.61**	**6.67** J1	**31.61** J1	**6.48**	**12.58**	**13.82**	**19.01**	**10.11**	**7.95**
Dibenzofuran	15	1.35 U	1.52 U	**0.91** J	**1.55**	0.88 U	**2.01**	**1.71**	1.41 U	**1.24**	**1.13** J
CONVENTIONALS											
Total Organic Carbon (PLUMB81TC) (%)	--	1.48	1.32	1.65	1.93	2.16	1.59	1.52	1.42	1.78	1.51
Total Solids (EPA160.3) (%)	--	42.00	38.40	39.70	37.60	52.90	55.90	51.00	50.90	55.60	38.20

-- Indicates no criteria established.
U = Indicates the compound was undetected at the reported concentration.
J = Reported detected result is less than the Reporting Limit but greater than the Method Detection Limit.
J1 = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) All organic data and screening levels are normalized to total organic carbon; this involves dividing the dry weight concentration of the constituent by the fraction of total organic carbon present.

TABLE 11
2007 MARINE SEDIMENT cPAHs FOR GATE 3 PROJECT
WELDCRAFT STEEL AND MARINE SITE

	DMMU POB 1	DMMU POB 2	DMMU POB 3	DMMU POB 4
	Gate3-CMP1 KQ93A/KR14A 3/8/2007	Gate3-CMP2 KQ93C/KR14B 3/8/2007	Gate3-CMP3 KQ93F/KR14C 3/9/2007	Gate3-CMP4 KQ93H/KR14D 3/9/2007
cPAHs Method 8270 (µg/kg)				
Benzo(a)anthracene	**160**	62 U	62 U	**96**
Chrysene	**200**	62 U	**120**	**190**
Benzo(b)fluoranthene	**140**	62 U	**63**	**120**
Benzo(k)fluoranthene	**110**	62 U	**100**	**180**
Benzo(a)pyrene	**76**	62 U	62 U	**84**
Dibenzo(a,h)anthracene	**9.8**	6.2 U	**6.8**	**9.8**
cPAH TEQ	**120.0**	ND	**18.2**	**126.5**

Bold = Detected compound.

U = Indicates the compound was undetected at the reported concentration.

TABLE 12
DETECTED CONSTITUENTS IN SURFACE WATER SAMPLES AND COMPARISON TO PRELIMINARY SURFACE WATER CLEANUP LEVELS
WELDCRAFT STEEL AND MARINE SITE

Location: Lab ID Date Collected:	Surface Water Screening Level	SW-1 KJ60N 12/21/06	SW-2 KP70B 02/26/07
DISSOLVED METALS (µg/L)			
Copper (200.8/6010B)	2.4	**4**	2 U
Nickel (200.8)	8.2	**10**	**6**
Zinc (200.8/6010B)	81	10 U	**9**
CONVENTIONALS			
N-Nitrate (Calculated) (mg-N/L)	NA	**0.512**	**1.2**
N-Nitrite (EPA 353.2) (mg-N/L)	NA	**0.018**	
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)	NA	**0.530**	
Sulfate (EPA 375.2/300.0)	NA	**1190**	**634**

U = Indicates compound was analyzed for, but was not detected at the given detection limit.
Bold values indicate concentration detected above laboratory reporting limits.
Boxed value indicates concentration above the screening level.
Blank indicates compound was not analyzed for.

TABLE 13
GROUNDWATER COC SCREENING SUMMARY
FOR CONSTITUENTS DETECTED IN GROUNDWATER
WELDCRAFT STEEL AND MARINE SITE

POTENTIAL COC	Preliminary Cleanup Level (µg/L)	Highest Detected Concentration	Number of Exceedances (a)
Antimony	640	0.2	0/4
Arsenic	5	2.0	0/8
Benzene	2.4	3,500	2/18
Copper	2.4	35	20/36
Ethylbenzene	2,100	1,800	0/18
Gasoline-Range Petroleum Hydrocarbons	800	95,000	2/28
Lead	8.1	3	0/26
Naphthalene	83	0.64	0/1
Nickel	8.2	37	17/36
Toluene	15,000	7,400	0/17
Zinc	81	280	14/36
1,1,1-Trichloroethane	11,000	5	0/12
o-xylenes	440	3,900	2/18

(a) Numerator equals number of exceedances, and denominator equals number of samples tested.

TABLE 14
PRELIMINARY CLEANUP LEVELS FOR COC
WELDCRAFT STEEL AND MARINE SITE

COC	Preliminary Soil Cleanup Level (mg/kg) (a)	Preliminary Groundwater Cleanup Level (μg/L) (b)	Preliminary Sediment Cleanup Level (mg/kg) (c)
Acenaphthylene	-- (e)	--	66 (f)
Benzene	0.014	2.4	--
Copper	36	2.4	--
Dibenzofuran	--	--	15 (f)
Ethylbenzene	18	2,100	--
Fluorene	--	--	23 (f)
Fluoranthene	--	--	160 (f)
Lead	250 (d)	8.1	--
Mercury	24 (g)	0.025	0.41
Nickel	48	8.2	--
o-Xylenes	--	440	--
Phenanthrene	--	--	100 (f)
Toluene	110	15,000	--
Total Xylenes	16,000	--	--
TPH-G	30 (h)	800	--
Zinc	100	81	410

Notes:
(a) Preliminary cleanup level based on lowest soil criteria corrected for practical quantitation limit (PQL) and background.
(b) Preliminary cleanup level based on lowest Water Quality Standard or PQL, unless noted otherwise.
(c) Preliminary cleanup level based on SMS Sediment Quality Standard (Chapter 173-204 WAC).
(d) MTCA Method A soil cleanup level based on preventing unacceptable blood lead levels.
(e) -- = Not applicable because constituent is not an Indicator Hazardous Substance for the media.
(f) Value normalized to total organic carbon.
(g) Preliminary cleanup level based on direct contact soil criteria.
(h) MTCA Method A cleanup level is 100 mg/kg if benzene is not present and the total of ethylbenzene, toluene, and xylenes is less than 1% of the gasoline mixture; otherwise the cleanup level is 30 mg/kg.

TABLE 15
SOIL COC SCREENING SUMMARY FOR CONSTITUENTS DETECTED IN SOIL
WELDCRAFT STEEL AND MARINE SITE

POTENTIAL COC	Preliminary Cleanup Level (mg/kg)	Highest Detected Concentration (mg/kg)	Number of Exceedances (a)
Antimony	320	7	0/9
Arsenic	20	8	0/21
Benzene	0.014	44	13/18
Benzo(a)anthracene	0.13	ND	0/3
Benzo(a)pyrene	0.14	ND	0/3
Benzo(b)fluoranthene	0.43	ND	0/3
Benzo(k)fluoranthene	0.43	ND	0/3
Beryllium	160	0.3	0/9
Cadmium	80.0	0.9	0/13
Carbon Tetrachloride	0.005	0.0043	0/6
Chromium	--	51.7	0/13
Chrysene	0.14	ND	0/3
Copper	36	545	20/29
CPAH TEQ	0.14	0.101	0/1
Diesel-Range Petroleum Hydrocarbons	2,000(b)	2,500	1/23
Ethylbenzene	18	63	4/24
Gasoline-Range Petroleum Hydrocarbons	30 (b,c)	15,000	24/43
Indeno(1,2,3-cd)pyrene	0.7	ND	0/3
Lead	250	1,160	3/26
Mercury	24 (d)	1.71	0/25
Naphthalene	0.27	ND	0/6
Nickel	48	86	2/23
Oil-Range Petroleum Hydrocarbons	2,000 (b)	1,600	0/23
o-Xylene	4	130	3/24
Toluene	110	61	0/24
Total Xylene	16,000	530	0/18
Trichloroethene	11 (d)	0.015	0/6
Zinc	100	1160	11/23

Notes:
(a) Numerator equals number of exceedances and denominator equals number of samples tested.
(b) MTCA Method A cleanup levels were use for diesel-, oil-, and gasoline-range petroleum hydrocarbons.
(c) MTCA Method A cleanup level is 100 mg/kg if benzene is not present and the total of ethylbenzene, toluene, and xylenes is less than 1% of the gasoline mixture; otherwise the cleanup level is 30 mg/kg.
(d) Mercury and trichloroethene were not detected in groundwater at concentrations exceeding the groundwater preliminary cleanup; therefore, preliminary soil cleanup levels for mercury and trichloroethene are based on direct contact.

TABLE 16
REMEDIAL ACTION ALTERNATIVES
WELDCRAFT STEEL AND MARINE SITE

Remedial Alternative Number	Remedial Alternative Name	Site Unit(1)	Soil	Groundwater	Indoor/Outdoor Air
1	Containment with Source Recovery	UST Site Unit	**Intermittent DPE** to extract free-phase product (if practicable) with montlhy extraction sessions for two years (passive recovery methods, including absorbent socks, will be used between DPE sessions). Soil **containment** by reparing/replacing (where needed) and maintaining pavement/concrete slab cover over petroleum contamination area. **Institutional controls** for maintaining source area cover and managing intrusive activities.	**Intermittent DPE** to extract free-phase product (if practicable) with monthly extraction sessions for two years (passive recovery methods, including product absorbent socks, to be used between DPE sessions. **Long-term compliance monitoring** to demonstrate compliance with groundwater cleanup standards. **Institutional controls** to restrict groundwater use and to provide proper management during intrusive activities.	**Active or passive soil vapor control system** to prevent lateral migration to offsite structures, if necessary. **Institutional controls** to ensure containment layer is maintained over time to reduce potential for vapor inhalation. **Compliance monitoring** to ensure offsite migration does not occur.
		Work Yard Site Unit	Soil **containment** by installing asphalt pavement in the North Work Yard, repairing/replacing, and maintaining pavement layer or concrete slabs over metals contamination area. **Institutional controls** for maintaining source area containment and managing soil during intrusive activities.	**Long-term compliance monitoring** (potentially including porewater analysis) to demonstrate compliance with groundwater cleanup standards. **Institutional controls** to restrict groundwater use, prevent direct contact (containment layer), and provide proper management during intrusive activities.	Not Applicable.
2	Containment with *In situ* Treatment and Source Recovery	UST Site Unit	**Intermittent DPE** to extract free-phase product (if practicable) with montlhy extraction sessions for six months (passive recovery methods, including absorbent socks, to be used between DPE sessions). **Air Sparging (AS)/Soil Vapor Extraction (SVE)** within petroleum contaminated soil area (SVE for two years; AS for 1.5 years). Soil **containment** by repairing (where needed), and maintaining pavement cover over residual petroleum contamination areas.	**Intermittent DPE** to extract free-phase product (if practicable) with monthly extraction sessions six months. **AS/SVE** across soil and groundwater plume area (AS for 1.5 years after intermittent DPE recovery/SVE at time of startup). **Compliance monitoring** to demonstrate compliance with groundwater cleanup standards.	**SVE** will provide necessary protection for potential vapor migration and provide for potential indoor/outdoor air quality concerns. **Institutional controls** to ensure containment layer is maintained over time to reduce potential for vapor inhalation.
		Work Yard Site Unit	Soil **containment** by installing asphalt pavement in the North Work Yard, repairing/replacing, and maintaining pavement layer or concrete slabs over metals contamination area. **Institutional controls** for maintaining source area containment and managing soil during intrusive activities.	**Long-term compliance monitoring** (potentially including porewater analysis) to demonstrate compliance with groundwater cleanup standards. **Institutional controls** to restrict groundwater use, prevent direct contact (containment layer), and provide proper management during intrusive activities.	Not Applicable.
3	Containment with Focused Source Removal	UST Site Unit	**Excavation** of petroleum source area contaminated soil (within the area most likely to contain potential LNAPL) and offsite disposal/treatment of excavated soil. I**nstitutional controls** for maintaining containment over residual petroleum contamination area and to manage intrusive activities.	**Excavation** of petroleum source area (within the area most likely to contain potential LNAPL). Application of **oxidant or oxygen-release compound** (ORC) to stimulate **natural attenuation** of residual groundwater impacts. **Compliance monitoring** to demonstrate compliance with groundwater cleanup standards. **Institutional controls** may be needed to restrict groundwater use and management during intrusive activities.	**Excavation** of potential vapor-related contaminant source with removal of source area soils and groundwater.
		Work Yard Site Unit	Soil **containment** by installing asphalt pavement in the North Work Yard, repairing/replacing, and maintaining pavement layer or concrete slabs over metals contamination area. **Institutional controls** for maintaining source area containment and managing soil during intrusive activities.	**Long-term compliance monitoring** (potentially including porewater analysis) to demonstrate compliance with groundwater cleanup standards. **Institutional controls** to restrict groundwater use, prevent direct contact (containment layer), and provide proper management during intrusive activities.	Not Applicable.
4	Site Wide Source Removal	UST Site Unit	**Excavation** of petroleum source area contaminated soil and offsite treatment or disposal.	**Excavation** of petroleum source area.	**Excavation** of potential vapor-related contaminant source with removal of source area soils and groundwater.
		Work Yard Site Unit	**Excavation** of metals-contaminated soil and offsite disposal. Site restoration.	**Compliance monitoring** (potentially including porewater analysis) to demonstrate compliance with groundwater cleanup standards. Site restoration.	Not Applicable.

Notes: 1) The remedial action alternatives do not include the Marine Site Unit because an interim action was implemented in 2003-2004 and this area of the site now meets cleanup standard. See Section 3.4.

TABLE 17
ALTERNATIVES COST ESTIMATE SUMMARY[1]
WELDCRAFT STEEL AND MARINE SITE

Remedial Alternative Number	Remedial Alternative Name	Estimated Cost
1	Containment with Source Recovery	$ 610,000
2	Containment with *In Situ* Treatment and Source Recovery	$ 950,000
3	Containment with Focused Source Removal	$ 1,100,000
4	Site-Wide Source Removal	$ 2,900,000

1) Estimated costs represent present worth based on a discount rate of 3% for long-term operation, monitoring, and maintenance tasks, and are considered order of magnitude estimates with a relative accuracy range of -30 to +50 percent. Use should be limited to the comparative evaluation of alternatives. More accurate costs will be developed during the design and implementation phases of the cleanup.

TABLE 18
SUMMARY OF MTCA ALTERNATIVES EVALUATION AND DCA RANKING
WELDCRAFT STEEL AND MARINE SITE

Alternative Number	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Alternative Name	**Containment with Source Recovery**	**Containment with *In Situ* Treatment and Source Recovery**	**Containment with Focused Source Removal**	**Site-Wide Source Removal**
Alternative Description				
UST Site Unit	Install (where necessary), repair/replace, inspect, and maintain containment layer; institutional controls (restrictive covenants); and long-term monitoring (assume 30 years). Soil vapor control system, if necessary (included in cost estimate).	Air sparge and soil vapor extraction with intermittent DPE LNAPL (source) removal (if practicable); system operations for two years; institutional controls. Compliance monitoring.	Excavation of petroleum contaminated soils (within area of potential LNAPL) and offsite disposal, including dewatering and potential LNAPL management; oxidant/oxygen-release compounds added in excavation; site restoration; institutional controls.	Excavation of petroleum contaminated soils (entire UST area) and offsite disposal, including dewatering and potential LNAPL management; site restoration.
Potential LNAPL Recovery Zone	Intermittent (monthly) DPE LNAPL recovery (if practicable) using a vactor truck with passive recovery (absorbent socks) between extraction sessions. Cease intermittent extraction sessions when it is yielding increasingly diminishing returns (assume two years of treatment).	Treat with SVE and intermittent DPE LNAPL recovery (if practicable) for the first six months. After the first six months, air sparging will be coupled with continued SVE treatment (intermittent DPE LNAPL recovery will not be continued after the first six months). Assumes two years of treatment.	Included in the focused source removal of the UST Site Unit.	Included in the source removal of the UST Site Unit.
Work Yard Site Unit	Install asphalt containment in North Work Yard, repair/replace, inspect, and maintain containment layer; institutional controls (restrictive covenants); and compliance monitoring (assume 30 years).	Install asphalt containment in North Work Yard, repair/replace, inspect, and maintain containment layer; institutional controls (restrictive covenants); and compliance monitoring (assume 30 years).	Install asphalt containment in North Work Yard, repair/replace/ inspect, and maintain containment layer; institutional controls (restrictive covenants); and compliance monitoring (assume 30 years).	Excavation of metal-impacted soils; offsite disposal; site restoration.
Individual Ranking Criteria				
1 Meets Remedial Action Objectives	Yes	Yes	Yes	Yes
2 Compliance With MTCA Threshold Criteria [WAC 173-340-360(2)(a)]				
-Protect human health and the environment	Yes	Yes	Yes	Yes
-Comply with cleanup standards	Yes	Yes	Yes	Yes
-Comply with applicable state/federal laws	Yes	Yes	Yes	Yes
-Provide for compliance monitoring	Yes	Yes	Yes	Yes
3 Restoration Time Frame [WAC 173-340-360(2)(b)(ii) and WAC 173-340-360(4)]	2 years	2 years	1 year	1 year
-Potential risk to human health and environment	Low	Low	Low	Low
-Practicability of achieving shorter restoration time	See DCA below	See DCA below	See DCA below	See DCA below
-Current use of site, surrounding area, and resources	Unrestricted/Industrial - no offsite migration	Unrestricted/Industrial - no offsite migration	Unrestricted/Industrial - no offsite migration	Unrestricted/Industrial - no offsite migration
-Future use of site, surrounding area, and resources	Unrestricted/Industrial - no offsite migration	Unrestricted/Industrial - no offsite migration	Unrestricted/Industrial - no offsite migration	Unrestricted/Industrial - no offsite migration
-Availability of alternative water supplies	Yes	Yes	Yes	Yes
-Likely effectiveness/reliability of institutional controls	High	High	High	Not Applicable
-Ability to monitor migration of hazardous substances	High	High	High	High
-Toxicity of hazardous substances at the site	Moderate	Moderate	Moderate	Moderate
-Natural processes that reduce concentrations	Yes	Yes	Yes	Yes
-Overall Reasonable Restoration Time Frame	Yes	Yes	Yes	Yes

4 Relative Benefits Ranking for DCA
[WAC 173-340-360(2)(b)(i) and WAC 173-340-36093)(f)]

Comparative Overall Benefit	Alt. 1 Comparative Benefit Rating	Score	Weighting Factor	Weighted Score	Alt. 2 Comparative Benefit Rating	Score	Weighting Factor	Weighted Score	Alt. 3 Comparative Benefit Rating	Score	Weighting Factor	Weighted Score	Alt. 4 Comparative Benefit Rating	Score	Weighting Factor	Weighted Score
-Overall Protectiveness	Medium	6	0.3	1.8	Medium High	8	0.3	2.4	Medium High	8	0.3	2.4	High	9	0.3	2.7
-Permanence	Medium	6	0.2	1.2	Medium High	8	0.2	1.6	Medium High	8	0.2	1.6	High	9	0.2	1.8
-Long Term Effectiveness	Medium High	8	0.2	1.6	Medium High	9	0.2	1.8	Medium High	9	0.2	1.8	High	10	0.2	2
-Manageability of Short Term Risk	High	10	0.1	1	High	9	0.1	0.9	Medium High	7	0.1	0.7	Medium	6	0.1	0.6
-Implementability	High	9	0.1	0.9	Medium	8	0.1	0.8	Medium Low	4	0.1	0.4	Low	1	0.1	0.1
-Consideration of Public Concerns	High	10	0.1	1	High	10	0.1	1	High	10	0.1	1	High	10	0.1	1
Overall Weighted Benefit Score				**7.5**				**8.5**				**7.9**				**8.2**

5 Disproportionate Cost Analysis	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Overall Weighted Benefit Score	7.5	8.5	7.9	8.2
Estimated Remedy Cost (including interim action)	$610,000	$950,000	$1,100,000	$2,900,000
Most practicable permanent solution	**Yes**	No	No	No
Lowest Cost Alternative	**Yes**	No	No	No
Relative Benefit/Cost Ratio*	3.7	2.7	2.2	0.8
Incremental Increase/Decrease in Relative Benefit to Most Permanent Alternative	-9%	4%	-4%	0%
Incremental Increase/Decrease in Relative Benefit to Next Most Expensive Alternative	-12%	8%	-4%	4%
Incremental Increase/Decrease in Cost Compared to Most Permanent Alternative	-79%	-67%	-62%	0%
Incremental Increase/Decrease in Cost Compared to Next Most Expensive Alternative	-36%	-14%	-62%	0%
Costs Disproportionate to Incremental Benefits	No	Yes	Yes	Yes
Remedy Permanent to the Maximum Extent Practicable?	Yes	No	No	No
Preferred Alternative	**Yes**	**No**	**No**	**No**

* Benefit/Cost Ratio scaled by $300,000 in order to compare ranges similar in scale to comparative overall benefit, as presented on Figure 36.

APPENDIX A

Pre-RI Boring Logs and Monitoring Well Construction Details

From the Phase II Environmental Site Assessment
Weldcraft Steel and Marine
June 25, 1998

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL (1)	TYPICAL DESCRIPTIONS (2)(3)
COARSE-GRAINED SOIL (More than 50% of material is larger than No.200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No.4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No.4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No.200 sieve size)	SILT AND CLAY (Liquid Limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid Limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand or silty soil
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content
	OTHER			AC/PC	Asphalt Concrete Pavement/Portland Cement Pavement

Notes: 1. USCS letter symbols correspond to the symbols used by the Unified Soil Classification System and ASTM Classification methods. Dual letter symbols (e.g., SM-SP) for a sand or gravel indicate a soil with an estimated 5-15% fines. Multiple letter symbols (e.g.,ML/CL) indicate borderline or multiple soil classifications.

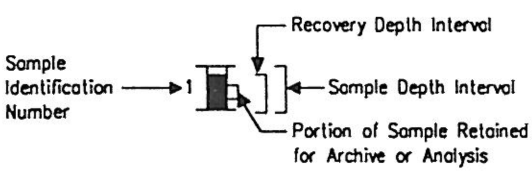
2. Soil classifications are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D2487.

3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	>50%	–	"GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	>30% and ≤50%	–	"very gravelly," "very sandy," "very silty," etc.
	>15% and ≤30%	–	"gravelly," "sandy," "silty," etc.
Additional Constituents:	>5% and ≤15%	–	"with gravel," "with sand," "with silt," etc.
	≤5%	–	"trace gravel," "trace sand," "trace silt," etc., or not noted.

Key

SAMPLE NUMBER & INTERVAL



TEST DATA

Code	Description

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon Sampler
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon Sampler
c	Shelby Tube
d	Grab Sample
e	3.00-inch I.D. Core Barrel Sampler
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	350-lb. Hammer, 30-inch Drop

OTHER

▽ ATD — Approximate Water Elevation At Time of Drilling (ATD) or On Date Noted

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Soil Classification System and Key | Figure A-1

SB-1

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0		Grass		
0-1.6	SW	Gray-brown, gravelly, coarse to fine SAND, trace silt (loose, moist-beach odor in sand)	SB-1 / 1.0-1.4	3.5
1.6-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.

SB-2

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0		Grass		
0-1.4	SW	Gray-brown and brown interlayered gravelly, coarse to fine SAND, trace silt (dense, moist)	SB-2 / 1.2-1.4	0.0
1.4-1.8	SW	Dark brown-black, coarse to fine SAND with organics (wood fragments), trace silt (dense, moist)		
1.8-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-3

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0		Gravel		
0-1	GP	Light gray-brown coarse sandy GRAVEL, trace silt (dense, moist)	* / 1.0-1.8	1.4
1-2.1	SP	Dark brown-gray brown gravelly fine SAND, trace silt. Zone of fine SAND at 1.4 ft to 1.8 ft (dense, moist)	S-1	1.4
2.1-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.
*Composited into SB-WW-COMP sample.

SB-4

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0		Gravel		
0-2.2	SW	Brown to dark brown, gravelly medium to fine SAND, trace coarse sand and silt (dense, moist)	* / 0-1.7	0.0
2.2-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.
*Composited into SB-WW-COMP sample.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-5

SAMPLE DATA					SOIL PROFILE			WELL DETAIL
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID	Graphic Symbol	USCS Symbol	Drilling Method: Strata Probe Ground Elevation (ft)	
0.0						SW	Gray-brown, gravelly, coarse to fine SAND, trace silt with interbedded black coarse to fine SAND (0-2.4' BGS composited into SB-WW-COMP sample)	
	S-1	b3		1.2				
2.5						SW	Dark brown and black, gravelly, coarse to fine SAND, trace silt (dense, moist)	
	S-2	b3		3.3				
5.0						SW SM	Dark brown and black interbedded gravelly, silty course to fine SAND with organics (wood fragments) (dense, wet)	
7.5	S-3	b3		0.6				
10.0								
12.5								
15.0								

Boring Completed 01/20/98
Total Depth = 9.0 ft

Depth to Water= 6.5 ft
at time of drilling

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Soil Boring SB-5

Figure A-4

SB-6

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0		Gravel		
0-1.4	SW	Dark brown, gravelly, medium to fine SAND, little silt with organics (wood) (loose, moist)	SB-6 / 0-1.4	1.0
1.4-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.

SB-7

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0		Gravel		
0-1.7	GW	Medium brown, sandy GRAVEL, trace silt (moderate dense, moist)	SB-7 / 0-1.7	1.1
1.7-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-8

SAMPLE DATA					SOIL PROFILE			WELL DETAIL
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID	Graphic Symbol	USCS Symbol	Drilling Method: Strata Probe Ground Elevation (ft)	
0.0						AC	ASPHALT	
						SW	Dark brown and black with orange traces, gravelly, coarse to fine SAND, trace silt (loose to medium dense, dry)	
2.5	S-1	b3		0.0				
						SW	Brown coarse to fine SAND, trace gravel and silt (loose, moist)	
5.0	S-2	b3		68.8		SW	Black coarse to fine SAND, trace gravel and silt (loose, moist to wet) (sheen on water) (4.7-5.6' BGS submitted for laboratory analysis)	
7.5	S-3	b3		790				
10.0								

Boring Completed 01/20/98
Total Depth = 10.0 ft

Depth to Water= 7.0
at time of drilling

12.5

15.0

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Soil Boring SB-8

Figure A-6

SB-9

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.25	AC	Asphalt		
0.25-2	SW	Gray-brown, interbedded, fine gravelly coarse to fine SAND (very dense with depth, dry)	* / 0.25-2.0	0.0
2-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.
*Composited into SB-BLDG3-COMP sample.

SB-11

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.5	AC	Asphalt		
0.5-0.9	SW	Brown, gravelly, medium to fine SAND, trace silt (dense, moist)	* / 0.5-2.3	0.0
0.9-1.8	SW	Gray-brown, coarse to fine SAND, trace silt (dense, moist)		0.0
1.8-2.3	GW	Gray-brown, sandy GRAVEL (very dense, moist)		0.0
2.3-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.
*Composited into SB-BLDG3-COMP sample.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-10

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID	USCS Symbol	Soil Profile
0.0					AC	ASPHALT
	S-1	b3		0.0	SW	Brown and gray brown, thin interbedded layers of coarse to fine SAND and gravelly coarse to fine SAND (loose to medium dense, moist) (shell fragments throughout) (0.7-2.2' BGS composited into SB-Bldg3-COMP sample)
2.5						
	S-2	b3		0.0		
5.0					GP/SW	Black, sandy, fine GRAVEL, trace silt (loose to medium dense, moist to wet)
7.5	S-3	b3		1.2		

Drilling Method: Strata Probe

Ground Elevation (ft):

WELL DETAIL

Boring Completed 01/20/98
Total Depth = 9.0 ft

Depth to Water: 6.0
at time of drilling

10.0

12.5

15.0

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Soil Boring SB-10

Figure A-8

SB-12

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.75	AC	Asphalt		
0.75-1.75	SW	Brown, gravelly, coarse to fine SAND, trace silt (low recovery due to rock) (loose, dry)	* / 0.75-1.75	0.0
1.75-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.
*Composited into SB-EW-COMP sample.

SB-13

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.75	AC	Asphalt		
0.75-2.4	GW	Gray-brown sandy GRAVEL trace silt (medium dense, dry)	* / 0.75-2.4	0.0
2.4-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.
*Composited into SB-EW-COMP sample.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-14

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.75	AC	Asphalt		
0.75-2.6	GW/SW	Brown and gray-brown, sandy GRAVEL and gravelly SAND (with shell fragments) interbedded with black coarse to fine SAND (very dense, moist)	* / 0.75-2.6	0.0
2.6-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.
*Composited into SB-EW-COMP sample.

SB-15

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.75	AC	Asphalt		
0.75-2	SW	Brown and gray-brown, gravelly coarse to fine SAND, trace silt with shell fragments (very dense, moist)	* / 0.75-2.0	0.0
2-3		No recovery		

Boring completed to 3 ft on January 20, 1998.
No groundwater seepage encountered.
*Composited into SB-EW-COMP sample.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-16

SAMPLE DATA					SOIL PROFILE			WELL DETAIL
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID	Graphic Symbol	USCS Symbol	Drilling Method: Strata Probe Ground Elevation (ft)	
0.0						AC	ASPHALT	
	S-1	b3		0.0		SW	Gray-brown and black, interbedded gravelly coarse to fine SAND and coarse to fine SAND, trace silt (medium dense to dense, moist to wet) (0.7-1.4' BGS composited into SB-EW-COMP sample)	
2.5								
	S-2	b3		0.0				
5.0								
				NA				
7.5	S-3	b3						
10.0								
12.5								
15.0								

Boring Completed 01/20/98
Total Depth = 9.0 ft

Depth to Water= 7.0
at time of drilling

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Soil Boring SB-16

Figure A-11

SB-17

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0.2-0.6	SW	Dark brown, gravelly, coarse to fine SAND with trace silt (loose, dry)	SB-17 / 0.2-0.6	0.0
0.6-3		No recovery		

Boring completed to 3 ft on January 21, 1998.
No groundwater seepage encountered.

SB-18

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.75	AC	Asphalt		
0.75-1.1	SW	Dark brown, gravelly, coarse to fine SAND (loose, moist)	SB-18 / 0.75-1.5	0.0
1.1-1.5	CL	Brown, sandy, gravelly SILT and CLAY (slightly plastic, moist)		0.0
1.5-3		No recovery		

Boring completed to 3 ft on January 21, 1998.
No groundwater seepage encountered.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-19

SAMPLE DATA					SOIL PROFILE			WELL DETAIL
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID	Graphic Symbol	USCS Symbol	Drilling Method: Strata Probe Ground Elevation (ft)	
0.0						AC	ASPHALT	
	S-1	b3		0.0		SW	Dark brown, gravelly, coarse to fine SAND, trace silt (shell fragments) (loose, moist) (0.5-2.1' BGS submitted for laboratory analysis)	
2.5								
	S-2	b3		0.0		SP/SW	Gray, medium to fine SAND, trace gravel and coarse sand (shell fragments) (very loose, moist)	
5.0								
7.5	S-3	b3		0.0		SW	Black and gray, interbedded gravelly coarse to fine SAND (shell fragments) (loose, wet)	
10.0								
12.5								
15.0								

Boring Completed 01/21/98
Total Depth = 9.0 ft

Depth to Water: 7.0
at time of drilling

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Soil Boring SB-19

Figure A-13

SB-20

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.4	AC	Asphalt		
0.4-1.7	SW	Brown and gray-brown, gravelly coarse to fine SAND with shell fragments (medium dense, dry to moist)	SB-20 / 0.4-1.7	0.0
1.7-3		No recovery		

Boring completed to 3 ft on January 21, 1998.
No groundwater seepage encountered.

SB-21

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.1	AC	Asphalt		
0.1-2	SW	Gray-brown, gravelly coarse to fine SAND, trace silt (dense to very dense, dry to moist)	* / 0.1-2.0	0.0
2-3		No recovery		

Boring completed to 3 ft on January 21, 1998.
No groundwater seepage encountered.
*Composited into SB-DS-COMP sample.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-22

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.1	AC	Asphalt		
0.1-0.3	SW	Gray-brown, coarse to fine SAND, trace gravel (medium dense, moist)		0.0
0.3-0.6	CL	Gray, silty CLAY (medium dense, moist)	* / 0.1-1.8	0.0
0.6-1.8	SW	Gray-brown gravelly coarse to fine SAND (dense, moist)		0.0
1.8-3		No recovery		

Boring completed to 3 ft on January 21, 1998.
No groundwater seepage encountered.
*Composited into SB-DS-COMP sample.

SB-23

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.1	AC	Asphalt		
0.1-0.8	SW	Gray-brown, gravelly coarse to fine SAND (medium dense, moist) (pushed rock)	* / 0.1-0.8	0.0
0.8-3		No recovery		

Boring completed to 3 ft on January 21, 1998.
No groundwater seepage encountered.
*Composited into SB-DS-COMP sample.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-24

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID	USCS Symbol	Soil Profile
						Drilling Method: Strata Probe Ground Elevation (ft)
0.0					SW	Brown, gravelly, coarse to fine SAND (loose, moist)
	S-1	b3		0.0	SW/GW	Gray-brown, gravelly, coarse to fine SAND to sandy coarse to fine GRAVEL (very dense, moist)
2.5						
	S-2	b3		0.0		
5.0						
					SW	Brown, gravelly, coarse to fine SAND (dense, moist)
					SW	Black, fine gravelly, coarse to fine SAND (dense, wet)
7.5	S-3	b3		0.0	ML/CL	Black SILT and CLAY with wood fragments (loose, wet)
					SW	Black, fine gravelly, coarse to fine SAND (dense, wet)

WELL DETAIL

Boring Completed 01/21/98
Total Depth = 9.0 ft

Depth to Water: 7.0
at time of drilling

10.0

12.5

15.0

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions.
2. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.
3. No soil sample submitted for laboratory analysis.

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Soil Boring SB-24

Figure A-16

SB-25

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0-5	--	No samples collected	--	--
5-5.7	SM	Brown and dark brown, silty fine SAND with trace coarse sand and gravel (loose, moist)		--
5.7-6.3	SP	Gray-brown, fine SAND, with trace gravel (shell fragments) (dense, moist)		--
6.3-6.8	SW	Black, gravelly, coarse to fine SAND, trace silt (shell fragments) (dense, moist)		--
6.8-7	SP	Gray, medium to fine SAND with trace coarse sand (gas odor) (dense, wet)		13.4
7-8		No recovery	SB-25 / 7	

Boring completed to 8 ft on January 21, 1998.
Groundwater seepage encountered at 7 ft.

SB-26

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0-5	--	No samples collected	--	--
5-6.2	SW	Brown, gravelly SAND (Shell fragments) (dense, dry)	**	--
6.2-6.8	SW	Interbedded gray-brown and black coarse to fine SAND, trace gravel and silt (shell fragments) (dense, moist)	**	--
6.8-7.5	SW	Gray and black interbedded coarse to fine SAND, trace gravel and silt (shell fragments, gas odor) (very dense, wet)	**	434
7.5-8		No recovery		

Boring completed to 8 ft on January 21, 1998.
Groundwater seepage encountered at 7 ft.
Shell fragments not associated with black layers.
** No sample submitted for laboratory analysis.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-27

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0-5	--	No samples collected	--	--
5-6.4	SW	Gray-brown and black interbedded coarse to fine SAND, trace gravel and silt (dense, moist)	**	--
6.4-7	SW	Gray and black interbedded coarse to fine SAND, trace gravel and silt (gas odor) (dense, wet)	**	354
7-8		No recovery		

Boring completed to 8 ft on January 21, 1998.
Groundwater seepage encountered at 7 ft.
**No sample submitted for laboratory analysis.

SB-28

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0-5	--	No samples collected	--	--
5-6.5	SW	Gray-brown, gravelly SAND, trace silt (very dense, moist)	**	--
6.5-7.3	SW	Gray-brown and black interbedded, gravelly SAND (gas odor) (very dense, wet)	**	637
7.3-8		No recovery		

Boring completed to 8 ft on January 21, 1998.
Groundwater seepage encountered at 7 ft.
**No sample submitted for laboratory analysis.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-29

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0-5	--	No samples collected	--	--
5-6.7	SW	Gray-brown and black interbedded gravelly coarse to fine SAND with trace silt (dense, moist)	**	--
6.7-7.2	SW	Black, gravelly coarse to fine SAND, trace silt (dense, wet) (gas odor)	**	12.6
7.2-8		No recovery		

Boring completed to 8 ft on January 21, 1998.
Groundwater seepage encountered at 7 ft.
**No sample submitted for laboratory analysis.

SB-30

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0-5	--	No samples collected	--	--
5-7	SW	Gray-brown and black interbedded gravelly coarse to fine SAND, trace silt (dense, moist)		0.0
7-7.5	SW	Black, gravelly coarse to fine SAND (dense, wet) (no odor detected)	SB-30 / 7	0.0
7.5-8		No recovery		

Boring completed to 8 ft on January 21, 1998.
Groundwater encountered at 7 ft.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

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Boring Logs

Figure A-19

SB-31

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0-5	--	No samples collected	--	--
5-6	SW	Gray-brown, brown and black interbedded, gravelly coarse to fine SAND, trace silt (dense, wet)	--	--
6-7	SW	Gray and black interbedded gravelly coarse to fine SAND, trace silt (strong gas odor) (dense, wet)	--	1,307
7-8		No recovery		

Boring completed to 8 ft on January 21, 1998.
Groundwater encountered at 7 ft.
**No sample submitted for laboratory analysis.

SB-32

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0-5	--	No samples collected	--	--
5-6.8	SW	Alternating layers of gray-brown, gravelly coarse to fine SAND with trace silt and wood fragments (no odor) (dense, moist)	SB-32 / 6.8	0.0
6.8-8		No recovery		

Boring completed to 8 ft on January 21, 1998.
Groundwater encountered at 7 ft.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

SB-33

(Approximate elevation N/A ft)

Depth (ft)	Unified Soil Classification System Symbol	Description	Sample No./Depth (ft)	PID
0-0.2	AC	Asphalt		
0-5	--	No samples collected	--	--
5-7.5	SW	Gray-brown, gravelly coarse to fine SAND, trace silt (no odor) (dense, moist to wet)	SB-33 / 7	0.0
7.5-8		No recovery		

Boring completed to 8 ft on January 21, 1998.
Groundwater seepage encountered at 7 ft.

Note: Stratigraphic contacts are based on field interpretations and are approximate. Refer to the text for an explanation of subsurface conditions. Refer to *Soil Classification System* figure for additional information on symbols and terminology.

From the Phase III Environmental Site Assessment
Weldcraft Steel and Marine
January 31, 2001

DA-101

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Water Level
							Drilling Method: Hollow-stem Auger Ground Elevation (ft): Drilled By: Cascade Drilling	
0						GP	Gray-brown sandy medium to coarse GRAVEL (crushed rock surfacing) with scattered vegetation and roots (medium dense, moist) (fill)	
	S-1	a2	32			SP	Gray-brown, very gravelly fine to coarse SAND with occasional wood debris and rare shell fragments (medium dense, moist) (fill) @ 2' - telephone cable cut by sampler	
2	S-2	a2	22					
4	S-3	a2	28					
8	S-4	a2	8			GP	Dark-brown black, fine GRAVEL (possible coal) with zones of silt, sand, and peaty material (loose, wet)(fill)	∇ Wet at 8.5'

Boring Completed 07/12/00
Total Depth of Boring = 9.0 ft.

Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Landau Associates

Weldcraft Steel & Marine
Bellingham, WA

Log of Boring DA-101

Figure A-6

DA-102

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-stem Auger Ground Elevation (ft): Drilled By: Cascade Drilling	Water Level
0						GP	Gray-brown, sandy, medium to coarse GRAVEL (crushed rock surfacing) (medium dense, moist) (fill)	
	S-1	a2	27	PID 0.0		SP	Brown-gray, very gravelly, fine to coarse SAND	
2								
	S-2	a2	31					
4								
	S-3	a2	25				@ 5' - scattered coal-like layer in sample and piece of wood in sampler	
6								
8	S-4	a2	6				@ 7.5' - darker in color with more organic material and wood chips	Wet at 8.5'
						SM	Gray, silty, fine to medium SAND to fine to medium SAND with silt (loose, wet) (fill)	

Boring Completed 07/12/00
Total Depth of Boring = 9.0 ft.

10 12 14 16 18 20

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.40 11/30/00 S:\SHAREDOC\001\024\001024.GPJ SOIL BORING LOG

Landau Associates

Weldcraft Steel & Marine
Bellingham, WA

Log of Boring DA-102

Figure A-7

DA-103

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Profile	Groundwater / Water Level
0					AC	Asphalt CONCRETE, 2-inch thick, covered with oily sediment-sludge	
	S-1	a2	16		GP/ SP	Gray-brown, very gravelly, medium to coarse SAND to sandy fine to medium GRAVEL (medium dense to very dense, moist) (fill)	
2	S-2	a2	54				
4	S-3	a2	52				
6	S-4	a2	14		GP	Dark brown-black GRAVEL (possible coal) mixed with sand (medium dense, moist to wet) (fill)	
8	S-5	a2	15				∇ Wet at 8.5'

Drilling Method: Hollow-stem Auger

Ground Elevation (ft):

Drilled By: Cascade Drilling

Boring Completed 07/12/00
Total Depth of Boring = 9.0 ft.

Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Landau Associates

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Bellingham, WA

Log of Boring DA-103

Figure A-8

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS [2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50%	- "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50%	- "very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30%	- "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15%	- "with gravel," "with sand," "with silt," etc.
	≤ 5%	- "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

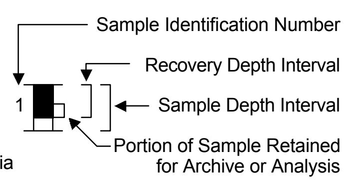
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽ Approximate water level at time of drilling (ATD)

▼ Approximate water level at time other than ATD

4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ SOIL CLASS SHEET

LANDAU ASSOCIATES

Weldcraft Steel & Marine
Bellingham, Washington

Soil Classification System and Key

Figure A-1

MW-1

SAMPLE DATA

Sample Number & Interval	Depth (ft)	Sampler Type	Blows/Foot	Test Data
S-1	~2.5–4	b1	2	
S-2	~5–6.5	b1	5	
S-3	~7.5–9	b1	15	
S-4	~10–11.5	b1	6	
S-5	~14–15.5	b1	28	W = 11 GS

SOIL PROFILE

Drilling Method: Hollow-stem Auger

Ground Elevation (ft): 14.62 (MLLW)

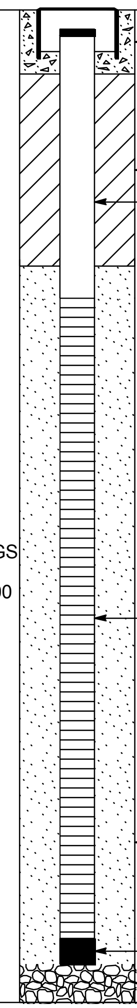
Drilled By: Cascade Drilling

USCS Symbol	Description
AC	Asphalt CONCRETE
GP	Crushed rock (1-1/2) base coarse
SP-SM	Dark brown to red brown fine to medium SAND with coarse sand, gravel, silt, wood pieces, and charcoal (very loose, moist) (fill).
SP-SM	Variable dark gray brown to gray brown fine to coarse SAND with gravel and silt to gravelly fine to coarse SAND with silt and pieces of wood (<2" size) and charcoal (variable loose to medium dense, moist to wet) (fill)
	@ 7.5' - becoming gravelly fine to coarse SAND with silt and wet

GROUNDWATER

Water Level: 8.2' BGS on 7/11/00

Well Detail



Boring Completed 07/10/00
Total Depth of Boring = 15.5 ft.

Well Completed 07/10/00
Total Depth of Well = 14.9 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.23 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ WELL LOG

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Bellingham, Washington

Log of Well MW-1

Figure A-2

MW-2

Drilling Method: Hollow-stem Auger
Ground Elevation (ft): 14.48 (MLLW)
Drilled By: Cascade Drilling

SAMPLE DATA

Sample Number & Interval	Sampler Type	Blows/Foot	Test Data
S-1	b1	17	
S-2	b1	20	
S-3	b1	5	
S-4	b1	0	
S-5	b1	41	W = 17 GS

SOIL PROFILE

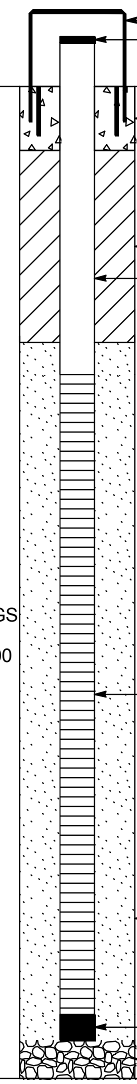
Depth (ft)	USCS Symbol	Description
0	AC	ASPHALT Concrete
0	SP	Brown gravelly fine to coarse SAND (medium dense, moist) (fill)
2	SP	Gray-brown fine to coarse SAND with occasional gravel; variable density (loose to medium dense, moist to wet) (possible fill) @ 7.5' - soil becomes wet
10	ML	Gray sandy clayey SILT; hammer drops on own weight; thickness not known (very soft, wet) (fill)
12	SP	Gray fine to coarse SAND with fine gravel (dense, wet) (possible dredge fill)

Boring Completed 07/10/00
Total Depth of Boring = 15.5 ft.

GROUNDWATER

Water Level: 8.0' BGS on 7/11/00

Well Detail



Well Completed 07/10/00
Total Depth of Well = 14.9 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.23 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ WELL LOG

LANDAU ASSOCIATES

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Bellingham, Washington

Log of Well MW-2

Figure A-3

MW-3

SAMPLE DATA / SOIL PROFILE / GROUNDWATER

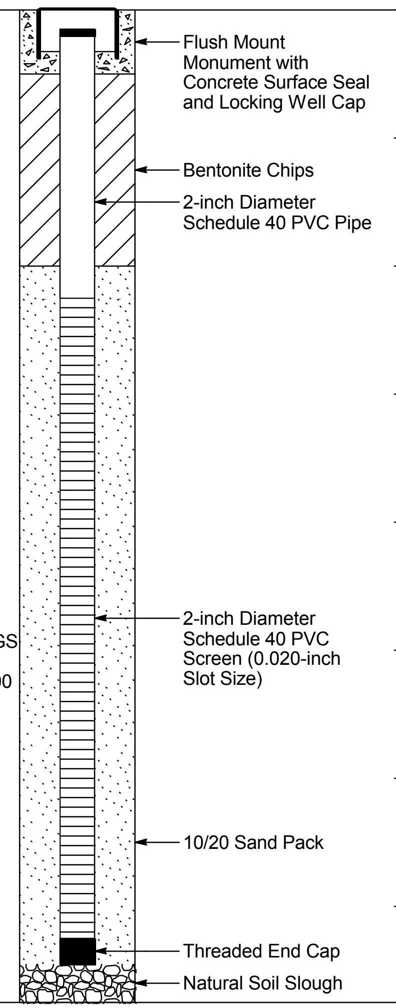
Drilling Method: Hollow-stem Auger

Ground Elevation (ft): 14.38 (MLLW)

Drilled By: Cascade Drilling

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Description	Water Level
0						GP	Coarse GRAVEL (2-inch) surface	
						SP-SM	Brown-gray (fine to coarse SAND with gravel and silt, with zones of very dark brown and red brown streaks and layers and variable amounts of organic and coal-like material (loose to medium dense, moist to wet) (fill)	
3	S-1	b1	12	PID 0.0				
6	S-2	b1	12					
7.5							@ 7.5' - wet	
8.5	S-3	b1	7	PID 0.0			@ 8.5' - dark brown coal-like layer, 6-inch thick	
9.6								9.6' BGS on 7/12/00
11	S-4	b1	26	W = 18 GS				
13						SP-SM	Dark brown-gray fine SAND with fine gravel and silt (medium dense, wet) (possible dredge fill)	
15	S-5	b1	11					

Well Detail



Boring Completed 07/10/00
Total Depth of Boring = 15.5 ft.

Well Completed 07/10/00
Total Depth of Well = 14.9 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.23 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ WELL LOG

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Bellingham, Washington

Log of Well MW-3

Figure A-4

MW-4

SAMPLE DATA / SOIL PROFILE / GROUNDWATER

Drilling Method: Hollow-stem Auger

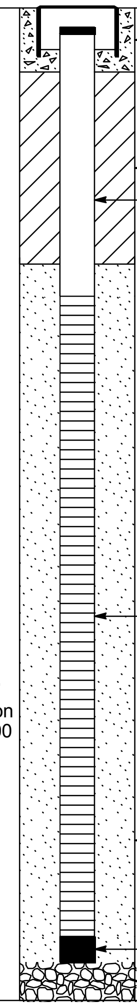
Ground Elevation (ft): 15.41 (MLLW)

Drilled By: Cascade Drilling

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Description
0					GP	Coarse GRAVEL (2-inch) surface
0–13					SP-SM	Brown to brown-gray fine to medium and fine to coarse SAND with gravel, red-brown and dark brown streaks, and fine organic and charcoal-like material (loose to medium dense, moist to wet at base) (fill)
~2.5–4	S-1	b1	5	PID 0.0		@ 3.5' - 2-inch thick coal like material
~5–6.5	S-2	b1	11	PID 0.0		
~7.5–9	S-3	b1	2			
~10–11.5	S-4	b1	7			@ 11' - 4-inch thick layer of coal-like material
13					SP-SM	@ 13' - wet Dark gray, gravelly, fine to coarse SAND with silt to sandy firm GRAVEL with dark gray-black coal-like material and shell fragments (loose, wet) (dredge fill)
~14–15.5	S-5	b1	6	W = 19 GS		

Water Level: 10.4' BGS on 7/12/00

Well Detail



Boring Completed 07/10/00
Total Depth of Boring = 15.5 ft.

Well Completed 07/10/00
Total Depth of Well = 14.9 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.23 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ WELL LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine
Bellingham, Washington

Log of Well MW-4

Figure A-5

MW-5

SAMPLE DATA / SOIL PROFILE / GROUNDWATER

Drilling Method: Hollow-stem Auger

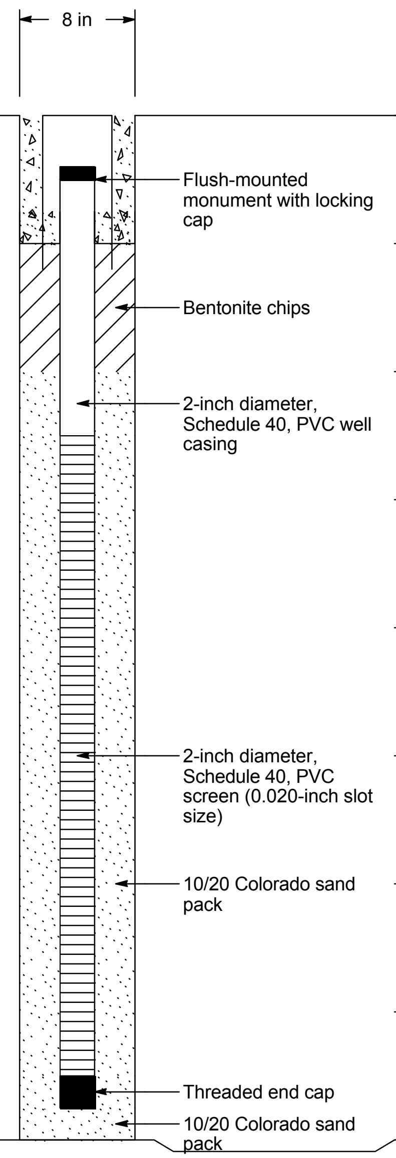
Ground Elevation (ft): 14.77 (MLLW)

Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Description
0					AC	Asphalt Pavement
					SP	Brown, fine to coarse SAND with gravel, cobbles and wood fragments (medium dense, moist) (Fill)
~6		a2	41			
~7.5					SP	Black-stained, fine to coarse SAND (loose to medium dense, moist) (petroleum odor) (Fill)
~8.5					ML	Gray SILT with trace fine sand (very loose, wet) (petroleum odor, slight sheen) (Fill)
~11	S-1	a2	8	143		
~13.5					SM	Dark gray, silty, fine to medium SAND with gravel (medium dense, wet) (petroleum odor, light sheen) (Dredge Fill)
~14	S-2	a2	34	105		
~15					SM	Gray, silty, fine to coarse SAND with trace small gravel (medium dense, wet) (petroleum odor, sheen) (Dredge Fill)
~15.5	S-3	a2	31	114		

Water Level: ATD (approx. 8 ft)

Monitoring Well Detail



Boring Completed 05/22/02
Total Depth of Boring = 16.0 ft.

Monitoring Well Completed 05/22/02
Total Depth of Monitoring Well = 15.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.23 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ WELL LOG

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Weldcraft Steel & Marine
Bellingham, Washington

Log of Monitoring Well MW-5

Figure A-6

MW-6

SAMPLE DATA

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data
~5–6.5	S-1	a2	34	4.6
~10–11.5	S-2	a2	22	22
~13.5–15	S-3	a2	30	30

SOIL PROFILE

Drilling Method: Hollow-stem Auger

Ground Elevation (ft): 14.97 (MLLW)

Drilled By: Cascade Drilling Inc.

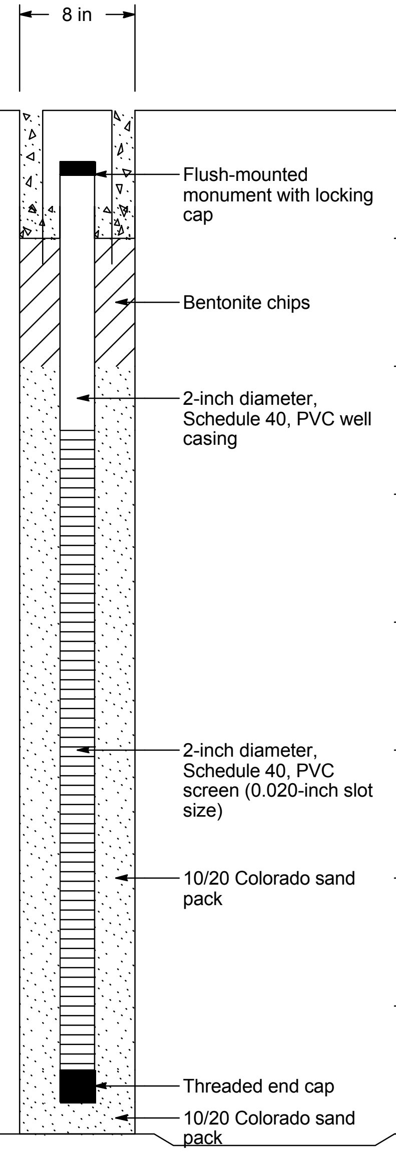
Depth (ft)	USCS Symbol	Description
0–0.5	GP	Washed, 3/4" GRAVEL
0.5–8	SP	Dark-gray, fine SAND with rust-stained gravel and coarse sand (medium dense, moist) (very slight petroleum odor) (Fill)
8–13	SP	Black COALI fragments and gray, fine SAND (medium dense, wet) (petroleum odor, slight sheen) (Fill)
13–16	SM	Dark-gray, silty, fine to medium SAND with gravel and trace coal fragments (medium dense, wet) (Dredge Fill)

Boring Completed 05/23/02
Total Depth of Boring = 16.0 ft.

GROUNDWATER

Water Level: ATD ▽ (approx. 8.5 ft)

Monitoring Well Detail



Monitoring Well Completed 05/23/02
Total Depth of Monitoring Well = 15.5 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.23 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ WELL LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine
Bellingham, Washington

Log of Monitoring Well MW-6

Figure A-7

MW-7

SAMPLE DATA

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data
5.0–6.5	S-1	a2	33	20.2
10.0–11.5	S-2	a2	10	17.6
15.0–16.5	S-3	a2	22	15.7
20.0–21.0	S-4	a2	36	11.4

SOIL PROFILE

Drilling Method: Hollow-stem Auger

Ground Elevation (ft): 14.10 (MLLW)

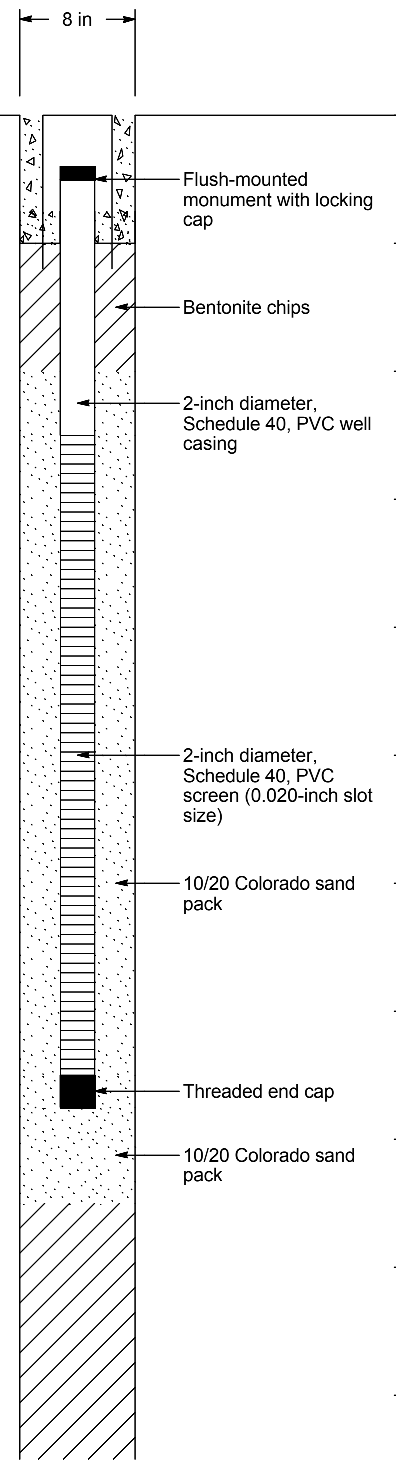
Drilled By: Cascade Drilling Inc.

Depth (ft)	USCS Symbol	Description
0	AC	Asphalt Pavement
~0.3	SP-SM	Dark-gray, fine to medium SAND with silt and gravel (loose to medium dense, moist) (Fill)
~3	SW	Gray, fine to coarse SAND with trace gravel and shell fragements (medium dense, moist) (Fill)
~9.5	SP	Black COAL fragments with silt and trace fine sand (loose, wet) (Fill)
~14.5	SW	Gray, fine to coarse SAND with gravel, trace silt, and shell fragments (loose to medium dense, wet) (Dredge Fill)
~19	SP	Gray, interbedded, fine SAND and medium SAND with occasional gravel and trace wood fragments (medium dense, wet) (slight sulphur odor) (Dredge Fill)

GROUNDWATER

Water Level: ATD ▽ (approx. 6 ft)

Monitoring Well Detail



Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine
Bellingham, Washington

Log of Monitoring Well MW-7

Figure A-8 (1 of 2)

MW-7

SAMPLE DATA / SOIL PROFILE / GROUNDWATER

Drilling Method: Hollow-stem Auger

Ground Elevation (ft): 14.10 (MLLW)

Drilled By: Cascade Drilling Inc.

Monitoring Well Detail

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Description
22	S-5	a2		11.1	SP	Gray, interbedded, fine SAND and medium SAND with occasional gravel and trace wood fragments (medium dense, wet) (slight sulphur odor) (Dredge Fill)
24					SW	Gray, fine to coarse SAND (medium dense, wet) (Native)
26	S-6	a2	24	12.8	SP	Gray, fine SAND (medium dense, wet) (Native)
					ML	Gray SILT (very stiff, wet) (Native)
28						
30	S-7					

Bentonite chips

Boring Completed 05/23/02
Total Depth of Boring = 30.0 ft.

Monitoring Well Completed 05/23/02
Total Depth of Monitoring Well = 15.5 ft.

32 34 36 38 40 42

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.23 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ WELL LOG

Landau Associates

Weldcraft Steel & Marine
Bellingham, Washington

Log of Monitoring Well MW-7

Figure A-8 (2 of 2)

MW-8

SAMPLE DATA / SOIL PROFILE / GROUNDWATER

Drilling Method: Hollow-stem Auger

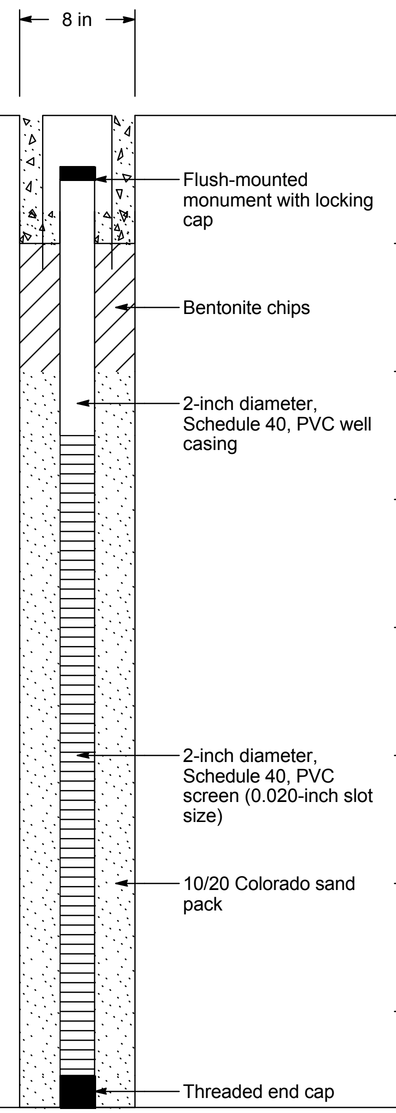
Ground Elevation (ft): 14.57 (MLLW)

Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Description
0					AC	Asphalt Pavement
					SW	Gray-brown, fine to coarse, gravelly SAND with cobbles (loose to medium dense, moist) (Fill)
					SP	Gray-brown, fine to medium SAND with wood debris (medium dense, moist to wet) (Fill)
	S-1	a2	9			
	S-2	a2	34	4.6		
					SM	Dark-gray, silty, fine SAND with trace fine sand seams (medium dense, wet) (Fill)
	S-3	a2	22	22		
					SP	Gray, fine to medium SAND and COAL with shell fragments (loose to medium dense, wet) (Dredge Fill)
	S-4	a2	30	30		

Water Level: ATD ▽ (approx. 8 ft)

Monitoring Well Detail



Boring Completed 05/22/02
Total Depth of Boring = 15.5 ft.

Monitoring Well Completed 05/22/02
Total Depth of Monitoring Well = 15.5 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine
Bellingham, Washington

Log of Monitoring Well MW-8

Figure A-9

MW-9

SAMPLE DATA | **SOIL PROFILE** | **GROUNDWATER**

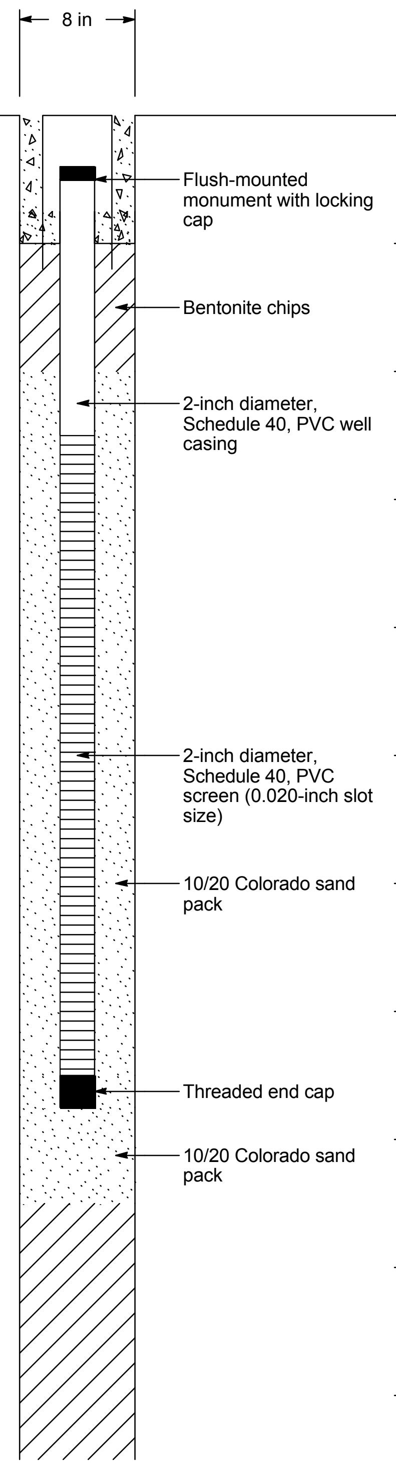
Drilling Method: Hollow-stem Auger

Ground Elevation (ft): 14.78 (MLLW)

Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Description	Water Level
0					AC	Asphalt Pavement	
					SP	Brown, fine to medium SAND with gravel (loose, moist) (Fill)	
2							
4							
	S-1a	a2	7/ 6"	61.0		Slight diesel odor	
6	S-1b	a2	20	18.7	SP	Black COAL fragments with fine to medium sand (loose, moist) (slight petroleum odor) (Fill)	
8							ATD ▽
10	S-2	a2	17	22.6			
12							
14					SW-SM	Gray, fine to coarse SAND with gravel and silt (medium dense, wet) (Dredge Fill)	
16	S-3	a2	46	6.5			
18					SP	Dark-gray to black, fine to medium SAND with coal fragments (medium dense, wet) (Dredge Fill)	
20	S-4	a2	50/	0			

Monitoring Well Detail



Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.23 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ WELL LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine
Bellingham, Washington

Log of Monitoring Well MW-9

Figure A-10 (1 of 2)

MW-9

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Profile	Monitoring Well Detail
21–23			5"		SP	Dark-gray to black, fine to medium SAND with coal fragments (medium dense, wet) (Dredge Fill)	Bentonite chips
23–26	S-5a	a2	28	0	SP-SM	Gray, fine to medium SAND with silt and shell fragments (medium dense, wet) (Dredge Fill)	
26–26.5	S-5b	a2	22/ 6"	0	ML	Gray, sandy SILT (very stiff, wet) (Native)	

Drilling Method: Hollow-stem Auger
Ground Elevation (ft): 14.78 (MLLW)
Drilled By: Cascade Drilling Inc.

Boring Completed 05/22/02
Total Depth of Boring = 26.5 ft.

Monitoring Well Completed 05/22/02
Total Depth of Monitoring Well = 15.5 ft.

Depth scale: 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.23 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ WELL LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine
Bellingham, Washington

Log of Monitoring Well MW-9

Figure A-10 (2 of 2)

APPENDIX B

Field Methods, Boring Logs, and Monitoring Well Construction Details

APPENDIX B
FIELD METHODS

This section describes the field methods used for the remedial investigation (RI) conducted under the Agreed Order for the Weldcraft Steel and Marine site (Site), including soil sampling, groundwater monitoring well installation, groundwater sampling and water level measurements, surface water sampling, weep hole sampling, and sediment sampling.

1.1 SOIL SAMPLING

Soil samples were collected using a truck-mounted Geoprobe™ direct-push drilling rig. Soil samples were obtained from the soil borings using a closed-piston sampling device with a 48-inch long, 1.5-inch inside-diameter (ID) core sampler. The sampler was advanced to the top of the sample interval with the piston in a locked position. The piston tip was loosened and the sampler was advanced over the desired depth interval, thereby coring the soil inside the sampler's disposable, single-use liner. The sampler was withdrawn to retrieve the liner and soil sample. The liner was cut to remove the soil sample. A new liner was placed in the core sampler and this process was repeated until all desired soil samples were obtained. Between samples, the core sampler, including the piston tip and rods, were decontaminated, as specified in Section 1.9.

After the liner was cut, the soil type was field-classified and recorded on the Log of Exploration form in accordance with the Uniform Soil Classification System [American Society for Testing and Materials (ASTM) 1998]. The soil column retained in the sample liner was field-screened by physical inspection. A visual examination was then made for discoloration of soil, the presence of sheen or non-aqueous phase liquid (NAPL), and precipitates. The presence of any odor was also documented.

The core was divided into the identified sample intervals, and the sample intervals were individually homogenized using decontaminated stainless-steel bowls and spoons. The homogenized sample volumes were then placed into the appropriate laboratory-supplied sample containers. However, volatile organic compound (VOC) soil samples, including samples for hydrocarbon testing, were collected from the undisturbed soil sample prior to homogenization, as described below.

The cores were field-screened using a photo-ionization detector (PID) prior to sampling or homogenization and were recorded for each 2-ft interval. If obvious signs of contamination were observed, a discrete sample was collected from the area with the greatest level of observed contamination. If the soil consisted primarily of coarse sand or finer grained material, U.S. Environmental Protection Agency (EPA) Method 5035A, described below, was used. If soil contained significant gravel content, the EPA method was not used and the previously accepted method of placing larger sample volume in a larger sample container was used.

The EPA Method 5035A soil sampling procedures were used to collect soil samples for gasoline-range petroleum hydrocarbons (TPH-G), and benzene, toluene, ethylbenzene, and xylene (BTEX) analyses consistent with recent Ecology guidance (Ecology 1998). The EPA 5035A soil sampling method is intended to reduce volatilization and biodegradation of samples. The EPA 5035A procedure for soil sample collection is as follows:

- Collect soil "cores" using coring devices (i.e., EnCore sampler, EasyDraw Syringe, or a Terra Core sampling device). Each core will consist of approximately 5 grams of soil. Collect three discrete cores from each sampling location. One EasyDraw Syringe or Terra Core device was used to collect the three discrete cores; however, if the EnCore samplers are used, three sampling devices are required.

- Remove excess soil from the coring device. If EasyDraw Syringe or Terra Core sampling devices are used for sample collection, place the cored soil directly into unpreserved 40 ml vials with a stirbar. If the EnCore sampler is used, close the sampler for transport to the laboratory.

- Collect one 2-oz jar of representative soil for moisture content and laboratory screening purposes. Fill the jar to minimize headspace.

- Samples were placed in shipping cooler at 4ºC. Samples were transported to the laboratory within 24 hours of sample collection and were stored at the laboratory at -7ºC.

Soil samples were collected and preserved consistent with the method-specific requirements.

1.2 MONITORING WELL INSTALLATION AND DEVELOPMENT

New monitoring wells were installed to a depth of 20.5 ft BGS (except well MW-12, which was installed to a depth of 19.3 ft BGS) with a 15 ft screen interval. Drilling was performed using hollow-stem auger equipment, and soil samples were collected for geologic characterization at 5-ft intervals during boring advancement.

The monitoring wells were constructed of 2-inch-diameter, Schedule 40 polyvinyl chloride (PVC) casing. The lower 15-ft of the well was screened with a 0.020-inch slotted screen. A filter pack using No. 10-20 silica sand was installed from the base of the boring to at least 1.5 ft above the top of the screen, and a bentonite chip seal was installed above the filter pack. Each well was completed with a flush-mount monument. Monitoring well construction was performed in accordance with the *Minimum Standards for Construction and Maintenance of Wells* (Chapter 173-160 WAC).

The wells were developed after construction to remove formation material from the well bore and the filter pack prior to groundwater level measurement and sampling. Development was achieved by repeatedly surging the well with a surge block and purging up to 10, but no less than 5, well casing volumes. The well was developed until the turbidity of the purged groundwater is no greater than 5 nephelometric turbidity units (NTUs), if practicable. If the well dewatered during the initial surging and purging effort, one final well casing volume was removed after the well has fully recharged, as practicable.

1.3 WATER LEVEL MEASUREMENTS

Water level measurements were obtained at each monitoring well prior to purging and sampling, but after the wells had been developed and fully recharged to static groundwater level conditions. Water level measurements were collected from all site monitoring wells prior to sample collection.

All water levels were measured using a decontaminated electronic water level indicator and were be recorded to the nearest 0.01 ft. Measurements were taken from the pre-surveyed reference mark at the top of the well casing.

1.4 GROUNDWATER SAMPLE COLLECTION

Groundwater samples were collected at each monitoring well using a low flow groundwater sampling technique as described by the following procedure:

- Immediately following removal of each well monument cover, the well head was observed for damage, leaks, and stains. Additionally, immediately following removal of the well head cap, any odors were recorded and the condition of the well opening was observed. Any damage or leakage to the well head or well opening was recorded.

- Depth to groundwater measurements were collected using a decontaminated electronic water level indicator and recorded to the nearest 0.01 ft. The measurement was recorded on the groundwater sampling form.

- Prior to sampling, each well were purged using a peristaltic pump that is attached to dedicated purge and sample collection tubing. Purging was maintained at a low purge rate (no more than 0.1 liter per minute). The rate was adjusted to minimize drawdown (with a target drawdown of less than 0.33 ft) during purging.

- Field parameters, including pH, temperature, conductivity, dissolved oxygen (DO), and turbidity, were continuously monitored during purging using a flow cell and recorded every 2 to 3 minutes. Purging of the well was considered complete when all field parameters become stable for three successive readings. The successive readings should be within +/- 0.1 units for pH, +/- 3 percent for conductivity, and +/- 10 percent for DO and turbidity.

- Purge data were recorded on a Groundwater Sample Collection form, including purge volume; time of commencement and termination of purging; any observations regarding color, turbidity, or other factors that may be important in evaluation of sample quality; and field measurements of pH, specific conductance, temperature, DO, and turbidity.

- Following the stabilization of field parameters, the flow cell was disconnected and groundwater samples were collected. Sample data were recorded on a Groundwater Sample Collection form, including sample number and time collected; the observed physical characteristics of the sample (e.g., color, turbidity); and field parameters (pH, specific conductance, temperature, DO, and turbidity).

- Four replicate field measurements of temperature, pH, specific conductance, DO, and turbidity were obtained using the following procedure:

  - A 250-mL plastic beaker was rinsed with deionized water followed by sample water.

  - The electrodes and temperature compensation probe were rinsed with deionized water followed by sample water.

  - The beaker was filled with sample water; the probes were placed in the beaker until the readings are stabilized. Temperature, pH, specific conductance, DO, and turbidity measurements were recorded on the Groundwater Sample Collection form.

  - The above steps were repeated to collect remaining replicates.

- Any problems or significant observations were noted in the "comments" section of the Groundwater Sample Collection form.

- Groundwater samples were collected into the appropriate sample containers using a peristaltic pump. Samples were chilled to 4°C immediately after collecting the sample. Clean gloves were worn when collecting each sample.

- Groundwater for dissolved metals analyses were collected last and filtered in the field through a 0.45-micron, in-line disposable filter. Dissolved metal samples were preserved. A note were made on the sample label, sample collection form, and chain of custody (COC) to indicate the sample has been field-filtered and preserved, including the type of preservative used.

Groundwater samples collected from the weep hole in the bulkhead between the 50-ton travel lift peers were collected from dedicated purge and sample collection tubing inserted into the weep hole through a fitting located at the top of the weep hole drop tube. After allowing water from the weep hole to flow freely from the tubing for at least 1 minute, laboratory supplied sample containers were filled directly from the discharge tubing.

Groundwater blind field duplicates that consisted of split samples collected at a single sample location were collected. Blind field duplicates were collected by alternately filling sample containers for both the original and the corresponding duplicate sample at the same location to decrease variability between the duplicates, and submitted "blind" to the laboratory as discrete samples (i.e., given unique sample identifiers to keep the duplicate identity unknown to the laboratory).

1.5 MARINE SURFACE WATER AND WEEP HOLE WATER SAMPLING

Marine surface water samples were collected by lowering a capped, unpreserved, laboratory-supplied sample bottle beneath the water surface to avoid entraining any surface debris in the sample. The bottle was then slowly uncapped and allowed to fill, and recapped prior to removal from the water. The surface water collected in the bottle was transferred to a preserved laboratory-supplied sample bottle, as appropriate.

1.6 SEDIMENT SAMPLING

Sediment samples were collected at pre-determined sampling locations by first positioning the sampling equipment at the desired location using a Trimble NT300D differential global positioning system (DGPS). Vertical position control was evaluated by using the depth sounder on the sampling vessel. A lead line (or weighted tape) was periodically used to measure from the water surface to the mudline as a check and to provide a correction factor (as necessary) for readings from the vessel's depth sounder. In-field adjustments to depth readings due to tidal stages were made using tidal prediction software loaded on the ship's navigational system. Actual mudline elevations [in mean lower low water (MLLW)] were adjusted after field activities were completed relative to tidal elevation observations made by National Ocean Services.

Surface sediment sample collection was conducted using PSEP protocols. Samples were collected from a sampling vessel with a mechanical grab sampler (i.e., hydraulically powered van Veen grab). The general procedures used for collecting surface sediment samples were as follows:

1. Make logbook entries, as necessary, throughout the sampling process for thorough recordkeeping.
2. Maneuver the sampling vessel to the proposed sampling location.
3. Prepare the sampler for deployment.
4. Guide the sampler into the water keeping it clear of the sampling vessel.
5. Lower the sampler through the water column to the bottom at approximately 0.3 m/sec.
6. Upon firm contact with the bottom, record the location with the DGPS.
7. Retrieve the sampler and raise it to the surface at approximately 0.3 m/sec.
8. Guide the sampler onto the deck of the sampling vessel; use care to avoid unnecessary jostling that might disturb the integrity of the sample.
9. Examine the sample relative to the following sediment acceptance criteria:
   - The sampler is not overfilled with sediment so that the sediment surface presses against the top of the sampler.
   - No leakage has occurred, as indicated by overlying water on the sediment surface.

– No winnowing has occurred, as indicated by a relatively flat, undisturbed surface.

– The penetration depth is adequate.

– The grab sampler is properly closed.

10. Siphon off any standing water from the surface of the sediment using a hose primed with site water. Be careful during siphoning not to disturb the integrity of the sediment surface.
11. Document sample observations.
12. Collect the upper 12 cm of material from the sampler using a stainless steel scoop or spoon. Take care not to include any material that has been in contact with any interior sampler surface.
13. Thoroughly rinse the interior of the sampler until all loose sediment has been washed off.
14. Repeat the sampling process until sufficient sediment volume is obtained to satisfy the volume requirements for the laboratory analysis. Collect successive grab samples, if necessary, within a radius of 3 meters of the targeted station coordinates.
15. Homogenize the bulk sediment with a stainless steel spoon or heavy-duty, variable-speed drill with stainless steel stirring paddle until the sediment appears uniform in color and texture.
16. Distribute homogenized sediment to appropriate laboratory-supplied sample containers and make certain that sample labels are completely filled out and affixed to the containers.
17. Clean the exterior of all sample containers and store them in an ice chest at approximately 4°C, away from the immediate work area.
18. Thoroughly decontaminate the sampler by following the procedure in Section 3.5.
19. Make sure that all logbook entries are complete.
20. Proceed to the next sampling location.

1.7 SAMPLE TRANSPORTATION AND HANDLING

The transportation and handling of soil, groundwater, surface water, and sediment samples was accomplished in a manner that not only protected the integrity of the sample, but also prevented any detrimental effects due to release of samples. Samples were kept in coolers on ice until delivery to the analytical laboratory. At the end of each day, samples were logged on a Chain-of-Custody (COC) form. The COC accompanied each shipment of samples to the laboratory.

1.8 SAMPLE CUSTODY AND DOCUMENTATION

Adequate sample custody was achieved by means of approved field and analytical documentation. Such documentation included the COC record that was initially completed by the sampler and was thereafter, signed by those individuals who accept custody of the sample

Sample control and COC in the field and during transportation to the laboratory was conducted in general conformance with the procedures described below:

- As few people as possible handled samples.
- Sample bottles were obtained new or pre-cleaned from the laboratory performing the analyses.
- The sample collector was personally responsible for the completion of the COC record and the care and custody of samples collected until they were transferred to another person or dispatched properly under COC rules.
- The coolers in which the samples were shipped were accompanied by the COC record identifying their contents. The original record and laboratory copy accompanied the shipment (sealed inside the shipping container). The other copy was forwarded to Landau Associates along with sample collection forms.
- Coolers were sealed with strapping tape and custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information was entered in the "remarks" section of the COC record.

When samples were transferred, the individuals relinquishing and receiving the samples signed the COC form and recorded the date and time of transfer. The sample collector signed the form in the first signature space. Each person taking custody observed whether the shipping container was correctly sealed and in the same condition as noted by the previous custodian.

1.9 EQUIPMENT DECONTAMINATION

The decontamination procedures described below were used by field personnel to clean drilling, sampling, and related field equipment.

1.9.1 SAMPLING EQUIPMENT

All used sampling equipment (e.g., stainless-steel bowls, stainless-steel spoons, hand augers, and Geoprobe core samplers, and hollow-stem auger split spoon samplers) were cleaned using a three-step process, as follows:

1. Surfaces of equipment that were in contact with the sample were scrubbed with brushes using an Alconox solution.
2. Equipment was rinsed and scrubbed with clean tap water.
3. Equipment was rinsed a final time with deionized water to remove tap water impurities.

Decontamination of the reusable sampling devices occurred between collection of each sample.

1.9.2 HEAVY EQUIPMENT

Heavy equipment (e.g., drilling rigs and drilling equipment used downhole, or equipment that contacts material) was cleaned with a hot water, high pressure wash before each use and at completion of the project. Potable tap water was used as the cleansing agent.

1.10 RESIDUAL WASTE MANAGEMENT

This section describes the management of the soil cuttings, well development water, purge water, and decontamination water generated during soil boring and well installation, well development, and groundwater sampling.

1.10.1 SOIL CUTTINGS

Soil cuttings from boreholes were temporarily stored in 55-gal drums. Soil cuttings from the monitoring well installation were segregated from the soil cuttings associated with the gasoline UST and SB-20 area investigations because the soil cuttings from the monitoring wells are not expected to be contaminated. Because Geoprobe investigations do not generate a significant volume of soil cuttings, a single drum will likely be sufficient for the UST and SB-20 investigation areas. Three to four drums will likely be required for the monitoring well cuttings.

Disposal of the soil cuttings was completed in accordance with appropriate regulations. Separate soil composite samples were collected from the materials in the drum containing the cuttings from the UST and SB-20 investigations, and the drums containing the monitoring well cuttings. Each composite sample was analyzed for parameters required for disposal.

1.10.2 DECONTAMINATION WATER, PURGE WATER, AND MONITORING WELL DEVELOPMENT WATER

Decontamination water, purge water, and monitoring well development water generated during soil and groundwater sampling and monitoring well installation were temporarily stored in 55-gal drums. Disposal methods were determined based on the analytical results for the groundwater samples.

1.10.3 RESIDUAL SEDIMENT

Excess sediment generated during sediment sampling was returned to the water at the station where it was collected.

1.11 UTILITY LOCATE

Prior to conducting subsurface explorations, the public utility locate service was contacted to locate underground utilities at the perimeter of the property. A private utility locate service was contracted to clear all exploration locations not located in the public right-of-way.

1.12 SURVEYING

Landau Associates personnel surveyed the location of each exploration using DGPS equipment to facilitate accurate placement of these features on project figures and drawings. Landau Associates also survey the vertical elevation of the new monitoring wells using land surveying equipment with the existing well reference elevations as the datum. Surveying was accomplished after site investigation activities were completed. To assist in relocating the sampling locations, a piece of masking tape with the sample designation noted on it was secured to the exploration location at the time of sampling.

2.0 REFERENCES

ASTM. 1998. Report: *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)* D 2488-93 *and Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System)* D 2487-93. American Society for Testing and Materials.

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EPA. 1986. Report: *Test Methods for Evaluating Solid Waste.* SW-846, Third Edition, with most recent updates. U.S. Environmental Protection Agency.

Landau Associates. 2005. Report: *Ecology Review Draft, Remedial Investigation/Feasibility Study, Weldcraft Steel and Marine (Gate 2 Boatyard), Bellingham, Washington.* January 14.

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS [2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:		> 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and	≤ 50% - "very gravelly," "very sandy," "very silty," etc.
	> 15% and	≤ 30% - "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and	≤ 15% - "with gravel," "with sand," "with silt," etc.
		≤ 5% - "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

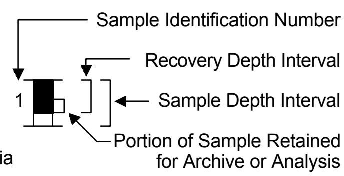
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

- ▽ Approximate water level at time of drilling (ATD)
- ▼ Approximate water level at time other than ATD

4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024-230.GPJ SOIL CLASS SHEET

LANDAU ASSOCIATES

Weldcraft Steel & Marine
Bellingham, Washington

Soil Classification System and Key

Figure B-1

MW-10

SAMPLE DATA / SOIL PROFILE / GROUNDWATER

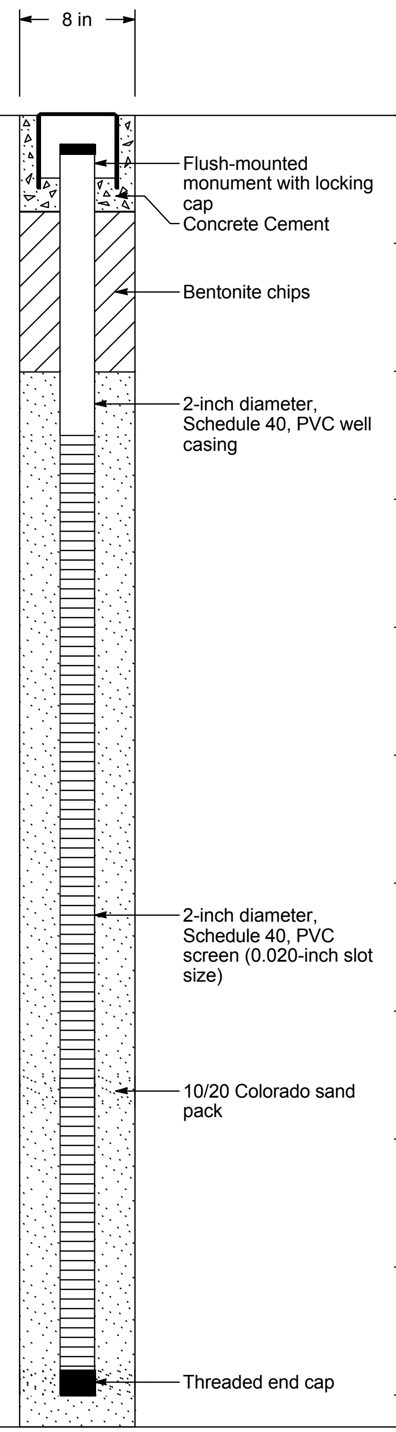
Drilling Method: Hollow-stem Auger

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Description	Water Level
0					SW	Gray to dark gray, gravelly medium to coarse SAND with cobbles (medium dense, damp to wet) (no odor, no stain) (FILL)	
5–6.5		a2	15	0			
7.5							ATD
10–11		a2	78/ 12"	0			
12.5					SW/ SP	Dark gray, silty, gravelly fine to medium SAND (no odor, no stain) (very dense, wet)	
15–16		a2	76/ 12"	0			
20–20.5		a2	50/ 6"	0		-Decreasing gravels (5%-15%) and silt (<5%)	

Monitoring Well Detail



Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Monitoring Well MW-10

Figure B-2 (1 of 2)

MW-10

SAMPLE DATA				SOIL PROFILE			GROUNDWATER

Depth (ft) | Sample Number & Interval | Sampler Type | Blows/Foot | PID (ppm) | Graphic Symbol | USCS Symbol | Water Level

Drilling Method: Hollow-stem Auger

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Monitoring Well Detail

Boring Completed 05/09/06
Total Depth of Boring = 20.5 ft.

Monitoring Well Completed 05/09/06
Elevation at Top of Monitoring Well Casing = 14.14 ft.
Total Depth of Monitoring Well = 20.5 ft.

22
24
26
28
30
32
34
36
38
40
42

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Monitoring Well MW-10

Figure B-2
(2 of 2)

MW-11

SAMPLE DATA | SOIL PROFILE | GROUNDWATER

Drilling Method: Hollow-stem Auger

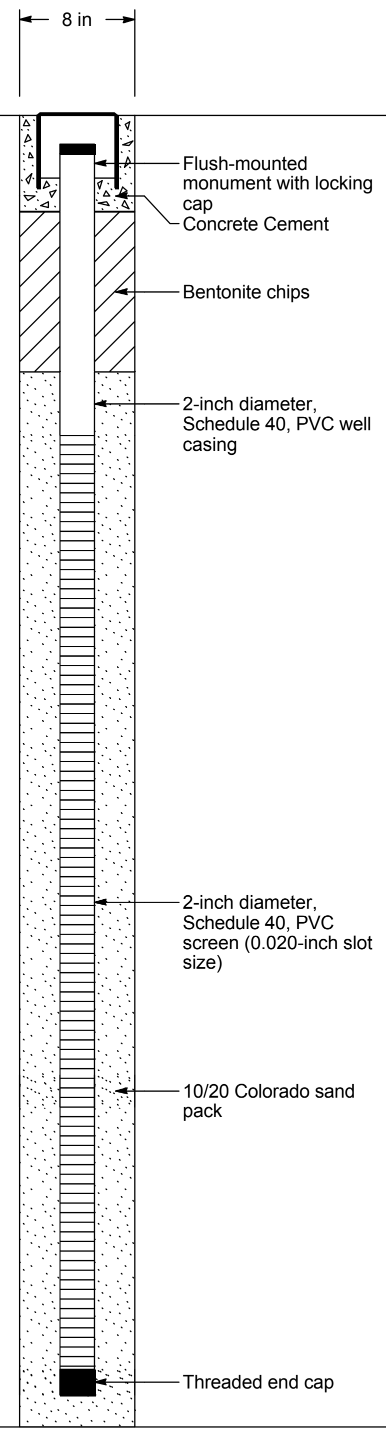
Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Description
0					SW	Gray, very gravelly well graded SAND (no odor, no staining) (medium dense, moist)
5–6.5		a2	31	0		
5.5					SP	Brown well sorted fine SAND with wood debris (staining from wood, no hydrocarbon stain or odor) (medium dense, moist)
8.2					SM	Brown to gray, fine to medium SAND with silt and shell fragments (black staining from 2-inches to 14-inches of 10' to 11.5' sample collected, no hydrocarbon odor or sheen) (moist to wet)
10–11.5		a2	20	0		
13.2					GM	Gray to dark gray silty fine to medium sandy GRAVEL/gravelly SAND with small to large shell fragments (no odor, no stain) (very dense, wet)
15–16.5		a2	34	0		
20–20.5		a2	50/ 6"	0		

Water Level: ATD ∇ (approx. 7.5 ft)

Monitoring Well Detail



Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ WELL LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Monitoring Well MW-11

Figure B-3
(1 of 2)

MW-11

SAMPLE DATA				SOIL PROFILE			GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Water Level	Monitoring Well Detail

Drilling Method: Hollow-stem Auger

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Boring Completed 05/09/06
Total Depth of Boring = 20.5 ft.

Monitoring Well Completed 05/09/06
Elevation at Top of Monitoring Well Casing = 13.76 ft.
Total Depth of Monitoring Well = 20.5 ft.

22
24
26
28
30
32
34
36
38
40
42

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ WELL LOG

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Monitoring Well MW-11

Figure B-3
(2 of 2)

MW-12

SAMPLE DATA / SOIL PROFILE / GROUNDWATER

Drilling Method: Hollow-stem Auger

Ground Elevation (ft):

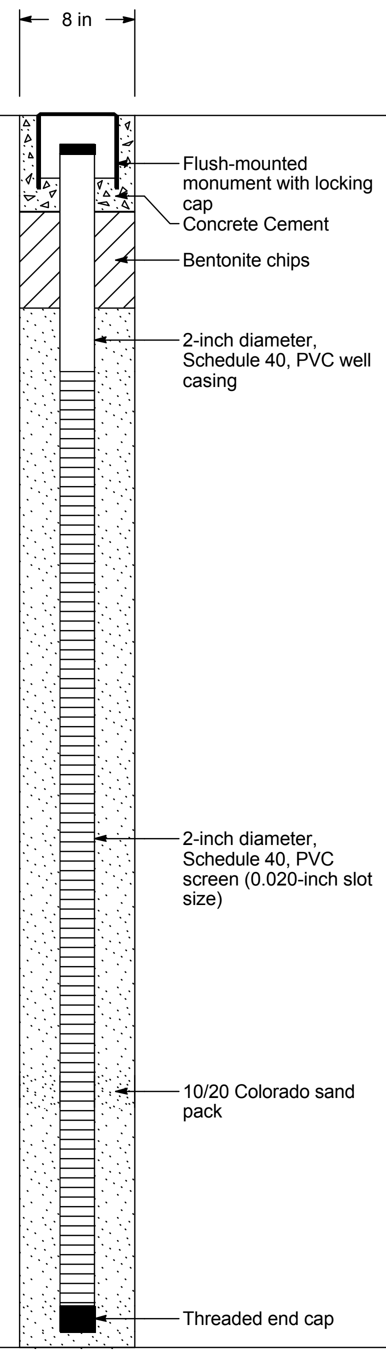
Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)
~5–6.5		a2	29	0
~10–11.5		a2	25	0
~15–16.5		a2	31	0

USCS Symbol	Description
AC	Asphalt Concrete
SW	Dark brown to dark gray gravelly well-graded medium to coarse SAND (medium dense, damp to wet) (no odor, no stain) (FILL)
SM	Dark brown to black silty, gravelly well graded fine to coarse SAND (medium dense, wet) (no odor, no stain) (FILL)
GP	Gray to black gravelly coarse SAND
SM	Gray silty, gravelly SAND

Water Level: ATD

Monitoring Well Detail



Boring Completed 05/09/06
Total Depth of Boring = 19.3 ft.

Monitoring Well Completed 05/09/06
Elevation at Top of Monitoring Well Casing = 13.86 ft.
Total Depth of Monitoring Well = 19.3 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ WELL LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Monitoring Well MW-12

Figure B-4

SB-34

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland Concrete Cement	
						SW	Black to gray, medium to coarse SAND with trace gravel (no odor) (loose, damp)	
2		g3		8.9				
4							-Decreasing medium sand, grading to higher percentage coarse sand	
6		g3		2.2			-Black to brown to orange WOOD DEBRIS in sand matrix	
8				17.2				∇ ATD
10	SB-34	g3				SM	Gray, silty fine to medium SAND with trace gravel	
12								

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-34

Figure B-5

SB-35

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland Concrete Cement	
						SW	Dark gray to gray, gravelly medium to coarse SAND (loose, damp to moist)	
2		g3		3.1				
4								
						WD	WOOD DEBRIS (slight hydrocarbon odor, no stain) (hard, moist)	
6						SW	Gray, gravelly medium to coarse SAND (loose, damp to moist)	
						WD	WOOD DEBRIS (slight hydrocarbon odor, no stain) (hard, moist)	
8		g3		II 38.2		SW	Gray to dark gray to black, medium to coarse SAND with gravel (moderate hydrocarbon odor) (loose, moist to wet)	
10	SB-35	g3						∇ ATD
12								

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site Bellingham, Washington	Log of Boring SB-35	Figure B-6

SB-36

SAMPLE DATA | SOIL PROFILE | GROUNDWATER

Drilling Method: Geoprobe™
Ground Elevation (ft):
Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Description	Water Level
0					PC	Portland Concrete Cement	
					SW	Gray, gravelly fine to coarse well-graded SAND with trace shell fragments. Various gray to black bands ranging in thickness from 2 to 8 inches within sand. Small (1/4-inch) chunks of coal-like material in sand at 9.5 to 12 ft bgs. (strong hydrocarbon odor in coal-like material at 9.5 ft bgs) (loose, damp to wet) (FILL)	
2		g3		29.5			
4							
6		g3		26.6			
8				1292		-Moderate hydrocarbon odor	
							ATD
						-Strong hydrocarbon odor	
10	SB-36	g3					
12							

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

14
16
18
20

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

SB-37

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland Concrete Cement	
						SW	Gray, medium SAND with shell fragments (loose, damp to wet)	
2		g3		15.8				
4								
6		g3		33.6				
							-Black coal-like material found in sand matrix from 7ft to 10.5 ft bgs	
8							-Moderate hydrocarbon odor	
				1608				
							-Strong hydrocarbon odor	∇ ATD
10	SB-37 SB-37B	g3						
12								

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site Bellingham, Washington	Log of Boring SB-37	Figure B-8

SB-38

SAMPLE DATA | **SOIL PROFILE** | **GROUNDWATER**

Drilling Method: Geoprobe™

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Description	Water Level
0					PC	Portland Concrete Cement	
					SW/SP	Gray to black, gravelly fine to coarse SAND (loose, damp to wet) (FILL)	
2		g3		5.6		-Alternating gray to black color	
4							
6		g3		12.6		-Small (2 to 3-inch) piece of wood debris	
						-Shell fragments	
						-Small (1/4-inch) pieces of coal-like material	
8				156		-Moderate hydrocarbon odor	ATD
10	SB-38	g3					
12							

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

14

16

18

20

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-38

Figure B-9

SB-39

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland Concrete Cement	
						SW	Brown to black to dark gray, very gravelly medium to coarse SAND (loose, damp to wet)	
							-No odor, no sheen	
2		g3		29.3				
							-Slight hydrocarbon odor	
4								
6		g3		33.7				
							-Shell fragments with a slight hydrocarbon odor	
8				1023				
							-Moderate hydrocarbon odor	▽ ATD
10	SB-39	g3						
12								

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

14

16

18

20

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-39

Figure
B-10

SB-40

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Description	Water Level
0						PC	Portland Concrete Cement	
						SW	Gray to black, gravelly fine to coarse well-graded SAND (no odor, no stain) (loose, damp)	
2		g3		0.2				
6		g3		1.5		SW	Gray, fine to medium SAND with gravel (no odor, no stain) (loose, damp to wet)	
8				8.6				ATD
10	SB-40	g3						
12								

Drilling Method: Geoprobe™

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

SB-41

Drilling Method: Geoprobe™
Ground Elevation (ft):
Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Soil Profile	Water Level
0					PC	Portland Concrete Cement	
					SM	Gray, gravelly, fine to medium SAND (damp, loose)	
2		g3		0			
4				26			
						-Shell fragments	
6	SB-41	g3			COL	2-inch layer of black coal-like material (moist, loose)	
					SM	Gray, gravelly, fine to medium SAND (damp, loose)	
8							ATD
					COL	Black coal-like material (moist, loose)	
10		g3		15.9	SP	Gray, medium SAND with abundant shell fragments	
12							

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

SB-42

SAMPLE DATA					SOIL PROFILE		GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Description	Water Level
0					PC	Portland Concrete Cement	
					SM	Gray to black, fine to medium SAND with gravel (loose, damp)	
2		g3		<1			
4							
6		g3		<5	COL	2-inch layer of black coal-like material (moist, loose)	
					WD	Wood debris	
					SP	Gray, medium SAND (moist, loose)	
					COL	Sandy, black, coal-like material (moist, loose) (slight hydrocarbon odor)	
8				52	COL	Black, coal-like material with sand (moist to wet) (moderate hydrocarbon odor)	ATD
10	SB-42	g3					
					SP	Black, gravelly medium SAND (wet)	
12							

Drilling Method: Geoprobe™

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-42

Figure B-13

SB-43

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Soil Profile	Water Level
0					PC	Portland Concrete Cement	
					SW	Gray, fine to medium SAND with gravel (loose, moist)	
2		g3		<1			
4							
					SW	Alternating layers of gray, fine to medium SAND and black COAL-like material (loose, moist) (slight hydrocarbon odor)	
6		g3		10.2			
					SP	Gray SAND	
					SP	Black SAND with wood debris (loose to medium dense, moist)	
8				32.6	SP	Gray SAND	ATD
					COL	Black, COAL-like material with sand (wet)	
10	SB-43	g3					
					SP	Dark gray, SAND with grael and shell fragments	
12							

Drilling Method: Geoprobe™

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Boring Completed 05/08/06
Total Depth of Boring = 12.0 ft.

Depth scale: 14, 16, 18, 20

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-43

Figure B-14

SB-44

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	
0						AC	Asphalt Concrete	Groundwater not encountered.
	SB-44 -0-1	g3				GW	Gray to dark gray, sandy GRAVEL (loose, damp) (fill)	
	SB-44 -1-2	g3						
2	SB-44 -2-3	g3						

Boring Completed 05/08/06
Total Depth of Boring = 3.0 ft.

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-44

Figure B-15

SB-45

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	
0	SB-45 -0-1	g3				AC	Asphalt concrete	Groundwater not encountered.
						SW	Gray to dark gray, very gravelly, medium to coarse SAND (loose, damp) (fill)	
	SB-45 -1-2	g3						
2	SB-45 -2-3	g3						

Boring Completed 05/08/06
Total Depth of Boring = 3.0 ft.

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-45

Figure
B-16

SB-46

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	
0	SB-46 -0-1	g3				AC	Asphalt concrete	Groundwater not encountered.
						SW	Gray to brown, very gravelly, medium to coarse SAND (loose, damp) (fill)	
	SB-46 -1-2	g3						
2	SB-46 -2-3	g3						

Boring Completed 05/08/06
Total Depth of Boring = 3.0 ft.

Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-46

Figure B-17

SB-47

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Soil Profile	Groundwater
0	SB-47 -0-1	Hand auger			AC	Asphalt concrete	Groundwater not encountered.
	SB-47 -1-2	Hand auger			SW	Gray to dark gray, gravelly, fine to coarse SAND with trace silt (loose, damp) (fill)	
2	SB-47 -2-3	Hand auger					

Drilling Method: Hand Auger

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Boring Completed 05/08/06
Total Depth of Boring = 3.0 ft.

Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-47

Figure B-18

SB-48

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Hand Auger Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	
0						AC	Asphalt concrete	
	SB-48 -0-1	Hand auger				GW	Gray, medium sandy, medium to coarse GRAVEL (loose, damp) (fill)	Groundwater not encountered.
2	SB-48 -1-2	Hand auger						
	SB-48 -2-3	Hand auger					-decreasing coarse gravel	

Boring Completed 06/29/06
Total Depth of Boring = 3.5 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-48

Figure B-19

SB-49

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Hand Auger Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	
0						AC	Asphalt concrete	Groundwater not encountered.
	SB-49 -0-1	Hand auger				GW	Dark gray grading to dark brown with depth, fine to medium sandy, GRAVEL (loose, damp) (fill)	
2	SB-49 -1-2	Hand auger						
	SB-49 -2-3	Hand auger						

Boring Completed 06/29/06
Total Depth of Boring = 3.5 ft.

Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-49

Figure B-20

SB-50

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Hand Auger Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	
0						AC	Asphalt Concrete	Groundwater not encountered.
	SB-50 -0-1	Hand auger				SW	Dark brown, fine to medium SAND with trace gravel (loose, damp to wet) (fill)	
2	SB-50 -1-2	Hand auger						
	SB-50 -2-3	Hand auger						

Boring Completed 06/29/06
Total Depth of Boring = 3.5 ft.

Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-50

Figure B-21

SB-51

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Hand Auger Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	
0						AC	Asphalt concrete	
	SB-50 -0-1	Hand auger				SW	Dark brown, fine to medium SAND with gravel (loose, moist) (fill)	Groundwater not encountered.
							-Refusal at 1.25 ft below asphalt	

Boring Completed 06/29/06
Total Depth of Boring = 1.3 ft.

2
4
6
8
10
12
14
16
18
20

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-51

Figure B-22

SB-52

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	
0						PC	Portland concrete cement	Groundwater not encountered.
						SW	Gray, gravelly, SAND with occasional black laminates (approximately 0.5-inch thick each) (loose, damp)	
2		g3						
4		g3						

Boring Completed 06/30/06
Total Depth of Boring = 5.0 ft.

-Refusal at 5 ft bgs due to large wood debris

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-52

Figure
B-23

SB-53

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland concrete cement	
						SP	Gray to brown to black, gravelly SAND (loose, damp) (fill)	
2		g3		0				
6		g3		0		COL	Black, COAL-like material with medium sand and some wood debris (loose, moist) (fill)	
				0				
10	SB-53 -9-10	g3						▼ ATD
12								

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-53

Figure B-24

SB-54

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland concrete cement	
						SW	Alternating black to gray, gravelly SAND (loose, damp) (fill)	
2		g3		0				
6		g3		0				
						COL	Black, crushed, COAL-like material (loose, moist to wet) (fill)	
				0				
10	SB-54 -9-10	g3						ATD
						SM	Black, fine to medium SAND with gravel (loose, wet)	
12								

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-54

Figure B-25

SB-55

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Soil Profile	Water Level
0					PC	Portland concrete cement	
					SW	Dark gray, gravelly SAND (loose, damp) (fill)	
2		g3		0			
6		g3		6.9			
					COL	Black, crushed, COAL-like material (loose, damp to wet) (fill)	
				1021			
10	SB-55 -10-11	g3					ATD
					SW	Brown, fine to medium SAND (loose, wet)	
12							

Drilling Method: Geoprobe™

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-55

Figure B-26

SB-56

Drilling Method: Geoprobe™
Ground Elevation (ft):
Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Soil Profile	Water Level
0					PC	Portland concrete cement	
					SW	Gray, medium to coarse gravelly, medium to coarse SAND (loose, damp to wet) (fill)	
2		g3		0			
6		g3		0.9			
						-Shell fragments and decreasing gravels	
10		g3		0	SP	Dark gray, medium gravelly, medium SAND (loose, damp to wet)	ATD
						-Drill point pushing rocks, no recovery between 10.25 to 12 ft bgs. No sample.	
12							

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-56

Figure B-27

SB-57

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland concrete cement	
						SP	Gray to black, medium SAND with abundant gravel and coal-like material (loose, damp) (fill)	
2		g3		0				
4								
6		g3		0.3			-Some alternating block to gray bands of sand (black sands have shell fragments) -Occasional coarse gravels	
8								
				0.3				
10	SB-57 -10-11	g3						ATD
12								

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

14
16
18
20

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-57

Figure B-28

SB-58

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	
0						PC	Portland concrete cement	Groundwater not encountered.
						SP	Gray to black medium SAND with gravel (very dense, damp) (fill)	
2		g3						
4	(sample 4–4.5)							
6		g3						
							-Some wood debris in bottom of sampler	
8								

Boring Completed 06/30/06
Total Depth of Boring = 8.0 ft.

Depth scale: 10, 12, 14, 16, 18, 20

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-58

Figure B-29

SB-59

SAMPLE DATA | **SOIL PROFILE** | **GROUNDWATER**

Drilling Method: Geoprobe™

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Description	Water Level
0					PC	Portland concrete cement	
					SP	Gray to black, medium SAND with gravel and trace shell fragments (loose, damp to moist) (fill)	
2		g3		0			
6		g3		0.1			
				0.7			
10	SB-59 -10-11	g3			SW	Black, fine to medium SAND with coal-like material (loose, wet) (fill)	ATD
12							

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-59

Figure B-30

SB-60

SAMPLE DATA | **SOIL PROFILE** | **GROUNDWATER**

Drilling Method: Geoprobe™

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Description	Groundwater
0						PC	Portland concrete cement	
						SP	Gray to black, gravelly medium SAND (loose to medium dense, damp to moist)	Groundwater not encountered.
2		g3		0				
4								
6		g3		0				
8								

Boring Completed 06/30/06
Total Depth of Boring = 8.0 ft.

-Refusal on wood debris at 8 ft bgs

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-60

Figure
B-31

SB-61

SAMPLE DATA					SOIL PROFILE		GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0					PC	Portland concrete cement	
					SW	Gray to black, fine to coarse gravelly, medium to coarse SAND (loose, damp to wet) (fill)	
2		g3		0			
6		g3		0		-grades to grown and gray	
8				2.3			
10	SB-61 10-11	g3				-some coal-like material with a slight hydrocarbon odor encountered in sands between 9.5 and 12 ft bgs	ATD
12							

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-61

Figure B-32

SB-62

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	USCS Symbol	Soil Profile	Water Level
0					PC	Portland concrete cement	
					SW	Gray to black to brown, fine gravelly, fine to medium SAND (loose, damp to wet)	
2		g3		0			
6		g3		0			
				2.6			
						-increasing fine sands	
10	SB-62 -10-11	g3					ATD
						-some coal-like material	
12							

Drilling Method: Geoprobe™

Ground Elevation (ft):

Drilled By: Cascade Drilling Inc.

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-62

Figure B-33

SB-63

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland concrete cement	
						SW	Gray, fine to medium gravelly, fine to medium SAND (loose, damp to moist) (fill)	
2		g3		0				
6		g3		0				
				4.3				
						COL	Black, COAL-like material with sand (loose, moist to wet) (fill)	ATD
10	SB-63 -9-10	g3				SW	Black to gray, fine to medium gravelly, fine to medium SAND (loose, wet)	
12								

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-63

Figure B-34

SB-64

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland concrete cement	
						SP	Gray, medium to coarse gravelly, medium SAND (loose, damp to wet) (fill)	
2		g3		0				
6		g3		0				
				0				
10	SB-64-9.5-10.5	g3						ATD
12								

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-64

Figure
B-35

SB-65

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland concrete cement	
						SP	Gray to dark gray, medium gravelly, medium SAND (loose, damp) (fill)	
2		g3		0				
6		g3		0				
						COL	Black COAL-like material with sand	
8				0		SP	Alternating layers (approximately 1/4" to 1/2" thick) of medium sand and black coal-like material (loose, moist to wet)	
10	SB-65-9-10	g3						ATD
						SP	Dark gray, medium SAND (loose, wet)	
12								

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

Landau Associates

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-65

Figure B-36

SB-66

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland concrete cement	
						SW	Gray, fine to medium gravelly, medium SAND (loose, damp to wet)	
2		g3		0				
6		g3		0				
8				0				
10	SB-66-9-10	g3						ATD
12								

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site
Bellingham, Washington

Log of Boring SB-66

Figure B-37

SB-67

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	PID (ppm)	Graphic Symbol	USCS Symbol	Drilling Method: Geoprobe™ Ground Elevation (ft): Drilled By: Cascade Drilling Inc.	Water Level
0						PC	Portland concrete cement	
						SP	Gray, gravelly, medium SAND (loose, damp to wet) (fill)	
2		g3		0				
4								
6		g3		0				
8								
				0				
10	SB-67-10.5-11.5	g3						
							-shell fragments	ATD
12								

Boring Completed 06/30/06
Total Depth of Boring = 12.0 ft.

Notes: 1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1024.20 4/3/09 \\EDMDATA\GINT\GINT7\PROJECTS\001024.200.270.GPJ SOIL BORING LOG

LANDAU ASSOCIATES

Weldcraft Steel & Marine (Gate 2 Boatyard) Site Bellingham, Washington	Log of Boring SB-67	Figure B-38

APPENDIX C

Interim Action Completion Report

Interim Action Completion Report
Sediment Remediation and Redevelopment Project
Weldcraft Steel and Marine (Gate 2 Boatyard) Site
Bellingham, Washington

August 18, 2006

Prepared for

Port of Bellingham
Bellingham, Washington

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APPENDICES

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1.0 INTRODUCTION

This interim action completion report documents the implementation of the sediment remediation and redevelopment project at the former Weldcraft Steel and Marine (Gate 2 Boatyard) site (Site) at the Port of Bellingham (Port) in Bellingham, Washington. A Site vicinity map is shown on Figure 1, and a project area Site map with an aerial photograph taken prior to conducting the interim action is shown on Figure 2.

The sediment interim action was conducted by the Port under Agreed Order No. DE 03TCPBE-5623 issued by the Washington State Department of Ecology (Ecology), which has an effective date of July 15, 2003. Project activities were conducted in accordance with the Ecology-approved Interim Action Work Plan (Landau Associates 2003a), which was prepared in accordance with Ecology's Model Toxics Control Act regulations (MTCA; WAC 173-340-430) and the Washington State Sediment Management Standards (SMS; WAC 173-204; Ecology 1995).

The interim action was also consistent with the goals of the Bellingham Bay Comprehensive Strategy. The Site was one of several sediment cleanup sites identified in the final Environmental Impact Statement (FEIS; Anchor Environmental 2000) developed under the Bay-wide Demonstration Pilot.

The primary objectives of the Gate 2 Boatyard sediment remediation and redevelopment project were to:

- Remediate contaminated sediments impacted by boatyard activities of the Port's former Site tenant, Weldcraft Steel and Marine
- Implement Site repairs and improvements necessary to allow continuing Site use as a water-dependent boatyard by the Port's new tenant, Seaview North Boatyard, Inc.
- Provide significant new marine habitat in the project vicinity, in addition to compensatory mitigation to address habitat losses associated with sediment dredging and Site improvements
- Beneficially use dredged material from the U.S. Army Corps of Engineers (USACE) maintenance dredging of the Squalicum Creek Waterway for construction of the new marine habitat bench along the existing Federal breakwater.

This report has been prepared for Ecology to document the satisfactory completion of the sediment interim action and Site redevelopment construction activities, and meets the Agreed Order requirements for an interim action completion report. The overall objective of this report is to document that the sediment remediation and marine habitat bench construction activities were completed in overall conformance with the Interim Action Work Plan, the Site preliminary cleanup levels based on the SMS Sediment Quality Standards, project permits and approvals, and the construction drawings and technical specifications included with the Port's contact documents (Port of Bellingham 2003). Brief summaries of the various Site redevelopment activities that were not part of the MTCA cleanup action are also included in this report for documentation purposes.

Project permits and approvals associated with the Gate 2 Boatyard sediment remediation and redevelopment project included the following:

- Clean Water Act (CWA) Section 404 Individual Permit No. 200201330, issued by the USACE, dated July 29, 2003, as modified on February 13, 2004 to extend the in-water construction period from February 15, 2004 to March 1, 2004
- Hydraulic Project Approval (Log No. ST-F7729-01) issued by the Washington State Department of Fish and Wildlife (WDFW) on June 9, 2003
- Water Quality Certification/Modification Order #03SEAHQ-5664 issued by Ecology on July 22, 2003, and First Amendment dated August 21, 2003
- City of Bellingham Building Permit No. BLD2003-00225 issued August 1, 2003 and Public Works Permit No. PBW2003-00932 issued August 1, 2003
- Authorization for a Habitat Bench in PMA #22-080025, Parcel 2, issued by the Washington State Department of Natural Resources (WDNR) dated July 18, 2003.

This interim action was focused on the in-water portion of the Site. Upland remediation will be addressed separately, following completion of a Site-wide remedial investigation/feasibility study (RI/FS) also being conducted under the Agreed Order between the Port and Ecology.

Section 2.0 of this report presents a summary of Site conditions. Section 3.0 presents a summary of the interim action construction activities. Section 4.0 presents a summary of sediment quality monitoring associated with the interim action. Section 5.0 presents the Professional Engineer's statement regarding implementation of the interim action. Section 6.0 presents the references for this document.

2.0 SITE CONDITIONS

This section presents a summary of Site conditions relevant to the Gate 2 Boatyard sediment remediation and redevelopment project. Additional details are presented in the Interim Action Work Plan (Landau Associates 2003a) and the Site-wide RI/FS report (Landau Associates 2005).

2.1 SITE LOCATION

The Site is located on Port property just south of Squalicum Way at Section 25, Township 38 North, Range 2 East, within and adjacent to Squalicum Outer Harbor in Bellingham, Washington, as shown on the Site map on Figure 2. The street address for the current Site tenant (Seaview North Boatyard) is 2652 Harbor Loop Drive, Bellingham, Washington, 98225.

2.2 SITE HISTORY

Historic fire insurance maps from 1904 and 1913 show the Site area was undeveloped tidelands of Bellingham Bay. In the 1920s, the area was filled with material dredged during construction of the Squalicum Creek Waterway. By the 1940s and 1950s, various large businesses began operation in the filled areas along the waterway. Construction of the existing Federal breakwater and dredging of the Squalicum marina area to Elevation -12 ft mean lower low water (MLLW) occurred in the early 1950s.

The Port became owner of the Site in 1927. Weldcraft Steel and Marine (Weldcraft) first leased the Site in 1946 and operated primarily as a shipyard that conducted boat construction, repair, and maintenance; vessel haul-out and launching; marine pipefitting; sheet metal work; painting; and other various shipyard activities.

The Port's lease with Weldcraft was terminated in February 2000 and the Port obtained full operational control of the Site in July 2000. The Site has been occupied by the Port's current tenant, Seaview North Boatyard, since April 2002.

2.3 SITE FEATURES PRIOR TO THE INTERIM ACTION

Site features that existed prior to the interim action are shown on Figure 3 and are summarized below, with an emphasis on Site features within the nearshore work areas versus the upland portions of the Site. A discussion of how the Site features were modified during the interim action is presented in Section 3.0. The relationship between true north and plan north used for the project is indicated on Figure 3 and other plan view figures.

The upland portion of the Site is relatively flat with a ground surface between about Elevation 13 and 15 ft MLLW. A preconstruction bathymetric survey of the near-shore marine area was performed by Blue Water Engineering of Seattle, Washington in October 2001. The horizontal survey data were referenced to Washington State plane coordinates - north zone (NAD 83), and the vertical data were referenced to MLLW datum. The bathymetric survey data were supplemented by spot mudline elevation measurements made by Landau Associates. The resulting preconstruction bathymetric contours are shown on Figure 3 and Drawings C-1 and C-2 in Appendix A.

A timber bulkhead had been constructed along the waterfront on the north and east sides of the Site to support the upland fill areas adjacent to Squalicum Outer Harbor. The timber bulkhead was constructed with creosote-treated timber piles that support horizontal timber lagging with tieback rods and deadman anchors at most pile locations. The bulkhead alignment was subdivided into three segments (A, B, and C) for Port planning purposes, as indicated on Figure 3. The bulkhead lengths for Segments A, B, and C are approximately 144 ft, 222 ft, and 258 ft, respectively. About 176 ft of bulkhead along the north side of the Site is covered by the Segment C timber wharf.

A marine railway structure had been constructed from the upland railway well area (approximately 30 ft wide by 100 ft long) into the water about 235 ft beyond the timber bulkhead, as indicated on Figure 3. The marine railway was supported on creosote-treated timber piles, with timber pile caps and stringers supporting the two steel rails. The sides of the marine railway well were supported by timber piles and lagging supplemented with concrete side walls along a portion of the structure. A concrete-lined vault at the east end of the railway well housed the winch and cable assemblies used to move the railway platform along the marine railway.

The existing 35-ton travel lift piers are supported on pairs of creosote-treated timber piles with timber cross bracing, and the timber and steel carrier beams extend about 77 ft beyond the timber bulkhead. The north travel lift float is a timber structure that extends about 350 ft beyond the timber bulkhead and is secured by fifteen timber piles.

The Segment C wharf located along the north side of the Site is a creosote-treated timber pile-supported structure with timber decking, stringers, pile caps, and cross bracing. The wharf is approximately 30 ft wide and 176 ft long, as indicated on Figure 3. A small shop building is situated on the eastern side of the wharf and extends upland onto the gravel surfaced area beyond the alignment of the Segment C bulkhead, as shown on Figure 3.

The upland areas to the east of the Segment B bulkhead contained several small sheds, the boatyard buildings, open storage and work areas, parking areas, and a grass bioswale, as indicated on Figure 3. The area north of the railway well was a gravel surfaced storage area, while the areas south of the railway well were paved with asphalt concrete. The upland areas to the east of the Segment A bulkhead contain structures and paved parking areas associated with the Squalicum Yacht Club and the Bellingham Yacht Club.

Several active and inactive stormwater outfall pipes extended through the timber bulkhead on the north and east sides of the Site, as indicated on Figure 3. Additional discussion of Site outfalls is provided in the Site-wide RI/FS report (Landau Associates 2005).

2.4 SITE ENVIRONMENTAL CONDITIONS

Site environmental investigations conducted within the interim action area, and environmental conditions that existed prior to the sediment interim action, are discussed in detail in the Interim Action Work Plan and are briefly summarized below.

The objective of the sediment investigations was to evaluate the horizontal and vertical extent of sediment contamination resulting from the presence and release of wastes or hazardous substances associated with previous Site activities. Many of the sediment samples underwent analysis for SMS metals, semivolatile organic compounds (SVOC), bulk butyltins including tributyltin (TBT), and total organic carbon (TOC). Sediment quality was evaluated based on SMS sediment quality standards (SQS) and cleanup screening levels (CSL). The SQS represents the concentration below, which no adverse affects should occur. The CSL represents the concentration above which more than minor adverse affects may occur. SQS and CSL have not been developed for TBT, so Site-specific cleanup levels were developed with the review and concurrence of Ecology.

Sediment quality exceedances were identified only in surface sediment samples and sediment core samples collected from 0.1 to 4 ft below the mudline. TBT and mercury were determined to be the most common constituents of concern in Site sediment. Bulk TBT concentrations tended to decrease from surface to subsurface sediment, indicating TBT was a more recent contaminant. Mercury concentrations tended to increase from surface to subsurface sediment, indicating mercury was an historical contaminant. Other sediment quality exceedances at the Site, excluding the organic and inorganic exceedances in the marine railway area, consist of copper, bis(2-ethylhexyl)phthalate (BEP), and fluoranthene.

Marine railway well exceedances included metals (arsenic, cadmium, copper, lead, mercury, zinc, and bulk TBT), numerous low and high molecular weight polycyclic aromatic hydrocarbons (PAHs), BEP, dibenzofuran, and n-nitrosodiphenylamine. The concentrations of gas-, diesel-, and oil-range total petroleum hydrocarbons (TPH) were also elevated in the railway sample.

Based on the distribution of Site sediment contamination, as generally indicated on Figure 4, the marine railway well area appeared to be the primary source of sediment contamination. To a lesser extent, the 35-ton travel lift area may have also contributed to sediment contamination in the past. Available data did not suggest that the existing storm drain outfalls were a significant source of Site sediment contamination.

2.5 INTERIM ACTION CLEANUP LEVELS

The primary constituents of concern were TBT and mercury. Other hazardous substances that exceeded the SQS, excluding the numerous organic and inorganic exceedances in the railway sample, consist of copper, BEP and fluoranthene. The SQS, and the Site-specific TBT no-effects cleanup level (79 µg/kg), were the sediment cleanup levels used for the interim action. The interim action sediment cleanup levels for the constituents of concern are presented in Table 1.

3.0 SUMMARY OF INTERIM ACTION CONSTRUCTION ACTIVITIES

This section presents a summary of the interim action construction activities performed by the Port's selected contractor, American Construction Company of Everett, Washington and its subcontractors. A summary of construction monitoring and oversight activities conducted by the Port and its independent quality assurance team is also included in this section.

A half-size set of the interim action construction drawings is included in Appendix A. Record drawings documenting as-constructed conditions for the sediment remediation and marine habitat bench components of the interim action are presented in Appendix B. Selected construction photographs are included in Appendix C. Field reports, record drawings, submittals, photographs, and notes documenting the work are being maintained by the Port and its subconsultants in accordance with the Agreed Order requirements.

3.1 PURPOSE OF THE INTERIM ACTION

The purpose of the interim action was to remediate contaminated sediment affected by the activities of the prior Site tenant, Weldcraft Steel and Marine. The sediment remediation activities were conducted in conjunction with redevelopment of the boatyard facility for use by Seaview North Boatyard. The interim action and redevelopment activities were conducted in accordance with the Interim Action Work Plan and consistent with the goals of the Bellingham Bay Comprehensive Strategy, including cleanup of a high priority contaminated sediment site and construction of a high priority habitat restoration site identified in the FEIS (Anchor Environmental 2000) developed under the Bay-wide Demonstration Pilot. Additionally, the interim action and redevelopment activities removed or isolated a significant amount of creosoted timbers and piling from the marine environment, consistent with the goals of the Whatcom County Marine Creosoted Piling Remediation Program (Ecology 2002).

The interim action consisted of the following four major in-water construction elements:

- Removal of the marine railway structure to facilitate dredging of contaminated sediments
- Installation of a new steel sheetpile bulkhead in front of the Segment B timber bulkhead where contaminated sediments were removed
- Sediment dredging to remove contaminated sediment above the SQS, and
- Construction of new marine habitat bench along the Squalicum Outer Harbor breakwater to address habitat losses associated with post-construction dredge depths and the location of the new bulkhead.

In conjunction with these interim action activities, the following Site redevelopment activities were implemented:

- Construction of a 150-ton travel lift pier to replace the marine railway
- Additional sediment dredging to attain adequate vessel drafts (at least Elevation -10 ft MLLW) in the vicinity of the new 150-ton travel lift
- Installation of a new cantilevered steel sheetpile bulkhead in front of the Segment A timber bulkhead
- Repair of the Segment C timber bulkhead along the north shoreline
- Repair/replacement of damaged timber piles associated with the Segment C wharf and timber bulkhead and the north travel lift float, and
- Repair/replacement of selected structural elements of the Segment C wharf.

3.2 COMPLIANCE MONITORING

In accordance with MTCA requirements in WAC 173-340-410, the project Compliance Monitoring Plan (Landau Associates 2003b) was developed for the interim action activities and was included as Appendix C to the Interim Action Work Plan. Compliance monitoring activities for the project included:

- Protection monitoring to confirm that human health and the environment were adequately protected during interim action construction
- Performance monitoring to confirm that the interim action attained the sediment cleanup standards established for the project and other performance standards (such as construction quality control monitoring necessary to demonstrate compliance with project permits), and
- Confirmational monitoring to confirm the long-term effectiveness of the interim action once the cleanup standards and other performance standards were attained.

3.2.1 HEALTH AND SAFETY

The Site-specific Health and Safety Plan used by Landau Associates and certain Port personnel was included as Exhibit C of the project contract documents. American Construction prepared and implemented its own Site Health and Safety Plan for the project.

3.2.2 SURFACE WATER QUALITY MONITORING

Surface water quality monitoring was performed by both Landau Associates and Port personnel in accordance with the Compliance Monitoring Plan and the Water Quality Certification/Modification Order and First Amendment issued by Ecology.

Background water quality monitoring was conducted on September 10, 2003 prior to the start of in-water construction activities. The two background locations selected for the project (sample sites A and F) were located near the entrances to Squalicum Outer Harbor, as shown on the sketch in Appendix D. The results of the water quality monitoring conducted during the interim action, as previously reported to Ecology, are also included in Appendix D.

3.2.3 SEDIMENT PERFORMANCE MONITORING

The results of sediment quality monitoring performed in conjunction with the interim action sediment dredging and excavation activities are discussed in Section 4.0.

3.3 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

This section summarizes the overall construction quality assurance/quality control (QA/QC) activities and the construction coordination process used during the work. Representatives from the Port, Landau Associates, and Geiger Engineers had primary responsibility for overall construction QA activities. American Construction had primary responsibility for QC of their contracted work. Ecology representatives also conducted periodic Site visits, review of selected submittals, and participated in progress meetings during project implementation.

Construction QA activities were conducted in general accordance with the construction quality assurance plan (CQA Plan), included as Exhibit D to the project contract documents (Port of Bellingham 2003), for the purpose of verifying and documenting that the work was performed in general conformance with the project plans, technical specifications, and construction drawings.

American Construction and their subcontractors were responsible for overall planning and QC of their contracted work. They were responsible for verifying that materials supplied for the work were properly produced or fabricated in compliance with design requirements, monitoring their construction activities, performing necessary testing/sampling/surveying activities, and documenting their work.

American Construction and their subcontractors provided a variety of submittals, shop drawings, construction plans, and material samples and certifications as required by the contract documents. The Port and its representatives reviewed these submittals for overall compliance with the construction drawings and technical specifications. If a submittal was not sufficient or did not represent materials or procedures that complied with the work requirements or the overall intent of the design, American Construction was notified verbally or by written submittal review form. The Port and its representatives also responded to written requests for information and coordinated with American Construction personnel on a frequent basis to respond to verbal questions and comments. The submittal review process and coordination between the Port and American Construction personnel was considered successful in correcting deficiencies in proposed materials or procedures prior to installation or implementation in the field, as well as for adjusting construction methods and sequences when needed to account for Site constraints and conditions encountered during performance of the work.

3.4 INTERIM ACTION CONSTRUCTION SUMMARY

American Construction conducted the in-water work during the agency-approved construction window from September 1, 2003 to March 1, 2004. Due to scheduling concerns, the Port requested an extension of the originally approved date for completion of in-water work activities, and the USACE modified the Section 404 Individual Permit on February 13, 2004 to extend the in-water construction period from February 15 to March 1, 2004.

The in-water and over-water construction and Site redevelopment activities are described in more detail in the following sections.

3.4.1 MARINE RAILWAY DEMOLITION/REMOVAL

The primary purpose for removal of the marine railway was to provide access for dredging of underlying sediment and allow construction of the new 150-ton travel lift finger piers along the railway alignment. American Construction demolished and removed most of the marine railway structure, the adjacent mooring piles, and the Segment C wharf fender piles during the period from September 23 to 25, 2003. A barge-mounted mechanical clamshell was used to pull the creosote-treated timber piles, pile caps, and stringers and offload the debris onto an adjacent flat-deck materials barge. The demolition debris was then cut to appropriate lengths and transported for disposal at Rabanco's Roosevelt Regional Landfill in Goldendale, Washington. The steel components of the marine railway platform and the steel rails were salvaged or recycled.

American Construction deployed a silt curtain around the work area, and water quality monitoring was conducted by the Port and Landau Associates to confirm that removal of the marine railway did not cause an exceedence of the project water quality criteria. The results of the water quality monitoring during removal of the marine railway structure are included in Appendix D.

3.4.2 Sediment Removal, Disposal, and Backfilling

Contaminated sediment removal areas included the designated area west of the new sheetpile bulkhead and the entire marine railway well area east of the new sheetpile bulkhead, as indicated on Figure 4. The planned sediment dredging depths shown on Figure 5 and Drawing C-2 in Appendix A were developed to remove the upper 4 ft of sediment within the identified zone of contamination, to the extent practicable given existing Site constraints, as well as to attain adequate vessel drafts (at least Elevation -10 ft MLLW) in the vicinity of the new 150-ton travel lift. The new Segment B sheetpile bulkhead was installed prior to dredging in front of, and excavating behind, the bulkhead to avoid undercutting and destabilizing the existing timber bulkhead. A total of 6,983 yd^3 of sediment was removed from the Site and disposed at Rabanco's Roosevelt Regional Landfill.

3.4.2.1 Marine Area Dredging

Sediment dredging in the marine area was conducted by American Construction during the period between December 24, 2003 and February 5, 2004 to remove contaminated sediment and to achieve minimum vessel draft requirements for access to the new travel lift. Sediment dredging was conducted using barge-mounted mechanical clamshell dredge equipment, with the dredged material placed on an adjacent barge. Due to the lack of a sufficient number of flat deck barges, American Construction alternately loaded one flat deck barge and one closed bottom dump barge for transportation to the offsite sediment offloading facility. Free water released from sediment placed on the flat deck barge was allowed to drain back to surface water in the work area, with geotextile filter material placed along the side boards of the barge to limit loss of material and control turbidity. Free water released from sediment placed in the closed bottom dump barge was mixed and offloaded with the dredged materials.

The design sediment dredging contours are shown on Figure 5; however, based on the results of initial sediment performance monitoring conducted on January 28, 2004, the Port directed the contractor to dredge additional sediment in the area directly in front of the bulkhead constructed across the former marine railway well. This additional dredging was conducted on February 5, 2004 over an area approximately 60 ft wide and approximately 65 to 73 ft out from the sheetpile bulkhead, and down to approximately Elevation -12 ft MLLW instead of the original design dredge cuts of Elevation -10 ft to -11 ft MLLW in this area.

To avoid adverse undercutting of the slope under the Segment C wharf and in the adjacent unshaded intertidal area, the toe of the dredge cut was offset approximately 12 to 13 ft south to allow the cutslope to daylight near the southern the edge of the wharf, as indicated on Figures 4 and 5. Following sediment dredging in this area, the contractor's progress survey (at Section X_000) showed that some slope material under the Segment C wharf had sloughed into the excavation. This area was subsequently redredged to full depth, but slope material continued sloughing into the excavation, as indicated on the final progress survey (see Appendix B). As agreed by Ecology, this slough material was left in place pending additional sediment performance monitoring. A sample (SPM-12) was collected along the Segment C wharf and analyzed to characterize the slough material (see Section 4.0).

American Construction deployed a silt curtain around most of the marine dredging work areas, and water quality monitoring was conducted by the Port and Landau Associates to confirm that sediment dredging activities did not cause an exceedence of the project water quality criteria. The results of the water quality monitoring during marine sediment dredging are included in Appendix D.

American Construction's surveying subcontractor, CRA-NW Survey Services, performed periodic bathymetric progress surveys to confirm that marine dredging achieved the design dredge depths. These data were reviewed by the Port and Landau Associates as part of construction QA activities. The final progress survey data is included in Appendix B. Based on the survey data, 6,536 yd^3 of sediment was removed from the marine dredging area, including overdredge material and 288 yd^3 of additional dredging that occurred in the area in front of the former marine railway well. This volume is consistent with the design dredge prism with a typical 6-inch overdredge.

3.4.2.2 Marine Sediment Offloading and Disposal

American Construction initially planned to transport the barges of sediment to Hazco's Ecowaste landfill in Richmond, Canada, which had been identified as one of the three pre-approved upland disposal sites. Hazco subsequently proposed to dispose of the sediments at the Mount Waddington Regional District landfill (the 7-Mile Landfill) near Port McNeil on Vancouver Island, but could not provide documentation regarding the adequacy of the landfill for disposal of the dredged material. This, combined with a significant increase in proposed disposal costs due to a stronger Canadian dollar, left the project needing another disposal alternative. American Construction subsequently proposed to transport the barges of sediment to an offsite location in Seattle and/or Everett for offloading and disposal at Rabanco's Roosevelt Regional Landfill in Goldendale, Washington. The Port and Landau Associates coordinated with USACE and Ecology representatives, and on January 5, 2004 received concurrence from the USACE that no modification to the Section 404 individual permit was necessary for this minor modification.

American Construction ultimately decided to offload the majority of the sediment at the Alaska Logistics site pier located along the Duwamish River at 6365 1st Avenue South in Seattle. As directed by the Port and Ecology, Landau Associates' personnel made periodic visits to the offloading facility to observe that American Construction and its subcontractors used sufficient environmental controls (e.g., synthetic liners, straw bales, etc.) to contain and collect minor spillage during the material transfer operations. A land-based crane with a mechanical clamshell bucket was used to transfer the dredged material from the barges to trucks which transported the material to Rabanco's 4th and Lander Street transfer station in Seattle for subsequent disposal at Rabanco's Roosevelt Regional Landfill. Once unloaded, the barges were returned to the Site and refilled. The sediment offloading activities occurred during the period from January 8 to about January 29, 2004. The haul trucks were decontaminated at Rabanco's transfer station, and the synthetic liner materials, the wood decking on the concrete pier, and some potentially contaminated soil at the end of the pier were removed and trucked to the transfer station for disposal at the landfill. The clamshell bucket used for sediment offloading and the barges were eventually decontaminated by removing any residual material at the offloading facility, followed by a final cleanout at the Site.

The last barge of sediment, containing the 288 yd^3 of additional material that was dredged in the area in front of the former marine railway well on February 5, 2004, remained covered at the Site until it was transported to a pier at American Construction's south yard facility at the Port of Everett in late April 2004. The sediment offloading activities occurred on April 27 and 28, 2004, using a barge-mounted crane with a mechanical clamshell bucket to transfer the relatively dry dredged sediment to trucks which transported the material to Rabanco's 4th and Lander St. transfer station in Seattle for subsequent disposal at Rabanco's Roosevelt Regional Landfill. As with the Seattle offloading facility, Landau Associates' personnel made periodic visits to confirm that American Construction used sufficient environmental controls (e.g., synthetic liners, etc.) to contain and collect minor spillage during the material transfer operations. The haul trucks were decontaminated at Rabanco's transfer station, and the synthetic liner materials and some potentially contaminated soil at the end of the pier were removed and trucked to the transfer station for disposal at the landfill. The clamshell bucket and barge were decontaminated at American Construction's facility.

3.4.2.3 Marine Area Backfilling

Marine areas of the Site that were dredged to below Elevation -13 ft MLLW were backfilled up to approximately Elevation -13 ft MLLW with clean imported gravelly sand backfill material, which contained about 17 percent fine gravel and about 83 percent fine to coarse sand. Marine area backfilling activities were conducted on February 4 and 5, 2004. The sand backfill was delivered to the Site by barge and placed with a clamshell bucket. Based on CRA-NW survey data, 1,139 yd^3 of sand backfill was placed in the designated marine areas, with backfill thicknesses ranging from approximately 0.5 to 4 ft. The sediment backfill areas and post-interim action bathymetry are indicated on Figure 6, and on the plan and profile record drawings in Appendix B.

3.4.2.4 Marine Railway Well Excavation and Backfilling

Sediment excavation within the marine railway well was conducted by American Construction and its subcontractors during the nights of January 20 to 21, 2004 in order to conduct the minimum 4-ft deep excavation "in the dry" during low tide, to the extent practicable. Land-based earthwork equipment was used to excavate sediment and remove debris (including creosote-treated piles that supported the former railway structure) located within the marine railway well, starting at the new bulkhead and proceeding in an upland direction. The material was loaded directly into trucks which transported the material to Rabanco's 4th and Lander Street transfer station in Seattle for subsequent disposal at Rabanco's Roosevelt Regional Landfill. Based on CRA-NW survey data, 447 yd^3 of sediment and debris was removed from the marine railway well.

Due to concerns for undercutting and destabilizing the sidewalls of the railway well, quarry spalls and some overlying structural fill was placed in portions of the excavation directly after removal of the contaminated sediment. This was possible because, with Ecology concurrence, two test pits had been excavated below the base of the railway well on January 15, 2004 to determine if the planned 4-ft cut depth would be sufficient to remove the contaminated sediment in the well. Sediment performance samples SPM-7 and SPM-11 were collected at a depth of 4-ft in the two test pits and analyzed to determine if material left at that depth would achieve the sediment cleanup action levels (see Section 4.0). Onsite observations were made by Port and Landau Associates personnel during excavation of the railway well to confirm that the minimum cut depth was achieved and that additional sediment that was cross-contaminated during material excavation and handling was removed for disposal.

Note that a flat-top fiberglass tank (approximately 4-ft wide by 6-ft long by 2-ft deep) was encountered in the upper/eastern portion of the marine railway well in October 2003 following removal of some of the railway stringers and pile caps. Sampling and analysis of the water and sediment in the tank was conducted by Landau Associates to help guide decisions regarding handling and disposal of the tank contents. The sampling results, which were previously reported to Ecology, confirmed that the tank sediment could be managed as a solid waste and that the water in the tank could be disposed along with the sediment removed from the railway well. This fiberglass tank was removed during excavation of the sediment and debris in marine railway well.

Following installation of the deadman anchors and associated tieback rods, the remainder of the area behind the new sheetpile bulkhead was backfilled with structural fill up to about Elevation 14 ft MLLW and subsequently graded and paved with asphalt concrete to support wheel loads associated with the new 150-ton travel lift hoist.

3.4.3 BULKHEAD REPLACEMENT

Approximately 368 feet of new galvanized-steel sheetpile bulkhead was installed about 3 ft in front of (i.e., waterward of) the existing creosote-treated timber pile and lagging bulkhead along the east shoreline. Segment A is within the Site boundary and is approximately 144 ft long and Segment B is south of the Site boundary and is approximately 222 ft long. This bulkhead replacement work was conducted both to facilitate sediment dredging and as part of the Port's Site redevelopment.

The steel sheetpile sections were driven to design depth with a vibratory hammer mounted on a barge-based crane. The alignment of the new sheetpile bulkhead was modified slightly by American Construction to avoid certain conflicts with existing facilities along the shoreline, but the new bulkhead was installed as generally indicated on Figure 7 and as detailed on Drawings S1.0 through S1.3 in Appendix A.

The new Segment B sheetpile bulkhead along the east side of the dredge area closed off the former marine railway well and utilized deadman anchors in the railway well area and helical tieback anchors along the remaining portions to stabilize the bulkhead structure. A.B. Chance® helical tieback anchors were installed by American Construction's subcontractor, Davis Construction Services, Inc., prior to installation of the sheet piling. This activity involved cutting holes in the timber lagging and using a land-based, backhoe-mounted hydraulic torque motor to screw the helical anchors into the fill and native materials behind the existing bulkhead. Due to the presence of debris and a previously unknown wooden bulkhead segment encountered behind the existing timber bulkhead, considerable caving of existing backfill and soil occurred behind the existing bulkhead, which resulted in the need to remove the existing bioswale and additional fill behind the bulkhead. These areas were eventually backfilled with structural fill material and the bioswale was reconstructed as part of Site restoration activities.

The new Segment A sheetpile bulkhead was a cantilevered structure that tied into the existing steel sheetpile bulkhead near the Bellingham Yacht Club building.

The existing Segment A and B timber bulkheads were left in place behind the new steel sheetpile bulkhead segments. The space between the existing and new bulkheads was backfilled with imported, free flowing gravel fill material up to about 2- to 3-ft below existing upland Site grades. Following installation of a geotextile separation layer, the upper portion between the walls was backfilled with topsoil and planted with various shrubs; however, in the areas near the two travel lifts that were eventually paved, this upper portion was backfilled with structural fill and crushed rock.

3.4.4 NEW 150-TON TRAVEL LIFT INSTALLATION

Following removal of the marine railway and marine sediment dredging activities, the finger piers associated with the new 150-ton travel lift were installed as generally indicated on Figure 7 and as detailed on Drawings S2.0 through S2.2 in Appendix A. Each concrete finger pier is approximately 6 ft wide and 145 ft long, with an average 105-ft length extending out beyond the alignment of the new bulkhead, and each finger pier has a 2.5-ft wide open-grated walkway and a handrail attached to the outer edge of the pier.

The two finger piers are supported by 26 2-ft diameter, open-ended, galvanized steel pipe piles driven with pile driving hammers and leads mounted on a barge-based crane. All the vertical and battered piles were installed with a vibratory hammer, except that the last 10 feet of the vertical piles were driven with an impact hammer to help confirm that adequate pile capacities had been obtained. In accordance with project permit requirements, the steel piles installed with an impact hammer were surrounded with an air bubble curtain system to mitigate the potential adverse effect of pile driving on fish that may have been in the work area.

3.4.5 SEGMENT C BULKHEAD REPAIRS

The portion of the timber bulkhead located under the Segment C wharf that received lagging repair is shown on Figure 7. The repairs consisted of installing vertical metal channels along the existing piles and attaching ammoniacal copper zinc arsenate (ACZA)-treated wood lagging between the channels, waterward of the existing lagging. The nominal 4-inch space between the old and new lagging was backfilled with clean, imported granular fill material. These repairs are detailed on Drawing S3.0 in Appendix A.

The Segment C timber bulkhead also contained two timber piles (Nos. 79 and 85) with less than 90 percent remaining cross sectional area that were repaired by removing the wharf decking near each damaged pile, using pile driving equipment to install galvanized steel H-piles on both sides of each damaged pile, and installing a galvanized channel to secure these H-piles to the existing tieback rod. This timber bulkhead pile repair is detailed on Drawing S3.0 in Appendix A.

3.4.6 TIMBER PILE REMOVAL, REPLACEMENT, AND REPAIRS

Based on previous underwater pile condition surveys performed for the Port in 2002, certain timber piles at the Site with less than 90 percent remaining cross sectional area were replaced with driven ACZA-treated timber piles, including:

- Six piles under the Segment C wharf
- All 16 fender piles along the south side of the Segment C wharf
- All 15 piles supporting the north travel lift float (only 5 were damaged, but all were replaced after temporary relocation of the float during sediment dredging activities).

Certain timber piles no longer in use were pulled out of the sediment or cut off below the final mudline elevation. These include piles supporting the marine railway, certain mooring piles, and various derelict pile stubs located adjacent to the Segment C bulkhead. Piles or pile segments that were removed were cut to appropriate lengths and transported for disposal at Rabanco's Roosevelt Regional Landfill.

3.4.7 SEGMENT C WHARF REPAIRS

In addition to the pile repair/replacement activities discussed above, certain structural repairs were made to the existing Segment C wharf as part of Site redevelopment. The wharf rehabilitation activities, as detailed on Drawings S3.0 and S3.1 in Appendix A, included repair/replacement of selected timber pile caps, stringers, decking, chocks, bull railing, and timber cross bracing.

3.4.8 MARINE HABITAT BENCH CONSTRUCTION

Various in-water dredging and filling activities at the Site were estimated to result in the loss of about 0.18 acre of intertidal habitat (above Elevation -4 ft MLLW) and about 0.23 acre of shallow subtidal habitat (between Elevation -4 ft and -10 ft MLLW), and an increase of about 0.46 acre of deep subtidal habitat (below Elevation -10 ft MLLW). In accordance with the project permit requirements, these impacts were mitigated by construction of a new marine habitat bench along the west (seaward) side of the Squalicum Outer Harbor federal breakwater, which is consistent with the habitat restoration goals and objectives of the Comprehensive Strategy for Bellingham Bay. The selected habitat restoration site was one of the high priority habitat action sites identified in the FEIS (Anchor Environmental 2000), and was constructed to provide significant habitat restoration in addition to compensatory mitigation.

The general location and configuration of the new marine habitat bench is shown on Figures 2 and 8. The goal of the marine habitat bench construction was to initially create a minimum of 2 acres of shallow subtidal habitat above Elevation -10 ft MLLW, including a minimum of 1 acre of habitat between Elevation -4 and -6 ft MLLW. Construction of this new habitat bench resulted in at least a 2:1 compensation ratio to address project impacts, plus additional habitat to concurrently fulfill enhancement and restoration objectives and ensure maintenance of compensatory habitat over time. The physical success criteria for the marine habitat bench is that, after 5 years, a minimum of 1 acre of shallow subtidal habitat above Elevation -10 ft MLLW is maintained, including a minimum of 0.5 acres of habitat above Elevation -6 ft MLLW.

Construction of the marine habitat bench was the result of a collaborative effort between the USACE and the Port, and included beneficial use of maintenance dredge material from the nearby Squalicum Creek Waterway as habitat bench fill material. Only sediment from Squalicum Creek Waterway dredge material management units (DMMUs) that exhibited chemical concentrations below the SQS was used as habitat bench fill material. Based on data available from the Puget Sound Dredge Disposal Analysis (PSSDA) sediment characterization report (Striplin Environmental 2000) and other construction considerations, it was decided to use only dredged material from DMMUs C5 through C11 for marine habitat bench construction. The majority of this dredged material was fine-grained silt to clayey silt with greater than about 90 percent material passing the U.S. No. 200 sieve. This material was considered highly desirable for habitat bench construction because the fine-grained material and organic content is expected to provide excellent colonization potential for aquatic invertebrates and eelgrass.

The USACE's maintenance dredging contractor, Manson Construction, used clamshell dredge equipment and bottom dump barges to load, transfer, and place the dredged material at the designated location along the federal breakwater during early January 2004. Manson Construction's survey boat and crew monitored habitat bench fill placement activities, and data from marine surveys conducted on January 15, 22, and 23, 2004 were used to create the as-constructed habitat bench contour plan shown on Figure 8. This figure shows that the habitat bench was constructed larger than the initial construction goals. It is estimated that approximately 39,000 yd^3 of dredged material was placed during habitat bench construction (as compared to the original estimate of about 30,000 to 35,000 yd^3). Based on the January 2004 survey data, about 4.5 acres of shallow subtidal habitat above Elevation -10 ft MLLW was created (as compared to the initial goal of at least 2 acres), about 2.3 acres of habitat above Elevation -6 ft MLLW was created (as compared to the initial goal of at least 1 acre between Elevation -4 and -6 ft MLLW), and about 0.55 acres of habitat above Elevation -4 ft MLLW was created. Future bathymetric surveys of the marine habitat bench in years 1, 2, 3, 5, and 10 will be used to document the stability of the habitat bench over time.

Because of the fine-grained nature of the dredged material, turbidity levels generated during habitat bench fill placement were anticipated to be greater than turbidity levels resulting from Gate 2 Boatyard marine dredging or backfilling activities. Surface water quality monitoring was performed by both Landau Associates and Port personnel to confirm that habitat bench construction did not cause an exceedence of the project water quality criteria. This monitoring was conducted in general accordance with the Compliance Monitoring Plan, the Water Quality Certification/Modification Order and First Amendment issued by Ecology for the Gate 2 Boatyard project, and the Water Quality Certification/Modification Order issued by Ecology for maintenance dredging of the Squalicum Creek Waterway. The results of the water quality monitoring conducted during construction of the marine habitat bench, as previously reported to Ecology, are included in Appendix D.

4.0 SEDIMENT QUALITY MONITORING

Sediment quality monitoring associated with the interim action sediment remediation addressed two objectives: 1) evaluation of the interim action in meeting cleanup standards; and 2) confirmation of the long-term effectiveness of the sediment cleanup action.

Sediment monitoring was accomplished in two main phases. The initial phase was performed in January 2004 and included sampling from 2 test pits excavated in the marine railway well (see Section 3.4.2.4), surface sediment sampling following completion of the planned sediment dredging activities, and sampling of the slough material along the Segment C wharf (see Section 3.4.2.1). Based on the results of the initial phase of sediment monitoring, additional sediment dredging was conducted in February 2004 and additional sediment confirmational monitoring, based on collection of sediment cores, was performed in July 2004.

The remainder of this section consists of summaries of the initial and additional sediment monitoring approaches, the results of the sediment monitoring activities, and comparison of the laboratory results for the initial and additional monitoring activities to the interim action cleanup levels.

4.1 INITIAL SEDIMENT PERFORMANCE MONITORING

Initial sediment performance monitoring was conducted in accordance with the project Sampling and Analysis Plan (SAP; Landau Associates 2003c) to evaluate sediment quality as compared to cleanup standards at locations where contaminated sediments were dredged, as well as at selected locations adjacent to the dredged area. The sampling locations were selected to provide adequate spatial coverage within this area. The initial performance monitoring samples were collected in January 2004 prior to initiation of marine area backfilling activities.

Sediment quality sampling and analysis activities are summarized in Table 2 and consisted of collection of surface sediment from 7 locations within the sediment removal area (SPM-1, SPM-2, SPM-3, SPM-4, SPM-5, SPM-6, and SPM-12), 3 locations outside the sediment removal area (SPM-8, SPM-9, and SPM-10), and two locations from within the marine railway well excavation area (SPM-7 and SPM-11). These sediment performance monitoring locations are shown on Figure 9. Samples were collected from the surface (0 to 12 cm interval) of the existing sediment for all monitoring locations except at locations SPM-7 and SPM-11, where the samples were collected from the lower portion of the sidewalls of 2 test pits advanced below the planned 4-ft sediment excavation depth within the marine railway well.

In accordance with the Compliance Monitoring Plan [(Landau Associates 2003b), included as Appendix C of the Final Interim Action Work Plan], the samples were analyzed for analytes and conventional parameters in accordance with the PSEP guidelines (PSEP 1997a,b,c) and protocols required by the Washington State Sediment Management Standards (SMS; WAC 173-204) (Ecology 1995). These analyses include semivolatile organic compounds (SVOCs) identified on the SMS list of chemical parameters; SMS metals (arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc); bulk organotins [including tributyltin ion (TBT)]; and total organic carbon (TOC) (see Table 2). The samples from the marine railway well area also underwent analysis for TPH using methods NWTPH-Gx and NWTPH-Dx. The analytical results were used to evaluate whether the cleanup levels were met in and adjacent to the dredged area. The chemical testing results of these samples provided a basis for evaluating whether additional dredging or monitoring was appropriate for a particular location.

Subsequent to receipt of analytical results from the initial phase of sediment sampling and discussions with Ecology personnel, marine area backfilling activities were performed by American Construction in the portions of the dredged area where sediment was removed below Elevation -13 ft MLLW (e.g., at sample locations SPM-1 and SPM-2). Backfilling brought the mudline elevations back to approximately Elevation -13 ft MLLW in these areas, as shown on Figure 6 and on the record drawings in Appendix B.

4.2 ADDITIONAL SEDIMENT CONFIRMATION MONITORING

Based on the results of the initial round of sediment performance monitoring and discussions with Ecology personnel, a plan for additional sediment confirmational sampling and analysis was prepared (Landau Associates 2004), approved by Ecology, and implemented in July 2004. The purpose of the additional sampling was to evaluate whether the contamination detected within the dredge prism during the initial round of monitoring was a thin layer of redistributed contamination associated with dredging activities, or indicative of more vertically extensive contamination. An additional goal of the supplementary sampling was to evaluate whether the additional dredging conducted in front of the former marine railway well subsequent to the initial round of sediment sampling achieved cleanup levels in the vicinity of the new travel lift piers. These supplementary samples were collected at locations where the surface sediment samples collected in January 2004 exceeded one or more of the interim action cleanup levels. Sampling consisted of collection of five 7-ft long confirmational core samples at locations SPM-2A through SPM-6A, as shown on Figure 9. Sample locations SPM-3A and SPM-5A were located in the area where additional dredging had occurred subsequent to the initial round of monitoring, although the locations had to be moved slightly because the new 150-ton travel lift piers were installed during the intervening period between the two sampling events.

Subsamples were collected from each core from the following intervals (based on zero being the top of the post-dredging surface or the base of the sand backfill): 0 to 4 inches (0 to 10 cm), 12 to 16 inches, and 24 to 28 inches. Backfill material, if present, was not sampled.

The additional sediment samples were analyzed for mercury. Samples collected from SPM-3 and SPM-5 were also analyzed for TBT, as those were locations where elevated levels of TBT had been detected during the initial sampling round.

4.3 SEDIMENT QUALITY MONITORING RESULTS

This section presents the sediment quality monitoring results, including field methods, laboratory analysis, and comparison to the interim action cleanup levels.

4.3.1 FIELD METHODS

4.3.1.1 Sample Acquisition

Marine area surface sediment samples (SPM-1 through SPM-6, SPM-8 through SPM-10, and SPM-12) were collected in general accordance with the Compliance Monitoring Plan and the SAP. A total of 10 surface sediment samples (0 to 12 cm) were collected using a stainless-steel power grab. The sampling locations (stations) were selected to provide adequate coverage to evaluate compliance within and adjacent to the planned sediment dredging area.

As agreed by Ecology, marine railway well sediment samples SPM-7 and SPM-11 were collected from the lower portion of the sidewalls of 2 test pits advanced below the planned 4-ft sediment excavation depth within the marine railway well. These samples were collected with hand tools on January 15, 2004 in accordance with the SAP.

Sediment cores were collected in general accordance with the Plan for Additional Sediment Confirmation Sampling (Landau Associates 2004). A total of 10 subsurface sediment samples were collected and analyzed from 5 sediment core locations. Subsurface sediment samples were collected using a vibracore with an aluminum core tube attached.

Sediment sampling locations are shown on Figure 9, and the field measured mudline elevations and coordinates are shown in Table 3. As indicated in Table 3, some field measured mudline elevations were slightly deeper than the design finish mudline; however, field measurements were collected by weighted line and tidally corrected, and should be considered approximate.

4.3.1.2 Surface and Subsurface Sediment Sample Processing

Sediment samples were collected from the sampler (power grab, opened core, or hand tool) using a clean stainless-steel spoon and placed in a stainless-steel mixing bowl. Samples were homogenized in the mixing bowl with a clean spoon until the material appeared uniform in color and texture. The homogenized sample was placed in the appropriate sample containers and maintained in a cooler on ice until delivery to the analytical laboratory.

4.3.1.3 Field Observations

Surface sediment field observations (including sample location, sample date, sampler penetration depth, and sediment descriptions) are summarized in Table 4. Field logs for the sediment cores are presented in Appendix E.

4.3.2 LABORATORY ANALYSES

Surface sediment samples from the 10 initial sampling locations within the marine dredging area were analyzed for the constituents identified in Table 2 to evaluate post-dredge surface sediment quality. The two sediment samples collected from the marine railway well area were analyzed for the constituents identified in Table 2. Subsurface confirmational samples from the 5 core sampling locations were analyzed for the constituents that exceeded cleanup levels in the respective surface sediment samples (see Table 2).

Samples were delivered in ice chests at approximately 4°C to the Analytical Resources, Inc. (ARI) laboratory in Tukwila, Washington which conducted the laboratory analyses. The analytical laboratory data for the initial performance and additional confirmational monitoring samples are provided in Appendix F. Landau Associates maintains the laboratory certificates in our project files.

Upon receipt of the laboratory data, Landau Associates performed a data quality evaluation of the analytical results. Data precision was evaluated through matrix spike duplicates and laboratory duplicates, and the accuracy of the data was evaluated through laboratory control samples, surrogate spikes, and matrix spikes. Based on the data quality evaluation, all of the data were determined to be acceptable with no qualifiers. No data were rejected and the completeness for the data was 100 percent.

4.3.3 INITIAL PERFORMANCE MONITORING – COMPARISON TO CLEANUP LEVELS

Table 5 presents the post-dredge surface sediment monitoring results for the Gate 2 Boatyard sediment remediation project. Information presented in Table 5 includes sediment chemical testing results and a comparison to the Sediment Quality Standards (SQS) and the Cleanup Screening Levels (CSL). Table 5 also indicates which sediment samples had constituents that exceeded the SQS or the CSL. The SQS represents the concentration below which no adverse affects should occur, while the CSL represents the concentration above which more than minor affects may occur.

Table 5 shows that the surface sediment samples collected from locations within the marine dredge area (SPM-1, SPM-2, SPM-3, SPM-4, SPM-5, SPM-6, and SPM-12) exceed the SQS or CSL for certain constituents. The exceedances are summarized below:

- **SPM-1** Mercury exceeded the CSL
- **SPM-2** Mercury exceeded the CSL; zinc exceeded the SQS
- **SPM-3*** TBT and PAHs (acenapthylene, fluorene, and phenanthrene) exceeded the SQS
- **SPM-4** Mercury exceeded the CSL; PAHs (acenaphthylene, fluorene, and phenanthrene) and dibenzofuran exceeded the SQS
- **SPM-5*** Mercury and TBT exceed the CSL; PAHs (acenaphthylene, fluorene, phenanthrene, 2-methylnapthalene, LPAH, and fluoranthene) and dibenzofuran exceeded the SQS
- **SPM-6** Mercury exceeded the SQS
- **SPM-12** PAHs (fluoranthene) exceeded the SQS.

* **Note**: Sediment associated with initial samples SPM-3 and SPM-5 was subsequently removed by additional dredging in front of the former marine railway well. The analytical results for SPM-3A and SPM-5A represent current sediment quality in this area, as presented in Table 6.

The analytical results for the three surface sediment samples collected outside the dredged area to assess baseline conditions (SPM-8 through SPM-10) indicate that none of these samples exceed the CSL, as shown in Table 5. However, SMP-8 and SPM-9 exhibited concentrations of mercury that exceeded the SQS.

4.3.4 ADDITIONAL CONFIRMATIONAL MONITORING – COMPARISON TO CLEANUP LEVELS

Chemical testing results for the additional confirmational monitoring samples are provided in Table 6. None of the sediment samples analyzed during the additional confirmational monitoring event exhibited exceedances of the SQS or CSL, except that mercury in SPM-4A (0-4 inches) was detected at a concentration above the CSL.

4.4 CONCLUSIONS

The analytical results for the initial phase of sediment monitoring completed in January 2004 showed that surface sediment exceeded the sediment cleanup levels for some constituents of concern, primarily mercury. The probable cause of these exceedances was redistribution of suspended dredged material during marine dredging activities. However, the possibility that the constituents present in the surface sediment samples represented pre-dredge conditions that could extend to greater depth could not be discounted at that time because only surface samples had been collected.

In the portion of the dredged area associated with the new travel lift pier, represented by initial monitoring results from sample locations SPM-3 and SPM-5, observations by the Port during dredging operations suggested that the exceedances in this area were likely the result of sloughing and spillage of sediment the contractor had not yet dredged along the outside of the adjacent sheetpile bulkhead. As a result, about 290 cy of additional sediment was removed from the SPM-3 and SPM-5 area prior to the additional sediment confirmational monitoring.

The results of the additional sediment confirmational monitoring activities completed in July 2004 indicate the following:

- Because no cleanup level exceedance were detected in core samples collected below surface sediment, post-dredging residual contamination is confirmed as resulting from redistribution caused by dredging activities, and is limited to about the upper 4 inches of sediment.
- Because the additional sediment sampling at SPM-2 and SPM-6 did not reproduce the mercury cleanup level exceedances from the initial round of monitoring, the thin veneer of sediment contamination is either intermittent in coverage or natural recovery processes are already occurring at the Site.
- The additional dredging performed in the vicinity of the new travel lift pier (represented by samples SPM-3A and SPM-5A) was successful in removing contaminated sediment remaining in this area after the first round of dredging.
- Backfilling activities associated with the interim action have covered a large portion of the area where surface sediment exceedances of cleanup levels were detected.

The thin and intermittent nature of residual sediment contamination and relatively low levels of criteria exceedance (less than 2.5 times the preliminary sediment cleanup levels), in conjunction with the limited area over which contaminated sediment is present within the biologically active zone, suggests that the sediment cleanup standards may be achieved through natural recovery for the portion of Site sediment where exceedances remain. This conclusion is supported by sediment data for Bellingham Bay that indicate that the combination of source removal, sedimentation, and bioturbation in the upper 16 cm (6 inches) of sediment have supported natural recovery of mercury-contaminated sediment associated with former releases from the Georgia Pacific Corporation chlor/alkali facility to Bellingham Bay (Patmont, et. al, 2004); the data for that evaluation were collected as part of the RI/FS for the Whatcom Waterway site, which was conducted under the Bay-wide Demonstration Pilot.

Although the sedimentation rate at the Site is likely lower than the rate for Bellingham Bay as a whole because of its location within Squalicum Outer Harbor, the lower initial contaminant concentrations relative to the cleanup levels, and the more limited vertical and areal extent of Site contamination, support an approach that allows sufficient natural recovery to occur at the Site to achieve the sediment cleanup levels within a reasonable restoration time frame. The adequacy of the interim action, and the need for any additional sediment monitoring or cleanup activities, will be evaluated during Site-wide RI/FS. An approach to monitor natural recovery will be incorporated into the Site-wide RI/FS report (Landau Associates 2005).

5.0 PROFESSIONAL ENGINEER'S STATEMENT

Landau Associates was retained by the Port of Bellingham to assist in planning, design, and construction QA oversight for the interim action sediment remediation and redevelopment project at the Weldcraft Steel and Marine (Gate 2 Boatyard) Site in Bellingham, Washington. In that role, Landau Associates, represented by the undersigned, maintained active involvement in the planning and implementation of the various interim action activities, preparation of construction drawings and technical specifications and other project documents, construction QA monitoring and oversight, and documentation of remedial construction activities.

As Landau Associates' representatives, we hereby conclude that, to the best of our knowledge, the interim action construction activities summarized in this report have been satisfactorily completed in substantial compliance with the Interim Action Work Plan, the construction drawings and specifications, and other related documents.

LANDAU ASSOCIATES, INC.

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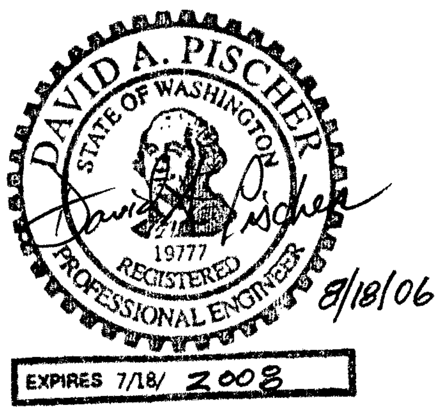
Washington P.E. Certificate/License No. 24755

David A. Pischer, P.E.
Senior Associate
Washington P.E. Certificate/License No. 19777



DAP/LDB/rgm

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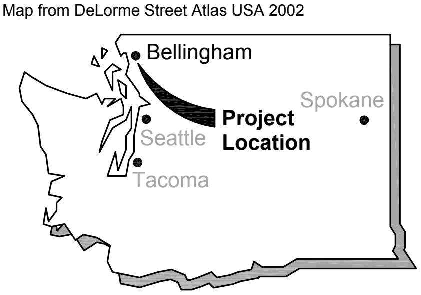
Map from DeLorme Street Atlas USA 2002



Site: Gate 2 Boatyard, Squalicum Harbor
Port of Bellingham
(Former Weldcraft Steel & Marine Site)

Address: 2652 Harbor Loop Drive
(Intersection Squalicum Way and
Harbor Loop Drive)
Bellingham, Washington 98225

Directions: (From Seattle, Washington)
I-5 North
Exit No. 253 (Lakeway Dr.)
Right on King St.
Right on Lakeway Dr./E. Holly St.
Left on "F" St.
Right on Roeder Ave.
Left on Squalicum Way
Left on Harbor Loop Drive

Latitude: 48° 45' 47"
Longitude: 122° 30' 36"

0 2000 4000

Approximate Scale in Feet

Port of Bellingham/Gate 2 Boatyard/Interim Action Completion Report | V:\001\027\261\F\Interim Action Completion Report\Fig1.dwg (A) "Figure 1" 8/17/2006

LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Vicinity Map**	Figure 1

Site: Gate 2 Boatyard, Squalicum Harbor
Port of Bellingham
(Former Weldcraft Steel & Marine Site)

Latitude: 48° 45' 47"
Longitude: 122° 30' 36"

Address: 2652 Harbor Loop Drive
(Intersection Squalicum Way and Harbor Loop Drive)
Bellingham, Washington 98225

0 400 800
Approximate Scale in Feet

Port of Bellingham/Gate 2 Boatyard/Interim Action Completion Report | V:\001\027\261\F\Interim Action Completion Report\Fig2.dwg (A) "Figure 2" 8/17/2006

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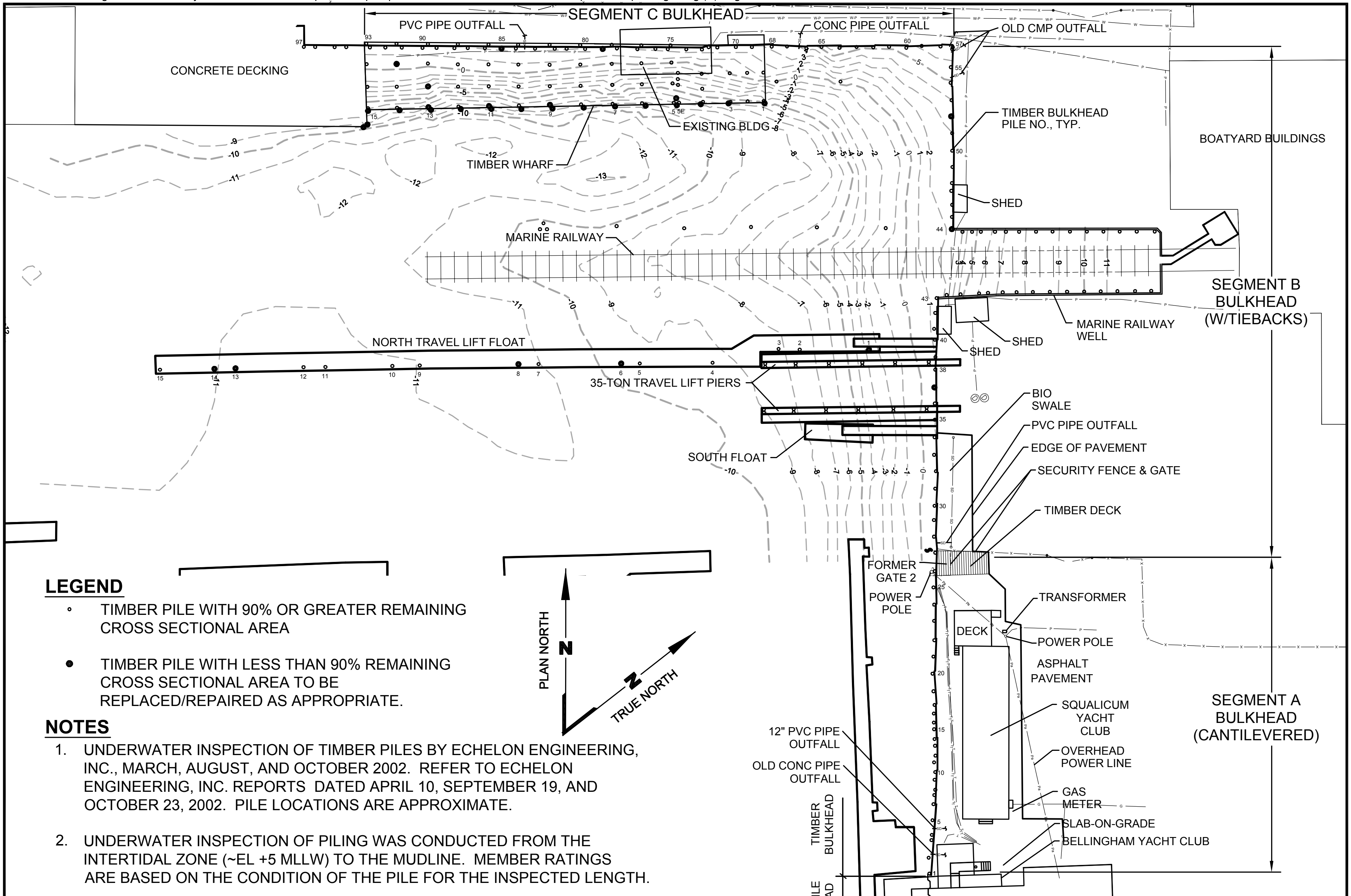
Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Project Area** **Site Map**	Figure 2



LEGEND

- ∘ TIMBER PILE WITH 90% OR GREATER REMAINING CROSS SECTIONAL AREA
- ● TIMBER PILE WITH LESS THAN 90% REMAINING CROSS SECTIONAL AREA TO BE REPLACED/REPAIRED AS APPROPRIATE.

NOTES

1. UNDERWATER INSPECTION OF TIMBER PILES BY ECHELON ENGINEERING, INC., MARCH, AUGUST, AND OCTOBER 2002. REFER TO ECHELON ENGINEERING, INC. REPORTS DATED APRIL 10, SEPTEMBER 19, AND OCTOBER 23, 2002. PILE LOCATIONS ARE APPROXIMATE.
2. UNDERWATER INSPECTION OF PILING WAS CONDUCTED FROM THE INTERTIDAL ZONE (~EL +5 MLLW) TO THE MUDLINE. MEMBER RATINGS ARE BASED ON THE CONDITION OF THE PILE FOR THE INSPECTED LENGTH.

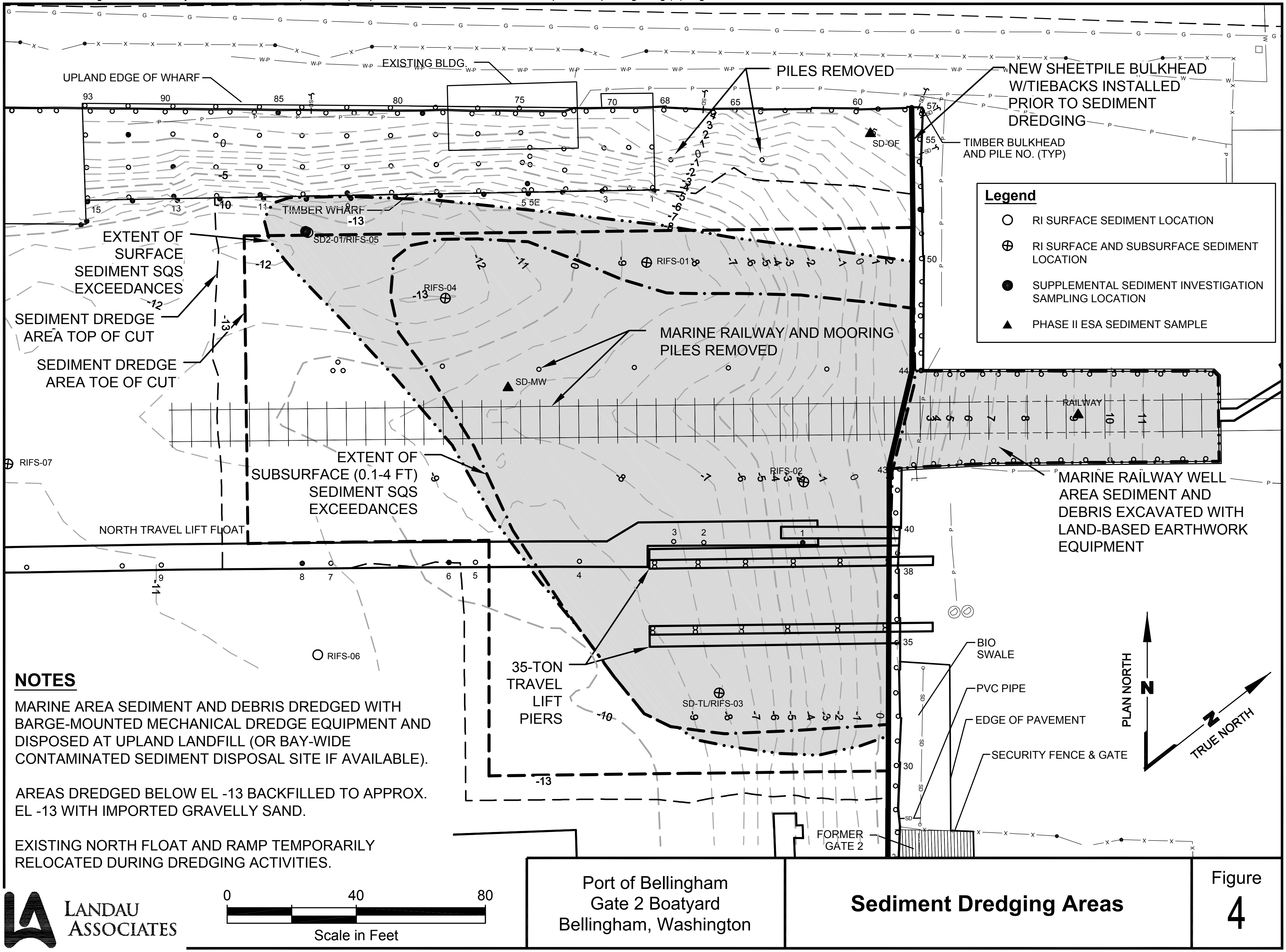
0 60 120
Scale in Feet

LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Former Site Conditions

Figure
3



NOTES

MARINE AREA SEDIMENT AND DEBRIS DREDGED WITH BARGE-MOUNTED MECHANICAL DREDGE EQUIPMENT AND DISPOSED AT UPLAND LANDFILL (OR BAY-WIDE CONTAMINATED SEDIMENT DISPOSAL SITE IF AVAILABLE).

AREAS DREDGED BELOW EL -13 BACKFILLED TO APPROX. EL -13 WITH IMPORTED GRAVELLY SAND.

EXISTING NORTH FLOAT AND RAMP TEMPORARILY RELOCATED DURING DREDGING ACTIVITIES.

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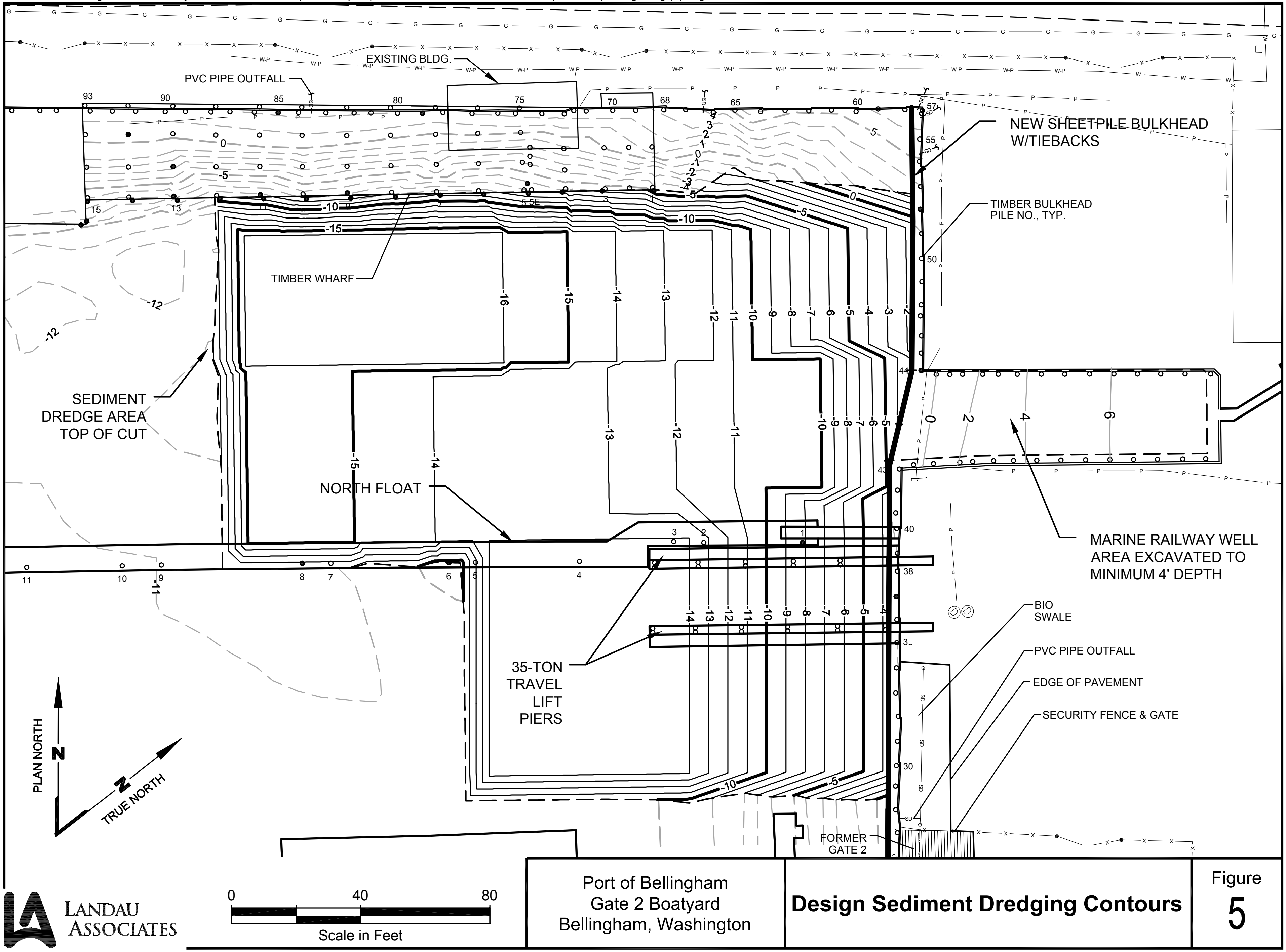
0 40 80
Scale in Feet

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Sediment Dredging Areas

Figure 4



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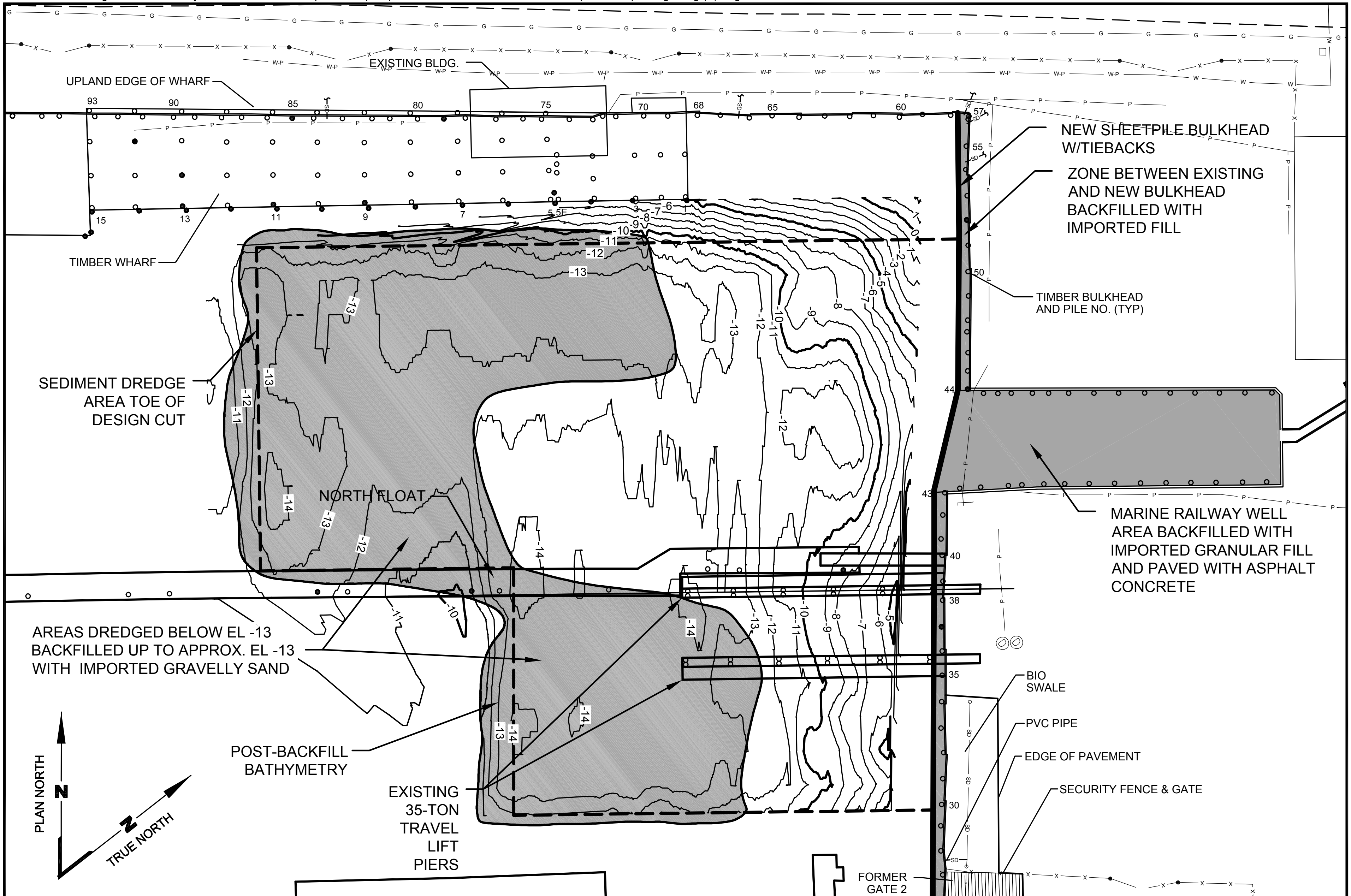
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Design Sediment Dredging Contours

Figure 5

Port of Bellingham/Gate 2 Boatyard/Interim Action Completion Report | V:\001\027\261\F\Interim Action Completion Report\Fig6.dwg (A) "Figure 6" 8/17/2006



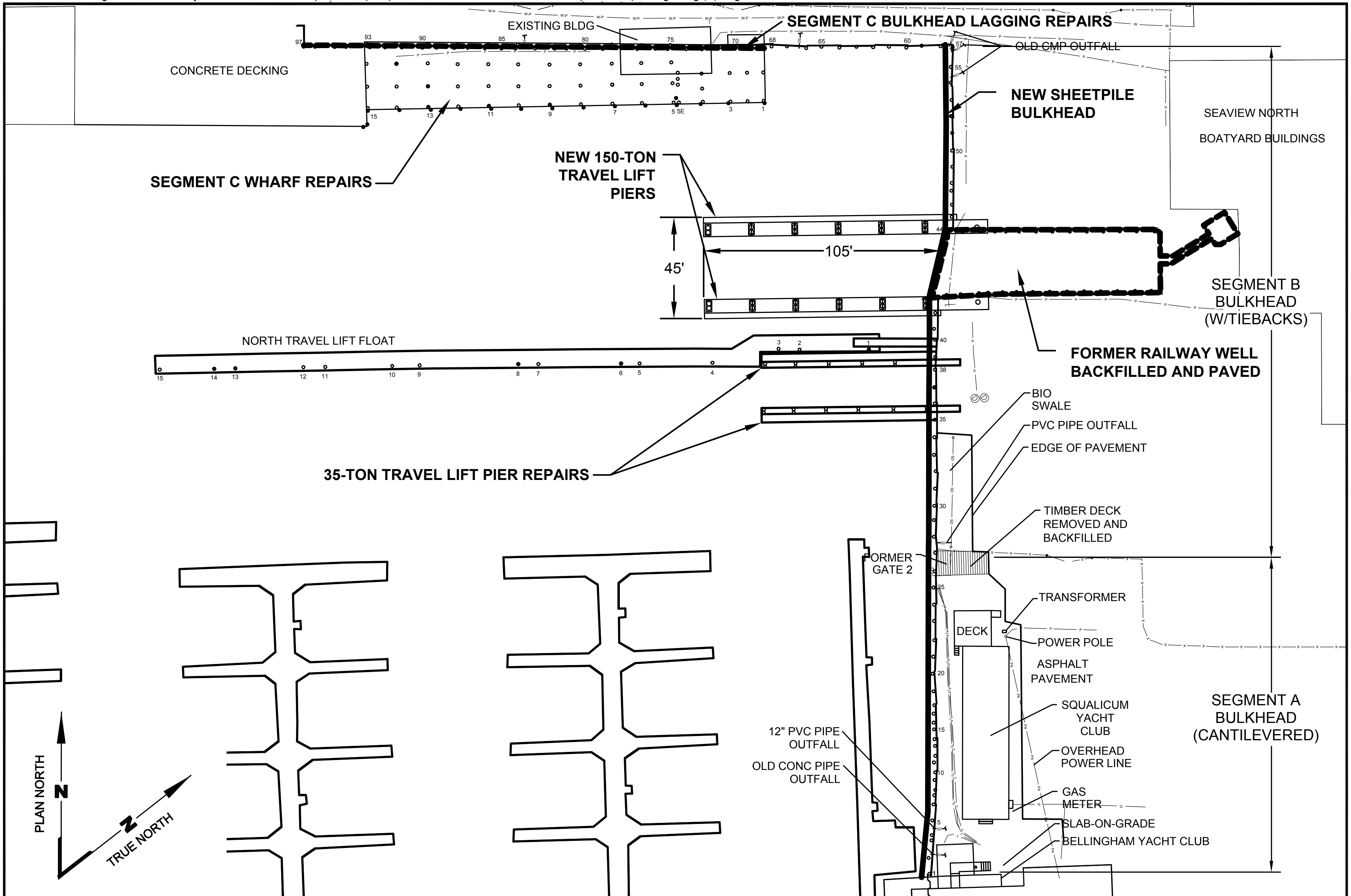
LANDAU ASSOCIATES

0 40 80
Scale in Feet

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

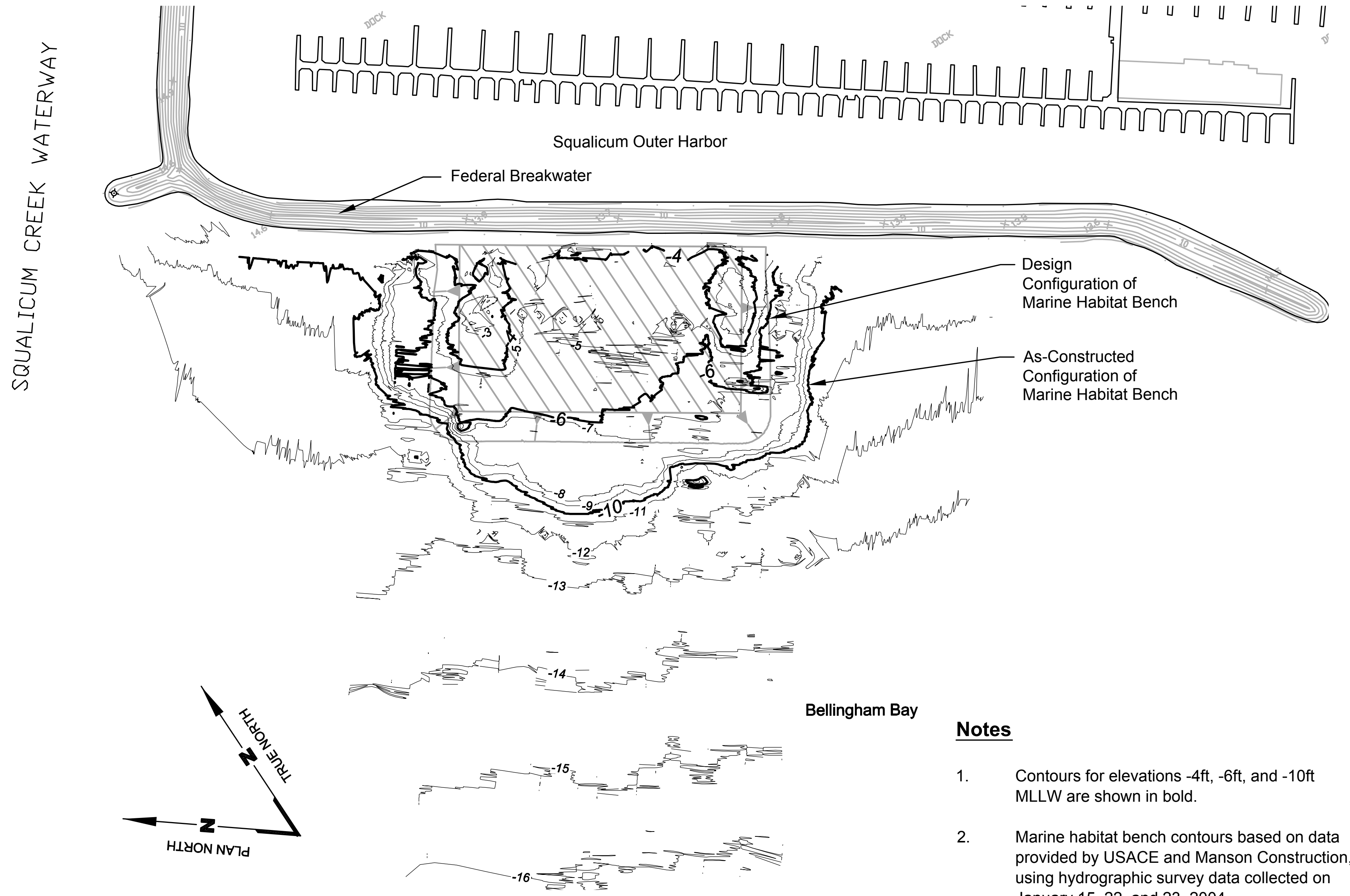
Sediment Backfill Areas

Figure 6



LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Site Improvements**	Figure 7



Notes

1. Contours for elevations -4ft, -6ft, and -10ft MLLW are shown in bold.

2. Marine habitat bench contours based on data provided by USACE and Manson Construction, using hydrographic survey data collected on January 15, 22, and 23, 2004.

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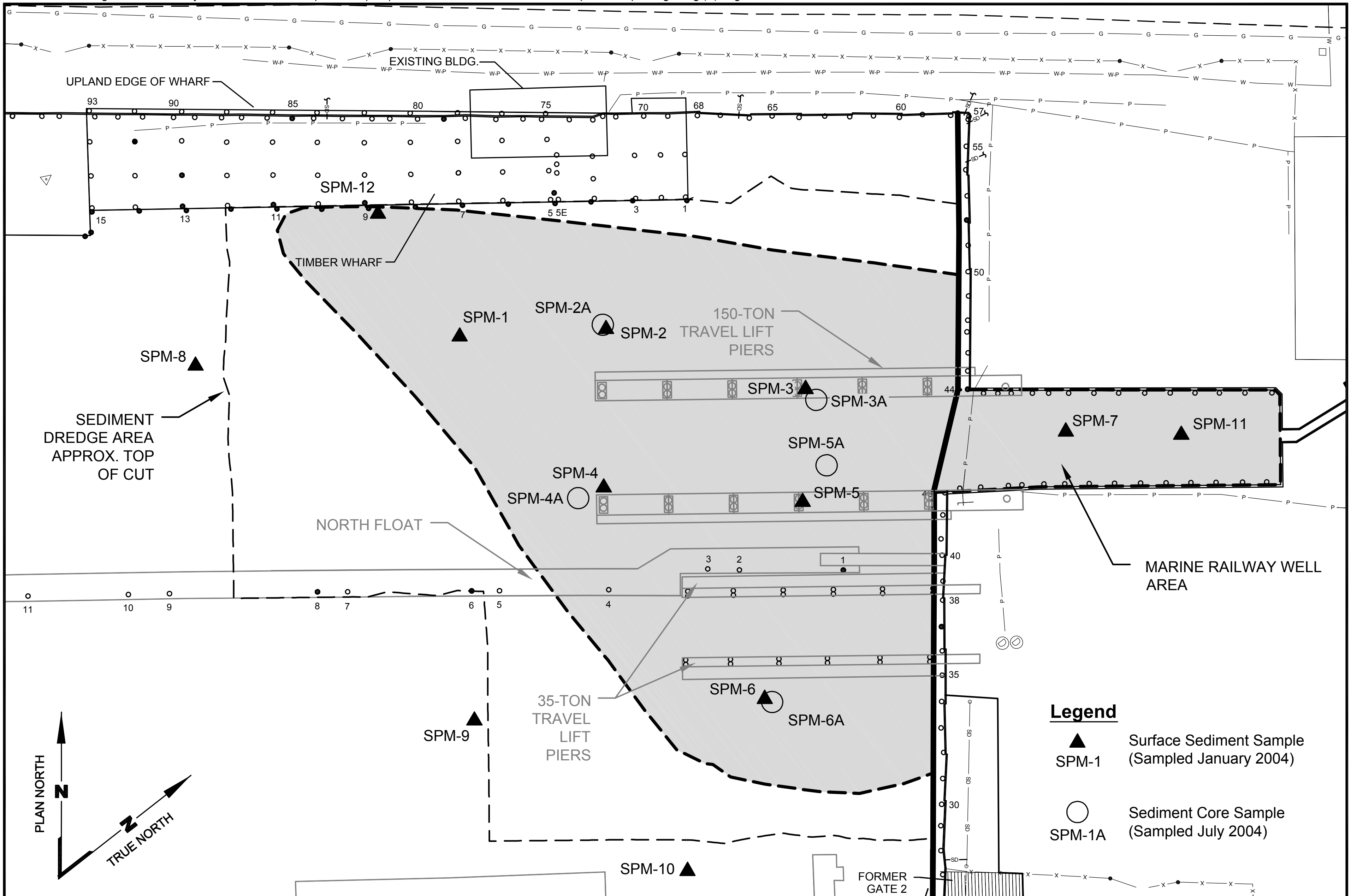
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

New Marine Habitat Bench

Figure 8



Landau Associates

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Sediment Performance Monitoring Locations

Figure 9

TABLE 1
INTERIM ACTION SEDIMENT CLEANUP LEVELS
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

Analyte	SQS (a)
Metals (mg/kg dry weight)	
Arsenic	57
Cadmium	5.1
Chromium	260
Copper	390
Lead	450
Mercury	0.41
Silver	6.1
Zinc	410
Bulk Organotin (ug/kg dry weight)	
Tributyltin (as TBT ion)	79 (b)
PAHs (mg/kg OC) (c)	
Naphthalene	99
Acenaphthylene	66
Acenaphthene	16
Fluorene	23
Phenanthrene	100
Anthracene	220
2-Methylnaphthalene	38
LPAH (d, e)	370
Fluoranthene	160
Pyrene	1000
Benzo(a)anthracene	110
Chrysene	110
Total Benzofluoranthenes (d,f)	230
Benzo(a)pyrene	99
Indeno(1,2,3-c,d)pyrene	34
Dibenz(a,h)anthracene	12
Benzo(g,h,i)perylene	31
HPAH (d,g)	960
SVOCs (mg/kg OC) (c)	
Dimethylphthalate	53
Diethylphthalate	61
Di-n-Butylphthalate	220
Butylbenzylphthalate	4.9
bis(2-Ethylhexyl)phthalate	47
Di-n-octyl phthalate	58
Dibenzofuran	15
N-Nitrosodiphenylamine	11

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) 79 μg/kg equals site-specific no effects TBT bulk sediment cleanup level.
(c) All organic data are normalized to total organic carbon; this involves dividing the dry weight concentration of the constituent by the fraction of total organic carbon present.
(d) Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:
  (i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers.
  (ii) Where chemical analyses detect one or more individual compounds/isomers, only the detected concentrations will be added to represent the group sum.
(e) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.
(f) The total benzofluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.
(g) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.

TABLE 2
SEDIMENT PERFORMANCE MONITORING SUMMARY
JANUARY 2004 THROUGH JULY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

Sample Location ID	Collection Date	TBT	Total Metals (a)	SVOC	TOC	TPH
Surface Sediment Samples						
SPM-1	1/28/2004	X	X	X	X	
SPM-2	1/28/2004	X	X	X	X	
SPM-3	1/28/2004	X	X	X	X	
SPM-4	1/28/2004	X	X	X	X	
SPM-5	1/28/2004	X	X	X	X	
SPM-6	1/28/2004	X	X	X	X	
SPM-7	1/15/2004	X	X	X	X	X
SPM-8	1/28/2004	X	X	X	X	
SPM-9	1/28/2004	X	X	X	X	
SPM-10	1/28/2004	X	X	X	X	
SPM-11	1/15/2004	X	X	X	X	X
SPM-12	1/28/2004	X	X	X	X	
Sediment Core Samples (intervals in inches)						
SPM-2A (0-6)	7/8/2004		X (b)			
SPM-2A (12-16)	7/8/2004		X (b)			
SPM-2A (24-28)	7/8/2004		A			
SPM-3A (0-6)	7/8/2004	X	X (b)			
SPM-3A (12-16)	7/8/2004	A	A			
SPM-3A (24-28)	7/8/2004	A	A			
SPM-4A (0-6)	7/8/2004		X (b)			
SPM-4A (12-16)	7/8/2004		X (b)			
SPM-4A (24-28)	7/8/2004		A			
SPM-5A (0-6)	7/8/2004	X	X (b)			
SPM-5A (12-16)	7/8/2004	A	A			
SPM-5A (24-28)	7/8/2004	A	A			
SPM-6A (0-6)	7/8/2004		X (b)			
SPM-6A (12-16)	7/8/2004		X (b)			
SPM-6A (24-28)	7/8/2004		A			

Notes:

TBT - Bulk organotins [including tributyltin (TBT)]
SVOC - Semivolatile organic compounds (identified on the SMS list of chemical parameters)
TOC - Total organic carbon
(a) - Total metals: arsenic, cadmium, chromium, copper, lead, mercury, silver and zinc; unless otherwise noted.
(b) - Mercury analysis only.
X - Collected for laboratory analysis and analyzed.
A - Collected for laboratory archive and not analyzed.
SPM-2A (0-6) - Numbers in parentheses indicate sample interval (inches) below identified fill material.

TABLE 3
SEDIMENT PERFORMANCE MONITORING STATION COORDINATES
JANUARY 2004 THROUGH JULY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

Sample Location ID	Collection Date	Approximate Mudline Elevation (MLLW, ft)	Northing (a)	Easting (a)
Surface Sediment Samples				
SPM-1	1/28/2004	-17.6	645595.50	1236818.81
SPM-2	1/28/2004	-17.0	645630.84	1236843.71
SPM-3	1/28/2004	-9.9	645666.24	1236893.94
SPM-4	1/28/2004	-14.1	645601.46	1236880.07
SPM-5	1/28/2004	-11.2	645645.00	1236919.62
SPM-6	1/28/2004	-12.1	645600.37	1236958.46
SPM-7	1/15/2004	(b)	(See Figure 9)	
SPM-8	1/28/2004	-11.0	645528.88	1236777.55
SPM-9	1/28/2004	-11.1	645529.03	1236910.67
SPM-10	1/28/2004	-10.8	645551.15	1236984.34
SPM-11	1/15/2004	(b)	(See Figure 9)	
SPM-12	1/28/2004	-7.6	645598.87	1236775.46
Sediment Core Samples				
SPM-2A	7/8/2004	-13.9	645630.87	1236842.10
SPM-3A	7/8/2004	-13.3	645666.75	1236898.38
SPM-4A	7/8/2004	-14.4	645593.60	1236877.89
SPM-5A	7/8/2004	-13.9	645657.26	1236915.46
SPM-6A	7/8/2004	-12.1	645601.54	1236960.50

Notes:

(a) - Washington State Plane North Zone (4601) NAD 83
(b) - Confirmation samples were collected from the sidewalls of test pits advanced approximately 4-5 ft below the pre-excavation grade in the marine railway well. The 4 to 5-inch depth interval below the planned 4-ft excavation depth was collected for analysis.
MLLW - Mean Lower Low Water:

TABLE 4
SURFACE SEDIMENT SAMPLE FIELD OBSERVATIONS
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

Sample Location ID	Collection Date	Sampler Penetration Depth (ft)	USCS Classification	Sample Description
SPM-1	1/28/2004	0.5	ML	Dark gray to black, SILT, with fine sand and gravel; slight petroleum odor and moderate to heavy sheen (wet)
SPM-2	1/28/2004	0.6	ML	Dark gray to black, SILT, with fine sand; no odor and minor sheen (wet)
SPM-3	1/28/2004	0.8	SM/ML	Dark gray, silty, fine SAND, with wood debris; heavy sheen and moderate petroleum odor (wet)
SPM-4	1/28/2004	0.9	ML	Dark gray to black, SILT, trace fine sand and wood debris; petroleum odor and heavy sheen, small shrimp present (wet).
SPM-5	1/28/2004	0.7	ML	Dark gray to black, SILT, with trace fine sand; petroleum odor and heavy sheen, shell fragments (wet)
SPM-6	1/28/2004	0.8	ML	Dark gray, SILT, with fine sand, trace wood debris; moderate sheen and no odor (wet)
SPM-7	1/15/2004	(a)	SP	Dark gray, fine to medium sand with a trace to some gravel, no odor and minor sheen (wet)
SPM-8	1/28/2004	0.7	ML	Dark gray to black with some dark green mottles, SILT, with fine sand and trace gravel; minor sheen and no odor (wet)
SPM-9	1/28/2004	1.0	ML	Dark gray to black, SILT, with trace fine sand; petroleum odor and very slight sheen (wet)
SPM-10	1/28/2004	0.7	ML	Dark gray to black, SILT, with trace fine sand; no odor and minor sheen, worms, snails and occasional shell fragments (wet)
SPM-11	1/15/2004	(a)	SP	Dark gray fine sand with lenses of black medium to coarse sand and fine gravel, no odor or sheen (wet).
SPM-12	1/28/2004	0.6	ML	Dark gray to black, SILT, with trace fine sand and gravel; petroleum odor and slight sheen, shell fragments (wet)

Notes:

USCS - Unified Soil Classification System.
All marine area surface sediment samples were collected with a Power Grab unit from the *R/V Peter R*
(a) Collected from marine railway well with hand tools (see text).

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS, JANUARY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-1 GG43A 1/28/2004	SPM-2 GG43B 1/28/2004	SPM-3 GG43C 1/28/2004	SPM-4 GG43D 1/28/2004	SPM-5 GG43E 1/28/2004	SPM-6 GG43F 1/28/2004	SPM-7 GF53A 1/15/2004	SPM-8 GG43G 1/28/2004
Metals (mg/kg)										
Arsenic	57	93	10	10	7 U	20	13	15	6 U	13
Cadmium	5.1	6.7	0.7	0.8	0.3 U	0.7	0.5	0.4	0.2 U	0.4
Chromium	260	270	65	136	26.9	67	46.5	48.7	23.5	51.2
Copper	390	390	201	190	150	220	309	140	84.3	134
Lead	450	530	48	42	25	48	54	32	7	30
Mercury	0.41	0.59	0.9 J	0.60	0.35	0.7	0.96	0.44	0.13	0.49
Silver	6.1	6.1	0.6 U	0.6 U	0.4 U	0.6 U	0.5 U	0.5 U	0.4 U	0.5 U
Zinc	410	960	210	468	111	230	218	127	89.2	110
Bulk Organotin (ug/kg)										
Tributyltin (as TBT ion)	79 (c)	156 (c)	34	24	140	61	260	69	12	18
PAHs (mg/kg OC) (d)										
Naphthalene	99	170	10	10	72	33	77	8.1	0.1 U	22
Acenaphthylene	66	66	0.7	0.8 U	1.5	1.4	2.7	1.1	0.1 U	0.9
Acenaphthene	16	57	12	10	42	30	54	7.8	0.1 U	9.1
Fluorene	23	79	15	11	33	29	46	8.3	0.1 U	7.8
Phenanthrene	100	480	53	38	119	119	180	31	0.1 U	29
Anthracene	220	1200	8.4	6.9	13	16	22	6.1	0.1 U	11
2-Methylnaphthalene	38	64	6.3	3.8	35	14	43	4.4	0.2	3.7
LPAH (e, f)	370	780	100	77	280	227	382	62	0.1 U	80
Fluoranthene	160	1200	47	38	102	100	220	42	0.1	41
Pyrene	1000	1400	31	30	67	67	123	25	0.2	35
Benzo(a)anthracene	110	270	14	13	21	27	40	14	0.1 U	15
Chrysene	110	460	16	16	33	33	54	20	0.1 U	23
Benzo(b)fluoranthene	None	None	13	13	20	27	34	15	0.1 U	17
Benzo(k)fluoranthene	None	None	11	12	17	22	28	11	0.1 U	13
Total Benzofluoranthenes (e,g)	230	450	24	25	37	50	62	27	0.1	30
Benzo(a)pyrene	99	210	8.1	8.1	12	15	20	8.9	0.1 U	11
Indeno(1,2,3-cd)pyrene	34	88	1.7	2.2	2.6	3.0	4.3	3.1	0.1 U	3.3
Dibenz(a,h)anthracene	12	33	0.6 U	0.8 U	0.7	1.0	1.2	0.9	0.1 U	1.0
Benzo(g,h,i)perylene	31	78	1.1	1.2	1.6	2.0	2.9	2.1	0.1 U	2.3
HPAH (e,h)	960	5300	143	134	277	298	528	143	0.3	161

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS, JANUARY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-1 GG43A 1/28/2004	SPM-2 GG43B 1/28/2004	SPM-3 GG43C 1/28/2004	SPM-4 GG43D 1/28/2004	SPM-5 GG43E 1/28/2004	SPM-6 GG43F 1/28/2004	SPM-7 GF53A 1/15/2004	SPM-8 GG43G 1/28/2004
SVOCs (mg/kg OC) (e)										
1,2-Dichlorobenzene	2.3	2.3	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
1,3-Dichlorobenzene	None	None	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
1,4-Dichlorobenzene	3.1	9	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
1,2,4-Trichlorobenzene	0.81	1.8	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
Hexachlorobenzene	0.38	2.3	0.6 U (i)	0.8 U (i)	0.4 U (i)	0.7 U (i)	0.6 U (i)	0.6 U (i)	0.1 U	0.8 U (i)
Dimethylphthalate	53	53	0.8	1.7	1.0	1.9	2.9	1.1	0.1 U	1.4
Diethylphthalate	61	110	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
Di-n-Butylphthalate	220	1700	0.6 U	0.8 U	0.4 U	0.7 U	1.2	0.6 U	0.1 U	0.8 U
Butylbenzylphthalate	4.9	64	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
bis(2-Ethylhexyl)phthalate	47	78	5.0	4.2	8.8	7.4	12.3	4.2	0.2	3.9
Di-n-Octyl phthalate	58	4500	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
Dibenzofuran	15	58	9.1	6.5	25.6	19	34	5.6	0.1	6.1
Hexachlorobutadiene	3.9	6.2	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
N-Nitrosodiphenylamine	11	11	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
SVOCs (ug/kg)										
Phenol	420	1200	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
2-Methylphenol	63	63	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
4-Methylphenol	670	670	24	20 U	47	20 U	20 U	20 U	19 U	19 U
2,4-Dimethylphenol	29	29	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
Pentachlorophenol	360	690	97 U	98 U	97 U	98 U	99 U	98 U	96 U	97 U
Benzyl Alcohol	57	73	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
Benzoic Acid	650	650	190 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U
Conventionals										
Total Organic Carbon (percent)	None	None	3.2	2.6	4.3	2.7	3.5	3.6	17	2.3
Total Solids (percent)	None	None	47.7	46.4	71.0	47.0	56.2	56.2	80.2	63.5
Si/Acid Cleaned NWTPH-Dx (mg/kg)										
Diesel	None	None							23	
Motor Oil	None	None							50	
NWTPH-G (mg/kg)	None	None								
Gasoline Range Hydrocarbons	None	None							6.2 U	

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS, JANUARY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-9 GG43H 1/28/2004	SPM-10 GG43I 1/28/2004	SPM-11 GF53B 1/15/2004	SPM-12 GG43J 1/28/2004
Metals (mg/kg)						
Arsenic	57	93	20	10	5 U	20
Cadmium	5.1	6.7	0.5	0.4 U	0.2 U	0.5
Chromium	260	270	64	72	19.5	63
Copper	390	390	126	110	17.3	124
Lead	450	530	27	20	7	22
Mercury	0.41	0.59	0.57	0.35	0.05	0.27
Silver	6.1	6.1	0.6 U	0.6 U	0.3 U	0.6 U
Zinc	410	960	149	146	123	164
Bulk Organotin (ug/kg)						
Tributyltin (as TBT ion)	79 (c)	156 (c)	25	6.5	3.8 U	12
PAHs (mg/kg OC) (d)						
Naphthalene	99	170	8.9	3.7	0.3 U	3.0
Acenaphthylene	66	66	1.1 U	0.9 U	0.3 U	4.8
Acenaphthene	16	57	13	3.9	0.3 U	7.6
Fluorene	23	79	12	4.3	0.3 U	8.1
Phenanthrene	100	480	54	17	0.3 U	67
Anthracene	220	1200	8.9	4.0	0.3 U	17
2-Methylnaphthalene	38	64	3.2	1.5	0.3 U	1.4
LPAH (e, f)	370	780	97	33	0.3 U	107
Fluoranthene	160	1200	61	29	0.3 U	205
Pyrene	1000	1400	38	20	0.3 U	129
Benzo(a)anthracene	110	270	19	9.5	0.3 U	62
Chrysene	110	460	21	12	0.3 U	105
Benzo(b)fluoranthene	None	None	16	10	0.3 U	57
Benzo(k)fluoranthene	None	None	12	7.3	0.3 U	40
Total Benzofluoranthenes (e,g)	230	450	28	17	0.3 U	97
Benzo(a)pyrene	99	210	12	5.9	0.3 U	31
Indeno(1,2,3-cd)pyrene	34	88	4.1	2.0	0.3 U	10
Dibenz(a,h)anthracene	12	33	1.2	0.9 U	0.3 U	3
Benzo(g,h,i)perylene	31	78	2.8	1.4	0.3 U	6.2
HPAH (e,h)	960	5300	186	97	0.3 U	648

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS, JANUARY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-9 GG43H 1/28/2004	SPM-10 GG43I 1/28/2004	SPM-11 GF53B 1/15/2004	SPM-12 GG43J 1/28/2004
SVOCs (mg/kg OC) (e)						
1,2-Dichlorobenzene	2.3	2.3	1.1 U	0.9 U	0.3 U	1.0 U
1,3-Dichlorobenzene	None	None	1.1 U	0.9 U	0.3 U	1.0 U
1,4-Dichlorobenzene	3.1	9	1.1 U	0.9 U	0.3 U	1.0 U
1,2,4-Trichlorobenzene	0.81	1.8	1.1 U (i)	0.9 U (i)	0.3 U	1.0 U (i)
Hexachlorobenzene	0.38	2.3	1.1 U (i)	0.9 U (i)	0.3 U	1.0 U (i)
Dimethylphthalate	53	53	1.3	1.0	0.3 U	1.6
Diethylphthalate	61	110	1.1 U	0.9 U	0.3 U	1.0 U
Di-n-Butylphthalate	220	1700	1.1 U	0.9 U	0.3 U	1.0 U
Butylbenzylphthalate	4.9	64	1.1 U	0.9 U	0.3 U	1.0 U
bis(2-Ethylhexyl)phthalate	47	78	16.1	3.1	0.3 U	4.1
Di-n-Octyl phthalate	58	4500	1.1 U	0.9 U	0.3 U	1.0 U
Dibenzofuran	15	58	9.4	3.5	0.3 U	5.2
Hexachlorobutadiene	3.9	6.2	1.1 U	0.9 U	0.3 U	1.0 U
N-Nitrosodiphenylamine	11	11	1.1 U	0.9 U	0.3 U	1.0 U
SVOCs (ug/kg)						
Phenol	420	1200	20 U	20 U	19 U	20 U
2-Methylphenol	63	63	20 U	20 U	19 U	20 U
4-Methylphenol	670	670	20 U	20 U	19 U	20 U
2,4-Dimethylphenol	29	29	20 U	20 U	19 U	20 U
Pentachlorophenol	360	690	98 U	99 U	94 U	98 U
Benzyl Alcohol	57	73	20 U	20 U	19 U	20 U
Benzoic Acid	650	650	200 U	200 U	190 U	200 U
Conventionals						
Total Organic Carbon (percent)	None	None	1.8	2.2	5.7	2.1
Total Solids (percent)	None	None	48.1	49.6	85.7	47.3
Si/Acid Cleaned NWTPH-Dx (mg/kg)						
Diesel	None	None			5.00 U	
Motor Oil	None	None			10 U	
NWTPH-G (mg/kg)	None	None				
Gasoline Range Hydrocarbons	None	None			5.9 U	

TABLE 5
INITIAL SEDIMENT MONITORING ANALYTICAL RESULTS - FOOTNOTES
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

A blank indicates testing not performed.

U = Indicates compound was analyzed for, but was not detected at the given detection limit.

J = Data validation flag indicating the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Boxed results exceed the SQS.

Shaded results exceed the CSL.

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).

(b) SMS Cleanup Screening Level (Chapter 173-204 WAC).

(c) 79 μg/kg equals site-specific no effects TBT bulk sediment screening level. 156 μg/kg equals site-specific potential adverse affects TBT bulk sediment screening level.

(d) Value normalized to total organic carbon; this involves dividing the dry weight concentration of the constituent by the fraction of total organic carbon present.

(e) Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:

(i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers.

(ii) Where chemical analyses detect one or more individual compounds/isomers, only the detected concentrations will be added to represent the group sum.

(f) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.

(g) The total benzofluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.

(h) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.

(i) Method detection limits exceed the SQS or CSL criteria.

TABLE 6
CONFIRMATIONAL SEDIMENT MONITORING ANALYTICAL RESULTS, JULY 2004
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-2A (0-4) GV33A 7/9/2004	SPM-2A (12-16) GV33B 7/9/2004	SPM-3A (0-4) GV33D 7/9/2004	SPM-4A (0-4) GV33M 7/9/2004	SPM-4A (12-16) GV33M 7/9/2004	SPM-5A (0-4) GV33J 7/9/2004	SPM-6A (0-4) GV33G 7/9/2004	SPM-6A (12-16) GV33H 7/9/2004
ORGANOTINS (µg/kg)										
Tributyl Tin Chloride	None	None	NA	NA	24	NA	NA	8.6	NA	NA
Dibutyl Tin Dichloride	None	None	NA	NA	23	NA	NA	8.3	NA	NA
Butyl Tin Trichloride	None	None	NA	NA	5.6 U	NA	NA	6.0 U	NA	NA
TBT as Tributyltin ion	79 (c)	156 (c)	NA	NA	21	NA	NA	7.7	NA	NA
TOTAL METALS (µg/kg)										
Mercury	0.41	0.59	0.09	0.04 U	0.10	0.92	0.05 U	0.05	0.36	0.15

Notes:

Shaded results exceed the CSL.
NA = Not analyzed.
U = Indicates the compound was undetected at the reported concentration.
(a) = SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) = SMS Cleanup Screening Level (Chapter 173-204 WAC).
(c) = 79 µg/kg equals site-specific no effects TBT bulk sediment screening level.
156 µg/kg equals site-specific potential adverse affects TBT bulk sedement screening level.

APPENDIX A

Construction Drawings

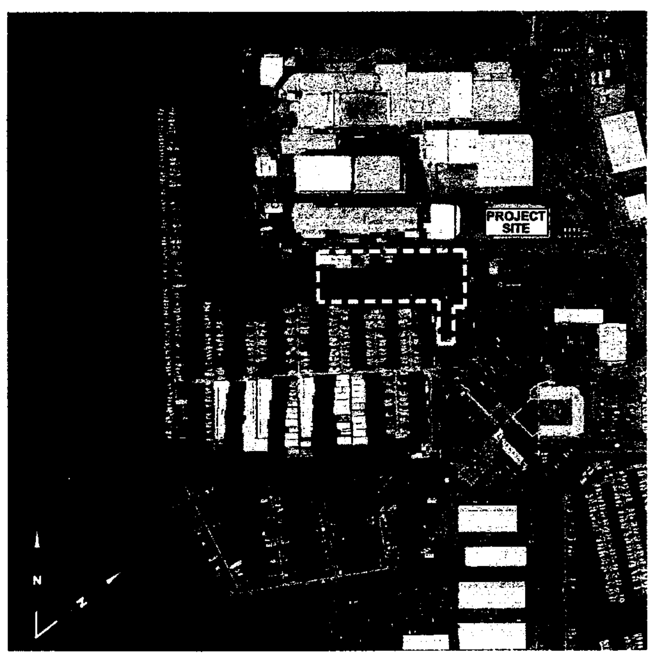
APPENDIX A
CONSTRUCTION DRAWINGS

A half-size set of the interim action construction drawings for the Gate 2 Boatyard sediment remediation and redevelopment project is included in this Appendix. While these drawings are noted as "Issued for Bid," they were used as the project "Issued for Construction" drawings because no revisions were made to the bid drawings.

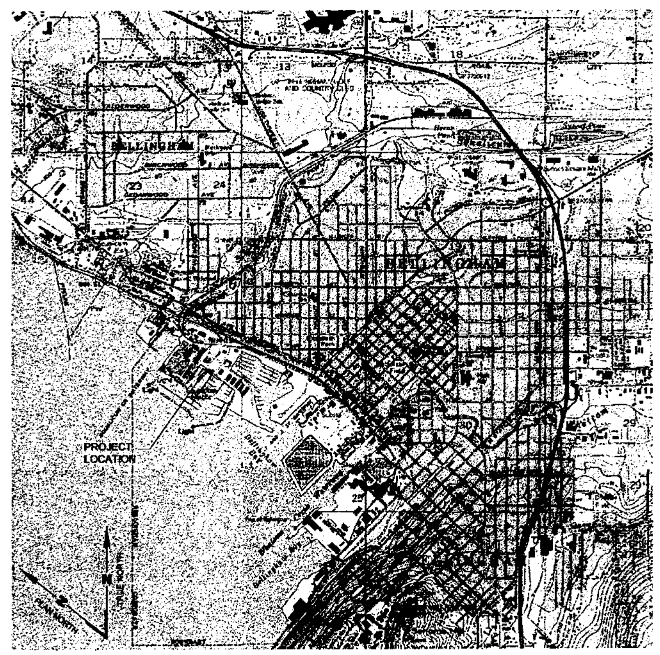
Construction of the new marine habitat bench was conducted by the U.S. Army Corps of Engineer's (USACE) contractor performing Squalicum Creek Waterway maintenance dredging activities. The enclosed drawings include the plan and cross-section views of the marine habitat bench that were included in the USACE's contract documents for the Swinomish Channel & Squalicum Waterway Maintenance Dredging FY 03/04 project.

PORT OF BELLINGHAM
Washington State

GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT



0 400 800
APPROXIMATE SCALE IN FEET



0 1/2 1
APPROXIMATE SCALE IN MILES

DRAWING LIST	
G-1	TITLE SHEET
G-2	GENERAL NOTES AND SYMBOLS
G-3	SITE VICINITY, ACCESS, AND STAGING AREAS
C-1	EXISTING CONDITIONS SITE PLAN
C-2	SEDIMENT DREDGING AND EXCAVATION PLAN
C-3	FINAL GRADING PLAN
C-4	SECTIONS
C-5	SECTIONS
C-6	SECTIONS AND DETAILS
S1.0	OVERALL BULKHEAD REPLACEMENT PLAN
S1.1	BULKHEAD REPLACEMENT ENLARGED PLAN
S1.2	BULKHEAD REPLACEMENT DETAILS
S1.3	BULKHEAD DETAILS AND STRUCTURAL NOTES
S2.0	150 TON LIFT PLAN & ELEVATIONS
S2.1	150 TON LIFT MISC. DETAILS
S2.2	150 TON LIFT STRUCTURAL NOTES & DETAILS
S3.0	WHARF "C" REPAIR PLAN & DETAILS
S3.1	WHARF "C" REPAIR DETAILS & STRUCTURAL NOTES
SURVEY-1	SURVEYOR'S UPLAND SURVEY - OVERALL PLAN

GENERAL NOTES

1. PORT OF BELLINGHAM (OWNER), GATE 2 BOATYARD PROJECT CONTACT:
   MR. JOHN HERGESHEIMER, PROJECT MANAGER
   1801 ROEDER AVENUE
   BELLINGHAM, WA. 98227
   TELEPHONE: 360-676-2500, EXT. 313
   FAX: 360-671-6411
   CELL: 360-319-0210
2. PROTECT ALL EXISTING UTILITIES DURING CONSTRUCTION.
3. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS AT THE JOB SITE BEFORE COMMENCING WORK AND SHALL REPORT ANY DISCREPANCIES TO THE OWNER.
4. CONTRACTOR'S CONSTRUCTION WORK PLANS SHALL BE SUBMITTED TO AND APPROVED BY THE OWNER PRIOR TO COMMENCEMENT OF WORK.
5. THE PORT'S SQUALICUM HARBOR FACILITIES AND THE SEAVIEW BOATYARD NORTH, INC. GATE 2 BOATYARD FACILITIES WILL BE IN OPERATION DURING CONSTRUCTION. CONTRACTOR SHALL KEEP ITS CREW, MATERIALS, AND EQUIPMENT CLEAR OF ALL MARINA ACTIVITIES, EXCEPT AS APPROVED BY OWNER.
6. CONTRACTOR SHALL COORDINATE ALL UTILITY INTERRUPTIONS AND DISCONNECTS THAT MAY BE REQUIRED WITH THE UTILITY OWNER(S), THE PORT, AND ITS TENANTS.
7. CONTRACTOR SHALL INSPECT THE SITE AND REVIEW EXISTING DATA AND PROJECT REPORTS REFERENCED IN THE CONTRACT DOCUMENTS, AS IT PERTAINS TO THE PERFORMANCE OF THE WORK.
8. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO STRICTLY CONTAIN CONSTRUCTION ACTIVITIES WITHIN THE LIMITS OF THE "CONTRACTOR WORK AREA" AND AVOID ANY DAMAGE TO ADJACENT STRUCTURES AND PROPERTY.
9. ANY DAMAGE INCURRED IN EXECUTION OF THIS CONTRACT TO ANY PART OF THE PROPERTY/STRUCTURES NOT SPECIFICALLY DESIGNATED IN THE PLANS AND/OR SPECIFICATIONS TO BE ALTERED OR DESTROYED SHALL BE REPAIRED, REPLACED AND/OR RECONSTRUCTED BY CONTRACTOR AT ITS EXPENSE, TO ITS ORIGINAL CONDITION AS DIRECTED BY THE OWNER.
10. THE OWNER WILL PROVIDE BENCH MARKS FOR CONSTRUCTION. CONTRACTOR SHALL VERIFY THESE BENCH MARKS PRIOR TO STARTING THE WORK.

Address: 2652 Harbor Loop Drive
(Intersection Squalicum Way and Harbor Loop Drive)
Bellingham, Washington 98225

Truck Access: (From Seattle, Washington)
I-5 North
Exit No. 256 (Guide Meridian)
Left on Guide Meridian to Squalicum Parkway
Right on Squalicum Parkway to Roeder Ave.
Left on Roeder Ave.
Right on Squalicum Way

DAVID A. PISCHER — STATE OF WASHINGTON — 19777 — REGISTERED PROFESSIONAL ENGINEER — 4/21/03
EXPIRES 7/18/04

"L"
NOTE: IF "L" DOES NOT MEASURE 1", ADJUST SCALES ACCORDINGLY

PORT OF BELLINGHAM *Washington State*

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED

		INITIAL	DATE
DRAFTED BY:	BRUCE L. SHELDON	BLS	4/21/03
DESIGNED BY:	DAVID A. PISCHER, P.E.	DAP	4/21/03
REVIEWED BY:	STEVE R. WRIGHT, P.E.	SRW	4/21/03
APPROVED BY:	LAWRENCE D. BEARD, P.E.	LDB	4/21/03
STATUS:	ISSUED FOR BID		

LANDAU ASSOCIATES
130 2nd AVENUE S.
EDMONDS, WA. 98020
(425) 778-0907, FAX (425) 778-6409

GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

TITLE SHEET

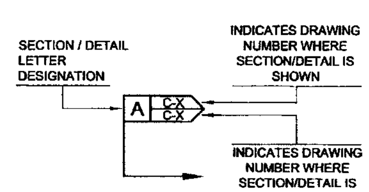
PROJECT NO. 001027
DATE APRIL 21, 2003
SHEET 1 OF 19
DRAWING NO. G-1

ABBREVIATION	DESCRIPTION
&	AND
'	FOOT OR FEET
"	INCHES OR SECONDS
#	NUMBER
%	PERCENT
ABAN	ABANDONED
AC	ACRES
ALIGN	ALIGNMENT
ALT	ALTERNATE
ALUM	ALUMINUM
APPROX	APPROXIMATE
BGS	BELOW GROUND SURFACE
BM	BENCH MARK
C TO C	CENTER TO CENTER
CB	CATCH BASIN
CI	CAST IRON
CIP	CAST IRON PIPE
CL	CENTERLINE, CLASS
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CPE	CORRUGATED POLYETHYLENE PIPE
CTR	CENTER
CU	CUBIC
CY	CUBIC YARD
CULV	CULVERT
DET	DETAIL
DIA	DIAMETER
DWG	DRAWING
DIP	DUCTILE IRON PIPE
(E)	EXISTING
E	EAST
EA	EACH
E-W	EAST-WEST
EL or ELEV	ELEVATION
ENGR	ENGINEER
EQUIP	EQUIPMENT
EXIST or EX	EXISTING
EXC	EXCAVATION
FT, FT^2, FT^3	FOOT, SQUARE FEET, CUBIC FEET

ABBREVIATION	DESCRIPTION
GA	GAUGE OR GAGE
GAL	GALLON
GALV	GALVANIZED
GR	GRADE
GRAN	GRANULAR
GRD	GROUND
H&S	HEALTH AND SAFETY
HDPE	HIGH DENSITY POLYETHYLENE
HORIZ	HORIZONTAL
HRS	HOURS
HSP	HEALTH AND SAFETY PLAN
HWL	HIGH WATER LEVEL
ID	INSIDE DIAMETER (OR IDENTIFICATION)
IE	INVERT ELEVATION
IN, IN^2, IN^3	INCH, SQUARE INCH, CUBIC INCH
JT	JOINT
LB, LBS	POUND, POUNDS
LF	LINEAR FEET
LNDSCP	LANDSCAPE
LS	LUMP SUM
MAT'L	MATERIAL
MAX	MAXIMUM
MFG	MANUFACTURER
MH	MANHOLE
MHHW	MEAN HIGHER HIGH WATER
MIN	MINIMUM (OR MINUTE)
MLLW	MEAN LOWER LOW WATER
MSL	MEAN SEA LEVEL
MW	MONITORING WELL
(N)	NEW
N	NORTH
N-S	NORTH - SOUTH
NO	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER

ABBREVIATION	DESCRIPTION
OH	OVERHEAD
PERF	PERFORATED
PORT	PORT OF BELLINGHAM
PP	POWER POLE
PRIM	PRIMARY
PROJ	PROJECT
PT	POINT
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
QTY	QUANTITY
R or RT	RIGHT
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
REINF	REINFORCED
REQ'D	REQUIRED
ROW or R/W	RIGHT-OF-WAY
S	SOUTH
SS	SANITARY SEWER
SD	STORM DRAIN
SEW	SEWER
SF	SQUARE FEET
SHT	SHEET
SP	STATE PLANE
SPEC(S)	SPECIFICATION(S)
SQ	SQUARE
STA	STATION
STD	STANDARD
STL	STEEL
SY	SQUARE YARDS
TBM	TEMPORARY BENCH MARK
TEMP	TEMPORARY OR TEMPERATURE
TP	TELEPHONE POLE
TYP	TYPICAL
VB	VALVE BOX
VERT	VERTICAL
VLV	VALVE
W	WEST
W/	WITH
W/O	WITHOUT
YD	YARD

SECTION AND DETAIL DESIGNATION



NOTE:

EXISTING — SITE FEATURES

- FENCE LINE
- PROPERTY BOUNDARY
- APPROXIMATE LOCATION OF UNDERGROUND NATURAL GAS LINE
- APPROXIMATE LOCATION OF ABOVE GROUND POWER LINE
- APPROXIMATE LOCATION OF UNDERGROUND POWER LINE
- APPROXIMATE LOCATION OF UNDERGROUND STORM DRAIN
- APPROXIMATE LOCATION OF UNDERGROUND SANITARY SEWER
- APPROXIMATE LOCATION OF TELEPHONE LINE
- EXISTING TOPOGRAPHY
- APPROXIMATE LOCATION OF UNDERGROUND WATER LINE

PROPOSED

- PROPOSED TOPOGRAPHY

LEGEND

- DIRECTION OF SLOPE
- MONITORING WELL LOCATION
- STORM DRAIN MANHOLE OR CATCH BASIN
- EXISTING TIMBER PILING
- EXISTING TIMBER PILING TO BE REPLACED W/ NEW PILING
- EXISTING DERELICT TIMBER PILE STUB TO BE CUT OFF BELOW MUDLINE
- FIRE HYDRANT
- TELEPHONE/POWER POLE
- TEMPORARY BENCH MARK OR CONTROL POINT
- STREET LIGHT
- SPOT ELEVATIONS
- SET REBAR AND CONTROL CAP
- HUB AND TACK
- PK NAIL
- SITE COORDINATE
- SITE COORDINATE GRID

645,300 N
1,258,800 E

HATCH PATTERNS

- CONCRETE
- OVERDREDGE ZONE
- GRAVEL BACKFILL
- SAND BACKFILL
- NATIVE EARTH
- STRUCTURAL FILL
- CRUSHED ROCK
- ASPHALT CONCRETE PAVEMENT SECTION
- ASPHALT CONCRETE PAVING AREA
- CONTRACTOR STAGING AREA

SURVEY DATA

SITE SURVEY OF UPLAND AND NEARSHORE AREAS PROVIDED BY CHRISTIE & CHRISTIE LAND SURVEYING, INC., FEB. 2003. SEE DWG SURVEY-1, WHICH REFERS TO PORT OF BELLINGHAM (PORT) DATUM AND NAD27 COORDINATES. SURVEY DATA AVAILABLE TO CONTRACTOR.

BATHYMETRY OF SEDIMENT SURFACE BASED ON SURVEY BY BLUE WATER ENGINEERING ON OCT. 10, 2001, SUPPLEMENTED BY SPOT MUDLINE ELEVATION MEASUREMENTS ALONG SEGMENT B-C BULKHEAD AND BELOW SEGMENT C WHARF BY LANDAU ASSOCIATES IN AUG. & OCT. 2002. SURVEY DATA AVAILABLE TO CONTRACTOR.

ALL OTHER SQUALICUM HARBOR TOPOGRAPHIC DATA AND SITE FEATURES BASED ON PHOTOGRAMMETRIC SURVEY BY WALKER AND ASSOCIATES, MAR. 2002.

HORIZONTAL DATUM

WASHINGTON STATE PLANE NORTH ZONE (NAD83) COORDINATES,

CONVERSION FROM NAD27 TO NAD83 COORDINATES:
NORTHING: NAD83 = NAD27 MINUS 53.77
EASTING: NAD83 = NAD27 MINUS 359,880.83

VERTICAL DATUM

MARINE ELEVATIONS SHOWN ON DWGS G-1 THROUGH S3.1 REFER TO MLLW AS PROJECT 0.00, BASED ON NOAA BENCHMARK "N6 RESET", EL 20.08 MLLW.

UPLAND ELEVATIONS SHOWN ON DWG SURVEY-1 REFER TO PORT OF BELLINGHAM (PORT) DATUM, BASED ON CONSTRUCTION BENCH MARK NO. 2, EL. 17.93 PORT, RR SPIKE IN SOUTH SIDE OF UTILITY POLE NO. 32956, NORTH SIDE OF HARBOR LOOP ROAD AND EAST SIDE OF SQUALICUM WAY.

TO CONVERT FROM PORT DATUM TO MLLW DATUM, SUBTRACT 0.44 FT. FROM PORT ELEVATION. CONSTRUCTION TBM NO. 2: EL 17.93 PORT = 17.49 MLLW.

TOLERANCES

1. ALL DIMENSIONS SHOWN ON THE DRAWINGS ARE MINIMUM UNLESS OTHERWISE NOTED.
2. CONSTRUCTION TOLERANCES SHALL BE IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS.
3. ALL UPLAND AREA WORK SHALL NOT VARY BY MORE THAN ONE TENTH OF A FOOT FROM THE LINES AND GRADES SHOWN ON THE DRAWINGS.

DAVID A. PISCHER, STATE OF WASHINGTON, 19377, REGISTERED PROFESSIONAL ENGINEER 4/21/03
EXPIRES 7/18/04

"L"
NOTE: IF "L" DOES NOT MEASURE 1", ADJUST SCALES ACCORDINGLY

PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED

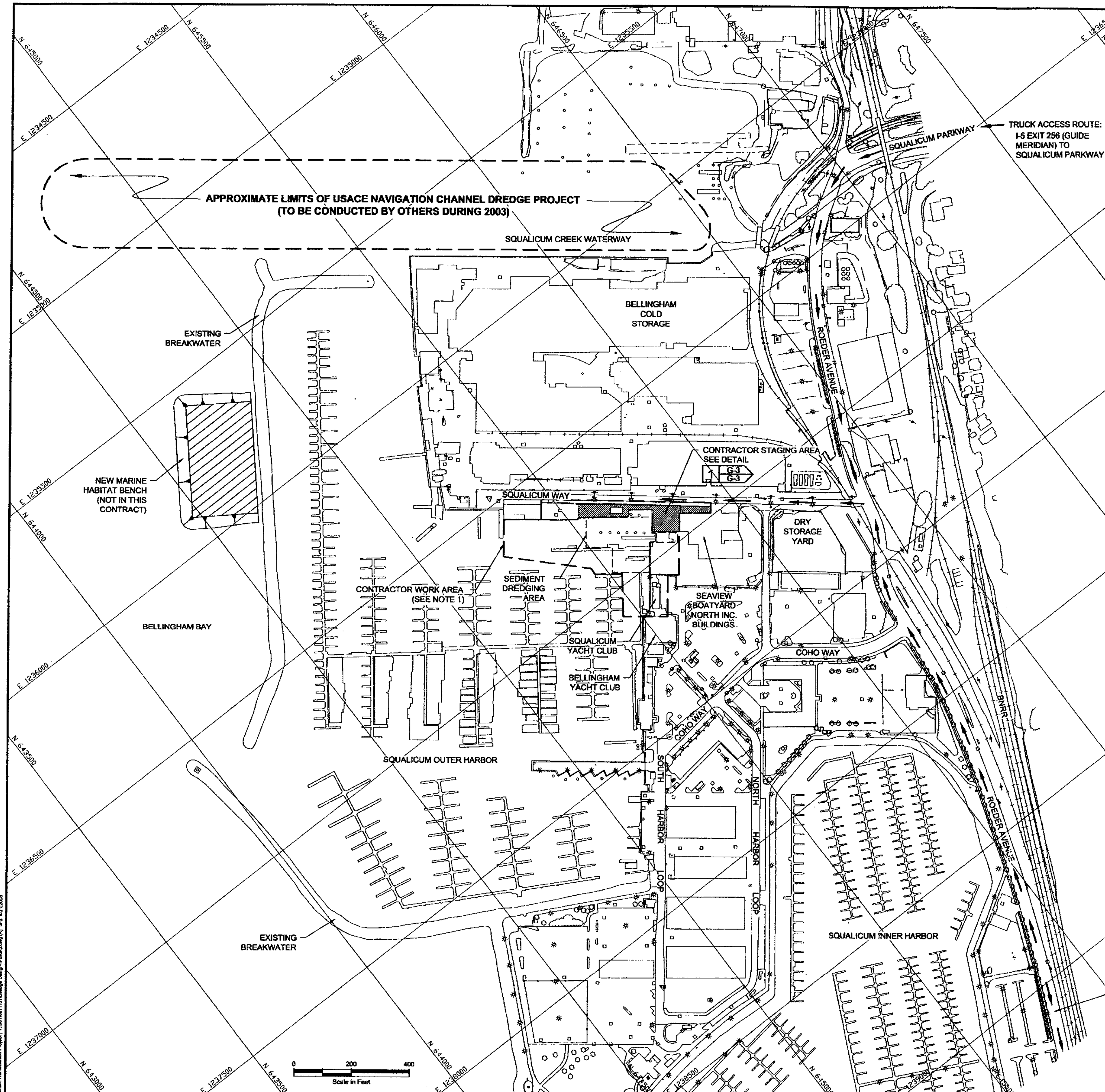
DRAFTED BY:	BRUCE L. SHELDON	BLS	4/21/03
DESIGNED BY:	DAVID A. PISCHER, P.E.	DAP	4/21/03
REVIEWED BY:	STEVE R. WRIGHT, P.E.	SRW	4/21/03
APPROVED BY:	LAWRENCE D. BEARD, P.E.	LDB	4/21/03
STATUS:	ISSUED FOR BID	INITIAL	DATE

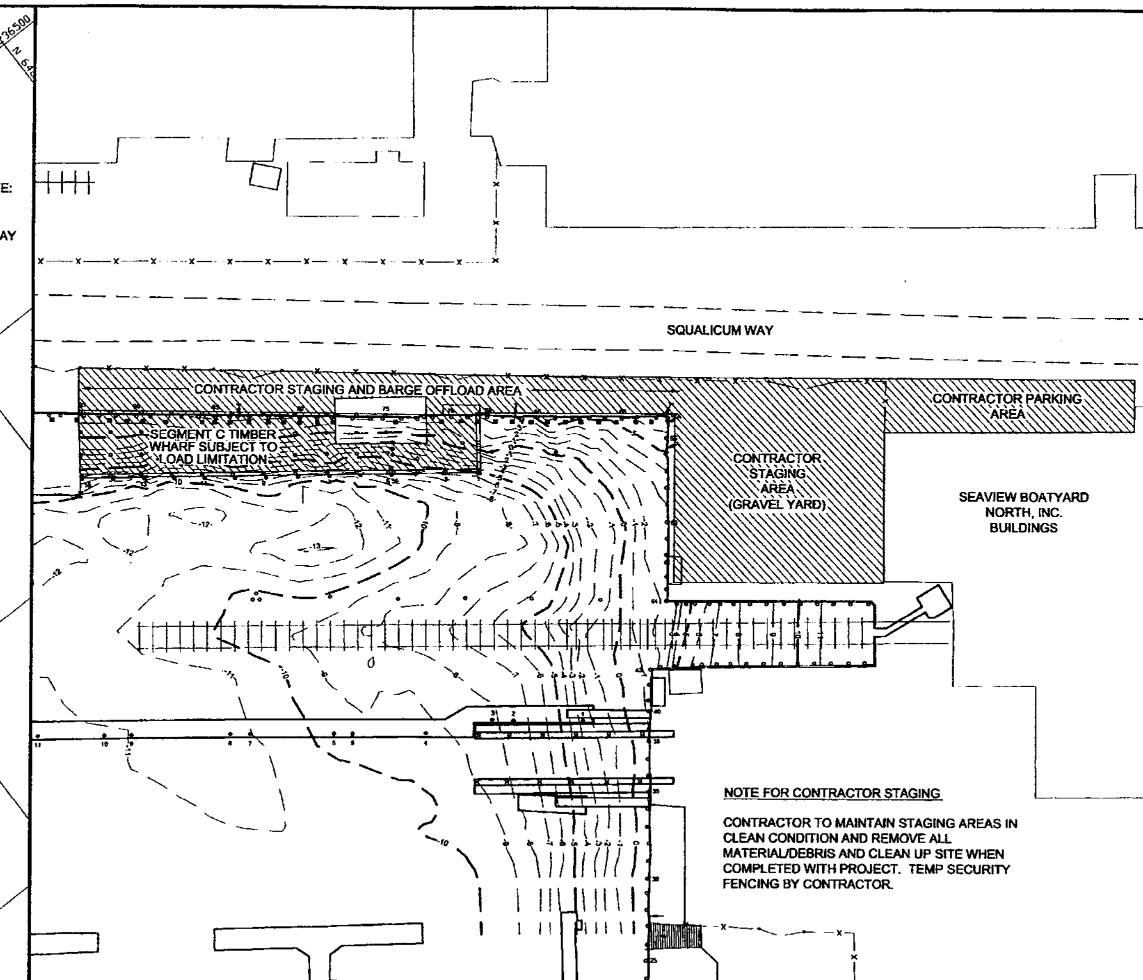
LANDAU ASSOCIATES
130 2nd AVENUE S.
EDMONDS, WA. 98020
(425) 778-0907, FAX (425) 778-6409

GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

GENERAL NOTES AND SYMBOLS

PROJECT NO. 001027
DATE APRIL 21, 2003
SHEET 2 OF 19
DRAWING NO. G-2





DETAIL 1 G-3/G-3 **CONTRACTOR STAGING AREAS**

0 40 80
Scale in Feet

PLAN NORTH
TRUE NORTH

DAVID A. PISCHER — STATE OF WASHINGTON — 19777 — REGISTERED PROFESSIONAL ENGINEER — 4/21/03
EXPIRES 7/18/04

LEGEND

- CONTRACTOR HAUL ROUTE
- CONTRACTOR WORK AREA
- SEDIMENT DREDGING AREA

NOTES:

1. CONTRACTOR'S TEMPORARY USE OF THE PORT OF BELLINGHAM WHARF AND DOCK FACILITIES ALONG THE NORTHERNMOST PORTION OF THE SITE WILL BE PERMITTED, SUBJECT TO THE RESTRICTIONS AND CONDITIONS SET FORTH IN THE CONTRACT DOCUMENTS, AND AS APPROVED BY THE OWNER.

"L"
NOTE: IF "L" DOES NOT MEASURE 1", ADJUST SCALES ACCORDINGLY

PORT OF BELLINGHAM
Washington State

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DESIGNED BY:	DAVID A. PISCHER, P.E.	DAP	4/21/03
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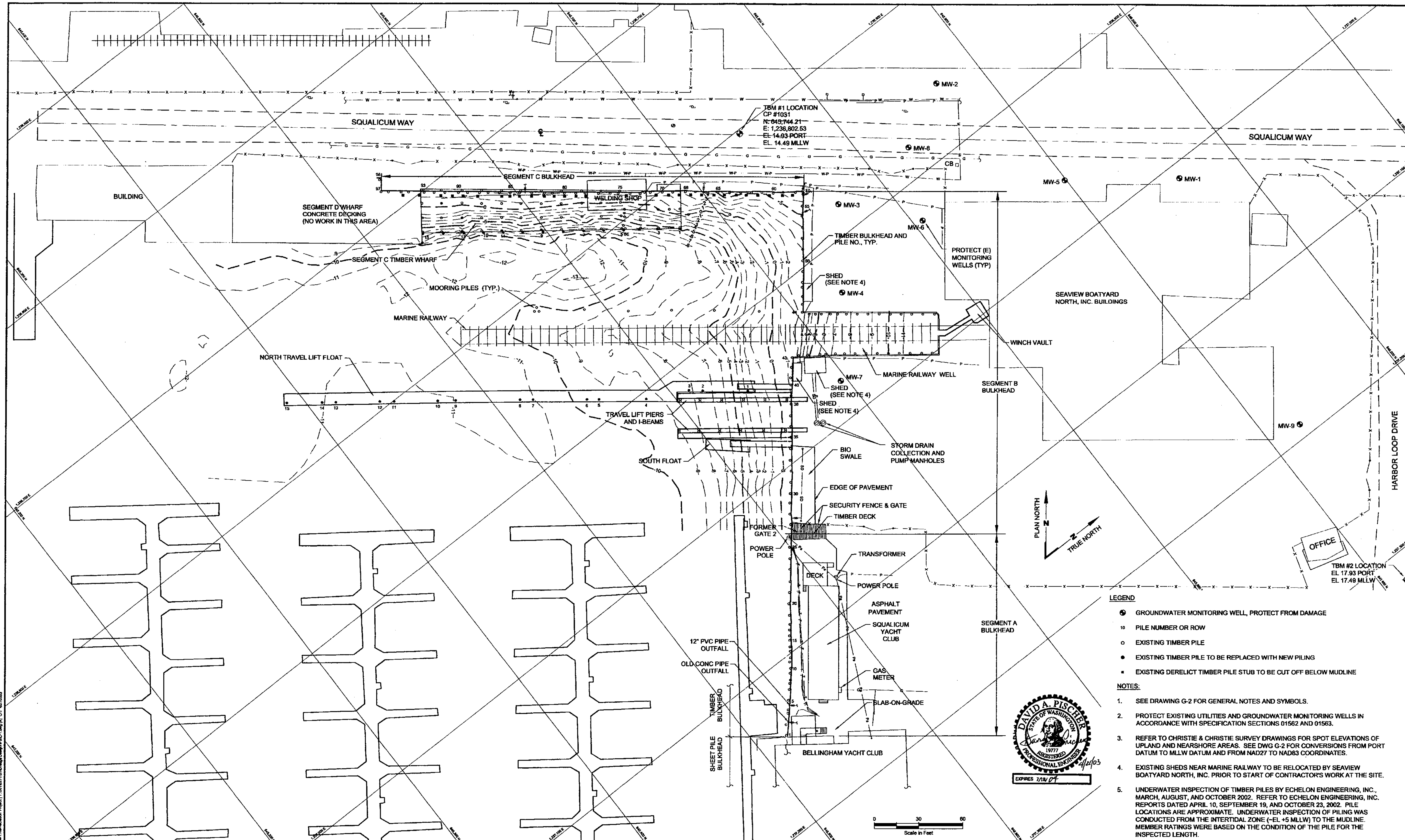
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

SITE VICINITY, ACCESS, AND STAGING AREAS

PROJECT NO. 001027
DATE APRIL 21, 2003
SHEET 3 OF 19
DRAWING NO. **G-3**



LEGEND

- GROUNDWATER MONITORING WELL, PROTECT FROM DAMAGE
- 10 PILE NUMBER OR ROW
- o EXISTING TIMBER PILE
- • EXISTING TIMBER PILE TO BE REPLACED WITH NEW PILING
- ▪ EXISTING DERELICT TIMBER PILE STUB TO BE CUT OFF BELOW MUDLINE

NOTES:

1. SEE DRAWING G-2 FOR GENERAL NOTES AND SYMBOLS.
2. PROTECT EXISTING UTILITIES AND GROUNDWATER MONITORING WELLS IN ACCORDANCE WITH SPECIFICATION SECTIONS 01562 AND 01563.
3. REFER TO CHRISTIE & CHRISTIE SURVEY DRAWINGS FOR SPOT ELEVATIONS OF UPLAND AND NEARSHORE AREAS. SEE DWG G-2 FOR CONVERSIONS FROM PORT DATUM TO MLLW DATUM AND FROM NAD27 TO NAD83 COORDINATES.
4. EXISTING SHEDS NEAR MARINE RAILWAY TO BE RELOCATED BY SEAVIEW BOATYARD NORTH, INC. PRIOR TO START OF CONTRACTOR'S WORK AT THE SITE.
5. UNDERWATER INSPECTION OF TIMBER PILES BY ECHELON ENGINEERING, INC., MARCH, AUGUST, AND OCTOBER 2002. REFER TO ECHELON ENGINEERING, INC. REPORTS DATED APRIL 10, SEPTEMBER 19, AND OCTOBER 23, 2002. PILE LOCATIONS ARE APPROXIMATE. UNDERWATER INSPECTION OF PILING WAS CONDUCTED FROM THE INTERTIDAL ZONE (~EL +5 MLLW) TO THE MUDLINE. MEMBER RATINGS WERE BASED ON THE CONDITION OF THE PILE FOR THE INSPECTED LENGTH.

"L"

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PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED

		INITIAL	DATE
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DESIGNED BY:	DAVID A. PISCHER, P.E.	DAP	4/21/03
REVIEWED BY:	STEVE R. WRIGHT, P.E.	SRW	4/21/03
APPROVED BY:	LAWRENCE D. BEARD, P.E.	LDB	4/21/03
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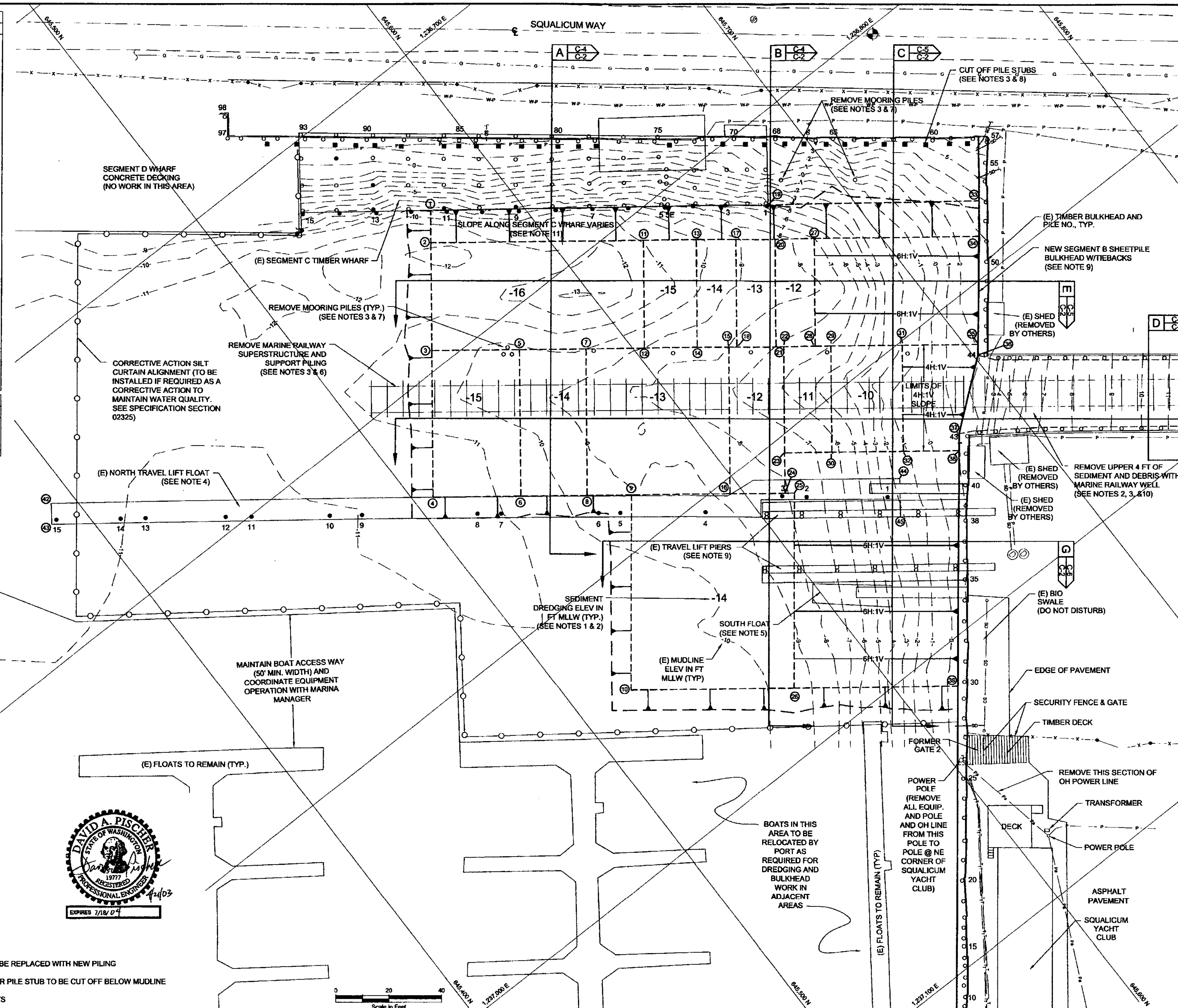
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND
REDEVELOPMENT PROJECT

EXISTING CONDITIONS SITE PLAN

PROJECT NO. 001027
DATE APRIL 21, 2003
SHEET 4 OF 19
DRAWING NO. C-1

SEDIMENT DREDGING AREA LAYOUT		
POINT	NORTHING	EASTING
1	645,571.75	1,236,751.74
2	645,564.47	1,236,761.27
3	645,539.97	1,236,793.36
4	645,506.64	1,236,837.01
5	645,566.20	1,236,813.39
6	645,532.87	1,236,857.04
7	645,586.07	1,236,828.56
8	645,552.74	1,236,872.21
9	645,565.98	1,236,882.31
10	645,520.96	1,236,939.75
11	645,628.05	1,236,809.82
12	645,603.55	1,236,841.91
13	645,643.95	1,236,821.96
14	645,619.45	1,236,854.05
15	645,628.99	1,236,861.33
16	645,595.66	1,236,904.98
17	645,655.87	1,236,831.06
18	645,631.37	1,236,863.15
19	645,673.50	1,236,828.52
20	645,667.79	1,236,840.16
21	645,643.29	1,236,872.25
22	645,645.68	1,236,874.07
23	645,621.56	1,236,905.66
24	645,612.35	1,236,917.72
25	645,615.26	1,236,919.94
26	645,570.25	1,236,977.38
27	645,679.72	1,236,849.27
28	645,655.22	1,236,881.36
29	645,659.98	1,236,885.00
30	645,635.87	1,236,916.58
31	645,681.44	1,236,901.38
32	645,657.33	1,236,932.97
33	645,737.17	1,236,876.57
34	645,729.01	1,236,886.90
35	645,703.98	1,236,918.59
36	645,701.48	1,236,921.78
37	645,677.77	1,236,940.69
38	645,673.90	1,236,945.62
39	645,619.29	1,237,014.82
40	645,775.25	1,236,981.58
41	645,760.05	1,237,001.35

NORTH TRAVEL LIFT FLOAT LAYOUT		
POINT	NORTHING	EASTING
42	645,391.89	1,236,750.23
43	645,387.24	1,236,756.62
44	645,649.88	1,236,940.21
45	645,645.36	1,236,946.36



LEGEND

- (4) LAYOUT POINT
- 10 PILE NUMBER OR ROW
- ○ EXISTING TIMBER PILE
- ● EXISTING TIMBER PILE TO BE REPLACED WITH NEW PILING
- ■ EXISTING DERELICT TIMBER PILE STUB TO BE CUT OFF BELOW MUDLINE
- - - - - NEATLINE DREDGING LIMITS

NOTES:

1. DREDGE ELEVATIONS AND SLOPES REPRESENT NEATLINE EXCAVATION GRADES. ACTUAL GRADES MAY VARY WITHIN SPECIFIED TOLERANCES. DREDGE CUT TRANSITION SLOPES ARE 2H:1V (TYP) UNLESS OTHERWISE NOTED.
2. SEE SPECIFICATION SECTION 02325 FOR SEDIMENT DREDGING, EXCAVATION, MATERIAL HANDLING, AND DISPOSAL REQUIREMENTS.
3. SEE SPECIFICATION SECTION 02220 FOR MARINE STRUCTURES DEMOLITION, MATERIAL HANDLING, AND DISPOSAL REQUIREMENTS.
4. DISCONNECT AND REMOVE NORTH FLOAT POWER LINES. REMOVE AND DISPOSE OF EXISTING 15 TIMBER PILES SUPPORTING THE NORTH FLOAT AND TEMPORARILY RELOCATE FLOAT AND ACCESS RAMP TO A LOCATION APPROVED BY THE OWNER. FOLLOWING SEDIMENT DREDGING AND PLACEMENT OF SAND BACKFILL, REINSTALL NORTH FLOAT WITH 14" DIA. (CLASS A) ACZA TREATED TIMBER PILES (CONTRACTOR TO VERIFY FIT; MIN. EMBEDMENT = 15 FT). OWNER TO REINSTALL ACCESS RAMP AND POWER LINES.
5. TEMPORARILY RELOCATE SOUTH FLOAT AND ACCESS RAMP TO A LOCATION APPROVED BY THE OWNER. OWNER TO REINSTALL FLOAT AND RAMP.
6. REMOVE AND DISPOSE OF MARINE RAILWAY STEEL RAILS, TIMBER STRINGERS (APPROX. 12" X 14"), PILE CAPS (APPROX. 12" X 12"), AND RAILWAY SUPPORT PILES (APPROX. 135 TIMBER PILES, ASSUMING 6' BENTS ALTERNATELY SUPPORTED ON 2 AND 3 PILES). MARINE RAILWAY REMOVAL INCLUDES SUPERSTRUCTURE AND SUPPORT PILING FROM EASTERN END OF RAILWAY WELL OUT TO END OF RAILWAY. COORDINATE MARINE RAILWAY REMOVAL WITH SEDIMENT DREDGING/EXCAVATION AND INSTALLATION OF NEW SEGMENT B BULKHEAD.
7. REMOVE AND DISPOSE OF 8 TIMBER MOORING PILES LOCATED ALONG MARINE RAILWAY AND 2 MOORING PILES LOCATED EAST OF SEGMENT C WHARF.
8. CUT OFF DERELICT TIMBER PILE STUBS ALONG SEGMENT C BULKHEAD AND UNDER SEGMENT C WHARF BELOW MUD LINE. 29 PILE STUBS (@ 6' LONG) BETWEEN PILES #58 AND #95 (WITHIN 3' OF EXISTING BULKHEAD)
9. INSTALL NEW SEGMENT B BULKHEAD PRIOR TO DREDGING TO AVOID UNDERCUTTING AND DESTABILIZING EXISTING TIMBER BULKHEAD. PROTECT NEW BULKHEAD AND EXISTING TRAVEL LIFT PIERS FROM DAMAGE DURING DREDGING AND MATERIAL HANDLING ACTIVITIES.
10. EXCAVATE SEDIMENT AND DEBRIS WITHIN THE MARINE RAILWAY WELL "IN THE DRY" WITH LAND-BASED EQUIPMENT. INSTALL TEMPORARY SHORING/SHEETING AS REQUIRED TO AVOID UNDERCUTTING AND DESTABILIZING SIDEWALLS OF RAILWAY WELL. CUT OFF DERELICT TIMBER PILES AND PILE STUBS WITHIN RAILWAY WELL AFTER EXCAVATION AND PRIOR TO PLACEMENT OF BACKFILL MATERIAL.
11. CAREFULLY REMOVE SURFICIAL SEDIMENT FROM THE EDGE OF THE SEGMENT C WHARF DOWN TO THE TOE OF THE ADJACENT DREDGE CUT. VARY CUT SLOPE AND DEPTH AS REQUIRED TO AVOID UNDERCUTTING EXISTING SLOPE UNDER SEGMENT C WHARF AND IN ADJACENT INTERTIDAL AREA. PROTECT SEGMENT C WHARF AND BULKHEAD FROM DAMAGE DURING DREDGING AND MATERIAL HANDLING ACTIVITIES.

"L"

NOTE: IF "L" DOES NOT MEASURE 1", ADJUST SCALES ACCORDINGLY

PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED

		INITIAL	DATE
DRAFTED BY:	BRUCE L. SHELDON		4/21/03
DESIGNED BY:	DAVID A. PISCHER, P.E.		4/21/03
REVIEWED BY:	STEVE R. WRIGHT, P.E.		4/21/03
APPROVED BY:	LAWRENCE D. BEARD, P.E.		4/21/03
STATUS:	ISSUED FOR BID		

LANDAU ASSOCIATES
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EDMONDS, WA. 98020
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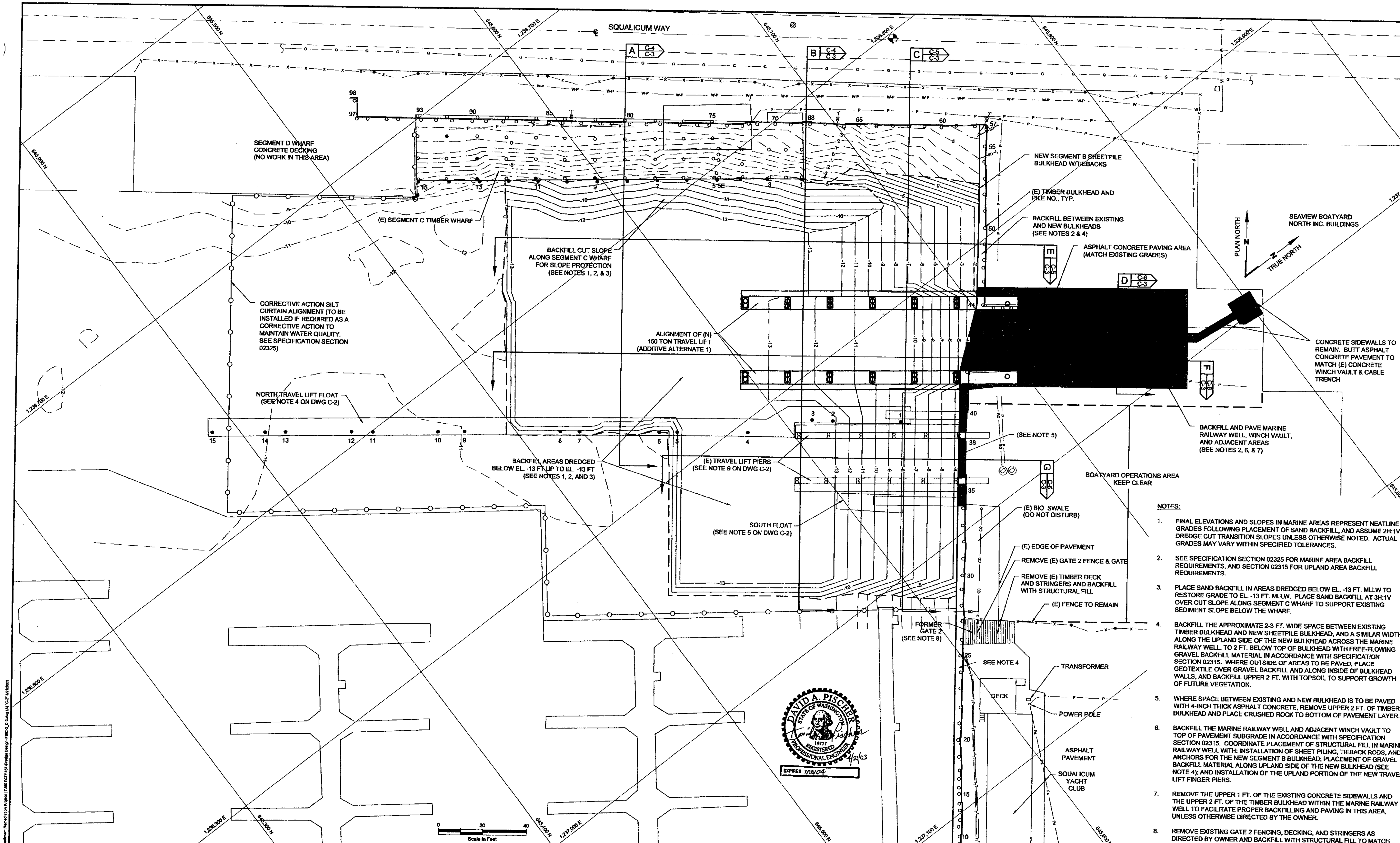
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND
REDEVELOPMENT PROJECT

SEDIMENT DREDGING AND EXCAVATION PLAN

PROJECT NO. 001027
DATE APRIL 21, 2003
SHEET 5 OF 19
DRAWING NO. C-2



NOTES:

1. FINAL ELEVATIONS AND SLOPES IN MARINE AREAS REPRESENT NEATLINE GRADES FOLLOWING PLACEMENT OF SAND BACKFILL, AND ASSUME 2H:1V DREDGE CUT TRANSITION SLOPES UNLESS OTHERWISE NOTED. ACTUAL GRADES MAY VARY WITHIN SPECIFIED TOLERANCES.

2. SEE SPECIFICATION SECTION 02325 FOR MARINE AREA BACKFILL REQUIREMENTS, AND SECTION 02315 FOR UPLAND AREA BACKFILL REQUIREMENTS.

3. PLACE SAND BACKFILL IN AREAS DREDGED BELOW EL. -13 FT. MLLW TO RESTORE GRADE TO EL. -13 FT. MLLW. PLACE SAND BACKFILL AT 3H:1V OVER CUT SLOPE ALONG SEGMENT C WHARF TO SUPPORT EXISTING SEDIMENT SLOPE BELOW THE WHARF.

4. BACKFILL THE APPROXIMATE 2-3 FT. WIDE SPACE BETWEEN EXISTING TIMBER BULKHEAD AND NEW SHEETPILE BULKHEAD, AND A SIMILAR WIDTH ALONG THE UPLAND SIDE OF THE NEW BULKHEAD ACROSS THE MARINE RAILWAY WELL, TO 2 FT. BELOW TOP OF BULKHEAD WITH FREE-FLOWING GRAVEL BACKFILL MATERIAL IN ACCORDANCE WITH SPECIFICATION SECTION 02315. WHERE OUTSIDE OF AREAS TO BE PAVED, PLACE GEOTEXTILE OVER GRAVEL BACKFILL AND ALONG INSIDE OF BULKHEAD WALLS, AND BACKFILL UPPER 2 FT. WITH TOPSOIL TO SUPPORT GROWTH OF FUTURE VEGETATION.

5. WHERE SPACE BETWEEN EXISTING AND NEW BULKHEAD IS TO BE PAVED WITH 4-INCH THICK ASPHALT CONCRETE, REMOVE UPPER 2 FT. OF TIMBER BULKHEAD AND PLACE CRUSHED ROCK TO BOTTOM OF PAVEMENT LAYER.

6. BACKFILL THE MARINE RAILWAY WELL AND ADJACENT WINCH VAULT TO TOP OF PAVEMENT SUBGRADE IN ACCORDANCE WITH SPECIFICATION SECTION 02315. COORDINATE PLACEMENT OF STRUCTURAL FILL IN MARINE RAILWAY WELL WITH: INSTALLATION OF SHEET PILING, TIEBACK RODS, AND ANCHORS FOR THE NEW SEGMENT B BULKHEAD; PLACEMENT OF GRAVEL BACKFILL MATERIAL ALONG UPLAND SIDE OF THE NEW BULKHEAD (SEE NOTE 4); AND INSTALLATION OF THE UPLAND PORTION OF THE NEW TRAVEL LIFT FINGER PIERS.

7. REMOVE THE UPPER 1 FT. OF THE EXISTING CONCRETE SIDEWALLS AND THE UPPER 2 FT. OF THE TIMBER BULKHEAD WITHIN THE MARINE RAILWAY WELL TO FACILITATE PROPER BACKFILLING AND PAVING IN THIS AREA, UNLESS OTHERWISE DIRECTED BY THE OWNER.

8. REMOVE EXISTING GATE 2 FENCING, DECKING, AND STRINGERS AS DIRECTED BY OWNER AND BACKFILL WITH STRUCTURAL FILL TO MATCH EXISTING GRADES.

"L"
NOTE: IF "L" DOES NOT MEASURE 1", ADJUST SCALES ACCORDINGLY

PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED

DRAFTED BY:	BRUCE L. SHELDON	BLS	4/21/03
DESIGNED BY:	DAVID A. PISCHER, P.E.	DAP	4/21/03
REVIEWED BY:	STEVE R. WRIGHT, P.E.	SRW	4/21/03
APPROVED BY:	LAWRENCE D. BEARD, P.E.	LDB	4/21/03
STATUS:	ISSUED FOR BID	INITIAL	DATE

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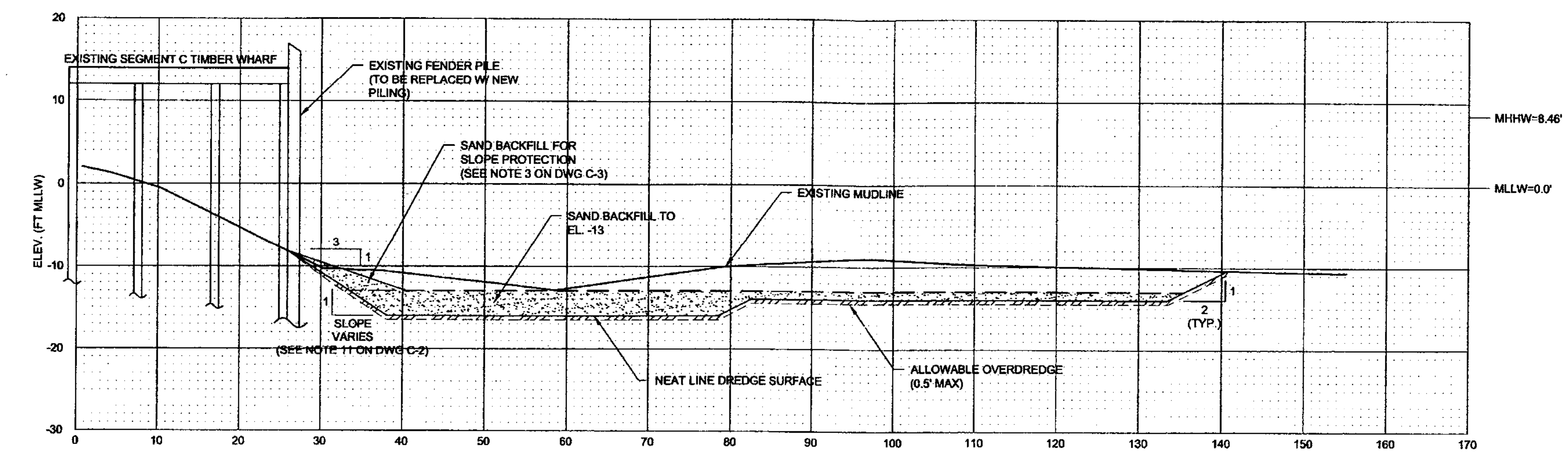
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

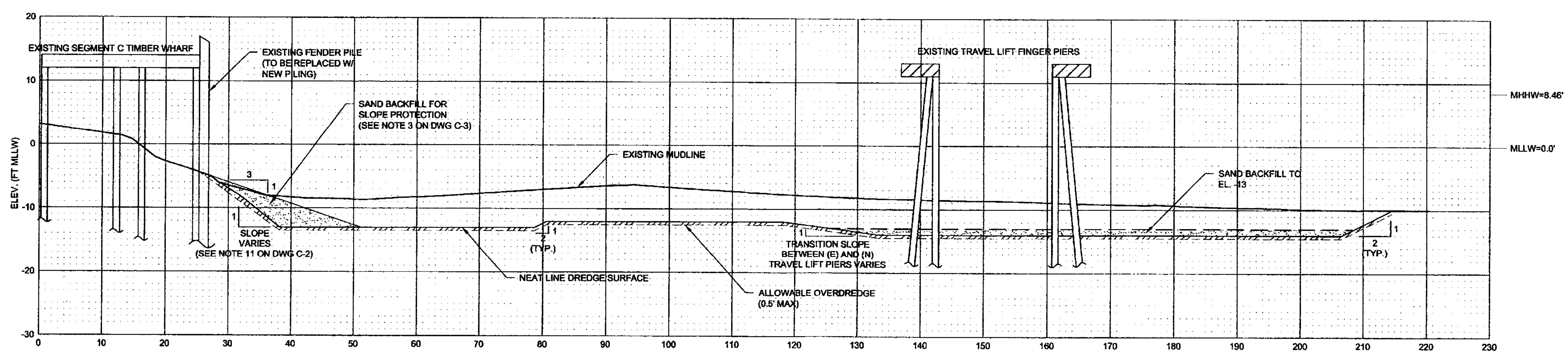
FINAL GRADING PLAN

PROJECT NO. 001027
DATE APRIL 21, 2003
SHEET 6 OF 19
DRAWING NO. C-3



CROSS SECTION A C-4/C-2 A C-4/C-3

Scale in Feet: 0 10 20



CROSS SECTION B C-4/C-2 B C-4/C-3

Scale in Feet: 0 10 20

NOTE:

CONTRACTOR TO VERIFY PRE-DREDGE, POST-DREDGE AND POST-BACKFILL ELEVATIONS AND CROSS SECTIONS PER SPECIFICATION SECTIONS 01720 AND 02325. (TYP.)

DAVID A. PISCHER — STATE OF WASHINGTON — 19777 — REGISTERED PROFESSIONAL ENGINEER — 4/21/03 — EXPIRES 7/18/04

"L" — NOTE: IF "L" DOES NOT MEASURE 1", ADJUST SCALES ACCORDINGLY

PORT OF BELLINGHAM Washington State

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED

DRAFTED BY:	BRUCE L. SHELDON	BS	4/21/03
DESIGNED BY:	DAVID A. PISCHER, P.E.	DP	4/21/03
REVIEWED BY:	STEVE R. WRIGHT, P.E.	SRW	4/21/03
APPROVED BY:	LAWRENCE D. BEARD, P.E.	LB	4/21/03
STATUS:	ISSUED FOR BID	INITIAL	DATE

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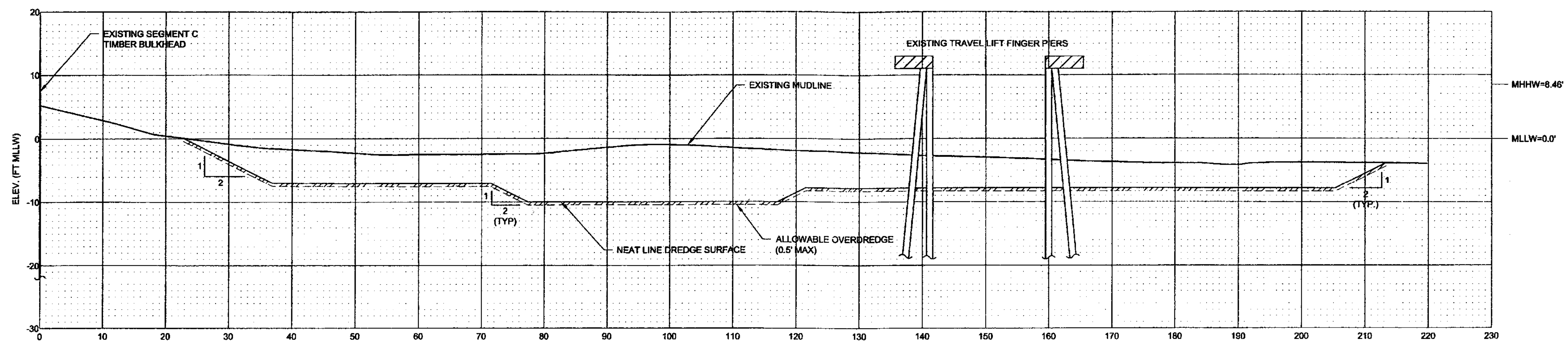
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

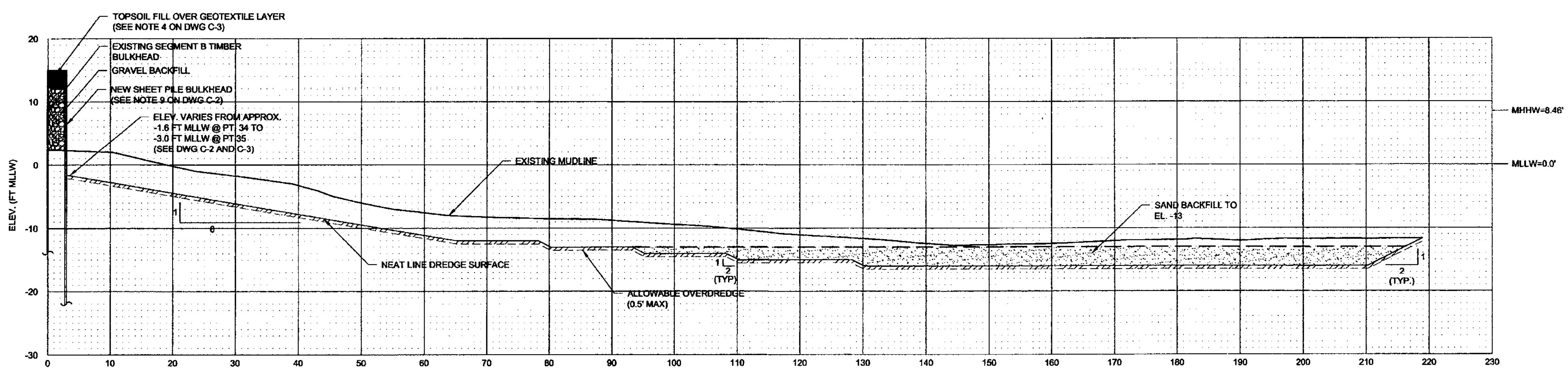
SECTIONS

PROJECT NO. 001027
DATE APRIL 21, 2003
SHEET 7 OF 19
DRAWING NO. C-4



CROSS SECTION C C-5/C-2 C C-5/C-3

0 10 20
Scale in Feet



CROSS SECTION E C-5/C-2 E C-5/C-3

0 10 20
Scale in Feet

NOTE:

CONTRACTOR TO VERIFY PRE-DREDGE, POST-DREDGE AND POST-BACKFILL ELEVATIONS AND CROSS SECTIONS PER SPECIFICATION SECTIONS 01720 AND 02325. (TYP)

DAVID A. PISCHER — STATE OF WASHINGTON — 19777 — REGISTERED PROFESSIONAL ENGINEER — 4/21/03
EXPIRES 7/18/04

"L"
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PORT OF BELLINGHAM Washington State

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		INITIAL	DATE
DRAFTED BY:	BRUCE L. SHELDON	BLS	4/21/03
DESIGNED BY:	DAVID A. PISCHER, P.E.	DAP	4/21/03
REVIEWED BY:	STEVE R. WRIGHT, P.E.	SRW	4/21/03
APPROVED BY:	LAWRENCE D. BEARD, P.E.	LDB	4/21/03
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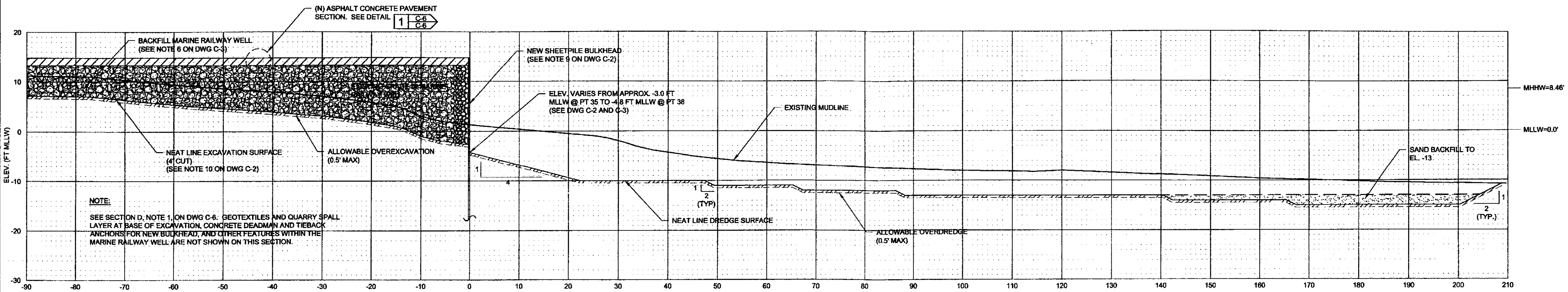
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

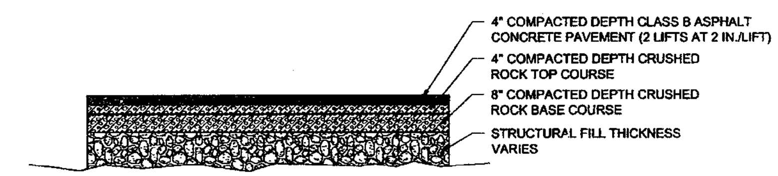
SECTIONS

PROJECT NO. 001027
DATE APRIL 21, 2003
SHEET 8 OF 19
DRAWING NO. C-5



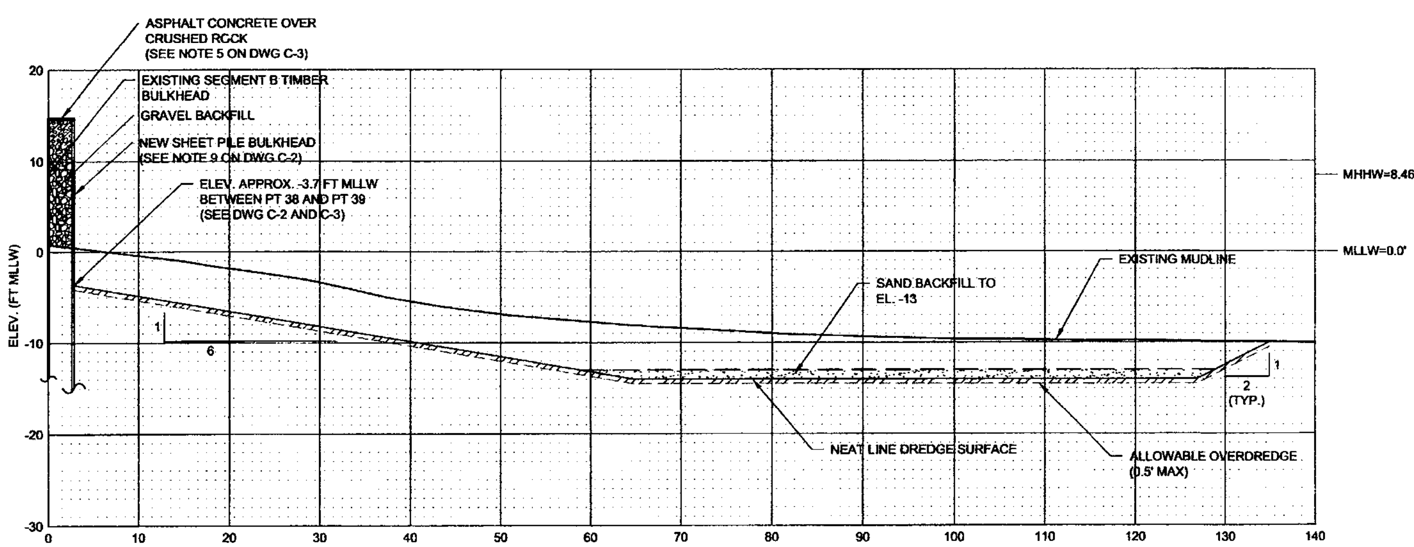
CROSS SECTION F C-6/C-2 F C-6/C-3

0 10 20
Scale in Feet



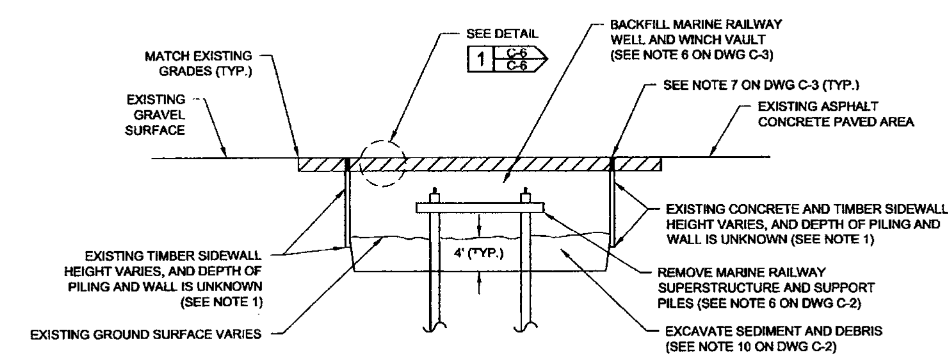
DETAIL 1 C-6/C-6 **TYPICAL PAVEMENT CONSTRUCTION**

NOT TO SCALE



CROSS SECTION G C-6/C-2 G C-6/C-3

0 10 20
Scale in Feet



SECTION D C-6/C-2 D C-6/C-3

NOT TO SCALE

NOTE:

1. SECTION IS SCHEMATIC IN NATURE. EXISTING TIMBER PILES, PILE CAPS, DERELICT PILES, AND OTHER FEATURES WITHIN THE MARINE RAILWAY WELL ARE NOT SHOWN. CONTRACTOR TO VERIFY ACTUAL SITE CONDITIONS THAT MAY AFFECT THE WORK WITHIN AND ADJACENT TO THE MARINE RAILWAY WELL.

NOTE:

CONTRACTOR TO VERIFY PRE-DREDGE, POST-DREDGE AND POST-BACKFILL ELEVATIONS AND CROSS SECTIONS PER SPECIFICATION SECTIONS 01720 AND 02325. (TYP.)

DAVID A. PISCHER, STATE OF WASHINGTON, 19777, REGISTERED PROFESSIONAL ENGINEER, 4/21/03, EXPIRES 7/18/04

"L"
NOTE: IF "L" DOES NOT MEASURE 1", ADJUST SCALES ACCORDINGLY

PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED

DRAFTED BY:	BRUCE L. SHELDON	BLS	4/21/03
DESIGNED BY:	DAVID A. PISCHER, P.E.	DAP	4/21/03
REVIEWED BY:	STEVE R. WRIGHT, P.E.	SRW	4/21/03
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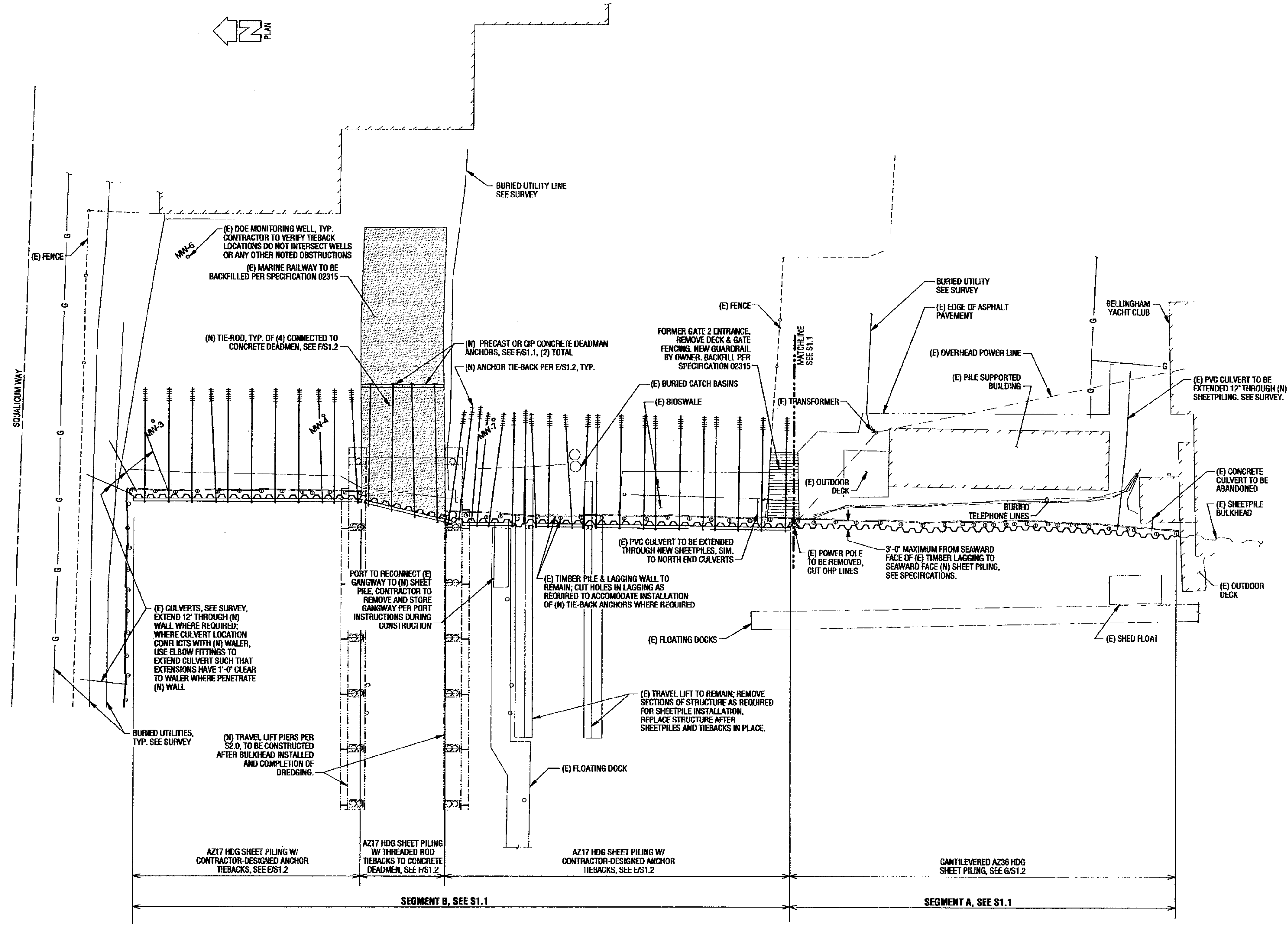
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

SECTIONS AND DETAILS

PROJECT NO. 001027
DATE APRIL 21, 2003
SHEET 9 OF 19
DRAWING NO. C-6



New Bulkhead Plan

Scale: 1" = 20'

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3 READ THE STRUCTURAL NOTES; THEY CONTAIN IMPORTANT INFORMATION ABOUT ALL MATERIALS OF CONSTRUCTION.

4 PILE DRIVING NOTES:
A. SEE ADDITIONAL GEOTECHNICAL INFORMATION IN EXHIBIT 'F'.

MATERIALS LEGEND:

SOILS — EARTH: — SAND:
GRAVEL: — ROCK:
STEEL:
EXISTING MATERIALS:

SYMBOLS LEGEND:

CALLOUTS: (DETAIL #/ STRUCT. DWG) — DETAIL: X/S4.XX — SECTION: X / S4.XX

NOTES:

1. SEE S1.1 PLAN FOR ADDITIONAL INFORMATION NOT SHOWN ON THIS SHEET.

2. SEAWARD FACE OF SHEETPILING SHALL NOT EXTEND BEYOND 3'-0" FROM THE FACE OF EXISTING TIMBER LAGGING UNLESS SMALL DEVIATIONS ARE REQUIRED IN ORDER TO MAINTAIN STRAIGHTNESS AND/OR AVOID OBSTACLES. EACH OF THESE DEVIATIONS SHALL BE APPROVED BY THE OWNER PRIOR TO INSTALLATION.

3. IF SHEETPILE LAYOUT AND/OR INSTALLED DIMENSIONS REQUIRE VARIATION FROM THE CONNECTIONS SHOWN ON S1.2 OR S1.3, AN ALTERNATIVE GEOMETRY FOR THESE CONNECTIONS SHALL BE PROPOSED BY THE CONTRACTOR AND APPROVED BY THE OWNER. ANY SUCH DEVIANCE SHALL BE PERFORMED AT NO ADDITIONAL COST TO THE OWNER.

4. TIEBACKS SHALL BE ORIENTED TO AVOID ALL NOTED OBSTACLES. ANY INCREASED LOAD DUE TO HORIZONTAL SKEW ANGLE SHALL BE CONSIDERED IN THE DESIGN OF THE TIEBACK ANCHOR.

5. SEE STRUCTURAL NOTES ON S1.3 AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

6. THIS DRAWING IS BASED ON SURVEY BY CHRISTIE & CHRISTIE DATED FEB. 2003. CONTRACTOR TO FIELD VERIFY LAYOUT OF SHEETPILING AND TIEBACKS WITH RESPECT TO ALL OBSTACLES AND OTHER CRITERIA OF THE CONTRACT DOCUMENTS. CONTRACTOR SHALL PROMPTLY NOTIFY OWNER OF ANY DISCREPANCIES PRIOR TO FABRICATION.

7. AT EACH LOCATION WHERE PIPES, CULVERTS, OR OTHER UTILITIES PENETRATE THE SHEETPILING, THE SHEETPILING SHALL BE REINFORCED TO MAINTAIN THE SAME SECTION MODULUS PER FOOT OF WALL AS FOR AN UNMODIFIED SECTION. CONTRACTOR SHALL SUBMIT FOR EACH SUCH LOCATION: FIELD-MEASURED HOLE LOCATION WITH RESPECT TO FLANGE AND WEB, HOLE SIZE, AND PROPOSED METHOD OF REINFORCING TO THE OWNER FOR APPROVAL.

CRAIG S. FUNSTON — STATE OF WASHINGTON — 27394 — REGISTERED PROFESSIONAL ENGINEER — 22 APRIL 03 — EXPIRES 31 JULY 03

WILLIAM A. HAYNES — STATE OF WASHINGTON — 32151 — REGISTERED PROFESSIONAL ENGINEER — 22 APR 03 — EXPIRES 11 SEP 04

File Name: 202816 Bulkhead Plan
Date Printed: Tue, 22, 2003 2:01:27 PM

PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED		REVIEWED		APPROVED	
	22 APR 03	ISSUED FOR BID	DDL	22Apr03	WAH	22Apr03	WAH	22Apr03

		INITIAL	DATE
DRAFTED BY:	CSAyers	CSA	22 Apr 03
DESIGNED BY:	DDLinkhart	DDL	22 APR 03
REVIEWED BY:	WAHaynes	WAH	22 Apr 03
APPROVED BY:			
STATUS:	ISSUED FOR BID		

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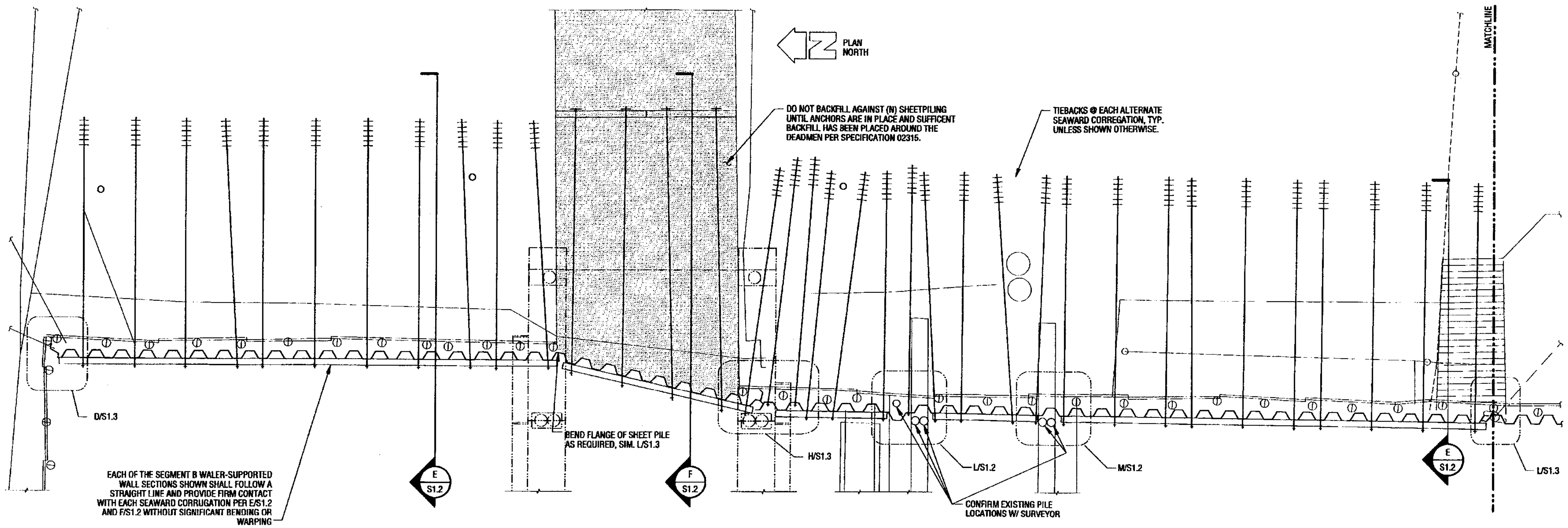
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

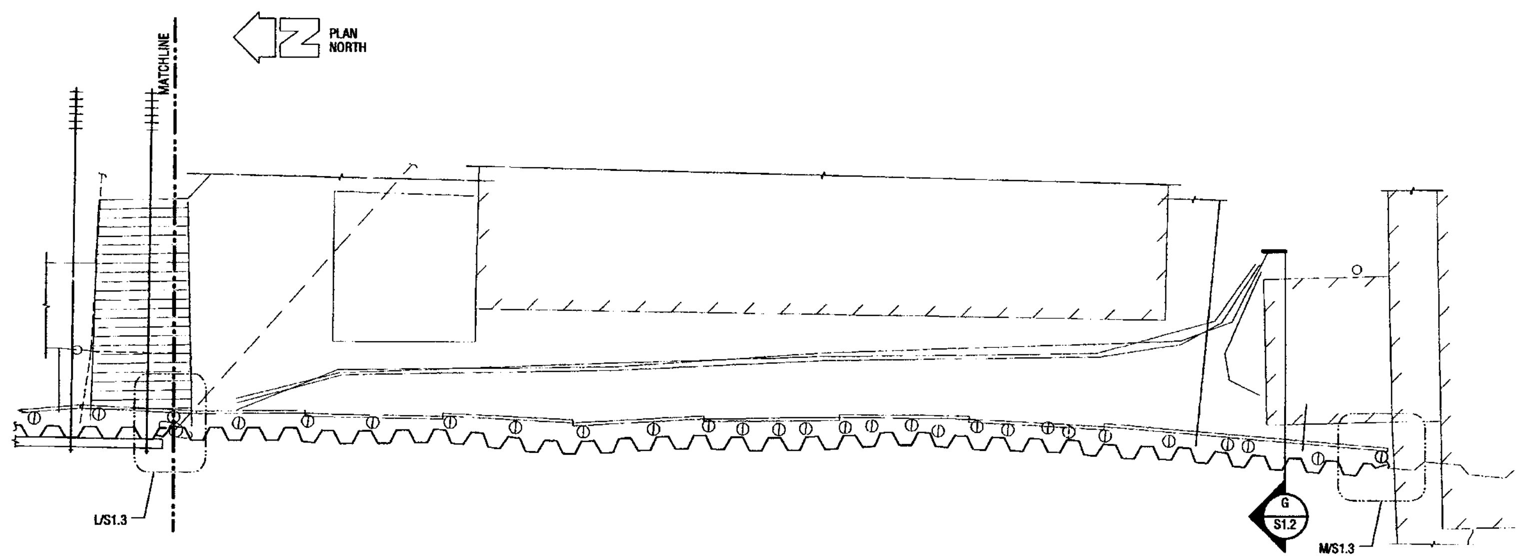
OVERALL BULKHEAD REPLACEMENT PLAN

PROJECT NO. 202816.01
DATE 22 APR 03
SHEET 10 OF 19
DRAWING NO. S1.0



BULKHEAD PLAN, SEGMENT B

Scale: 1" = 10'



BULKHEAD PLAN, SEGMENT A

Scale: 1" = 10'

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3 READ THE STRUCTURAL NOTES; THEY CONTAIN IMPORTANT INFORMATION ABOUT ALL MATERIALS OF CONSTRUCTION.

4 PILE DRIVING NOTES:
A. SEE ADDITIONAL GEOTECHNICAL INFORMATION IN EXHIBIT 'F'.

MATERIALS LEGEND:

SOILS — EARTH: SAND: GRAVEL: ROCK:

STEEL:

EXISTING MATERIALS:

SYMBOLS LEGEND:

CALLOUTS: (DETAIL #/ STRUCT. DWG) — DETAIL: X/S4.XX — SECTION: X / S4.XX

NOTES:

1. SEE S1.0 PLAN FOR ADDITIONAL INFORMATION NOT SHOWN ON THIS SHEET.

2. SEAWARD FACE OF SHEETPILING SHALL NOT EXTEND BEYOND 3'-0" FROM THE FACE OF EXISTING TIMBER LAGGING UNLESS SMALL DEVIATIONS ARE REQUIRED IN ORDER TO MAINTAIN STRAIGHTNESS AND/OR AVOID OBSTACLES. EACH OF THESE DEVIATIONS SHALL BE APPROVED BY THE OWNER PRIOR TO INSTALLATION.

3. IF SHEETPILE LAYOUT AND/OR INSTALLED DIMENSIONS REQUIRE VARIATION FROM THE CONNECTIONS SHOWN ON S1.2 OR S1.3, AN ALTERNATIVE GEOMETRY FOR THESE CONNECTIONS SHALL BE PROPOSED BY THE CONTRACTOR AND APPROVED BY THE OWNER. ANY SUCH DEVIANCE SHALL BE PERFORMED AT NO ADDITIONAL COST TO THE OWNER.

4. TIEBACKS SHALL BE ORIENTED TO AVOID ALL NOTED OBSTACLES. ANY INCREASED LOAD DUE TO HORIZONTAL SKEW ANGLE SHALL BE CONSIDERED IN THE DESIGN OF THE TIEBACK ANCHOR.

5. SEE STRUCTURAL NOTES ON S1.3 AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

6. THIS DRAWING IS BASED ON SURVEY BY CHRISTIE & CHRISTIE DATED FEB. 2003. CONTRACTOR TO FIELD VERIFY LAYOUT OF SHEETPILING AND TIEBACKS WITH RESPECT TO ALL OBSTACLES AND OTHER CRITERIA OF THE CONTRACT DOCUMENTS. CONTRACTOR SHALL PROMPTLY NOTIFY OWNER OF ANY DISCREPANCIES PRIOR TO FABRICATION.

CRAIG S. FUNSTON — STATE OF WASHINGTON — 27394 — REGISTERED PROFESSIONAL ENGINEER — 22 APRIL 03
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PORT OF BELLINGHAM Washington State

NO.	DATE	REVISIONS	DESIGNED		REVIEWED		APPROVED	
	22 APR 03	ISSUED FOR BID	DDL	22Apr03	WAH	22Apr03	WAH	22Apr03

		INITIAL	DATE
DRAFTED BY:	CSAyers	CSA	22 Apr 03
DESIGNED BY:	DDLinkhart	DDL	22 APR 03
REVIEWED BY:	WAHaynes	WAH	22 APR 03
APPROVED BY:			
STATUS:	ISSUED FOR BID		

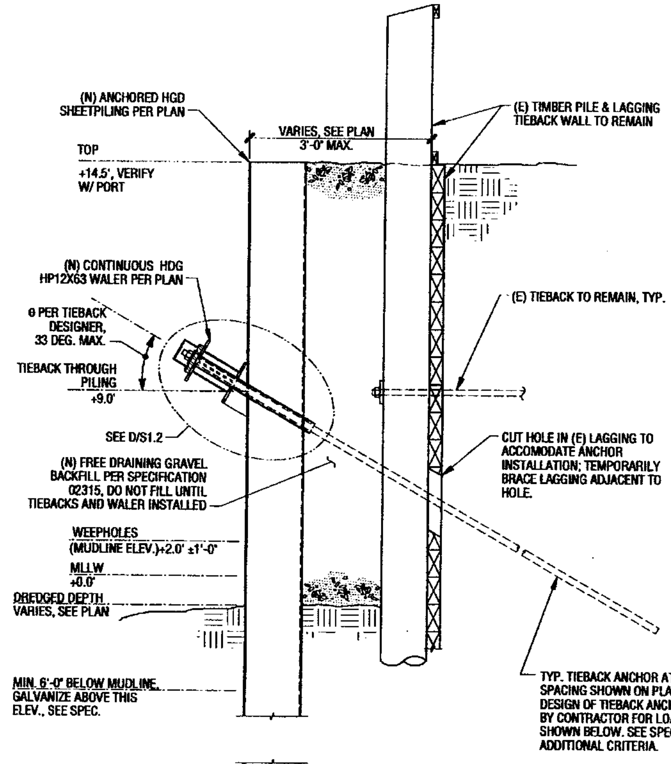
GEIGER ENGINEERS
114 W. Magnolia Street Suite 505 Bellingham . WA . 98225-4369
tel 360.734.7194 . fax 360.734.7399 . e-mail : mail@geigerengineers.com

GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

BULKHEAD REPLACEMENT
ENLARGED PLAN

PROJECT NO. 202816.01
DATE 22 APR 03
SHEET 11 OF 19
DRAWING NO. S1.1

File Name: 202816 * Plan 1-10
Date Printed: Tue 22, 2003 2:02:11 PM



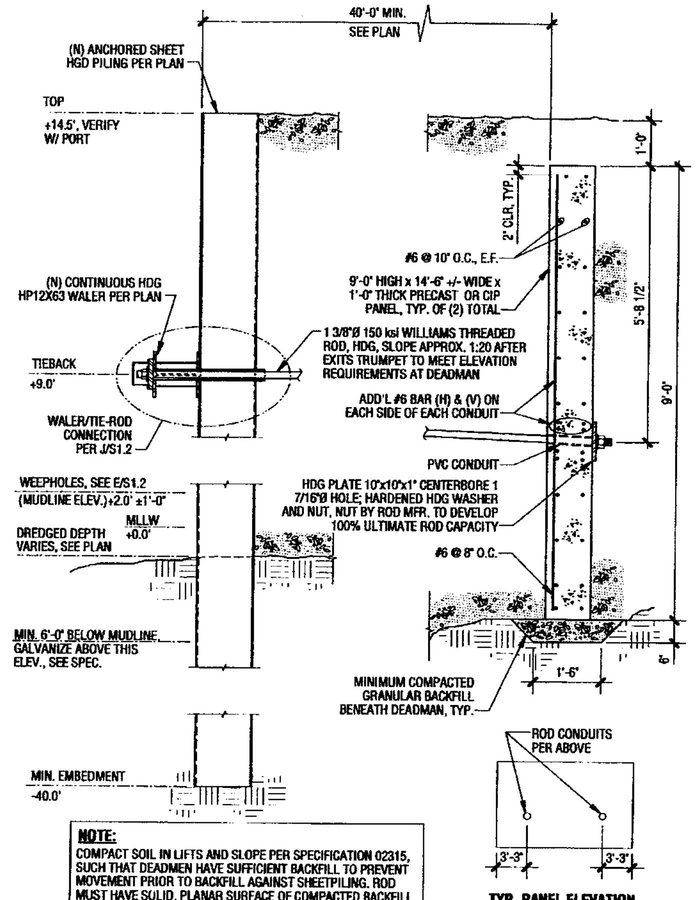
TIEBACK DESIGN LOADS

θ (DEG)	SEISMIC	LOAD
0	INCLUDED	87 KIPS

NOTE THAT THESE LOADS ARE SERVICE LEVEL LOADS THAT MUST BE INCREASED FOR θ > 0. LOADS BASED UPON TIEBACKS @ 8.27 FT. O.C. MINIMUM ULTIMATE LOAD SHALL BE 1.5*(DESIGN LOAD). TIEBACKS SHALL BE DESIGNED TO RESIST THE MAXIMUM OF THE ULTIMATE LOAD OR THE TEST LOADINGS REQUIRED BY THE SPECIFICATION.

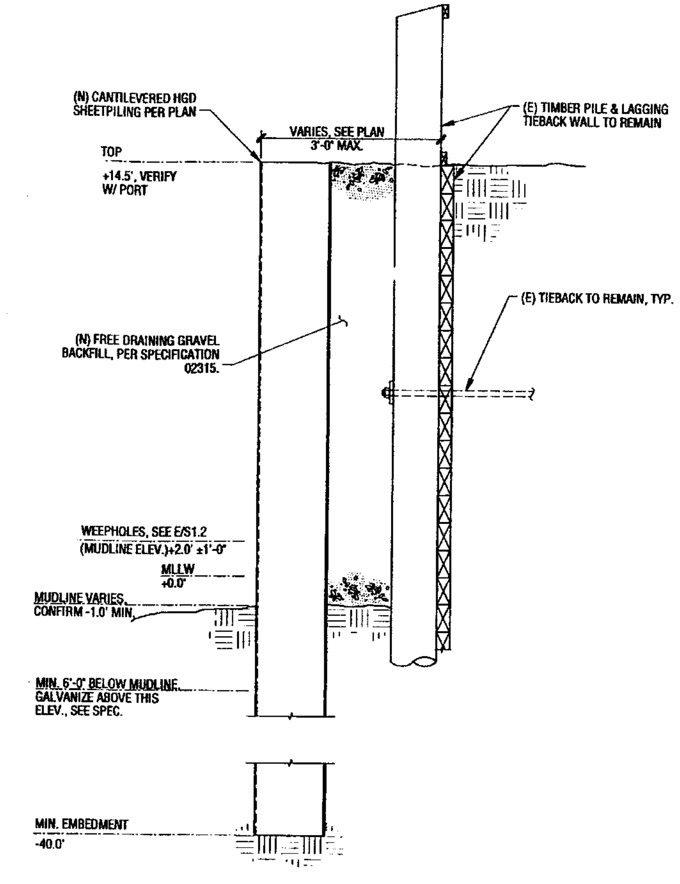
NOTE:
WEEPHOLES SHALL BE 3"Ø @ 10'-0" O.C. (HORIZONTAL) MAX. ATTACH NON-METALLIC SCREEN (SUCH AS GEOTEXTILE FABRIC) TO BACKFILL SIDE OF EACH HOLE TO RETAIN SOIL. CONTRACTOR TO SUBMIT CANDIDATE SCREEN MATERIAL AND METHOD OF ATTACHMENT TO OWNER FOR APPROVAL.

E/S1.2 Segment B: Section @ Tieback Anchor Supported Bulkhead
Scale: N.T.S.

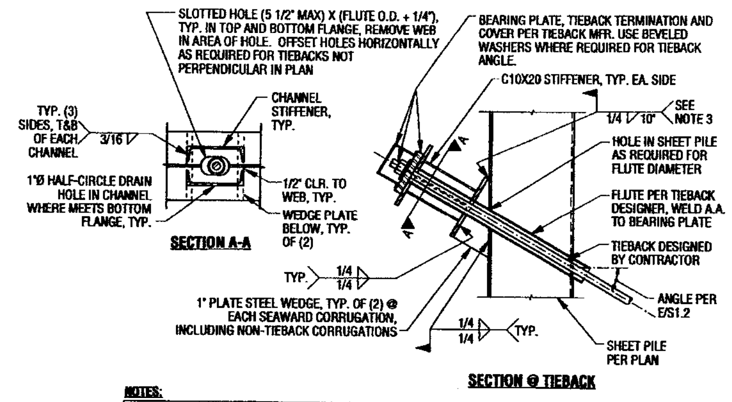


NOTE:
COMPACT SOIL IN LIFTS AND SLOPE PER SPECIFICATION 02315, SUCH THAT DEADMEN HAVE SUFFICIENT BACKFILL TO PREVENT MOVEMENT PRIOR TO BACKFILL AGAINST SHEETPILING. ROD MUST HAVE SOLID, PLANAR SURFACE OF COMPACTED BACKFILL BENEATH PRIOR TO COVERAGE.

F/S1.2 Segment B: Section @ Deadman Supported Bulkhead
Scale: N.T.S.

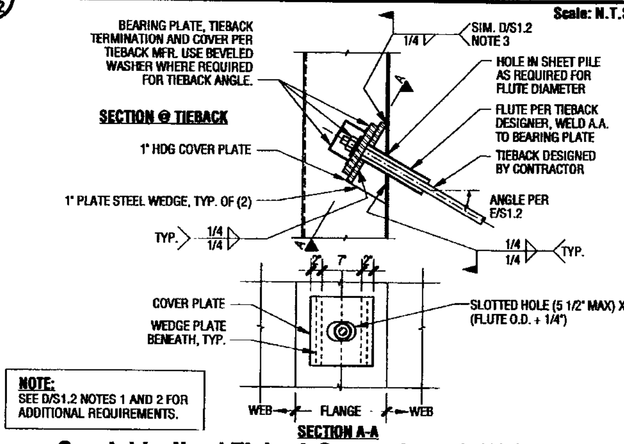


G/S1.2 Segment A: Section @ Cantilever Bulkhead
Scale: N.T.S.



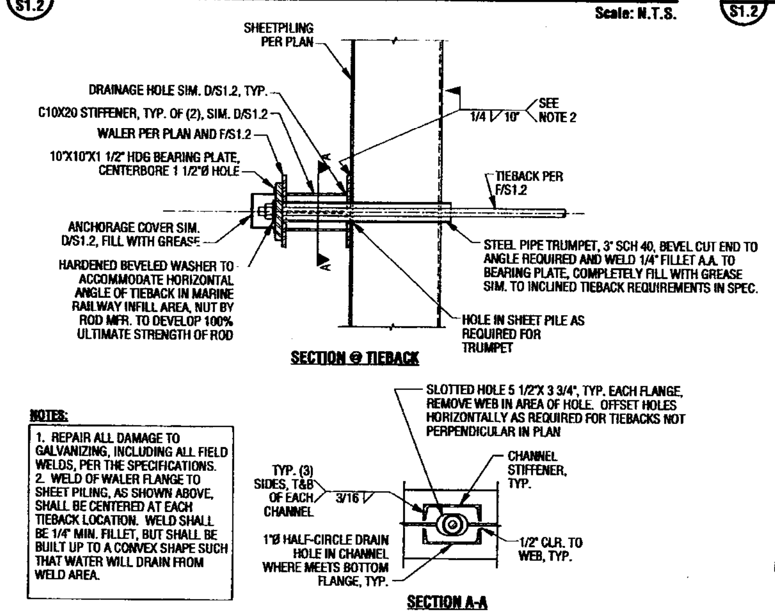
NOTES:
1. REPAIR ALL DAMAGE TO GALVANIZING, INCLUDING ALL FIELD WELDS, PER THE SPECIFICATIONS.
2. THIS CONNECTION IS SCHEMATIC ONLY; TIEBACK DESIGNER IS RESPONSIBLE FOR DESIGN OF CONNECTION TO WALER. PROVIDE CORROSION PROTECTION PER SPEC.
3. WELD OF WALER FLANGE TO SHEET PILING, AS SHOWN ABOVE, SHALL BE CENTERED AT EACH TIEBACK LOCATION. WELD SHALL BE 1/4" MIN. FILLET, BUT SHALL BE BUILT UP TO A CONVEX SHAPE SUCH THAT WATER WILL DRAIN FROM WELD AREA.

D/S1.2 Typical Inclined Tieback Connection @ Waler
Scale: N.T.S.



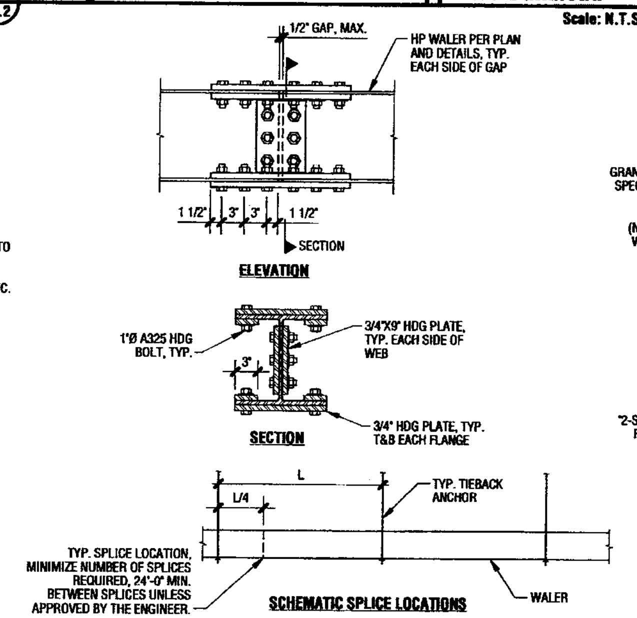
NOTE:
SEE D/S1.2 NOTES 1 AND 2 FOR ADDITIONAL REQUIREMENTS.

H/S1.2 Special Inclined Tieback Connection w/o Waler
Scale: N.T.S.

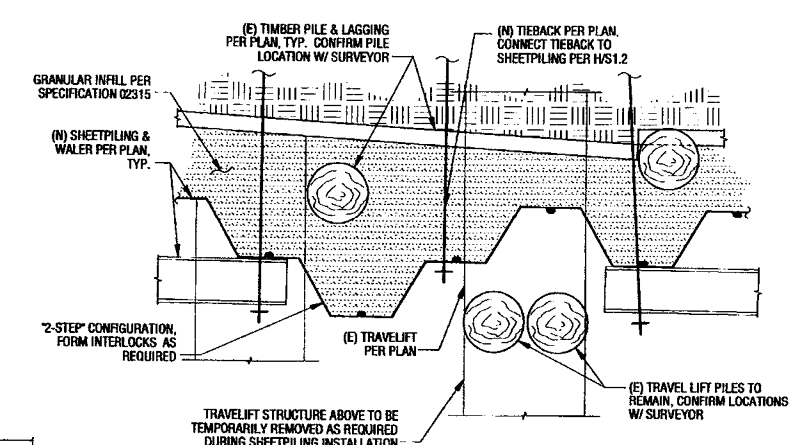


NOTES:
1. REPAIR ALL DAMAGE TO GALVANIZING, INCLUDING ALL FIELD WELDS, PER THE SPECIFICATIONS.
2. WELD OF WALER FLANGE TO SHEET PILING, AS SHOWN ABOVE, SHALL BE CENTERED AT EACH TIEBACK LOCATION. WELD SHALL BE 1/4" MIN. FILLET, BUT SHALL BE BUILT UP TO A CONVEX SHAPE SUCH THAT WATER WILL DRAIN FROM WELD AREA.

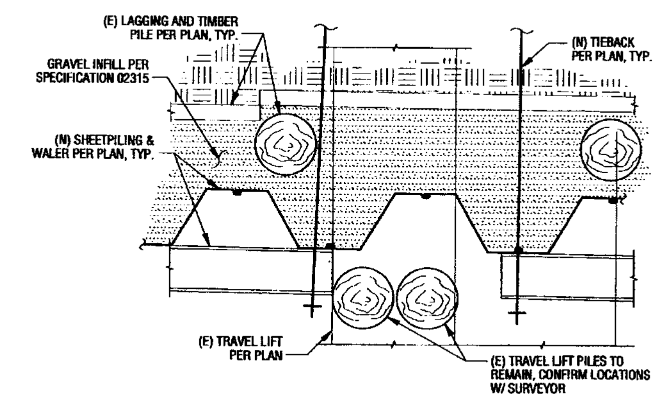
J/S1.2 Marine Railway Infill Area Waler-Tieback Connection
Scale: 3/4" = 1'-0"



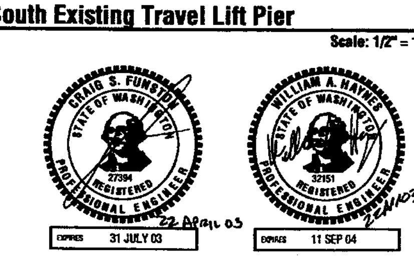
K/S1.2 Typical Waler Splice
Scale: 1" = 1'-0"



L/S1.2 Plan @ North Existing Travel Lift Pier
Scale: 1/2" = 1'-0"



M/S1.2 Plan @ South Existing Travel Lift Pier
Scale: 1/2" = 1'-0"



PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED		REVIEWED		APPROVED	
	22 APR 03	ISSUED FOR BID	DDL	22Apr03	WAH	22Apr03	WAH	22Apr03

		INITIAL	DATE
DRAFTED BY:	CSAyers	CSA	22 Apr 03
DESIGNED BY:	DDLinkhart	DDL	22 Apr 03
REVIEWED BY:	WAHaynes	WAH	22 Apr 03
APPROVED BY:			
STATUS:	ISSUED FOR BID		

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GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

BULKHEAD REPLACEMENT DETAILS

PROJECT NO.	202816.01
DATE	22 APR 03
SHEET	12 OF 19
DRAWING NO.	S1.2

File Name: 202816 S1.2 Bulkhead Details
Date Printed: Apr 22, 2003 2:03:01 PM

BULKHEAD REPAIR STRUCTURAL NOTES:

The notes contained on this sheet are to be used in conjunction with the specification. These notes apply only to drawing sheets pertaining to the bulkhead replacement (S1.0, S1.1, S1.2, and S1.3).

BUILDING CODE CRITERIA

1. All construction is to be in accordance with the minimum provisions of the 1997 Uniform Building Code (UBC). Where these plans and specifications do not state specifically otherwise the provisions of the UBC shall apply.
2. Structural system: New steel sheetpile bulkhead placed in front of existing timber pile and lagging bulkhead; backfill placed between the two bulkheads; existing bulkhead allowed to degrade. New bulkhead is a combination of cantilevered and tieback anchored. Tieback anchors are to be designed by the contractor for the loads and criteria provided in the design documents, with the exception of the marine well infill area where concrete deadman anchors are utilized.
3. Vertical Live Loads:

Vertical Live Load	300	PSF (Uniform on upland surface, includes load due to new travel lift)

4. Seismic Loads:

Above Mudline	8*H	PSF Uniform Active Pressure (H = wall height above mudline)

5. Retaining Walls

Above Water Table	32.8	PCF Equivalent Fluid Pressure
Below Water Table	81	PCF Equivalent Fluid Pressure

6. Special Inspections:
   The following special inspections are required, and will be performed by the owner's testing agency. In addition, special inspection is required where noted on the drawings. Provide necessary cooperation and access for the inspector. Provide adequate notice for inspection before covering work.
   - A Foundation and Earthwork:
     1. Piling installation, blow counts, length, casting, weld splicing, etc. See specification for additional requirements.
   - B Concrete work:
     The following tests shall be made for all reinforced concrete work:
     1. Concrete slump, air content, and strength. Taking of cylinders per UBC 1905. Placement of concrete.
     2. Inspect reinforcing cover, size, number, lap lengths, bends, grades.
   - C Structural Steel:
     1. Welding: Examine welders' certificates.
        - a The following welds may be inspected intermittently, and by visual inspection.
          - i Single-pass fillet welds ≤ 5/16"
        - b Continuously inspect all other structural welds, except as noted.
     2. High-Strength Bolting: Verify torques. Check bolts for exclusion of threads from shear planes and for contact of plies.
7. Material Certifications:
   See specification for submittal requirements.
8. Structural Observation
   The Structural Engineer of record will perform Structural Observations per UBC Section 1702, as required.

01000 GENERAL

1. Employ good standards of workmanship throughout. Provide all materials and perform all construction as indicated. Secure architect's approval for substitutions.
2. See specifications for detailed material and methods. In case of conflict between applicable codes, these notes, and the drawings, the more stringent will govern.
3. Verify all dimensions in the field and with the engineer, and upon discovery of any discrepancy between the structural drawings and field conditions or other drawings, notify the engineer.
4. Use these drawings in conjunction with other disciplines' drawings. They are not to stand alone. These drawings and the designs herein are copyrighted by Geiger Engineers, and are for use on this project only. They may not be copied or used for any other project or purpose other than as originally intended without written approval from Geiger Engineers.
5. Do not scale drawings.
6. Use typical details and schedules wherever applicable. Specific notes and details shall govern over typical details, but any parts of typical details not so altered will still apply.
7. The structure as shown on these drawings is designed to be stable and to resist the indicated loads in the completed condition. The drawings do not indicate the method or sequence of construction, except as may be specifically noted. The contractor is solely responsible for design and supply of all erection bracing and shoring to resist vertical and lateral loads, and for safety programs, methods, and procedures of operation for the construction of the design shown on these drawings.
8. Determine that loading applied to the structure during construction does not exceed the safe load-carrying capacity of the structural system or its members. The loads used in design of the members are listed above in "Building Code Criteria."

01340 SHOP DRAWINGS AND SUBMITTALS

1. Submit shop drawings of all fabricated items prior to fabrication. Allow 10 working days for review. Provide one reproducible and four prints of each submittal.
2. Submit shop drawings and calculations for tieback anchor system as required by the drawings and specifications.
3. Review and stamp all shop drawings for coordination with other suppliers prior to submittal.
4. Shop drawings shall demonstrate the fabricator's understanding of the project documents. Reproduction of the contract documents in part or in whole to create shop drawings is not permitted. Shop drawings thus created will be returned without review.
5. Shop drawings shall be clear and legible. Each shop drawing shall include:
   - A Title block showing name of project, fabricator's name, contractor, date, and unique drawing title and/or number.
   - B A blank space sufficient for contractor's and design team's review stamps.
6. Submittals consisting of manufacturer's cut sheets shall clearly identify the project and the model intended to be supplied.
7. Resubmittals shall be clearly identified as revisions, and all changes clearly marked. The design team will not be responsible to find unmarked changes.
8. Do not submit partial or incomplete drawings as a means of requesting information. Incomplete shop drawings will be returned without review.
9. See specifications for additional submittal requirements.

02220 FOUNDATIONS AND EARTHWORK

1. Backfill where required by drawings shall be placed and compacted according to the requirements of Specification 02315.
2. Do not backfill against tieback-supported bulkhead until tiebacks are in place. In the marine railway infill area, place backfill to the satisfaction of the geotechnical engineer around the concrete deadmen prior to backfilling against the sheetpile bulkhead.
3. Tiebacks (except in marine railway infill area) are to be designed by the contractor for the loads and requirements provided in the contract documents. Tiebacks may be helical anchors or grouted anchors. See specification for additional requirements for tieback anchors and sheet piling.

03200 REINFORCING

1. Materials (except as noted in drawings):
   Reinforcing bars: ASTM A615, Grade 60
2. Bar detailing not shown otherwise, and support of reinforcing bars in forms, shall conform to the CRSI Manual of Standard Practice. Reinforcing which is marked "continuous" in plans or details shall extend as far as possible in the concrete and terminate in a 12-diameter bend or per typical corner details, as appropriate. Shop fabricate all bends, except as noted.
3. Lap all continuous reinforcement 48 dia. unless noted otherwise on plans. Wire tie all lap splices.
4. Welding of reinforcing is not permitted.
5. Provide the following minimum cover from face of bar to face of concrete, except as detailed; provide necessary accessories to maintain clearances:

Concrete cast against ground	3"
Concrete formed but exposed to weather or ground	2"

03300 CONCRETE

1. Materials (except as noted in drawings):

Aggregate:	Stone aggregate per ASTM C33	
Cement:	Type I or II per ASTM C150	
	Type III may be used for plant-cast precast units	
Admixtures:	Water-reducing	ASTM C494 Type A

   All concrete shall be ready-mix. Comply with requirements of ASTM C 94 and as specified.
2. 28-day strengths shall be as follow, except as noted:

Application	f'c (psi)	w/c (max)	aggregate (max)
A. Deadman Panels	4000	0.55	1"

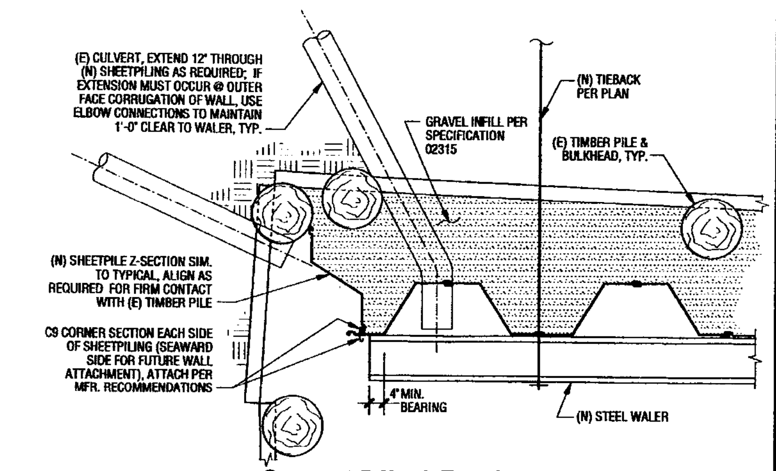
3. If panels are precast and lifted into position: Reinforcing shown and identified on drawings is the minimum required for all in-situ loads. Contractor shall be responsible for design, supply, and placement of lifting inserts and any extra reinforcement required for lifting and handling of tilt-up panels. All contractor design to be performed under the direction of and sealed by a Washington State Registered Structural Engineer, at Contractor's expense.
   Do not lift panels until field-cured cylinder tests demonstrate that concrete has achieved required strength, with factor of safety of 2.0 for f_r divided by unfactored stresses.
4. Brace all panels until sufficient backfill is placed on each side to provide stability.

05120 STRUCTURAL STEEL

1. Fabricate, erect, design, and detail all structural steel in accordance with AISC Standard Practice, except as noted.
2. Materials (except as noted in drawings):
   All materials shall be new stock, unless noted otherwise.

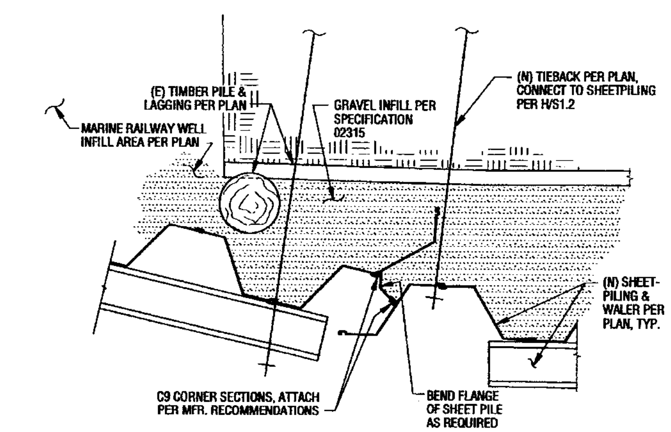
HP Sections:	ASTM A992 GR50	
Sheet Piling:	ASTM A572 GR50 or A328 with Fy = 50ksi min.	
Channels:	ASTM A36	
Plates and Bars:	ASTM A36 (A529, A572, A588 optional)	
Bolts, High-strength:	ASTM A325-N Type 1	
Heavy-Hex Nuts	ASTM A563	
Hardened Washers	ASTM F436	
Threaded Rods	ASTM A722 Fu=150ksi (Williams or Approved Equivalent)	
Weld electrode:	AWS D1.1–98, Table3.1, E70xx Low hydrogen	
Galvanizing:	Shapes and weldments	ASTM A123
	Bolts and hardware	ASTM A153

   See specification for additional material requirements.
3. Minimum welds:
   Welds not specified shall be 3/16" continuous fillet welds, or minimum size per AISC, whichever is greater.
   All weld sizes are effective sizes; increase as required if gaps exist at meeting surfaces.
   Groove welds not otherwise noted shall be complete penetration.
4. Welding shall be by WABO Certified welders and shall be as detailed or as specified by American Welding Society Standards D1.1-90.
5. Field welding is not permitted, except as specifically detailed
6. Prior to fabrication, identify all highly restrained welds and welds susceptible to cracking, and develop weld procedures to minimize restraint and cracking.
7. Bolt holes shall not be more than 1/16th" over-sized, and shall be drilled or punched; if punched, without distortion of the piece. Do not burn holes at any place.
8. All steel, including sheet piling, shall be hot-dip galvanized unless noted otherwise. Where galvanizing is damaged by drilling, punching, cutting, welding, or otherwise, the galvanizing shall be repaired by either hot-stick or spray metallize methods per ASTM A780. Fabrication shall be performed prior to hot-dip galvanizing wherever possible, and necessary field repairs to galvanizing shall be minimized. See specification for additional requirements.
9. Sheet piling shall be hot-dip galvanized on both sides from the top of each pile to 6'-0" below the final mudline, minimum. Interlocks shall be kept free of galvanizing such that pile driving may occur without significant interlock frictional resistance. Coating shall be per specifications.
9. Re-entrant corners to have 1/2" radius, minimum, and be free of notches.



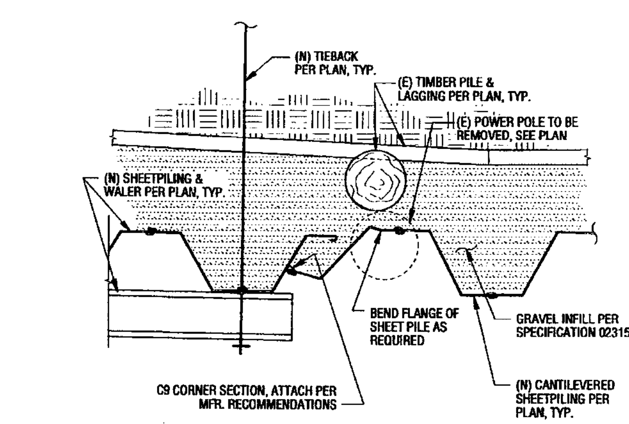
D / S1.3 **Segment B North Termination**

Scale: 1/2" = 1'-0"



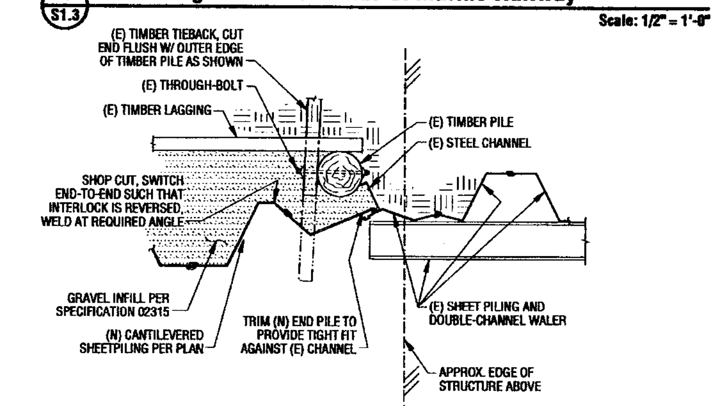
H / S1.3 **Segment B South End of Marine Railway**

Scale: 1/2" = 1'-0"



L / S1.3 **Segment B/A Interface**

Scale: 1/2" = 1'-0"



M / S1.3 **Segment A South Termination**

Scale: 1/2" = 1'-0"

EXPIRES 31 JULY 03

EXPIRES 11 SEP 04

PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED		REVIEWED		APPROVED	
	22 APR 03	ISSUED FOR BID	DDL	22Apr03	WAH	22Apr03	WAH	22Apr03

DRAFTED BY:	CSAyers	CSA	22 Apr 03
DESIGNED BY:	DDLinkhart	DDL	22APR03
REVIEWED BY:	WAHaynes	WAH	22 Apr 03
APPROVED BY:			
STATUS:	ISSUED FOR BID	INITIAL	DATE

GEIGER ENGINEERS
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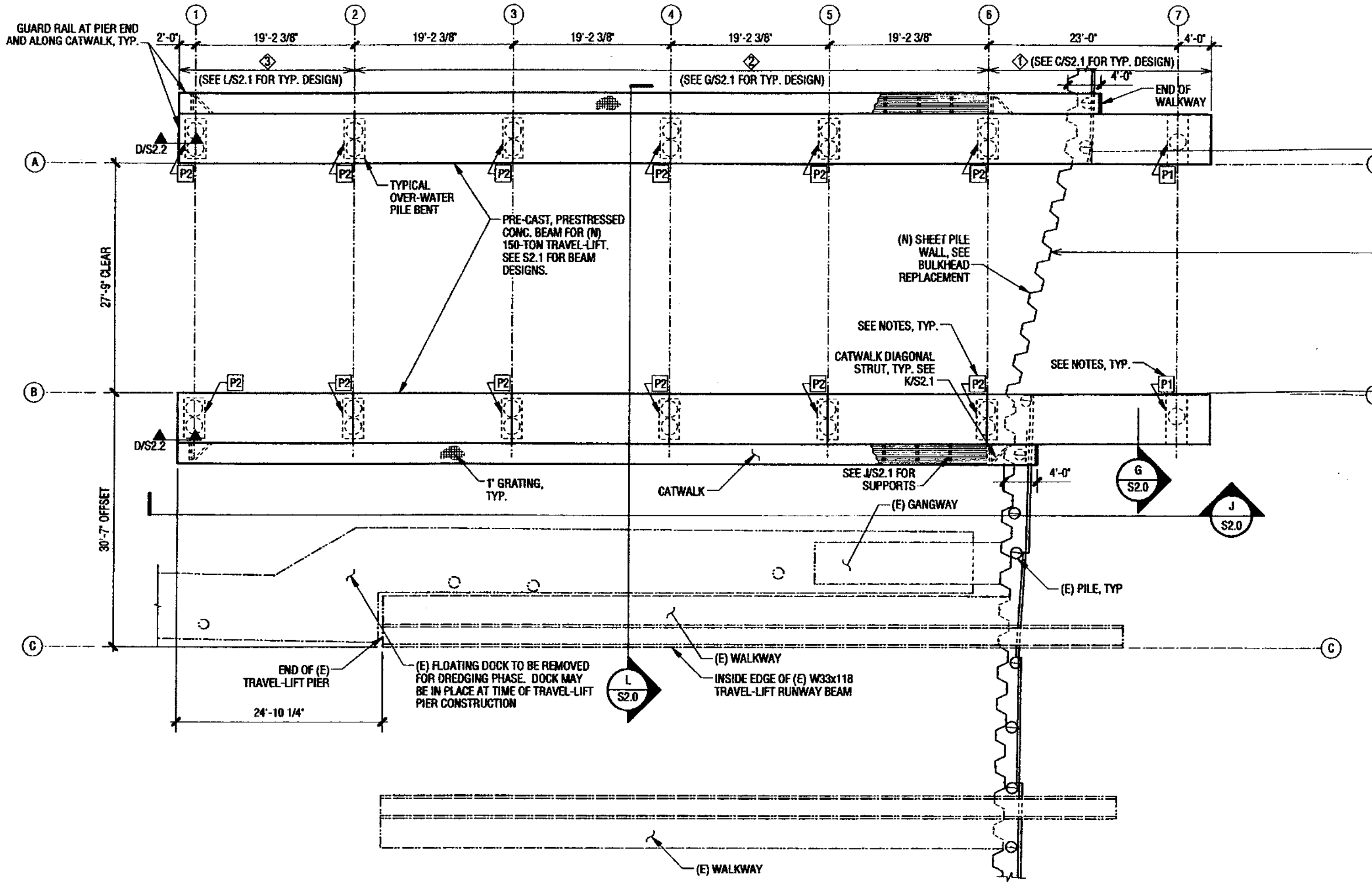
tel 360.734.7194 . fax 360.734.7399 . e-mail : mail@geigerengineers.com

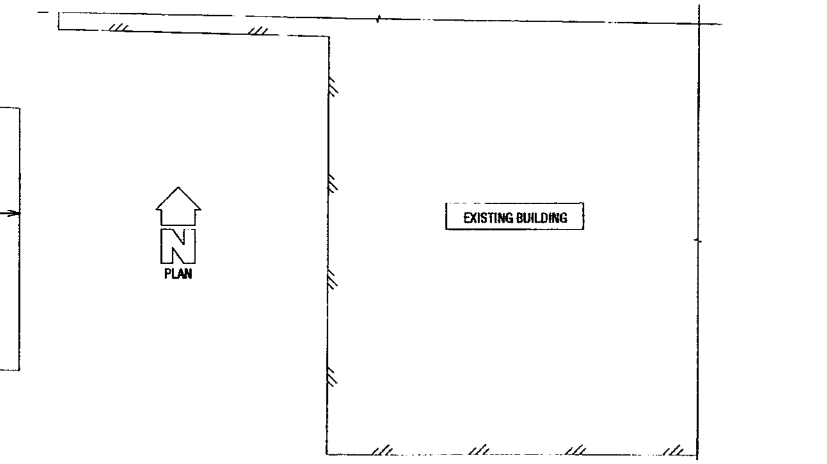
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

BULKHEAD DETAILS & STRUCTURAL NOTES

PROJECT NO. 202816.01
DATE 22 APR 03
SHEET 13 OF 19
DRAWING NO. **S1.3**

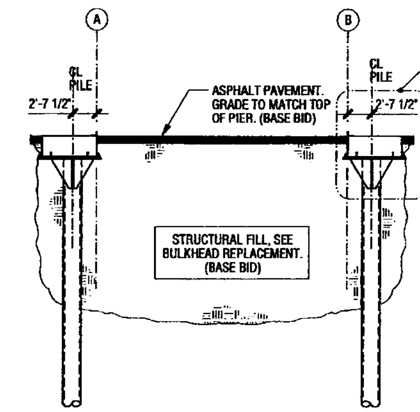
File Name: 202816\...3 Details & Notes
Date Printed: Tue ... 22, 2003 2:04:18 PM





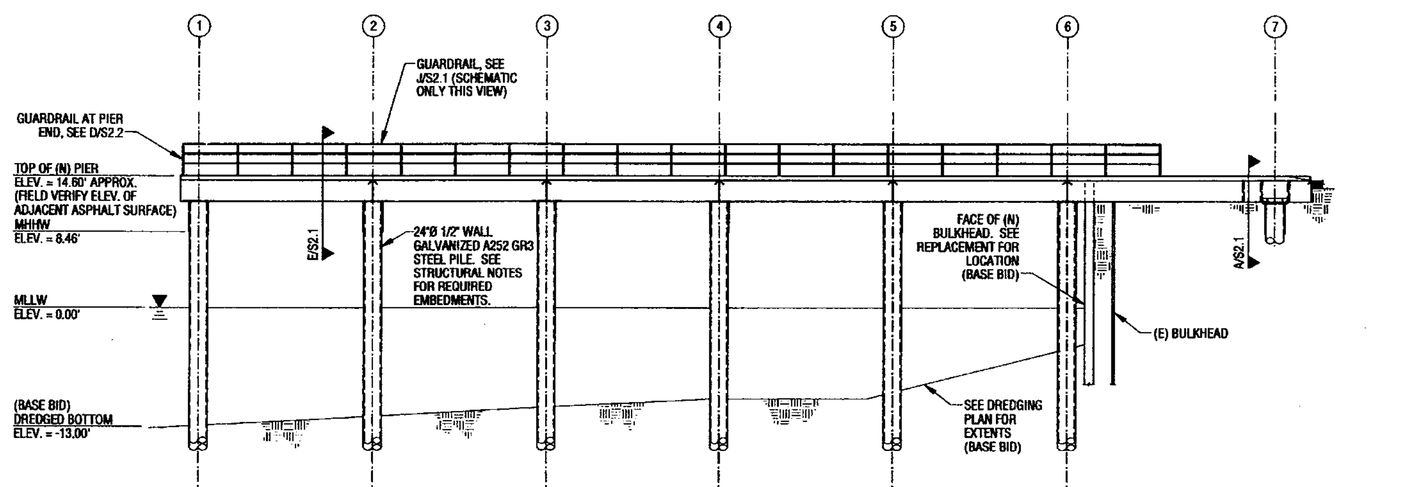
E/S2.0 **Additive Alternate # 2 - 150 Ton Lift Plan**

Scale: 1" = 10'



G/S2.0 **150 Ton Upland Section**

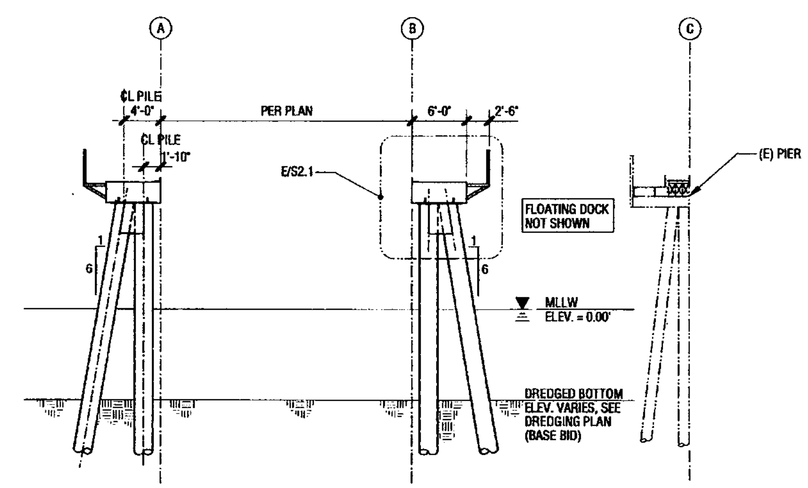
Scale: 1" = 10'



NOTE:
TRAVEL LIFT PIER SHALL NOT BE USED TO REMOVE OR LAUNCH VESSELS FOR A MINIMUM OF ONE MONTH FOLLOWING INSTALLATION OF ALL 24"Ø PILES.

J/S2.0 **150 Ton Lift - Elevation at South Pier**

Scale: 1" = 10'



L/S2.0 **150 Ton Over-Water Section**

Scale: 1" = 10'

DRAWING NOTES:

1. THIS DRAWING IS COPYRIGHTED, IT MAY NOT BE USED WITHOUT THE PERMISSION OF, OR CONTRARY TO THE INTERESTS OF GEIGER ENGINEERS.
2. THE DESIGN SHOWN ON THESE DRAWINGS IS INTENDED TO BE STABLE AND PERFORM PROPERLY WHEN COMPLETE. THE CONTRACTOR IS RESPONSIBLE FOR SITE SAFETY, SAFETY PROGRAMS AND PROVISIONS, MEANS AND METHODS OF CONSTRUCTION, SHORING, BRACING DURING ERECTION, PROTECTION OF WORK, ETC. DURING CONSTRUCTION.
3. READ THE STRUCTURAL NOTES; THEY CONTAIN IMPORTANT INFORMATION ABOUT ALL MATERIALS OF CONSTRUCTION.
4. PILE CAPS ARE CALLED OUT THUS:
   P1 - SINGLE PILE CAP
   P2 - TWO PILE CAP

MATERIALS LEGEND:

SOILS — EARTH: / SAND: / GRAVEL: / ROCK:

MATERIALS (IN PLAN): CONCRETE:

STEEL:

EXISTING MATERIALS:

SYMBOLS LEGEND:

CALLOUTS: (DETAIL #/ STRUCT. DWG) — DETAIL: X/S4.XX — SECTION: X/S4.XX

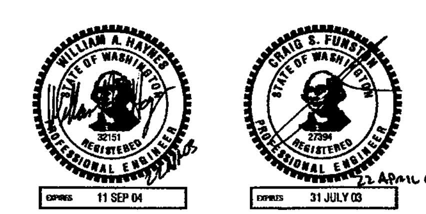
BEAM TYPE: (SEE S2.1 FOR DESIGN)

PILE UP FROM FRAMING PLAN SHOWN:

PILE BELOW FRAMING PLAN SHOWN:

PILE GROUPS: P1 (DL = XX, LL = XX)
CAP TYPE:
UNFACTORED DEAD LOAD (KIPS) FOR GROUP:
UNFACTORED LIVE LOAD (KIPS) FOR GROUP:

SPOT ELEVATION: (TOP-OF-CONCRETE, U.N.O.) +XXX.X



PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED		REVIEWED		APPROVED	
	22 APR 03	ISSUED FOR BID	NJO	22Apr03	WAH	22Apr03	WAH	22Apr03

		INITIAL	DATE
DRAFTED BY:	PATTY DEPASQUALE		
DESIGNED BY:	NELS J. OJARD, E.I.T.		
REVIEWED BY:	WILLIAM H. HAYNES, P.E.	WAH	22 Apr 03
APPROVED BY:			
STATUS:	ISSUED FOR BID		

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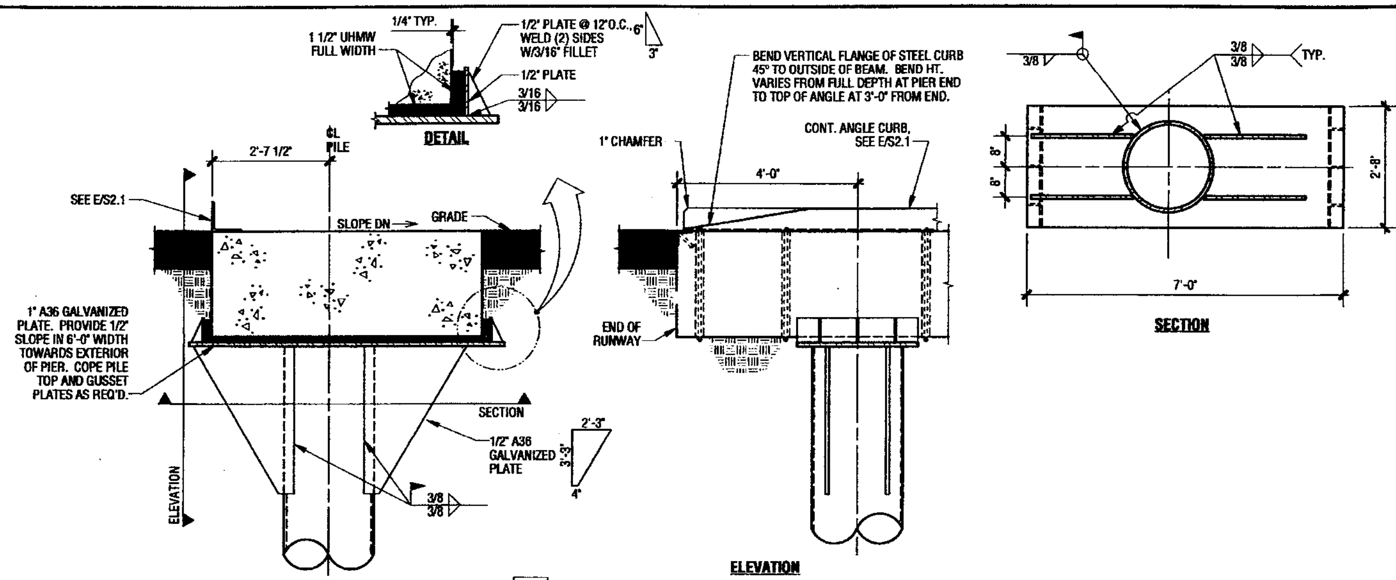
tel 360.734.7194 . fax 360.734.7399 . e-mail : mail@geigerengineers.com

GATE 2 BOATYARD
SEDIMENT REMEDIATION AND
REDEVELOPMENT PROJECT

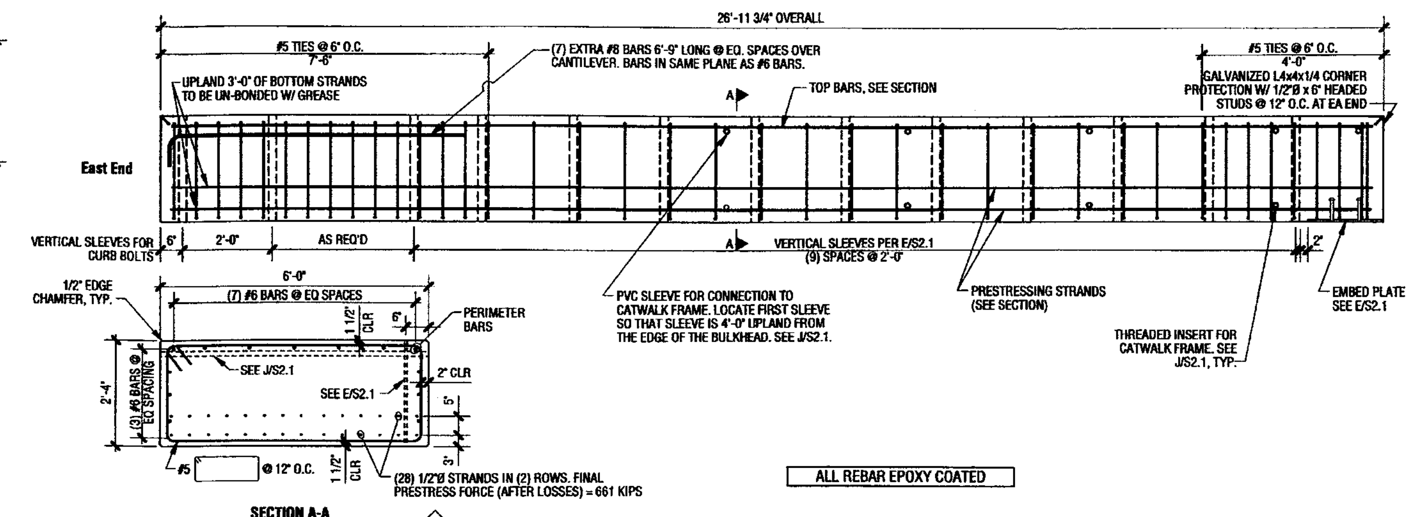
ADDITIVE ALTERNATE #1
150 TON LIFT PLAN & ELEVATIONS

PROJECT NO. 202816.02
DATE 22 APR 03
SHEET 14 OF 19
DRAWING NO. **S2.0**

File Name: 202816.02 S2.0 Travel Lift Plan
Date Printed: Tuesday, April 22, 2003 2:06:47 PM

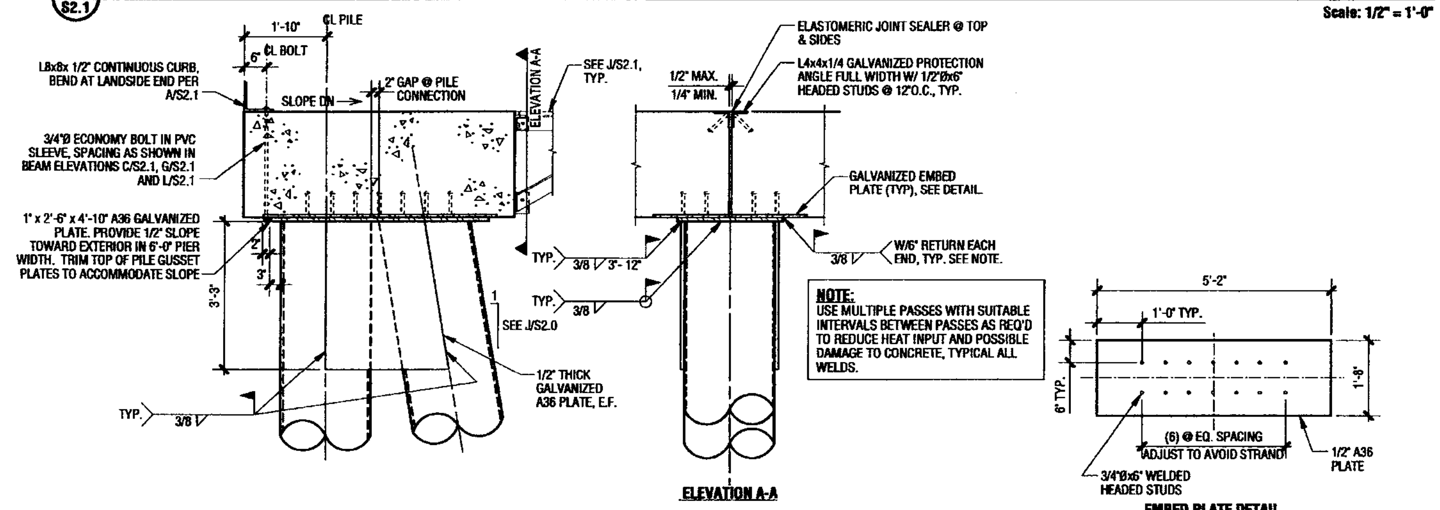


A/S2.1 — **P1 Interior End Pile Connection**



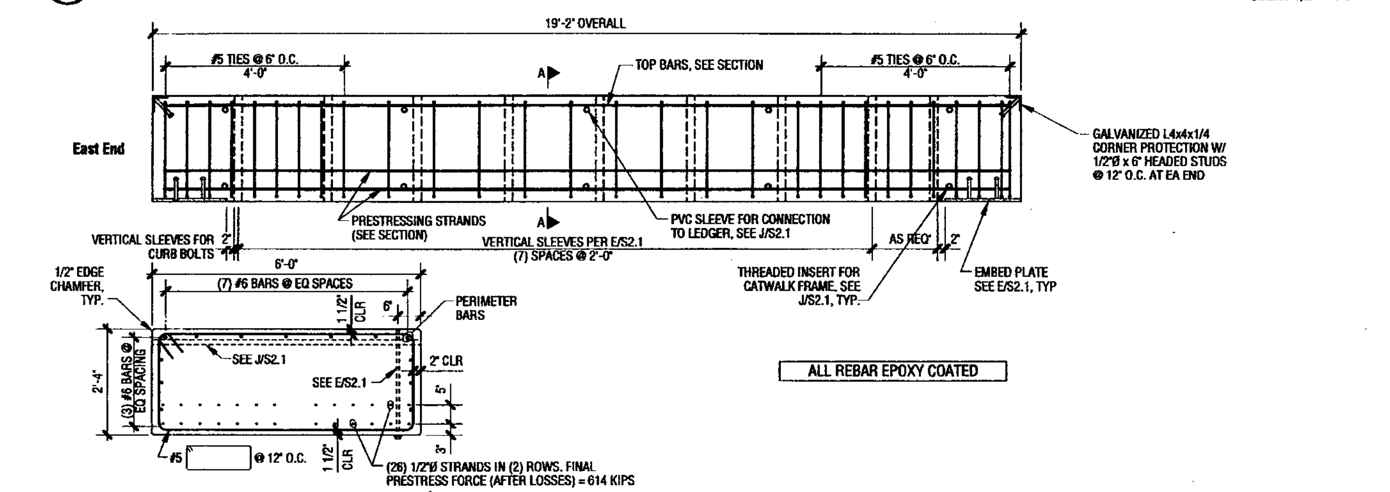
C/S2.1 — **Beam ① - Upland Precast-Prestressed Concrete Beam, Elevation View**

Scale: 1/2" = 1'-0"



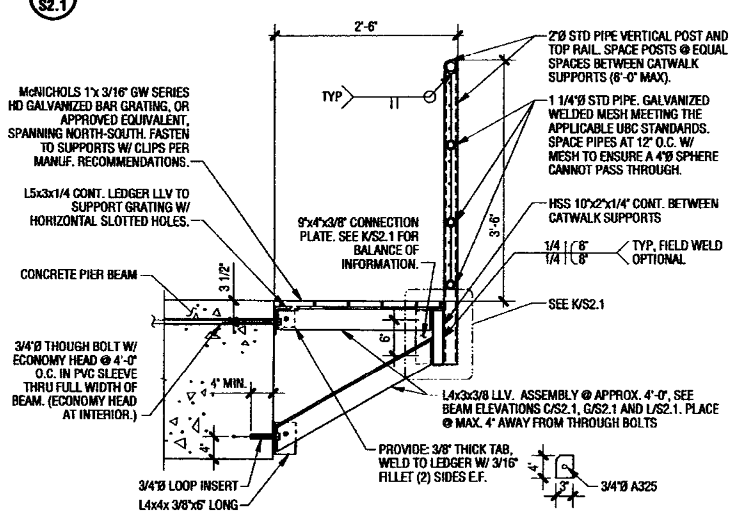
E/S2.1 — **P2 Typical Pile Connection Detail**

Scale: 1/2" = 1'-0"



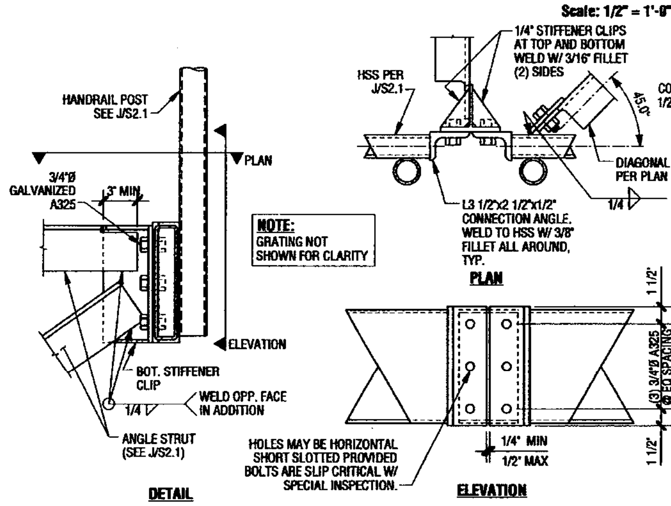
G/S2.1 — **Beam ② - Precast-Prestressed Concrete Beam, Elevation View**

Scale: 1/2" = 1'-0"



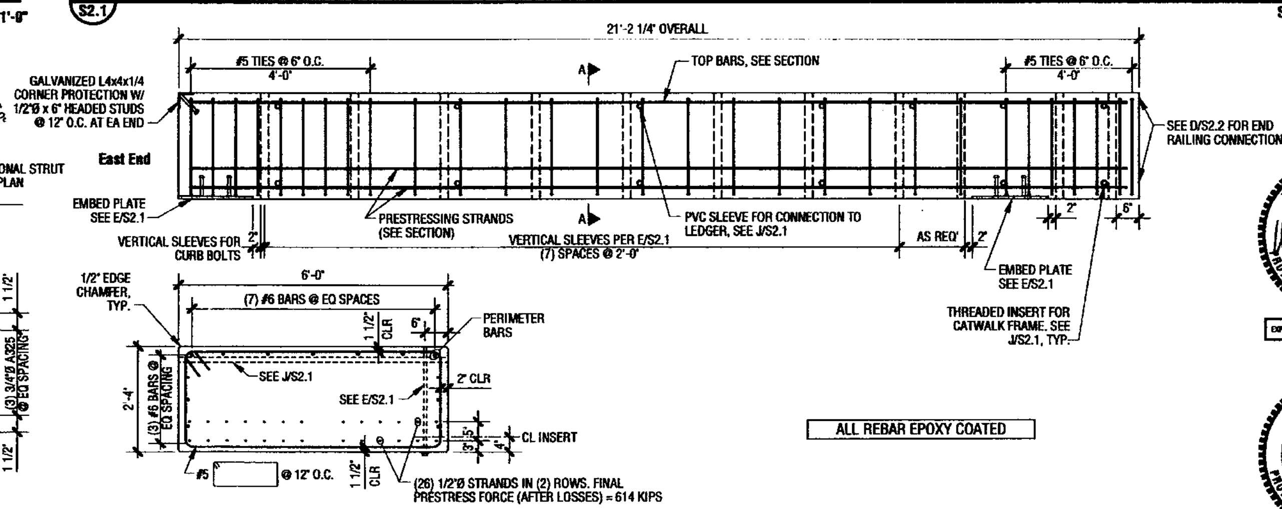
J/S2.1 — **Typical Catwalk Detail**

Scale: 3/4" = 1'-0"



K/S2.1 — **Catwalk Connection Detail**

Scale: 1 1/2" = 1'-0"



L/S2.1 — **Beam ③ - Outboard Precast-Prestressed Concrete Beam, Elevation View**

Scale: 1/2" = 1'-0"

WILLIAM H. HAYNES — STATE OF WASHINGTON — 32151 — REGISTERED PROFESSIONAL ENGINEER — EXPIRES 11 SEP 04

CRAIG S. FUNSTON — STATE OF WASHINGTON — 27394 — REGISTERED PROFESSIONAL ENGINEER — EXPIRES 31 JULY 03 — 22 APR 03

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Washington State

NO.	DATE	REVISIONS	DESIGNED		REVIEWED		APPROVED	
	22 APR 03	ISSUED FOR BID	NJO	22Apr03	WAH	22Apr03	WAH	22Apr03

		INITIAL	DATE
DRAFTED BY:	COREY S. AYERS	CSA	22 Apr 03
DESIGNED BY:	NELS J. OJARD, E.I.T.		
REVIEWED BY:	WILLIAM H. HAYNES, P.E.	WHH	22-Apr-03
APPROVED BY:			
STATUS:	ISSUED FOR BID		

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GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

ADDITIVE ALTERNATE #1
150 TON LIFT MISC. DETAILS

PROJECT NO.	202816.02
DATE	22 APR 03
SHEET	15 OF 19
DRAWING NO.	S2.1

File Name: 202816.02 S2.1 Trvl Lft Details
Date Printed: Tuesd… 2, 2003 2:07:38 PM

Structural Notes:

BUILDING CODE CRITERIA

1 All construction is to be in accordance with the minimum provisions of the 1997 Uniform Building Code (UBC). Where these plans and specifications do not state specifically otherwise the provisions of the UBC shall apply.

6 Structural system:

The structure shown consists of precast-prestressed concrete beams supported on steel pipe piles. Battered piles resist transverse lateral forces. Cantilevered bending of the piles resists longitudinal lateral forces. The system is designed to be independent of the adjacent bulkhead and related repairs.

Beams are designed to accommodated moving wheel loads from a 150-Ton capacity Marine Travel-Lift (Model 150 AMO). Influence of wheel loads is limited to the loaded span only due to axle spacing.

3 Vertical Live Loads:

Catwalks	100	PSF
150 Ton Travel-Lift		
Moving Wheel ' ad	160,000	LB.

4 Dead Loads: Vertical

Pier 2,200PLF (Including Catwalk)

5 Lateral Loads:

Seismic Loading		Wind Loading	
Seismic Zone	III	Basic Wind Speed	80 MPH
Soil Profile	Se	Exposure	C
Importance Factor	1.0	Importance Factor	1.0
R (Transverse)	5.6		
R (Longitudinal)	2.2		

Lateral Component of Live Load = 16,000 lbs at Travel-Lift wheel location

6 Retaining Walls (Included in Bulkhead Repairs)

7 Special Inspections

The following special inspections are required, and will be performed by the owner's testing agency. In addition, special inspection is required where noted on the drawings. Provide necessary cooperation and access for the inspector. Provide adequate notice for inspection before covering work.

A Foundation and Earthwork:

1 Optimum density and compaction of fill under runway pier.

2 Moisture level and density under precast pier segment, immediately prior to placement.

3 Piling installation, blow counts, length, casting, weld splicing, etc.

B Concrete work:

The following tests shall be made for all reinforced concrete work.

1 Concrete slump, air content, and strength. Taking of cylinders per UBC 1905. Placement of concrete

2 Inspect reinforcing cover, size, number, lap lengths, bends, grades.

3 Location and stressing of prestressing tendons.

C Anchor Bolts

1 Installation and placement of concrete around cast-in-place bolts

2 installation of expansion anchor bolts; hole preparation and installation of epoxy and/or cement grouted anchor bolts.

D Structural Steel:

1. Welding: Examine welders' certificates.

a The following welds may be inspected intermittently, and by visual inspection.

I Single-pass fillet welds ≤ 5/16"

ii Welded headed studs for composite systems

iii Catwalks and railings

b Continuously inspect all other structural welds, except as noted.

c All primary connections for special and ordinary moment-resisting frames shall be non-destructively tested per UBC Section 1703.

d Per the Specifications.

2 High-Strength Bolting: Verify torques. Check bolts for exclusion of threads from shear planes and for contact of plies.

8 Material Certifications:

Submit the following Certificates to the Engineer of Record:

A Structural Steel: Steel certificates

9 Structural Observation

The Structural Engineer of record will perform Structural Observations per UBC Section 1702, as required.

01000 GENERAL

1 Employ good standards of workmanship throughout. Provide all materials and perform all construction as indicated. Secure architect's approval for substitutions.

2 See specifications for detailed material and methods. In case of conflict between applicable codes, these notes, and the drawings, the more stringent will govern.

3 Verify all dimensions in the field and with the architect, and upon discovery of any discrepancy between the structural drawings and field conditions or other drawings, notify the architect.

4 Use these drawings in conjunction with the architectural and other disciplines' drawings. They are not to stand alone. These drawings and the designs herein are copyrighted by Geiger Engineers, and are for use on this project only. They may not be copied or used for any other project or purpose other than as originally intended without written approval from Geiger Engineers.

5 Do not scale drawings.

6 Use typical details and schedules wherever applicable. Specific notes and details shall govern over typical details, but any parts of typical details not so altered will still apply.

7 The structure as shown on these drawings is designed to be stable and to resist the indicated loads in the completed condition. The drawings do not indicate the method or sequence of construction, except as may be specifically noted. The contractor is solely responsible for design and supply of all erection bracing and shoring to resist vertical and lateral loads, and for safety programs, methods, and procedures of operation for the construction of the design shown on these drawings.

8 Determine that loading applied to the structure during construction does not exceed the safe load-carrying capacity of the structural system or its members. The loads used in design of the members are listed in Sections 3, 4 and 5 "Building Code Criteria."

01340 SHOP DRAWINGS AND SUBMITTALS

1 Submit shop drawings of all fabricated items prior to fabrication. Allow two weeks for review. Provide one reproducible and two prints of each submittal.

2 Submit shop drawings and calculations for all manufactured framing systems, sealed by a Washington registered Structural Engineer, showing design for all identified loads and conditions. Such engineering shall be at the contractor's expense.

3 Review and stamp all shop drawings for coordination with other suppliers prior to submittal.

4 Shop drawings shall demonstrate the fabricator's understanding of the project documents. Reproduction of the contract documents in part or in whole to create shop drawings is not permitted. Shop drawings thus created will be returned without review.

5 Shop drawings shall be clear and legible. Each shop drawing shall include:

A Title block showing name of project, fabricator's name, contractor, date, and unique drawing title and/or number.

B A blank space sufficient for contractor's and design team's review stamps.

6 Submittals consisting of manufacturer's cut sheets shall clearly identify the project and the model intended to be supplied.

7 Resubmittals shall be clearly identified as revisions, and all changes clearly marked. The design team will not be responsible to find unmarked changes.

8 Do not submit partial or incomplete drawings as a means of requesting information. Incomplete shop drawings will be returned without review.

02220 FOUNDATIONS AND EARTHWORK

Piles:

Steel pipe piles shall be new and conform with ASTM A252, Grade 3 minimum and shall have the material and chemical properties of ASTM A36 steel with the following exceptions: Minimum yield strength = 45 ksi, Minimum tensile strength = 66 ksi. Piles shall be longitudinally welded, no spirals welded piles will be allowed.

Pile splices, if used, shall be complete penetration weld conforming to provision of AWS D1.1. There shall be no more than three splices per steel pile.

Steel piles shall be hot dipped galvanized in accordance with ASTM A123.

Jetting of piles will not be permitted. Piles may be driven with a vibro hammer to a depth 30 feet above final tip elevation. An impact hammer shall be utilized to drive the final 30 feet of pile embedment. Selection of hammer size shall be the responsibility of the contractor.

Piles shall be placed in the specific location and alignment as shown unless otherwise directed and to the following tolerance:

A Less than or equal to 2 inches of horizontal deviation in any direction

B Deviate no more than 1 inch in 10 feet (0.833%) from batter indicated.

C Top of piles shall be cut off at the elevations required.

24" dia. X 1/2" piles shall be driven to an approximate tip elevation of –75 MLLW with a vertical pile capacity of 70 tons.

24" dia. X 1/2" piles at bent 7 shall be driven to an approximate tip elevation of –85 MLLW with a vertical pile capacity of 110 tons.

Pile Records:

Keep a complete and accurate record of each driven pile indicating the pile location (as driven), size, driven length, embedded length, final elevations of tip and top, number of splices and locations, blows required for each foot of penetration throughout the entire length of the pile and for the final 6 inches of penetration, and the total driving time. The record shall include the type and size of the hammer used and the rate of operation. Any unusual conditions encountered during the pile installation shall also be recorded and immediately reported to the Engineer.

For additional earthwork requirements, refer to Structural Notes for Bulkhead Repairs.

03150 CONCRETE ACCESSORIES AND HARDWARE

1 Adhesive-installed anchor bolts shall be of galvanized steel conforming to ASTM F1554 Grade 55, set in holes of at least 3/32" larger diameter and embedment as noted, with epoxy or polymer resin adhesive of consistency appropriate to the application.

Accepted products include:

A. ITW-Ramset Epcon system with "Ceramic 6" polymer adhesive

B. Hilti HVA adhesive anchor system with HEA adhesive capsule

C. Hilti HAS threaded rods in Hilti C-100 adhesive

2 For any other anchor type, use only product identified on drawings.

3 Epoxy anchor bolts shall have minimum embedment of 12 bolt diameters, unless noted otherwise on drawings. Hole diameter per manufacturer's instructions; thoroughly clean hole before installation.

4 Cast-in-place anchor bolts set in concrete or masonry shall conform to ASTM Grade 55, and shall be either headed steel bolts with rolled or cut threads and a standard washer, or threaded steel rod with a standard nut and washer at the embedded end.

5 Embedment (to the closest face of the washer) shall be 8 diameters but not less than 7 inches. Anchor bolts for hold-downs are as above, except that the washer shall be a minimum 3/16" x 2" plate washer, and embedment 16 diameters but not less than 12."

03200 REINFORCING

1 Materials (except as noted in drawings):

Epoxy-Coated Reinforcing bars: ASTM A615, Grade 60, except that #3 bars may be grade 40 conforming to the requirements of A775 for epoxy casting. Provide weldable bars conforming to ASTM A706 where welding is required by details.

Prestressing Tendon: ASTM A416-88

2 Bar detailing not shown otherwise, and support of reinforcing bars in forms, shall conform to the CRSI Manual of Standard Practice. Reinforcing which is marked "continuous" in plans or details shall extend as far as possible in the concrete and terminate in a 12-diameter bend or per typical corner details, as appropriate. Shop fabricate all bends, except as noted.

3 Lap all continuous reinforcement 48 dia. unless noted otherwise on plans.

4 Welding of reinforcing is not permitted except as detailed. Any reinforcing bar to be welded shall be a weldable grade. Do not weld within 3" of a bend. Follow American Welding Society ANSI/AWS D1.4, latest edition.

5 Provide the following minimum cover from face of bar to face of concrete, except as detailed; provide necessary accessories to maintain clearances:

Concrete formed but exposed to weather or ground	2"
Concrete formed, exposed to ground, with moisture barrier	1-1/2"
Where none of above apply,	
Exterior face of beams with bars #5 or smaller,	1-1/2"
Ties and stirrups	1-1/2"

03300 CONCRETE

1 Materials (except as noted in drawings):

Aggregate:	Stone aggregate per ASTM C33
Cement:	Type II per ASTM C150 less than 0.60%
	Alkali (as Na_2O equivalent)
	Type III may be used for plant-cast precast units
Admixtures:	Air Entraining ASTM C260
	Water-reducing ASTM C494 Type A

All concrete shall be ready-mix. Comply with requirements of ASTM C 94 and as specified.

2 28-day strengths shall be as follow, except as noted:

Application	f'c (psi)	f'ci (psi)	w/c (max)	aggregate (max)
A. Precast Concrete (except as noted)	6000	4000	0.55	3/4"

3 Concrete that is to be exposed to weather, including foundation walls, shall have air content as below. Observe UBC requirements for hot- and cold- weather work.

Average Air Content	Nominal Max. Aggregate Size
7.5 % + 1.5 %	3/8 inch
7.0 % + 1.5 %	1/2 inch
6.0 % + 1.5 %	3/4 inch to 1 inch

4 Hold all bolts, anchors, dowels, reinforcing bars and metal inserts firmly and accurately in place before concrete is poured; do not insert ("stab") after pouring concrete.

5 Provide sleeves for attachment of curb angle as shown on plans.

03400 STRUCTURAL PRECAST CONCRETE

1 The contractor shall be responsible for lifting design and associated hardware. Submit shop drawings and lifting calculations sealed by an engineer registered in Washington State.

05120 STRUCTURAL STEEL

1 Fabricate, erect, design, and detail all structural steel in accordance with AISC Standard Practice, except as noted.

2 Materials (except as noted in drawings):

All materials shall be new stock, unless noted otherwise.

Shapes, Plates and Bars:	ASTM A36	
Structural Tubing:	ASTM A500, Grade B (round, square, rectangular)	
Steel Pipe (Railings):	ASTM A53, Grade B	
Bolts, Regular:	ASTM A307	
Bolts, High-strength:	ASTM A325 Type 3	
Welded Headed Studs	ASTM A108; Type B	
Threaded Anchor Rods	ASTM F1554, Grade 55, with Supplement S1	
Other Threaded Rods	ASTM A36	
Weld electrode:	AWS D1.1–2002, Table3.1, E70xx Low hydrogen	
Galvanizing:	Shapes and weldments	ASTM A123
	Bolts and hardware	ASTM A153
Spray Metalizing:	Steel Structures Painting Council Guide No.23. (Minimum zinc thickness = 10 mils.)	

3 Minimum welds:

Welds not specified shall be 1/4" continuous fillet welds, or minimum size per AISC, whichever is greater.

All welded connections exposed to the exterior environment shall have continuous fillet filler weld (minimum 1/8") all around, except for members to be hot-dipped galvanized.

All weld sizes are effective sizes; increase as required if gaps exist at meeting surfaces.

4 Welding shall be by WABO Certified welders and shall be as detailed or as specified by American Welding Society Standards D1.1-2002.

5 Field welding is not permitted, except as specifically detailed.

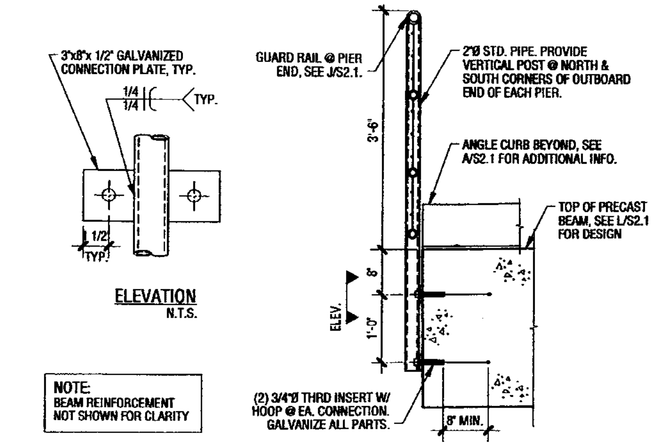
6. Bolt holes shall not be more than 1/16th" over-sized, and shall be drilled or punched; if punched, without distortion of the piece. Do not burn holes at any place.

7. All steel shall be hot-dipped galvanized as noted above.

8. Headed Anchor Studs, Threaded Studs, and Deformed Anchor Studs shall be automatically end-welded per AWS D1.1-2002. Shop-weld where possible.

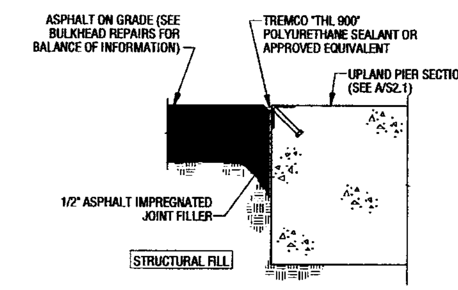
9. Where galvanized surface is compromised due to grinding, welding, etc., repair surface with spray metalizing material to meet the requirements of SSPCG No.23 and ASTM A780.

10. All surfaces where spray metalizing repair is required must be cleaned by mechanical means and reconditioned by blasting in accordance with SSPC-SP5. Surface preparation shall be extended into the surrounding undamaged galvanized coating.



D / S2.2 **Guard Rail Connection @ West End Of Pier**

Scale: 3/4" = 1'-0"



H / S2.2 **Section At Pier Approach**

Scale: 3/4" = 1'-0"

EXPIRES 11 SEP 04

EXPIRES 31 JULY 03

PORT OF BELLINGHAM
Washington State

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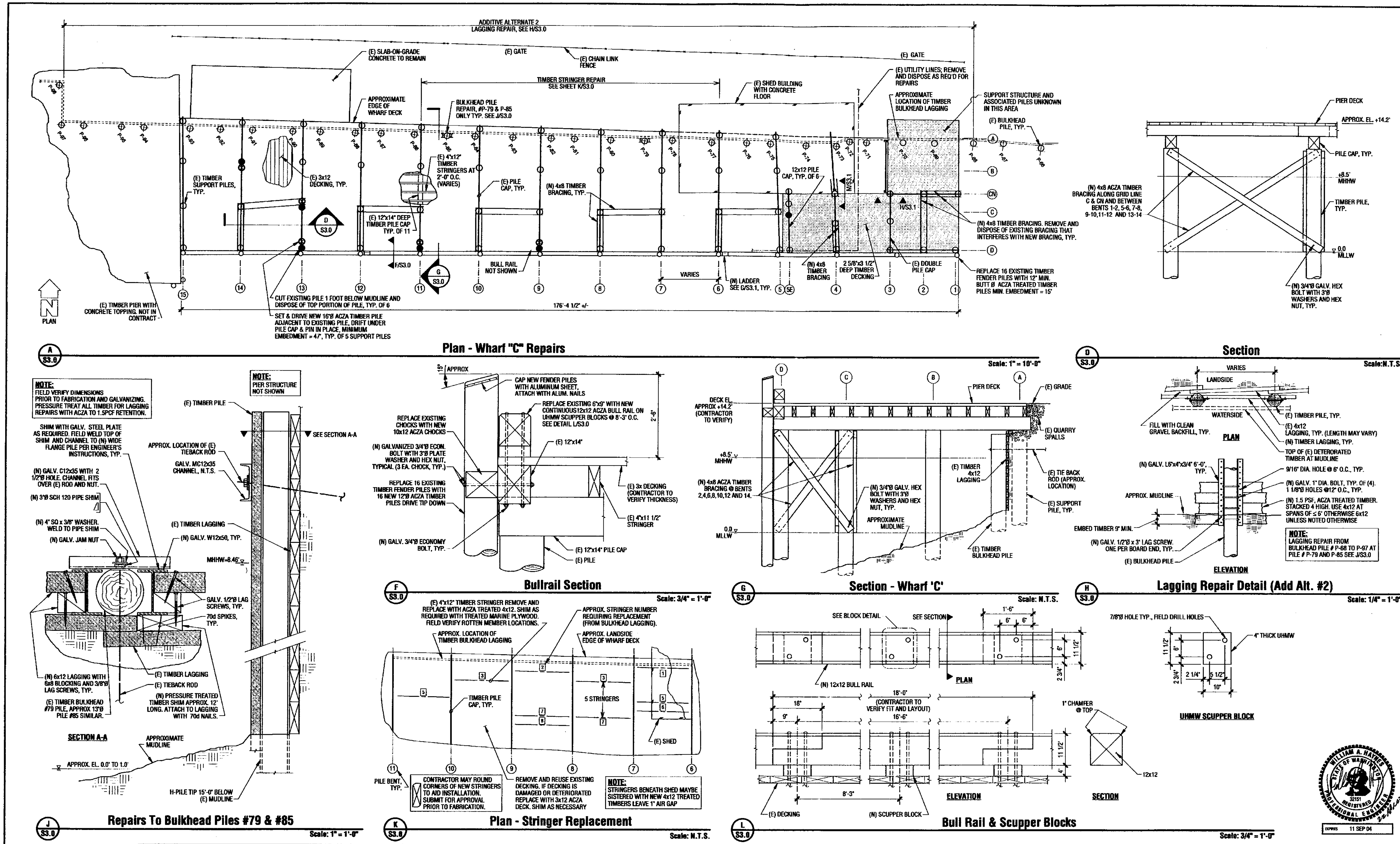
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND
REDEVELOPMENT PROJECT

ADDITIVE ALTERNATE #1
150 TON LIFT STRUCTURAL NOTES & DETAILS

PROJECT NO. 202816.02
DATE 22 APR 03
SHEET 16 OF 19
DRAWING NO. S2.2

File Name: 202816.0 ...ctNotes&Dets Date Printed: Tuesday, April 22, 2003 2:08:22 PM



PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED
	22 APR 03	ISSUED FOR BID	WAH 22Apr03	WAH 22Apr03	WAH 22Apr03

		INITIAL	DATE
DRAFTED BY:	CSAyers	CSA	22 Apr 03
DESIGNED BY:	WAHaynes	WAH	22 Apr 03
REVIEWED BY:	WAHaynes	WAH	22 Apr 03
APPROVED BY:			
STATUS:	ISSUED FOR BID		

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GATE 2 BOATYARD
SEDIMENT REMEDIATION AND
REDEVELOPMENT PROJECT

WHARF "C" REPAIR PLAN & DETAILS

PROJECT NO. 202816.02
DATE 22 APR 03
SHEET 17 OF 19
DRAWING NO. S3.0

File Name: 202816.02 S3.0 Wharf C Repair   Date Printed: Tuesday, April 22, 2003 2:08:12 PM

STRUCTURAL NOTES:

BUILDING CODE CRITERIA

1 All construction is to be in accordance with the minimum provisions of the 1997 Uniform Building Code (UBC). Where these plans and specifications do not state specifically otherwise the provisions of the UBC shall apply.

2 Structural system:

The existing Wharf C structure is of typical pier construction; driven piles supporting pile caps in turn supporting stringers and decking. The proposed repair work will replace deteriorated piles and stringers. New diagonal bracing will be added. The use and value of the structure will not be significantly altered.

3 Vertical Live Loads:

Deck Live Load 170 PSF

4 Lateral Loads:

This work does not add significant building mass or wind area, and does not reduce the capacity of the lateral-force resisting system. Rather, the lateral-force resisting system is improved.

5 Special Inspections

The following special inspections are required, and will be performed by the Owner's testing agency. In addition, special inspection is required where noted on the drawings. Provide necessary cooperation and access for the inspector. Provide adequate notice for inspection before covering work.

A Piles:

1. Piling installation, length, treatment, etc.

B Structural Steel:

1. Welding: Examine welders' certificates.

a The following welds may be inspected intermittently, and by visual inspection.

i Single-pass fillet welds ≤ 5/16"

ii Ladders

6 Material Certifications:

Submit the following Certificates to the Owner:

A Timber: ACZA treatment certificates for all new timber

B Structural Steel: Steel certificates

7 Structural Observations:

The Structural Engineer of record will perform structural observations per UBC Section 1702, as required.

01000 GENERAL

1 Employ good standards of workmanship throughout. Provide all materials and perform all construction as indicated. Secure engineer's approval for substitutions.

2 In case of conflict between applicable codes, these notes, and the drawings, the more stringent will govern.

3 Verify all dimensions in the field, and upon discovery of any discrepancy between the structural drawings and field conditions or other drawings, notify the engineer.

4 Use these drawings in conjunction with other project drawings. They are not to stand alone. These drawings and the designs herein are copyrighted by Geiger Engineers, and are for use on this project only. They may not be copied or used for any other project or purpose other than as originally intended without written approval from Geiger Engineers.

5 The contractor shall confine his activities to the work site and staging area designated by the Port. Facilities adjacent to the Wharf C project work will continue normal operations through construction. The contractor shall coordinate the work on this project with the Port.

6 Do not scale drawings. Drawings are for the use on this project only; do not re-use without written approval from Geiger Engineers.

7 Use typical details and schedules wherever applicable. Specific notes and details shall govern over typical details, but any parts of typical details not so altered will still apply.

8 The structure as shown on these drawings is designed to be stable and to resist the indicated loads in the completed condition. The drawings do not indicate the method or sequence of construction, except as may be specifically noted. The contractor is solely responsible for design and supply of all erection bracing and shoring to resist vertical and lateral loads, and for safety programs, methods, and procedures of operation for the construction of the design shown on these drawings.

9 Determine that loading applied to the structure during construction does not exceed the safe load-carrying capacity of the structural system or its members.

01340 SHOP DRAWINGS AND SUBMITTALS

1 Submit shop drawings of all fabricated items prior to fabrication. Allow 10 working days for review. Provide one reproducible and two prints of each submittal.

2 Submit shop drawings and calculations for all manufactured framing systems, if any, sealed by a Washington registered Structural Engineer, showing design for all identified loads and conditions. Such engineering shall be at the contractor's expense.

3 Review and stamp all shop drawings for coordination with other suppliers prior to submittal.

4 Shop drawings shall demonstrate the fabricator's understanding of the project documents. Reproduction of the contract documents in part or in whole to create shop drawings is not permitted. Shop drawings thus created will be returned without review.

5 Shop drawings shall be clear and legible. Each shop drawing shall include:

A Title block showing name of project, fabricator's name, contractor, date, and unique drawing title and/or number.

B A blank space sufficient for contractor's and design team's review stamps.

6 Submittals consisting of manufacturer's cut sheets shall clearly identify the project and the model intended to be supplied.

7 Resubmittals shall be clearly identified as revisions, and all changes clearly marked. The design team will not be responsible to find unmarked changes.

8 Do not submit partial or incomplete drawings as a means of requesting information. Incomplete shop drawings will be returned without review.

02220 FOUNDATIONS AND EARTHWORK

1 Lagging repair timber shall be pressure treated No.1 and better Douglas Fir with minimum ACZA treatment of 1.5 pcf retention.

2 Backfill for the lagging repairs shall be washed gravel, or engineer approved substitute.

03200 REINFORCING AND HARDWARE

1 Materials (except as noted in the drawings):

Provide weldable bars conforming to ASTM A706 where welding is required by details. Follow American Welding Society ANSI?AWS D1.4, latest edition.

05120 STRUCTURAL STEEL

1 Fabricate, erect, design, and detail all structural steel in accordance with AISC Standard Practice, except as noted.

2 Materials (except as noted in drawings):

All materials shall be new stock, unless noted otherwise.

Other Shapes:	ASTM A36	
Plates and bars:	ASTM A36 (A529, A572, and A588 optional)	
Steel Pipe:	ASTM A53, Grade A	
Bolts, Regular:	ASTM A307	
Heavy-Hex Nuts	ASTM A563	
Weld electrode:	AWS D1.1–98, Table 3.1, E70xx Low hydrogen	
Galvanizing:	Shapes and weldments	ASTM A123
	Bolts and hardware	ASTM A153

3 Minimum welds:

Welds not specified shall be 3/16" continuous fillet welds, or minimum size per AISC, whichever is greater.

All welded connections exposed to the exterior environment shall have continuous fillet filler weld (minimum 1/8") all around, except for members to be hot-dipped galvanized.

All weld sizes are effective sizes; increase as required if gaps exist at meeting surfaces.

Groove welds not otherwise noted shall be complete penetration.

4 Welding shall be by WABO Certified welders and shall be as detailed or as specified by American Welding Society Standards D1.1- latest edition.

5 Field welding is not permitted, except as specifically detailed.

6 Unless otherwise noted bolt holes shall not be more than 1/16th" over-sized, and shall be drilled or punched; if punched, without distortion of the piece. Do not burn holes at any place.

7 Bolts, nuts, washers and misc. steel hardware shall be hot dip galvanized in accordance with ASTM A153.

8 All steel shall be hot dip galvanized after fabrication in accordance with ASTM A123.

06100 TIMBER PILES AND ROUGH CARPENTRY

1 All treated timber piles shall be Pacific Coast Douglas Fir and shall meet the requirements of ASTM D25-91.

2 All new timber piles shall be ACZA pressure treated to 1.5 pcf retention per AWPA Standards. No creosote treated piles shall be used.

3 The minimum butt circumference of support piles shall be 44-inches as measured 3 feet from the butt cut-off.

4 The minimum butt circumference of fender piles shall be 38-inches as measured 3 feet from the butt cut-off.

5 The contractor's pile order lengths shall include the length necessary to provide for a fresh heading and to reach from the cut-off elevation up to the position of the pile driving equipment.

6 Cutting off of piles shall be with pneumatic tools, sawing, or other approved means.

7 All timber piles shall be driven tip down to the minimum pile embedments shall be per the plans. The contractor shall be responsible for determining the hammer energy rating necessary to install the piles.

8 Materials for wood construction shall be of Coastal Range Douglas Fir #1, S4S, graded in accordance with requirements of the West Coast Lumber Inspection Bureau. All are kiln-dried with moisture content not to exceed 19%.

9 All new chocks, bullrails, stringers and blocking shall be pressure treated with ACZA to a minimum of 0.4 pcf retention.

10 Use galvanized fasteners, and galvanized or similarly protected hardware and fittings.

11 Lag bolts or screws shall be square-head steel bolts with cut threads. Use washers under heads, typical. Pre-drill holes with bit approximately 60% of shank diameter; install bolts by turning, do not hammer into place.

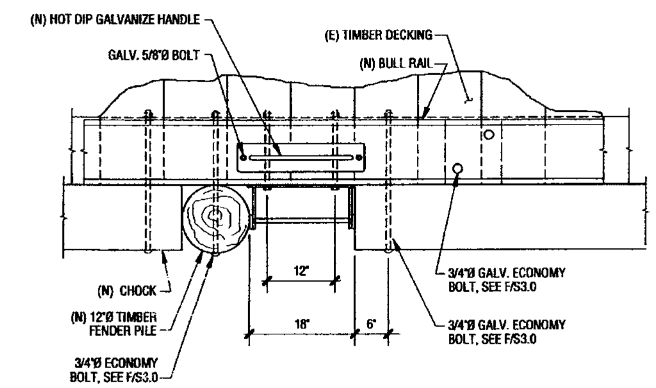
12 Machine bolts shall be ASTM 307 bolts, unless otherwise noted. Use washers under head at timber connections and nut.

13 Drilling and cutting of wood shall be accomplished prior to pressure treatment. If drilling and cutting is required after pressure treatment, all cuts and holes shall receive two heavy coats of copper napthanate solution in accordance with AWPA Standard M4.

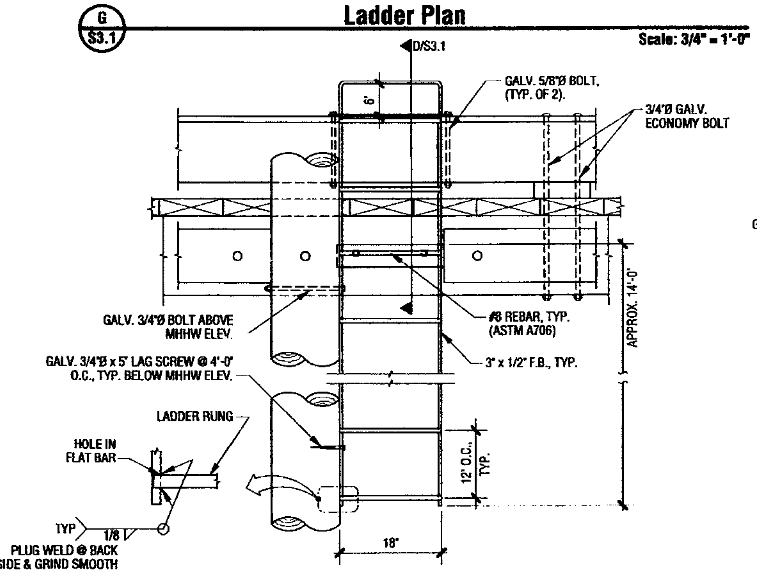
14 Holes drilled through existing bulkhead piles for work related to lagging repairs shall receive two coats of copper napthanate as described above followed by injection of grease. The bolts shall be coated with grease prior to insertion in the piles. The grease shall exhibit the following characteristics:

- provide a barrier to moisture and air,
- provides a self-healing film and displaces water,
- is environmentally friendly.

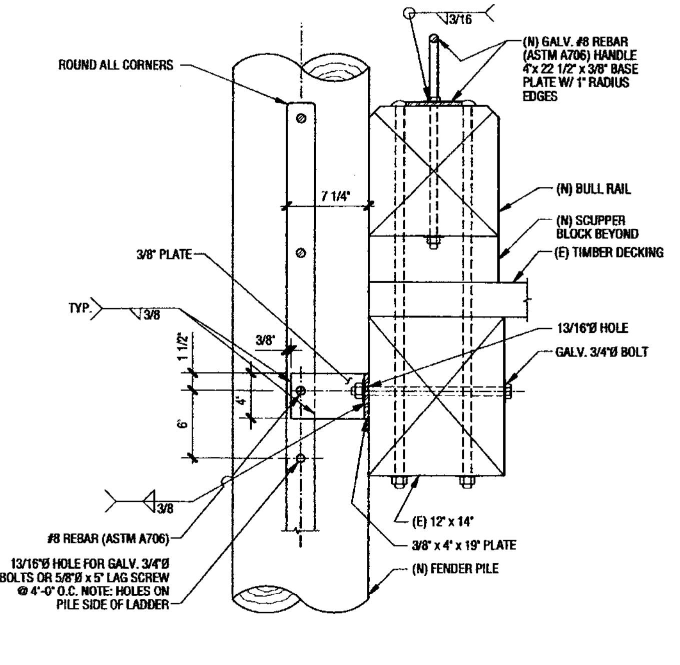
15 Bullrail blocking shall consist of TIVAR® Uniblend UHMW plastic or engineer approved equivalent.



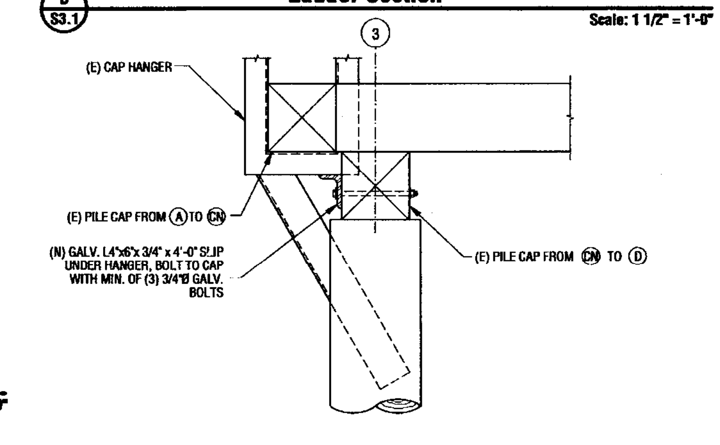
G S3.1 **Ladder Plan** Scale: 3/4" = 1'-0"



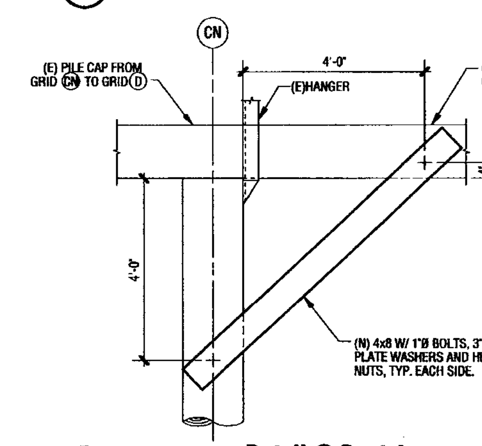
L S3.1 **Ladder Elevation** Scale: 3/4" = 1'-0"



D S3.1 **Ladder Section** Scale: 1 1/2" = 1'-0"



H S3.1 **Detail @ Bent 3** Scale: 3/4" = 1'-0"



M S3.1 **Detail @ Bent 4** Scale: 1/2" = 1'-0"

WILLIAM A. HAYNES
STATE OF WASHINGTON
32151 REGISTERED PROFESSIONAL ENGINEER
22 Apr 03
EXPIRES 11 SEP 04

PORT OF BELLINGHAM
Washington State

NO.	DATE	REVISIONS	DESIGNED		REVIEWED		APPROVED	
	22 APR 03	ISSUED FOR BID	WAH	22Apr03	WAH	22Apr03	WAH	22Apr03

		INITIAL	DATE
DRAFTED BY:	CSAyers	CSA	22 Apr 03
DESIGNED BY:	WAHaynes	WAH	22 Apr 03
REVIEWED BY:	WAHaynes	WAH	22 Apr 03
APPROVED BY:			
STATUS:	ISSUED FOR BID		

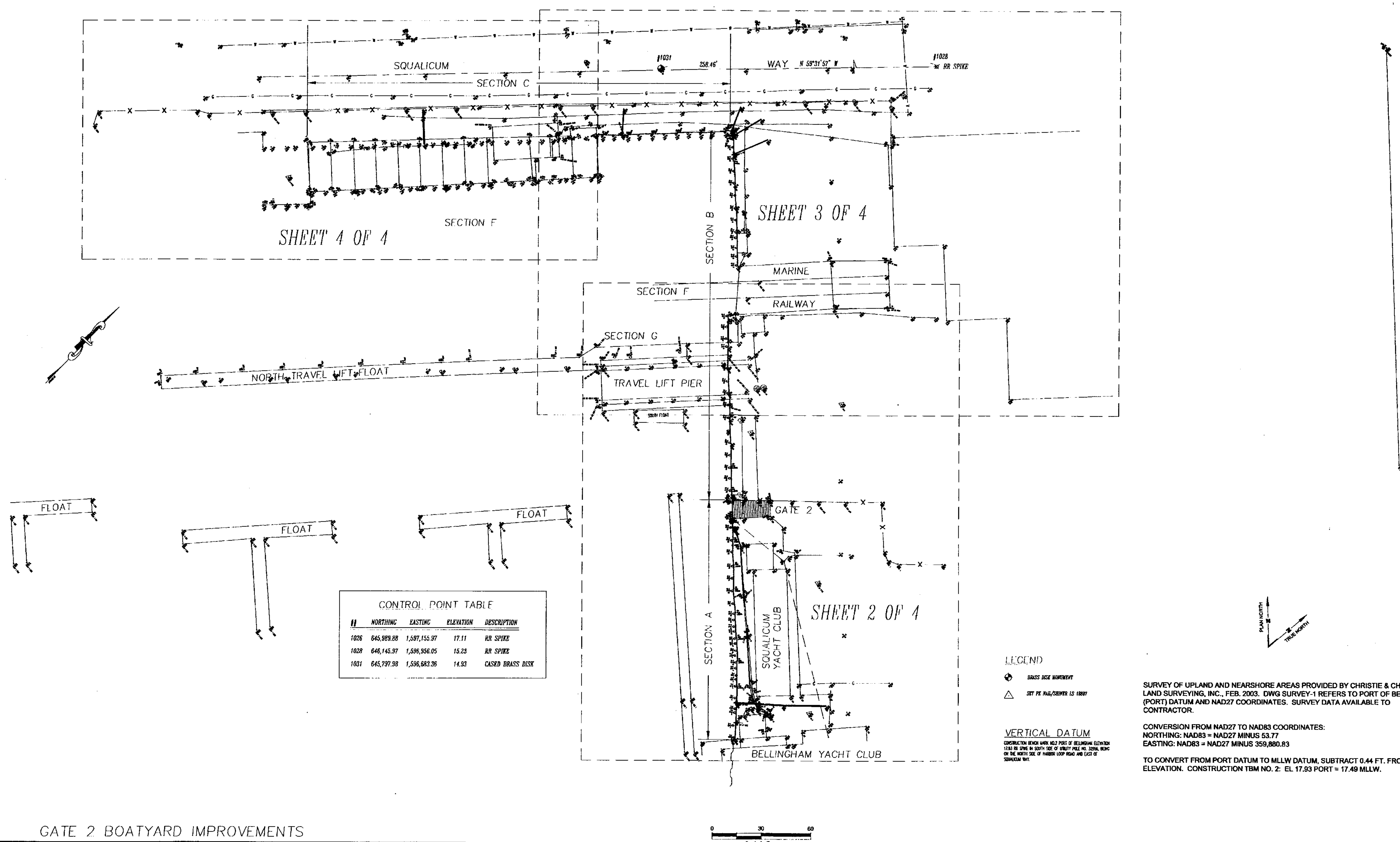
GEIGER ENGINEERS
114 W. Magnolia Street Suite 505 Bellingham . WA . 98225-4369
tel 360.734.7194 . fax 360.734.7399 . e-mail : mail@geigerengineers.com

GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

WHARF "C" REPAIR DETAIL & STRUCTURAL NOTES

PROJECT NO. 202816.02
DATE 22 APR 03
SHEET 18 OF 19
DRAWING NO. S3.1

File Name: 202816.02 S3.1 Wharf C Details Date Printed: Tuesday, April 22, 2003 1:27:11 PM



CONTROL POINT TABLE

#	NORTHING	EASTING	ELEVATION	DESCRIPTION
1026	645,989.88	1,597,155.97	17.11	RR SPIKE
1028	646,145.97	1,596,956.05	15.23	RR SPIKE
1031	645,797.98	1,596,683.36	14.93	CASED BRASS DISK

LEGEND

BRASS DISK MONUMENT

SET PK NAIL/SHINER LS 18897

VERTICAL DATUM

CONSTRUCTION BENCH MARK NO.2 PORT OF BELLINGHAM ELEVATION 17.93 RR SPIKE IN SOUTH SIDE OF UTILITY POLE NO. 32956, BEING ON THE NORTH SIDE OF HARBOR LOOP ROAD AND EAST OF SQUALICUM WAY.

SURVEY OF UPLAND AND NEARSHORE AREAS PROVIDED BY CHRISTIE & CHRISTIE LAND SURVEYING, INC., FEB. 2003. DWG SURVEY-1 REFERS TO PORT OF BELLINGHAM (PORT) DATUM AND NAD27 COORDINATES. SURVEY DATA AVAILABLE TO CONTRACTOR.

CONVERSION FROM NAD27 TO NAD83 COORDINATES:
NORTHING: NAD83 = NAD27 MINUS 53.77
EASTING: NAD83 = NAD27 MINUS 359,880.83

TO CONVERT FROM PORT DATUM TO MLLW DATUM, SUBTRACT 0.44 FT. FROM PORT ELEVATION. CONSTRUCTION TBM NO. 2: EL 17.93 PORT = 17.49 MLLW.

GATE 2 BOATYARD IMPROVEMENTS

CHRISTIE & CHRISTIE LAND SURVEYING INC.
222 GRAND AVE. SUITE 'D', BELLINGHAM, WASHINGTON 98225
PH. # 360.671.8855, FAX # 360.671.8823,

PREPARED FOR: PORT OF BELLINGHAM
1801ROEDER AVENUE / P.O. BOX 1677
BELLINGHAM, WA 98225

DATE: FEB. 2003	DRAWN BY: PTJ	JOB NO. 2211237
SCALE: AS SHOWN	CHECKED BY: BDC	SHEET 1 OF 4

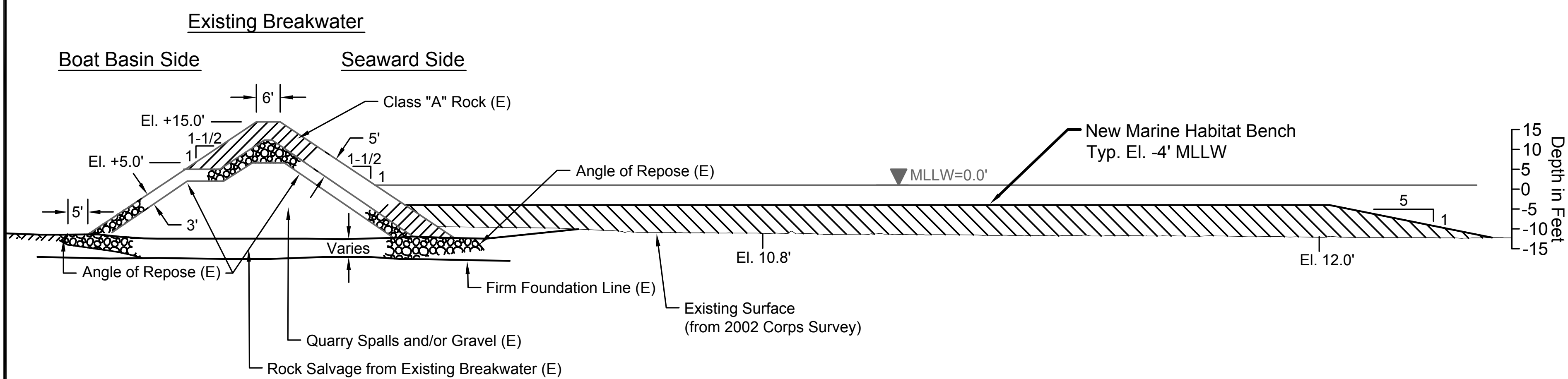
BRIAN D. CHRISTIE, STATE OF WASHINGTON, REGISTERED PROFESSIONAL LAND SURVEYOR 18897, EXPIRES 5-4-2003

OVERALL PLAN

GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

SURVEYOR'S UPLAND SURVEY - OVERALL PLAN

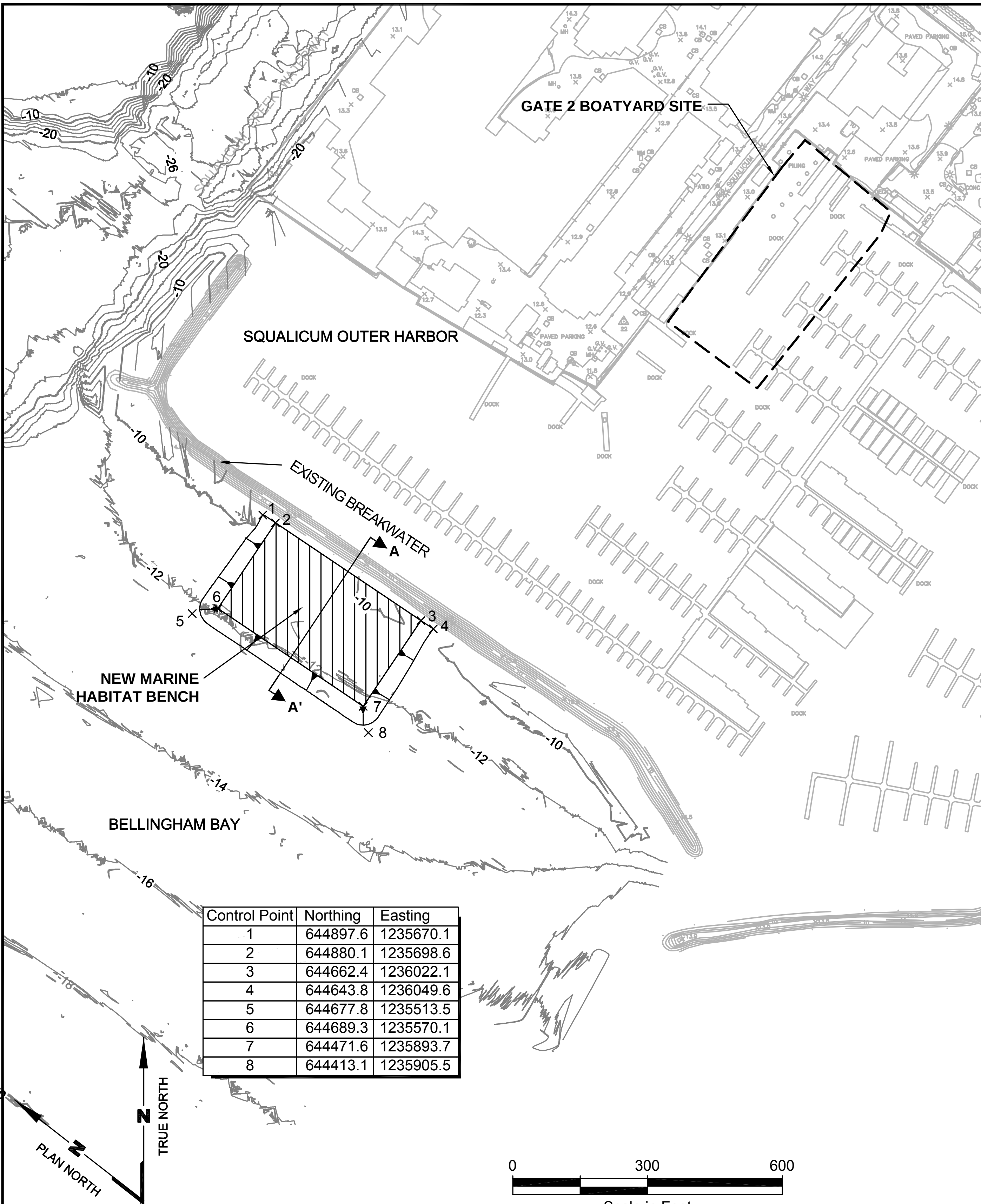
PROJECT NO.	001027
DATE	APRIL 21, 2003
SHEET	19 OF 19
DRAWING NO.	SURVEY-1



(E)=Existing

Adapted from: Anchor Environmental

Landau Associates	Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**New Marine Habitat Bench** **Cross Section A-A'**	Figure **Section**



Control Point	Northing	Easting
1	644897.6	1235670.1
2	644880.1	1235698.6
3	644662.4	1236022.1
4	644643.8	1236049.6
5	644677.8	1235513.5
6	644689.3	1235570.1
7	644471.6	1235893.7
8	644413.1	1235905.5

Adapted from: Anchor Environmental

Port of Bellingham/Gate 2 Boatyard | T:\001\027\151\USACE Contract Documents\Plan.dwg (A) "Figure 1" 6/6/2003

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**New Marine Habitat Bench**	Figure Plan

APPENDIX B

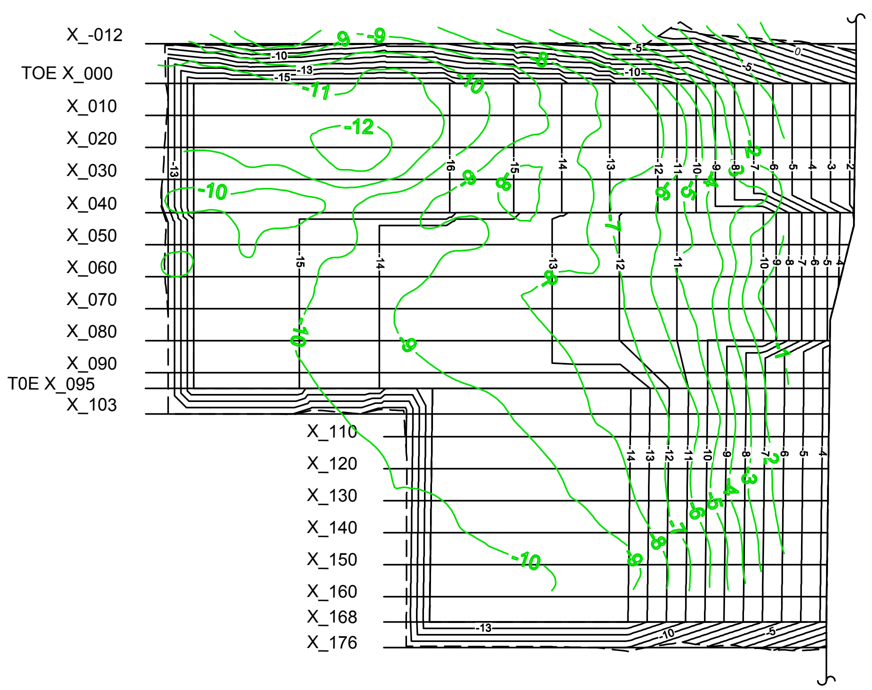
Selected Record Drawings

APPENDIX B
SELECTED RECORD DRAWINGS

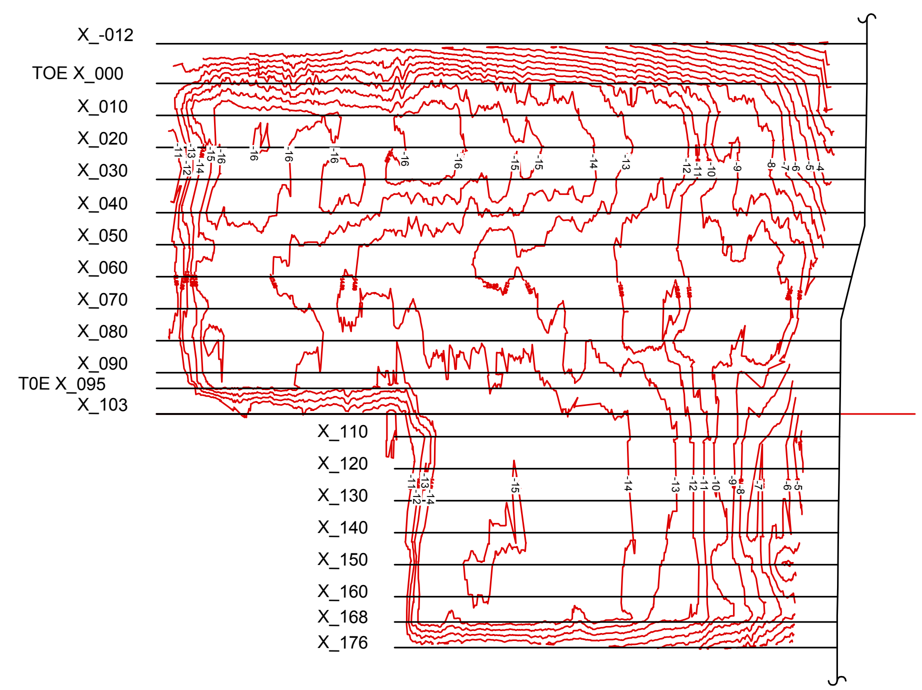
Selected record drawings for the sediment remediation and marine habitat bench components of the interim action at the Gate 2 Boatyard project are included in this Appendix. Plan and cross sectional views associated with sediment dredging and backfilling activities are based on survey data provided by American Construction and CRA-NW Survey Services.

Contour data for the new marine habitat bench are based on survey data provided by the USACE and Manson Construction who constructed the habitat bench with Squalicum Creek Waterway maintenance dredge material.

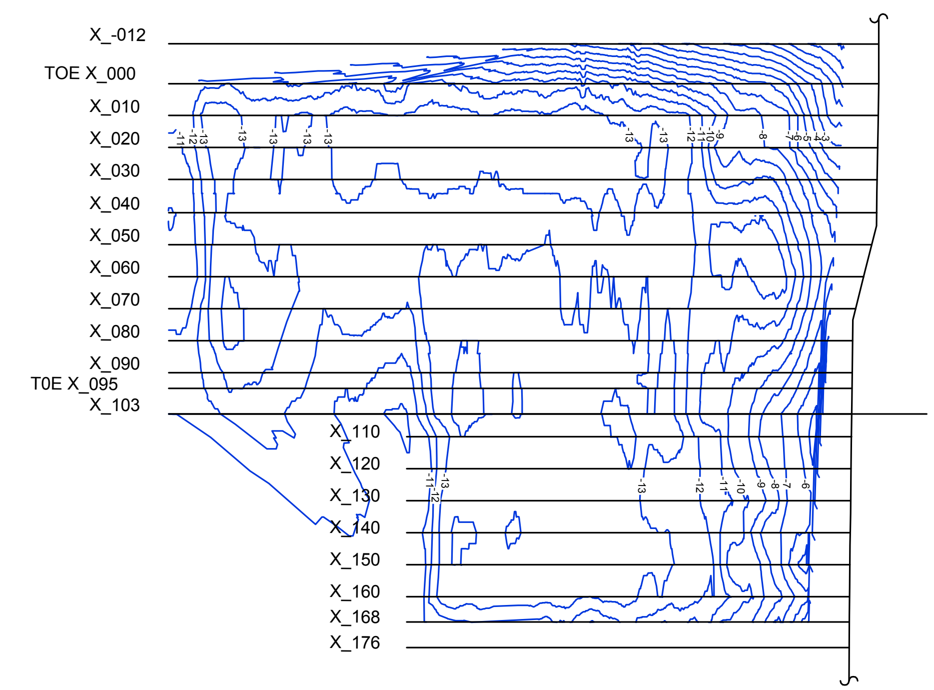
Record drawings associated with installation of the new sheetpile bulkheads and other site redevelopment components are being maintained by the Port and other firms involved in the project.



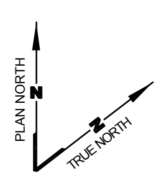
PRE-DREDGE CONTOURS AND
DESIGN DREDGE ELEVATIONS



POST-DREDGE CONTOURS



POST-BACKFILL CONTOURS



LEGEND

- PRE-DREDGE ELEVATIONS
- POST-DREDGE ELEVATIONS
- POST-BACKFILL ELEVATIONS

Notes

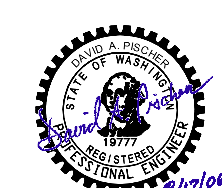
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

2. The post-dredge contours approximate conditions between hyrdographic survey data collection points obtained by CRA-NW Survey Services. Some contours have been smoothed for clarity. The presence of the tieback anchor system for the new sheetpile bulkhead prevented collection of data close to the new bulkhead.

0 30 60
Scale in Feet

REFERENCE

POST-DREDGE AND POST-BACKFILL CONTOURS AND ASSOCIATED CROSS SECTIONS BASED ON BATHYMETRIC SURVEYS PERFORMED BY AMERICAN CONSTRUCTION COMPANY AND CRA-NW SURVEY SERVICES DURING MARINE DREDGING AND BACKFILLING ACTIVITIES.



EXPIRES:7/18/2008

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REVIEWED BY:
APPROVED BY:
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LANDAU ASSOCIATES
130 2nd AVENUE S.
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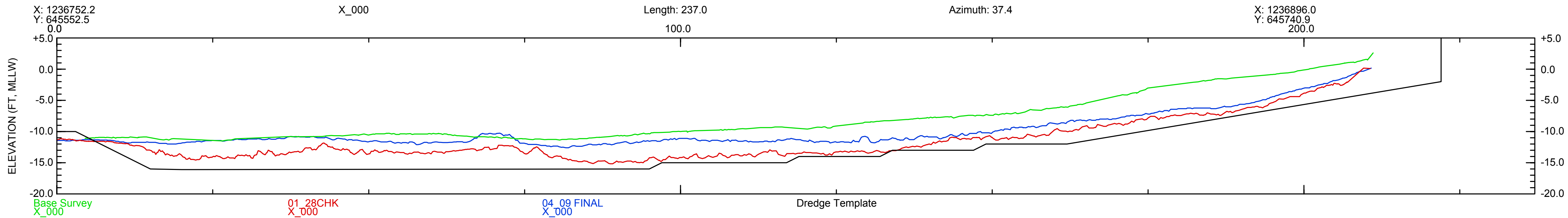
(425) 778-0907, FAX (425) 778-6409

GATE 2 BOATYARD
SEDIMENT REMEDIATION AND
REDEVELOPMENT PROJECT

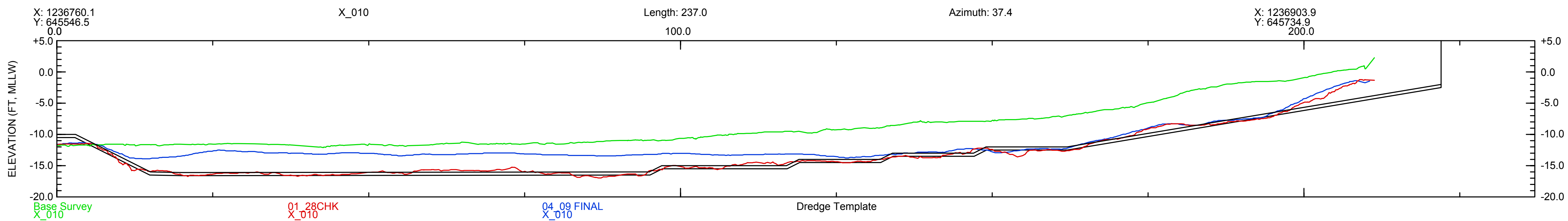
PLAN VIEW CONTOURS

PROJECT NO. 001027.261
DATE 1/14/2005
SHEET 1 OF 7
DRAWING NO. **B-1**

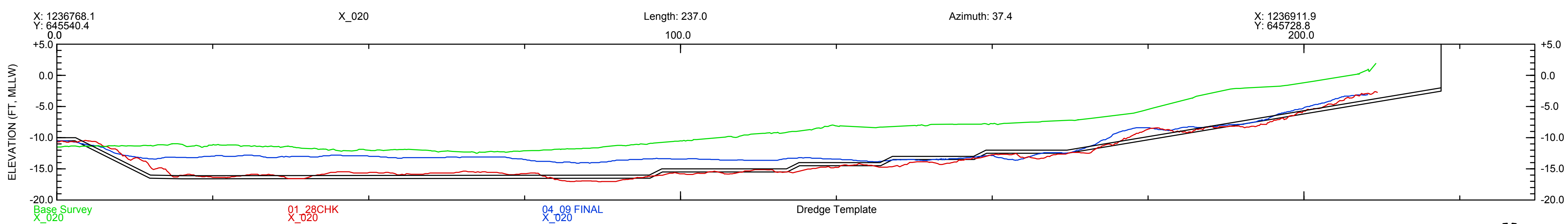
Port of Bellingham/Gate 2 Boatyard/Interim Action Completion Report | V:\001\027\261\F\Interim Action Completion Report\AppendixA.dwg (A) "Plan" 8/17/2006



Cross Section X_000



Cross Section X_010



Cross Section X_020

LEGEND

- PRE-DREDGE ELEVATIONS
- POST-DREDGE ELEVATIONS
- POST-BACKFILL ELEVATIONS

REFERENCE

POST-DREDGE AND POST-BACKFILL CONTOURS AND ASSOCIATED CROSS SECTIONS BASED ON BATHYMETRIC SURVEYS PERFORMED BY AMERICAN CONSTRUCTION COMPANY AND CRA-NW SURVEY SERVICES DURING MARINE DREDGING AND BACKFILLING ACTIVITIES.

EXPIRES:7/18/2008

NOTES

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. These cross sections approximates conditions between hydrographic survey data collections points obtained by CRA-NW Survey Services.

0 30 60
Scale in Feet

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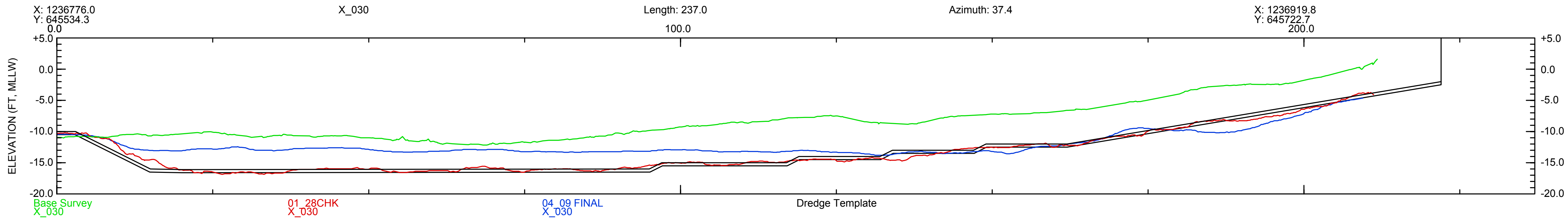
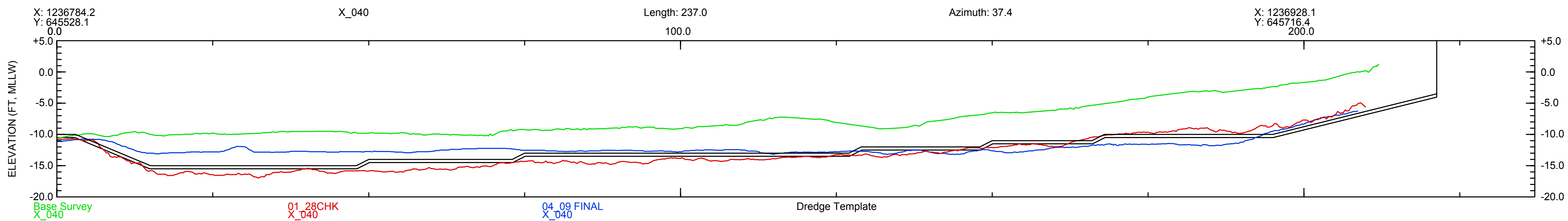
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

CROSS SECTIONS X_000
X_010 AND X_020

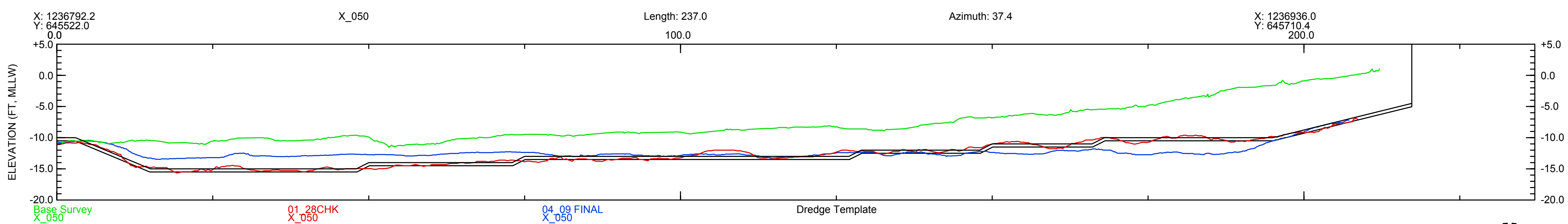
PROJECT NO. 001027.261
DATE 1/14/2005
SHEET 2 OF 7
DRAWING NO. **B-2**



Cross Section X_030



Cross Section X_040



Cross Section X_050

LEGEND

- PRE-DREDGE ELEVATIONS
- POST-DREDGE ELEVATIONS
- POST-BACKFILL ELEVATIONS

REFERENCE

POST-DREDGE AND POST-BACKFILL CONTOURS AND ASSOCIATED CROSS SECTIONS BASED ON BATHYMETRIC SURVEYS PERFORMED BY AMERICAN CONSTRUCTION COMPANY AND CRA-NW SURVEY SERVICES DURING MARINE DREDGING AND BACKFILLING ACTIVITIES.

NOTES

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0 30 60
Scale in Feet

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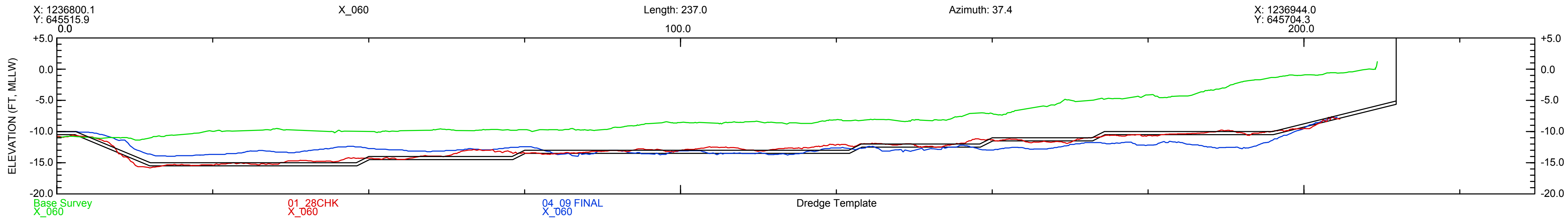
CROSS SECTIONS X_030
X_040 AND X_050

PROJECT NO. 001027.261
DATE 1/14/2005
SHEET 3 OF 7
DRAWING NO. **B-3**



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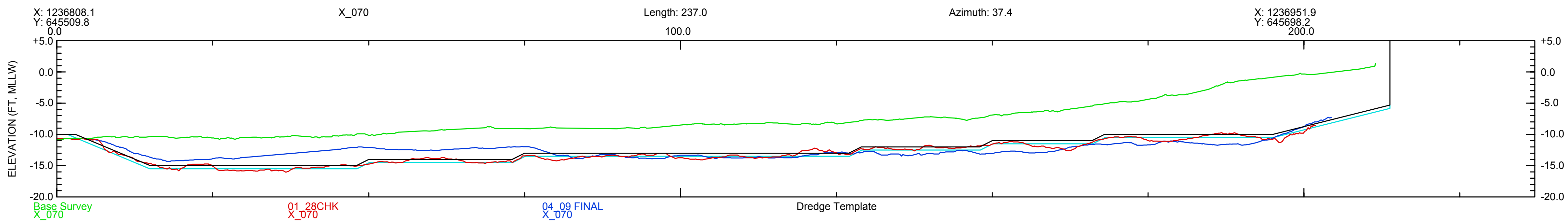
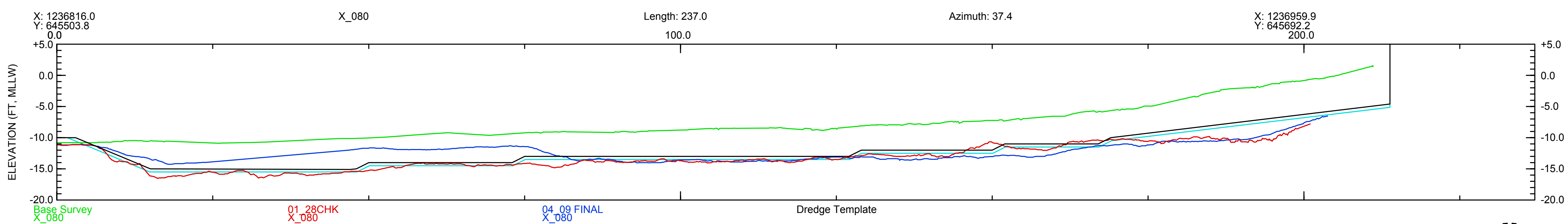


Cross Section X_070



Cross Section X_080

LEGEND

- PRE-DREDGE ELEVATIONS
- POST-DREDGE ELEVATIONS
- POST-BACKFILL ELEVATIONS

REFERENCE

POST-DREDGE AND POST-BACKFILL CONTOURS AND ASSOCIATED CROSS SECTIONS BASED ON BATHYMETRIC SURVEYS PERFORMED BY AMERICAN CONSTRUCTION COMPANY AND CRA-NW SURVEY SERVICES DURING MARINE DREDGING AND BACKFILLING ACTIVITIES.

NOTES

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0 30 60
Scale in Feet

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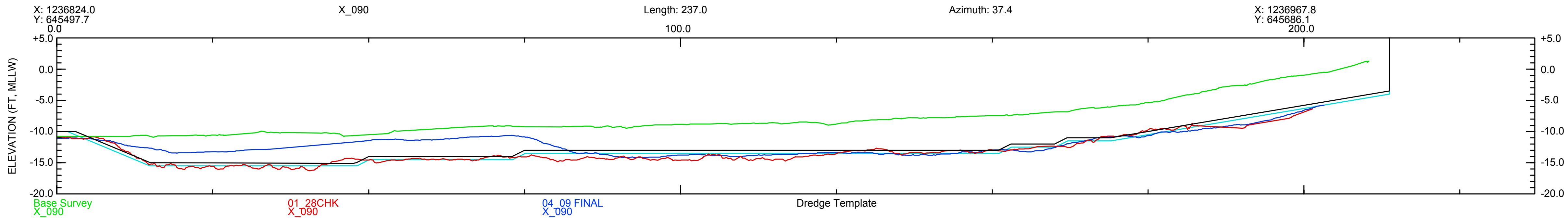
SEDIMENT REMEDIATION AND
REDEVELOPMENT PROJECT

CROSS SECTIONS X_060
X_070 AND X_080

PROJECT NO. 001027.261
DATE 1/14/2005
SHEET 4 OF 7
DRAWING NO. **B-4**



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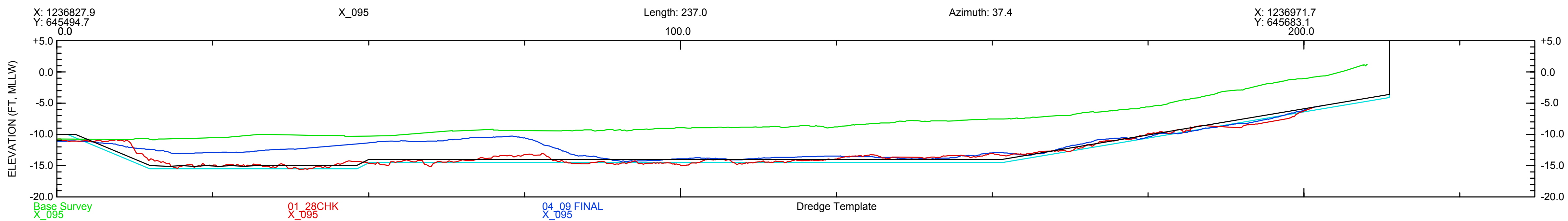

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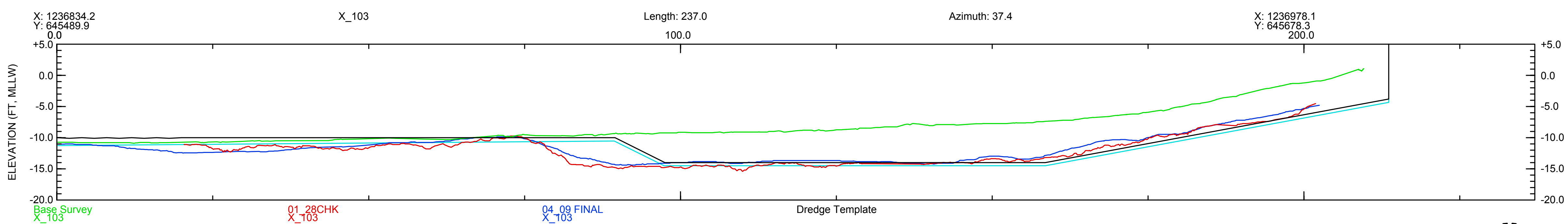

Cross Section X_103

LEGEND

- PRE-DREDGE ELEVATIONS
- POST-DREDGE ELEVATIONS
- POST-BACKFILL ELEVATIONS

REFERENCE

POST-DREDGE AND POST-BACKFILL CONTOURS AND ASSOCIATED CROSS SECTIONS BASED ON BATHYMETRIC SURVEYS PERFORMED BY AMERICAN CONSTRUCTION COMPANY AND CRA-NW SURVEY SERVICES DURING MARINE DREDGING AND BACKFILLING ACTIVITIES.

DAVID A. PISCHER — STATE OF WASHINGTON — 19777 — REGISTERED PROFESSIONAL ENGINEER — 8/17/06

EXPIRES:7/18/2008

NOTES

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2. These cross sections approximates conditions between hydrographic survey data collections points obtained by CRA-NW Survey Services.

0 30 60
Scale in Feet

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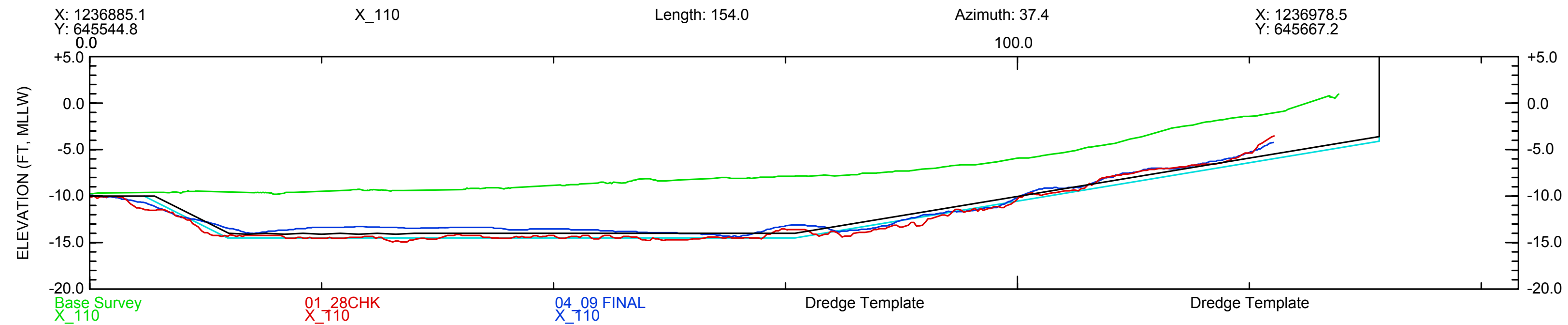
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

CROSS SECTIONS X_090 X_095 AND X_103

PROJECT NO. 001027.261
DATE 1/14/2005
SHEET 5 OF 7
DRAWING NO. **B-5**



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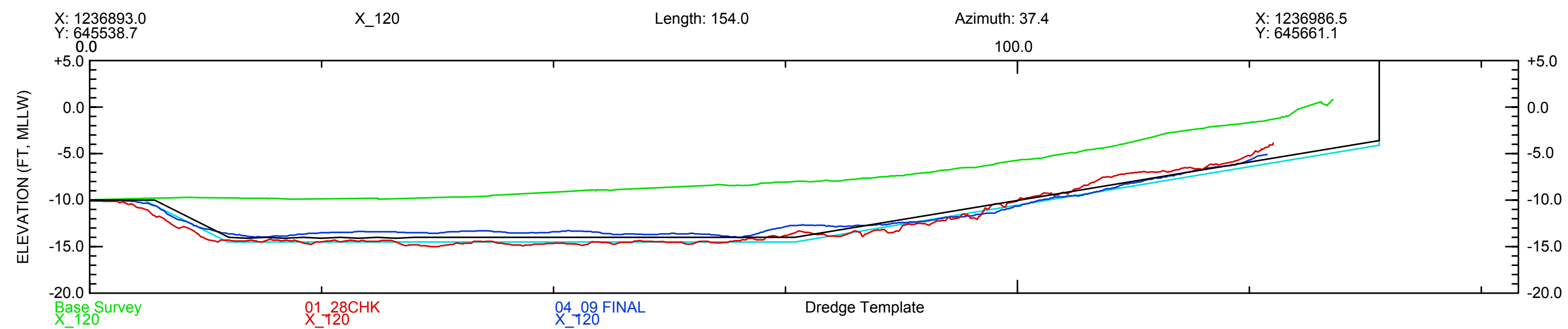

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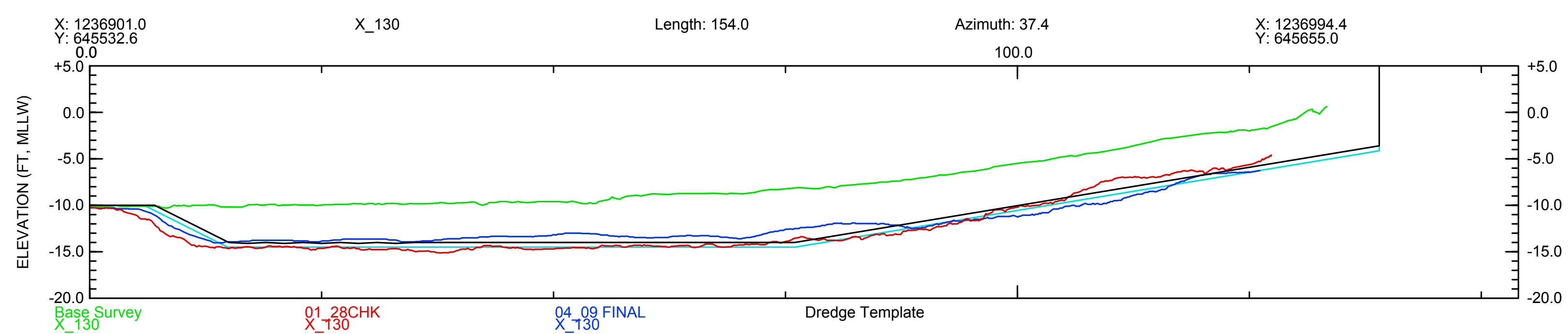

Cross Section X_130

LEGEND

- PRE-DREDGE ELEVATIONS
- POST-DREDGE ELEVATIONS
- POST-BACKFILL ELEVATIONS

REFERENCE

POST-DREDGE AND POST-BACKFILL CONTOURS AND ASSOCIATED CROSS SECTIONS BASED ON BATHYMETRIC SURVEYS PERFORMED BY AMERICAN CONSTRUCTION COMPANY AND CRA-NW SURVEY SERVICES DURING MARINE DREDGING AND BACKFILLING ACTIVITIES.

NOTES

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. These cross sections approximates conditions between hydrographic survey data collections points obtained by CRA-NW Survey Services.

0 30 60
Scale in Feet

STATE OF WASHINGTON
DAVID A. PISCHER
19777
REGISTERED PROFESSIONAL ENGINEER
8/17/06
EXPIRES:7/18/2008

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED

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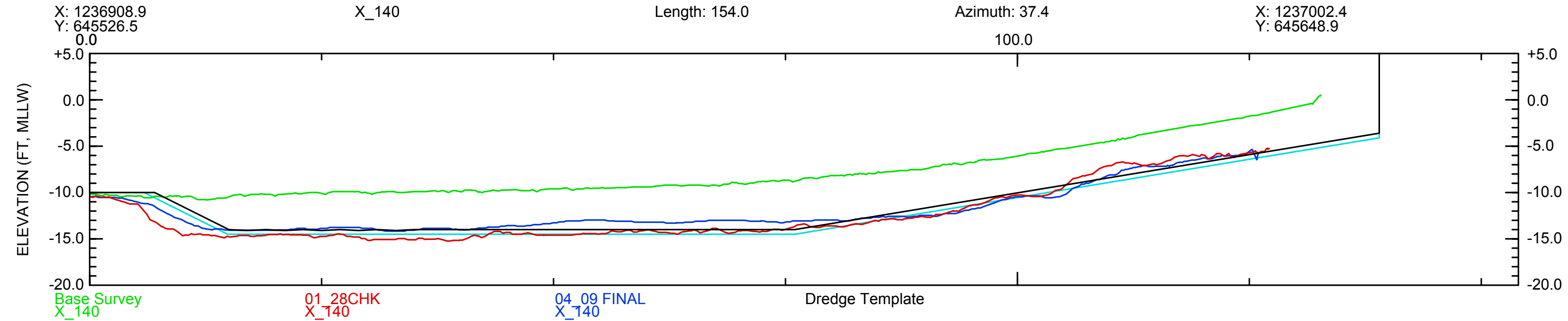
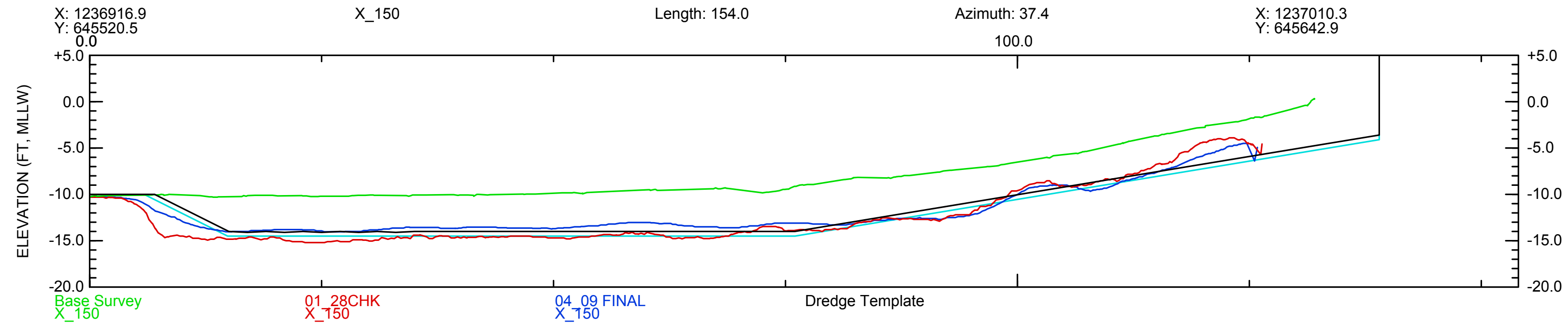
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

CROSS SECTIONS X_110 X_120 AND X_130

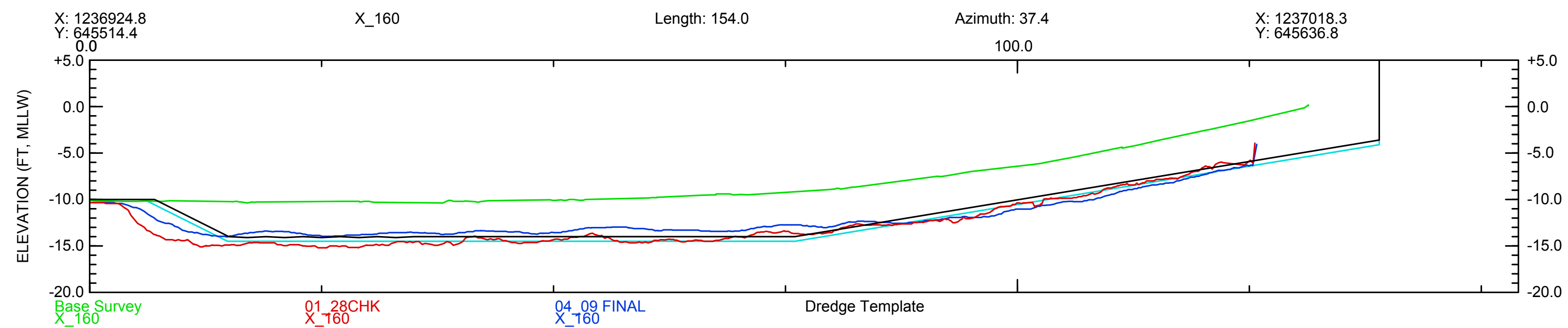
PROJECT NO. 001027.261
DATE 1/14/2005
SHEET 6 OF 7
DRAWING NO. **B-6**



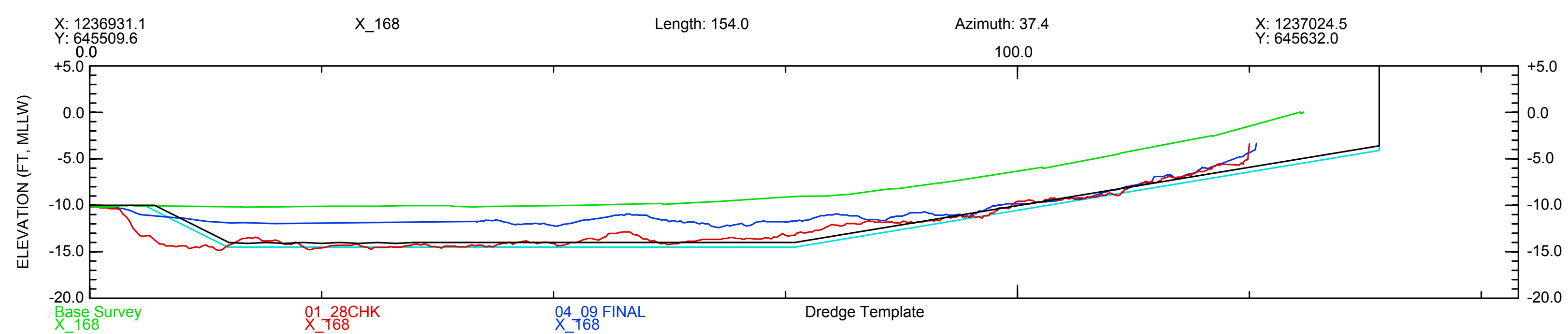
Cross Section X_140



Cross Section X_150



Cross Section X_160



Cross Section X_168

LEGEND

- PRE-DREDGE ELEVATIONS
- POST-DREDGE ELEVATIONS
- POST-BACKFILL ELEVATIONS

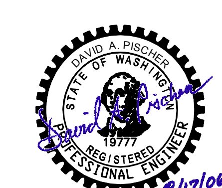
REFERENCE

POST-DREDGE AND POST-BACKFILL CONTOURS AND ASSOCIATED CROSS SECTIONS BASED ON BATHYMETRIC SURVEYS PERFORMED BY AMERICAN CONSTRUCTION COMPANY AND CRA-NW SURVEY SERVICES DURING MARINE DREDGING AND BACKFILLING ACTIVITIES.

NOTES

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
2. These cross sections approximates conditions between hydrographic survey data collections points obtained by CRA-NW Survey Services.

0 30 60
Scale in Feet



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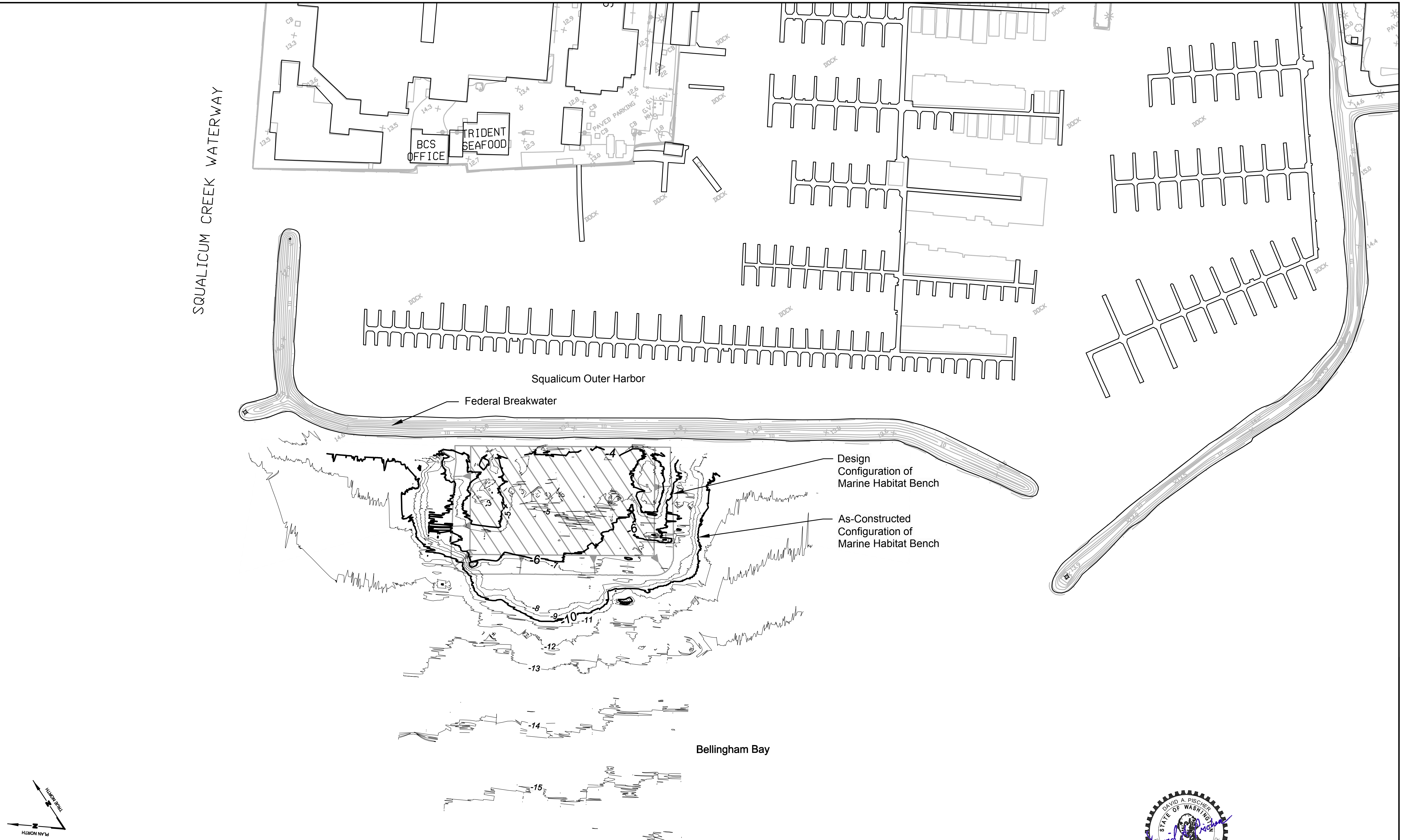
GATE 2 BOATYARD
SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

CROSS SECTIONS X_140
X_150 X_160 AND X_168

PROJECT NO. 001027.261
DATE 1/14/2005
SHEET 7 OF 7
DRAWING NO. **B-7**



REFERENCE

MARINE HABITAT BENCH CONTOURS BASED ON DATA PROVIDED BY USACE AND MASON CONSTRUCTION, USING HYDROGRAPHIC SURVEY DATA COLLECTED ON JANUARY 15, 22, AND 23, 2004.

NO.	DATE	REVISIONS	DESIGNED	REVIEWED	APPROVED

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GATE 2 BOATYARD
SEDIMENT REMEDIATION AND
REDEVELOPMENT PROJECT

MARINE HABITAT BENCH

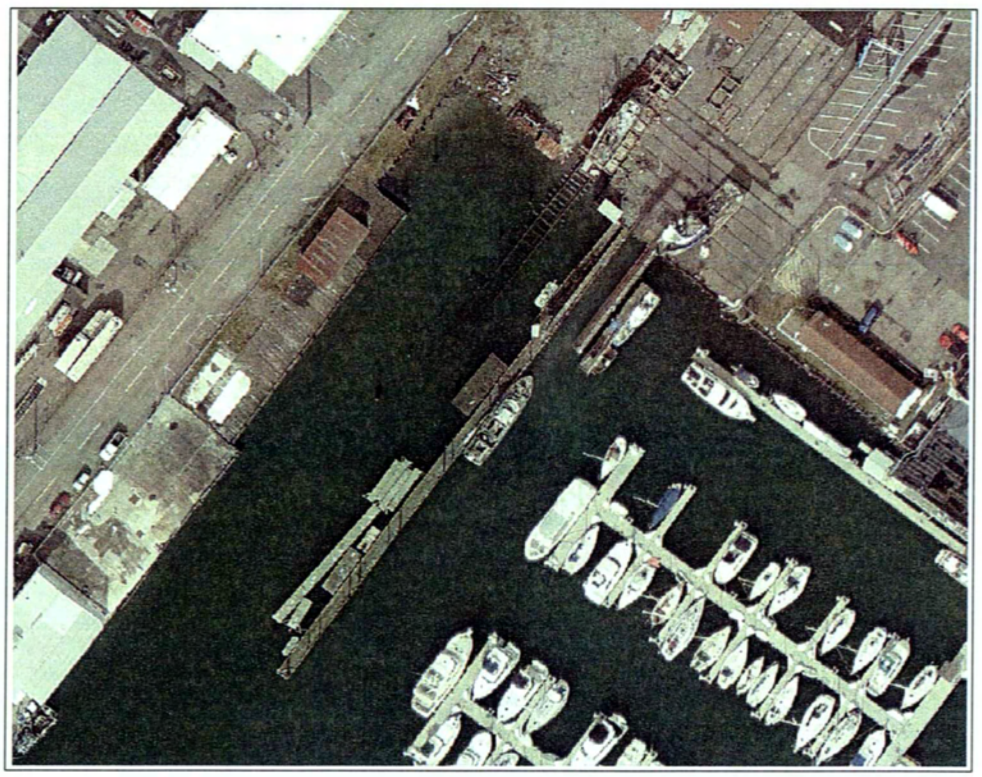
PROJECT NO. 001027.261
DATE 1/14/2005
SHEET 8 OF 8
DRAWING NO. **B-8**

Port of Bellingham/Gate 2 Boatyard/Interim Action Completion Report | V:\001027\261\F\Interim Action Completion Report\DWG B-8.dwg (A) "Plan" 8/17/2006

APPENDIX C

Selected Construction Photographs

1. Squalicum Harbor.



2. Gate 2 Boatyard prior to redevelopment.

LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Selected Site Photographs

Figure
C-1

3. Old timber bulkhead and marine railway well.

4. Former marine railway.

5. Marine railway demolition.

6. Marine railway demolition debris.

7. Initial sediment dredging on December 24, 2003.

8. Sediment dredging and barge loading.

LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Selected Site Photographs**	Figure C-4

9. Initial loading of dredge spoils on flat deck barge.

10. Initial barge load of dredge spoils.

11. Barge with dredge spoils.

12. Sediment offloading at Alaska Logistics facility.

01/21/05 S:\WPROC\001\027\261\EcologyInterimActCompRpt\A_apc-6.doc

LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Selected Site Photographs**	Figure C-6

13. Sediment offloading at Alaska Logistics facility.

14. Sediment offloading at American Construction's south yard.

01/21/05 S:\WPROC\001\027\261\EcologyInterimActCompRpt\A_apc-7.doc

LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Selected Site Photographs**	Figure C-7

15. Sediment offloading at American Construction's south yard.

16. Marine railway well excavation/backfilling on January 20, 2004.

17. Marine railway well excavation/backfilling on January 21, 2004.

18. U.S. Army Corps of Engineers dredging of Squalicum Creek Waterway.

19. Marine habitat bench construction.

20. Bottom dump barge after unloading at marine habitat bench.

21. Helical tieback anchor installation for new bulkhead.

22. Helical tieback anchor installation for new bulkhead.

01/21/05 S:\WPROC\001\027\261\EcologyInterimActCompRpt\A_apc-11.doc

LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Selected Site Photographs

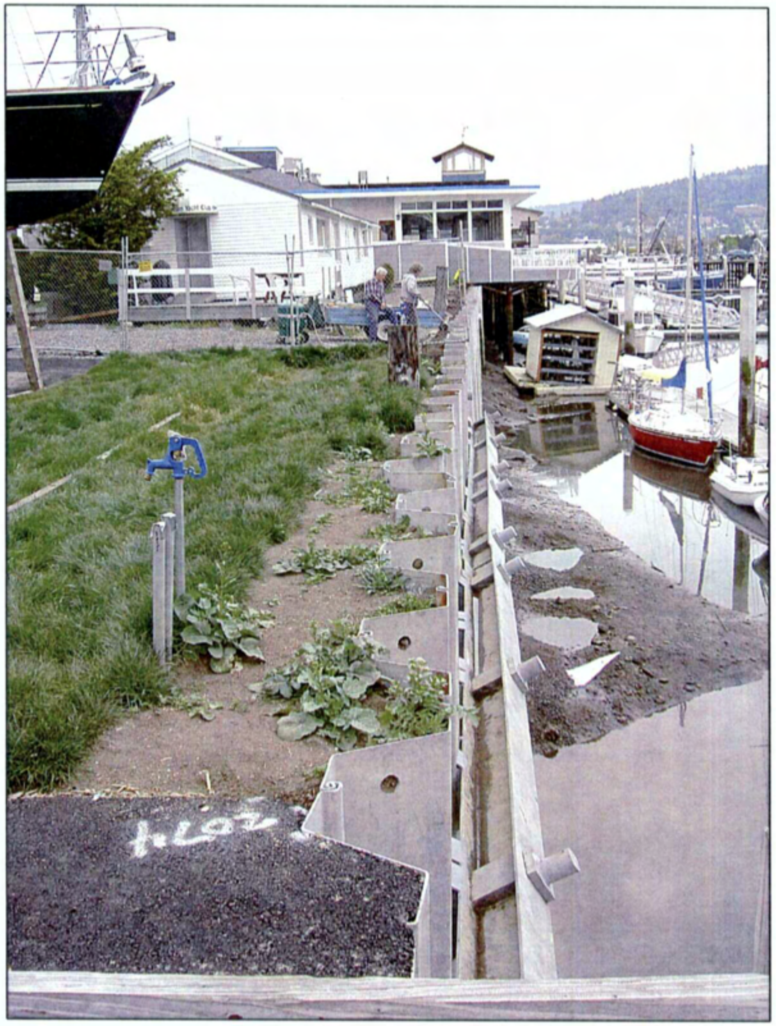
Figure
C-11

23. Installation of new sheetpile bulkhead.

24. Installation of new sheetpile bulkhead across marine railway well.

25. New sheetpile bulkhead installed in front of old timber bulkhead.

26. Segment B bulkhead and tieback system.



27. Transition from Segment B to Segment A bulkhead and reconstructed bioswale.

28. 150-ton travel lift pile installation with vibratory hammer.

LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Selected Site Photographs

Figure
C-14

29. 150-ton travel lift pile driving with air bubble curtain.

30. 150-ton travel lift pile installation with vibratory hammer.

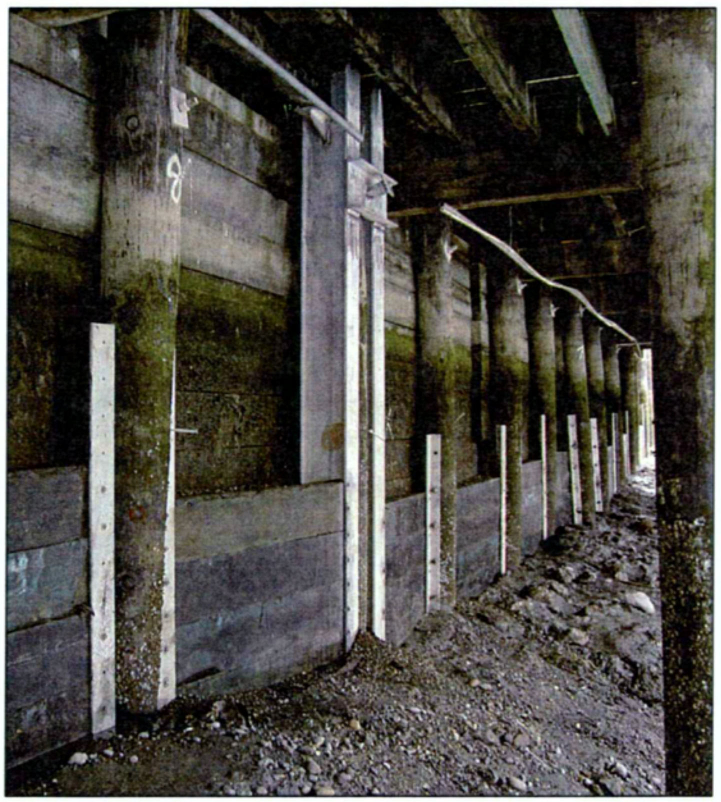
LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Selected Site Photographs

Figure C-15

31. Installing new AZCA-treated fender piles along Segment C wharf.



32. Segment C wharf lagging and pile repairs.

33. Post-construction view of redeveloped Gate 2 Boatyard with new 150-ton travel lift piers.

APPENDIX D

Water Quality Monitoring Results

APPENDIX D
WATER QUALITY MONITORING RESULTS

Background water quality monitoring was conducted on September 10, 2003 prior to the start of marine railway demolition and other in-water construction activities. The two background locations selected for the project (sample sites A and F) were located near the entrances to Squalicum Outer Harbor, as shown on the enclosed sketches. The locations and results of surface water quality monitoring conducted during selected in-water construction activities, as previously reported to Ecology, are also included in this Appendix for documentation purposes.

BACKGROUND WATER QUALITY MONITORING DATA - SEPTEMBER 10, 2003
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
PORT OF BELLINGHAM

Site	Date	Time	Depth of Water (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (°C)	Salinity (%)
A	9/10/2003	9:40	1.5	8.54	38.7	2	10.76	16.8	2.47
A	9/10/2003	9:45	8.5	8.55	40.3	2	10.18	16.7	2.57
A	9/10/2003	12:12	1.5	8.50	38.1	3	9.73	16.6	2.39
A	9/10/2003	12:14	8	8.62	35.9	2	10.15	16.7	2.25
A	9/10/2003	14:02	1.5	8.56	29.8	8	9.63	16.3	1.77
A	9/10/2003	14:04	10	8.74	41.2	3	11.44	16.2	2.63
A	9/10/2003	16:02	1.5	8.66	38.2	2	10.56	16.5	2.42
A	9/10/2003	16:04	10	8.78	41.3	1	12.06	16.1	2.64
B	9/10/2003	10:22	1.5	8.19	38.4	2	9.34	16.9	2.44
B	9/10/2003	10:25	5.5	8.41	39.4	1	7.73	17.1	2.53
B	9/10/2003	12:40	1.5	8.38	37.0	2	8.98	16.8	2.34
B	9/10/2003	12:42	5.5	8.50	41.5	1	8.03	16.6	2.68
B	9/10/2003	14:22	1.5	8.38	30.6	2	8.83	16.0	1.94
B	9/10/2003	14:24	6.5	8.62	39.5	0	8.56	17.0	2.52
C	9/10/2003	10:47	1.5	8.25	38.7	1	8.93	16.8	2.45
C	9/10/2003	10:49	5.5	8.47	42.2	1	9.42	16.6	2.70
C	9/10/2003	12:54	1.5	8.31	37.8	0	7.02	17.0	2.39
C	9/10/2003	12:56	6	8.49	41.6	1	8.27	16.2	2.66
C	9/10/2003	14:44	1.5	8.47	33.2	3	6.72	16.5	2.07
C	9/10/2003	14:46	7	8.62	39.5	1	9.55	16.9	2.52
D	9/10/2003	11:02	1.5	8.27	38.9	0	8.39	17.2	2.47
D	9/10/2003	11:04	5	8.44	41.2	1	9.05	16.6	2.65
D	9/10/2003	13:07	1.5	8.47	38.1	1	7.77	16.9	2.42
D	9/10/2003	13:09	5	8.52	38.8	1	8.77	17.1	2.48
D	9/10/2003	14:53	1.5	8.54	38.5	0	7.91	16.9	2.44
D	9/10/2003	14:55	7	8.65	40.1	1	8.05	16.9	2.56
D	9/10/2003	16:19	1.5	8.54	38.0	0	7.20	17.0	2.42
D	9/10/2003	16:21	8	8.65	39.8	1	7.44	16.9	2.55
E	9/10/2003	11:17	1.5	8.32	39.0	0	8.36	17.0	2.50
E	9/10/2003	11:19	5	8.49	40.9	1	8.37	16.8	2.60
E	9/10/2003	13:17	1.5	8.42	37.6	1	6.89	16.8	2.36
E	9/10/2003	13:19	5	8.56	38.8	1	8.67	17.1	2.47
E	9/10/2003	15:02	1.5	8.56	37.4	0	8.45	16.8	2.38
E	9/10/2003	15:04	7	8.63	40.0	0	8.48	16.9	2.56
E	9/10/2003	16:26	1.5	8.48	36.8	0	7.83	16.8	2.32
E	9/10/2003	16:28	8	8.64	40.2	1	9.39	16.8	2.56
F	9/10/2003	11:50	1.5	8.49	39.3	1	9.02	16.9	2.50
F	9/10/2003	11:52	6	8.57	39.9	1	9.95	16.9	2.54
F	9/10/2003	13:39	1.5	8.60	39.1	1	8.55	16.8	2.49
F	9/10/2003	13:41	7	8.67	39.6	2	9.96	16.8	2.52
F	9/10/2003	15:28	1.5	8.66	38.8	1	10.84	16.7	2.45
F	9/10/2003	15:30	8	8.67	40.2	2	10.46	16.6	2.56
F	9/10/2003	16:42	1.5	8.64	38.6	1	8.52	16.8	2.45
F	9/10/2003	16:44	10	8.74	40.7	1	10.69	16.3	2.60

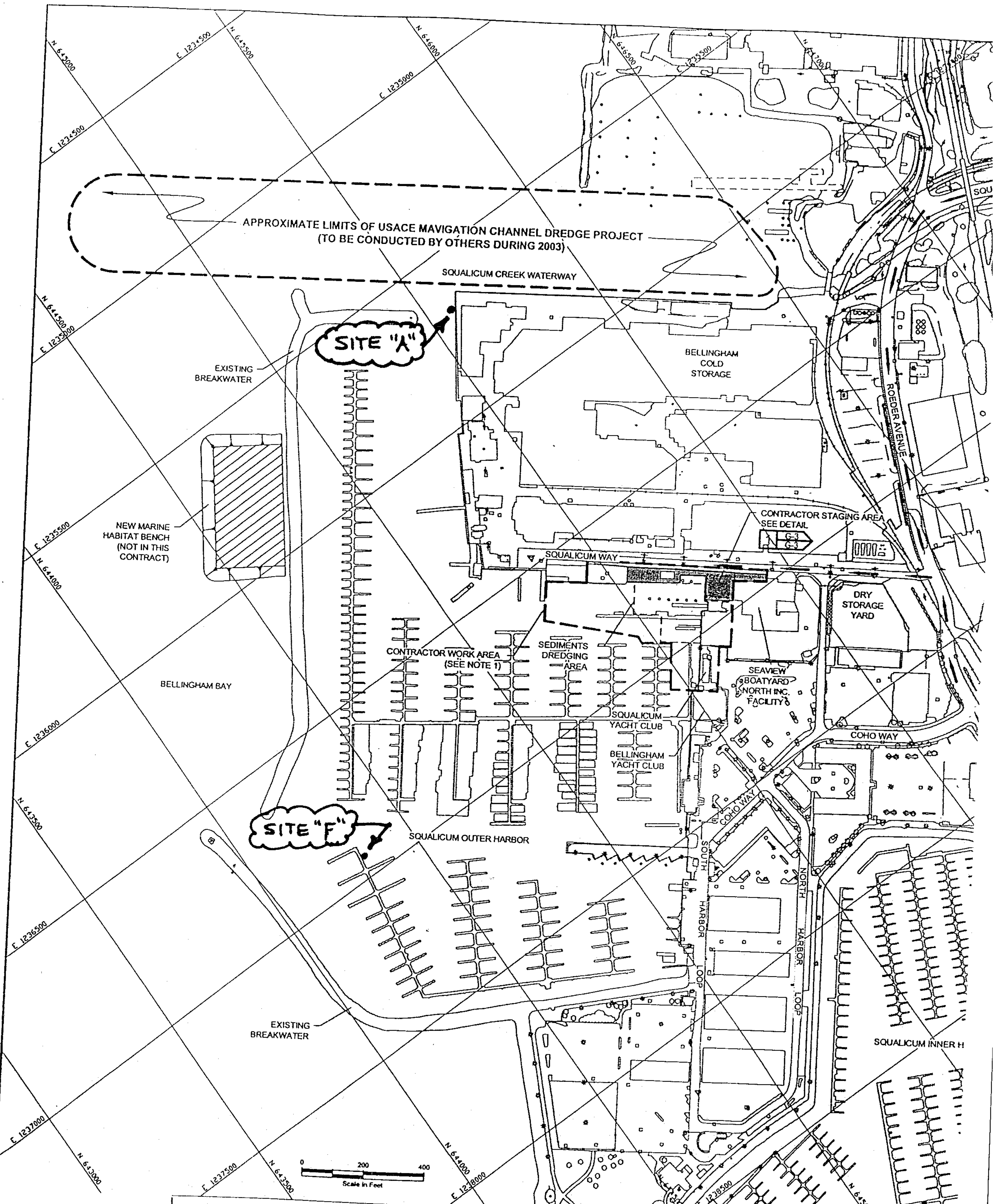
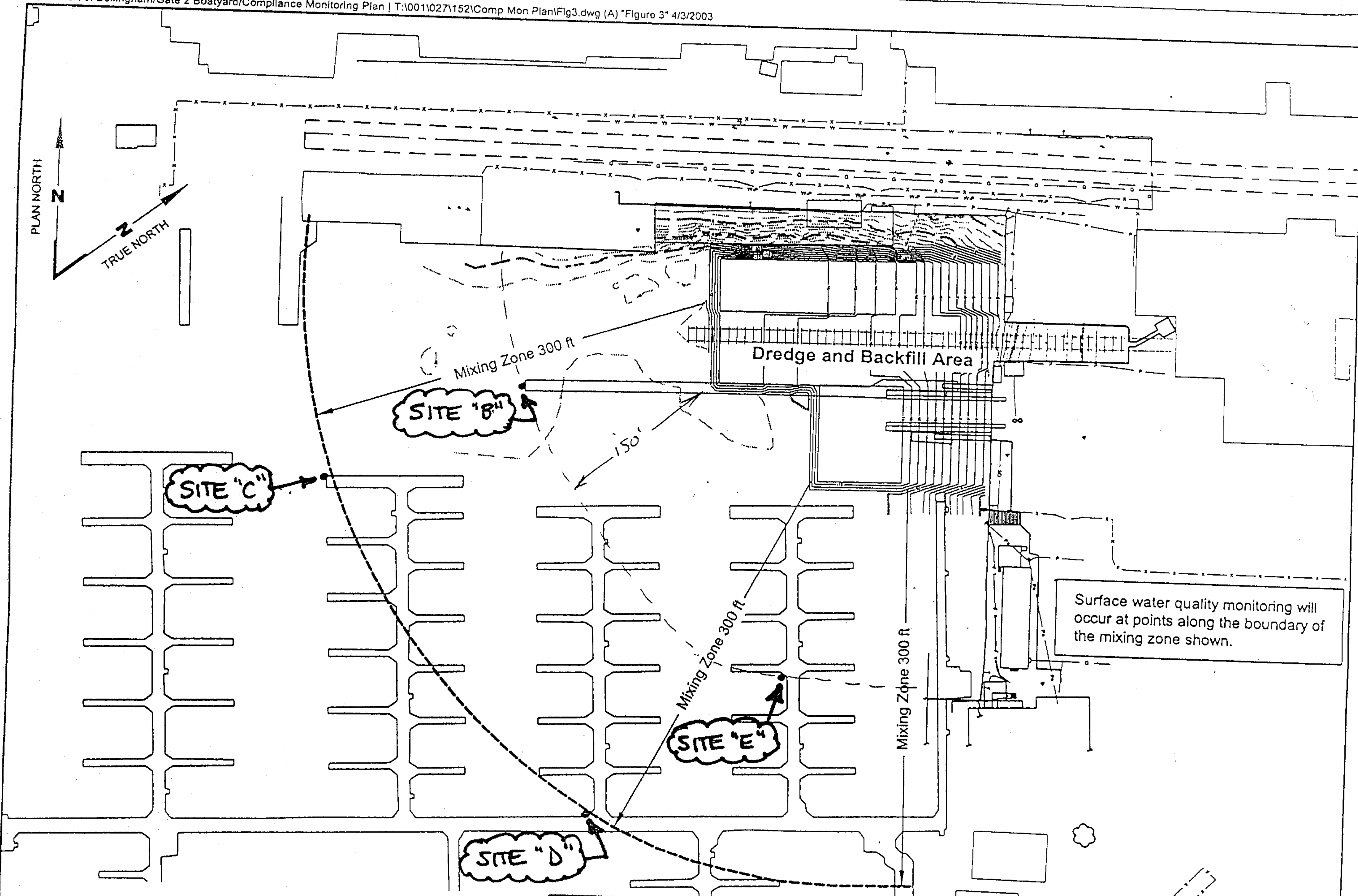


Fig 1

PORT OF BELLINGHAM
Washington State

BACKGROUND WATER QUALITY MONITORING LOCATIONS

Port of Bellingham/Gate 2 Boatyard/Compliance Monitoring Plan | T:\001\027\152\Comp Mon Plan\Fig3.dwg (A) "Figure 3" 4/3/2003



LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Surface Water Mixing Zone
~~Dredging and Backfilling Activities~~
BACKGROUND WATER QUALITY

Figure 2

COPY

PORT OF BELLINGHAM
Washington State, USA

TO:	LOREE' RANDALL	MARY O'HERRON	DAVE PISCHER
COMPANY:	DOE	DOE	LANDAU
FAX NUMBER:	360-407-6902	360-738-6253	425-778-6409
FROM:	JOHN HERGESHEIMER		
DATE SENT:	9/25/03		

6 PAGE (S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: W. Q. MONITORING REPORTS FOR 9/23/03 & 9/24/03 DURING MARINE RAILWAY REMOVAL

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

FAX NUMBER (360) 671-6411

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PORT OF BELLINGHAM

GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT

SURFACE WATER QUALITY MONITORING DATA

Date: Tues 9/23/03 Construction Activity: N Float / Mooring Pile / RR Pile Removal

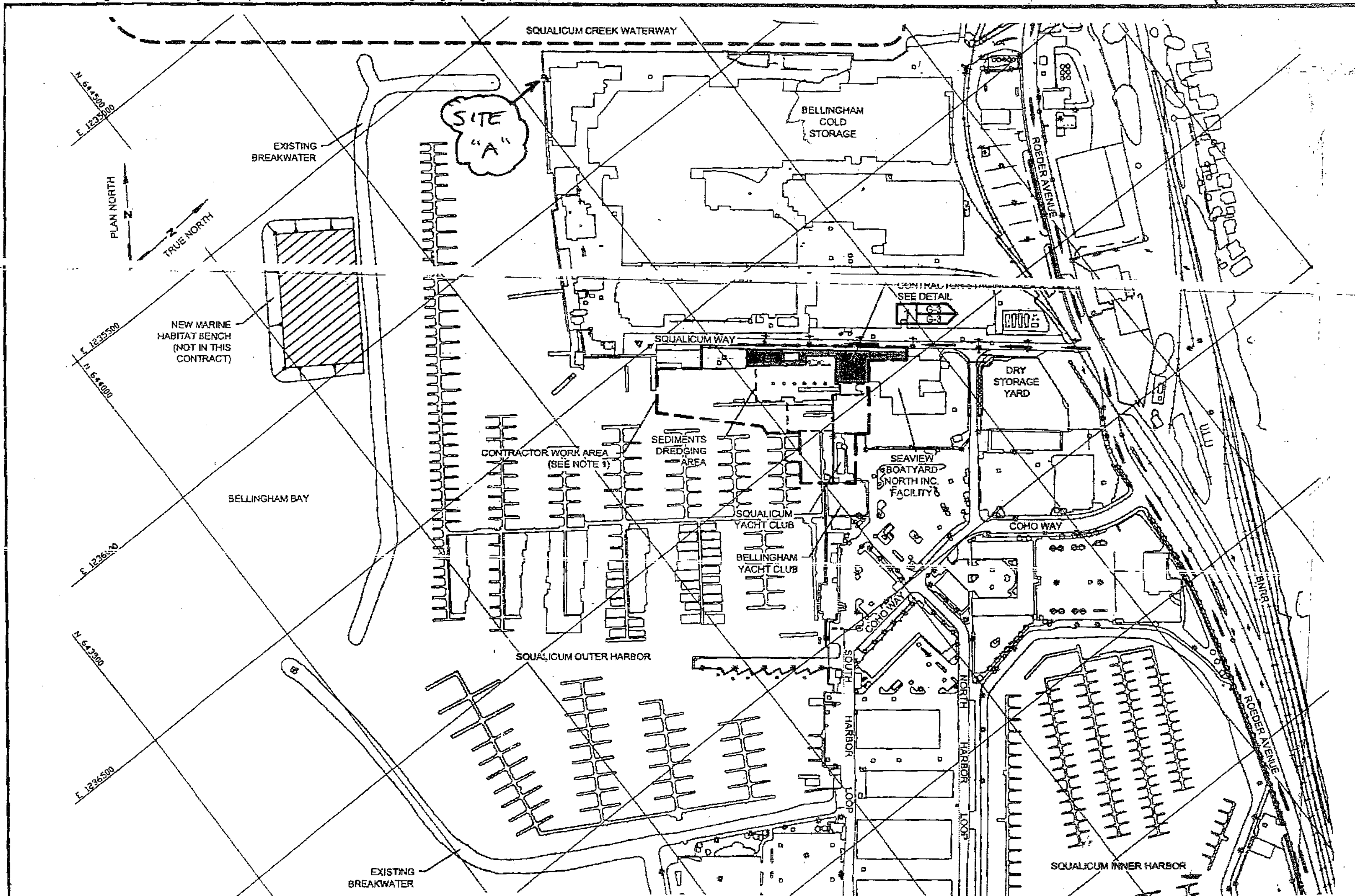
Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
A	1009	17'	1.5	8.35	21.1	2	9.40	14.3	BKgd e BCS
A	1012	"	8.5	8.40	39.6	2	1056	14.8	"
C	1056	12	1.5	8.30	23.2	4	8.76	14.7	300' before/during
C	1059	"	6.0	8.42	37.1	1	8.86	14.9	pulling mooring pile (a)
G	1109	10.5	1.5	—	—	2	—	—	150' reading "
G	1110		5.5	—	—	3	—	—	" " "
A	12:17	19.5	1.5	8.28	14.5	6	9.67	15.3	BCS Bkgd
A	12:20		10	8.59	39.4	1	10.94	15.3	"
C	12:35	14.2'	1.5	8.36	19.2	2	8.90	15.1	
C	12:38		7	8.48	37.3	1	9.79	15.1	
G	12:48	13	1.5	—	—	4	—	—	150' - RR
G	12:49		6.5	—	—	2	—	—	
A	1:33	22	1.5	8.34	24.1	4	10.35	15.5	
A	1:39		11	8.53	40.6	1	11.10	14.7	
H	1.50	14'	1.5	[illegible]	[illegible]	12	[illegible]	[illegible]	150' (A West 12)
H	1.53		7'	[illegible]	[illegible]	1	[illegible]	[illegible]	"
C	2:00	17.2'	1.5	8.35	17.4	1	8.77	15.5	
C	2:02		9.5	8.47	38.4	1	11.0	15.0	
G	2:05	15.0'	1.5	—	—	3	—	—	150'
G	2:07		7.5	—	—	1	—	—	150'
A	3:43	23.0'	1.5	8.17	23.0	N/R	10.20	15.7	K b
A	3:53		11.5	8.35	35.5	N/R	[illegible]	14.6	K b
H	4:08	17.1'	1.5	—	—	N/R	—	—	K b
H	4:14		8.6'	—	—	N/R	—	—	K b
G	4:18	17.8'	1.5						
G			8.8'						
C	4:26	19.2'	1.5	8.14	26.0	N/R	8.52	15.7	K b
C			9.[illegible]	8.30	38.4	N/R	9.80	14.7	K b

Additional Notes & Observations

(a) Horiba calib prevented 1hr "prior" readings. @ 11:51 start clamshell on marine railway removal near N end. Piles & caps together

*(b) TURBIDITY NOT READING CORRECTLY (NEGATIVE NUMBERS) WILL RECALIBRATE FOR AM READINGS 9/24

Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\...\Gate 2 SAP\Fig...dwg (A) "Figure



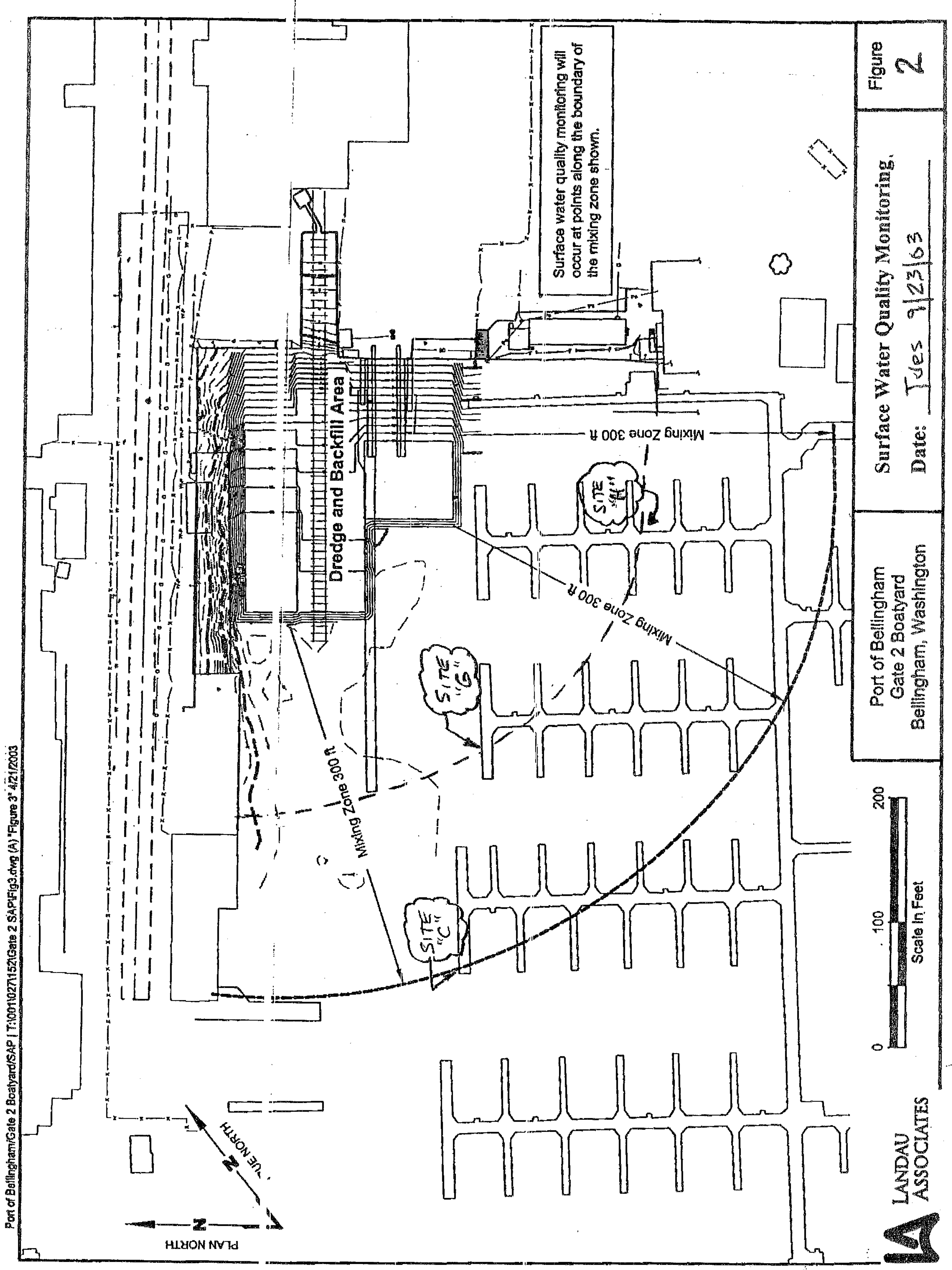
LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Surface Water Quality Monitoring

Date: Tues 9/23/03

Figure
1


Surface water quality monitoring will occur at points along the boundary of the mixing zone shown.
Dredge and Backfill Area
Mixing Zone 300 ft
Mixing Zone 300 ft
Mixing Zone 300 ft
SITE "A"
SITE "G"
SITE "C"
PLAN NORTH
0
100
200
Scale In Feet
LANDAU ASSOCIATES
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington
Surface Water Quality Monitoring
Date: Ides 9/23/03
Figure 2
Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\152\Gate 2 SAP\Fig3.dwg (A) "Figure 3" 4/21/2003

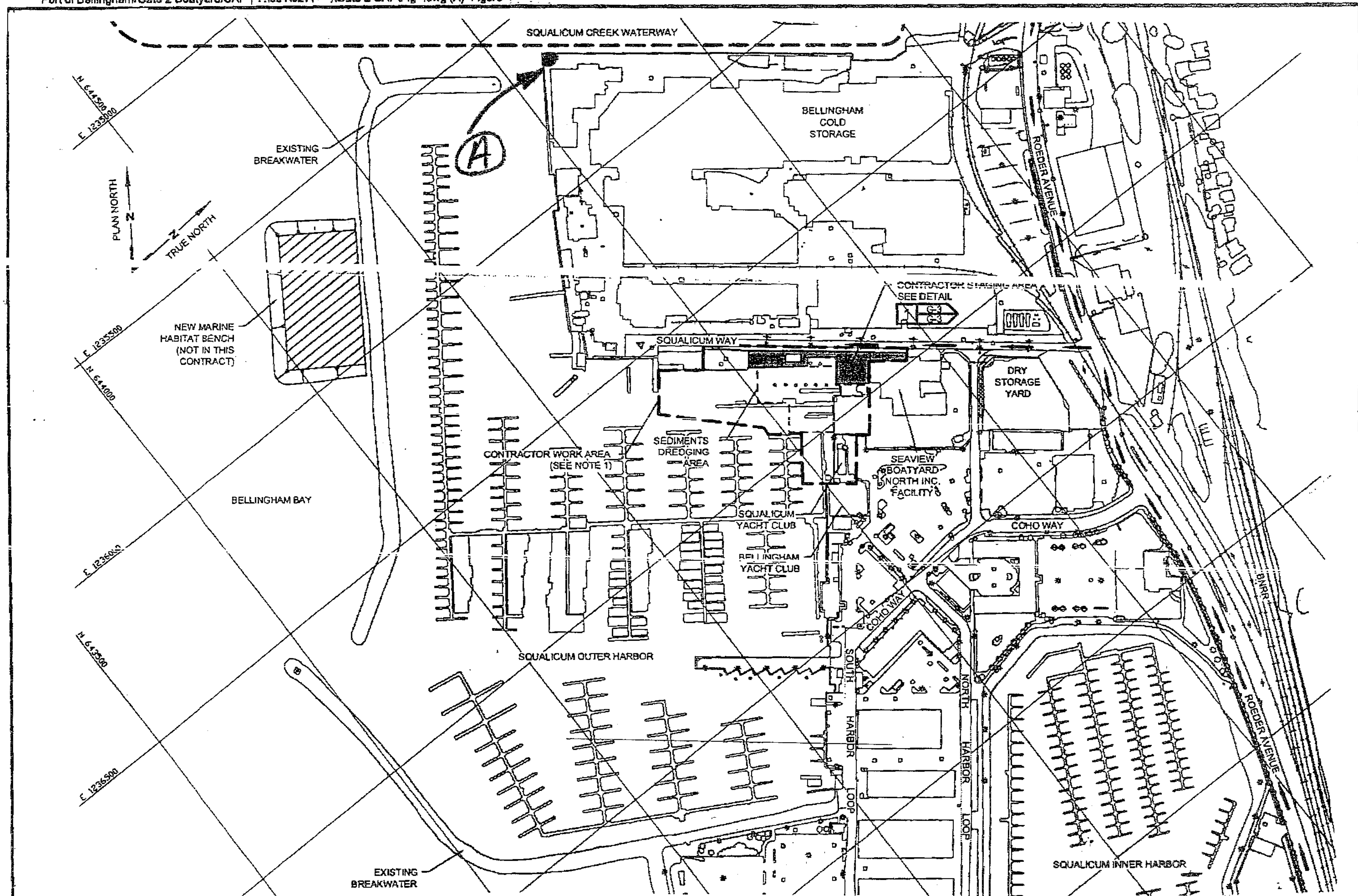
PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

Date: WED 9/24/03 Construction Activity: MARINE RWAY REMOVAL

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
C	11:43	12	1.5	7.89	36.7	1	9.40	15.2	
C	11.48		6.0	8.00	40.0	3	9.08	13.7	
G	11:53	10.9	1.5	—	—	2	—	—	
G	11:55		5.5	—	—	3	—	—	
H	11:59	10.2	1.5	—	—	3	—	—	
H	12:02		5.1	—	—	40	—	—	
J	12:32	9.0	1.5	—	—	5	—	—	
J	12:34		4.5	—	—	27	—	—	
I	12:47	14.0	1.5	8.04	36.9	5	9.32	15.2	300' BY LADDER
I	12:54		5.5	8.04	40.4	12	9.30	14.2	300' "
A	1:04	24.5	1.5	8.10	35.4	2	10.78	16.0	
A	1:09		12.2	8.01	41.8	4	10.68	13.1	
H	3:23	16.0	1.5	—	—	0	—	—	
H	3:24		8.0	—	—	28	—	—	
G	3:29	16.6	1.5	—	—	1	—	—	
G	3:31		8.3	—	—	12	—	—	
C	3:36	18.0	1.5	8.13	34.9	1	9.78	16.2	
C	3:37		9.0	8.16	40.9	1	10.60	13.8	
J	3:48	13.5	1.5	—	—	1	—	—	
J	3:51		6.8	—	—	20	—	—	
I	3:59	16.5	1.5	8.12	35.2	1	8.80	16.2	300
I	4:01		8.3	8.16	40.3	3	10.30	13.8	300
A	4:11	29.0	1.5	8.10	34.8	1	10.15	16.2	
A	4:15		14.5	8.08	42.1	2	11.45	12.7	

Additional Notes & Observations [signature]

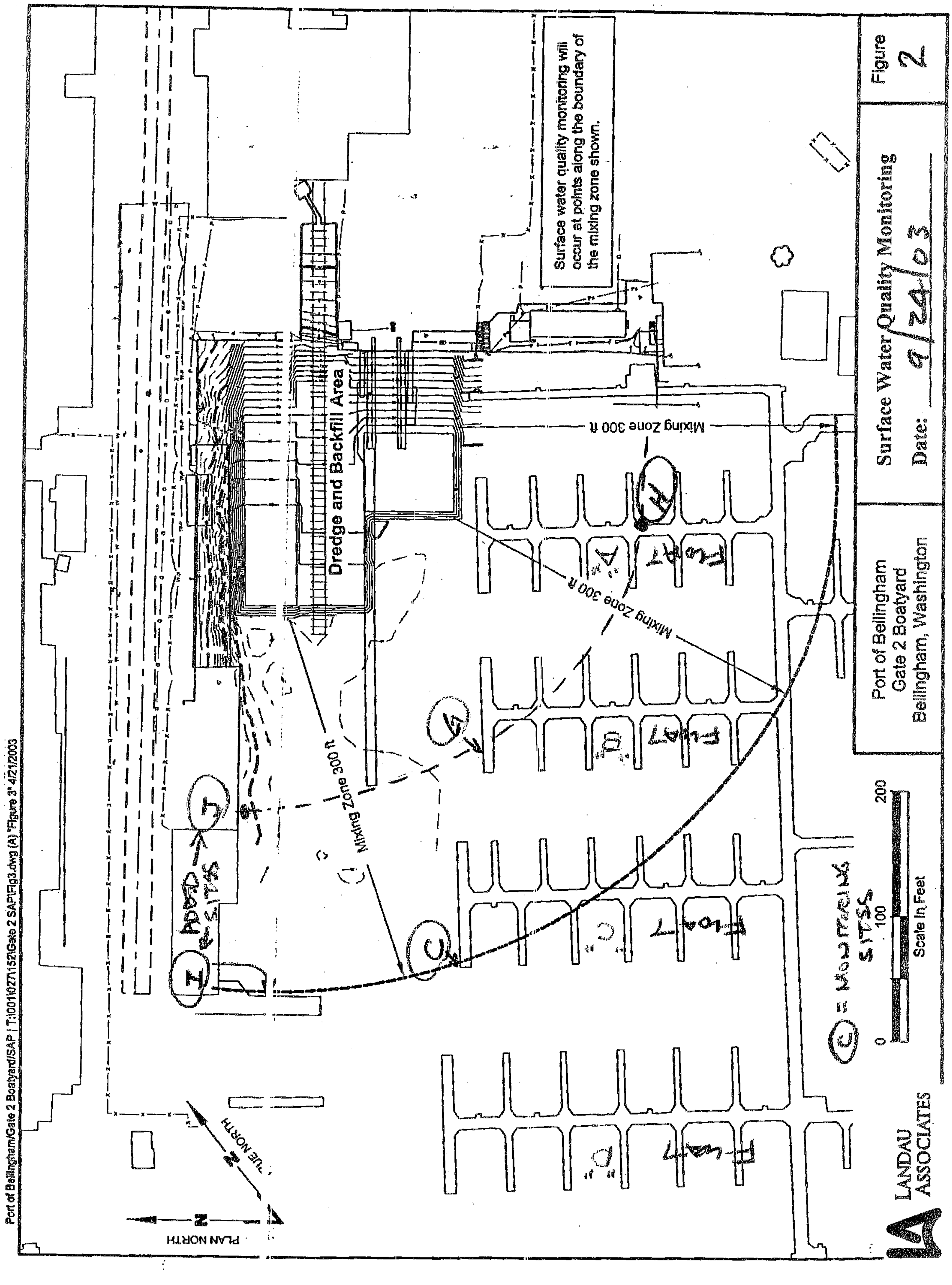
Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\ \Gate 2 SAP\Fig .dwg (A) "Figure



LANDAU ASSOCIATES

0 200 400
Scale in Feet

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	Surface Water Quality Monitoring Date: 9/24/03	Figure 1


Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\152\Gate 2 SAP\Fig3.dwg (A) "Figure 3" 4/21/2003
Surface water quality monitoring will occur at points along the boundary of the mixing zone shown.
Dredge and Backfill Area
Mixing Zone 300 ft
Mixing Zone 300 ft
Mixing Zone 300 ft
H
G
J
I
C
ADDED SITES
FLOAT A
FLOAT B
FLOAT C
FLOAT D
C = MONITORING SITES
0 100 200
Scale in Feet
PLAN NORTH
N
TRUE NORTH
LANDAU ASSOCIATES
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington
Surface Water Quality Monitoring
Date: 9/24/03
Figure 2

COPY

PORT OF BELLINGHAM
Washington State, USA

TO: LOREE' RANDALL / MARY O'HERRON / DAVE PISCHER

COMPANY: ECOLOGY / ECOLOGY / LANDAU ASSOC.

FAX NUMBER: 360-407-6902 / 360-738-6253 / 425-778-6409

FROM: JOHN HERGESHEIMER

DATE SENT: 9/26/03

3 PAGE(S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: WATER QUALITY MONITORING REPORTS FOR: 9/25/03

WORK PERFOMED: LAST DAY OF MARINE RAILWAY REMOVAL, UNTIL DREDGING. ALSO REMOVAL OF WHARF "C" FENDER PILES.

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

FAX NUMBER (360) 671-6411

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PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

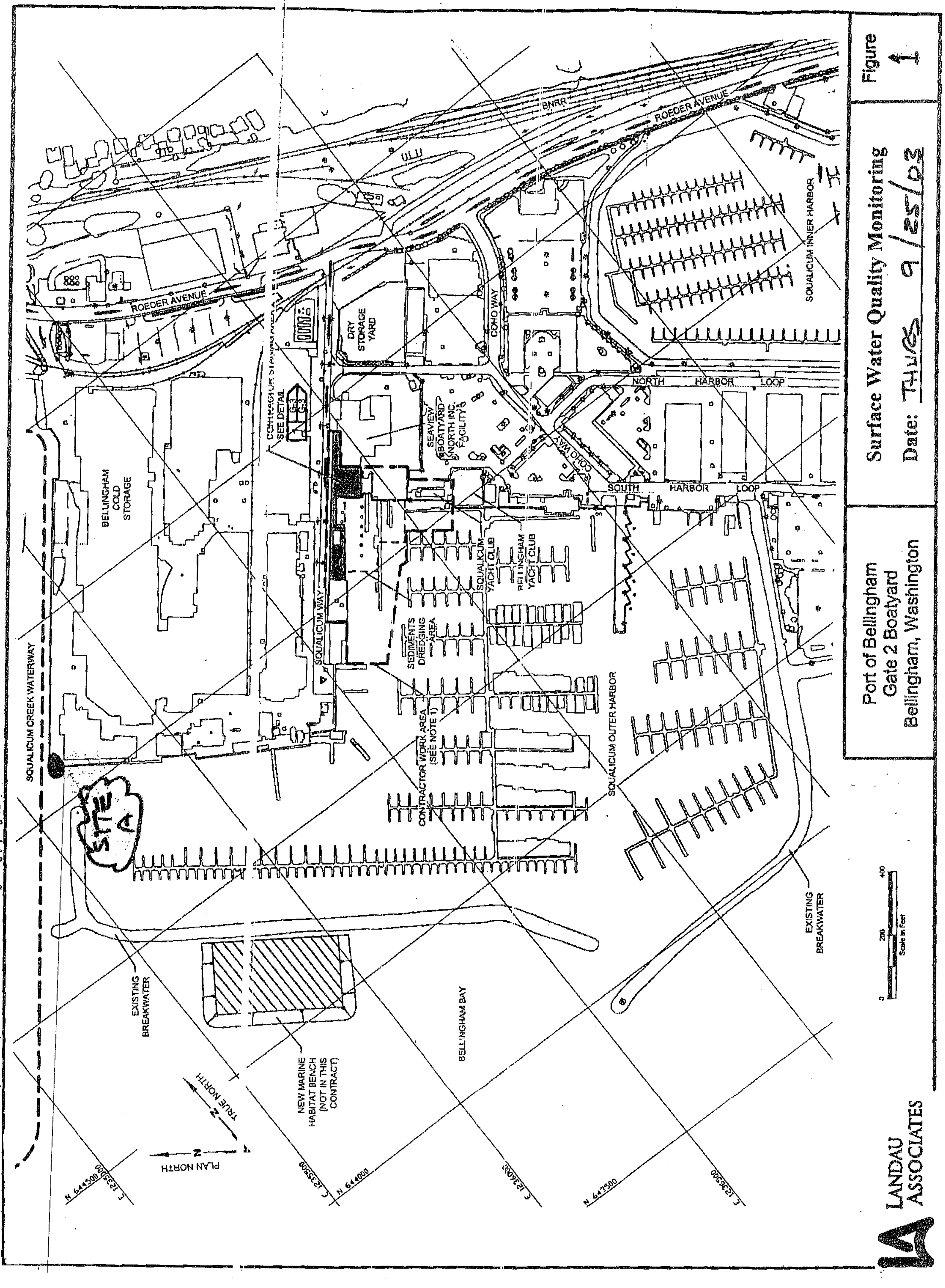
Date: THURS 9/25/03 Construction Activity: REMOVE MARINE RAILWAY

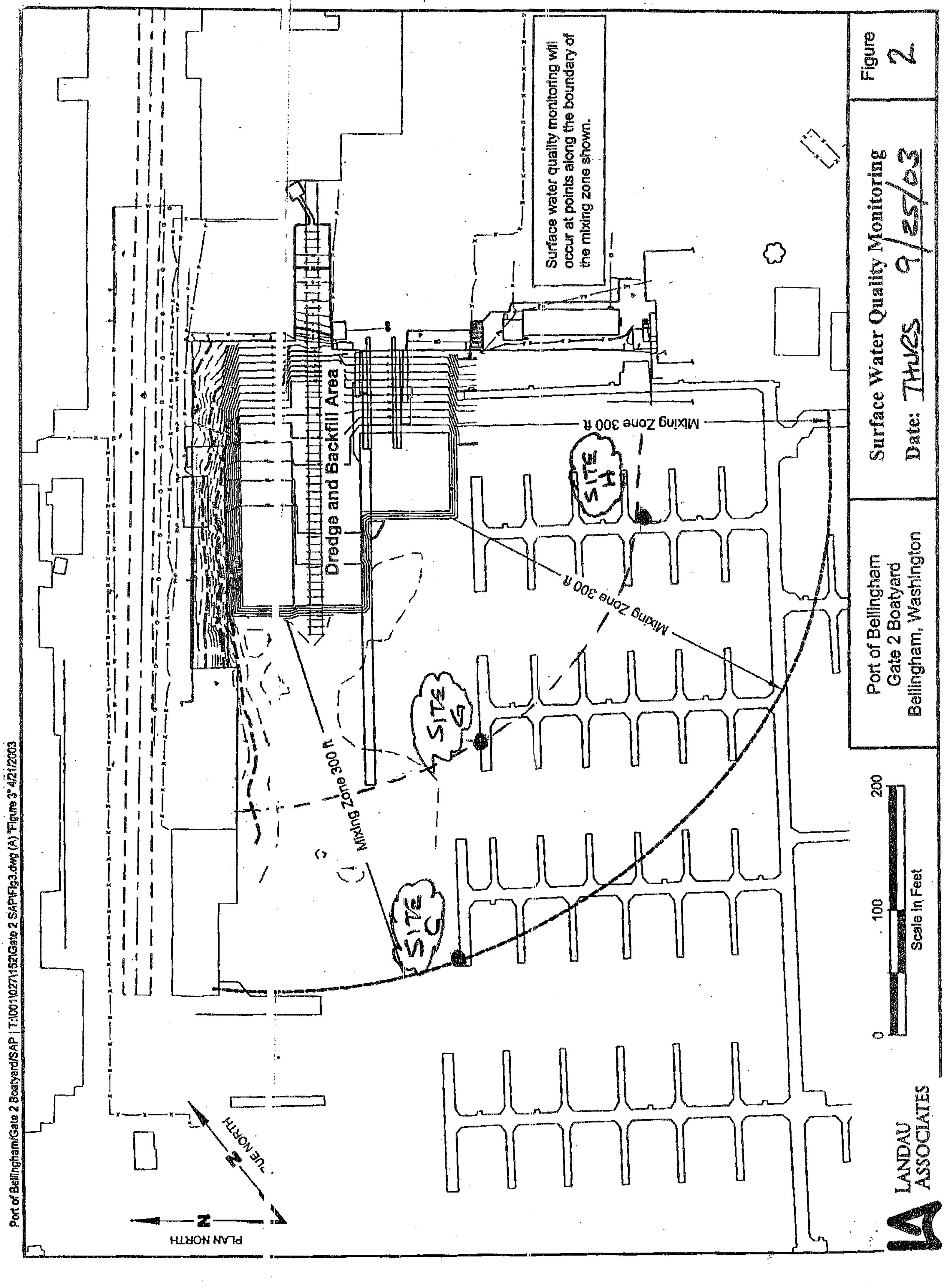
	Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
	H	9:51	10.5	1.5	—	—	1	—	—	b
	H	9:53		5.3	—	—	1	—	—	b
	G	9:56	11.0	1.5	—	—	2	—	—	b
①	G	9:56		5.5	—	—	0	—	—	b
	C	9:58	12.2	1.5	8.17	33.7	2	7.72	15.3	b
	C	10:03		6.1	8.23	36.4	1	7.70	15.7	b
	A	10:20	18.0	1.5	8.05	13.9	10	8.74	14.4	a, b
	A	10:24		9.0	8.33	39.2	2	12.35	14.8	a, b
	H	12:58	11.2	1.5	—	—	6	—	—	
	H	12:59		5.6	—	—	1	—	—	
	G	1:02	12.8	1.5	—	—	7	—	—	
②	G	1:03		6.4	—	—	4	—	—	
	C	1:07	13.2	1.5	8.05	19.5	8	7.55	15.8	
	C	1:09		6.6	8.22	36.9	2	8.70	15.7	
	A	1:20	20.0	1.5	8.13	19.0	9	8.85	15.9	
	A	1:22		10.0	8.34	39.0	1	12.12	14.9	
	H	4:08	16.5	1.5	—	—	1	—	—	c
	H	4:09		8.2	—	—	4	—	—	c
	G	4:12	17.0	1.5	—	—	3	—	—	c.
③	G	4:13		8.5	—	—	1	—	—	c.
	C	4:23	18.5	1.5	8.15	27.2	3	8.08	16.4	c.
	C	4:26		9.3	8.40	38.6	1	12.18	15.2	c.
	A	4:37	23.8	1.5	8.15	27.9	3	8.68	16.1	c.
	A	4:40		11.9	8.44	39.4	1	12.63	14.9	c.

Additional Notes & Observations: a) BREEZY & SITE A IS MURKY DUE TO WESTERLY BREEZE IN THE BAY AT LOW TIDE
b) COINCIDES w/ 1 HR PRIOR TO WORK START AND LOW TIDE
c) COINCIDES w/ CESSATION OF PILING / TIMBER REMOVAL FOR THE DAY AND FOR THIS ACTIVITY. [signature]

09/26/03 09:51 FAX

003/004




Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\152\Gate 2 SAP\Fig3.dwg (A) "Figure 3" 4/21/2003
Surface water quality monitoring will occur at points along the boundary of the mixing zone shown.
Dredge and Backfill Area
Mixing Zone 300 ft
Mixing Zone 300 ft
Mixing Zone 300 ft
SITE H
SITE G
SITE C
PLAN NORTH
N
0
100
200
Scale in Feet
LANDAU ASSOCIATES
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington
Surface Water Quality Monitoring
Date: THURS 9/25/03
Figure 2

PROJECT FILE
No. 001 027.23(

PORT OF BELLINGHAM
Washington State, USA

TO: LORI E RANDALL / MARY O HERRON / DAVE PISCHER

COMPANY: ECOLOGY / ECOLOGY / LANDAU ASSOC.

FAX NUMBER: 360-407-6902 / 360-738-6253 / 425-778-6409

FROM: JOHN HERGESHEIMER

DATE SENT: 12/24/03

1 PAGE (S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: WATER QUALITY MONITORING REPORTS FOR: 12/24

WORK PERFOMED: DREDGING

HAND DELIVERED COPY TO AMERICAN CONSTRUCTION

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

FAX NUMBER (360) 671-6411

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PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

Date: 12/24/03 Construction Activity: DREDGING @ WEST SIDE: GATE 2

1.5 & MID.

	Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
BACKGROUND PRIOR TO DREDGE	A	8:34	30.8	1.5	7.59	33.3	5	12.46	7.4	BKGD @ BCS
	A	8:35	"	15.4	7.61	33.8	9	12.88	7.5	"
	C	8:13	22.0	1.5	7.24	33.3	2	11.71	7.5	C W. 23
	C	8:15	"	11.0	7.54	34.1	2	11.14	7.7	"
	D	NOT TAKEN SEE 'G'								B W. [illegible]
	D									"
	G	8:20	21.2	1.5	—	—	2	—	—	B W. 23 150'
	G	8:21	"	10.6	—	—	2	—	—	"
	H	NOT TAKEN SEE 'G'								A W. 12 150'
	H									"
DURING DREDGING	C	10:35	21.0	1.5	7.60	33.5	2	12.08	7.5	DURING
	C	10:37	"	10.5	7.60	33.8	2	11.11	7.6	DREDGING
	G	10:41	19.7	1.5	—	—	3	—	—	DREDGE TO
	G	10:43	"	9.9	—	—	6	—	—	END @
	A	10:55	29.5	1.5	7.61	32.9	6	12.46	7.4	NOON
	A	10:56	"	14.8	7.60	31.9	6	12.74	7.5	

Additional Notes & Observations: [signature]

SILT CURTAIN DEPLOYED. 10' FROM BOTTOM OF FLOAT TO BOTTOM OF CURTAIN. TIDES @ 11.5 @ 8 AM & 10 @ 11:30 AM.
DREDGE PART DAY ONLY ; BEGAN @ 8:54 AM ENDED AT 11:30 AM. LOADED BARGE "EVERETT".

PROJECT FILE
No. 001 027. 231

PORT OF BELLINGHAM
Washington State, USA

TO: LOREE' RANDALL / MARY O'HERRON / DAVE PISCHER

COMPANY: ECOLOGY / ECOLOGY / LANDAU ASSOC.

FAX NUMBER: 360-407-6902 / 360-738-6253 / 425-778-6409

FROM: JOHN HERGESHEIMER

DATE SENT: 12/30/03

3 PAGE(S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: WATER QUALITY MONITORING REPORTS FOR: 12/29/03
1 REPORT + 2 MAPS (FOR 12/24 & 12/29)

WORK PERFOMED: DREDGING

HAND DELIVERED COPY TO AMERICAN CONSTRUCTION

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

FAX NUMBER (360) 671-6411

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PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

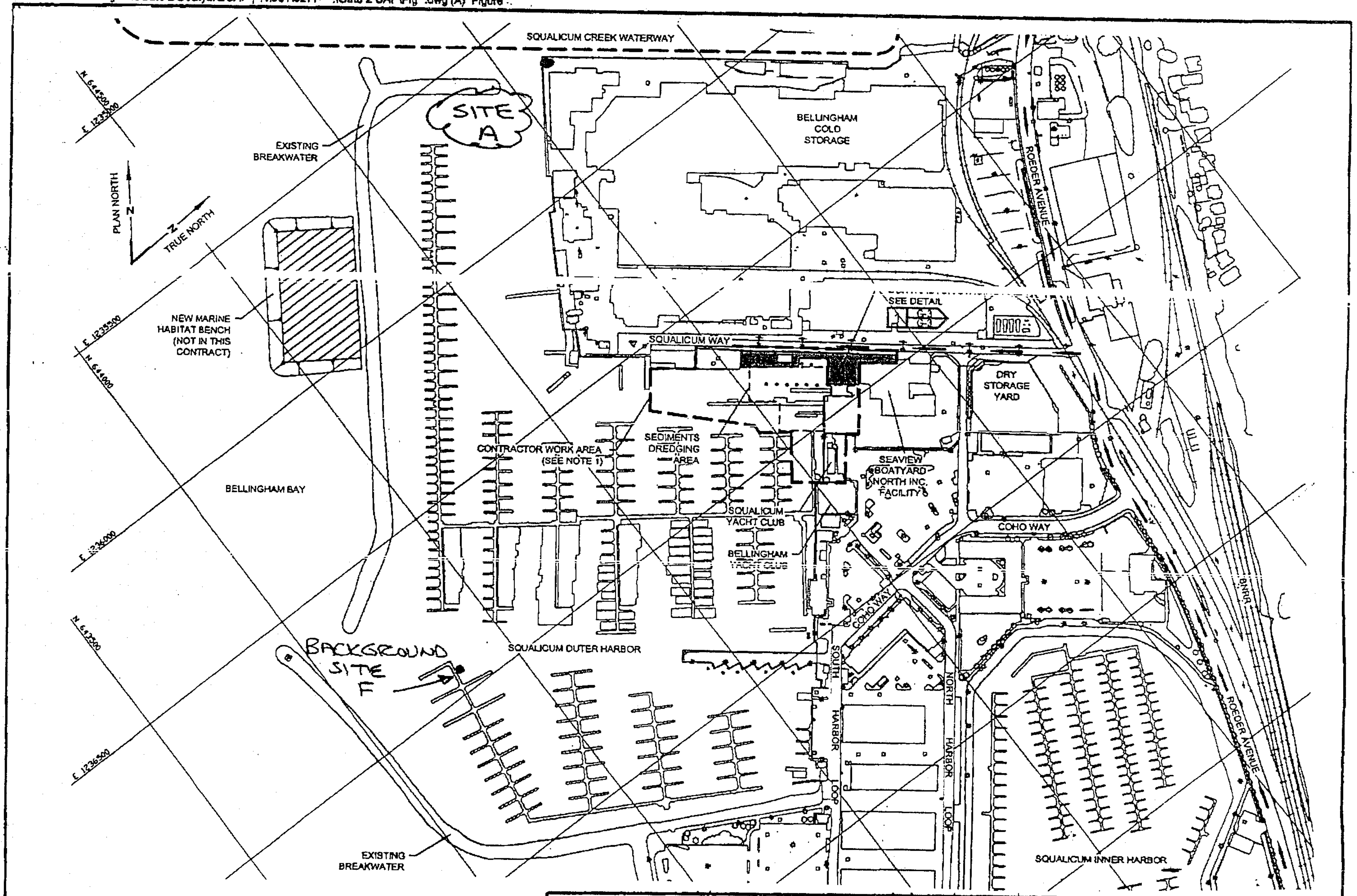
Date: 12/29/03 Construction Activity: DREDGING @ WEST SIDE : GATE 2

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
C	10:04	21.7	1.5	7.43	33.7	1	9.87	6.7	
C	10:06		10.8	7.61	34.5	2	10.34	7.1	
G	10:13	20.0	1.5	7.66	33.5	2	9.11	6.8	
G	10:15		10.0	7.66	34.0	2	10.45	7.1	
A	10:28	26.5	1.5	7.64	33.4	2	10.63	6.9	
A	10:30		13.3	7.66	[illegible] → 35.2	4	10.49	7.4	

Additional Notes & Observations COLD (±33°) W/ N.E. WIND
DREDGING BEGAN ± 8:30 TO TOP OFF BARGE "EVERETT" FROM 12/24, 1ST DAY OPERATION.
WORK PERFORMED FROM 8:00 AM TO ± 10:30 AM. ONLY SILT CURTAIN IN PLACE
HIGH TIDE @ 10:21 AM

12/30/03 11:50 FAX

Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\...\Gate 2 SAP\Fig...dwg (A) "Figure



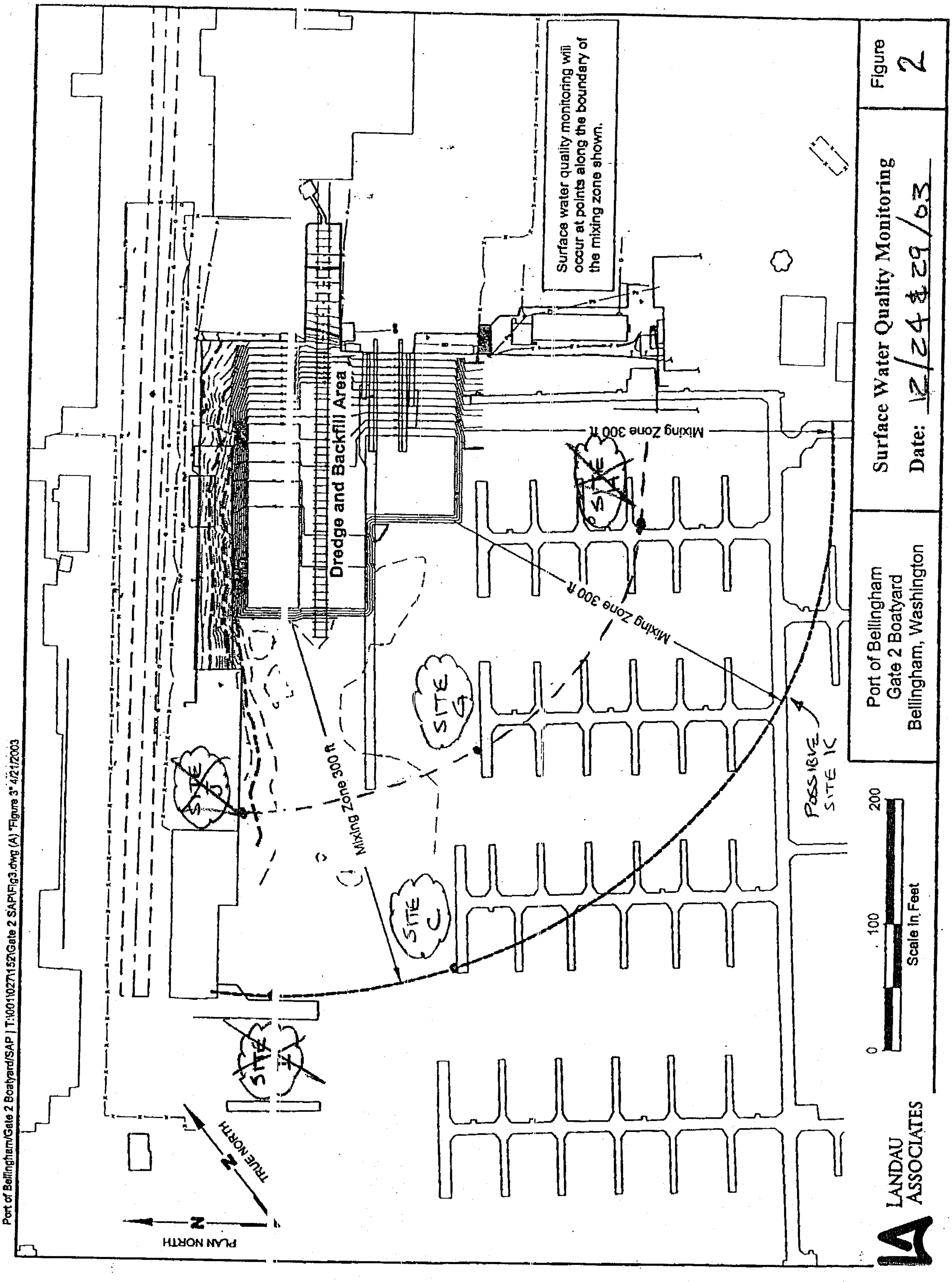
LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Surface Water Quality Monitoring

Date: 12/24 & 29/03

Figure 1



Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\152\Gate 2 SAP\Fig3.dwg (A) "Figure 3" 4/21/2003
Surface water quality monitoring will occur at points along the boundary of the mixing zone shown.
Dredge and Backfill Area
Mixing Zone 300 ft
Mixing Zone 300 ft
Mixing Zone 300 ft
SITE A
SITE G
SITE C
POSSIBLE SITE K
TRUE NORTH
N
PLAN NORTH
0
100
200
Scale In Feet
LANDAU ASSOCIATES
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington
Surface Water Quality Monitoring
Date: 12/24 & 29/03
Figure 2

PROJECT FILE No. 001027.231

PORT OF BELLINGHAM
Washington State, USA

TO: LOI EE' RANDALL / MARY O'HERRON / DAVE PISCHER

COMPANY: I COLOGY / ECOLOGY / LANDAU ASSOC.

FAX NUMBER: 36(-407-6902 / 360-738-6253 / 425-778-6409

FROM: JOI N HERGESHEIMER

DATE SENT: 1/5/04

3 PAGE (S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: WATER QUAI ITY MONITORING REPORTS FOR: 1/05/04

WORK PERFOMED: DREDGING @ WEST 1/2 OF GATE 2 & FIRST LOAD AT HABITAT BENCH.
HAND DELIVERED COPY TO AMERICAN CONSTRUCTION

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

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at (360) 676-2500*

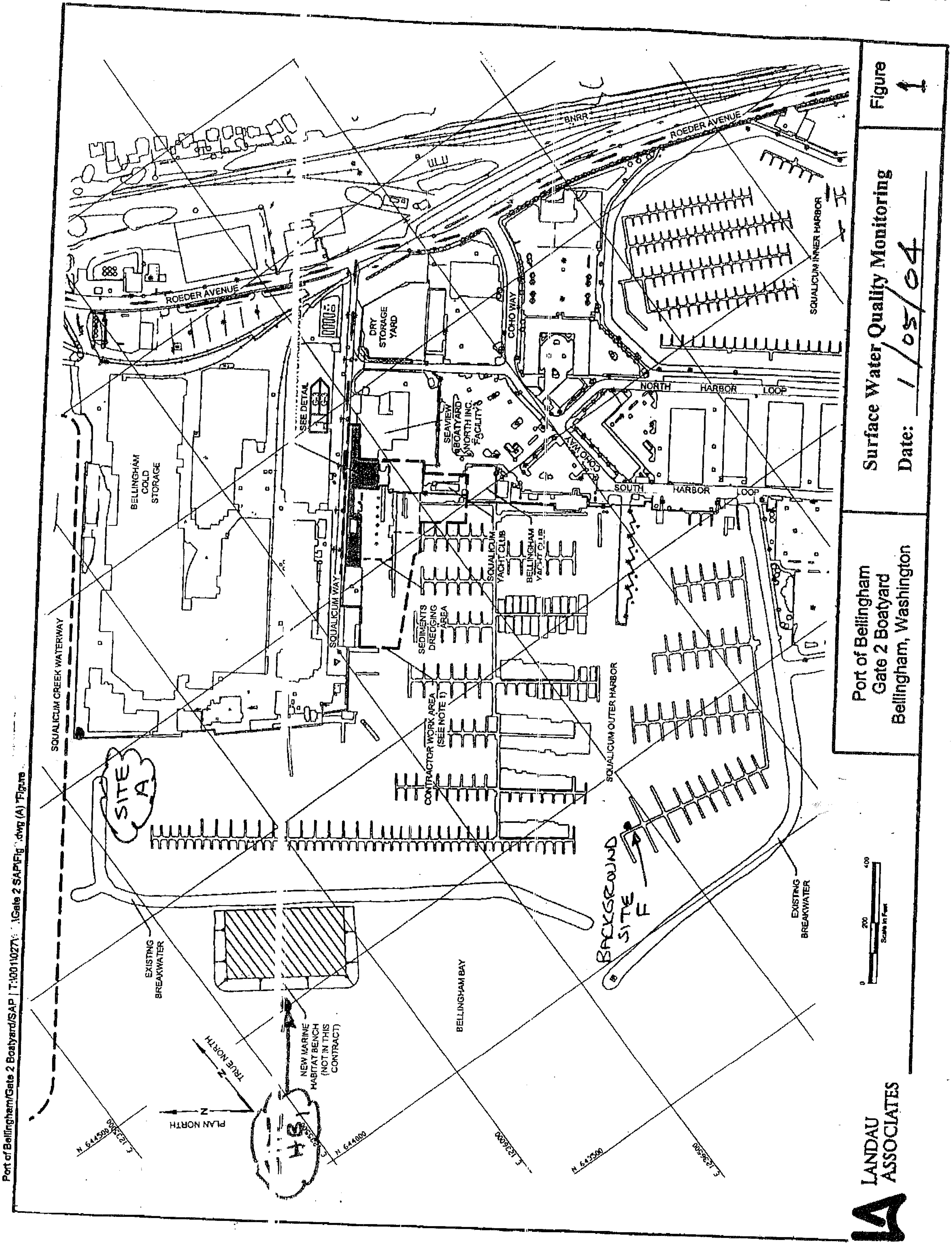
PORT OF BELLINGHAM
GATE 2 BOAT 'ARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

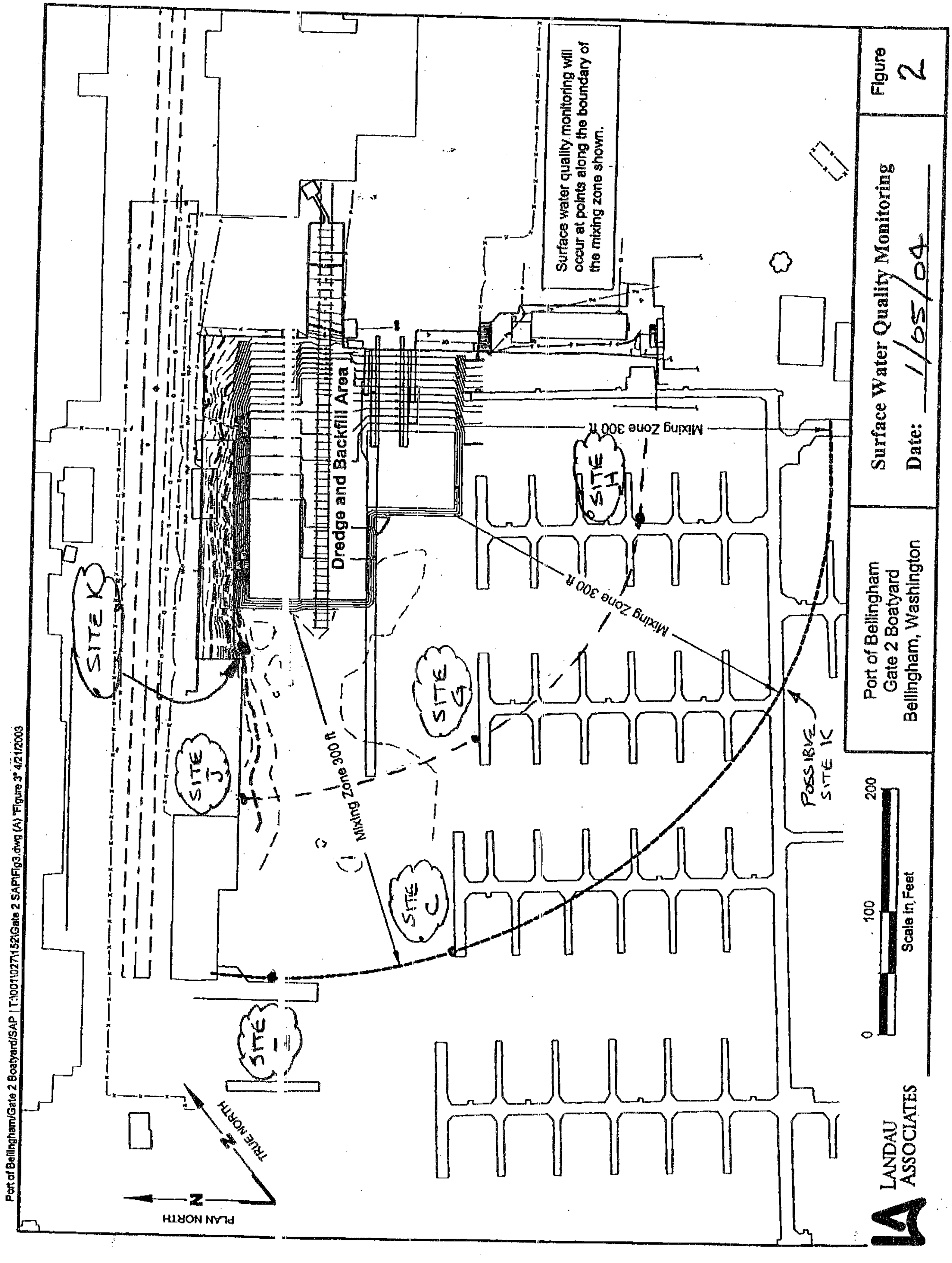
Date: 1/05/04 Construction Activity: DREDGING WEST (NORTH) AREA

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
C	12:26	19.0	1.5	7.60	45.0	1	9.99	3.7	
C	12:28		9.5	7.55	45.4	4	10.29	3.7	
G	12:32	17.3	1.5	—	—	0	—	—	
G	12:33		8.6	—	—	2	—	—	
H	12:37	17.0	1.5	—	—	0	—	—	
H	12:38		8.5	—	—	1	—	—	
J	12:51	14.3	1.5	7.57	45.0	1	9.95	3.6	[illegible]
J	12:52		7.1	7.57	45.4	1	10.23	3.7	
K	12:54	15.2	1.5	[illegible]	[illegible]	2	[illegible]	—	150' FM DREDGE BUCKET
K	12:55		7.6	[illegible]	—	3	[illegible]	—	@ WHARF E'
A	1:11	27.5	1.5	7.56	45.0	2	9.19	4.5	[illegible] @ BCS
A	1:13		13.7	7.55	40.0	3	10.05	4.7	"
HB1	3:45	18.0	1.5	7.56	45.3	2	11.40	4.8	HABITAT BENCH *
HB1	3:47		9.0	7.55	41.1	3	11.79	4.9	"

* NOTE: MANSON CONSTN' DUMPED FIRST SCOW FOR HABITAT BENCH AT 3:15 pm. HB1 TAKEN 30 MIN AFTER, DOWN CURRENT OF DUMP SITE BY APPROX 200'. HIGH TIDE @ 1:16 PM

Additional Notes & Observations: 3RD DAY OF DREDGING
DREDGE BEGAN IN MORNING AND FILLED SCOW "LUMMI ISLAND" TO 8 TOTAL DRAFT. STOPPED ABOUT 2:15 PM DUE TO EXPECTED -1.5 TIDE TO ASSURE THAT BARGE DID NOT BOTTOM OUT OVERNIGHT.
COLD <32° W/ NO WIND. SILT CURTAIN OPEN ON S. END.
MANSON BEGAN DREDGING SQUALICUM FED. CHANNEL @ ±2:50 PM 1/2/04 ON 24/7 BASIS.


Surface Water Quality Monitoring
Date: 1/05/04
Figure 1
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington
LANDAU ASSOCIATES
Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\...\Gate 2 SAP\Fig...dwg (A) "Figure
BNRR
ROEDER AVENUE
ROEDER AVENUE
SQUALICUM INNER HARBOR
NORTH HARBOR LOOP
SOUTH HARBOR LOOP
COHO WAY
COHO WAY
DRY STORAGE YARD
SEE DETAIL
SEAVIEW BOATYARD NORTH INC. FACILITY
BELLINGHAM COLD STORAGE
SQUALICUM WAY
SQUALICUM YACHT CLUB
BELLINGHAM YACHT CLUB
SEDIMENTS DREDGING AREA
CONTRACTOR WORK AREA (SEE NOTE 1)
SQUALICUM OUTER HARBOR
SQUALICUM CREEK WATERWAY
SITE A
BACKGROUND SITE F
EXISTING BREAKWATER
EXISTING BREAKWATER
BELLINGHAM BAY
NEW MARINE HABITAT BENCH (NOT IN THIS CONTRACT)
TRUE NORTH
PLAN NORTH
N
HS1
N 644500
N 644000
N 643500
E 1235500
E 1236000
E 1236500
0
200
400
Scale in Feet



Surface water quality monitoring will occur at points along the boundary of the mixing zone shown.
Dredge and Backfill Area
Mixing Zone 300 ft
Mixing Zone 300 ft
Mixing Zone 300 ft
SITE K
SITE J
SITE I
SITE C
SITE G
SITE H
POSSIBLE SITE K
TRUE NORTH
PLAN NORTH
N
0
100
200
Scale in Feet
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington
Surface Water Quality Monitoring
Date: 1/05/04
Figure 2
LANDAU ASSOCIATES
Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\152\Gate 2 SAP\Fig3.dwg (A) "Figure 3" 4/21/2003

01/08/04 15:11 FAX ☑001

PROJECT FILE No. 001 027.231

PORT OF BELLINGHAM
Washington State, USA

TO: LORIE RANDALL / MARY O'HERRON / DAVE PISCHER

COMPANY: ECOLOGY / ECOLOGY / LANDAU ASSOC.

FAX NUMBER: 360-407-6902 / 360-738-6253 / 425-778-6409

FROM: JOHN HERGESHEIMER

DATE SENT: 1/08/04

10 ~~8~~ PAGE (S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: WATER QUALITY MONITORING REPORTS FOR: DREDGING & BENCH CONST. @ SQUALICUM FEDERAL CHANNEL & GATE 2 HABITAT BENCH

WORK PERFOMED: PERIOD: 1/03/04 THRU 1/06/04

(FAXED & MAILED TO HIRAM ARDEN, USACE, 1/07/04)

HAND DELIVERED COPY TO MANSON [redacted] CONSTRUCTION ON SITE

NOTE: "HB" DESIGNATIONS ARE FOR HABITAT BENCH, ALL OTHERS ARE DREDGING, EXCEPT A & A, ARE BACKGROUND TESTS.

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

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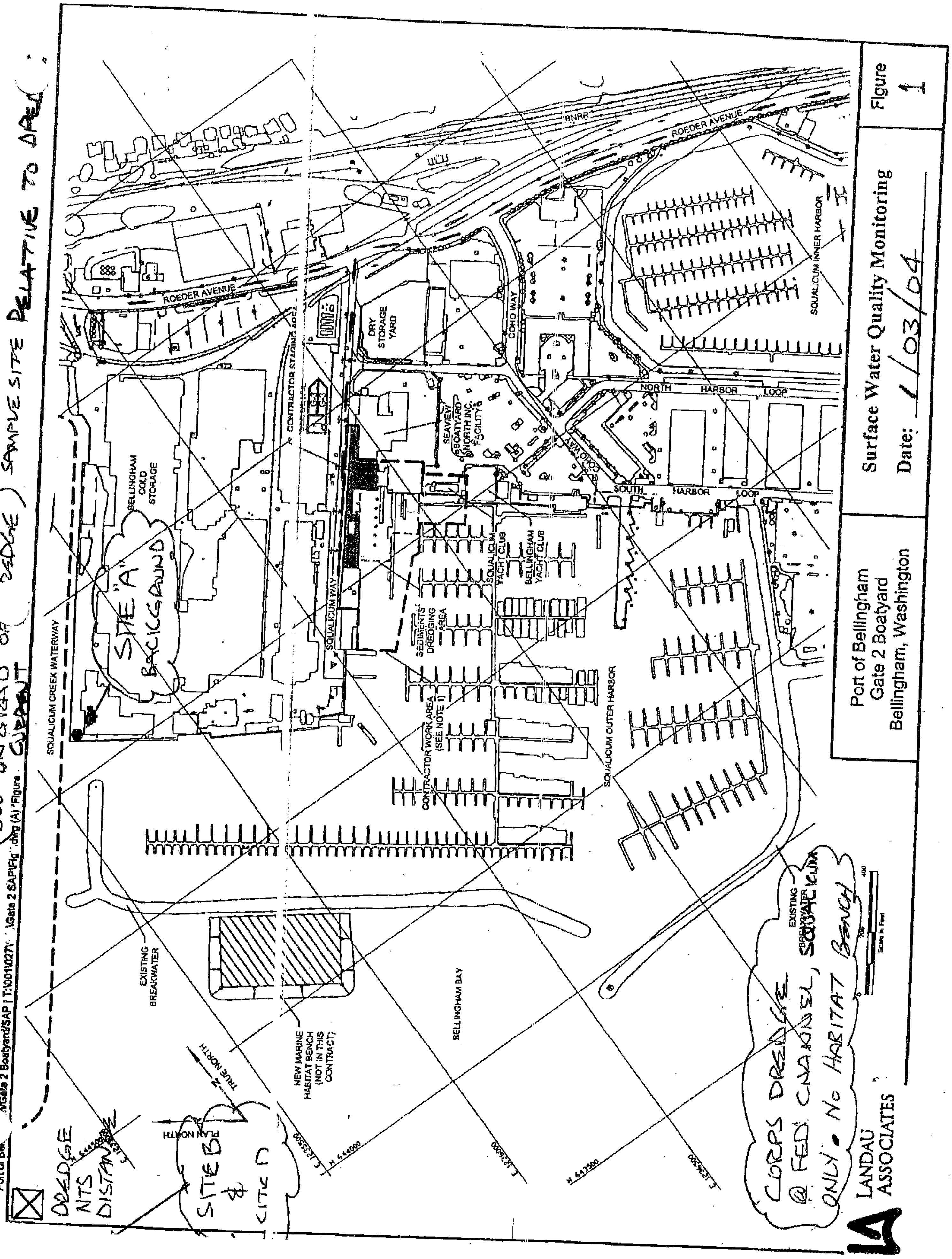
PORT OF BELLINGHAM
~~GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT~~
SURFACE WATER QUALITY MONITORING DATA

Date: 1/03/04 Construction Activity: MANSON DREDGING @ SQUALICUM FEDERAL CHANNEL, BELLINGHAM BAY

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
C	8:40	32.0	1.5	7.56	44.5	3	13.02	4.4	600' N.E
C	8:43		16.0	7.62	42.7	1	10.90	6.7	"
A	9:20	27.6	1.5	7.59	44.6	4	10.00	6.0	BACKGND@BCS
A	9:22		13.8	7.58	45.2	3	9.54	6.2	"
B	12:40	36.0	1.5	7.61	39.6	2	10.74	6.7	600' S.W
B	12:45		18.0	7.61	39.4	2	10.68	6.7	"
A	1:10	28.0	1.5	7.63	44.5	3	9.87	5.6	BCS
A	1:15		14.0	7.55	45.5	4	10.08	5.8	BCS
D	3:45	36.0	1.5	7.55	45.8	2	11.00	6.2	600' S.W.
D	3:50		14.0	7.60	42.0	0	11.00	6.0	"
A	4:15	25.0	1.5	7.60	45.0	0	9.90	6.0	BCS
A	4:18		12.5	7.50	46.0	0	10.40	6.0	BCS

Additional Notes & Observations: GENERAL NOTES BELOW APPLY TO ALL FUTURE SAMPLES. SITES ARE RELATIVE TO DREDGE POSITION & PLAN NORTH. BACKGROUND @ BELLINGHAM COLD STORAGE PIER (BCS). SITES LOCATED IN RELATION TO EXPECTED CURRENT BASED ON TIDES

J. Hengehan


Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington
Surface Water Quality Monitoring
Date: 1/03/04
Figure
1
LANDAU
ASSOCIATES
ROEDER AVENUE
BNRR
DRY STORAGE YARD
COHO WAY
NORTH HARBOR LOOP
SOUTH HARBOR LOOP
SQUALICUM INNER HARBOR
SEAVIEW BOATYARD NORTH INC. FACILITY
CONTRACTOR STAGING AREA
BELLINGHAM COLD STORAGE
SQUALICUM WAY
SEDIMENTS DREDGING AREA
SQUALICUM YACHT CLUB
BELLINGHAM YACHT CLUB
SQUALICUM CREEK WATERWAY
CONTRACTOR WORK AREA (SEE NOTE 1)
SQUALICUM OUTER HARBOR
EXISTING BREAKWATER
NEW MARINE HABITAT BENCH (NOT IN THIS CONTRACT)
BELLINGHAM BAY
TRUE NORTH
PLAN NORTH
N 644000
N 643500
Scale in Feet
0
200
400
SITE "A" BACKGROUND
SITE C (600 DNGRAD OF DREDGE) SAMPLE SITE RELATIVE TO AREA
SITE B & CITE D
DREDGE NTS DISTANT
CORPS DREDGE @ FED. CHANNEL, SQUALICUM ONLY. NO HABITAT BENCH

PORT OF BELLINGHAM

~~GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT~~

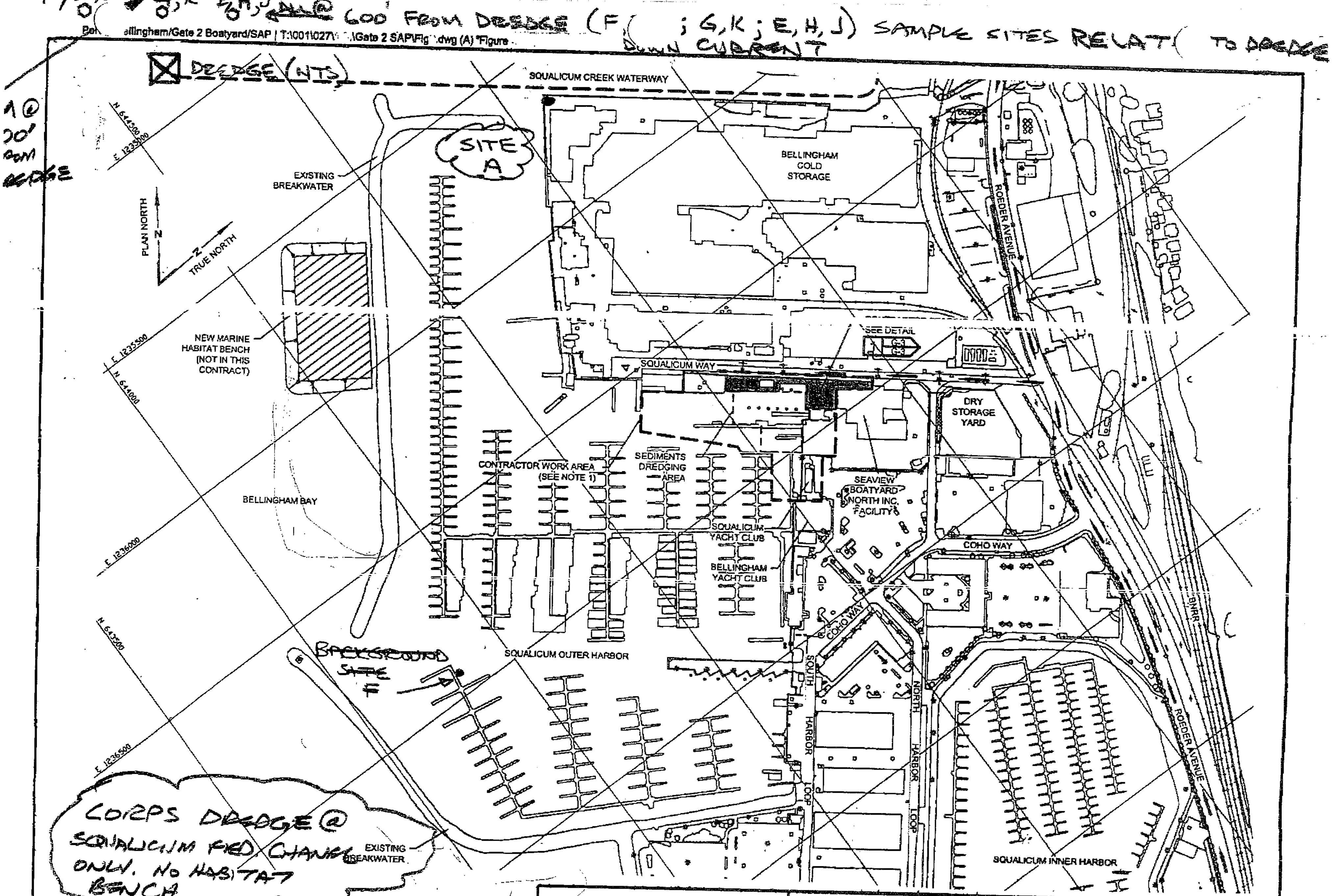
SURFACE WATER QUALITY MONITORING DATA

Date: 1/04/04 Construction Activity: MANSON DREDGING @ SQ. FED. CHANNEL, BELLINGHAM, WA

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
E	8:38	22.0	1.5	6.55	42.9	3	9.14	4.8	600' NNE
E	8:40		11.0	7.33	43.5	4	9.56	5.0	"
F	8:42	28.0	1.5	7.51	43.7	2	10.81	4.6	600' NNW
F	8:45		14.0	7.52	39.5	3	9.66	5.2	"
A	9:06	27.0	1.5	7.60	46.0	3	8.04	4.5	BCS
A	9:08		13.5	7.58	44.5	5	8.29	5.0	BCS
G	1:11	21.0	1.5	7.41	42.2	6	9.73	5.3	600' N
G	1:13		10.5	7.56	41.5	14	9.91	5.4	"
H	1:18	21.0	1.5	7.65	44.2	5	9.65	5.2	600' NE
H	1:20		10.5	7.64	39.9	9	9.84	5.3	"
I	1:23	22.0	1.5	7.67	46.8	3	10.01	5.2	600' NW
I	1:25		11.0	7.66	38.7	3	9.90	5.3	"
A	2:00	26.5	1.5	7.68	43.2	5	8.38	5.0	BCS
A	2:02		13.2	7.65	41.7	3	7.78	4.7	BCS
J	3:40	16.0	1.5	6.57	44.1	2	9.56	5.2	600' NE
J	3:42		8.0	7.54	42.1	2	9.85	5.3	"
K	3:44	21.0	1.5	7.61	43.2	11	9.74	4.3	600' N
K	3:46		10.5	7.62	38.8	21	9.93	5.3	"
L	3:50	26.0	1.5	7.65	42.4	5	10.28	5.1	600' NW
L	3:52		13.0	7.65	37.6	4	10.04	5.3	"
M	3:56	21.0	1.5	7.68	45.3	6	9.29	5.2	900' N
M	3:58		10.5	7.65	36.8	4	9.85	5.2	"
A	4:11	25.8	1.5	7.56	41.7	4	8.39	4.1	BCS
A	4:12		12.9	7.60	44.5	2	8.90	4.1	BCS

Additional Notes & Observations:

SAMPLES POSITIONS RELATIVE TO DREDGE & PLAN NORTH.



0 200 400
Scale in Feet

LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	Surface Water Quality Monitoring Date: 1/04/04	Figure 1

PORT OF BELLINGHAM

~~GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT~~

SURFACE WATER QUALITY MONITORING DATA

Date: 1/05/04

Construction Activity: MANSON DREDGING @ SQ. FED. CHANNEL BELLINGHAM, WA + HABITAT BENCH

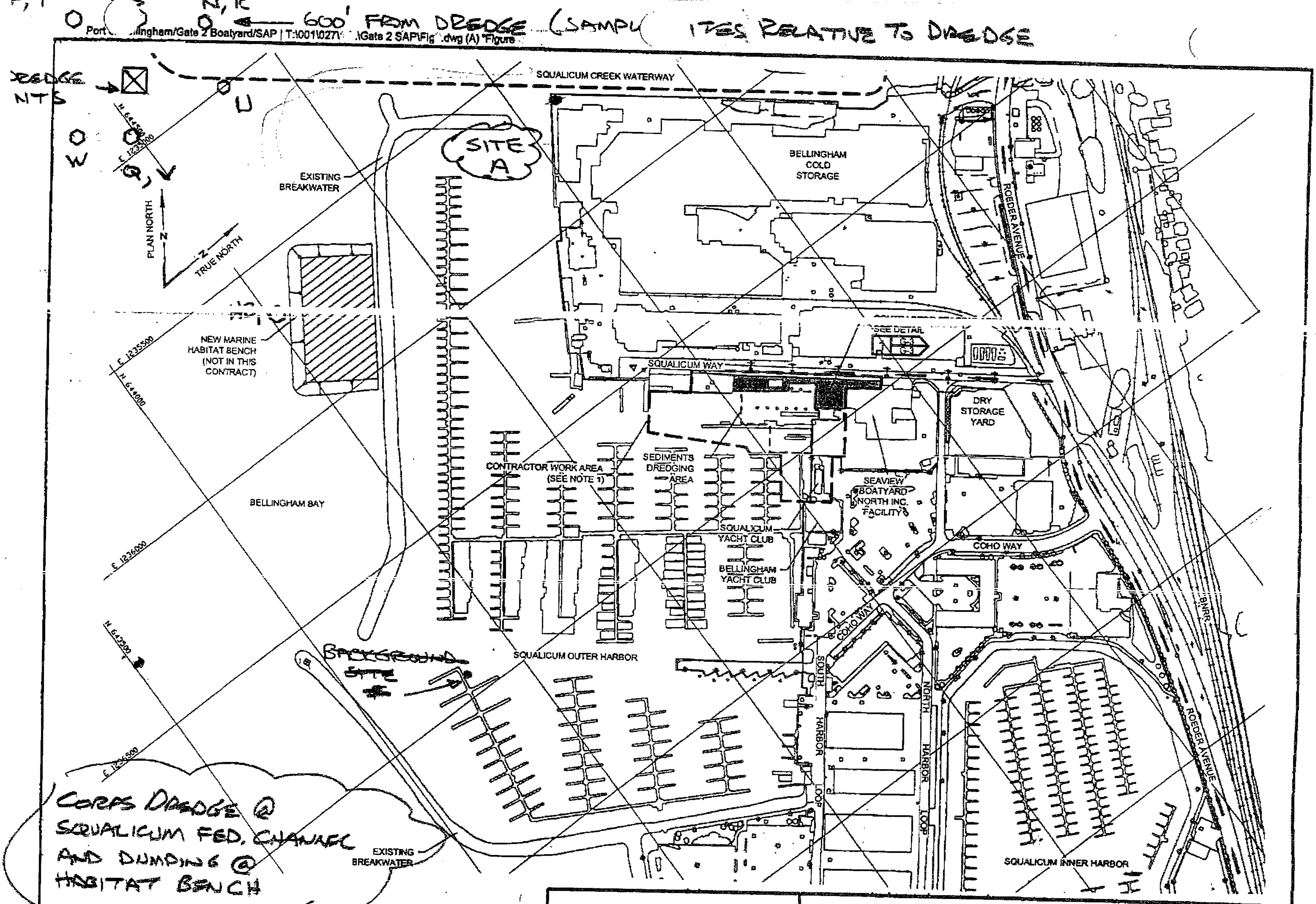
Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
N	9:09	21.5	1.5	7.29	43.9	1	11.71	4.7	600' NE *A
N	9:11		10.5	7.45	44.2	1	12.11	4.9	"
O	9:13	24.8	1.5	7.55	44.6	1	12.48	4.5	600' N
O	9:15		12.4	7.55	39.0	1	12.02	5.0	"
P	9:20	28.8	1.5	7.61	44.5	1	11.89	4.7	600' NW
P	9:22		14.4	7.57	39.3	1	12.19	5.1	"
Q	9:25	27.5	1.5	7.65	44.0	2	11.85	4.7	600' S
Q	9:27		13.7	7.60	39.4	1	12.18	4.9	"
A	9:51	26.5	1.5	7.60	44.4	1	9.65	4.5	BCS
A	9:53		13.3	7.57	45.0	3	10.33	4.8	BCS
R	1:38	21.7	1.5	7.59	44.6	1	11.61	4.6	600' NE
R	1:40		10.8	7.58	45.1	1	12.10	4.8	"
S	1:43	25.3	1.5	7.62	45.6	1	12.56	4.6	600' N
S	1:45		2.6	7.59	39.9	1	12.30	5.2	"
T	1:47	29.4	1.5	7.63	47.4	1	12.31	4.6	600' NW
T	1:48		14.7	7.58	41.1	1	12.37	5.3	"
U	1:53	21.4	1.5	7.60	45.9	2	12.74	4.5	600' E
U	1:55		10.7	7.61	40.3	1	12.52	4.8	"
A	1:11	27.5	1.5	7.56	45.0	2	9.19	4.5	BCS
A	1:13		13.7	7.55	40.0	3	10.65	4.7	BCS
HB1	3:45	18.0	1.5	7.56	45.3	2	11.40	4.8	500' N *B
HB1	3:47		9.0	7.55	41.1	3	11.79	4.9	"
V	3:52	27.0	1.5	7.61	48.7	4	12.54	4.8	600' S
V	3:53		3.5	7.59	41.4	6	12.16	5.0	"
W	3:56	29.8	1.5	7.60	45.4	5	12.25	4.8	600' SW
W	3:58		4.9	7.56	40.0	8	12.29	5.1	"

Additional Notes & Observations:

SAMPLE POSITIONS RELATIVE TO DREDGE & PLAN NORTH.
* A: DREDGE STOPPED ± 8:00 AM – 10:AM FOR BUCKET REPAIR.
* B: RELATIVE TO NORTH EDGE OF HABITAT BENCH USING PLAN NORTH. 1ST LOAD @ BENCH DUMPED 3:18 AM 1/05/04 LOAD DUMPED ABOUT 3:00 PM 1/05/04.

J. Nargahen

Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\ \Gate 2 SAP\Fig .dwg (A) "Figure



LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Surface Water Quality Monitoring

Date: 1/05/04

Figure 1

PORT OF BELLINGHAM

~~GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT~~

SURFACE WATER QUALITY MONITORING DATA

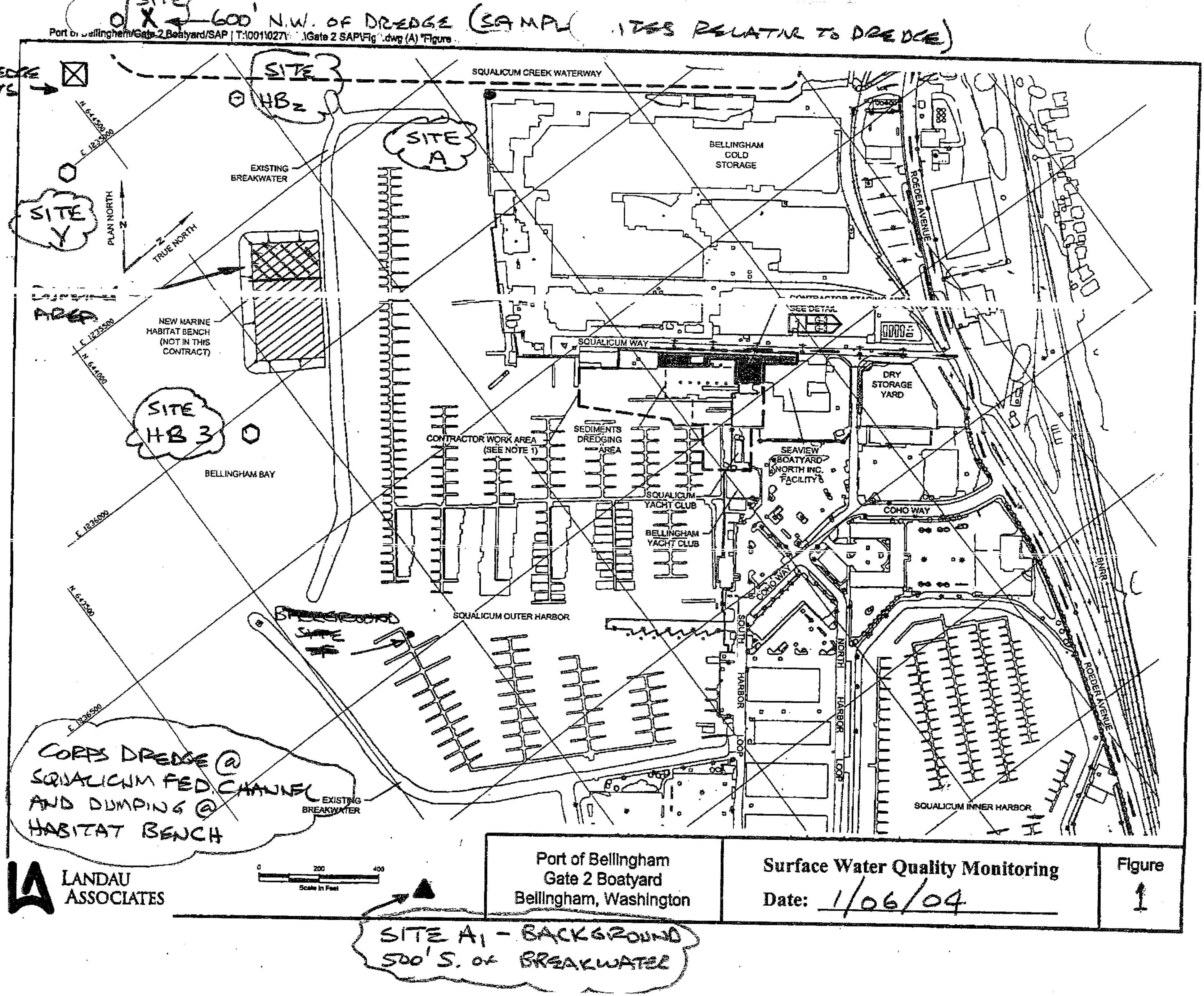
Date: 1/06/04

Construction Activity: MANSON DREDGING @ SQ. FED CHANNEL BELLINGHAM, WA + HABITAT BENCH

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes	
A	11:30	27.5	1.5	7.89	40.8	23	10.81	4.9	BCS	
A	11:32		13.8	7.71	41.3	24	11.13	4.7	BCS	
HB2	12:15	20.5	1.5	7.66	42.1	3	11.50	4.7	500' N	*A
HB2	12:17		10.2	7.62	42.2	9	11.75	4.7	"	*A
X	12:25	22.9	1.5	7.65	42.2	15	11.93	4.4	600' N/E	
X	12:27		11.6	7.62	42.2	21	11.57	4.7	"	
A	3:40	27.5	1.5	6.34	41.4	7	11.60	4.9	BCS	
A	3:42		13.7	7.24	41.5	20	11.85	5.0	BCS	
A1	5:00	20.8	1.5	7.50	42.3	-10	11.25	4.3	NEW BACK	*B
A1	5:02		0.4	7.59	42.4	-10	11.63	4.7	NEW BACK	*B
HB3	5:06	21.5	1.5	7.61	42.1	-10	11.53	4.7	500' S	*C
HB3	5:08		0.7	7.61	42.4	-10	11.86	4.6	"	*C
Y	5:12	26.0	1.5	7.66	42.5	-10	11.27	4.4	600' S	*D
Y	5:13		3.0	7.63	42.6	-10	11.53	4.8	"	*D

Additional Notes & Observations:

*A: SAMPLE 2 500' W (PLAN) OF NORTH END OF BENCH
*B: NEW BACKGROUND SAMPLE SITE, 500' S (PLAN) OF BEND IN WALL OF BREAKWATER AT SOUTH ENTRANCE OF MARINA.
DUE TO TUGS OPERATING AT BCS PIER STIRRING UP WATER, &/OR STREAM RUNOFF, *C: SOUTH OF NORTH 1/2 OF BENCH SITE DUE TO TIDE CHANGE. *D: TURB @ -10 = INSUFFICIENT LIGHT.



Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\...\Gate 2 SAP\Fig...dwg (A) "Figure

LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Surface Water Quality Monitoring

Date: 1/06/04

Figure 1

PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

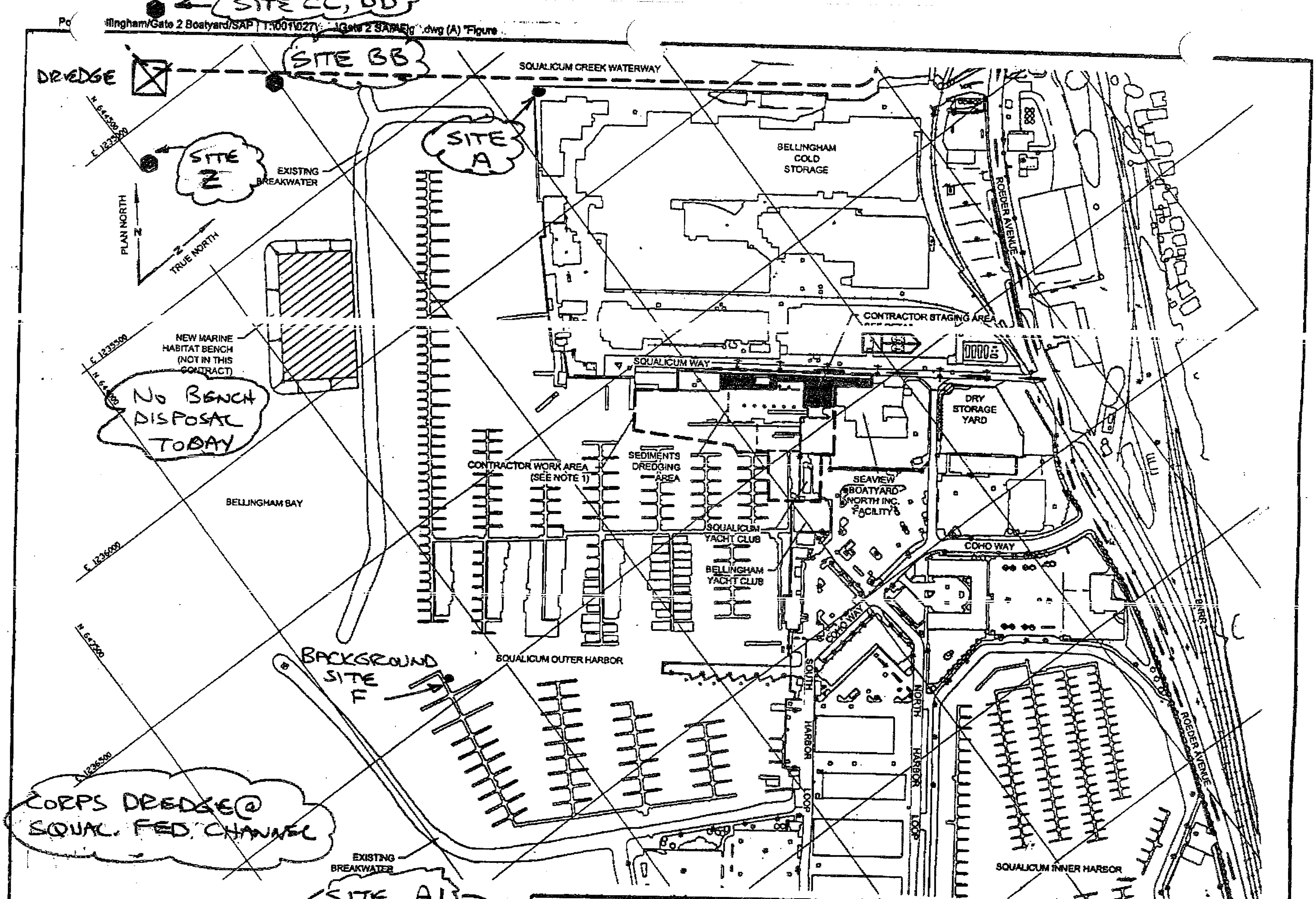
Date: 1/07/04

Construction Activity: MANSON DREDGING @ SQUALICUM FED. CHANNEL & HABITAT BENCH CONST'N. BELLINGHAM BAY

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
A	9:15	30.9	1.5	6.82	44.7	12	11.11	4.7	BCS (N. CURRENT)
A			15.5	7.55	45.7	5	10.93	4.9	BCS "
A1	10:30	23.1	1.5	7.51	43.9	-10	10.24	5.7	500' S. OF S. BREAKWAT. *A
A1			11.5	7.52	40.7	-10	11.47	5.1	
Z	11:45	20.0	1.5	7.52	44.4	-10	11.34	7.9	600' S.
Z			10.0	7.53	39.5	-10	11.68	4.9	"
BB	11:50	18.0	1.5	7.59	43.4	-10	11.33	5.0	600' E
BB			9.0	7.58	39.1	-10	11.52	5.0	"
A	2:50	31.0	1.5	6.71	44.3	30	11.56	5.2	BCS (N. CURRENT)
A			15.5	6.57	42.9	14	11.37	5.1	BCS "
CC	3:45	16.0	1.5	5.97	41.6	27	12.46	6.6	600' N
CC			8.0	5.98	39.7	34	12.39	5.2	"
DD	4:00	15.0	1.5	6.02	44.7	7.0	11.59	5.1	" NOT DREDGING
DD			7.5	6.03	39.9	8.0	12.04	5.1	" "

Additional Notes & Observations: ALL POSITIONS RELATIVE TO MAP PLAN NORTH. SITES A & A1 ARE BACKGROUND SITES. SITE A MAY BE IMPACTED BY HABITAT CONST'N AND TUGS OPERATING NEXT TO 17, TYING UP WAITING EMPTY SCOWS. NO DUMPING @ HABITAT BENCH TODAY DUE TO HIGH S'LY WIND. *A: TURBIDITY NO READING = -10

MONITORING BY MARIO LOPEZ; COPIED TO FORM BY J. [signature]



LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Surface Water Quality Monitoring

Date: 1/07/04

Figure 1

PROJECT FILE No. 001 027.231

PORT OF BELLINGHAM
Washington State, USA

TO: LORIE RANDALL / MARY O'HERRON / DAVE PISCHER

COMPANY: ECOLOGY / ECOLOGY / LANDAU ASSOC.

FAX NUMBER: 360-407-6902 / 360-738-6253 / 425-778-6409

FROM: JOHN HERGESHEIMER

DATE SENT: 1/15/04

3 PAGE(S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: WATER QUALITY MONITORING REPORTS FOR: DREDGING & BENCH CONST. @ SQUALICUM FEDERAL CHANNEL & GATE 2 HABITAT BENCH

WORK PERFOMED: PERIOD: 1/08/04 & 1/09/04

MANSON

HAND DELIVERED COPY TO [redacted] CONSTRUCTION ON SITE

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

FAX NUMBER (360) 671-6411

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PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

Date: 1/08/04

Construction Activity: MANSON DREDGING @ SQUALICUM FED. CHANNEL & GATE 2 HABITAT BENCH CONSTRUCTION

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
A	4:00	28.3	1.5	7.71	44.5	21	12.26	5.5	BCS BACKGROUND *A
A			4.1	7.83	42.1	68	10.36	5.5	"
A1	4:28	22.3	1.5	7.92	47.8	3	11.47	5.5	BACKGROUND *B
A1			11.1	7.91	48.3	1	11.91	5.4	"
HB4	4:31	21.0	1.5	7.97	47.1	3	11.68	5.3	500' SW *C
HB4			10.5	7.96	45.0	11	11.77	5.3	"
HB5	4:34	21.0	1.5	7.96	47.7	9	11.90	5.2	300' S.W. *C
HB5			10.5	7.97	43.0	8	11.98	5.3	"
EE	4:38	21.1	1.5	8.01	46.9	13	11.71	5.2	400' S/DREDGE
EE			10.5	7.99	42.9	7	11.92	5.2	"
FF	4:41	25.0	1.5	7.99	45.7	12	12.02	5.1	300' SW OF
FF			12.5	8.00	43.2	3	12.21	5.2	" DREDGE

Additional Notes & Observations: HIGH TIDE @ 7:06 AM & 3:18 PM w/ CHANGE OF 2' FROM HIGH TO LOW BETWEEN HIGHS.
BARGE DUMPED AT HAB. BENCH SITE @ 3:30 PM
*A: DREDGE @ 900' FROM BACKGROUND SITE + TUGS OPERATING W/IN 30' OF SITE. *B: ALTERNATE BACKGROUND SITE
*C: LOCATION RELATIVE TO ACTUAL BARGE DUMP LOCATION AT HABITAT BENCH.

[signature]

PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

Date: 1/09/04

Construction Activity: MANSON DREDGING @ SQUALICUM FED. CHANNEL & GATE 2 HABITAT BENCH CONSTRUCTION

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
A1	1:30	21.9	1.5	7.54	46.8	36	12.10	5.8	BACKGROUND
A1			10.5	7.62	45.4	46	12.44	5.7	"
HB6	1:40	19.0	1.5	7.50	46.5	8	12.03	5.5	500' S OF H.B.
HB6			9.5	7.48	44.9	10	12.12	5.6	DUMP SITE
HB7	1:45	16.0	1.5	—	—	7	12.83	—	OVER H.B.
HB7			8.0	—	—	7	12.91	—	SITE
HB 8	2:00	16.0	1.5	7.41	43.1	5	12.10	5.3	"
HB 8			8.0	7.45	49.7	8	11.48	5.5	"
HB9	2:18	21.0	1.5	7.47	43.4	46	11.85	5.3	*A
HB9			10.5	7.39	44.5	245	11.79	5.4	*A
GG	2:16	34.8	1.5	7.47	49.7	25	11.58	5.8	@ DREDGE *B
GG			17.7	7.44	44.5	24	12.15	5.5	" *B
GG			25.0	7.42	44.8	31	12.03	5.6	" *B
HB10	2:20	21.8	1.5	7.42	45.1	3	12.16	5.3	500' S OF H.B.
HB10			10.6	7.39	44.9	1	12.09	5.4	DUMP SITE
A	2:36	28.0	1.5	7.44	49.5	17	11.07	5.4	BCS BACKGROUND
A			14.0	7.43	50.4	28	10.90	5.5	"

Additional Notes & Observations: HIGH TIDE @ 7:35P & 4:03 P with APPROX 1' LOWER BETWEEN

*A: BARGE DUMP @ 2:09. SAMPLE @ ±100' WEST OF DUMP SITE 10 MIN AFTER DUMP.

*B: SAMPLES AT DREDGE ± 50' FROM DREDGING OPERATION.

RAIN LAST 2 DAYS HAS MUDDIED THE BAY.

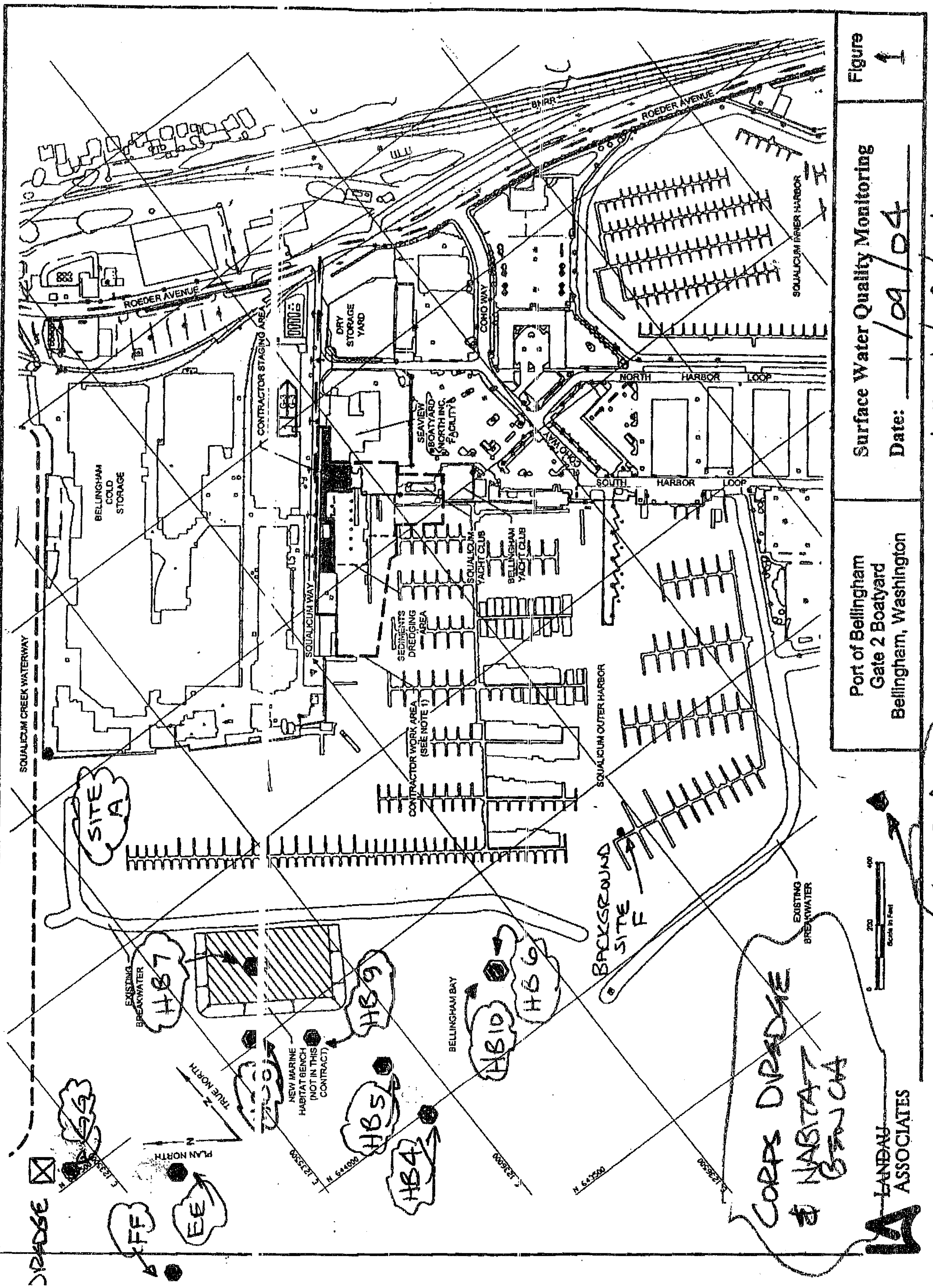
Figure 1
Surface Water Quality Monitoring
Date: 1/09/04
AND 1/08/04
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington
LANDAU ASSOCIATES
ROEDER AVENUE
BNRR
COHO WAY
NORTH HARBOR LOOP
SOUTH HARBOR LOOP
DRY STORAGE YARD
SEAVIEW BOATYARD NORTH INC. FACILITY
CONTRACTOR STAGING AREA
BELLINGHAM COLD STORAGE
SQUALICUM WAY
SQUALICUM CREEK WATERWAY
SQUALICUM INNER HARBOR
SQUALICUM OUTER HARBOR
SQUALICUM YACHT CLUB
BELLINGHAM YACHT CLUB
SEDIMENTS DREDGING AREA
CONTRACTOR WORK AREA (SEE NOTE 1)
NEW MARINE HABITAT BENCH (NOT IN THIS CONTRACT)
EXISTING BREAKWATER
BELLINGHAM BAY
TRUE NORTH
PLAN NORTH
SITE A
SITE A1 BACKGROUND
BACKGROUND SITE F
HB7
HB9
HB6
HB10
HB5
HB4
GG
EE
FF
DREDGE
CORPS DREDGE & HABITAT BENCH
N 644000
N 643500
Port of Bellingham/Gate 2 Boatyard/SAP

PROJECT FILE
No. 001 027.231

PORT OF BELLINGHAM
Washington State, USA

TO: LOREE' RANDALL / MARY O'HERRON / DAVE PISCHER

COMPANY: ECOLOGY / ECOLOGY / LANDAU ASSOC.

FAX NUMBER: 360-407-6902 / 360-738-6253 / 425-778-6409

FROM: JOHN HERGESHEIMER

DATE SENT: 1/13/04

4 PAGE(S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: WATER QUALITY MONITORING REPORTS FOR: 1/12 & 1/13/04

WORK PERFOMED: DREDGING @ MARINE RAIL AREA BY NORTH FLOATS

HAND DELIVERED COPY TO AMERICAN CONSTRUCTION ON SITE

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

FAX NUMBER (360) 671-6411

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PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

Date: 1/12/04 Construction Activity: AMSRIAN DREDGING @ 35-TON TRAVC LIFT w/o SILT CURTAIN

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
C	10:02	21.7	1.5	7.47	43.9	12	10.66	6.1	300'
C			10.8	7.54	48.3	25	10.38	5.9	300'
G	10:05	20.0	1.5	—	—	2	10.82	—	150'
G			10.0	—	—	3	10.06	—	150'
H	10:08	19.5	1.5	—	—	6	9.97	—	150'
H			9.8	—	—	2	10.07	—	150'
A	11:42	26.5	1.5	7.50	47.4	7	10.30	5.7	BCS BACK *A
A			13.2	7.50	49.5	7	8.83	5.8	"
A2	11:16	21.5	1.5	7.48	47.0	1	9.40	5.7	[illegible] 5 BACK *B
A2			11.2	7.49	49.4	6	10.02	5.7	" [illegible] "
J	10:15	15.0	1.5	7.47	48.0	5	9.73	5.7	~~300'~~/50
J			7.5	7.46	49.8	3	10.00	5.7	~~300'~~/50
I	10:25	19.5	1.5	7.47	47.4	3	10.46	5.7	300
I			8.8	7.50	45.0	3	10.09	5.7	300
C	10:58	21.0	1.5	7.47	47.8	8	9.85	5.7	
C			10.0	7.49	49.1	3	[illegible]	5.6	

4TH DAY OF DREDGING

Additional Notes & Observation: NOTE: SILT CURTAIN WAS MOVED TO CHANGE BARGES LAST WEEK. DREDGING BEGAN AGAIN ON 1/12/04 w/ DAY #4 OF DREDGING, LOADING "KIKRETT"! DREDGE FROM 8:30 - 10:00 AM. BARGE FULL.

*A: DREDGE @ 200' FROM BACKGROUND POINT

*B: NEW BACKGROUND SITE A2 CORRESPONDS TO BACKGROUND SITE "F" OF INITIAL WQ MONITORING, @ END OF GMN'L

PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

Date: 1/13/04   Construction Activity: AMERICAN DREDGING @ 35 TON LIFT & MARINE RAILWAY AREA

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
H	12:06	17.6	1.5	—	—	[illegible]		—	150'
H	12:0[illegible]		8.8	—	—	[illegible]		—	"
G	12:12	17.8	1.5	—	—	20	10.34	—	150'
G			8.9	—	—	13	10.55	—	"
C	12:18	19.2	1.5	7.49	40.1	[illegible]	10.77	6.0	300'
C			9.6	7.50	44.1	6	10.30	5.9	"
D	12:25	17.5	1.5	7.48	41.1	4	9.24	6.0	300'
D			8.3	7.49	43.8	6	10.05	5.8	"
H	12:29	17.6	1.5	—	—	2	—	—	150'
H			8.8	—	—	7	—	—	"
G	12:32	17.8	1.5	—	—	11	—	—	150'
G	12:35		8.9	—	—	11	—	—	"
J	12:44	14.0	1.5	—	—	14	10.38	—	150' @ WWTD
J			7.0	—	—	9	10.46	—	" "
I	1:04	17.0	1.5	7.45	38.5	9	9.52	6.1	300'
I			8.5	7.47	42.2	6	10.18	5.8	"
	1:00		1.5	—	—	8	—		50' FM Dredge
			10.0	—	—	18	—		"
A2	1:20	~~19.0~~	1.5	7.45	40.7	1	9.78	5.9	*A
A2			9.5	7.46	44.5	6	9.35	5.8	"
A	1:34	24.5	1.5	7.46	41.3	5	9.67	5.8	DREDGE @ 800' *B
A			12.2	7.45	45.0	13	9.62	5.9	"
H	2:00	15.5	1.5	—	—	12	—		150'
H			7.8	—	—	9	—		"
G	2:09	15.8	1.5	—	—	32	—	—	150'
G			7.9	—	—	6	—		"
C	2:14	17.0	1.5	7.47	42.0	16	9.30	5.8	300'
C	~~2:24~~	~~[illegible]~~	8.5	7.46	44.4	6	9.58	5.8	"
D	2:04	15.5	7.5	7.45	39.5	8	10.66	6.0	300'
D			7.8	7.47	43.9	6	9.93	5.8	"

Additional Notes & Observations: HIGH TIDE @ 9:28. 5TH DAY OF DREDGING. BEGAN DREDGING ± 11:00 AM @ WEST (NORTH) SIDE BY N. FLOATS, IN VICINITY OF OLD MARINE RAILWAY
* A: FORMER BACKGROUND SITE "F" @ GATE 5 FLOAT
* B: DREDGE WORKING @ SO. CHANNEL ± 800' AWAY FROM BCS BACKGROUND SITE 'A'.

[signature]

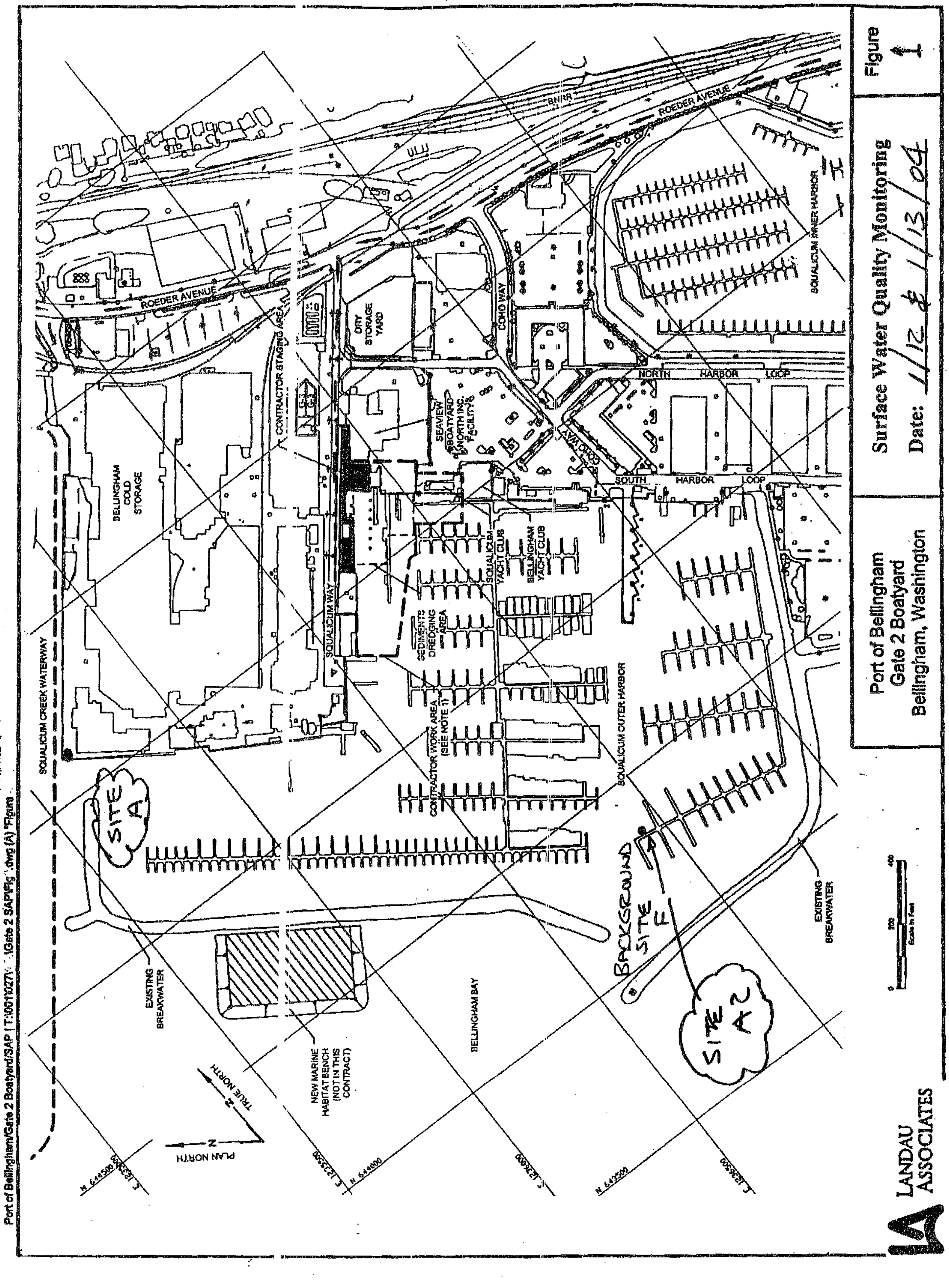
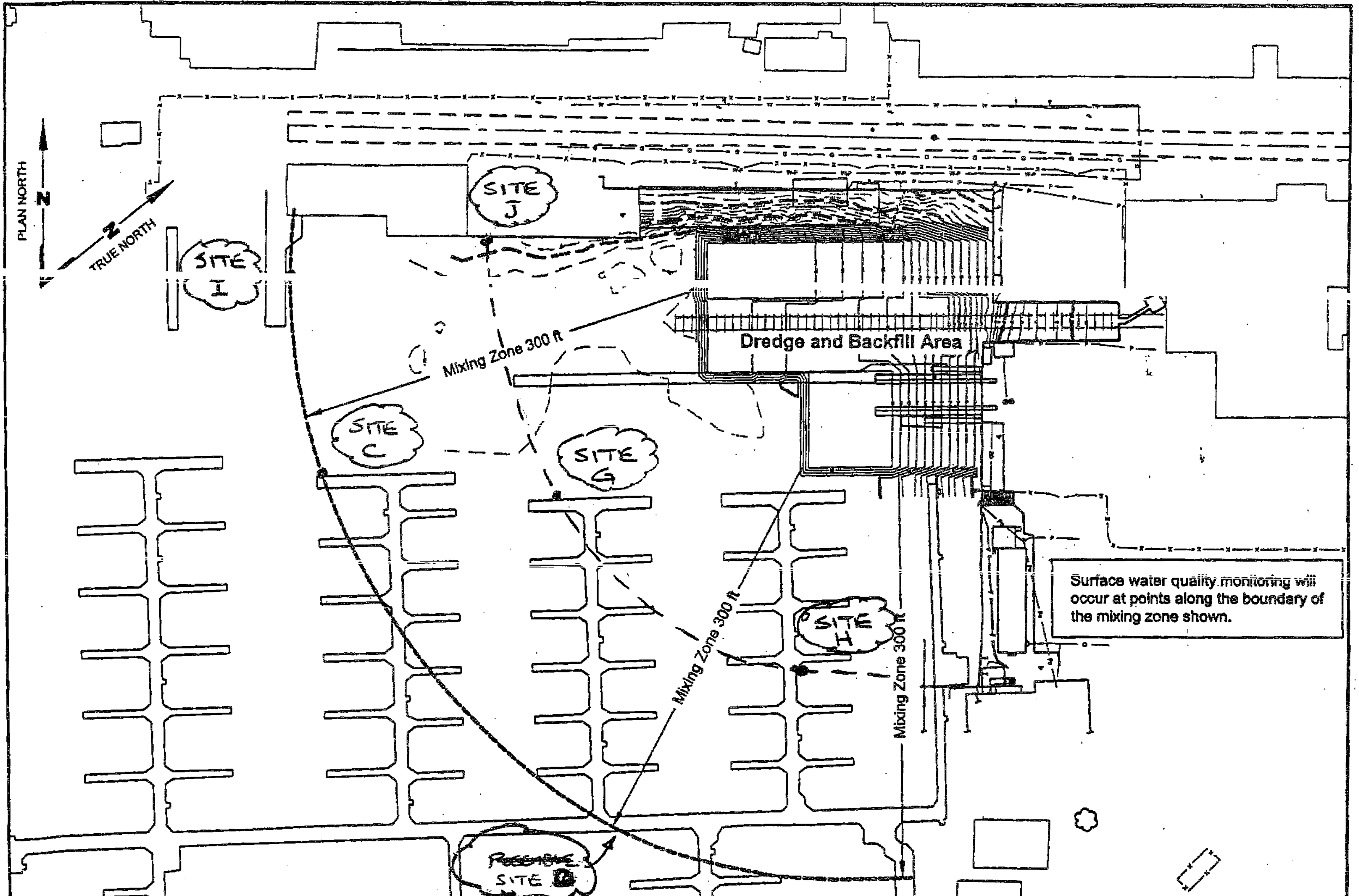


Figure 1
Surface Water Quality Monitoring
Date: 1/12 & 1/13/04
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington
LANDAU ASSOCIATES
Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\ ...\Gate 2 SAP\Fig ...dwg (A) "Figure
ROEDER AVENUE
BNRR
COHO WAY
DRY STORAGE YARD
CONTRACTOR STAGING AREA
SEAVIEW BOATYARD NORTH INC. FACILITY
NORTH HARBOR LOOP
SOUTH HARBOR LOOP
SQUALICUM INNER HARBOR
BELLINGHAM COLD STORAGE
SQUALICUM WAY
SQUALICUM YACHT CLUB
BELLINGHAM YACHT CLUB
SEDIMENTS DREDGING AREA
CONTRACTOR WORK AREA (SEE NOTE 1)
SQUALICUM OUTER HARBOR
SQUALICUM CREEK WATERWAY
SITE A
BACKGROUND SITE F
SITE A2
EXISTING BREAKWATER
EXISTING BREAKWATER
NEW MARINE HABITAT BENCH (NOT IN THIS CONTRACT)
BELLINGHAM BAY
TRUE NORTH
PLAN NORTH
N 644500
E 1235000
E 1235500
N 644000
E 1236000
N 643500
E 1236500
0
200
400
Scale in Feet

Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\152\Gate 2 SAP\Fig3.dwg (A) "Figure 3" 4/21/2003



LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Surface Water Quality Monitoring

Date: 1/12 & 1/13/04

Figure 2

PROJECT FILE
No. 001 027.231

PORT OF BELLINGHAM
Washington State, USA

TO: LOREE' RANDALL / MARY O'HERRON / DAVE PISCHER

COMPANY: ECOLOGY / ECOLOGY / LANDAU ASSOC.

FAX NUMBER: 360-407-6902 / 360-738-6253 / 425-778-6409

FROM: JOHN HERGESHEIMER

DATE SENT: ______

3 PAGE(S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: WATER QUALITY MONITORING REPORTS FOR: 1/14/04

WORK PERFOMED: DREDGING @ MARINE RAILWAY NEARSHORE

HAND DELIVERED COPY TO AMERICAN CONSTRUCTION ON SITE

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

FAX NUMBER (360) 671-6411

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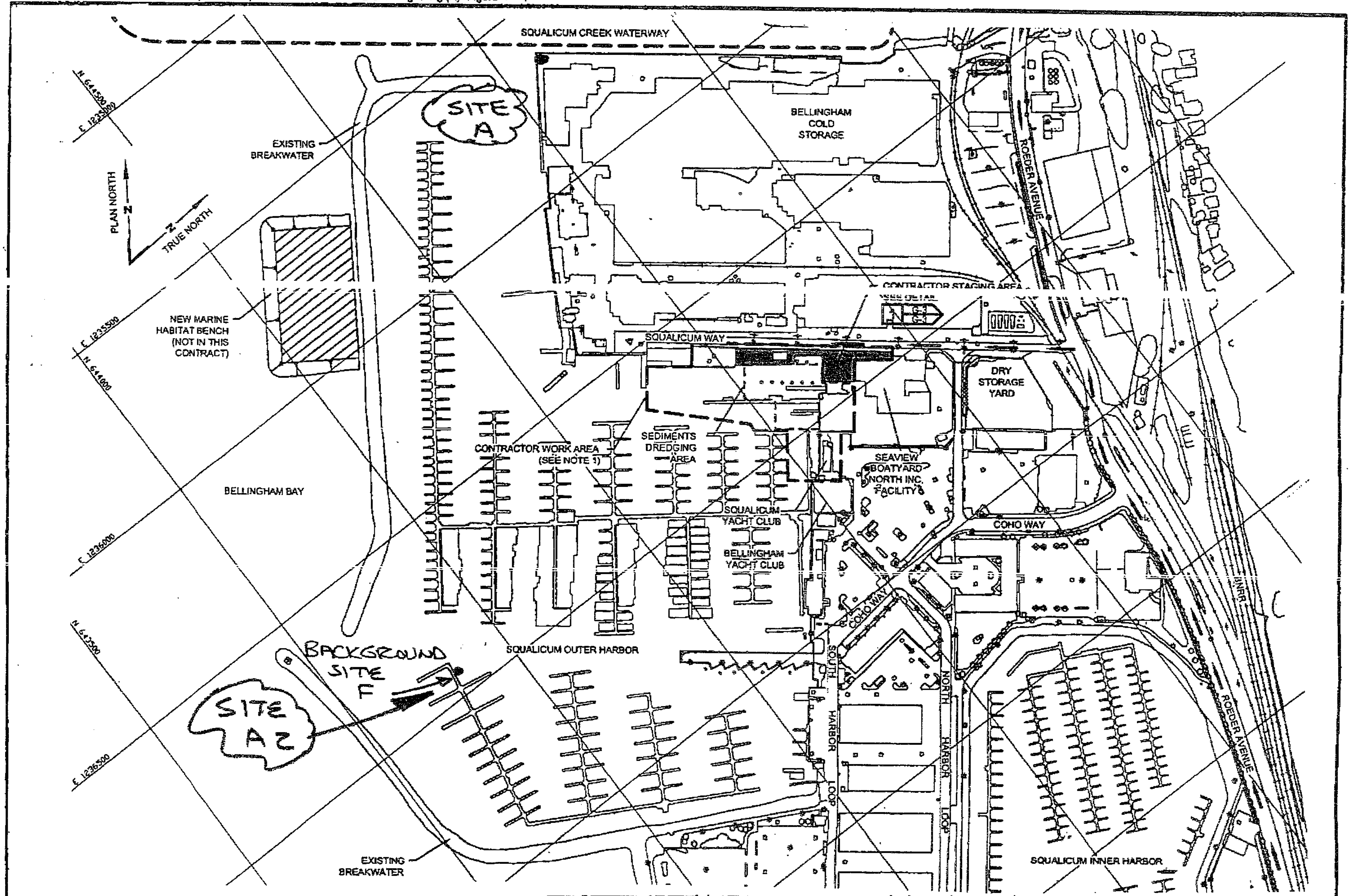
at (360) 676-2500

PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

Date: 1/14/04 Construction Activity: DREDGING @ MARINE RAIL AREA ± 80' FROM SHEET PILE BULKHEAD

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes	
~~H~~	~~10:15~~	~~19.5~~	~~1.5~~			~~5~~	~~10.11~~		150' No Good	32 270' A
~~H~~			~~1.8~~			~~4~~	~~10.54~~		No Good	18
G	10:28	20.0	1.5			14	10.88		150'	
G			10.0			4	10.23			
C	10:34	21.5	1.5	7.38	28.9	15	10.91	6.1	300'	
C			11.2	7.35	45.2	5	10.77	6.0		
D	10:25	20.0	1.5	7.39	30.5	13	10.39	6.3	300'	
D			10.0	7.37	44.0	5	10.80	6.1		
H	10:43	19.5	1.5			14			150'	15 270' A
H			9.8			6				3
A2	10:55	22.2	1.5	7.39	34.1	11	11.26	6.1	BACKGROUND	*A
A2			11.1	7.35	45.3	4	10.83	6.0	"	*A
A	11:12	27.2	1.5	7.39	36.4	8	11.27	6.0	BCS "	*B
A			13.6	7.35	45.3	6	10.27	6.1	BCS "	*B

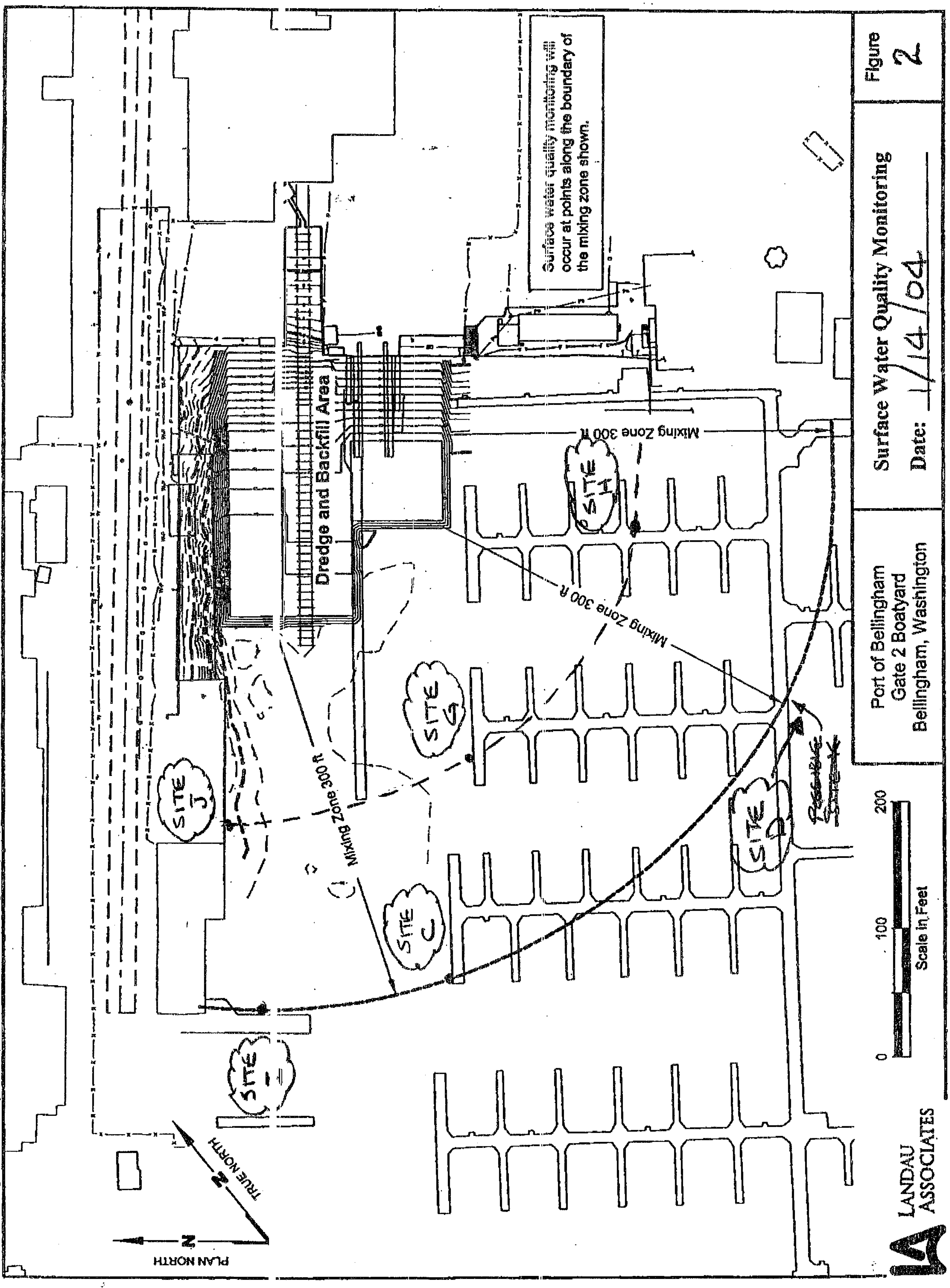
Additional Notes & Observations: NO SILT CURTAIN IN PLACE. BEGAN DREDGING ± 8:30 AM IN MARINE WELL AREA ± 100'-50' FROM BULKHEAD
RAIN LAST NIGHT ⇒ STREAM FLOW IMPACTING BAY, W. QUALITY.
*A: FORMER BACKGROUND SITE 'F'
HIGH TIDE @ 9:54. SW BREEZE & WIND AT TIMES
*B: DREDGE IN SQ. CHANNEL @ ± 1000' (TURNING BASIN)



LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	**Surface Water Quality Monitoring** **Date:** 1/14/04	Figure 1

Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\152\Gate 2 SAP\Fig3.dwg (A) "Figure 3" 4/21/2003



PROJECT FILE No. 001 027. 231

PORT OF BELLINGHAM

Washington State, USA

TO: DAVE PISCHER

COMPANY: LANDAU ASSOC.

FAX NUMBER: 425-778-6409

FROM: JOHN HERGESHEIMER

DATE SENT: ~~2/06/04~~ 12/22/04

5 PAGE (S) TO FOLLOW (NOT INCLUDING COVER SHEET)

NOTE: WATER QUALITY MONITORING REPORTS FOR: 2/04/04 AND 2/05/04

WORK PERFOMED: SAND BACKFILL AND RE-DREDGE AREA NEAR MARINE RAILWAY, 60'X60', ABUTTING BULKHEAD

HAND DELIVERED COPY TO AMERICAN CONSTRUCTION ON SITE

PORT OF BELLINGHAM
P.O. Box 1677
BELLINGHAM, WA 98227-1677

FAX NUMBER (360) 671-6411

HARD COPY: [WILL] [WILL NOT] FOLLOW BY MAIL

If you do not receive all pages, please contact the Port of Bellingham at (360) 676-2500

PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

Date: 2/04/04   Construction Activity: SAND BACKFILL IN DREDGED AREA

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
A	12:46	22.8	1.5	7.41	39.4	13	9.05	7.6	BCS BACKGRND
A			11.4	7.50	39.2	13	9.85	7.4	" "
C	1:00	19.0	1.5	7.38	38.8	14	8.61	7.2	300'
C			9.5	7.44	42.4	15	9.70	7.2	
G	1:07	17.5	1.5	7.46	39.3	8	9.58	7.0	150'
G			8.8	7.44	42.5	20	9.62	7.0	
H	1:12	17.0	1.5	7.47	40.5	3	8.59	7.0	150'
H			8.5	7.45	42.8	6	[illegible]	6.9	
A	2:59	22.2	1.5	7.48	39.0	2	9.64	7.2	BCS
A			11.1	7.46	42.5	1	8.62	7.1	BCS
C	3:12	18.3	1.5	7.44	[illegible]	[illegible]	9.50	7.0	300'
C			9.1	7.45	42.9	3	9.05	7.0	"
G	3:37	17.0	1.5			13			150'
G			8.5			8			"
H	3:44	16.0	1.5			4			150'
H			8.0			22			"
M	3:21	17.5	1.5	7.38	38.7	15	9.55	7.0	E WEST @600'
M			8.7	7.42	42.7	2	8.26	6.9	"
D	3:33	16.3	1.5	7.43	37.9	3	9.07	6.8	300'
D			8.2	7.40	42.7	13	8.99	6.9	"
I	4:40	16.0	1.5	7.40	38.4	15	9.81	6.8	300'
I			8.0	7.39	41.0	4	8.55	6.9	"
A	4:50	22.0	1.5	7.45	41.0	1	8.19	6.8	BCS
A			11.0	7.42	43.6	2	8.77	6.9	BCS
M	5:04	16.0	1.5	7.39	39.1	3	10.16	6.7	E WEST @600'
M			8.0	7.40	43.2	2	8.38	6.9	"
C	5:10	16.5	1.5	7.39	38.6	13	9.48	6.9	300'
C			8.2	7.41	43.3	4	9.53	6.9	"
G	5:15	16.0	1.5			75			150'
G			8.0			6			"
H	5:23	16.0	1.5			15			150'
H			8.0			21			"
D	5:20	16	1.5			2			300'
D			8.0			12			

Additional Notes & Observations: TIDES: H 9.1' @ 5:39 A, L 7.2' @ 10:59 A, H 7.8' @ 1:55 P
BEGAN PLACING BACKFILL W/ DREDGE ± 9:00 AM. STOPPED @ 5:00 PM
RAIN LAST NIGHT CAUSED HIGH BACKGROUND TURBIDITY @ BCS SITE AND LASTED ALL DAY INSIDE MARINA AREA DUE TO SHELTER FROM CURRENTS. BCS SITE CLEARED UP DUE TO NO RAIN TODAY, CLEAR STREAM FLOW & CURRENTS. ALL OF MARINA WAS AFFECTED ALL DAY BY RAIN-CAUSED TURBIDITY OF 2/03/04

PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

Date: 2/05/04 Construction Activity: SAND BACKFILL IN DREDGED ARE[A]

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
A	10:31A	24.0	1.5	7.42	41.9	2	8.12	6.6	
A			12.0	7.40	44.1	2	7.85	6.9	
M	10:01	18	1.5	7.30	42.3	3	9.45	7.1	E WEST @ 600'
M			9.0	7.37	43.1	2	9.17	7.2	"
C	10:10	18.5	1.5	[illegible]	42.6	4	9.23	6.9	300'
C			9.2	[illegible]	43.6	7	8.20	7.1	"
G	10:15	17.2	1.5	7.41	43.0	23	9.04	6.9	150'
G			8.6	7.40	43.5	20	9.21	7.0	"
H	10:21	16.8	1.5	7.42	[illegible]	6	[illegible]	6.9	150'
H			8.4	7.40	43.5	20	[illegible]	7.0	"

Additional Notes & Observations: COMPLETION OF WORK FROM 2/04/04

[signature]

12/22/04 17:34 FAX

☑004

PORT OF BELLINGHAM
GATE 2 BOATYARD SEDIMENT REMEDIATION AND REDEVELOPMENT PROJECT
SURFACE WATER QUALITY MONITORING DATA

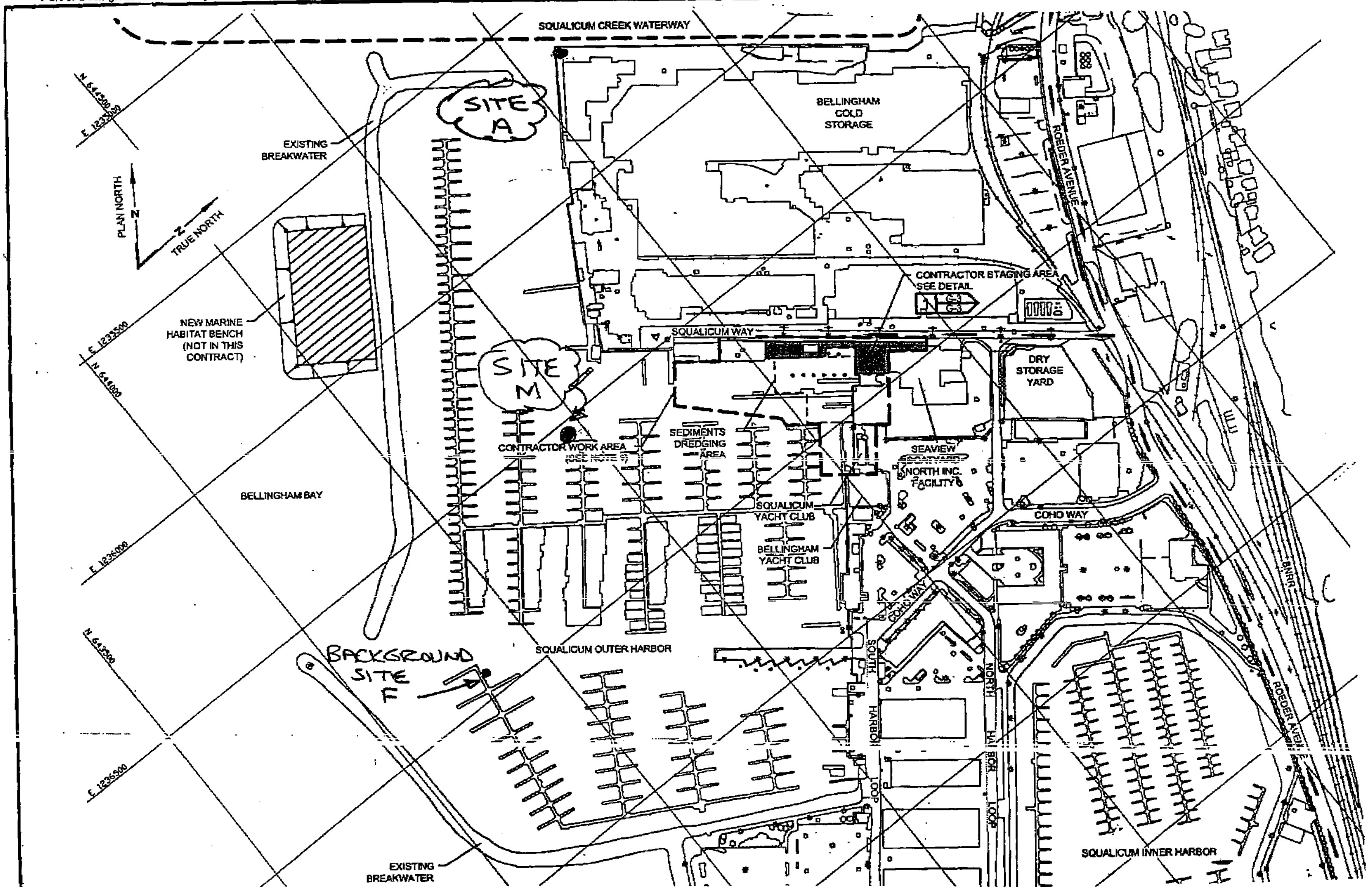
Date: 2/05/04 Construction Activity: ADDITIONAL DREDGING WATERSIDE OF MARINE RAILWAY WALL

Sample Site	Time	Water Depth (ft)	Sample Depth (ft)	pH	Conductivity (ms/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (°C)	Notes
M	3:13p	18.4	1.5	7.43	42.4	3	9.94	6.9	E WEST @ 600'
M			9.2	7.41	43.4	10	8.93	7.1	"
C	3:20	18.8	1.5	7.43	43.1	2	8.61	7.0	300'
C			9.4	7.39	43.6	12	8.45	7.1	"
G	3:27	17.5	1.5			5			150'
G			8.7			22			"
H	3:31	17.0	1.5			2			150'
H			8.5			14			"
A	3:40	24.5	1.5	7.43	42.7	1	[illegible]	6.3	BCS
A			13.2	7.40	44.4	2	9.04	7.0	BCS
M	4:58	17.4	1.5	7.41	42.6	2	8.17	6.5	600'
M			8.7	7.38	43.9	8	7.59	6.9	"
C	5:05	17.6	1.5	7.39	43.0	3	7.85	6.8	300'
C			8.8	7.36	43.8	25	8.17	7.0	"
G	5:11	16.3	1.5			2			
G			8.1			8			
H	5:16	15.5	1.5			4			
H			7.7			10			

Additional Notes & Observations: TIDES: H: 6:03A = 9.1', L: 11:25A = 6.9, H: 2:50P = 7.7'
MARINA [illegible] HAS [illegible] TURBIDITY FROM RAIN
ON 2/[illegible] [illegible] 2/04 [illegible]. ADDED SITE M @ 600' ON
E' WEST REPRESENTS TYPICAL MARINA CONDITIONS AWAY FROM SITE

[signature]

Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\ \Gate 2 SAP\Fig .dwg (A) "Figure



LANDAU ASSOCIATES

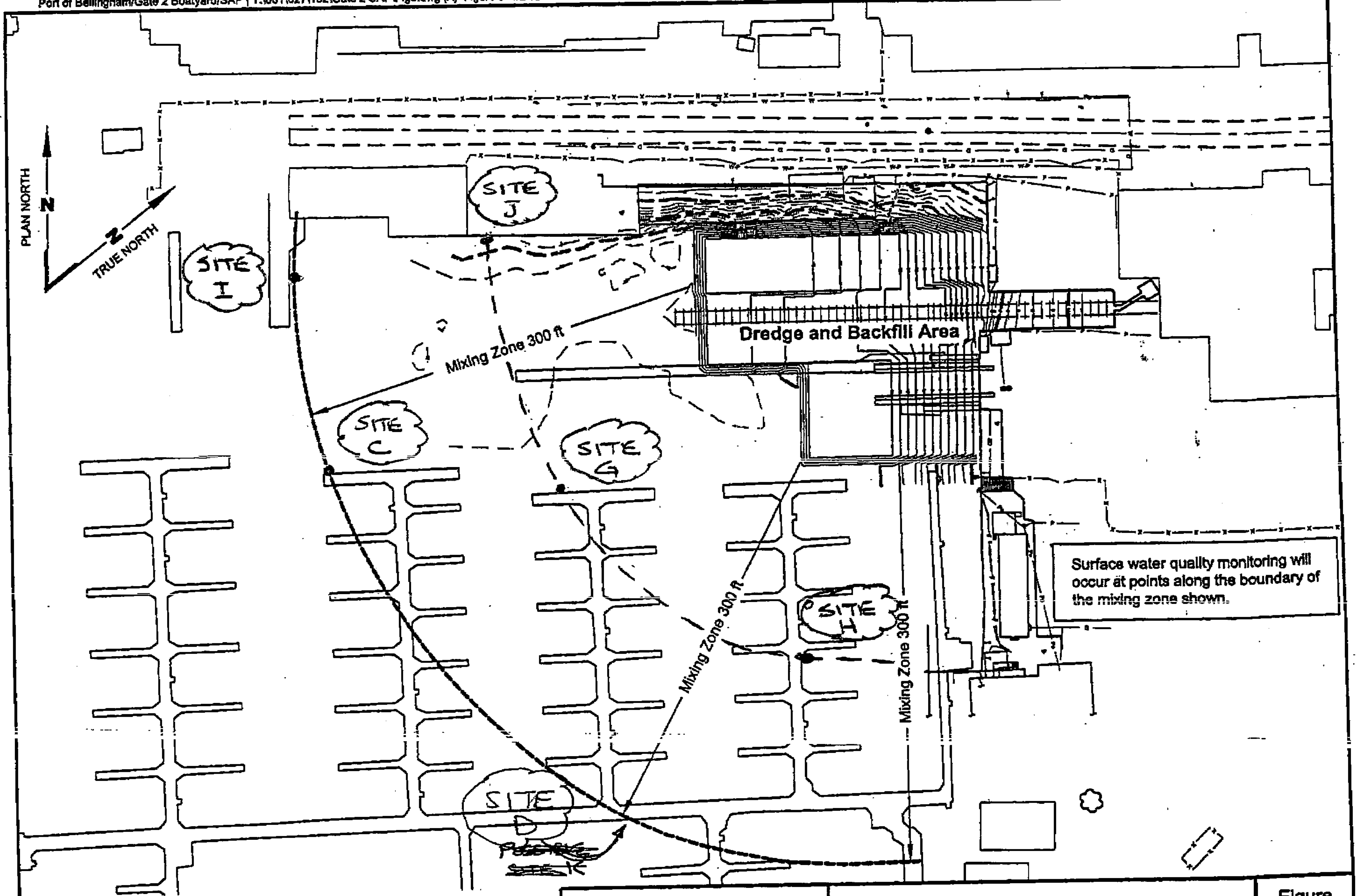
Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Surface Water Quality Monitoring

Date: 2/04/04 & 2/05/04

Figure 1

Port of Bellingham/Gate 2 Boatyard/SAP | T:\001\027\152\Gate 2 SAP\Fig3.dwg (A) "Figure 3" 4/21/2003



LANDAU ASSOCIATES

Port of Bellingham
Gate 2 Boatyard
Bellingham, Washington

Surface Water Quality Monitoring

Date: 2/04/04 & 2/05/04

Figure 2

APPENDIX E

Sediment Core Logs

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS[2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

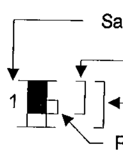
OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to the symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM) for a sand or gravel indicate a soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50%	"GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50%	"very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30%	"gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15%	"with gravel," "with sand," "with silt," etc.
	≤ 5%	"trace gravel," "trace sand," "trace silt," etc., or not noted.

Drilling and Sampling Key

SAMPLE NUMBER & INTERVAL



- Sample Identification Number
- Recovery Depth Interval
- Sample Depth Interval
- Portion of Sample Retained for Archive or Analysis

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Other - See text if applicable

Groundwater

▽ ATD — Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.

Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

SPM-2A

SAMPLE DATA			SEDIMENT DESCRIPTION		
Depth (ft)	In situ Sample Interval (ft)	Test Data	Graphic Symbol	USCS Symbol	Coring Method: Vibracorer Elevation (ft): -13.9 (MLLW)
0				SP	Tan to light brown, gravely, medium to coarse SAND; no odor and no sheen (loose, wet) (fill)
	SPM-2A (0-4)	Hg		SM/ML	Gray to dark gray, fine to medium SAND, with silt; no odor and no sheen (medium dense, moist)
2				CL	Black, CLAY, with fine to medium sand; petroleum odor and no sheen (loose, wet)
	SPM-2A (12-16)	Hg		SM	Gray, fine to coarse SAND with silt; no odor and no sheen (loose, wet)
				SM/ML	Gray to dark gray, fine to medium SAND, with silt; no odor and no sheen (medium dense, moist)
	SPM-2A (24-28)	Archived			
4				SW	Gray, fine to coarse SAND, with fine gravel; no odor and no sheen (loose, wet)
				CL	Gray, silty, CLAY; no odor and no sheen (medium dense, moist)
6					
8					
10					

Coring Completed 07/08/04
Core logged and sampled by ERG on 7/9/2004
Total Penetration = 7.0 ft.

Notes: Collected a continuous core from 0 - 7 feet

1027.234 12/21/04 \\EDMDATA\GINT\GINT6\PROJECTS\001027.234.GPJ SEDIMENT LOG

LANDAU ASSOCIATES

Port of Bellingham Gate 2
Boatyard
Bellingham, Washington

Log of Sediment Core SPM-2A

Figure
E-2

SPM-3A

SAMPLE DATA			SEDIMENT DESCRIPTION		
Depth (ft) / Sample	In situ Sample Interval (ft)	Test Data	Graphic Symbol	USCS Symbol	Coring Method: Vibracorer Elevation (ft): -13.3 (MLLW)
0 — SPM-3A (0-4)	▯	Hg,TBT		SW	Black to very dark gray, gravely, fine to coarse SAND, with trace wood and coal (?) debris; moderate petroleum odor and sheen present on water surface (loose, wet)
SPM-3A (12-16)	▯	Archived		CL	Brown, silty, CLAY; no odor and no sheen (soft, wet)
				SM/ ML	Gray, fine to medium SAND, with silt; no odor and no sheen (dense, moist)
2 — SPM-3A (24-28)	▯	Archived			
					-Sand grain size increases from fine to medium to fine to coarse
4					-intact bivalve shell
6					

Coring Completed 07/08/04
Core logged and sampled by ERG on 7/9/2004
Total Penetration = 7.0 ft.

8

10

Notes: Collected a continuous core from 0 - 7 feet

1027.234 12/21/04 \\EDMDATA\GINT\GINT6\PROJECTS\001027.234.GPJ SEDIMENT LOG

LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	Log of Sediment Core SPM-3A	Figure E-3

SPM-4A

SAMPLE DATA			SEDIMENT DESCRIPTION		
Depth (ft) / Sample	In situ Sample Interval (ft)	Test Data	Graphic Symbol	USCS Symbol	Coring Method: Vibracorer Elevation (ft): -14.4 (MLLW)
0 SPM-4A (0-4)		Hg		ML	Black, clayey, SILT, with sand; petroleum odor and slight sheen (loose, wet)
SPM-4A (12-16)		Hg		SM	Olive gray, fine to medium SAND, with silt; no odor and no sheen (dense, wet)
2 SPM-4A (24-28)		Archived			
4				SM/ ML	Tan, silty, fine SAND with clay; faint laminae, no odor and no sheen (dense, moist)
6				SM	Gray, fine to medium SAND, with silt; no odor and no sheen (dense, moist)

Coring Completed 07/08/04
Core logged and sampled by ERG on 7/9/2004
Total Penetration = 7.0 ft.

8

10

Notes: Collected a continuous core from 0 - 7 feet

1027.234 12/21/04 \\EDMDATA\GINT\GINT6\PROJECTS\001027.234.GPJ SEDIMENT LOG

LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	Log of Sediment Core SPM-4A	Figure E-4

SPM-5A

SAMPLE DATA			SEDIMENT DESCRIPTION		
Depth (ft)	In situ Sample Interval (ft)	Test Data	Graphic Symbol	USCS Symbol	Coring Method: Vibracorer Elevation (ft): -13.9 (MLLW)
0 — SPM-5A (0-4)		Hg, TBT		SM	Gray, fine to medium SAND, with silt; no odor and no sheen (loose, wet)
SPM-5A (12-16)		Archived			
				SP	Gray, fine to coarse SAND with shell fragments and trace silt; no odor and no sheen (medium dense, moist)
2 — SPM-5A (24-28)		Archived			
				SP	Greenish gray, fine to coarse SAND; no odor and no sheen (medium dense, moist)
4					
				SW	Greenish gray, medium to coarse SAND, with fine gravel; no odor and no sheen (loose, wet)
6					

Coring Completed 07/08/04
Core logged and sampled by ERG on 7/9/2004
Total Penetration = 7.0 ft.

8

10

Notes: Collected a continuous core from 0 - 7 feet

1027.234 12/21/04 \\EDMDATA\GINT\GINT6\PROJECTS\001027.234.GPJ SEDIMENT LOG

LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard Bellingham, Washington	Log of Sediment Core SPM-5A	Figure E-5

SPM-6A

SAMPLE DATA				SEDIMENT DESCRIPTION		
Depth (ft)	Sample	In situ Sample Interval (ft)	Test Data	Graphic Symbol	USCS Symbol	Coring Method: Vibracorer Elevation (ft): -12.1 (MLLW)
0	SPM-6A (0-4)		Hg		CL	Gray, silty, CLAY, with sand and trace bivalve shell fragments; hydrogen sulfide odor and no sheen (soft, wet)
	SPM-6A (12-16)		Archived		SM/ ML	Olive green to gray; silty, fine to medium SAND, with trace coal (?) debris; no odor and no sheen (dense, moist)
2	SPM-6A (24-28)		Archived			
4					SM	Olive green to gray; medium to coarse sand, with silt; no odor and no sheen (loose, wet)
					CL	Gray, silty, CLAY; no odor and no sheen (medium stiff, moist)
6						

Coring Completed 07/08/04
Core logged and sampled by ERG on 7/9/2004
Total Penetration = 7.0 ft.

8

10

Notes: Collected a continuous core from 0 - 7 feet

1027.234 12/21/04 \\EDMDATA\GINT\GINT6\PROJECTS\001027.234.GPJ SEDIMENT LOG

LANDAU ASSOCIATES

Port of Bellingham Gate 2 Boatyard
Bellingham, Washington

Log of Sediment Core SPM-6A

Figure E-6

APPENDIX F

Analytical Laboratory Data

Analytical Resources, Incorporated
Analytical Chemists and Consultants

July 26, 2004

Gary Huitsing
Landau Associates, Inc.
130 Second Avenue South
Edmonds, WA 98020

1027
RE: Project No: 00~~1024~~.200 Bellingham, WA /July 2004
ARI Job No: GV33

Dear Mr. Huitsing:

Please find enclosed chain-of-custody documentation and the data package for the above referenced project.

Sample receipt and analyses are discussed in the case narrative.

A copy of this report and the supporting data will remain on file with ARI. If you have any questions or require additional information, please contact me at your convenience.

Respectfully,

ANALYTICAL RESOURCES, INC.

for MLF

Mary Lou Fox
Project Manager
206-695-6211

MLF/sdrd

Landau Associates, Inc.
Bellingham Washington July 2004
Project No. 001024.200
ARI Job No: GV33

Laboratory Case Narrative

Analytical Resources received fifteen sediment samples on July 12, 2004. The samples were hand delivered with a cooler temperature of 4.5 °C. Samples arrived in good condition with no discrepancies in paperwork. Seven of the samples were to be archived until further notice.

Mercury Analysis by EPA SW7471

Samples were analyzed for Mercury following EPA Method SW7471. Laboratory QC met method requirements. No analytical complications were noted for this analysis.

Butyl Tin Analysis by Krone GC/MS

The analysis for Butyl Tins was completed as requested. There was no recovery of Butyl Tin in the LCS, which is not unusual for this method. Recoveries of the Butyl Tin were within requirements for the MS/MSD, so no further corrective action was taken. No other analytical complications were noted for this analysis.

☒ Seattle (Edmonds) (425) 778-0907
☐ Tacoma (253) 926-2493
☐ Spokane (509) 327-9737
☐ Portland (Lake Oswego) (503) 443-6010
☐ ______

4.5

Date 7-9-04
Page 1 of 1

Landau Associates

Chain-of-Custody Record

Project Name: Gate 2 Boat Yard Project No. 001027.200 (original number struck out; "1027" written above)
Project Location/Event: Bellingham, WA ~~98?~~
Sampler's Name: Erik Gerking
Project Contact: Erik Gerking
Send Results To: ↓ ↓

Testing Parameters: Hg, TBT, Archive

Turnaround Time: ☒ Standard ☐ Accelerated ☐ ______

Sample I.D.	Date	Time	Matrix	No. of Containers	Hg	TBT	Archive	Observations/Comments
SPM-2A (0-4)	7-9-04	1350	Sediment	1	X			X = Analyze
SPM-2A (12-16)	↓	1355	↓	1	X			A = Archive until
SPM-2A (24-28)		1400		1	A			further notified
SPM-3A (0-4)		1420		2	X	X	✱	
SPM-3A (12-16)		1425		1	A	A		✱✱ Analyze MS/MSD
SPM-3A (24-28)		1430		1	A	A		from this sample
SPM-6A (0-4)		1440		1	X			
SPM-6A (12-16)		1445		1	X			
SPM-6A (24-28)		1450		1	A			
SPM-5A (0-4)✱✱		1505		1	X	X		
SPM-5A (12-16)		1510		1	A	A		
SPM-5A (24-28)		1515		1	A	A		
SPM-4A (0-4)		1620		2	X		A	
SPM-4A (12-16)		1630		1	X			
SPM-4A (24-28)	↓	1635	↓	1	A			

Special Shipment/Handling or Storage Requirements: Store @ 4° C
Method of Shipment: Courier

Relinquished by	Received by	Relinquished by	Received by
Signature: Erik R. Gerking (signature)	Signature: Eric Branson (signature)	Signature:	Signature:
Printed Name: Erik Gerking	Printed Name: Eric Branson	Printed Name:	Printed Name:
Company: LAI	Company: ARI	Company:	Company:
Date 7-12-04 Time 1025	Date 7/12/04 Time 1025	Date Time	Date Time

WHITE COPY - Project File   YELLOW COPY - Laboratory   PINK COPY - Client Representative

Rev 4/01

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-3A(0-4)
SAMPLE

Lab Sample ID: GV33D
LIMS ID: 04-10752
Matrix: Sediment
Data Release Authorized:
Reported: 07/21/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Date Extracted: 07/16/04
Date Analyzed: 07/21/04 10:31
Instrument/Analyst: NT1/PK
Alumina Cleanup: YES

Sample Amount: 5.32 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 18.8%
pH: 8.4

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**5.6**	**24**
683-18-1	**Dibutyl Tin Dichloride**	**5.6**	**23**
1118-46-3	Butyl Tin Trichloride	5.6	< 5.6 U
	TBT as Tin ion	5.0	21

Reported in µg/kg (ppb)

TBT Surrogate Recovery	
Tripropyl Tin Chloride	47.6%
Tripentyl Tin Chloride	44.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: MB-071604
METHOD BLANK

Lab Sample ID: MB-071604
LIMS ID: 04-10752
Matrix: Sediment
Data Release Authorized:
Reported: 07/21/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: NA
Date Received: NA

Date Extracted: 07/16/04
Date Analyzed: 07/21/04 09:53
Instrument/Analyst: NT1/PK
Alumina Cleanup: NO

Sample Amount: 5.00 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

CAS Number	Analyte	RL	Result
1461-22-9	Tributyl Tin Chloride	6.0	< 6.0 U
683-18-1	Dibutyl Tin Dichloride	6.0	< 6.0 U
1118-46-3	Butyl Tin Trichloride	6.0	< 6.0 U

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	84.1%
Tripentyl Tin Chloride	59.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-5A(0-4)
SAMPLE

Lab Sample ID: GV33J
LIMS ID: 04-10758
Matrix: Sediment
Data Release Authorized:
Reported: 07/21/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Date Extracted: 07/16/04
Date Analyzed: 07/21/04 10:50
Instrument/Analyst: NT1/PK
Alumina Cleanup: YES

Sample Amount: 5.02 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 23.0%
pH: 8.5

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**6.0**	**8.6**
683-18-1	**Dibutyl Tin Dichloride**	**6.0**	**8.3**
1118-46-3	Butyl Tin Trichloride	6.0	< 6.0 U
	TBT as Tin ion	5.3	7.7

Reported in μg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	43.4%
Tripentyl Tin Chloride	46.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-5A(0-4)
MATRIX SPIKE

Lab Sample ID: GV33J
LIMS ID: 04-10758
Matrix: Sediment
Data Release Authorized:
Reported: 07/21/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Date Extracted: 07/16/04
Date Analyzed: 07/21/04 11:09
Instrument/Analyst: NT1/PK
Alumina Cleanup: YES

Sample Amount: 5.00 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 23.0%
pH: 8.5

CAS Number	Analyte	RL	Result
1461-22-9	Tributyl Tin Chloride	6.0	---
683-18-1	Dibutyl Tin Dichloride	6.0	---
1118-46-3	Butyl Tin Trichloride	6.0	---

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	59.6%
Tripentyl Tin Chloride	48.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-5A(0-4)
MATRIX SPIKE DUPLICATE

Lab Sample ID: GV33J
LIMS ID: 04-10758
Matrix: Sediment
Data Release Authorized:
Reported: 07/21/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Date Extracted: 07/16/04
Date Analyzed: 07/21/04 11:28
Instrument/Analyst: NT1/PK
Alumina Cleanup: YES

Sample Amount: 5.04 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 23.0%
pH: 8.5

CAS Number	Analyte	RL	Result
1461-22-9	Tributyl Tin Chloride	6.0	---
683-18-1	Dibutyl Tin Dichloride	6.0	---
1118-46-3	Butyl Tin Trichloride	6.0	---

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	51.9%
Tripentyl Tin Chloride	46.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-5A(0-4)
MS/MSD

Lab Sample ID: GV33J
LIMS ID: 04-10758
Matrix: Sediment
Data Release Authorized:
Reported: 07/21/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Date Extracted MS/MSD: 07/16/04

Sample Amount MS: 5.00 g-dry-wt
MSD: 5.04 g-dry-wt

Date Analyzed MS: 07/21/04 11:09
MSD: 07/21/04 11:28
Instrument/Analyst MS: NT1/PK
MSD: NT1/PK
Alumina Cleanup: YES

Final Extract Volume MS: 0.5 mL
MSD: 0.5 mL
Dilution Factor MS: 1.00
MSD: 1.00
Percent Moisture: 23.0%
pH: 8.5

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Tributyl Tin Chloride	8.6	103	100	94.4%	84.1	99.2	76.1%	20.2%
Dibutyl Tin Dichloride	8.3	79.1	100	70.8%	64.0	99.2	56.1%	21.1%
Butyl Tin Trichloride	< 6.0	24.3	100	24.3%	28.5	99.2	28.7%	15.9%

Results reported in µg/kg
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: LCS-071604
LAB CONTROL

Lab Sample ID: LCS-071604
LIMS ID: 04-10752
Matrix: Sediment
Data Release Authorized:
Reported: 07/21/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Date Extracted: 07/16/04
Date Analyzed: 07/21/04 10:12
Instrument/Analyst: NT1/PK
Alumina Cleanup: YES

Sample Amount: 5.00 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

Analyte	Lab Control	Spike Added	Recovery
Tributyl Tin Chloride	107	100	107%
Dibutyl Tin Dichloride	65.7	100	65.7%
Butyl Tin Trichloride	0.0	100	0.0%

TBT Surrogate Recovery

Tripropyl Tin Chloride	84.8%
Tripentyl Tin Chloride	59.7%

Results reported in µg/kg

ANALYTICAL RESOURCES INCORPORATED

SOIL TBT SURROGATE SUMMARY

Matrix: Sediment

QC Report No: GV33
Project: Gate 2 Boat Yard
001024.200

LIMS ID	Lab ID	Client ID	TPT	#	TPNT	#	TOT OUT
04-10752MB	071604MB	Method Blank	84.1%		59.7%		0
04-10752LCS	071604LCS	Lab Control	84.8%		59.7%		0
04-10752	GV33D	SPM-3A(0-4)	47.6%		44.9%		0
04-10758	GV33J	SPM-5A(0-4)	43.4%		46.7%		0
04-10758MS	GV33J	SPM-5A(0-4)	59.6%		48.5%		0
04-10758MSD	GV33J	SPM-5A(0-4)	51.9%		46.0%		0

Control Limits	MB/LCS	Sample
(TPT) = Tripropyl Tin Chloride	(29-120)	(10-122)
(TPNT) = Tripentyl Tin Chloride	(16-108)	(10-104)

Column to be used to flag recovery values

* Values outside of required QC limits

D Surrogate Compound diluted out

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: METHOD BLANK

Lab Sample ID: GV33MB
LIMS ID: 04-10749
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: NA
Date Received: NA

Percent Total Solids: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	07/14/04	7471A	07/16/04	7439-97-6	Mercury	0.05	0.05	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: SPM-2A(0-4)
SAMPLE

Lab Sample ID: GV33A
LIMS ID: 04-10749
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

Percent Total Solids: 76.2%

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	07/14/04	7471A	07/16/04	7439-97-6	Mercury	0.06	0.09	

U-Analyte undetected at given RL
RL-Reporting Limit

FORM-I

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-2A(12-16)
SAMPLE

Lab Sample ID: GV33B
LIMS ID: 04-10750
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Percent Total Solids: 79.8%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	07/14/04	7471A	07/16/04	7439-97-6	Mercury	0.04	0.04	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-3A(0-4)
SAMPLE

Lab Sample ID: GV33D
LIMS ID: 04-10752
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Percent Total Solids: 79.6%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	07/14/04	7471A	07/16/04	7439-97-6	Mercury	0.04	0.10	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-6A(0-4)
SAMPLE

Lab Sample ID: GV33G
LIMS ID: 04-10755
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Percent Total Solids: 57.7%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	07/14/04	7471A	07/16/04	7439-97-6	Mercury	0.07	0.36	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-6A(12-16)
SAMPLE

Lab Sample ID: GV33H
LIMS ID: 04-10756
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Percent Total Solids: 62.0%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	07/14/04	7471A	07/16/04	7439-97-6	Mercury	0.07	0.15	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-5A(0-4)
SAMPLE

Lab Sample ID: GV33J
LIMS ID: 04-10758
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Percent Total Solids: 76.5%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	07/14/04	7471A	07/16/04	7439-97-6	Mercury	0.04	0.05	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-5A(0-4)
DUPLICATE

Lab Sample ID: GV33J
LIMS ID: 04-10758
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Mercury	7471A	0.05	0.06	18.2%	+/- 0.04	L

Reported in mg/kg-dry

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-5A(0-4)
MATRIX SPIKE

Lab Sample ID: GV33J
LIMS ID: 04-10758
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Mercury	7471A	0.05	0.52	0.44	107%	

Reported in mg/kg-dry

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-4A(0-4)
SAMPLE

Lab Sample ID: GV33M
LIMS ID: 04-10761
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Percent Total Solids: 52.6%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	07/14/04	7471A	07/16/04	7439-97-6	Mercury	0.09	0.92	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-4A(12-16)
SAMPLE

Lab Sample ID: GV33N
LIMS ID: 04-10762
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: 07/09/04
Date Received: 07/12/04

Percent Total Solids: 81.3%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
CLP	07/14/04	7471A	07/16/04	7439-97-6	Mercury	0.05	0.05	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: LAB CONTROL

Lab Sample ID: GV33LCS
LIMS ID: 04-10749
Matrix: Sediment
Data Release Authorized:
Reported: 07/19/04

QC Report No: GV33-Landau Associates, Inc.
Project: Gate 2 Boat Yard
001024.200
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Mercury	7471A	1.04	1.00	104%	

Reported in mg/kg-dry

N-Control limit not met
Control Limits: 80-120%

Analytical Resources, Incorporated
Analytical Chemists and Consultants

26 January 2004

Dave Pischer
Landau Associates, Inc.
130 Second Avenue South
Edmonds WA 98020-9129

RE: Project: Port of Bellingham Gate 2- Marine Railway Well TPs/ 001 027.232
ARI Job No: GF53

Dear Dave:

Please find enclosed the original chain of custody (COC) and analytical results for the above referenced project. Analytical Resources, Inc. (ARI) accepted two soil samples on January 16, 2004. ARI received the samples in good condition. There were no discrepancies between the COC and the sample containers' labels.

The samples were analyzed for SMS semivolatiles, tributyl tin, NWTPH-Dx with acid/silica gel cleanup, NWTPH-G, total metals referencing US EPA methods 6010B and 7470A, and TOC.

The semivolatiles continuing calibration (C-Cal) showed drift of pentachlorophenol 12.6% above the QC limit. The analyst noted that because the drift was high and no pentachlorophenol was detected in either sample, no corrective action was taken. The non-detected values are unaffected by the high bias.

The analyst who performed the NWTPH-G analyses noted that he inadvertently added 4.5 mLs methanol to the laboratory control sample duplicate (LCSD), rather than 4.75 mLs, which was correct. He caught the error with the LCSD and added the correct volumes of methanol to the samples and remaining QC. The lower volume of methanol in the LCSD resulted in higher concentration of the surrogates and spike. The spike recovery was 15% above the control limit and the trifluorotoluene (TFT) surrogate recovery was 31% above the QC limit. Spike recovery of gas in the LCS was good; recovery of the TFT surrogate in the LCS was 2% above the limit. Because the source of the problem was traceable to the LCSD and the samples were undetected, no corrective action was taken. Possible high bias does not affect non-detects.

Landau Associates, Inc.
Client Project: Port of Bellingham gate 2-Marine Railway Well TPs / 001 027.232
ARI Job No: GF53
Page 2

The analyst who performed the TOC analysis noted that the RSD for the triplicate performed on sample **SPM-7** was above the QC limit by 2.9%. The level of TOC in the samples was relatively high. The analyst noted that he observed pieces of shiny black material in this sample, which appeared to be a carbon material. He noted that he observed more of this material in the duplicate than in the sample or triplicate. The duplicate did show a higher level of organic carbon.

No further analytical complications were noted. A copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Mary Lou Fox

Mary Lou Fox
Project Manager
(206) 695-6211
marylou@arilabs.com

MLF/mlf
enclosure
cc: GF53

GFS3

2.5°c

☒ Seattle (Edmonds) (425) 778-0907
☐ Tacoma (253) 926-2493
☐ Spokane (509) 327-9737
☐ Portland (Lake Oswego) (503) 443-6010
☐

Landau Associates

Date JAN 15, 04

Page 1 of 1

Chain-of-Custody Record

Project Name: Port of Bellingham

Project No. 001 027. 232

Project Location/Event: GATE 2 - MARINE RAILWAY WELL TPs

Sampler's Name: DAVE PISCHER

Project Contact: same

Send Results To: same

Testing Parameters

Turnaround Time
☐ Standard
☒ Accelerated ★
☐

Sample I.D.	Date	Time	Matrix	No. of Containers	Tributyltin (as TBT ion)	SVOCs *	TOC	Metals **	NWTPH-Dx ***	NWTPH-Gx							Observations/Comments
SPM-7	1/15/04	1715	soil	4	✓	✓	✓	✓	✓	✓							* SVOCs as identified on the SMS list of chemical parameters
SPM-11	1/15/04	1600	soil	4	✓	✓	✓	✓	✓	✓							

** Metals include As, Cd, Cr, Cu, Pb, Hg, Ag, Zn

All analytical testing and reporting must be conducted in accordance with PSEP protocols

*** Need acid/silica-gel cleanup on NWTPH-Dx analyses

Special Shipment/Handling or Storage Requirements: STORE @ ~4°C

Method of Shipment: HAND DELIVERY

Relinquished by	Received by	Relinquished by	Received by
Signature: David A Pischer	Signature: [signature]	Signature:	Signature:
Printed Name: DAVID A PISCHER	Printed Name: BRIAN KEBEL	Printed Name:	Printed Name:
Company: LANDAU ASSOC	Company: ARI	Company:	Company:
Date 1/15/04 Time 2245	Date 1/16/04 Time 0710	Date Time	Date Time

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: MB-011604
METHOD BLANK

Lab Sample ID: MB-011604
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/19/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Date Extracted: 01/16/04
Date Analyzed: 01/19/04 09:49
Instrument/Analyst: NT6/Van
GPC Cleanup: NO

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	Naphthalene	20	< 20 U
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	2-Methylnaphthalene	20	< 20 U
131-11-3	Dimethylphthalate	20	< 20 U
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	Acenaphthene	20	< 20 U
132-64-9	Dibenzofuran	20	< 20 U
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	Fluorene	20	< 20 U
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	100	< 100 U
85-01-8	Phenanthrene	20	< 20 U
120-12-7	Anthracene	20	< 20 U
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	Fluoranthene	20	< 20 U
129-00-0	Pyrene	20	< 20 U
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	Benzo(a)anthracene	20	< 20 U
117-81-7	bis(2-Ethylhexyl)phthalate	20	< 20 U
218-01-9	Chrysene	20	< 20 U
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	Benzo(b)fluoranthene	20	< 20 U
207-08-9	Benzo(k)fluoranthene	20	< 20 U
50-32-8	Benzo(a)pyrene	20	< 20 U
193-39-5	Indeno(1,2,3-cd)pyrene	20	< 20 U
53-70-3	Dibenz(a,h)anthracene	20	< 20 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: MB-011604
METHOD BLANK

Lab Sample ID: MB-011604
LIMS ID: 04-406
Matrix: Soil
Date Analyzed: 01/19/04 09:49

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	20	< 20 U

Reported in μg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	57.2%	2-Fluorobiphenyl	59.7%
d14-p-Terphenyl	93.4%	d4-1,2-Dichlorobenzene	52.9%
d5-Phenol	55.5%	2-Fluorophenol	49.4%
2,4,6-Tribromophenol	62.6%	d4-2-Chlorophenol	52.1%

ANALYTICAL RESOURCES INCORPORATED

SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232

Client ID	NBZ	FBP	TPH	DCB	PHL	2FP	TBP	2CP	TOT OUT
MB-011604	57.2%	59.7%	93.4%	52.9%	55.5%	49.4%	62.6%	52.1%	0
LCS-011604	62.1%	66.4%	92.6%	60.5%	63.0%	55.9%	64.9%	60.4%	0
SPM-7	62.9%	65.8%	82.4%	49.9%	62.7%	61.1%	88.9%	62.6%	0
SPM-11	64.2%	66.4%	81.8%	58.4%	62.7%	62.1%	84.3%	63.9%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(28-106)	(15-112)
(FBP) = 2-Fluorobiphenyl	(43-106)	(44-104)
(TPH) = d14-p-Terphenyl	(41-143)	(36-136)
(DCB) = d4-1,2-Dichlorobenzene	(35-99)	(31-87)
(PHL) = d5-Phenol	(33-108)	(34-105)
(2FP) = 2-Fluorophenol	(28-112)	(19-116)
(TBP) = 2,4,6-Tribromophenol	(25-122)	(20-139)
(2CP) = d4-2-Chlorophenol	(34-103)	(32-98)

Prep Method: SW3550B
Log Number Range: 04-406 to 04-407

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: LCS-011604
LAB CONTROL

Lab Sample ID: LCS-011604
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/19/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Date Extracted: 01/16/04
Date Analyzed: 01/19/04 10:19
Instrument/Analyst: NT6/Van
GPC Cleanup: NO

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

Analyte	Lab Control	Spike Added	Recovery
Phenol	445	750	59.3%
1,4-Dichlorobenzene	281	500	56.2%
1,2,4-Trichlorobenzene	305	500	61.0%
Acenaphthene	341	500	68.2%
Pentachlorophenol	534	750	71.2%
Pyrene	405	500	81.0%

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	62.1%
2-Fluorobiphenyl	66.4%
d14-p-Terphenyl	92.6%
d4-1,2-Dichlorobenzene	60.5%
d5-Phenol	63.0%
2-Fluorophenol	55.9%
2,4,6-Tribromophenol	64.9%
d4-2-Chlorophenol	60.4%

Results reported in µg/kg

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-7
SAMPLE

Lab Sample ID: GF53A
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/19/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Date Extracted: 01/16/04
Date Analyzed: 01/19/04 10:48
Instrument/Analyst: NT6/Van
GPC Cleanup: NO

Sample Amount: 26.1 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 19.1%
pH: 8.3

CAS Number	Analyte	RL	Result
108-95-2	Phenol	19	< 19 U
541-73-1	1,3-Dichlorobenzene	19	< 19 U
106-46-7	1,4-Dichlorobenzene	19	< 19 U
100-51-6	Benzyl Alcohol	19	< 19 U
95-50-1	1,2-Dichlorobenzene	19	< 19 U
95-48-7	2-Methylphenol	19	< 19 U
106-44-5	4-Methylphenol	19	< 19 U
105-67-9	2,4-Dimethylphenol	19	< 19 U
65-85-0	Benzoic Acid	190	< 190 U
120-82-1	1,2,4-Trichlorobenzene	19	< 19 U
91-20-3	Naphthalene	19	< 19 U
87-68-3	Hexachlorobutadiene	19	< 19 U
91-57-6	**2-Methylnaphthalene**	**19**	**32**
131-11-3	Dimethylphthalate	19	< 19 U
208-96-8	Acenaphthylene	19	< 19 U
83-32-9	Acenaphthene	19	< 19 U
132-64-9	**Dibenzofuran**	**19**	**22**
84-66-2	Diethylphthalate	19	< 19 U
86-73-7	Fluorene	19	< 19 U
86-30-6	N-Nitrosodiphenylamine	19	< 19 U
118-74-1	Hexachlorobenzene	19	< 19 U
87-86-5	Pentachlorophenol	96	< 96 U
85-01-8	Phenanthrene	19	< 19 U
120-12-7	Anthracene	19	< 19 U
84-74-2	Di-n-Butylphthalate	19	< 19 U
206-44-0	**Fluoranthene**	**19**	**20**
129-00-0	**Pyrene**	**19**	**36**
85-68-7	Butylbenzylphthalate	19	< 19 U
56-55-3	Benzo(a)anthracene	19	< 19 U
117-81-7	**bis(2-Ethylhexyl)phthalate**	**19**	**26**
218-01-9	Chrysene	19	< 19 U
117-84-0	Di-n-Octyl phthalate	19	< 19 U
205-99-2	Benzo(b)fluoranthene	19	< 19 U
207-08-9	Benzo(k)fluoranthene	19	< 19 U
50-32-8	Benzo(a)pyrene	19	< 19 U
193-39-5	Indeno(1,2,3-cd)pyrene	19	< 19 U
53-70-3	Dibenz(a,h)anthracene	19	< 19 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-7
SAMPLE

Lab Sample ID: GF53A
LIMS ID: 04-406
Matrix: Soil
Date Analyzed: 01/19/04 10:48

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	19	< 19 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	62.9%	2-Fluorobiphenyl	65.8%
d14-p-Terphenyl	82.4%	d4-1,2-Dichlorobenzene	49.9%
d5-Phenol	62.7%	2-Fluorophenol	61.1%
2,4,6-Tribromophenol	88.9%	d4-2-Chlorophenol	62.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-11
SAMPLE

Lab Sample ID: GF53B
LIMS ID: 04-407
Matrix: Soil
Data Release Authorized:
Reported: 01/19/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Date Extracted: 01/16/04
Date Analyzed: 01/19/04 11:18
Instrument/Analyst: NT6/Van
GPC Cleanup: NO

Sample Amount: 26.7 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 14.4%
pH: 7.7

CAS Number	Analyte	RL	Result
108-95-2	Phenol	19	< 19 U
541-73-1	1,3-Dichlorobenzene	19	< 19 U
106-46-7	1,4-Dichlorobenzene	19	< 19 U
100-51-6	Benzyl Alcohol	19	< 19 U
95-50-1	1,2-Dichlorobenzene	19	< 19 U
95-48-7	2-Methylphenol	19	< 19 U
106-44-5	4-Methylphenol	19	< 19 U
105-67-9	2,4-Dimethylphenol	19	< 19 U
65-85-0	Benzoic Acid	190	< 190 U
120-82-1	1,2,4-Trichlorobenzene	19	< 19 U
91-20-3	Naphthalene	19	< 19 U
87-68-3	Hexachlorobutadiene	19	< 19 U
91-57-6	2-Methylnaphthalene	19	< 19 U
131-11-3	Dimethylphthalate	19	< 19 U
208-96-8	Acenaphthylene	19	< 19 U
83-32-9	Acenaphthene	19	< 19 U
132-64-9	Dibenzofuran	19	< 19 U
84-66-2	Diethylphthalate	19	< 19 U
86-73-7	Fluorene	19	< 19 U
86-30-6	N-Nitrosodiphenylamine	19	< 19 U
118-74-1	Hexachlorobenzene	19	< 19 U
87-86-5	Pentachlorophenol	94	< 94 U
85-01-8	Phenanthrene	19	< 19 U
120-12-7	Anthracene	19	< 19 U
84-74-2	Di-n-Butylphthalate	19	< 19 U
206-44-0	Fluoranthene	19	< 19 U
129-00-0	Pyrene	19	< 19 U
85-68-7	Butylbenzylphthalate	19	< 19 U
56-55-3	Benzo(a)anthracene	19	< 19 U
117-81-7	bis(2-Ethylhexyl)phthalate	19	< 19 U
218-01-9	Chrysene	19	< 19 U
117-84-0	Di-n-Octyl phthalate	19	< 19 U
205-99-2	Benzo(b)fluoranthene	19	< 19 U
207-08-9	Benzo(k)fluoranthene	19	< 19 U
50-32-8	Benzo(a)pyrene	19	< 19 U
193-39-5	Indeno(1,2,3-cd)pyrene	19	< 19 U
53-70-3	Dibenz(a,h)anthracene	19	< 19 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-11
SAMPLE

Lab Sample ID: GF53B
LIMS ID: 04-407
Matrix: Soil
Date Analyzed: 01/19/04 11:18

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	19	< 19 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	64.2%	2-Fluorobiphenyl	66.4%
d14-p-Terphenyl	81.8%	d4-1,2-Dichlorobenzene	58.4%
d5-Phenol	62.7%	2-Fluorophenol	62.1%
2,4,6-Tribromophenol	84.3%	d4-2-Chlorophenol	63.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: MB-011604
METHOD BLANK

Lab Sample ID: MB-011604
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/19/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Date Extracted: 01/16/04
Date Analyzed: 01/19/04 12:33
Instrument/Analyst: NT2/Van
Alumina Cleanup: NO

Sample Amount: 5.00 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

CAS Number	Analyte	RL	Result
1461-22-9	Tributyl Tin Chloride	6.0	< 6.0 U

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	63.0%
Tripentyl Tin Chloride	84.6%

FORM I

ANALYTICAL RESOURCES INCORPORATED

SOIL TBT SURROGATE SUMMARY

Matrix: Soil

QC Report No: GF53
Project: Port of Bellingham
001 027.232

LIMS ID	Lab ID	Client ID	TPT	#	TPNT	#	TOT OUT
04-406MB	011604MB	Method Blank	63.0%		84.6%		0
04-406LCS	011604LCS	Lab Control	52.7%		74.0%		0
04-406	GF53A	SPM-7	61.3%		100%		0
04-407	GF53B	SPM-11	54.5%		74.0%		0

Control Limits	MB/LCS	Sample
(TPT) = Tripropyl Tin Chloride	(29-120)	(10-122)
(TPNT) = Tripentyl Tin Chloride	(16-108)	(10-104)

Column to be used to flag recovery values

* Values outside of required QC limits

D Surrogate Compound diluted out

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: LCS-011604
LAB CONTROL

Lab Sample ID: LCS-011604
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/19/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Date Extracted: 01/16/04
Date Analyzed: 01/19/04 12:50
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.00 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

Analyte	Lab Control	Spike Added	Recovery
Tributyl Tin Chloride	32.1	50.0	64.2%

TBT Surrogate Recovery	
Tripropyl Tin Chloride	52.7%
Tripentyl Tin Chloride	74.0%

Results reported in µg/kg

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: SPM-7
SAMPLE

Lab Sample ID: GF53A
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/19/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Date Extracted: 01/16/04
Date Analyzed: 01/19/04 13:06
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.68 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 19.1%
pH: 8.3

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**5.3**	**11**
	TBT as µg TBT ion	4.1	12

Reported in µg/kg (ppb)

TBT Surrogate Recovery	
Tripropyl Tin Chloride	61.3%
Tripentyl Tin Chloride	100%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-11
SAMPLE

Lab Sample ID: GF53B
LIMS ID: 04-407
Matrix: Soil
Data Release Authorized:
Reported: 01/19/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Date Extracted: 01/16/04
Date Analyzed: 01/19/04 13:23
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 6.03 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 14.4%
pH: 7.7

CAS Number	Analyte	RL	Result
1461-22-9	Tributyl Tin Chloride	5.0	< 5.0 U
	TBT as µg TBT ion	3.8	< 3.8 U

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	54.5%
Tripentyl Tin Chloride	74.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL GASOLINE RANGE HYDROCARBONS
NWTPHg Toluene to Naphthalene
Page 1 of 1
Matrix: Soil

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232

Data Release Authorized:
Reported: 01/20/04

ARI ID	Client ID	Analysis Date	Basis	Range	Result mg/kg
MB-011904 04-406	Method Blank	01/19/04	---	Gasoline HC ID Trifluorotoluene Bromobenzene	5.0 U --- 106% 104%
GF53A 04-406	SPM-7	01/19/04	Dry	Gasoline HC ID Trifluorotoluene Bromobenzene	6.2 U -- 75.8% 77.4%
GF53B 04-407	SPM-11	01/19/04	Dry	Gasoline HC ID Trifluorotoluene Bromobenzene	5.9 U -- 78.7% 77.8%

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

ANALYTICAL RESOURCES INCORPORATED

SOIL TPHg SYSTEM MONITORING COMPOUND SUMMARY

Matrix: Soil　　　　　　　　　　　　QC Report No: GF53

LIMS ID	Lab ID	Client ID	TFT	BB	TOT OUT
04-406MB	011904MBS	Method Blank	106%	104%	0
04-406LC	011904LCS	Lab Control	129%*	117%	1
04-406LCD	011904LCDS	LCDuplicate	158%*	116%	1
04-406	GF53A	SPM-7	76%	77%	0
04-407	GF53B	SPM-11	79%	78%	0

		MB/LCS QC LIMITS	SAMPLE QC LIMITS
(TFT) = Trifluorotoluene	158 129	(74-127)	(61-132)
(BB) = Bromobenzene		(74-123)	(52-141)

Limits Updated - 07/01/02

\# Column to be used to flag recovery values

D System Monitoring Compound diluted out

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHg - Toluene to Naphthalene

Sample ID: LCS-011904
LCS/LCSD

Lab Sample ID: LCS-011904
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: PID1/PKC
LCSD: PID1/PKC
Date Analyzed LCS: 01/19/04 15:40
LCSD: 01/19/04 16:09

Sample Amount LCS: 0.10 g
LCSD: 0.10 g

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Gasoline Range Hydrocarbons	118	125	94.4%	166	125	133%	33.8%

Results reported in mg/kg (ppm).
RPD calculated using sample concentrations per SW846.

Gasoline Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	129%	158%
Bromobenzene	117%	116%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned
Page 1 of 1
Matrix: Soil

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232

Data Release Authorized:
Reported: 01/20/04

ARI ID	Sample ID	Extraction Date	Analysis Date	DL	Range	Result mg/kg
MB-011604 04-406	Method Blank	01/16/04	01/20/04	1.0	Diesel	< 5.0 U
					Motor Oil	< 10 U
					HC ID	---
					o-Terphenyl	80.9%
GF53A 04-406	SPM-7	01/16/04	01/20/04	1.0	**Diesel**	**23**
					Motor Oil	**50**
					HC ID	DRO/RRO
					o-Terphenyl	83.3%
GF53B 04-407	SPM-11	01/16/04	01/20/04	1.0	Diesel	< 5.0 U
					Motor Oil	< 10 U
					HC ID	---
					o-Terphenyl	82.7%

Diesel quantitation on total peaks in the range from C12 to C24.
Motor Oil quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

ANALYTICAL RESOURCES INCORPORATED

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232

Client ID	O-TER	TOT OUT
MB-011604	80.9%	0
LCS-011604	92.2%	0
SPM-7	83.3%	0
SPM-11	82.7%	0

	LCS/MB LIMITS	QC LIMITS
(O-TER) = o-Terphenyl	(45-136)	(30-120)

Prep Method: SW3550B
Log Number Range: 04-406 to 04-407

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned

Sample ID: LCS-011604
LAB CONTROL

Lab Sample ID: LCS-011604
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Date Extracted: 01/16/04
Date Analyzed: 01/20/04 01:18
Instrument/Analyst: FID/LJR

Sample Amount: 10.0 g
Final Extract Volume: 1.0 mL
Dilution Factor: 1.0

Range	Lab Control	Spike Added	Recovery
Diesel	110	150	73.3%

TPHD Surrogate Recovery	
o-Terphenyl	92.2%

Results reported in mg/kg

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: GF53
Matrix: Soil
Project: Port of Bellingham
Date Received: 01/16/04
001 027.232

ARI ID	Client ID	Client Amt	Final Vol	Basis	Prep Date
04-406-011604MB1	Method Blank	10.0 g	1.00 mL	-	01/16/04
04-406-011604LCS1	Lab Control	10.0 g	1.00 mL	-	01/16/04
04-406-GF53A	SPM-7	8.09 g	1.00 mL	D	01/16/04
04-407-GF53B	SPM-11	8.57 g	1.00 mL	D	01/16/04

Basis: D=Dry Weight W=As Received

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ANALYTICAL RESOURCES INCORPORATED

ARI Job: GF53
Matrix: Soil
Project: Port of Bellingham
Date Received: 01/16/04
001 027.232

ARI ID	Client ID	Client Amt	Final Vol	Basis	Prep Date
04-406-011604MB1	Method Blank	10.0 g	1.00 mL	-	01/16/04
04-406-011604LCS1	Lab Control	10.0 g	1.00 mL	-	01/16/04
04-406-GF53A	SPM-7	8.09 g	1.00 mL	D	01/16/04
04-407-GF53B	SPM-11	8.57 g	1.00 mL	D	01/16/04

Basis: D=Dry Weight W=As Received

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: METHOD BLANK

Lab Sample ID: GF53MB
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: NA
Date Received: NA

Percent Total Solids: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/16/04	6010B	01/19/04	7440-38-2	Arsenic	5	5	U
3050B	01/16/04	6010B	01/19/04	7440-43-9	Cadmium	0.2	0.2	U
3050B	01/16/04	6010B	01/19/04	7440-47-3	Chromium	0.5	0.5	U
3050B	01/16/04	6010B	01/19/04	7440-50-8	Copper	0.2	0.2	U
3050B	01/16/04	6010B	01/19/04	7439-92-1	Lead	2	2	U
CLP	01/16/04	7471A	01/20/04	7439-97-6	Mercury	0.05	0.05	U
3050B	01/16/04	6010B	01/19/04	7440-22-4	Silver	0.3	0.3	U
3050B	01/16/04	6010B	01/19/04	7440-66-6	Zinc	0.6	0.6	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: STD REFERENCE
ERA D034

Lab Sample ID: GF53SRM
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: NA
Date Received: NA

Analyte	Analysis Method	Analysis Date	mg/kg-dry	Certified Value	Advisory Range
Arsenic	6010B	01/19/04	202	197	156-238
Cadmium	6010B	01/19/04	74.2	69.1	55.6-82.6
Chromium	6010B	01/19/04	80.8	82.6	63.8-101
Copper	6010B	01/19/04	140	127	102-152
Lead	6010B	01/19/04	97	95	73-117
Mercury	7471A	01/20/04	9.8	9.4	6.2-12.6
Silver	6010B	01/19/04	175	141	63.4-219
Zinc	6010B	01/19/04	275	275	211-337

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-7
Gate 2 Marine Railway

Lab Sample ID: GF53A
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Percent Total Solids: 81.4%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/16/04	6010B	01/19/04	7440-38-2	Arsenic	6	6	U
3050B	01/16/04	6010B	01/19/04	7440-43-9	Cadmium	0.2	0.2	U
3050B	01/16/04	6010B	01/19/04	7440-47-3	Chromium	0.6	23.5	
3050B	01/16/04	6010B	01/19/04	7440-50-8	Copper	0.2	84.3	
3050B	01/16/04	6010B	01/19/04	7439-92-1	Lead	2	7	
CLP	01/16/04	7471A	01/20/04	7439-97-6	Mercury	0.05	0.13	
3050B	01/16/04	6010B	01/19/04	7440-22-4	Silver	0.4	0.4	U
3050B	01/16/04	6010B	01/19/04	7440-66-6	Zinc	0.7	89.2	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-11
Gate 2 Marine Railway

Lab Sample ID: GF53B
LIMS ID: 04-407
Matrix: Soil
Data Release Authorized:
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Percent Total Solids: 85.6%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/16/04	6010B	01/19/04	7440-38-2	Arsenic	5	5	U
3050B	01/16/04	6010B	01/19/04	7440-43-9	Cadmium	0.2	0.2	U
3050B	01/16/04	6010B	01/19/04	7440-47-3	Chromium	0.5	19.5	
3050B	01/16/04	6010B	01/19/04	7440-50-8	Copper	0.2	17.3	
3050B	01/16/04	6010B	01/19/04	7439-92-1	Lead	2	7	
CLP	01/16/04	7471A	01/20/04	7439-97-6	Mercury	0.05	0.05	
3050B	01/16/04	6010B	01/19/04	7440-22-4	Silver	0.3	0.3	U
3050B	01/16/04	6010B	01/19/04	7440-66-6	Zinc	0.6	123	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: MB-GF53
METHOD BLANK

Lab Sample ID: MB-GF53
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: NA
Date Received: NA

METHOD BLANK RESULTS
CONVENTIONALS

Analyte	Analysis Date	Method	RL	Units	Result	
Total Solids	01/19/04	EPA 160.3 SM 2540 B	0.01	Percent	< 0.01	U
Total Organic Carbon	01/19/04	Plumb,1981	0.020	Percent	< 0.020	U

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: MS/MSD-GF53
MATRIX SPIKE

Lab Sample ID: MS-GF53
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized: [signature]
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Received: 01/16/04

MATRIX SPIKE RESULTS
CONVENTIONALS

Analyte	Method	Units	Sample	Spike	MS/ MSD	REC
ARI ID: 04-406, GF53A	**Client Sample ID: SPM-7**					
Total Organic Carbon	Plumb,1981	Percent	17.2	17.9	35.7	103%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: DUP-GF53
DUPLICATE

Lab Sample ID: DUP-GF53
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized: [signature]
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Received: 01/16/04

DUPLICATE RESULTS
CONVENTIONALS

Analyte	Method	Units	Sample	Replicate	RPD/RSD
ARI ID: 04-406, GF53A	**Client Sample ID: SPM-7**				
Total Solids	EPA 160.3 SM 2540 B	Percent	80.2	79.9 77.7	1.7%
Total Organic Carbon	Plumb,1981	Percent	17	24 16	22.9%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SRM-GF53
STANDARD REFERENCE

Lab Sample ID: SRM-GF53
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized:
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: NA
Date Received: NA

STANDARD REFERENCE RESULTS
CONVENTIONALS

Analyte	Analysis Date & Batch	Method	Units	SRM	True	REC
NIST #8704						
Total Carbon	01/19/04 011904#1	Plumb,1981	Percent	3.48	3.35	104%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-7
Gate 2 Marine Railway

Lab Sample ID: GF53A
LIMS ID: 04-406
Matrix: Soil
Data Release Authorized: [signature]
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/19/04 011904#1	EPA 160.3 SM 2540 B		0.01	Percent	80.2
Total Organic Carbon	01/19/04 011904#1	Plumb,1981	10	0.20	Percent	17

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-11
Gate 2 Marine Railway

Lab Sample ID: GF53B
LIMS ID: 04-407
Matrix: Soil
Data Release Authorized: [signature]
Reported: 01/20/04

QC Report No: GF53-Landau Associates, Inc.
Project: Port of Bellingham
001 027.232
Date Sampled: 01/15/04
Date Received: 01/16/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/19/04 011904#1	EPA 160.3 SM 2540 B		0.01	Percent	85.7
Total Organic Carbon	01/19/04 011904#1	Plumb,1981		0.020	Percent	5.7

RL Analytical reporting limit
U Undetected at reported detection limit

Analytical Resources, Incorporated
Analytical Chemists and Consultants

4 February 2004

Dave Pischer
Landau Associates, Inc.
130 Second Avenue South
Edmonds WA 98020-9129

RE: Project: Port of Bellingham 001 027.232
ARI Job No: GG43

Dear Dave:

Please find enclosed the original chain of custody (COC) and analytical results for the above referenced project. Analytical Resources, Inc. (ARI) accepted ten sediment samples on January 29, 2004. ARI received the samples in good condition. There were no discrepancies between the COC and the sample containers' labels.

The samples were analyzed for SMS semivolatiles, tributyl tin, total metals referencing US EPA methods 6010B and 7470A, and TOC.

A matrix spike and matrix spike duplicate (MS/MSD) was performed on sample **SPM-3** for the TBT analysis. The native level of TBT in the sample was significantly higher than the level of the spike. When this is the case, the analytical spike tends to get lost within the analytical variability associated with the sample, preventing meaningful information. The relative percent difference (RPD) for the MS/MSD was good as well as recovery in the laboratory control sample (LCS). Sample heterogeneity is most likely the cause of the high spike recoveries.

In the undiluted analyses of the samples for semivolatiles, the d12-perylene internal standard showed areas below the QC limit in samples SPM-3, SPM-4, and SPM-5. All internal standards were in control in the dilutions of these samples. Recoveries of the 2-fluorobiphenyl surrogate were above the control limit in the LCS and in the undiluted analyses of samples SPM-1, SPM-2, SPM-4, SPM-5, SPM-6, and SPM-8. No corrective action is required for one surrogate outside the QC limits. All surrogate recoveries were in control in the dilutions.

An MS/MSD was performed on sample SPM-3 for the semivolatiles analysis. The same issue with native concentrations relative to spike levels was present for acenaphthene and pyrene, which showed recoveries and/or RPDs outside the control limits. Good recoveries and RPDs were obtained for the analytes not present in the sample. Spike recoveries in the LCS were also good.

4611 South 134th Place, Suite 100 • Tukwila WA 98168 • **206-695-6200** • **206-695-6201** fax

Landau Associates, Inc.
Client Project: Port of Bellingham gate 2-Marine Railway Well TPs / 001 027.232
ARI Job No: GF53
Page 2

A matrix spike and sample duplicate were performed on sample SPM-1 for the total metals analysis. Recovery of mercury in the MS was above the QC limit. The client was notified regarding this issue and determined that no corrective action was necessary.

No further analytical complications were noted. A copy of this report and all associated raw data will remain on file with ARI. If you have any questions or require additional information, please feel free to contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.

Mary Lou Fox

Mary Lou Fox
Project Manager
(206) 695-6211
marylou@arilabs.com

MLF/mlf
enclosure
cc: GG43

GG43

9.2°C

☒ Seattle (Edmonds) (425) 778-0907
☐ Tacoma (253) 926-2493
☐ Spokane (509) 327-9737
☐ Portland (Lake Oswego) (503) 443-6010
☐

Landau Associates

Chain-of-Custody Record

Date 1/29/04
Page 1 of 1

Project Name
Project No. 001027.232
Project Location/Event Port of Bellingham
Sampler's Name Ken Reid / Erik Gerking
Project Contact Stacy Pischer
Send Results To Stacy Pischer

Testing Parameters

Turnaround Time
☐ Standard
☒ Accelerated
☐ 48hr

Sample I.D.	Date	Time	Matrix	No. of Containers	TBT	SVOC	Metals (Total)	TOC								Observations/Comments
SPM-1	1/28/04	1420	Sed.	3	X	X	X	X								
SPM-2	↓	1350	↓	↓	↓	↓	↓	↓								
SPM-3	↓	1100	↓	↓	↓	↓	↓	↓								
SPM-4	↓	1300	↓	↓	↓	↓	↓	↓								
SPM-5	↓	1330	↓	↓	↓	↓	↓	↓								
SPM-6	↓	1115	↓	↓	↓	↓	↓	↓								
SPM-8	↓	1445	↓	↓	↓	↓	↓	↓								
SPM-9	↓	1145	↓	↓	↓	↓	↓	↓								
SPM-10	↓	1155	↓	↓	↓	↓	↓	↓								
SPM-12	↓	1510	↓	↓	↓	↓	↓	↓								

Special Shipment/Handling or Storage Requirements

Method of Shipment

Relinquished by	Received by	Relinquished by	Received by
Signature: Erik R. Gerking (signed)	Signature: (signed)	Signature	Signature
Printed Name: Erik R. Gerking	Printed Name: BRIAN KEGEL	Printed Name	Printed Name
Company: LAI	Company: ARI	Company	Company
Date 1/29/04 Time 0830	Date 1/29/04 Time 0830	Date Time	Date Time

WHITE COPY - Project File YELLOW COPY - Laboratory PINK COPY - Client Representative

Rev 4/01

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: MB-012904
METHOD BLANK

Lab Sample ID: MB-012904
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 13:54
Instrument/Analyst: NT2/Van
Alumina Cleanup: NO

Sample Amount: 5.00 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

CAS Number	Analyte	RL	Result
1461-22-9	Tributyl Tin Chloride	6.0	< 6.0 U

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	68.1%
Tripentyl Tin Chloride	72.2%

ANALYTICAL RESOURCES INCORPORATED

SOIL TBT SURROGATE SUMMARY

Matrix: Sediment

QC Report No: GG43
Project: Port of Bellingham
001027.232

LIMS ID	Lab ID	Client ID	TPT #	TPNT #	TOT OUT
04-978MB	012904MB	Method Blank	68.1%	72.2%	0
04-978LCS	012904LCS	Lab Control	68.1%	66.9%	0
04-978	GG43A	SPM-1	59.6%	58.1%	0
04-979	GG43B	SPM-2	57.9%	59.9%	0
04-980	GG43C	SPM-3	52.7%	58.1%	0
04-980MS	GG43C	SPM-3	45.9%	49.3%	0
04-980MSD	GG43C	SPM-3	51.0%	47.6%	0
04-981	GG43D	SPM-4	51.0%	56.4%	0
04-982	GG43E	SPM-5	47.6%	49.3%	0
04-982DL	GG43E	SPM-5	47.6%	52.7%	0
04-983	GG43F	SPM-6	49.3%	56.4%	0
04-984	GG43G	SPM-8	52.7%	52.9%	0
04-985	GG43H	SPM-9	54.5%	54.6%	0
04-986	GG43I	SPM-10	51.0%	54.6%	0
04-987	GG43J	SPM-12	49.3%	59.9%	0

Control Limits	MB/LCS	Sample
(TPT) = Tripropyl Tin Chloride	(29-120)	(10-122)
(TPNT) = Tripentyl Tin Chloride	(16-108)	(10-104)

Column to be used to flag recovery values

* Values outside of required QC limits

D Surrogate Compound diluted out

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: SPM-3
MATRIX SPIKE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 15:16
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.36 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 24.0%
pH: 7.7

CAS Number	Analyte	RL	Result
1461-22-9	Tributyl Tin Chloride	5.6	---

Reported in µg/kg (ppb)

TBT Surrogate Recovery	
Tripropyl Tin Chloride	45.9%
Tripentyl Tin Chloride	49.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-3
MATRIX SPIKE DUPLICATE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 15:33
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.34 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 24.0%
pH: 7.7

CAS Number	Analyte	RL	Result
1461-22-9	Tributyl Tin Chloride	5.6	---

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	51.0%
Tripentyl Tin Chloride	47.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-3
MS/MSD

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted MS/MSD: 01/29/04

Date Analyzed MS: 01/31/04 15:16
MSD: 01/31/04 15:33
Instrument/Analyst MS: NT2/Van
MSD: NT2/Van
Alumina Cleanup: YES

Sample Amount MS: 5.36 g-dry-wt
MSD: 5.34 g-dry-wt
Final Extract Volume MS: 0.5 mL
MSD: 0.5 mL
Dilution Factor MS: 1.00
MSD: 1.00
Percent Moisture: 24.0%
pH: 7.7

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Tributyl Tin Chloride	161	250	46.6	191%	290	46.8	276%	14.8%

Results reported in µg/kg
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: LCS-012904
LAB CONTROL

Lab Sample ID: LCS-012904
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 14:11
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.00 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

Analyte	**Lab Control**	**Spike Added**	**Recovery**
Tributyl Tin Chloride	36.4	50.0	72.8%

TBT Surrogate Recovery	
Tripropyl Tin Chloride	68.1%
Tripentyl Tin Chloride	66.9%

Results reported in µg/kg

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-1
SAMPLE

Lab Sample ID: GG43A
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 14:27
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 4.72 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 53.0%
pH: 7.6

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**6.4**	**39**
	TBT as Tin ion	5.7	34

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	59.6%
Tripentyl Tin Chloride	58.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-2
SAMPLE

Lab Sample ID: GG43B
LIMS ID: 04-979
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 14:44
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 4.69 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 53.3%
pH: 7.8

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**6.4**	**27**
	TBT as Tin ion	5.7	24

Reported in µg/kg (ppb)

TBT Surrogate Recovery	
Tripropyl Tin Chloride	57.9%
Tripentyl Tin Chloride	59.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: SPM-3
SAMPLE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 15:00
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.34 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 24.0%
pH: 7.7

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**5.6**	**160**
	TBT as Tin ion	5.0	140

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	52.7%
Tripentyl Tin Chloride	58.1%

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: SPM-4
SAMPLE

Lab Sample ID: GG43D
LIMS ID: 04-981
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 15:49
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.15 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 53.3%
pH: 7.8

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**5.8**	**68**
	TBT as Tin ion	5.2	61

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	51.0%
Tripentyl Tin Chloride	56.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-5
SAMPLE

Lab Sample ID: GG43E
LIMS ID: 04-982
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 16:06
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.39 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 40.4%
pH: 7.5

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**5.6**	**330 E**
	TBT as Tin ion	5.0	290 E

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	47.6%
Tripentyl Tin Chloride	49.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-5
DILUTION

Lab Sample ID: GG43E
LIMS ID: 04-982
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 17:45
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.39 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 5.00
Percent Moisture: 40.4%
pH: 7.5

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**28**	**290**
	TBT as Tin ion	25	260

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	47.6%
Tripentyl Tin Chloride	52.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-6
SAMPLE

Lab Sample ID: GG43F
LIMS ID: 04-983
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 16:22
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.27 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 41.8%
pH: 7.7

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**5.7**	**77**
	TBT as Tin ion	5.1	69

Reported in µg/kg (ppb)

TBT Surrogate Recovery	
Tripropyl Tin Chloride	49.3%
Tripentyl Tin Chloride	56.4%

FORM I

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-8
SAMPLE

Lab Sample ID: GG43G
LIMS ID: 04-984
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 16:39
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.53 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 38.8%
pH: 8.2

CAS Number	Analyte	RL	Result
1461-22-9	Tributyl Tin Chloride	5.4	20
	TBT as Tin ion	4.8	18

Reported in µg/kg (ppb)

TBT Surrogate Recovery	
Tripropyl Tin Chloride	52.7%
Tripentyl Tin Chloride	52.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-9
SAMPLE

Lab Sample ID: GG43H
LIMS ID: 04-985
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 16:55
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.23 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 52.5%
pH: 7.4

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**5.7**	**28**
	TBT as Tin ion	5.1	25

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	54.5%
Tripentyl Tin Chloride	54.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS

Sample ID: SPM-10
SAMPLE

Lab Sample ID: GG43I
LIMS ID: 04-986
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 17:12
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.31 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 51.8%
pH: 7.5

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**5.6**	**7.4**
	TBT as Tin ion	5.0	6.5

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	51.0%
Tripentyl Tin Chloride	54.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TBT by Selected Ion Monitoring GC/MS
Page 1 of 1

Sample ID: SPM-12
SAMPLE

Lab Sample ID: GG43J
LIMS ID: 04-987
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/29/04
Date Analyzed: 01/31/04 17:28
Instrument/Analyst: NT2/Van
Alumina Cleanup: YES

Sample Amount: 5.38 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 51.3%
pH: 7.7

CAS Number	Analyte	RL	Result
1461-22-9	**Tributyl Tin Chloride**	**5.6**	**14**
	TBT as Tin ion	5.0	12

Reported in µg/kg (ppb)

TBT Surrogate Recovery

Tripropyl Tin Chloride	49.3%
Tripentyl Tin Chloride	59.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: MB-013004
METHOD BLANK

Lab Sample ID: MB-013004
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 12:48
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	Naphthalene	20	< 20 U
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	2-Methylnaphthalene	20	< 20 U
131-11-3	Dimethylphthalate	20	< 20 U
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	Acenaphthene	20	< 20 U
132-64-9	Dibenzofuran	20	< 20 U
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	Fluorene	20	< 20 U
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	100	< 100 U
85-01-8	Phenanthrene	20	< 20 U
120-12-7	Anthracene	20	< 20 U
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	Fluoranthene	20	< 20 U
129-00-0	Pyrene	20	< 20 U
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	Benzo(a)anthracene	20	< 20 U
117-81-7	bis(2-Ethylhexyl)phthalate	20	< 20 U
218-01-9	Chrysene	20	< 20 U
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	Benzo(b)fluoranthene	20	< 20 U
207-08-9	Benzo(k)fluoranthene	20	< 20 U
50-32-8	Benzo(a)pyrene	20	< 20 U
193-39-5	Indeno(1,2,3-cd)pyrene	20	< 20 U
53-70-3	Dibenz(a,h)anthracene	20	< 20 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: MB-013004
METHOD BLANK

Lab Sample ID: MB-013004
LIMS ID: 04-978
Matrix: Sediment
Date Analyzed: 02/02/04 12:48

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	20	< 20 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	75.8%	2-Fluorobiphenyl	79.2%
d14-p-Terphenyl	105%	d4-1,2-Dichlorobenzene	72.0%
d5-Phenol	85.6%	2-Fluorophenol	91.1%
2,4,6-Tribromophenol	78.6%	d4-2-Chlorophenol	74.1%

ANALYTICAL RESOURCES INCORPORATED

SW8270 SURROGATE RECOVERY SUMMARY

Matrix: Sediment

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

Client ID	NBZ	FBP	TPH	DCB	PHL	2FP	TBP	2CP	TOT OUT
MB-013004	75.8%	79.2%	105%	72.0%	85.6%	91.1%	78.6%	74.1%	0
LCS-013004	67.5%	71.9%	96.0%	63.1%	77.6%	106%*	75.8%	69.0%	1
SPM-1	76.5%	81.0%	106%	69.0%	86.5%	137%*	104%	80.8%	1
SPM-1 DL	75.8%	80.4%	92.4%	66.6%	83.9%	85.1%	99.6%	75.2%	0
SPM-2	71.1%	70.8%	79.9%	56.6%	83.6%	116%*	88.0%	77.4%	1
SPM-2 DL	66.0%	65.4%	67.6%	53.6%	78.0%	78.4%	79.7%	69.1%	0
SPM-3	57.3%	60.5%	82.9%	53.0%	66.5%	76.6%	73.8%	60.7%	0
SPM-3 DL	56.4%	61.2%	68.0%	52.8%	59.2%	60.5%	69.3%	57.3%	0
SPM-3 MS	78.8%	83.6%	85.6%	67.6%	83.2%	85.6%	88.8%	79.5%	0
SPM-3 MSD	82.0%	86.4%	90.8%	74.8%	89.9%	92.3%	91.2%	85.3%	0
SPM-4	72.9%	74.4%	95.8%	61.1%	83.3%	129%*	91.4%	77.4%	1
SPM-4 DL	73.6%	75.2%	79.6%	59.4%	83.2%	83.7%	92.3%	75.6%	0
SPM-5	71.9%	72.0%	105%	55.1%	85.5%	144%*	89.6%	78.4%	1
SPM-5 DL	71.2%	75.2%	77.6%	55.6%	83.7%	79.2%	87.7%	75.5%	0
SPM-6	79.7%	84.8%	89.0%	69.9%	91.4%	156%*	101%	83.5%	1
SPM-6 DL	75.8%	79.4%	86.8%	66.2%	83.3%	85.1%	92.7%	77.5%	0
SPM-8	73.7%	77.1%	86.7%	58.3%	86.1%	141%*	100%	80.4%	1
SPM-9	75.4%	81.1%	93.3%	64.8%	85.7%	105%	99.9%	79.6%	0
SPM-9 DL	77.2%	80.8%	94.4%	64.6%	87.4%	87.9%	98.8%	78.8%	0
SPM-10	68.3%	73.0%	93.6%	52.0%	83.0%	89.6%	93.8%	73.7%	0
SPM-12	70.3%	74.9%	87.7%	51.4%	82.9%	97.4%	98.5%	76.2%	0
SPM-12 DL	69.0%	72.0%	88.0%	52.2%	81.6%	79.2%	91.3%	72.1%	0

	LCS/MB LIMITS	QC LIMITS
(NBZ) = d5-Nitrobenzene	(39-93)	(28-103)
(FBP) = 2-Fluorobiphenyl	(40-95)	(33-104)
(TPH) = d14-p-Terphenyl	(46-116)	(31-120)
(DCB) = d4-1,2-Dichlorobenzene	(41-86)	(30-84)
(PHL) = d5-Phenol	(45-91)	(29-109)
(2FP) = 2-Fluorophenol	(36-100)	(24-112)
(TBP) = 2,4,6-Tribromophenol	(34-110)	(27-134)
(2CP) = d4-2-Chlorophenol	(46-89)	(34-101)

Prep Method: SW3550B
Log Number Range: 04-978 to 04-987

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-3
MATRIX SPIKE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/03/04 11:27
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.7 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 10.0
Percent Moisture: 24.0%
pH: 7.7

CAS Number	Analyte	RL	Result
108-95-2	Phenol	190	---
541-73-1	1,3-Dichlorobenzene	190	< 190 U
106-46-7	1,4-Dichlorobenzene	190	---
100-51-6	Benzyl Alcohol	190	< 190 U
95-50-1	1,2-Dichlorobenzene	190	< 190 U
95-48-7	2-Methylphenol	190	< 190 U
106-44-5	4-Methylphenol	190	< 190 U
105-67-9	2,4-Dimethylphenol	190	< 190 U
65-85-0	Benzoic Acid	1900	< 1,900 U
120-82-1	1,2,4-Trichlorobenzene	190	---
91-20-3	**Naphthalene**	**190**	**4,600**
87-68-3	Hexachlorobutadiene	190	< 190 U
91-57-6	**2-Methylnaphthalene**	**190**	**2,100**
131-11-3	Dimethylphthalate	190	< 190 U
208-96-8	Acenaphthylene	190	< 190 U
83-32-9	Acenaphthene	190	---
132-64-9	**Dibenzofuran**	**190**	**1,600**
84-66-2	Diethylphthalate	190	< 190 U
86-73-7	**Fluorene**	**190**	**1,800**
86-30-6	N-Nitrosodiphenylamine	190	< 190 U
118-74-1	Hexachlorobenzene	190	< 190 U
87-86-5	Pentachlorophenol	970	---
85-01-8	**Phenanthrene**	**190**	**6,300**
120-12-7	**Anthracene**	**190**	**2,500**
84-74-2	Di-n-Butylphthalate	190	< 190 U
206-44-0	**Fluoranthene**	**190**	**22,000 E**
129-00-0	Pyrene	190	---
85-68-7	Butylbenzylphthalate	190	< 190 U
56-55-3	**Benzo(a)anthracene**	**190**	**5,500**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**190**	**470**
218-01-9	**Chrysene**	**190**	**8,700**
117-84-0	Di-n-Octyl phthalate	190	< 190 U
205-99-2	**Benzo(b)fluoranthene**	**190**	**2,900**
207-08-9	**Benzo(k)fluoranthene**	**190**	**2,300**
50-32-8	**Benzo(a)pyrene**	**190**	**1,700**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**190**	**750**
53-70-3	Dibenz(a,h)anthracene	190	< 190 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-3
MATRIX SPIKE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Date Analyzed: 02/03/04 11:27

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	190	550

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	78.8%	2-Fluorobiphenyl	83.6%
d14-p-Terphenyl	85.6%	d4-1,2-Dichlorobenzene	67.6%
d5-Phenol	83.2%	2-Fluorophenol	85.6%
2,4,6-Tribromophenol	88.8%	d4-2-Chlorophenol	79.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-3
MATRIX SPIKE DUPLICATE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized:
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/03/04 12:04
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.8 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 10.0
Percent Moisture: 24.0%
pH: 7.7

CAS Number	Analyte	RL	Result
108-95-2	Phenol	190	---
541-73-1	1,3-Dichlorobenzene	190	< 190 U
106-46-7	1,4-Dichlorobenzene	190	---
100-51-6	Benzyl Alcohol	190	< 190 U
95-50-1	1,2-Dichlorobenzene	190	< 190 U
95-48-7	2-Methylphenol	190	< 190 U
106-44-5	4-Methylphenol	190	< 190 U
105-67-9	2,4-Dimethylphenol	190	< 190 U
65-85-0	Benzoic Acid	1900	< 1,900 U
120-82-1	1,2,4-Trichlorobenzene	190	---
91-20-3	**Naphthalene**	**190**	**4,100**
87-68-3	Hexachlorobutadiene	190	< 190 U
91-57-6	**2-Methylnaphthalene**	**190**	**1,700**
131-11-3	Dimethylphthalate	190	< 190 U
208-96-8	Acenaphthylene	190	< 190 U
83-32-9	Acenaphthene	190	---
132-64-9	**Dibenzofuran**	**190**	**1,300**
84-66-2	Diethylphthalate	190	< 190 U
86-73-7	**Fluorene**	**190**	**1,500**
86-30-6	N-Nitrosodiphenylamine	190	< 190 U
118-74-1	Hexachlorobenzene	190	< 190 U
87-86-5	Pentachlorophenol	970	---
85-01-8	**Phenanthrene**	**190**	**5,000**
120-12-7	**Anthracene**	**190**	**660**
84-74-2	Di-n-Butylphthalate	190	< 190 U
206-44-0	**Fluoranthene**	**190**	**3,700**
129-00-0	Pyrene	190	---
85-68-7	Butylbenzylphthalate	190	< 190 U
56-55-3	**Benzo(a)anthracene**	**190**	**810**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**190**	**690**
218-01-9	**Chrysene**	**190**	**940**
117-84-0	Di-n-Octyl phthalate	190	< 190 U
205-99-2	**Benzo(b)fluoranthene**	**190**	**810**
207-08-9	**Benzo(k)fluoranthene**	**190**	**610**
50-32-8	**Benzo(a)pyrene**	**190**	**500**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**190**	**260**
53-70-3	Dibenz(a,h)anthracene	190	< 190 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-3
MATRIX SPIKE DUPLICATE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Date Analyzed: 02/03/04 12:04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	190	210

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	82.0%	2-Fluorobiphenyl	86.4%
d14-p-Terphenyl	90.8%	d4-1,2-Dichlorobenzene	74.8%
d5-Phenol	89.9%	2-Fluorophenol	92.3%
2,4,6-Tribromophenol	91.2%	d4-2-Chlorophenol	85.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-3
MS/MSD

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted MS/MSD: 01/30/04

Date Analyzed MS: 02/03/04 11:27
MSD: 02/03/04 12:04
Instrument/Analyst MS: NT4/LJR
MSD: NT4/LJR
GPC Cleanup: NO

Sample Amount MS: 25.7 g-dry-wt
MSD: 25.8 g-dry-wt
Final Extract Volume MS: 0.5 mL
MSD: 0.5 mL
Dilution Factor MS: 10.0
MSD: 10.0
Percent Moisture: 24.0%
pH: 7.7

Analyte	Sample	MS	Spike Added-MS	MS Recovery	MSD	Spike Added-MSD	MSD Recovery	RPD
Phenol	< 19.4	610	729	83.7%	612	728	84.1%	0.3%
1,4-Dichlorobenzene	< 19.4	338	486	69.5%	351	485	72.4%	3.8%
1,2,4-Trichlorobenzene	< 19.4	373	486	76.7%	381	485	78.6%	2.1%
Acenaphthene	2210	2990	486	160%	2450	485	49.5%	19.9%
Pentachlorophenol	< 97.0	686	729	94.1%	641	728	88.0%	6.8%
Pyrene	1330	11000	486	1990%	2910	485	326%	116%

Results reported in µg/kg
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: LCS-013004
LAB CONTROL

Lab Sample ID: LCS-013004
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 13:25
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.0 g
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: NA
pH: NA

Analyte	Lab Control	Spike Added	Recovery
Phenol	541	750	72.1%
1,4-Dichlorobenzene	288	500	57.6%
1,2,4-Trichlorobenzene	312	500	62.4%
Acenaphthene	331	500	66.2%
Pentachlorophenol	738	750	98.4%
Pyrene	310	500	62.0%

Semivolatile Surrogate Recovery	
d5-Nitrobenzene	67.5%
2-Fluorobiphenyl	71.9%
d14-p-Terphenyl	96.0%
d4-1,2-Dichlorobenzene	63.1%
d5-Phenol	77.6%
2-Fluorophenol	106%
2,4,6-Tribromophenol	75.8%
d4-2-Chlorophenol	69.0%

Results reported in µg/kg

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-1
SAMPLE

Lab Sample ID: GG43A
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 21:27
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.7 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 53.0%
pH: 7.6

CAS Number	Analyte	RL	Result
108-95-2	Phenol	19	< 19 U
541-73-1	1,3-Dichlorobenzene	19	< 19 U
106-46-7	1,4-Dichlorobenzene	19	< 19 U
100-51-6	Benzyl Alcohol	19	< 19 U
95-50-1	1,2-Dichlorobenzene	19	< 19 U
95-48-7	2-Methylphenol	19	< 19 U
106-44-5	**4-Methylphenol**	**19**	**24**
105-67-9	2,4-Dimethylphenol	19	< 19 U
65-85-0	Benzoic Acid	190	< 190 U
120-82-1	1,2,4-Trichlorobenzene	19	< 19 U
91-20-3	**Naphthalene**	**19**	**330**
87-68-3	Hexachlorobutadiene	19	< 19 U
91-57-6	**2-Methylnaphthalene**	**19**	**200**
131-11-3	**Dimethylphthalate**	**19**	**27**
208-96-8	**Acenaphthylene**	**19**	**22**
83-32-9	**Acenaphthene**	**19**	**390**
132-64-9	**Dibenzofuran**	**19**	**290**
84-66-2	Diethylphthalate	19	< 19 U
86-73-7	**Fluorene**	**19**	**490**
86-30-6	N-Nitrosodiphenylamine	19	< 19 U
118-74-1	Hexachlorobenzene	19	< 19 U
87-86-5	Pentachlorophenol	97	< 97 U
85-01-8	**Phenanthrene**	**19**	**1,600 E**
120-12-7	**Anthracene**	**19**	**270**
84-74-2	Di-n-Butylphthalate	19	< 19 U
206-44-0	**Fluoranthene**	**19**	**1,400 E**
129-00-0	**Pyrene**	**19**	**950 E**
85-68-7	Butylbenzylphthalate	19	< 19 U
56-55-3	**Benzo(a)anthracene**	**19**	**440**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**19**	**160**
218-01-9	**Chrysene**	**19**	**520**
117-84-0	Di-n-Octyl phthalate	19	< 19 U
205-99-2	**Benzo(b)fluoranthene**	**19**	**410**
207-08-9	**Benzo(k)fluoranthene**	**19**	**360**
50-32-8	**Benzo(a)pyrene**	**19**	**260**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**19**	**53**
53-70-3	Dibenz(a,h)anthracene	19	< 19 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-1
SAMPLE

Lab Sample ID: GG43A
LIMS ID: 04-978
Matrix: Sediment
Date Analyzed: 02/02/04 21:27

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	19	36

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	76.5%	2-Fluorobiphenyl	81.0%
d14-p-Terphenyl	106%	d4-1,2-Dichlorobenzene	69.0%
d5-Phenol	86.5%	2-Fluorophenol	137%
2,4,6-Tribromophenol	104%	d4-2-Chlorophenol	80.8%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-1
DILUTION

Lab Sample ID: GG43A
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized:
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 14:03
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.7 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 5.00
Percent Moisture: 53.0%
pH: 7.6

CAS Number	Analyte	RL	Result
108-95-2	Phenol	97	< 97 U
541-73-1	1,3-Dichlorobenzene	97	< 97 U
106-46-7	1,4-Dichlorobenzene	97	< 97 U
100-51-6	Benzyl Alcohol	97	< 97 U
95-50-1	1,2-Dichlorobenzene	97	< 97 U
95-48-7	2-Methylphenol	97	< 97 U
106-44-5	4-Methylphenol	97	< 97 U
105-67-9	2,4-Dimethylphenol	97	< 97 U
65-85-0	Benzoic Acid	970	< 970 U
120-82-1	1,2,4-Trichlorobenzene	97	< 97 U
91-20-3	**Naphthalene**	**97**	**320**
87-68-3	Hexachlorobutadiene	97	< 97 U
91-57-6	**2-Methylnaphthalene**	**97**	**190**
131-11-3	Dimethylphthalate	97	< 97 U
208-96-8	Acenaphthylene	97	< 97 U
83-32-9	**Acenaphthene**	**97**	**380**
132-64-9	**Dibenzofuran**	**97**	**280**
84-66-2	Diethylphthalate	97	< 97 U
86-73-7	**Fluorene**	**97**	**440**
86-30-6	N-Nitrosodiphenylamine	97	< 97 U
118-74-1	Hexachlorobenzene	97	< 97 U
87-86-5	Pentachlorophenol	490	< 490 U
85-01-8	**Phenanthrene**	**97**	**1,700**
120-12-7	**Anthracene**	**97**	**240**
84-74-2	Di-n-Butylphthalate	97	< 97 U
206-44-0	**Fluoranthene**	**97**	**1,500**
129-00-0	**Pyrene**	**97**	**1,000**
85-68-7	Butylbenzylphthalate	97	< 97 U
56-55-3	**Benzo(a)anthracene**	**97**	**420**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**97**	**140**
218-01-9	**Chrysene**	**97**	**490**
117-84-0	Di-n-Octyl phthalate	97	< 97 U
205-99-2	**Benzo(b)fluoranthene**	**97**	**320**
207-08-9	**Benzo(k)fluoranthene**	**97**	**290**
50-32-8	**Benzo(a)pyrene**	**97**	**240**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**97**	**130**
53-70-3	Dibenz(a,h)anthracene	97	< 97 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-1
DILUTION

Lab Sample ID: GG43A
LIMS ID: 04-978
Matrix: Sediment
Date Analyzed: 02/02/04 14:03

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	97	100

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	75.8%	2-Fluorobiphenyl	80.4%
d14-p-Terphenyl	92.4%	d4-1,2-Dichlorobenzene	66.6%
d5-Phenol	83.9%	2-Fluorophenol	85.1%
2,4,6-Tribromophenol	99.6%	d4-2-Chlorophenol	75.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-2
SAMPLE

Lab Sample ID: GG43B
LIMS ID: 04-979
Matrix: Sediment
Data Release Authorized:
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 22:04
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.4 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 53.3%
pH: 7.8

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	**Naphthalene**	**20**	**270**
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	**2-Methylnaphthalene**	**20**	**100**
131-11-3	**Dimethylphthalate**	**20**	**45**
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	**Acenaphthene**	**20**	**270**
132-64-9	**Dibenzofuran**	**20**	**170**
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	**Fluorene**	**20**	**280**
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	98	< 98 U
85-01-8	**Phenanthrene**	**20**	**1,200 E**
120-12-7	**Anthracene**	**20**	**180**
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**1,200 E**
129-00-0	**Pyrene**	**20**	**790**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	**Benzo(a)anthracene**	**20**	**340**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20**	**110**
218-01-9	**Chrysene**	**20**	**420**
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	**Benzo(b)fluoranthene**	**20**	**340**
207-08-9	**Benzo(k)fluoranthene**	**20**	**300**
50-32-8	**Benzo(a)pyrene**	**20**	**210**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**20**	**56**
53-70-3	Dibenz(a,h)anthracene	20	< 20 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-2
SAMPLE

Lab Sample ID: GG43B
LIMS ID: 04-979
Matrix: Sediment
Date Analyzed: 02/02/04 22:04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	20	32

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	71.1%	2-Fluorobiphenyl	70.8%
d14-p-Terphenyl	79.9%	d4-1,2-Dichlorobenzene	56.6%
d5-Phenol	83.6%	2-Fluorophenol	116%
2,4,6-Tribromophenol	88.0%	d4-2-Chlorophenol	77.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-2
DILUTION

Lab Sample ID: GG43B
LIMS ID: 04-979
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 14:40
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.4 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 5.00
Percent Moisture: 53.3%
pH: 7.8

CAS Number	Analyte	RL	Result
108-95-2	Phenol	98	< 98 U
541-73-1	1,3-Dichlorobenzene	98	< 98 U
106-46-7	1,4-Dichlorobenzene	98	< 98 U
100-51-6	Benzyl Alcohol	98	< 98 U
95-50-1	1,2-Dichlorobenzene	98	< 98 U
95-48-7	2-Methylphenol	98	< 98 U
106-44-5	4-Methylphenol	98	< 98 U
105-67-9	2,4-Dimethylphenol	98	< 98 U
65-85-0	Benzoic Acid	980	< 980 U
120-82-1	1,2,4-Trichlorobenzene	98	< 98 U
91-20-3	**Naphthalene**	**98**	**260**
87-68-3	Hexachlorobutadiene	98	< 98 U
91-57-6	2-Methylnaphthalene	98	< 98 U
131-11-3	Dimethylphthalate	98	< 98 U
208-96-8	Acenaphthylene	98	< 98 U
83-32-9	**Acenaphthene**	**98**	**240**
132-64-9	**Dibenzofuran**	**98**	**160**
84-66-2	Diethylphthalate	98	< 98 U
86-73-7	**Fluorene**	**98**	**250**
86-30-6	N-Nitrosodiphenylamine	98	< 98 U
118-74-1	Hexachlorobenzene	98	< 98 U
87-86-5	Pentachlorophenol	490	< 490 U
85-01-8	**Phenanthrene**	**98**	**1,000**
120-12-7	**Anthracene**	**98**	**160**
84-74-2	Di-n-Butylphthalate	98	< 98 U
206-44-0	**Fluoranthene**	**98**	**1,000**
129-00-0	**Pyrene**	**98**	**750**
85-68-7	Butylbenzylphthalate	98	< 98 U
56-55-3	**Benzo(a)anthracene**	**98**	**320**
117-81-7	bis(2-Ethylhexyl)phthalate	98	< 98 U
218-01-9	**Chrysene**	**98**	**380**
117-84-0	Di-n-Octyl phthalate	98	< 98 U
205-99-2	**Benzo(b)fluoranthene**	**98**	**260**
207-08-9	**Benzo(k)fluoranthene**	**98**	**220**
50-32-8	**Benzo(a)pyrene**	**98**	**190**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**98**	**100**
53-70-3	Dibenz(a,h)anthracene	98	< 98 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-2
DILUTION

Lab Sample ID: GG43B
LIMS ID: 04-979
Matrix: Sediment
Date Analyzed: 02/02/04 14:40

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	98	< 98 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	66.0%	2-Fluorobiphenyl	65.4%
d14-p-Terphenyl	67.6%	d4-1,2-Dichlorobenzene	53.6%
d5-Phenol	78.0%	2-Fluorophenol	78.4%
2,4,6-Tribromophenol	79.7%	d4-2-Chlorophenol	69.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-3
SAMPLE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 22:41
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.8 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 24.0%
pH: 7.7

CAS Number	Analyte	RL	Result
108-95-2	Phenol	19	< 19 U
541-73-1	1,3-Dichlorobenzene	19	< 19 U
106-46-7	1,4-Dichlorobenzene	19	< 19 U
100-51-6	Benzyl Alcohol	19	< 19 U
95-50-1	1,2-Dichlorobenzene	19	< 19 U
95-48-7	2-Methylphenol	19	< 19 U
106-44-5	**4-Methylphenol**	**19**	**47**
105-67-9	2,4-Dimethylphenol	19	< 19 U
65-85-0	Benzoic Acid	190	< 190 U
120-82-1	1,2,4-Trichlorobenzene	19	< 19 U
91-20-3	**Naphthalene**	**19**	**2,800 E**
87-68-3	Hexachlorobutadiene	19	< 19 U
91-57-6	**2-Methylnaphthalene**	**19**	**1,900 E**
131-11-3	**Dimethylphthalate**	**19**	**41**
208-96-8	**Acenaphthylene**	**19**	**64**
83-32-9	**Acenaphthene**	**19**	**2,200 E**
132-64-9	**Dibenzofuran**	**19**	**1,400 E**
84-66-2	Diethylphthalate	19	< 19 U
86-73-7	**Fluorene**	**19**	**1,800 E**
86-30-6	N-Nitrosodiphenylamine	19	< 19 U
118-74-1	Hexachlorobenzene	19	< 19 U
87-86-5	Pentachlorophenol	97	< 97 U
85-01-8	**Phenanthrene**	**19**	**3,000 E**
120-12-7	**Anthracene**	**19**	**570**
84-74-2	Di-n-Butylphthalate	19	< 19 U
206-44-0	**Fluoranthene**	**19**	**2,200 E**
129-00-0	**Pyrene**	**19**	**1,300 E**
85-68-7	Butylbenzylphthalate	19	< 19 U
56-55-3	**Benzo(a)anthracene**	**19**	**900**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**19**	**380**
218-01-9	**Chrysene**	**19**	**1,500 E**
117-84-0	Di-n-Octyl phthalate	19	< 19 U
205-99-2	**Benzo(b)fluoranthene**	**19**	**860**
207-08-9	**Benzo(k)fluoranthene**	**19**	**730**
50-32-8	**Benzo(a)pyrene**	**19**	**500**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**19**	**110**
53-70-3	**Dibenz(a,h)anthracene**	**19**	**31**

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-3
SAMPLE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Date Analyzed: 02/02/04 22:41

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	19	69

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	57.3%	2-Fluorobiphenyl	60.5%
d14-p-Terphenyl	82.9%	d4-1,2-Dichlorobenzene	53.0%
d5-Phenol	66.5%	2-Fluorophenol	76.6%
2,4,6-Tribromophenol	73.8%	d4-2-Chlorophenol	60.7%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: **SPM-3**
DILUTION

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 15:17
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.8 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 10.0
Percent Moisture: 24.0%
pH: 7.7

CAS Number	Analyte	RL	Result
108-95-2	Phenol	190	< 190 U
541-73-1	1,3-Dichlorobenzene	190	< 190 U
106-46-7	1,4-Dichlorobenzene	190	< 190 U
100-51-6	Benzyl Alcohol	190	< 190 U
95-50-1	1,2-Dichlorobenzene	190	< 190 U
95-48-7	2-Methylphenol	190	< 190 U
106-44-5	4-Methylphenol	190	< 190 U
105-67-9	2,4-Dimethylphenol	190	< 190 U
65-85-0	Benzoic Acid	1900	< 1,900 U
120-82-1	1,2,4-Trichlorobenzene	190	< 190 U
91-20-3	**Naphthalene**	**190**	**3,100**
87-68-3	Hexachlorobutadiene	190	< 190 U
91-57-6	**2-Methylnaphthalene**	**190**	**1,500**
131-11-3	Dimethylphthalate	190	< 190 U
208-96-8	Acenaphthylene	190	< 190 U
83-32-9	**Acenaphthene**	**190**	**1,800**
132-64-9	**Dibenzofuran**	**190**	**1,100**
84-66-2	Diethylphthalate	190	< 190 U
86-73-7	**Fluorene**	**190**	**1,400**
86-30-6	N-Nitrosodiphenylamine	190	< 190 U
118-74-1	Hexachlorobenzene	190	< 190 U
87-86-5	Pentachlorophenol	970	< 970 U
85-01-8	**Phenanthrene**	**190**	**5,100**
120-12-7	**Anthracene**	**190**	**520**
84-74-2	Di-n-Butylphthalate	190	< 190 U
206-44-0	**Fluoranthene**	**190**	**4,400**
129-00-0	**Pyrene**	**190**	**2,900**
85-68-7	Butylbenzylphthalate	190	< 190 U
56-55-3	**Benzo(a)anthracene**	**190**	**820**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**190**	**330**
218-01-9	**Chrysene**	**190**	**1,400**
117-84-0	Di-n-Octyl phthalate	190	< 190 U
205-99-2	**Benzo(b)fluoranthene**	**190**	**760**
207-08-9	**Benzo(k)fluoranthene**	**190**	**640**
50-32-8	**Benzo(a)pyrene**	**190**	**470**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**190**	**250**
53-70-3	Dibenz(a,h)anthracene	190	< 190 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-3
DILUTION

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Date Analyzed: 02/02/04 15:17

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	190	< 190 U

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	56.4%	2-Fluorobiphenyl	61.2%
d14-p-Terphenyl	68.0%	d4-1,2-Dichlorobenzene	52.8%
d5-Phenol	59.2%	2-Fluorophenol	60.5%
2,4,6-Tribromophenol	69.3%	d4-2-Chlorophenol	57.3%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-4
SAMPLE

Lab Sample ID: GG43D
LIMS ID: 04-981
Matrix: Sediment
Data Release Authorized:
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 23:17
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.5 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 53.3%
pH: 7.8

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	**Naphthalene**	**20**	**980 E**
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	**2-Methylnaphthalene**	**20**	**390**
131-11-3	**Dimethylphthalate**	**20**	**50**
208-96-8	**Acenaphthylene**	**20**	**38**
83-32-9	**Acenaphthene**	**20**	**800**
132-64-9	**Dibenzofuran**	**20**	**500**
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	**Fluorene**	**20**	**790**
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	98	< 98 U
85-01-8	**Phenanthrene**	**20**	**2,400 E**
120-12-7	**Anthracene**	**20**	**420**
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**2,100 E**
129-00-0	**Pyrene**	**20**	**1,200 E**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	**Benzo(a)anthracene**	**20**	**740**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20**	**200**
218-01-9	**Chrysene**	**20**	**900**
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	**Benzo(b)fluoranthene**	**20**	**740**
207-08-9	**Benzo(k)fluoranthene**	**20**	**600**
50-32-8	**Benzo(a)pyrene**	**20**	**410**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**20**	**80**
53-70-3	**Dibenz(a,h)anthracene**	**20**	**27**

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-4
SAMPLE

Lab Sample ID: GG43D
LIMS ID: 04-981
Matrix: Sediment
Date Analyzed: 02/02/04 23:17

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	20	54

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	72.9%	2-Fluorobiphenyl	74.4%
d14-p-Terphenyl	95.8%	d4-1,2-Dichlorobenzene	61.1%
d5-Phenol	83.3%	2-Fluorophenol	129%
2,4,6-Tribromophenol	91.4%	d4-2-Chlorophenol	77.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-4
DILUTION

Lab Sample ID: GG43D
LIMS ID: 04-981
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 15:54
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.5 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 5.00
Percent Moisture: 53.3%
pH: 7.8

CAS Number	Analyte	RL	Result
108-95-2	Phenol	98	< 98 U
541-73-1	1,3-Dichlorobenzene	98	< 98 U
106-46-7	1,4-Dichlorobenzene	98	< 98 U
100-51-6	Benzyl Alcohol	98	< 98 U
95-50-1	1,2-Dichlorobenzene	98	< 98 U
95-48-7	2-Methylphenol	98	< 98 U
106-44-5	4-Methylphenol	98	< 98 U
105-67-9	2,4-Dimethylphenol	98	< 98 U
65-85-0	Benzoic Acid	980	< 980 U
120-82-1	1,2,4-Trichlorobenzene	98	< 98 U
91-20-3	**Naphthalene**	**98**	**880**
87-68-3	Hexachlorobutadiene	98	< 98 U
91-57-6	**2-Methylnaphthalene**	**98**	**370**
131-11-3	Dimethylphthalate	98	< 98 U
208-96-8	Acenaphthylene	98	< 98 U
83-32-9	**Acenaphthene**	**98**	**740**
132-64-9	**Dibenzofuran**	**98**	**470**
84-66-2	Diethylphthalate	98	< 98 U
86-73-7	**Fluorene**	**98**	**700**
86-30-6	N-Nitrosodiphenylamine	98	< 98 U
118-74-1	Hexachlorobenzene	98	< 98 U
87-86-5	Pentachlorophenol	490	< 490 U
85-01-8	**Phenanthrene**	**98**	**3,200**
120-12-7	**Anthracene**	**98**	**390**
84-74-2	Di-n-Butylphthalate	98	< 98 U
206-44-0	**Fluoranthene**	**98**	**2,700**
129-00-0	**Pyrene**	**98**	**1,800**
85-68-7	Butylbenzylphthalate	98	< 98 U
56-55-3	**Benzo(a)anthracene**	**98**	**680**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**98**	**180**
218-01-9	**Chrysene**	**98**	**830**
117-84-0	Di-n-Octyl phthalate	98	< 98 U
205-99-2	**Benzo(b)fluoranthene**	**98**	**660**
207-08-9	**Benzo(k)fluoranthene**	**98**	**480**
50-32-8	**Benzo(a)pyrene**	**98**	**400**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**98**	**190**
53-70-3	Dibenz(a,h)anthracene	98	< 98 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-4
DILUTION

Lab Sample ID: GG43D
LIMS ID: 04-981
Matrix: Sediment
Date Analyzed: 02/02/04 15:54

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	98	140

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	73.6%	2-Fluorobiphenyl	75.2%
d14-p-Terphenyl	79.6%	d4-1,2-Dichlorobenzene	59.4%
d5-Phenol	83.2%	2-Fluorophenol	83.7%
2,4,6-Tribromophenol	92.3%	d4-2-Chlorophenol	75.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-5
SAMPLE

Lab Sample ID: GG43E
LIMS ID: 04-982
Matrix: Sediment
Data Release Authorized:
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 23:54
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.4 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 40.4%
pH: 7.5

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	**Naphthalene**	**20**	**2,500 E**
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	**2-Methylnaphthalene**	**20**	**1,800 E**
131-11-3	**Dimethylphthalate**	**20**	**100**
208-96-8	**Acenaphthylene**	**20**	**96**
83-32-9	**Acenaphthene**	**20**	**2,200 E**
132-64-9	**Dibenzofuran**	**20**	**1,400 E**
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	**Fluorene**	**20**	**1,900 E**
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	99	< 99 U
85-01-8	**Phenanthrene**	**20**	**3,300 E**
120-12-7	**Anthracene**	**20**	**760**
84-74-2	**Di-n-Butylphthalate**	**20**	**41**
206-44-0	**Fluoranthene**	**20**	**3,100 E**
129-00-0	**Pyrene**	**20**	**1,300 E**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	**Benzo(a)anthracene**	**20**	**1,400 E**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20**	**430**
218-01-9	**Chrysene**	**20**	**1,800 E**
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	**Benzo(b)fluoranthene**	**20**	**1,200 E**
207-08-9	**Benzo(k)fluoranthene**	**20**	**980**
50-32-8	**Benzo(a)pyrene**	**20**	**710**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**20**	**150**
53-70-3	**Dibenz(a,h)anthracene**	**20**	**41**

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-5
SAMPLE

Lab Sample ID: GG43E
LIMS ID: 04-982
Matrix: Sediment
Date Analyzed: 02/02/04 23:54

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	20	100

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	71.9%	2-Fluorobiphenyl	72.0%
d14-p-Terphenyl	105%	d4-1,2-Dichlorobenzene	55.1%
d5-Phenol	85.5%	2-Fluorophenol	144%
2,4,6-Tribromophenol	89.6%	d4-2-Chlorophenol	78.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-5
DILUTION

Lab Sample ID: GG43E
LIMS ID: 04-982
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 16:31
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.4 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 10.0
Percent Moisture: 40.4%
pH: 7.5

CAS Number	Analyte	RL	Result
108-95-2	Phenol	200	< 200 U
541-73-1	1,3-Dichlorobenzene	200	< 200 U
106-46-7	1,4-Dichlorobenzene	200	< 200 U
100-51-6	Benzyl Alcohol	200	< 200 U
95-50-1	1,2-Dichlorobenzene	200	< 200 U
95-48-7	2-Methylphenol	200	< 200 U
106-44-5	4-Methylphenol	200	< 200 U
105-67-9	2,4-Dimethylphenol	200	< 200 U
65-85-0	Benzoic Acid	2000	< 2,000 U
120-82-1	1,2,4-Trichlorobenzene	200	< 200 U
91-20-3	**Naphthalene**	**200**	**2,700**
87-68-3	Hexachlorobutadiene	200	< 200 U
91-57-6	**2-Methylnaphthalene**	**200**	**1,500**
131-11-3	Dimethylphthalate	200	< 200 U
208-96-8	Acenaphthylene	200	< 200 U
83-32-9	**Acenaphthene**	**200**	**1,900**
132-64-9	**Dibenzofuran**	**200**	**1,200**
84-66-2	Diethylphthalate	200	< 200 U
86-73-7	**Fluorene**	**200**	**1,600**
86-30-6	N-Nitrosodiphenylamine	200	< 200 U
118-74-1	Hexachlorobenzene	200	< 200 U
87-86-5	Pentachlorophenol	990	< 990 U
85-01-8	**Phenanthrene**	**200**	**6,300**
120-12-7	**Anthracene**	**200**	**710**
84-74-2	Di-n-Butylphthalate	200	< 200 U
206-44-0	**Fluoranthene**	**200**	**7,700**
129-00-0	**Pyrene**	**200**	**4,300**
85-68-7	Butylbenzylphthalate	200	< 200 U
56-55-3	**Benzo(a)anthracene**	**200**	**1,400**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**200**	**340**
218-01-9	**Chrysene**	**200**	**1,900**
117-84-0	Di-n-Octyl phthalate	200	< 200 U
205-99-2	**Benzo(b)fluoranthene**	**200**	**1,200**
207-08-9	**Benzo(k)fluoranthene**	**200**	**1,000**
50-32-8	**Benzo(a)pyrene**	**200**	**730**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**200**	**350**
53-70-3	Dibenz(a,h)anthracene	200	< 200 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-5
DILUTION

Lab Sample ID: GG43E
LIMS ID: 04-982
Matrix: Sediment
Date Analyzed: 02/02/04 16:31

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	200	260

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	71.2%	2-Fluorobiphenyl	75.2%
d14-p-Terphenyl	77.6%	d4-1,2-Dichlorobenzene	55.6%
d5-Phenol	83.7%	2-Fluorophenol	79.2%
2,4,6-Tribromophenol	87.7%	d4-2-Chlorophenol	75.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-6
SAMPLE

Lab Sample ID: GG43F
LIMS ID: 04-983
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/03/04 12:41
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.5 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 41.8%
pH: 7.7

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	**Naphthalene**	**20**	**290**
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	**2-Methylnaphthalene**	**20**	**160**
131-11-3	**Dimethylphthalate**	**20**	**40**
208-96-8	**Acenaphthylene**	**20**	**39**
83-32-9	**Acenaphthene**	**20**	**280**
132-64-9	**Dibenzofuran**	**20**	**200**
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	**Fluorene**	**20**	**300**
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	98	< 98 U
85-01-8	**Phenanthrene**	**20**	**1,300 E**
120-12-7	**Anthracene**	**20**	**220**
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**1,800 E**
129-00-0	**Pyrene**	**20**	**900**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	**Benzo(a)anthracene**	**20**	**520**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20**	**150**
218-01-9	**Chrysene**	**20**	**730**
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	**Benzo(b)fluoranthene**	**20**	**550**
207-08-9	**Benzo(k)fluoranthene**	**20**	**410**
50-32-8	**Benzo(a)pyrene**	**20**	**320**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**20**	**110**
53-70-3	**Dibenz(a,h)anthracene**	**20**	**32**

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-6
SAMPLE

Lab Sample ID: GG43F
LIMS ID: 04-983
Matrix: Sediment
Date Analyzed: 02/03/04 12:41

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	20	74

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	79.7%	2-Fluorobiphenyl	84.8%
d14-p-Terphenyl	89.0%	d4-1,2-Dichlorobenzene	69.9%
d5-Phenol	91.4%	2-Fluorophenol	156%
2,4,6-Tribromophenol	101%	d4-2-Chlorophenol	83.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-6
DILUTION

Lab Sample ID: GG43F
LIMS ID: 04-983
Matrix: Sediment
Data Release Authorized: Mw
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 17:08
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.5 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 5.00
Percent Moisture: 41.8%
pH: 7.7

CAS Number	Analyte	RL	Result
108-95-2	Phenol	98	< 98 U
541-73-1	1,3-Dichlorobenzene	98	< 98 U
106-46-7	1,4-Dichlorobenzene	98	< 98 U
100-51-6	Benzyl Alcohol	98	< 98 U
95-50-1	1,2-Dichlorobenzene	98	< 98 U
95-48-7	2-Methylphenol	98	< 98 U
106-44-5	4-Methylphenol	98	< 98 U
105-67-9	2,4-Dimethylphenol	98	< 98 U
65-85-0	Benzoic Acid	980	< 980 U
120-82-1	1,2,4-Trichlorobenzene	98	< 98 U
91-20-3	**Naphthalene**	**98**	**270**
87-68-3	Hexachlorobutadiene	98	< 98 U
91-57-6	**2-Methylnaphthalene**	**98**	**150**
131-11-3	Dimethylphthalate	98	< 98 U
208-96-8	Acenaphthylene	98	< 98 U
83-32-9	**Acenaphthene**	**98**	**260**
132-64-9	**Dibenzofuran**	**98**	**180**
84-66-2	Diethylphthalate	98	< 98 U
86-73-7	**Fluorene**	**98**	**260**
86-30-6	N-Nitrosodiphenylamine	98	< 98 U
118-74-1	Hexachlorobenzene	98	< 98 U
87-86-5	Pentachlorophenol	490	< 490 U
85-01-8	**Phenanthrene**	**98**	**1,100**
120-12-7	**Anthracene**	**98**	**200**
84-74-2	Di-n-Butylphthalate	98	< 98 U
206-44-0	**Fluoranthene**	**98**	**1,500**
129-00-0	**Pyrene**	**98**	**1,000**
85-68-7	Butylbenzylphthalate	98	< 98 U
56-55-3	**Benzo(a)anthracene**	**98**	**470**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**98**	**150**
218-01-9	**Chrysene**	**98**	**670**
117-84-0	Di-n-Octyl phthalate	98	< 98 U
205-99-2	**Benzo(b)fluoranthene**	**98**	**510**
207-08-9	**Benzo(k)fluoranthene**	**98**	**420**
50-32-8	**Benzo(a)pyrene**	**98**	**310**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**98**	**150**
53-70-3	Dibenz(a,h)anthracene	98	< 98 U

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

ANALYTICAL RESOURCES INCORPORATED

Sample ID: SPM-6
DILUTION

Lab Sample ID: GG43F
LIMS ID: 04-983
Matrix: Sediment
Date Analyzed: 02/02/04 17:08

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	98	120

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	75.8%	2-Fluorobiphenyl	79.4%
d14-p-Terphenyl	86.8%	d4-1,2-Dichlorobenzene	66.2%
d5-Phenol	83.3%	2-Fluorophenol	85.1%
2,4,6-Tribromophenol	92.7%	d4-2-Chlorophenol	77.5%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-8
SAMPLE

Lab Sample ID: GG43G
LIMS ID: 04-984
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/03/04 13:18
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.7 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 38.8%
pH: 8.2

CAS Number	Analyte	RL	Result
108-95-2	Phenol	19	< 19 U
541-73-1	1,3-Dichlorobenzene	19	< 19 U
106-46-7	1,4-Dichlorobenzene	19	< 19 U
100-51-6	Benzyl Alcohol	19	< 19 U
95-50-1	1,2-Dichlorobenzene	19	< 19 U
95-48-7	2-Methylphenol	19	< 19 U
106-44-5	4-Methylphenol	19	< 19 U
105-67-9	2,4-Dimethylphenol	19	< 19 U
65-85-0	Benzoic Acid	190	< 190 U
120-82-1	1,2,4-Trichlorobenzene	19	< 19 U
91-20-3	**Naphthalene**	**19**	**500**
87-68-3	Hexachlorobutadiene	19	< 19 U
91-57-6	**2-Methylnaphthalene**	**19**	**84**
131-11-3	**Dimethylphthalate**	**19**	**32**
208-96-8	**Acenaphthylene**	**19**	**21**
83-32-9	**Acenaphthene**	**19**	**210**
132-64-9	**Dibenzofuran**	**19**	**140**
84-66-2	Diethylphthalate	19	< 19 U
86-73-7	**Fluorene**	**19**	**180**
86-30-6	N-Nitrosodiphenylamine	19	< 19 U
118-74-1	Hexachlorobenzene	19	< 19 U
87-86-5	Pentachlorophenol	97	< 97 U
85-01-8	**Phenanthrene**	**19**	**660**
120-12-7	**Anthracene**	**19**	**260**
84-74-2	Di-n-Butylphthalate	19	< 19 U
206-44-0	**Fluoranthene**	**19**	**950**
129-00-0	**Pyrene**	**19**	**800**
85-68-7	Butylbenzylphthalate	19	< 19 U
56-55-3	**Benzo(a)anthracene**	**19**	**340**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**19**	**90**
218-01-9	**Chrysene**	**19**	**540**
117-84-0	Di-n-Octyl phthalate	19	< 19 U
205-99-2	**Benzo(b)fluoranthene**	**19**	**390**
207-08-9	**Benzo(k)fluoranthene**	**19**	**290**
50-32-8	**Benzo(a)pyrene**	**19**	**250**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**19**	**76**
53-70-3	**Dibenz(a,h)anthracene**	**19**	**22**

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-8
SAMPLE

Lab Sample ID: GG43G
LIMS ID: 04-984
Matrix: Sediment
Date Analyzed: 02/03/04 13:18

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	19	52

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	73.7%	2-Fluorobiphenyl	77.1%
d14-p-Terphenyl	86.7%	d4-1,2-Dichlorobenzene	58.3%
d5-Phenol	86.1%	2-Fluorophenol	141%
2,4,6-Tribromophenol	100%	d4-2-Chlorophenol	80.4%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-9
SAMPLE

Lab Sample ID: GG43H
LIMS ID: 04-985
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/03/04 13:55
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.5 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 52.5%
pH: 7.4

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	**Naphthalene**	**20**	**160**
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	**2-Methylnaphthalene**	**20**	**57**
131-11-3	**Dimethylphthalate**	**20**	**24**
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	**Acenaphthene**	**20**	**230**
132-64-9	**Dibenzofuran**	**20**	**170**
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	**Fluorene**	**20**	**220**
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	98	< 98 U
85-01-8	**Phenanthrene**	**20**	**1,000 E**
120-12-7	**Anthracene**	**20**	**160**
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**1,200 E**
129-00-0	**Pyrene**	**20**	**690**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	**Benzo(a)anthracene**	**20**	**340**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20**	**290**
218-01-9	**Chrysene**	**20**	**370**
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	**Benzo(b)fluoranthene**	**20**	**280**
207-08-9	**Benzo(k)fluoranthene**	**20**	**220**
50-32-8	**Benzo(a)pyrene**	**20**	**210**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**20**	**74**
53-70-3	**Dibenz(a,h)anthracene**	**20**	**21**

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-9
SAMPLE

Lab Sample ID: GG43H
LIMS ID: 04-985
Matrix: Sediment
Date Analyzed: 02/03/04 13:55

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	20	51

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	75.4%	2-Fluorobiphenyl	81.1%
d14-p-Terphenyl	93.3%	d4-1,2-Dichlorobenzene	64.8%
d5-Phenol	85.7%	2-Fluorophenol	105%
2,4,6-Tribromophenol	99.9%	d4-2-Chlorophenol	79.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-9
DILUTION

Lab Sample ID: GG43H
LIMS ID: 04-985
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 18:23
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.5 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 3.00
Percent Moisture: 52.5%
pH: 7.4

CAS Number	Analyte	RL	Result
108-95-2	Phenol	59	< 59 U
541-73-1	1,3-Dichlorobenzene	59	< 59 U
106-46-7	1,4-Dichlorobenzene	59	< 59 U
100-51-6	Benzyl Alcohol	59	< 59 U
95-50-1	1,2-Dichlorobenzene	59	< 59 U
95-48-7	2-Methylphenol	59	< 59 U
106-44-5	4-Methylphenol	59	< 59 U
105-67-9	2,4-Dimethylphenol	59	< 59 U
65-85-0	Benzoic Acid	590	< 590 U
120-82-1	1,2,4-Trichlorobenzene	59	< 59 U
91-20-3	**Naphthalene**	**59**	**160**
87-68-3	Hexachlorobutadiene	59	< 59 U
91-57-6	2-Methylnaphthalene	59	< 59 U
131-11-3	Dimethylphthalate	59	< 59 U
208-96-8	Acenaphthylene	59	< 59 U
83-32-9	**Acenaphthene**	**59**	**230**
132-64-9	**Dibenzofuran**	**59**	**160**
84-66-2	Diethylphthalate	59	< 59 U
86-73-7	**Fluorene**	**59**	**210**
86-30-6	N-Nitrosodiphenylamine	59	< 59 U
118-74-1	Hexachlorobenzene	59	< 59 U
87-86-5	Pentachlorophenol	290	< 290 U
85-01-8	**Phenanthrene**	**59**	**980**
120-12-7	**Anthracene**	**59**	**170**
84-74-2	Di-n-Butylphthalate	59	< 59 U
206-44-0	**Fluoranthene**	**59**	**1,100**
129-00-0	**Pyrene**	**59**	**760**
85-68-7	Butylbenzylphthalate	59	< 59 U
56-55-3	**Benzo(a)anthracene**	**59**	**340**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**59**	**300**
218-01-9	**Chrysene**	**59**	**370**
117-84-0	Di-n-Octyl phthalate	59	< 59 U
205-99-2	**Benzo(b)fluoranthene**	**59**	**270**
207-08-9	**Benzo(k)fluoranthene**	**59**	**240**
50-32-8	**Benzo(a)pyrene**	**59**	**210**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**59**	**91**
53-70-3	Dibenz(a,h)anthracene	59	< 59 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-9
DILUTION

Lab Sample ID: GG43H
LIMS ID: 04-985
Matrix: Sediment
Date Analyzed: 02/02/04 18:23

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	59	69

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	77.2%	2-Fluorobiphenyl	80.8%
d14-p-Terphenyl	94.4%	d4-1,2-Dichlorobenzene	64.6%
d5-Phenol	87.4%	2-Fluorophenol	87.9%
2,4,6-Tribromophenol	98.8%	d4-2-Chlorophenol	78.8%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-10
SAMPLE

Lab Sample ID: GG43I
LIMS ID: 04-986
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 19:36
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.2 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 51.8%
pH: 7.5

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	**Naphthalene**	**20**	**81**
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	**2-Methylnaphthalene**	**20**	**34**
131-11-3	**Dimethylphthalate**	**20**	**23**
208-96-8	Acenaphthylene	20	< 20 U
83-32-9	**Acenaphthene**	**20**	**85**
132-64-9	**Dibenzofuran**	**20**	**77**
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	**Fluorene**	**20**	**95**
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	99	< 99 U
85-01-8	**Phenanthrene**	**20**	**380**
120-12-7	**Anthracene**	**20**	**88**
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**640**
129-00-0	**Pyrene**	**20**	**430**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	**Benzo(a)anthracene**	**20**	**210**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20**	**68**
218-01-9	**Chrysene**	**20**	**270**
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	**Benzo(b)fluoranthene**	**20**	**220**
207-08-9	**Benzo(k)fluoranthene**	**20**	**160**
50-32-8	**Benzo(a)pyrene**	**20**	**130**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**20**	**45**
53-70-3	Dibenz(a,h)anthracene	20	< 20 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-10
SAMPLE

Lab Sample ID: GG43I
LIMS ID: 04-986
Matrix: Sediment
Date Analyzed: 02/02/04 19:36

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	20	31

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	68.3%	2-Fluorobiphenyl	73.0%
d14-p-Terphenyl	93.6%	d4-1,2-Dichlorobenzene	52.0%
d5-Phenol	83.0%	2-Fluorophenol	89.6%
2,4,6-Tribromophenol	93.8%	d4-2-Chlorophenol	73.7%

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-12
SAMPLE

Lab Sample ID: GG43J
LIMS ID: 04-987
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/03/04 14:32
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.6 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 1.00
Percent Moisture: 51.3%
pH: 7.7

CAS Number	Analyte	RL	Result
108-95-2	Phenol	20	< 20 U
541-73-1	1,3-Dichlorobenzene	20	< 20 U
106-46-7	1,4-Dichlorobenzene	20	< 20 U
100-51-6	Benzyl Alcohol	20	< 20 U
95-50-1	1,2-Dichlorobenzene	20	< 20 U
95-48-7	2-Methylphenol	20	< 20 U
106-44-5	4-Methylphenol	20	< 20 U
105-67-9	2,4-Dimethylphenol	20	< 20 U
65-85-0	Benzoic Acid	200	< 200 U
120-82-1	1,2,4-Trichlorobenzene	20	< 20 U
91-20-3	**Naphthalene**	**20**	**64**
87-68-3	Hexachlorobutadiene	20	< 20 U
91-57-6	**2-Methylnaphthalene**	**20**	**30**
131-11-3	**Dimethylphthalate**	**20**	**33**
208-96-8	**Acenaphthylene**	**20**	**100**
83-32-9	**Acenaphthene**	**20**	**160**
132-64-9	**Dibenzofuran**	**20**	**110**
84-66-2	Diethylphthalate	20	< 20 U
86-73-7	**Fluorene**	**20**	**170**
86-30-6	N-Nitrosodiphenylamine	20	< 20 U
118-74-1	Hexachlorobenzene	20	< 20 U
87-86-5	Pentachlorophenol	98	< 98 U
85-01-8	**Phenanthrene**	**20**	**1,600 E**
120-12-7	**Anthracene**	**20**	**360**
84-74-2	Di-n-Butylphthalate	20	< 20 U
206-44-0	**Fluoranthene**	**20**	**3,300 E**
129-00-0	**Pyrene**	**20**	**1,300 E**
85-68-7	Butylbenzylphthalate	20	< 20 U
56-55-3	**Benzo(a)anthracene**	**20**	**1,500 E**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**20**	**86**
218-01-9	**Chrysene**	**20**	**2,200 E**
117-84-0	Di-n-Octyl phthalate	20	< 20 U
205-99-2	**Benzo(b)fluoranthene**	**20**	**1,100 E**
207-08-9	**Benzo(k)fluoranthene**	**20**	**840**
50-32-8	**Benzo(a)pyrene**	**20**	**660**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**20**	**220**
53-70-3	**Dibenz(a,h)anthracene**	**20**	**63**

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-12
SAMPLE

Lab Sample ID: GG43J
LIMS ID: 04-987
Matrix: Sediment
Date Analyzed: 02/03/04 14:32

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	20	130

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	70.3%	2-Fluorobiphenyl	74.9%
d14-p-Terphenyl	87.7%	d4-1,2-Dichlorobenzene	51.4%
d5-Phenol	82.9%	2-Fluorophenol	97.4%
2,4,6-Tribromophenol	98.5%	d4-2-Chlorophenol	76.2%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-12
DILUTION

Lab Sample ID: GG43J
LIMS ID: 04-987
Matrix: Sediment
Data Release Authorized: MW
Reported: 02/03/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Date Extracted: 01/30/04
Date Analyzed: 02/02/04 18:59
Instrument/Analyst: NT4/LJR
GPC Cleanup: NO

Sample Amount: 25.6 g-dry-wt
Final Extract Volume: 0.5 mL
Dilution Factor: 5.00
Percent Moisture: 51.3%
pH: 7.7

CAS Number	Analyte	RL	Result
108-95-2	Phenol	98	< 98 U
541-73-1	1,3-Dichlorobenzene	98	< 98 U
106-46-7	1,4-Dichlorobenzene	98	< 98 U
100-51-6	Benzyl Alcohol	98	< 98 U
95-50-1	1,2-Dichlorobenzene	98	< 98 U
95-48-7	2-Methylphenol	98	< 98 U
106-44-5	4-Methylphenol	98	< 98 U
105-67-9	2,4-Dimethylphenol	98	< 98 U
65-85-0	Benzoic Acid	980	< 980 U
120-82-1	1,2,4-Trichlorobenzene	98	< 98 U
91-20-3	Naphthalene	98	< 98 U
87-68-3	Hexachlorobutadiene	98	< 98 U
91-57-6	2-Methylnaphthalene	98	< 98 U
131-11-3	Dimethylphthalate	98	< 98 U
208-96-8	Acenaphthylene	98	< 98 U
83-32-9	**Acenaphthene**	**98**	**150**
132-64-9	**Dibenzofuran**	**98**	**100**
84-66-2	Diethylphthalate	98	< 98 U
86-73-7	**Fluorene**	**98**	**150**
86-30-6	N-Nitrosodiphenylamine	98	< 98 U
118-74-1	Hexachlorobenzene	98	< 98 U
87-86-5	Pentachlorophenol	490	< 490 U
85-01-8	**Phenanthrene**	**98**	**1,400**
120-12-7	**Anthracene**	**98**	**300**
84-74-2	Di-n-Butylphthalate	98	< 98 U
206-44-0	**Fluoranthene**	**98**	**4,300**
129-00-0	**Pyrene**	**98**	**2,700**
85-68-7	Butylbenzylphthalate	98	< 98 U
56-55-3	**Benzo(a)anthracene**	**98**	**1,300**
117-81-7	**bis(2-Ethylhexyl)phthalate**	**98**	**99**
218-01-9	**Chrysene**	**98**	**2,200**
117-84-0	Di-n-Octyl phthalate	98	< 98 U
205-99-2	**Benzo(b)fluoranthene**	**98**	**1,200**
207-08-9	**Benzo(k)fluoranthene**	**98**	**1,100**
50-32-8	**Benzo(a)pyrene**	**98**	**680**
193-39-5	**Indeno(1,2,3-cd)pyrene**	**98**	**310**
53-70-3	Dibenz(a,h)anthracene	98	< 98 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
PSDDA Semivolatiles by GC/MS

Sample ID: SPM-12
DILUTION

Lab Sample ID: GG43J
LIMS ID: 04-987
Matrix: Sediment
Date Analyzed: 02/02/04 18:59

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232

CAS Number	Analyte	RL	Result
191-24-2	Benzo(g,h,i)perylene	98	210

Reported in µg/kg (ppb)

Semivolatile Surrogate Recovery

d5-Nitrobenzene	69.0%	2-Fluorobiphenyl	72.0%
d14-p-Terphenyl	88.0%	d4-1,2-Dichlorobenzene	52.2%
d5-Phenol	81.6%	2-Fluorophenol	79.2%
2,4,6-Tribromophenol	91.3%	d4-2-Chlorophenol	72.1%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: METHOD BLANK

Lab Sample ID: GG43MB
LIMS ID: 04-979
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: NA
Date Received: NA

Percent Total Solids: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	5	5	U
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.2	0.2	U
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	0.5	0.5	U
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.2	0.2	U
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	2	2	U
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.05	0.05	U
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.3	0.3	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	0.6	0.6	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-1
MATRIX SPIKE

Lab Sample ID: GG43A
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Spike	Spike Added	% Recovery	Q
Arsenic	6010B	10	450	430	102%	
Cadmium	6010B	0.7	110	106	103%	
Chromium	6010B	65	164	106	93.4%	
Copper	6010B	201	309	106	102%	
Lead	6010B	48	458	425	96.5%	
Mercury	7471A	0.9	2.6	1.0	170%	N
Silver	6010B	0.6 U	109	106	103%	
Zinc	6010B	210	313	106	97.2%	

Reported in mg/kg-dry

N-Control Limit Not Met
H-% Recovery Not Applicable, Sample Concentration Too High
NA-Not Applicable, Analyte Not Spiked

Percent Recovery Limits: 75-125%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-1
DUPLICATE

Lab Sample ID: GG43A
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Analysis Method	Sample	Duplicate	RPD	Control Limit	Q
Arsenic	6010B	10 – DL	20	66.7%	+/- 10	L
Cadmium	6010B	0.7	0.6	15.4%	+/- 0.4	L
Chromium	6010B	65	66	1.5%	+/- 20%	
Copper	6010B	201	193	4.1%	+/- 20%	
Lead	6010B	48	47	2.1%	+/- 20%	
Mercury	7471A	0.9	1.0	10.5%	+/- 20%	
Silver	6010B	0.6 U	0.6 U	0.0%	+/- 0.6	L
Zinc	6010B	210	215	2.4%	+/- 20%	

Reported in mg/kg-dry

*-Control Limit Not Met
L-RPD Invalid, Limit = Detection Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: STD REFERENCE
ERA D034

Lab Sample ID: GG43SRM
LIMS ID: 04-979
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: NA
Date Received: NA

Analyte	Analysis Method	Analysis Date	mg/kg-dry	Certified Value	Advisory Range
Arsenic	6010B	01/30/04	206	197	156-238
Cadmium	6010B	01/30/04	76.2	69.1	55.6-82.6
Chromium	6010B	01/30/04	79.2	82.6	63.8-101
Copper	6010B	01/30/04	138	127	102-152
Lead	6010B	01/30/04	101	95	73-117
Mercury	7471A	01/31/04	9.8	9.4	6.2-12.6
Silver	6010B	01/30/04	172	141	63.4-219
Zinc	6010B	01/30/04	274	275	211-337

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-1
SAMPLE

Lab Sample ID: GG43A
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 46.2%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	10	10	
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.4	0.7	
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	1	65	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.4	201	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	4	48	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.1	0.9	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.6	0.6	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	1	210	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-2
SAMPLE

Lab Sample ID: GG43B
LIMS ID: 04-979
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 46.4%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	10	10	
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.4	0.8	
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	1	136	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.4	190	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	4	42	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.08	0.60	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.6	0.6	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	1	468	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-3
SAMPLE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 70.8%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	7	7	U
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.3	0.3	U
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	0.7	26.9	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.3	150	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	3	25	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.06	0.35	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.4	0.4	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	0.8	111	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-4
SAMPLE

Lab Sample ID: GG43D
LIMS ID: 04-981
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 45.1%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	10	20	
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.4	0.7	
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	1	67	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.4	220	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	4	48	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.1	0.7	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.6	0.6	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	1	230	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-5
SAMPLE

Lab Sample ID: GG43E
LIMS ID: 04-982
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 53.4%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	9	13	
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.3	0.5	
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	0.9	46.5	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.3	309	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	3	54	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.08	0.96	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.5	0.5	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	1	218	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-6
SAMPLE

Lab Sample ID: GG43F
LIMS ID: 04-983
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 55.5%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	9	15	
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.3	0.4	
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	0.9	48.7	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.3	140	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	3	32	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.06	0.44	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.5	0.5	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	1	127	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-8
SAMPLE

Lab Sample ID: GG43G
LIMS ID: 04-984
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 61.8%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	8	13	
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.3	0.4	
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	0.8	51.2	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.3	134	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	3	30	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.07	0.49	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.5	0.5	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	0.9	110	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-9
SAMPLE

Lab Sample ID: GG43H
LIMS ID: 04-985
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 46.1%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	10	20	
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.4	0.5	
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	1	64	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.4	126	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	4	27	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.09	0.57	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.6	0.6	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	1	149	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-10
SAMPLE

Lab Sample ID: GG43I
LIMS ID: 04-986
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 48.9%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	10	10	
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.4	0.4	U
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	1	72	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.4	110	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	4	20	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.09	0.35	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.6	0.6	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	1	146	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: SPM-12
SAMPLE

Lab Sample ID: GG43J
LIMS ID: 04-987
Matrix: Sediment
Data Release Authorized:
Reported: 02/02/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Percent Total Solids: 48.8%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/29/04	6010B	01/30/04	7440-38-2	Arsenic	10	20	
3050B	01/29/04	6010B	01/30/04	7440-43-9	Cadmium	0.4	0.5	
3050B	01/29/04	6010B	01/30/04	7440-47-3	Chromium	1	63	
3050B	01/29/04	6010B	01/30/04	7440-50-8	Copper	0.4	124	
3050B	01/29/04	6010B	01/30/04	7439-92-1	Lead	4	22	
CLP	01/29/04	7471A	01/31/04	7439-97-6	Mercury	0.07	0.27	
3050B	01/29/04	6010B	01/30/04	7440-22-4	Silver	0.6	0.6	U
3050B	01/29/04	6010B	01/30/04	7440-66-6	Zinc	1	164	

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: MB-GG43
METHOD BLANK

Lab Sample ID: MB-GG43
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: NA
Date Received: NA

METHOD BLANK RESULTS
CONVENTIONALS

Analyte	Analysis Date	Method	RL	Units	Result	
Total Solids	01/29/04	EPA 160.3 SM 2540 B	0.01	Percent	< 0.01	U
Total Organic Carbon	01/30/04	Plumb,1981	0.020	Percent	< 0.020	U

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: MS/MSD-GG43
MATRIX SPIKE

Lab Sample ID: MS-GG43
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized:
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Received: 01/29/04

MATRIX SPIKE RESULTS
CONVENTIONALS

Analyte	Method	Units	Sample	Spike	MS/ MSD	REC
ARI ID: 04-978, GG43A	**Client Sample ID: SPM-1**					
Total Organic Carbon	Plumb, 1981	Percent	3.19	3.79	6.96	99.5%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: DUP-GG43
DUPLICATE

Lab Sample ID: DUP-GG43
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Received: 01/29/04

DUPLICATE RESULTS
CONVENTIONALS

Analyte	Method	Units	Sample	Replicate	RPD/RSD
ARI ID: 04-978, GG43A	**Client Sample ID: SPM-1**				
Total Solids	EPA 160.3 SM 2540 B	Percent	47.7	47.4 47.6	0.3%
Total Organic Carbon	Plumb,1981	Percent	3.2	2.6 2.8	10.7%

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SRM-GG43
STANDARD REFERENCE

Lab Sample ID: SRM-GG43
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: NA
Date Received: NA

STANDARD REFERENCE RESULTS
CONVENTIONALS

Analyte	Analysis Date & Batch	Method	Units	SRM	True	REC
NIST #8704						
Total Carbon	01/30/04 013004#1	Plumb,1981	Percent	3.43	3.35	102%

Standard Reference QA Report for GG43 received 01/29/04

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-1
SAMPLE

Lab Sample ID: GG43A
LIMS ID: 04-978
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	47.7
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	3.2

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-2
SAMPLE

Lab Sample ID: GG43B
LIMS ID: 04-979
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	46.4
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	2.6

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-3
SAMPLE

Lab Sample ID: GG43C
LIMS ID: 04-980
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	71.0
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	4.3

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS
Page 1 of 1

Sample ID: SPM-4
SAMPLE

Lab Sample ID: GG43D
LIMS ID: 04-981
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	47.0
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	2.7

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-5
SAMPLE

Lab Sample ID: GG43E
LIMS ID: 04-982
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	56.2
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	3.5

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS
Page 1 of 1

Sample ID: SPM-6
SAMPLE

Lab Sample ID: GG43F
LIMS ID: 04-983
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	56.2
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	3.6

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-8
SAMPLE

Lab Sample ID: GG43G
LIMS ID: 04-984
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	63.5
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	2.3

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-9
SAMPLE

Lab Sample ID: GG43H
LIMS ID: 04-985
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	48.1
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	1.8

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-10
SAMPLE

Lab Sample ID: GG43I
LIMS ID: 04-986
Matrix: Sediment
Data Release Authorized:
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	49.6
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	2.2

RL Analytical reporting limit
U Undetected at reported detection limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
LABORATORY ANALYSIS OF CONVENTIONAL PARAMETERS

Sample ID: SPM-12
SAMPLE

Lab Sample ID: GG43J
LIMS ID: 04-987
Matrix: Sediment
Data Release Authorized: [signature]
Reported: 01/30/04

QC Report No: GG43-Landau Associates
Project: Port of Bellingham
001027.232
Date Sampled: 01/28/04
Date Received: 01/29/04

Analyte	Analysis Date & Batch	Method	DF	RL	Units	Result
Total Solids	01/29/04 012904#1	EPA 160.3 SM 2540 B		0.01	Percent	47.3
Total Organic Carbon	01/30/04 013004#1	Plumb,1981		0.020	Percent	2.1

RL Analytical reporting limit
U Undetected at reported detection limit

APPENDIX D

Pre-Interim Action Marine Sediment Analytical Results

TABLE D-1
PRE-INTERIM ACTION MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:			RIFS-01		RIFS-02		
Sample ID:			RIFS-01	RIFS-01	RIFS-02	RIFS-02	RIFS-02
Depth:			(0-10cm)	(0-4ft)	(0-10cm)	(0-4ft)	(4-8ft)
Sample Date:	SQS (a)	CSL (b)	9/26/2001	9/25/2001	9/26/2001	9/25/2001	9/25/2001
Metals (mg/kg)							
Arsenic	57	93	7	10	11	13	6 U
Cadmium	5.1	6.7	0.6	0.3 U	0.6	0.3 U	0.3 U
Chromium	260	270	70.9	54.4 J	71.5	49.5 J	28.6
Copper	390	390	154 J	72.7 J	827 J	273 J	40.4
Lead	450	530	17 J	24 J	51 J	73 J	30
Mercury	0.41	0.59	0.26 J	0.37 J	1.17 J	1.78 J	0.19
Silver	6.1	6.1	1	0.4 U	1	0.5 U	0.4 U
Zinc	410	960	164	98.5 J	268	182 J	52.8 J
Bulk Organotin (ug/kg)							
Tributyltin (as TBT ion)	79 (c)	156 (c)	89	61 J	670	310	5.3 U
Tributyltin (as chloride)	None	None	100	69 J	760	350	5.9 U
Tetrabutyltin	None	None					
Dibutyltin (as Chloride)	None	None					
Butyltin (as Chloride)	None	None					
Porewater Organotin (ug/L)							
Tributyltin (as TBT ion)	0.15 (d)	None	0.053		0.85		
Tributyltin (as chloride)	None	None	0.06		0.96		
PAHs (mg/kg OC) (e)							
Naphthalene	99	170	2.71 U		2.03 U		
Acenaphthylene	66	66	3.14		5.26		
Acenaphthene	16	57	2.71 U		2.03 U		
Fluorene	23	79	2.71 U		3.68		
Phenanthrene	100	480	12.38		22.11		
Anthracene	220	1200	10.00		13.95		
2-Methylnaphthalene	38	64	2.71 U		2.03 U		
LPAH (f, g)	370	780	25.52		45.00		
Fluoranthene	160	1200	30.48		78.95		
Pyrene	1000	1400	43.81		71.05		
Benzo(a)anthracene	110	270	15.24		36.84		
Chrysene	110	460	28.57		73.68		
Benzo(b)fluoranthene	None	None	23.33		65.79		
Benzo(K)fluoranthene	None	None	23.33		47.37		
Total Benzofluoranthenes (f, h)	230	450	46.67		113.16		
Benzo(a)pyrene	99	210	13.33		28.95		
Indeno(1,2,3-c,d)pyrene	34	88	5.24		18.68		
Dibenz(a,h)anthracene	12	33	2.71 U		4.21		
Benzo(g,h,i)perylene	31	78	3.19		8.42		
HPAH (f, i)	960	5300	186.52		433.95		

TABLE D-1
PRE-INTERIM ACTION MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:			RIFS-01		RIFS-02		
Sample ID:			RIFS-01	RIFS-01	RIFS-02	RIFS-02	RIFS-02
Depth:			(0-10cm)	(0-4ft)	(0-10cm)	(0-4ft)	(4-8ft)
Sample Date:	SQS (a)	CSL (b)	9/26/2001	9/25/2001	9/26/2001	9/25/2001	9/25/2001
SVOCs (mg/kg OC) (e)							
1,2-Dichlorobenzene	2.3	2.3	2.71 U(j)		2.03 U		
1,3-Dichlorobenzene	None	None	2.71 U		2.03 U		
1,4-Dichlorobenzene	3.1	9	2.71 U		2.03 U		
1,2,4-Trichlorobenzene	0.81	1.8	2.71 U(j)		2.03 U(j)		
Hexachlorobenzene	0.38	2.3	2.71 U(j)		2.03 U(j)		
Dimethylphthalate	53	53	4.76		14.21		
Diethylphthalate	61	110	2.71		2.03 U		
Di-n-Butylphthalate	220	1700	2.71 U		4.47		
Butylbenzylphthalate	4.9	64	2.71 U		2.03 U		
bis(2-Ethylhexyl)phthalate	47	78	37.14		63.16		
Di-n-octyl phthalate	58	4500	2.71 U		2.03 U		
Dibenzofuran	15	58	2.71 U		2.11		
Hexachlorobutadiene	3.9	6.2	2.71 U		2.03 U		
N-Nitrosodiphenylamine	11	11	2.71 U		2.03 U		
SVOCs (ug/kg)							
Phenol	420	1200	100		77 U		
2-Methylphenol	63	63	57 U		77 U		
4-Methylphenol	670	670	57 U		77 U		
2,4-Dimethylphenol	29	29	57 U		77 U		
Pentachlorophenol	360	690	280 U		390 U(j)		
Benzyl Alcohol	57	73	57 U		77 U		
Benzoic Acid	650	650	570 U		770 U(j)		
Conventionals							
Total Organic Carbon (percent)	None	None	2.1		3.8		
Total Solids (percent)	None	None	45.1		39.6		
N-Ammonia (mg-N/kg)	None	None	11		13		
Sulfide (mg/kg)	None	None	660		720		
DOC (mg/l)	None	None	14		13		
Total PCBs (f) (mg/kg OC)	12	65					
Grain Size (%)							
Gravel	None	None	0.7		2.5		
Sand	None	None	3.5		15.9		
Silt	None	None	53		47.8		
Clay	None	None	42.6		33.8		
Fines	None	None					

TABLE D-1
PRE-INTERIM ACTION MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:			RIFS-03				RIFS-04			
Sample ID:			SD-TL	RIFS-03	RIFS-03	RIFS-03	SD-MW	RIFS-04	RIFS-04	RIFS-04
Depth:			(0-10cm)	(0-10cm)	(0-4ft)	(4-8ft)	(0-10cm)	(0-10cm)	(0-4ft)	(4-8ft)
Sample Date:	SQS (a)	CSL (b)	1/22/1998	9/26/2001	9/25/2001	9/25/2001	1/22/1998	9/26/2001	9/25/2001	9/25/2001
Metals (mg/kg)										
Arsenic	57	93	10.0 U		14	6 U	10 U		10	6 U
Cadmium	5.1	6.7	0.6		0.4 U	0.2 U	0.9		0.4 U	0.5
Chromium	260	270	83.0		67.4 J	26.6	80		82 J	29.6
Copper	390	390	158.0		100 J	10.3	380		149 J	31.8
Lead	450	530	25.0		37 J	2 U	88		33 J	4
Mercury	0.41	0.59	0.3		0.58 J	0.05 U	0.4		0.59 J	0.05
Silver	6.1	6.1	0.6 U		0.6 U	0.3 U	0.7 U		0.6 U	0.3 U
Zinc	410	960	177.0		126 J	33.8 J	281		170 J	66.9 J
Bulk Organotin (ug/kg)										
Tributyltin (as TBT ion)	79 (c)	156 (c)	116.0		75	5.1 U	1,400		170	5.2 U
Tributyltin (as chloride)	None	None			85	5.8 U			190	5.8 U
Tetrabutyltin	None	None								
Dibutyltin (as Chloride)	None	None								
Butyltin (as Chloride)	None	None								
Porewater Organotin (ug/L)										
Tributyltin (as TBT ion)	0.15 (d)	None		0.034 M				0.022 U		
Tributyltin (as chloride)	None	None		0.038 M				0.025 U		
PAHs (mg/kg OC) (e)										
Naphthalene	99	170	4.6				3.35			
Acenaphthylene	66	66	4.4				3.73			
Acenaphthene	16	57	3.2				8.08			
Fluorene	23	79	11.1				12.31			
Phenanthrene	100	480	63.2				96.15			
Anthracene	220	1200	15.3 M				17.69			
2-Methylnaphthalene	38	64	2.4 M				5.77			
LPAH (f, g)	370	780	104.0				147.08			
Fluoranthene	160	1200	268.4				146.15			
Pyrene	1000	1400	242.1				173.08			
Benzo(a)anthracene	110	270	57.9				42.31			
Chrysene	110	460	73.7 M				88.46			
Benzo(b)fluoranthene	None	None								
Benzo(K)fluoranthene	None	None								
Total Benzofluoranthenes (f, h)	230	450	102.1				103.85			
Benzo(a)pyrene	99	210	36.3				38.46			
Indeno(1,2,3-c,d)pyrene	34	88	9.5 M				21.54			
Dibenz(a,h)anthracene	12	33	6.3 M				7.69			
Benzo(g,h,i)perylene	31	78	12.1				16.92			
HPAH (f, i)	960	5300	848.4				638.46			

TABLE D-1
PRE-INTERIM ACTION MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:			RIFS-03				RIFS-04			
Sample ID:			SD-TL	RIFS-03	RIFS-03	RIFS-03	SD-MW	RIFS-04	RIFS-04	RIFS-04
Depth:			(0-10cm)	(0-10cm)	(0-4ft)	(4-8ft)	(0-10cm)	(0-10cm)	(0-4ft)	(4-8ft)
Sample Date:	SQS (a)	CSL (b)	1/22/1998	9/26/2001	9/25/2001	9/25/2001	1/22/1998	9/26/2001	9/25/2001	9/25/2001
SVOCs (mg/kg OC) (e)										
1,2-Dichlorobenzene	2.3	2.3	1.1 U				0.73 U			
1,3-Dichlorobenzene	None	None								
1,4-Dichlorobenzene	3.1	9	1.1 U (j)				0.73 U			
1,2,4-Trichlorobenzene	0.81	1.8	1.1 U (j)				0.73 U			
Hexachlorobenzene	0.38	2.3	1.1 U				0.73 U (j)			
Dimethylphthalate	53	53	6.3				20.00			
Diethylphthalate	61	110	1.1 U				0.73 U			
Di-n-Butylphthalate	220	1700	1.1 M				1.12			
Butylbenzylphthalate	4.9	64	1.2 M				2.04			
bis(2-Ethylhexyl)phthalate	47	78	25.3				84.62			
Di-n-octyl phthalate	58	4500	1.1 U				0.73 U			
Dibenzofuran	15	58	7.9				10.38			
Hexachlorobutadiene	3.9	6.2	2.1 U				1.50 U			
N-Nitrosodiphenylamine	11	11	1.1 U				0.73 U			
SVOCs (ug/kg)										
Phenol	420	1200	40.0 U				39 U			
2-Methylphenol	63	63	40.0 U				39 U			
4-Methylphenol	670	670	28.0				29			
2,4-Dimethylphenol	29	29	60.0 U (j)				58 U (j)			
Pentachlorophenol	360	690	100.0 U				97 U			
Benzyl Alcohol	57	73	100.0 U (j)				97 U (j)			
Benzoic Acid	650	650	200.0 U				190 U			
Conventionals										
Total Organic Carbon (percent)	None	None	1.9				2.6			
Total Solids (percent)	None	None								
N-Ammonia (mg-N/kg)	None	None								
Sulfide (mg/kg)	None	None								
DOC (mg/l)	None	None		17				15		
Total PCBs (f) (mg/kg OC)	12	65								
Grain Size (%)										
Gravel	None	None								
Sand	None	None								
Silt	None	None								
Clay	None	None								
Fines	None	None								

TABLE D-1
PRE-INTERIM ACTION MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:			RIFS-05		RIFS-06	RIFS-07	SD-OF	SD2-02	SD2-03
Sample ID:			SD2-01	RIFS-05	RIFS-06	RIFS-07	SD-OF	SD2-02	SD2-03
Depth:			(0-10cm)	(0-10cm)	(0-10cm)	(0-10cm)	(0-10cm)	(0-10cm)	(0-10cm)
Sample Date:	SQS (a)	CSL (b)	11/21/2000	9/26/2001	9/26/2001	9/26/2001	1/22/1998	11/21/2000	11/21/2000
Metals (mg/kg)									
Arsenic	57	93	5 U				6 U	5 U	6
Cadmium	5.1	6.7	0.2 U				0.2 U	0.2 U	0.2 U
Chromium	260	270	39.1				22.1	37.4	37.0
Copper	390	390	60.4				63.4	33.7	64.0
Lead	450	530	10				28	7	8
Mercury	0.41	0.59	0.2				0.05 U	0.1	0.2
Silver	6.1	6.1	0.3 U				0.4	0.3 U	0.3 U
Zinc	410	960	73.1				60.0	60.8	65.5
Bulk Organotin (ug/kg)									
Tributyltin (as TBT ion)	79 (c)	156 (c)	120		4.7 J	9.2 M	23.00 M	11	14
Tributyltin (as chloride)	None	None			5.3 J	10 M			
Tetrabutyltin	None	None	5.9 U					5.9 U	6.0 U
Dibutyltin (as Chloride)	None	None	27					2.2 J	5.2 J
Butyltin (as Chloride)	None	None	13 J					5.9 UJ	6.0 UJ
Porewater Organotin (ug/L)									
Tributyltin (as TBT ion)	0.15 (d)	None		0.022 U	0.022 U	0.022 U			
Tributyltin (as chloride)	None	None		0.025 U	0.025 U	0.025 U			
PAHs (mg/kg OC) (e)									
Naphthalene	99	170	2.0				1.13 M	2.4	1.4
Acenaphthylene	66	66	2.5				0.80 U	1.1 J	1.7
Acenaphthene	16	57	2.0				1.20 M	1.6	1.6
Fluorene	23	79	3.9				2.33	3.1	1.9
Phenanthrene	100	480	20				4.20	9.4	20
Anthracene	220	1200	12				1.07 M	12	4.7
2-Methylnaphthalene	38	64	2.1				2.40 M	1.9	1.4
LPAH (f, g)	370	780	43				12.33	29	31
Fluoranthene	160	1200	57				6.00	20	55
Pyrene	1000	1400	48				4.40	22	43
Benzo(a)anthracene	110	270	23				0.93	7.1	19
Chrysene	110	460	38				2.13 M	12	25
Benzo(b)fluoranthene	None	None							
Benzo(K)fluoranthene	None	None							
Total Benzofluoranthenes (f, h)	230	450	46				2.13 M	13	29
Benzo(a)pyrene	99	210	17				0.80 U	4.5	8.0
Indeno(1,2,3-c,d)pyrene	34	88	9.5				0.80 U	2.5	5.0
Dibenz(a,h)anthracene	12	33	3.1				0.80 U	1.2 U	1.6
Benzo(g,h,i)perylene	31	78	6.7				2.00 M	2.0	3.5
HPAH (f, i)	960	5300	248				17.60	84	188

TABLE D-1
PRE-INTERIM ACTION MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:			RIFS-05		RIFS-06	RIFS-07	SD-OF	SD2-02	SD2-03
Sample ID:			SD2-01	RIFS-05	RIFS-06	RIFS-07	SD-OF	SD2-02	SD2-03
Depth:			(0-10cm)	(0-10cm)	(0-10cm)	(0-10cm)	(0-10cm)	(0-10cm)	(0-10cm)
Sample Date:	SQS (a)	CSL (b)	11/21/2000	9/26/2001	9/26/2001	9/26/2001	1/22/1998	11/21/2000	11/21/2000
SVOCs (mg/kg OC) (e)									
1,2-Dichlorobenzene	2.3	2.3	0.90 U				0.80 U	1.2 U	1.0 U
1,3-Dichlorobenzene	None	None							
1,4-Dichlorobenzene	3.1	9	0.90 U				0.80 U	1.2 U	1.0 U
1,2,4-Trichlorobenzene	0.81	1.8	0.90 U				0.80 U	1.2 U	1.0 U
Hexachlorobenzene	0.38	2.3	0.04 U				0.80 U (j)	0.05 U	0.05 U
Dimethylphthalate	53	53	2.3				0.80 U	1.2 U	1.4
Diethylphthalate	61	110	0.90 U				0.80 U	1.2 U	1.0 U
Di-n-Butylphthalate	220	1700	3.9				0.80 U	2.4	1.6
Butylbenzylphthalate	4.9	64	0.90 U				0.80 U	1.2 U	1.0 U
bis(2-Ethylhexyl)phthalate	47	78	18				6.00	12 U	11 U
Di-n-octyl phthalate	58	4500	0.90 U				0.80 U	1.2 U	1.0 U
Dibenzofuran	15	58	4.5				2.33	3.2	2.6
Hexachlorobutadiene	3.9	6.2	0.04 U				1.60 U	0.05 U	0.05 U
N-Nitrosodiphenylamine	11	11	0.90 U				8.00 Y	1.2 U	1.0 U
SVOCs (ug/kg)									
Phenol	420	1200					240 U		
2-Methylphenol	63	63					240 U (j)		
4-Methylphenol	670	670					120 U		
2,4-Dimethylphenol	29	29					360 U (j)		
Pentachlorophenol	360	690					610 U (j)		
Benzyl Alcohol	57	73					610 U (j)		
Benzoic Acid	650	650					1200 U (j)		
Conventionals									
Total Organic Carbon (percent)	None	None	2.1 J		2.1	2.2	15.0	1.7 J	2.0 J
Total Solids (percent)	None	None			41	48.4			
N-Ammonia (mg-N/kg)	None	None							
Sulfide (mg/kg)	None	None							
DOC (mg/l)	None	None		24	22	26			
Total PCBs (f) (mg/kg OC)	12	65					0.32 J		
Grain Size (%)									
Gravel	None	None	2.4					3.1	6.0
Sand	None	None	4.0					5.6	4.5
Silt	None	None	49.4					57.5	46.4
Clay	None	None	44.3					33.9	42.9
Fines	None	None	93.7					91.4	89.3

TABLE D-1
PRE-INTERIM ACTION MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:			SD2-04	SD2-05
Sample ID:			SD2-04	SD2-05
Depth:			(0-10cm)	(0-10cm)
Sample Date:	SQS (a)	CSL (b)	11/21/2000	11/21/2000
Metals (mg/kg)				
Arsenic	57	93	5 U	5 U
Cadmium	5.1	6.7	0.2 U	0.2 U
Chromium	260	270	36.0	38.2
Copper	390	390	33.0	40.9
Lead	450	530	8	8
Mercury	0.41	0.59	0.20	0.17
Silver	6.1	6.1	0.3 U	0.3 U
Zinc	410	960	57.5	66.5
Bulk Organotin (ug/kg)				
Tributyltin (as TBT ion)	79 (c)	156 (c)	3.8 J	28
Tributyltin (as chloride)	None	None		
Tetrabutyltin	None	None	5.9 U	5.8 U
Dibutyltin (as Chloride)	None	None	1.2 J	7.1
Butyltin (as Chloride)	None	None	5.9 U	5.8 UJ
Porewater Organotin (ug/L)				
Tributyltin (as TBT ion)	0.15 (d)	None		
Tributyltin (as chloride)	None	None		
PAHs (mg/kg OC) (e)				
Naphthalene	99	170	1.3	3.6
Acenaphthylene	66	66	0.95 J	2.8
Acenaphthene	16	57	0.79 J	3.4
Fluorene	23	79	1.3	5.2
Phenanthrene	100	480	4.7	36
Anthracene	220	1200	2.6	5.2
2-Methylnaphthalene	38	64	1.2	2.4
LPAH (f, g)	370	780	12	56
Fluoranthene	160	1200	11	41
Pyrene	1000	1400	14	32
Benzo(a)anthracene	110	270	4.2	11
Chrysene	110	460	6.8	25
Benzo(b)fluoranthene	None	None		
Benzo(K)fluoranthene	None	None		
Total Benzofluoranthenes (f, h)	230	450	9.1	33
Benzo(a)pyrene	99	210	3.3	8.6
Indeno(1,2,3-c,d)pyrene	34	88	1.7	3.7
Dibenz(a,h)anthracene	12	33	1.0 U	1.2
Benzo(g,h,i)perylene	31	78	1.2	2.4
HPAH (f, i)	960	5300	51	159

TABLE D-1
PRE-INTERIM ACTION MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:			SD2-04	SD2-05
Sample ID:			SD2-04	SD2-05
Depth:			(0-10cm)	(0-10cm)
Sample Date:	SQS (a)	CSL (b)	11/21/2000	11/21/2000
SVOCs (mg/kg OC) (e)				
1,2-Dichlorobenzene	2.3	2.3	1.0 U	0.90 U
1,3-Dichlorobenzene	None	None		
1,4-Dichlorobenzene	3.1	9	1.0 U	0.90 U
1,2,4-Trichlorobenzene	0.81	1.8	1.0 U	0.90 U
Hexachlorobenzene	0.38	2.3	0.05 U	0.05 U
Dimethylphthalate	53	53	1.1	2.6
Diethylphthalate	61	110	1.0 U	0.90 U
Di-n-Butylphthalate	220	1700	1.2	2.0
Butylbenzylphthalate	4.9	64	1.0 U	0.90 U
bis(2-Ethylhexyl)phthalate	47	78	7.4 U	14
Di-n-octyl phthalate	58	4500	1.0 U	0.90 U
Dibenzofuran	15	58	1.5	5.7
Hexachlorobutadiene	3.9	6.2	0.05 U	0.05 U
N-Nitrosodiphenylamine	11	11	1.0 U	0.90 U
SVOCs (ug/kg)				
Phenol	420	1200		
2-Methylphenol	63	63		
4-Methylphenol	670	670		
2,4-Dimethylphenol	29	29		
Pentachlorophenol	360	690		
Benzyl Alcohol	57	73		
Benzoic Acid	650	650		
Conventionals				
Total Organic Carbon (percent)	None	None	1.9 J	2.1 J
Total Solids (percent)	None	None		
N-Ammonia (mg-N/kg)	None	None		
Sulfide (mg/kg)	None	None		
DOC (mg/l)	None	None		
Total PCBs (f) (mg/kg OC)	12	65		
Grain Size (%)				
Gravel	None	None	2.7	3.6
Sand	None	None	16.5	7.3
Silt	None	None	46.1	48.1
Clay	None	None	34.6	41.0
Fines	None	None	80.7	89.1

TABLE D-1
PRE-INTERIM ACTION MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

A blank indicates testing not performed.
U = Indicates compound was analyzed for, but was not detected at the given detection limit.
J = Estimated value.
M = Indicates an estimated value of analyte detected and confirmed by analyst with low spectral match parameters.
Y = Raised reporting limit due to matrix interferences.
Boxed results exceed the SQS.
Shaded results exceed the CSL.

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) SMS Cleanup Screening Level (Chapter 173-204 WAC).
(c) 79 µg/kg equals site-specific no effects TBT bulk sediment screening level.
156 µg/kg equals site-specific potential adverse affects TBT bulk sediment screening level.
(d) TBT porewater screening level established by PSDDA.
(e) All organic data (except phenols, benzyl alcohol, and benzoic acid) are normalized to total organic carbon; this involves dividing the dry weight concentration of the constituent by the fraction of total organic carbon present.
(f) Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:
(i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers.
(ii) Where chemical analyses detect one or more individual compounds/isomers, only the detected concentrations will be added to represent the group sum.
(g) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.
(h) The total benzofluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.
(i) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.
(j) Method detection limits exceed the SQS or CSL criteria.

APPENDIX E

Sediment Data Report

Sediment Data Report
Weldcraft Steel and Marine Site
Bellingham, Washington

December 4, 2009

Prepared for

Port of Bellingham
Bellingham, Washington

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1.0 INTRODUCTION

This report presents the results for the sediment quality monitoring conducted in October 2009 at the Weldcraft Steel and Marine (Gate 2 Boatyard) Site (Site) located in Bellingham Bay, Bellingham, Washington (Figure 1). The sediment quality monitoring is being conducted as part of the Site-wide remedial investigation (RI), in accordance with Agreed Order No. DE 03TCPBE-5623 (Agreed Order) between the Washington State Department of Ecology (Ecology) and the Port of Bellingham (Port).

The purpose of the sediment quality monitoring was to evaluate sediment quality in the marine portion of the Site (Marine Area) five years following completion of the 2003 sediment interim action. This report describes the activities conducted, identifies the samples collected and their locations, presents the chemical results for the sediment samples, and evaluates the results based on applicable Sediment Management Standards (SMS; WAC 173-204; Ecology 1995) criteria.

1.1 SITE DESCRIPTION

The Site is located in the northern corner of Squalicum Outer Harbor and consists of several buildings, open storage areas, parking lots, and until 2003, a marine railway. The Marine Area is defined by the extent of pre-interim action marine sediment contamination, and is shown on Figure 2. It consists of about 0.6 acres, including almost no intertidal habitat (Elevation 0 to 10 ft MLLW), about 0.1 acre shallow subtidal (Elevation -4 to 0 ft MLLW), and about 0.5 acre of deep subtidal (below Elevation -10 ft MLLW). Numerous marine structures are present in the Marine Area, including a bulkhead along its entire shoreline, and two sets of travel-lift piers.

1.2 SITE BACKGROUND

The Port entered into the Agreed Order in 2003 to remediate contaminated marine sediment and to conduct an RI/FS. Prior to entering into the Agreed Order, the Port had conducted a number of environmental investigations and an interim action in the Marine Area. A Phase II Environmental Site Assessment (ESA) was conducted in 1998, which identified surface sediment contamination at the marine railway well that consisted of a number of metals and organic constituents. In 2000 and 2001, a supplemental marine sediment investigation and a marine sediment remedial assessment were conducted, respectively. These investigations concluded that marine sediment contamination associated with historic boatyard activities occurred in the vicinity of the former marine railway and the existing 30-ton travel lift, and consisted primarily of tributyltin (TBT) and mercury contamination with less extensive, co-located, marine sediment contamination consisting of other metals and organic constituents. Available data did not suggest that existing outfalls are (or were) a significant source of Site marine sediment contamination.

In 2003/2004, a marine sediment interim action that consisted of dredging about 6,800 cubic yards of contaminated marine sediment was conducted. Areas dredged to below elevation -13 ft MLLW were backfilled with clean, imported gravelly sand. Marine sediment dredging was conducted in conjunction with removal of the marine railway, construction of a new bulkhead, and other Site improvements, as shown on Figure 2.

Marine sediment interim action compliance monitoring was performed in 2004 following completion of sediment dredging activities. Twelve surface marine sediment samples (SPM-1 through SPM-12) were collected in January 2004 and tested for semivolatile organic compounds (SVOCs), metals (As, Cd, Cr, Cu, Pb, Hg, Zn, and Ag), bulk organotins (including TBT), and total organic carbon (TOC). The analytical results from the initial round of compliance monitoring indicated that surface marine sediment within the marine dredge area exceed the Sediment Management Standards (SMS), Sediment Quality Standards (SQS), or SMS Cleanup Screening Levels (CSL) for mercury, TBT and/or polycyclic aromatic hydrocarbons. Based on these results, marine sediment in front of the former marine railway well was removed by additional dredging.

Four marine sediment surface samples (SPM-2A, SPM-3A, SPM-5A, and SPM-6A), and three core samples were collected during the second round of compliance monitoring and were tested for mercury, and two of the surface samples (SPM-3A and SPM-5A) were also tested for bulk organotins.

Based on the results of the post-interim action marine sediment compliance monitoring, it was concluded that post-dredging residual contamination resulted from redistribution caused by dredging activities, and is limited to about the upper 5 inches of marine sediment because no cleanup level exceedances were detected in core samples collected below surface sediment. It was also concluded that because the additional marine sediment sampling at two locations did not replicate the mercury cleanup level exceedances from the initial round of monitoring, the thin veneer of post-dredging marine sediment contamination is either intermittent in coverage or natural recovery processes are already occurring at the Site.

Post-interim action marine sediment quality data for detected constituents in conjunction with the marine sediment screening levels are presented in Table 1. Marine sediment samples collected during the initial round of compliance monitoring from areas that were subsequently dredged are not presented because they do not represent current sediment quality conditions.

A constituent was identified as being of concern if at least one post-interim action marine sediment sample exceeded the SQS criteria for that constituent. Based on this criterion, the constituents of concern (COCs) identified for Site marine sediment are mercury, zinc, acenaphthene, flourene, fluoranthene, phenanthrene, and dibenzofuran. Mercury is the most ubiquitous sediment COC, and is shown for all sampling locations on Figure 3. Other COCs are shown on Figure 3 at locations where their respective SQS value was exceeded.

2.0 FIELD ACTIVITIES

Sediment quality monitoring for the supplemental RI sediment investigation was conducted in accordance with the sediment sampling and analysis plan (SAP; Landau Associates 2009) that was reviewed and approved by Ecology. This section describes the sample locations, depths, laboratory analyses and field quality control samples. Sample collection procedures are briefly described, but the SAP should be reviewed for a more detailed description of the sample collection procedures.

2.1 SAMPLE LOCATIONS AND DEPTH

Sediment samples were collected at nine locations. Six samples were collected from the location of the interim action dredge prism and five of these samples were co-located with post-interim action compliance monitoring locations. The remaining three samples were collected immediately outside the former dredge prism and were also co-located with previous sampling locations. Where applicable, the sample identifications included the post-interim action compliance monitoring sample identifications and the year 2009. The supplemental RI sediment sampling locations are shown on Figure 4 in conjunction with the post-interim action sampling locations. Each sediment sample consisted of sediment collected from the upper 12 cm, which is considered the biologically active zone for Bellingham Bay (RETEC 2006).

2.2 SAMPLE COLLECTION AND ANALYSIS

Sediment was retrieved at each sampling station using a 36-ft vessel with a pneumatic power grab sampler. In accordance with the SAP (Landau Associates 2009), samples for laboratory analysis were collected from the upper 12 cm using a stainless-steel spoon, homogenized in a stainless-steel bowl, and placed in the appropriate sample container. The sediment samples were analyzed for the COCs (mercury, zinc, acenaphthene, flourene, fluoranthene, phenanthrene, and dibenzofuran). TOC in each sediment sample was also measured. Methods used for the analysis of the sediment samples are identified in Tables 1 and 2.

2.3 FIELD QUALITY CONTROL SAMPLES

For data validation purposes, a blind field duplicate sample was collected at station SPM-4-09 (duplicate sample identified as SPM-0-09). Matrix spike and matrix spike duplicate samples were also collected at station SPM-10-09. The blind field duplicate and the matrix spike and matrix spike duplicates were analyzed for all of the COCs.

3.0 ANALYTICAL RESULTS

This section presents the physical and analytical results for the supplemental RI sediment investigation. The purpose of the sediment quality monitoring was to evaluate surface sediment quality in the Marine Area following five years of natural recovery after completion of the 2003/2004 sediment interim action. Natural recovery occurs through a combination of processes, including the deposition of clean marine sediment, intermixing of clean and affected sediment through bioturbation, and contaminant transformation and weathering. As previously discussed, the sediment interim action removed all but an intermittent, thin veneer of surface sediment contamination that resulted from redistribution during dredging, so it was anticipated that the Marine Area would respond rapidly to natural recovery processes.

The samples were analyzed and validated according to the quality control procedures described in the SAP. All of the data were determined to be acceptable for use and no data was rejected. However, the relative percent difference (RPD) between sample and the associated field duplicate were outside the recommended control limits for phenanthrene and fluoranthene. Due to the natural heterogeneity of sediment, it is common for the RPD between sediment samples and duplicates to be outside of the recommended control limits. Nonetheless, the phenanthrene and fluoranthene results for sample SPM-4-09 and the duplicate sample SPM-0-09 were qualified as estimates and flagged (J) based on the RPDs being outside the recommended RPD control limits

3.1 PHYSICAL RESULTS

Because sediment that has accumulated within the Marine Area subsequent to the interim action is similar in composition to pre-existing sediment, identifying the amount of post-interim action sediment accumulation is difficult. However, the western portion of the dredge prism was backfilled with gravelly sand, which provides a clear contrast to the fine-grained naturally occurring sediment at the Site. As a result, the top of the gravelly sand layer provides a clear marker layer for post-interim action sediment accumulation for those samples collected from the backfilled area.

Three samples, SPM-1-09, SPM-2-09 and SPM-13-09 were collected from the backfill area. At sample locations SPM-1-09 and SPM-2-09, only fine-grained sediment (silt) was encountered in the 12 cm surface sediment samples. At sample location SPM-13-09, silt was observed to a depth of 10 cm and a medium to coarse sand (interim action backfill) was observed below 10 cm. Based on these observations it is concluded that at least 10 cm of sediment has been deposited within the dredge prism following the interim action, indicating that significant natural recovery is occurring.

3.2 ANALYTICAL RESULTS

To evaluate the sediment quality, the analytical results for the sediment samples were compared to the SQS and CSL, as presented in Table 1. Because the SQS and CSL for acenapthylene, fluorene, phenanthrene, fluoranthene, and dibenzofuran are expressed on a TOC-normalized basis, the analytical results for these constituents have been organic carbon normalized. As shown in Table 1, mercury, zinc, and two or more of the SVOCs were detected in each sample; however, none of the concentrations exceed the SQS or CSL criteria. Reporting limits for the non-detected constituents are also below the SQS and CSL criteria.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the 2009 sediment compliance monitoring, sediment quality criteria have been achieved by natural recovery and no further investigation or cleanup of Site sediment is necessary. The results of the 2009 sediment compliance monitoring will be incorporated into the Site RI/FS report.

5.0 USE OF THIS DOCUMENT

This report has been prepared for the exclusive use of the Port of Bellingham for specific application to the Weldcraft Steel and Marine Sediment Compliance Monitoring Project. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of the Port and Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by the Port and Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

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Principal

LDB/SJL/rgm

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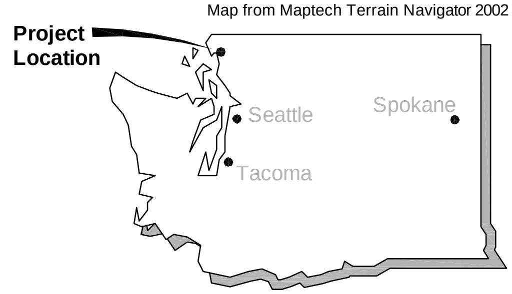
RETEC. 2006. *Supplemental Remedial Investigation & Feasibility Study, Volume 1: RI Report, Whatcom Waterway Site, Bellingham, Washington*. Report (draft) prepared for the Washington Department of Ecology, Northwest Regional Office. October 10.

Map from Maptech Terrain Navigator 2002



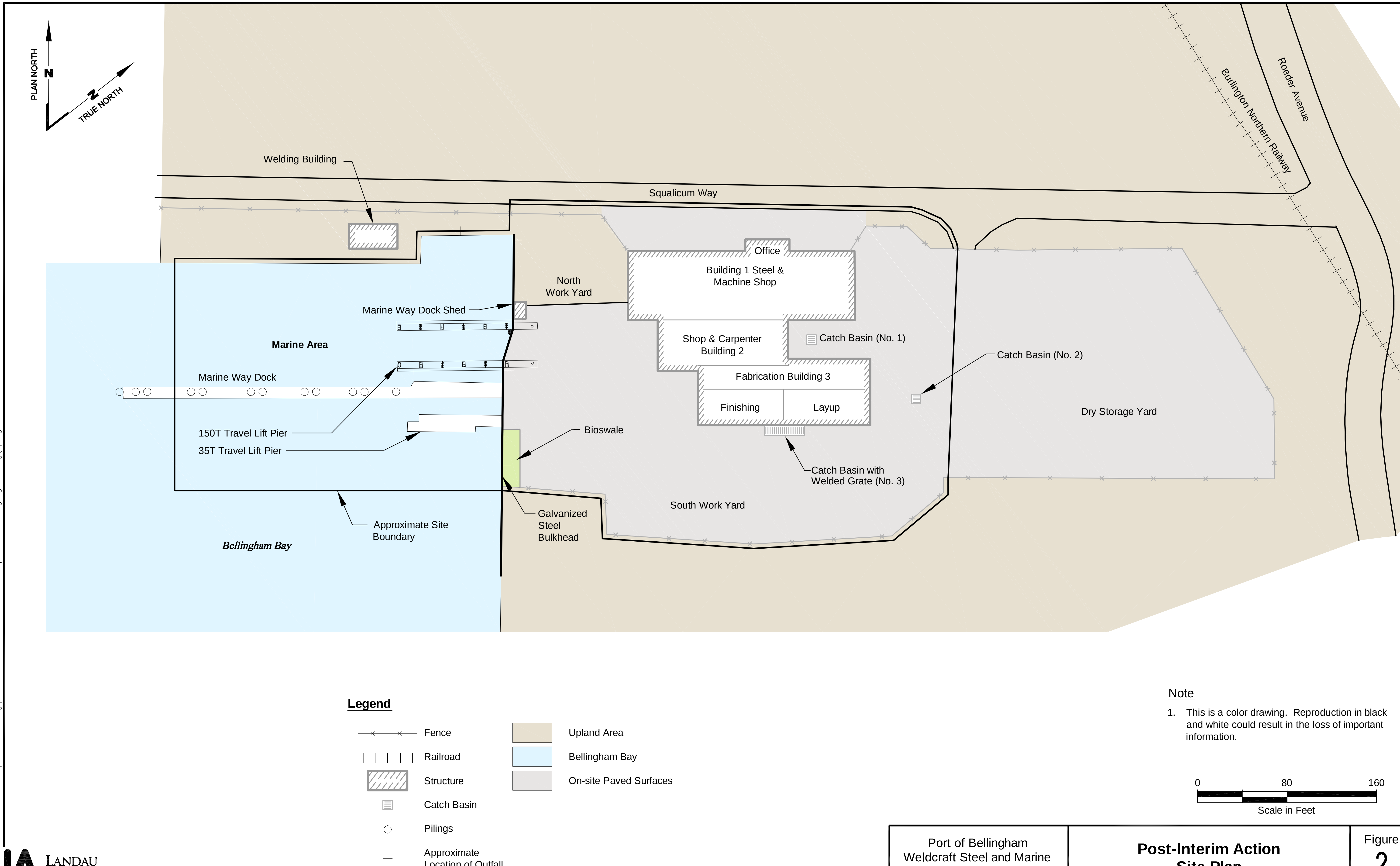
0 2000 4000

Scale in Feet

2009 Sediment Compliance Monitoring | V:\001\024\200\300\2009 Sediment Compliance Monitoring\Figure 1.dwg (A) "Figure 1" 11/24/2009

LANDAU ASSOCIATES

Port of Bellingham Weldcraft Steel and Marine Bellingham, Washington	**Vicinity Map**	Figure 1



Note

1. This is a color drawing. Reproduction in black and white could result in the loss of important information.

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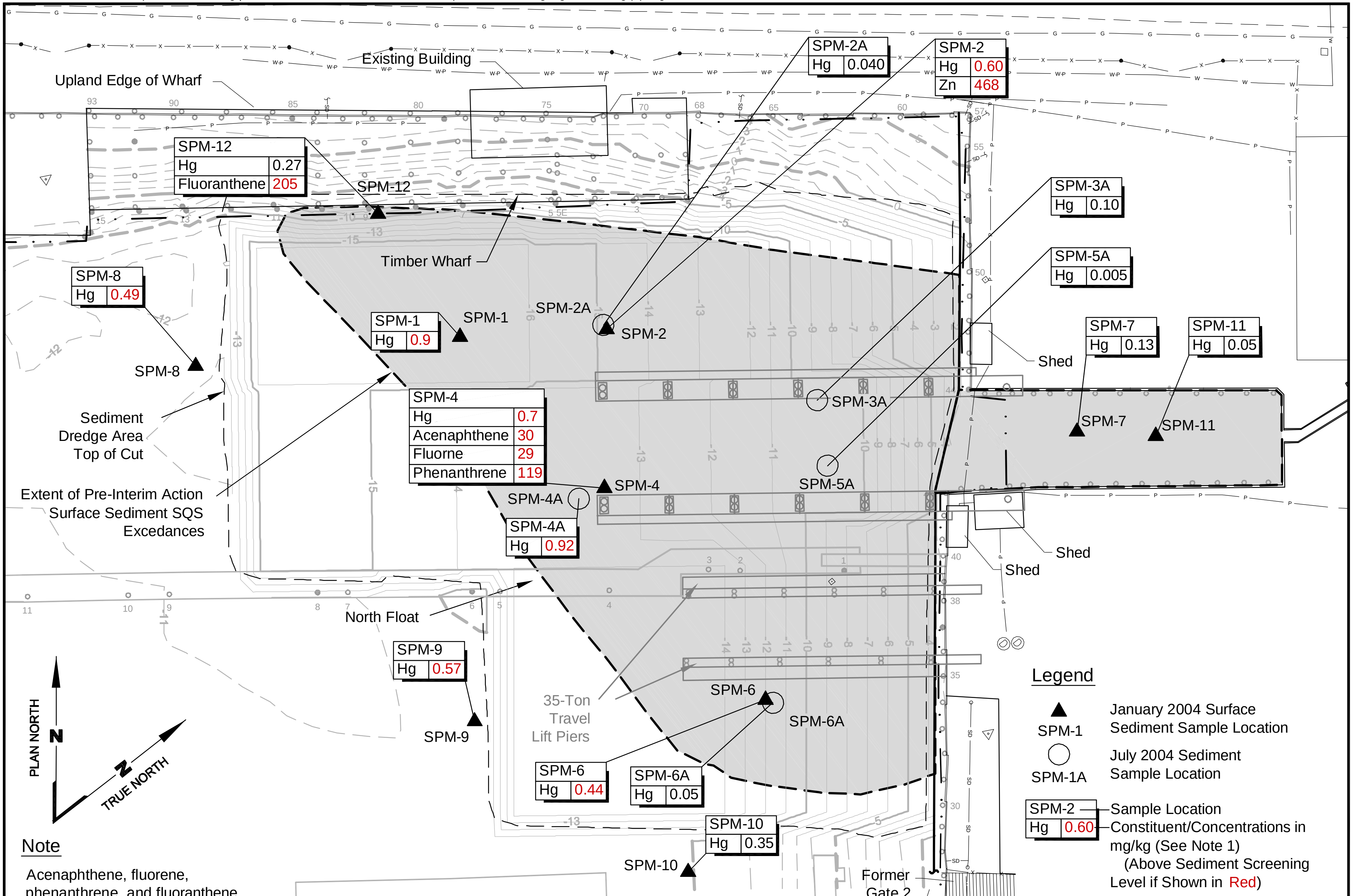
Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Post-Interim Action Site Plan

Figure 2



Note

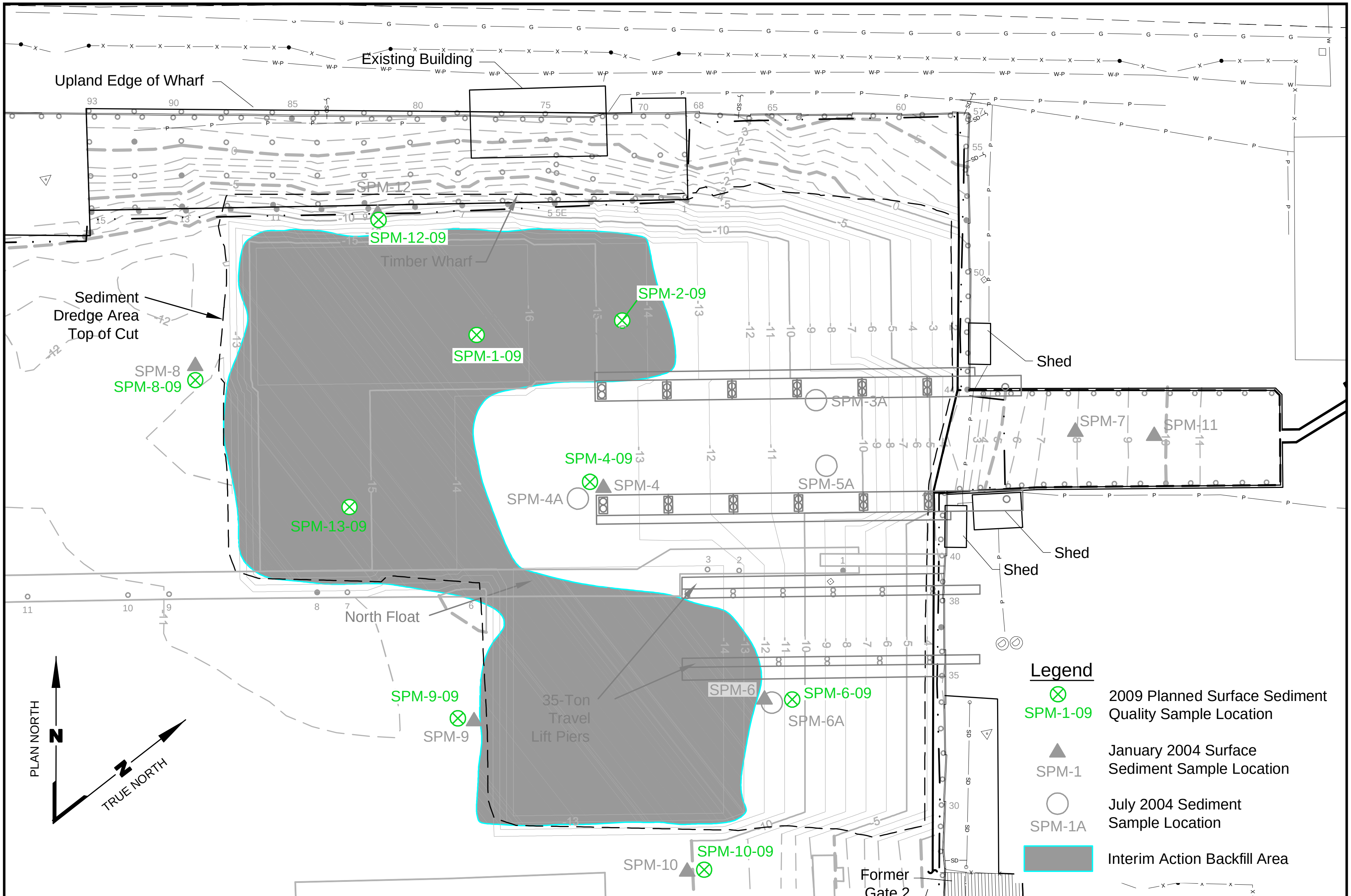
Acenaphthene, fluorene, phenanthrene, and fluoranthene results are organic carbon normalized.

Landau Associates

Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

Post-Interim Action Sediment Results

Figure 3



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0 40 80

Scale in Feet

Port of Bellingham
Weldcraft Steel and Marine
Bellingham, Washington

2009 Compliance Monitoring Sediment Sample Locations

Figure 4

TABLE 1
2009 SEDIMENT COMPLIANCE MONITORING RESULTS
WELDCRAFT STEEL AND MARINE
PORT OF BELLINGHAM

	Sediment Management Standards		SPM-1-09 (0-12cm)	SPM-2-09 (0-12cm)	SPM-4-09 (0-12cm)	Dup of SPM-4-09 (0-12cm) SPM-0-09 (0-12cm)	SPM-6-09 (0-12cm)	SPM-8-09 (0-12cm)	SPM-9-09 (0-12cm)	SPM-10-09 (0-12cm)	SPM-12-09 (0-12cm)	SPM-13-09 (0-12cm)
			PU05I	PU05H	PU05D	PU05E	PU05G	PU05B	PU05A	PU05J	PU05C	PU05F
	SQS (a)	CSL (b)	10/22/2009	10/22/2009	10/22/2009	10/22/2009	10/22/2009	10/22/2009	10/22/2009	10/22/2009	10/22/2009	10/22/2009
TOTAL METALS (mg/kg-dry wt)												
Methods SW6010B/SW7471A												
Mercury	0.41	0.59	**0.12**	**0.11**	**0.14**	**0.12**	**0.27**	**0.19**	**0.18**	**0.17**	**0.14**	**0.12**
Zinc	410	960	**145**	**159**	**160**	**161**	**148**	**144**	**157**	**167**	**176**	**121**
SEMIVOLATILES (mg/kg OC) (c)												
Method SW8270D												
Acenaphthylene	66	66	1.35 U	1.52 U	1.21 U	**0.73** J	0.88 U	**0.69** J	1.32 U	1.41 U	**0.56** J	1.32 U
Fluorene	23	79	1.35 U	1.52 U	**0.73** J	**1.50**	0.88 U	**1.51**	**1.38**	**0.85** J	**1.18**	**0.86** J
Phenanthrene	100	480	**2.43**	**3.48**	**3.15** J1	**16.58** J1	**1.85**	**4.28**	**4.54**	**4.58**	**3.31**	**4.24**
Fluoranthene	160	1200	**4.05**	**5.61**	**6.67** J1	**31.61** J1	**6.48**	**12.58**	**13.82**	**19.01**	**10.11**	**7.95**
Dibenzofuran	15	58	1.35 U	1.52 U	**0.91** J	**1.55**	0.88 U	**2.01**	**1.71**	1.41 U	**1.24**	**1.13** J
CONVENTIONALS												
Total Organic Carbon (PLUMB81TC) (%)	--	--	1.48	1.32	1.65	1.93	2.16	1.59	1.52	1.42	1.78	1.51
Total Solids (EPA160.3) (%)	--	--	42.00	38.40	39.70	37.60	52.90	55.90	51.00	50.90	55.60	38.20

-- Indicates no criteria established.
U = Indicates the compound was undetected at the reported concentration.
J = Reported detected result is less than the Reporting Limit but greater than the Method Detection Limit.
J1 = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).
(b) SMS Cleanup Screening Level (Chapter 173-204 WAC).
(c) All organic data are normalized to total organic carbon; this involves dividing the dry weight concentration of the constituent by the fraction of total organic carbon present.

APPENDIX F

2004 Performance Monitoring Marine Sediment Analytical Results

TABLE F-1
2004 PERFORMANCE MONITORING MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-1 GG43A 1/28/2004	SPM-2 GG43B 1/28/2004	SPM-3 GG43C 1/28/2004	SPM-4 GG43D 1/28/2004	SPM-5 GG43E 1/28/2004	SPM-6 GG43F 1/28/2004	SPM-7 GF53A 1/15/2004	SPM-8 GG43G 1/28/2004
Metals (mg/kg)										
Arsenic	57	93	10	10	7 U	20	13	15	6 U	13
Cadmium	5.1	6.7	0.7	0.8	0.3 U	0.7	0.5	0.4	0.2 U	0.4
Chromium	260	270	65	136	26.9	67	46.5	48.7	23.5	51.2
Copper	390	390	201	190	150	220	309	140	84.3	134
Lead	450	530	48	42	25	48	54	32	7	30
Mercury	0.41	0.59	0.9 J	0.60	0.35	0.7	0.96	0.44	0.13	0.49
Silver	6.1	6.1	0.6 U	0.6 U	0.4 U	0.6 U	0.5 U	0.5 U	0.4 U	0.5 U
Zinc	410	960	210	468	111	230	218	127	89.2	110
Bulk Organotin (ug/kg)										
Tributyltin (as TBT ion)	79 (c)	156 (c)	34	24	140	61	260	69	12	18
PAHs (mg/kg OC) (d)										
Naphthalene	99	170	10	10	72	33	77	8.1	0.1 U	22
Acenaphthylene	66	66	0.7	0.8 U	1.5	1.4	2.7	1.1	0.1 U	0.9
Acenaphthene	16	57	12	10	42	30	54	7.8	0.1 U	9.1
Fluorene	23	79	15	11	33	29	46	8.3	0.1 U	7.8
Phenanthrene	100	480	53	38	119	119	180	31	0.1 U	29
Anthracene	220	1200	8.4	6.9	13	16	22	6.1	0.1 U	11
2-Methylnaphthalene	38	64	6.3	3.8	35	14	43	4.4	0.2	3.7
LPAH (e, f)	370	780	100	77	280	227	382	62	0.1 U	80
Fluoranthene	160	1200	47	38	102	100	220	42	0.1	41
Pyrene	1000	1400	31	30	67	67	123	25	0.2	35
Benzo(a)anthracene	110	270	14	13	21	27	40	14	0.1 U	15
Chrysene	110	460	16	16	33	33	54	20	0.1 U	23
Benzo(b)fluoranthene	None	None	13	13	20	27	34	15	0.1 U	17
Benzo(k)fluoranthene	None	None	11	12	17	22	28	11	0.1 U	13
Total Benzofluoranthenes (e,g)	230	450	24	25	37	50	62	27	0.1	30
Benzo(a)pyrene	99	210	8.1	8.1	12	15	20	8.9	0.1 U	11
Indeno(1,2,3-cd)pyrene	34	88	1.7	2.2	2.6	3.0	4.3	3.1	0.1 U	3.3
Dibenz(a,h)anthracene	12	33	0.6 U	0.8 U	0.7	1.0	1.2	0.9	0.1 U	1.0
Benzo(g,h,i)perylene	31	78	1.1	1.2	1.6	2.0	2.9	2.1	0.1 U	2.3
HPAH (e,h)	960	5300	143	134	277	298	528	143	0.3	161

TABLE F-1
2004 PERFORMANCE MONITORING MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-1 GG43A 1/28/2004	SPM-2 GG43B 1/28/2004	SPM-3 GG43C 1/28/2004	SPM-4 GG43D 1/28/2004	SPM-5 GG43E 1/28/2004	SPM-6 GG43F 1/28/2004	SPM-7 GF53A 1/15/2004	SPM-8 GG43G 1/28/2004
SVOCs (mg/kg OC) (e)										
1,2-Dichlorobenzene	2.3	2.3	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
1,3-Dichlorobenzene	None	None	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
1,4-Dichlorobenzene	3.1	9	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
1,2,4-Trichlorobenzene	0.81	1.8	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
Hexachlorobenzene	0.38	2.3	0.6 U (i)	0.8 U (i)	0.4 U (i)	0.7 U (i)	0.6 U (i)	0.6 U (i)	0.1 U	0.8 U (i)
Dimethylphthalate	53	53	0.8	1.7	1.0	1.9	2.9	1.1	0.1 U	1.4
Diethylphthalate	61	110	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
Di-n-Butylphthalate	220	1700	0.6 U	0.8 U	0.4 U	0.7 U	1.2	0.6 U	0.1 U	0.8 U
Butylbenzylphthalate	4.9	64	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
bis(2-Ethylhexyl)phthalate	47	78	5.0	4.2	8.8	7.4	12.3	4.2	0.2	3.9
Di-n-Octyl phthalate	58	4500	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
Dibenzofuran	15	58	9.1	6.5	25.6	19	34	5.6	0.1	6.1
Hexachlorobutadiene	3.9	6.2	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
N-Nitrosodiphenylamine	11	11	0.6 U	0.8 U	0.4 U	0.7 U	0.6 U	0.6 U	0.1 U	0.8 U
SVOCs (ug/kg)										
Phenol	420	1200	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
2-Methylphenol	63	63	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
4-Methylphenol	670	670	24	20 U	47	20 U	20 U	20 U	19 U	19 U
2,4-Dimethylphenol	29	29	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
Pentachlorophenol	360	690	97 U	98 U	97 U	98 U	99 U	98 U	96 U	97 U
Benzyl Alcohol	57	73	19 U	20 U	19 U	20 U	20 U	20 U	19 U	19 U
Benzoic Acid	650	650	190 U	200 U	190 U	200 U	200 U	200 U	190 U	190 U
Conventionals										
Total Organic Carbon (percent)	None	None	3.2	2.6	4.3	2.7	3.5	3.6	17	2.3
Total Solids (percent)	None	None	47.7	46.4	71.0	47.0	56.2	56.2	80.2	63.5
Si/Acid Cleaned NWTPH-Dx (mg/kg)										
Diesel	None	None							23	
Motor Oil	None	None							50	
NWTPH-G (mg/kg)	None	None								
Gasoline Range Hydrocarbons	None	None							6.2 U	

TABLE F-1
2004 PERFORMANCE MONITORING MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-9 GG43H 1/28/2004	SPM-10 GG43I 1/28/2004	SPM-11 GF53B 1/15/2004	SPM-12 GG43J 1/28/2004
Metals (mg/kg)						
Arsenic	57	93	20	10	5 U	20
Cadmium	5.1	6.7	0.5	0.4 U	0.2 U	0.5
Chromium	260	270	64	72	19.5	63
Copper	390	390	126	110	17.3	124
Lead	450	530	27	20	7	22
Mercury	0.41	0.59	0.57	0.35	0.05	0.27
Silver	6.1	6.1	0.6 U	0.6 U	0.3 U	0.6 U
Zinc	410	960	149	146	123	164
Bulk Organotin (ug/kg)						
Tributyltin (as TBT ion)	79 (c)	156 (c)	25	6.5	3.8 U	12
PAHs (mg/kg OC) (d)						
Naphthalene	99	170	8.9	3.7	0.3 U	3.0
Acenaphthylene	66	66	1.1 U	0.9 U	0.3 U	4.8
Acenaphthene	16	57	13	3.9	0.3 U	7.6
Fluorene	23	79	12	4.3	0.3 U	8.1
Phenanthrene	100	480	54	17	0.3 U	67
Anthracene	220	1200	8.9	4.0	0.3 U	17
2-Methylnaphthalene	38	64	3.2	1.5	0.3 U	1.4
LPAH (e, f)	370	780	97	33	0.3 U	107
Fluoranthene	160	1200	61	29	0.3 U	205
Pyrene	1000	1400	38	20	0.3 U	129
Benzo(a)anthracene	110	270	19	9.5	0.3 U	62
Chrysene	110	460	21	12	0.3 U	105
Benzo(b)fluoranthene	None	None	16	10	0.3 U	57
Benzo(k)fluoranthene	None	None	12	7.3	0.3 U	40
Total Benzofluoranthenes (e,g)	230	450	28	17	0.3 U	97
Benzo(a)pyrene	99	210	12	5.9	0.3 U	31
Indeno(1,2,3-cd)pyrene	34	88	4.1	2.0	0.3 U	10
Dibenz(a,h)anthracene	12	33	1.2	0.9 U	0.3 U	3
Benzo(g,h,i)perylene	31	78	2.8	1.4	0.3 U	6.2
HPAH (e,h)	960	5300	186	97	0.3 U	648

TABLE F-1
2004 PERFORMANCE MONITORING MARINE SEDIMENT ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE
PORT OF BELLINGHAM

	SQS (a)	CSL (b)	SPM-9 GG43H 1/28/2004	SPM-10 GG43I 1/28/2004	SPM-11 GF53B 1/15/2004	SPM-12 GG43J 1/28/2004
SVOCs (mg/kg OC) (e)						
1,2-Dichlorobenzene	2.3	2.3	1.1 U	0.9 U	0.3 U	1.0 U
1,3-Dichlorobenzene	None	None	1.1 U	0.9 U	0.3 U	1.0 U
1,4-Dichlorobenzene	3.1	9	1.1 U	0.9 U	0.3 U	1.0 U
1,2,4-Trichlorobenzene	0.81	1.8	1.1 U (i)	0.9 U (i)	0.3 U	1.0 U (i)
Hexachlorobenzene	0.38	2.3	1.1 U (i)	0.9 U (i)	0.3 U	1.0 U (i)
Dimethylphthalate	53	53	1.3	1.0	0.3 U	1.6
Diethylphthalate	61	110	1.1 U	0.9 U	0.3 U	1.0 U
Di-n-Butylphthalate	220	1700	1.1 U	0.9 U	0.3 U	1.0 U
Butylbenzylphthalate	4.9	64	1.1 U	0.9 U	0.3 U	1.0 U
bis(2-Ethylhexyl)phthalate	47	78	16.1	3.1	0.3 U	4.1
Di-n-Octyl phthalate	58	4500	1.1 U	0.9 U	0.3 U	1.0 U
Dibenzofuran	15	58	9.4	3.5	0.3 U	5.2
Hexachlorobutadiene	3.9	6.2	1.1 U	0.9 U	0.3 U	1.0 U
N-Nitrosodiphenylamine	11	11	1.1 U	0.9 U	0.3 U	1.0 U
SVOCs (ug/kg)						
Phenol	420	1200	20 U	20 U	19 U	20 U
2-Methylphenol	63	63	20 U	20 U	19 U	20 U
4-Methylphenol	670	670	20 U	20 U	19 U	20 U
2,4-Dimethylphenol	29	29	20 U	20 U	19 U	20 U
Pentachlorophenol	360	690	98 U	99 U	94 U	98 U
Benzyl Alcohol	57	73	20 U	20 U	19 U	20 U
Benzoic Acid	650	650	200 U	200 U	190 U	200 U
Conventionals						
Total Organic Carbon (percent)	None	None	1.8	2.2	5.7	2.1
Total Solids (percent)	None	None	48.1	49.6	85.7	47.3
Si/Acid Cleaned NWTPH-Dx (mg/kg)						
Diesel	None	None			5.00 U	
Motor Oil	None	None			10 U	
NWTPH-G (mg/kg)	None	None				
Gasoline Range Hydrocarbons	None	None			5.9 U	

TABLE F-1
2004 PERFORMANCE MONITORING MARINE SEDIMENT ANALYTICAL RESULTS
PORT OF BELLINGHAM

A blank indicates testing not performed.

U = Indicates compound was analyzed for, but was not detected at the given detection limit.

J = Data validation flag indicating the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Boxed results exceed the SQS.

Shaded results exceed the CSL.

(a) SMS Sediment Quality Standard (Chapter 173-204 WAC).

(b) SMS Cleanup Screening Level (Chapter 173-204 WAC).

(c) 79 µg/kg equals site-specific no effects TBT bulk sediment screening level. 156 µg/kg equals site-specific potential adverse affects TBT bulk sediment screening level.

(d) Value normalized to total organic carbon; this involves dividing the dry weight concentration of the constituent by the fraction of total organic carbon present.

(e) Where chemical criteria in this table represent the sum of individual compounds or isomers, the following methods shall be applied:

(i) Where chemical analyses identify an undetected value for every individual compound/isomer, then the single highest detection limit shall represent the sum of the respective compounds/isomers.

(ii) Where chemical analyses detect one or more individual compounds/isomers, only the detected concentrations will be added to represent the group sum.

(f) The LPAH criterion represents the sum of the following "low molecular weight polynuclear aromatic hydrocarbon" compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAH compounds listed.

(g) The total benzofluoranthenes criterion represents the sum of the concentrations of the "B," "J," and "K" isomers.

(h) The HPAH criterion represents the sum of the following "high molecular weight polynuclear aromatic hydrocarbon" compounds: fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAH compounds as listed.

(i) Method detection limits exceed the SQS or CSL criteria.

APPENDIX G

Pre-RI and RI Soil Analytical Results

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-1	SB-2	SB-6	SB-7	SB-8	SB-17	SB-18	SB-19	SB-20	SB-WW-Comp (b)	SB-Bldg3-Comp (c)	SB-EW-Comp (d)	SB-DS-Comp (e)	SB-25	SB-30	SB-32
Sample Depth (ft BGS)	1-1.4	1.2-1.4	0-1.4	0-1.7	4.7-5.6	0.2-0.6	0.75-1.5	0.5-2.1	0.4-1.7					7-8	7-7.5	5-6.8
Date Collected:	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																
Method WA HCID																
Gas Range	20 U	20 U	400 U		3200											
Diesel Range	25 U	25 U	500 U		340											
Oil Range	50 U	50 U	1100		790											
NWTPHg																
Gasoline Range Hydrocarbons																
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																
Method NWTPHd																
Gas Range																
Diesel Range (f)																
Oil Range (f)																
Method WTPHg																
Gas Range														180 J	26 J	5.4 UJ
BTEX (mg/kg)																
Method 8020																
Benzene														8.1 J	0.22 J	0.054 UJ
Toluene														3.2 J	1.2 J	0.054 UJ
Ethylbenzene														5 J	0.56 J	0.081 J
m,p-Xylene														27 J	2 J	0.39 J
o-Xylene														4.6 J	0.96 J	0.054 UJ
Total Xylenes														31.6	2.96	0.39 J
PRIORITY POLLUTANT METALS (mg/kg)																
Antimony (6010)				7		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
Arsenic (6010)				5 U		6	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
Beryllium (6010)				0.3		0.2	0.3	0.2	0.1	0.2	0.2	0.2	0.2			
Cadmium (6010)				0.6		0.3	0.6	0.4	0.9	0.4	0.3	0.2	0.2			
Chromium (6010)				38.5		28.4	51.7	29.9	35.4	36.5	26.5	27.6	23.4			
Copper (6010)				135		95.7	91.2	247	173	89.8	44.5	43.2	27.3			
Lead (6010)				40		50	43	120	1160	77	36	15	8			
Mercury (7471)				0.37		0.23	0.37	1.71	0.13	0.15	0.11	0.10	0.04 U			
Nickel (6010)				52		86	42	23	31	27	22	23	23			
Selenium (6010)				5 U		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
Silver (6010)				0.3 U		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U			
Thallium (6010)				5 U		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U			
Zinc (6010)				376		113	220	146	441	171	61.5	53.5	42.5			
VOLATILES (µg/kg)																
EPA Method SW8260																
Chloromethane																
Bromomethane																
Vinyl Chloride																
Chloroethane																
Methylene Chloride																
Acetone																
Carbon Disulfide																
1,1-Dichloroethene																
1,1-Dichloroethane																
trans-1,2-Dichloroethene																
cis-1,2-Dichloroethene																
Chloroform																
1,2-Dichloroethane																
2-Butanone																
1,1,1-Trichloroethane																
Carbon Tetrachloride																
Vinyl Acetate																
Bromodichloromethane																
1,2-Dichloropropane																
cis-1,3-Dichloropropene																
Trichloroethene																
Dibromochloromethane																

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-1	SB-2	SB-6	SB-7	SB-8	SB-17	SB-18	SB-19	SB-20	SB-WW-Comp (b)	SB-Bldg3-Comp (c)	SB-EW-Comp (d)	SB-DS-Comp (e)	SB-25	SB-30	SB-32
Sample Depth (ft BGS)	1-1.4	1.2-1.4	0-1.4	0-1.7	4.7-5.6	0.2-0.6	0.75-1.5	0.5-2.1	0.4-1.7					7-8	7-7.5	5-6.8
Date Collected:	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998
1,1,2-Trichloroethane																
Benzene																
trans-1,3-Dichloropropene																
2-Chloroethylvinylether																
Bromoform																
4-Methyl-2-Pentanone (MIBK)																
2-Hexanone																
Tetrachloroethene																
1,1,2,2-Tetrachloroethane																
Toluene																
Chlorobenzene																
Ethylbenzene																
Styrene																
Trichlorofluoromethane																
1,1,2-Trichlorotrifluoroethane																
m,p-Xylene																
o-Xylene																
Total Xylene																
1,2-Dichlorobenzene																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Acrolein																
Methyl Iodide																
Bromoethane																
Acrylonitrile																
1,1-Dichloropropene																
Dibromomethane																
1,1,1,2-Tetrachloroethane																
1,2-Dibromo-3-chloropropane																
1,2,3-Trichloropropane																
trans-1,4-Dichloro-2-butene																
1,3,5-Trimethylbenzene																
1,2,4-Trimethylbenzene																
Hexachlorobutadiene																
Ethylene Dibromide																
Bromochloromethane																
2,2-Dichloropropane																
1,3-Dichloropropane																
Isopropylbenzene																
n-Propylbenzene																
Bromobenzene																
2-Chlorotoluene																
4-Chlorotoluene																
tert-Butylbenzene																
sec-Butylbenzene																
4-Isopropyltoluene																
n-Butylbenzene																
1,2,4-Trichlorobenzene																
Naphthalene																
1,2,3-Trichlorobenzene																
Methyl tert-Butyl Ether																
SEMIVOLATILES (µg/kg)																
EPA Method SW8270																
Phenol																
Bis-(2-Chloroethyl) Ether																
2-Chlorophenol																
1,3-Dichlorobenzene																
1,4-Dichlorobenzene																
Benzyl Alcohol																
1,2-Dichlorobenzene																
2-Methylphenol																
2,2'-Oxybis(1-Chloropropane)																
4-Methylphenol																
N-Nitroso-Di-N-Propylamine																
Hexachloroethane																

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-1	SB-2	SB-6	SB-7	SB-8	SB-17	SB-18	SB-19	SB-20	SB-WW-Comp (b)	SB-Bldg3-Comp (c)	SB-EW-Comp (d)	SB-DS-Comp (e)	SB-25	SB-30	SB-32
Sample Depth (ft BGS)	1-1.4	1.2-1.4	0-1.4	0-1.7	4.7-5.6	0.2-0.6	0.75-1.5	0.5-2.1	0.4-1.7					7-8	7-7.5	5-6.8
Date Collected:	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998	1/21/1998
Nitrobenzene																
Isophorone																
2-Nitrophenol																
2,4-Dimethylphenol																
Benzoic Acid																
bis(2-Chloroethoxy) Methane																
2,4-Dichlorophenol																
1,2,4-Trichlorobenzene																
Naphthalene																
4-Chloroaniline																
Hexachlorobutadiene																
4-Chloro-3-methylphenol																
2-Methylnaphthalene																
Hexachlorocyclopentadiene																
2,4,6-Trichlorophenol																
2,4,5-Trichlorophenol																
2-Chloronaphthalene																
2-Nitroaniline																
Dimethylphthalate																
Acenaphthylene																
3-Nitroaniline																
Acenaphthene																
2,4-Dinitrophenol																
4-Nitrophenol																
Dibenzofuran																
2,6-Dinitrotoluene																
2,4-Dinitrotoluene																
Diethylphthalate																
4-Chlorophenyl-phenylether																
Fluorene																
4-Nitroaniline																
4,6-Dinitro-2-Methylphenol																
N-Nitrosodiphenylamine																
4-Bromophenyl-phenylether																
Hexachlorobenzene																
Pentachlorophenol																
Phenanthrene																
Carbazole																
Anthracene																
Di-n-Butylphthalate																
Fluoranthene																
Pyrene																
Butylbenzylphthalate																
3,3'-Dichlorobenzidine																
Benzo(a)anthracene																
bis(2-Ethylhexyl)phthalate																
Chrysene																
Di-n-Octyl phthalate																
Benzo(b)fluoranthene																
Benzo(k)fluoranthene																
Benzo(a)pyrene																
Indeno(1,2,3-cd)pyrene																
Dibenz(a,h)anthracene																
Benzo(g,h,i)perylene																
PCBs (µg/kg)																
Method 8082																
Aroclor 1016																
Aroclor 1242																
Aroclor 1248																
Aroclor 1254																
Aroclor 1260																
Aroclor 1221																
Aroclor 1232																
Total PCBs																

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a): Sample Depth (ft BGS) Date Collected:	SB-1 1-1.4 1/20/1998	SB-2 1.2-1.4 1/20/1998	SB-6 0-1.4 1/20/1998	SB-7 0-1.7 1/20/1998	SB-8 4.7-5.6 1/20/1998	SB-17 0.2-0.6 1/21/1998	SB-18 0.75-1.5 1/21/1998	SB-19 0.5-2.1 1/21/1998	SB-20 0.4-1.7 1/21/1998	SB-WW- Comp (b) 1/20/1998	SB-Bldg3- Comp (c) 1/20/1998	SB-EW- Comp (d) 1/20/1998	SB-DS- Comp (e) 1/21/1998	SB-25 7-8 1/21/1998	SB-30 7-7.5 1/21/1998	SB-32 5-6.8 1/21/1998
PAHs (µg/kg)																
SW8270-SIM																
Naphthalene																
2-Methylnaphthalene																
1-Methylnaphthalene																
Total naphthalene																
Benzo(a)anthracene																
Chrysene																
Benzo(b)fluoranthene																
Benzo(k)fluoranthene																
Benzo(a)pyrene																
Indeno(1,2,3-cd)pyrene																
Dibenz(a,h)anthracene																
TEF																

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a): Sample Depth (ft BGS) Date Collected:	SB-33 5-7.5 1/21/1998	Drum Area 1 surface 1/23/1998	Drum Area 2 surface 1/23/1998	DA101-0.75 BW26A 7/12/2000	DA101-2.5 BW26B 7/12/2000	DA101-8.0 BW26C 7/12/2000	DA102-0.75 BW26D 7/12/2000	DA102-3.0 BW26E 7/12/2000	DA102-8.0 BW26F 7/12/2000	DA103-0.5 BW26G 7/12/2000	DA103-2.5 BW26H 7/12/2000	DA103-8.0 BW26I 7/12/2000	SB-601A 0.0-1.5' CA23A 8/17/2000	SB-601B 1.5-3.0' CA23B 8/17/2000	UST-A CQ31A 1/4/2001	UST-B CQ31B 1/4/2001
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																
Method WA HCID																
Gas Range		200 UJ	200 UJ												20 U	470
Diesel Range		690 J	250 UJ												50 U	50 U
Oil Range		900 J	630 J												100 U	100 U
NWTPHg																
Gasoline Range Hydrocarbons																
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																
Method NWTPHd																
Gas Range													20 U	20 U		
Diesel Range (f)				14	7.2	36	8.7	5.2 U	10	15	8.9	72	50 U	50 U		
Oil Range (f)				54	17	55	26	10 U	14	38	10 U	100	150	100 U		
Method WTPHg																
Gas Range	5.7 UJ															
BTEX (mg/kg)																
Method 8020																
Benzene	0.057 UJ															
Toluene	0.057 UJ															
Ethylbenzene	0.057 UJ															
m,p-Xylene	0.072 J															
o-Xylene	0.057 UJ															
Total Xylenes	0.072 J															
PRIORITY POLLUTANT METALS (mg/kg)																
Antimony (6010)																
Arsenic (6010)															6 U	6 U
Beryllium (6010)																
Cadmium (6010)															0.2 U	0.3
Chromium (6010)															21.2	22.5
Copper (6010)															41.2	55.6
Lead (6010)															28	26
Mercury (7471)															0.06 U	0.06 U
Nickel (6010)															17	20
Selenium (6010)																
Silver (6010)																
Thallium (6010)																
Zinc (6010)																
VOLATILES (µg/kg)																
EPA Method SW8260																
Chloromethane				1.0 U			1.1 U			1.1 U						
Bromomethane				1.0 U			1.1 U			1.1 U						
Vinyl Chloride				1.0 U			1.1 U			1.1 U						
Chloroethane				1.0 U			1.1 U			1.1 U						
Methylene Chloride				3.1 U			3.3 U			3.2 U						
Acetone				5.2 U			5.4 U			5.3 U						
Carbon Disulfide				1.0 U			1.1 U			1.1 U						
1,1-Dichloroethene				1.0 U			1.1 U			1.1 U						
1,1-Dichloroethane				1.0 U			1.1 U			1.1 U						
trans-1,2-Dichloroethene				1.0 U			1.1 U			1.1 U						
cis-1,2-Dichloroethene				1.0 U			1.1 U			1.1 U						
Chloroform				1.0 U			1.1 U			1.1 U						
1,2-Dichloroethane				1.0 U			1.1 U			1.1 U						
2-Butanone				5.2 U			5.4 U			5.3 U						
1,1,1-Trichloroethane				1.0 U			1.1 U			1.1 U						
Carbon Tetrachloride				1.9			4.3			1.3						
Vinyl Acetate				5.2 U			5.4 U			5.3 U						
Bromodichloromethane				1.0 U			1.1 U			1.1 U						
1,2-Dichloropropane				1.0 U			1.1 U			1.1 U						
cis-1,3-Dichloropropene				1.0 U			1.1 U			1.1 U						
Trichloroethene				9.4			15			4.4						
Dibromochloromethane				1.0 U			1.1 U			1.1 U						

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-33	Drum Area 1	Drum Area 2	DA101-0.75	DA101-2.5	DA101-8.0	DA102-0.75	DA102-3.0	DA102-8.0	DA103-0.5	DA103-2.5	DA103-8.0	SB-601A	SB-601B	UST-A	UST-B
Sample Depth (ft BGS)	5-7.5	surface	surface	BW26A	BW26B	BW26C	BW26D	BW26E	BW26F	BW26G	BW26H	BW26I	0.0-1.5' CA23A	1.5-3.0' CA23B	CQ31A	CQ31B
Date Collected:	1/21/1998	1/23/1998	1/23/1998	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	8/17/2000	8/17/2000	1/4/2001	1/4/2001
1,1,2-Trichloroethane				1.0 U			1.1 U			1.1 U						
Benzene				1.0 U			1.1 U			1.1 U						
trans-1,3-Dichloropropene				1.0 U			1.1 U			1.1 U						
2-Chloroethylvinylether				5.2 U			5.4 U			5.3 U						
Bromoform				1.0 U			1.1 U			1.1 U						
4-Methyl-2-Pentanone (MIBK)				5.2 U			5.4 U			5.3 U						
2-Hexanone				5.2 U			5.4 U			5.3 U						
Tetrachloroethene				1.0 U			1.1 U			1.1 U						
1,1,2,2-Tetrachloroethane				1.0 U			1.1 U			1.1 U						
Toluene				1.4			2.2			1.1 U						
Chlorobenzene				1.0 U			1.1 U			1.1 U						
Ethylbenzene				1.0 U			1.1 U			1.1 U						
Styrene				1.0 U			1.1 U			1.1 U						
Trichlorofluoromethane				1.0 U			1.1 U			1.1 U						
1,1,2-Trichlorotrifluoroethane				1.0 U			1.1 U			1.1 U						
m,p-Xylene				1.0 U			1.1 U			1.1 U						
o-Xylene				1.0 U			1.1 U			1.1 U						
Total Xylene																
1,2-Dichlorobenzene				1.0 U			1.1 U			1.1 U						
1,3-Dichlorobenzene				1.0 U			1.1 U			1.1 U						
1,4-Dichlorobenzene				1.0 U			1.1 U			1.1 U						
Acrolein				52 U			54 U			53 U						
Methyl Iodide				1.0 U			1.1 U			1.1 U						
Bromoethane				2.1 U			2.2 U			2.1 U						
Acrylonitrile				5.2 U			5.4 U			5.3 U						
1,1-Dichloropropene				1.0 U			1.1 U			1.1 U						
Dibromomethane				1.0 U			1.1 U			1.1 U						
1,1,1,2-Tetrachloroethane				1.0 U			1.1 U			1.1 U						
1,2-Dibromo-3-chloropropane				5.2 U			5.4 U			5.3 U						
1,2,3-Trichloropropane				2.1 U			2.2 U			2.1 U						
trans-1,4-Dichloro-2-butene				5.2 U			5.4 U			5.3 U						
1,3,5-Trimethylbenzene				1.0 U			1.1 U			1.1 U						
1,2,4-Trimethylbenzene				1.0 U			1.1 U			1.1 U						
Hexachlorobutadiene				5.2 U			5.4 U			5.3 U						
Ethylene Dibromide				1.0 U			1.1 U			1.1 U						
Bromochloromethane				1.0 U			1.1 U			1.1 U						
2,2-Dichloropropane				1.0 U			1.1 U			1.1 U						
1,3-Dichloropropane				1.0 U			1.1 U			1.1 U						
Isopropylbenzene				1.0 U			1.1 U			1.1 U						
n-Propylbenzene				1.0 U			1.1 U			1.1 U						
Bromobenzene				1.0 U			1.1 U			1.1 U						
2-Chlorotoluene				1.0 U			1.1 U			1.1 U						
4-Chlorotoluene				1.0 U			1.1 U			1.1 U						
tert-Butylbenzene				1.0 U			1.1 U			1.1 U						
sec-Butylbenzene				1.0 U			1.1 U			1.1 U						
4-Isopropyltoluene				1.0 U			1.1 U			1.1 U						
n-Butylbenzene				2.1 U			1.1 U			1.1 U						
1,2,4-Trichlorobenzene				5.2 U			5.4 U			5.3 U						
Naphthalene				5.2 U			5.4 U			5.3 U						
1,2,3-Trichlorobenzene				5.2 U			5.4 U			5.3 U						
Methyl tert-Butyl Ether																
SEMIVOLATILES (µg/kg)																
EPA Method SW8270																
Phenol				140 U			140 U			140 U						
Bis-(2-Chloroethyl) Ether				140 U			140 U			140 U						
2-Chlorophenol				69 U			71 U			69 U						
1,3-Dichlorobenzene				69 U			71 U			69 U						
1,4-Dichlorobenzene				69 U			71 U			69 U						
Benzyl Alcohol				340 U			350 U			340 U						
1,2-Dichlorobenzene				69 U			71 U			69 U						
2-Methylphenol				140 U			140 U			140 U						
2,2'-Oxybis(1-Chloropropane)				69 U			71 U			69 U						
4-Methylphenol				69 U			71 U			69 U						
N-Nitroso-Di-N-Propylamine				140 U			140 U			140 U						
Hexachloroethane				140 U			140 U			140 U						

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-33	Drum Area 1	Drum Area 2	DA101-0.75	DA101-2.5	DA101-8.0	DA102-0.75	DA102-3.0	DA102-8.0	DA103-0.5	DA103-2.5	DA103-8.0	SB-601A	SB-601B	UST-A	UST-B
Sample Depth (ft BGS)	5-7.5	surface	surface	BW26A	BW26B	BW26C	BW26D	BW26E	BW26F	BW26G	BW26H	BW26I	0.0-1.5' CA23A	1.5-3.0' CA23B	CQ31A	CQ31B
Date Collected:	1/21/1998	1/23/1998	1/23/1998	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	7/12/2000	8/17/2000	8/17/2000	1/4/2001	1/4/2001
Nitrobenzene				69 U			71 U			69 U						
Isophorone				69 U			71 U			69 U						
2-Nitrophenol				340 U			350 U			340 U						
2,4-Dimethylphenol				210 U			210 U			210 U						
Benzoic Acid				690 U			710 U			690 U						
bis(2-Chloroethoxy) Methane				69 U			71 U			69 U						
2,4-Dichlorophenol				210 U			210 U			210 U						
1,2,4-Trichlorobenzene				69 U			71 U			69 U						
Naphthalene				69 U			71 U			69 U						
4-Chloroaniline				210 U			210 U			210 U						
Hexachlorobutadiene				140 U			140 U			140 U						
4-Chloro-3-methylphenol				140 U			140 U			140 U						
2-Methylnaphthalene				69 U			71 U			69 U						
Hexachlorocyclopentadiene				340 U			350 U			340 U						
2,4,6-Trichlorophenol				340 U			350 U			340 U						
2,4,5-Trichlorophenol				340 U			350 U			340 U						
2-Chloronaphthalene				69 U			71 U			69 U						
2-Nitroaniline				340 U			350 U			340 U						
Dimethylphthalate				69 U			71 U			69 U						
Acenaphthylene				69 U			71 U			69 U						
3-Nitroaniline				410 U			420 U			410 U						
Acenaphthene				69 U			71 U			69 U						
2,4-Dinitrophenol				690 U			710 U			690 U						
4-Nitrophenol				340 U			350 U			340 U						
Dibenzofuran				69 U			71 U			69 U						
2,6-Dinitrotoluene				340 U			350 U			340 U						
2,4-Dinitrotoluene				340 U			350 U			340 U						
Diethylphthalate				69 U			71 U			69 U						
4-Chlorophenyl-phenylether				69 U			71 U			69 U						
Fluorene				69 U			71 U			69 U						
4-Nitroaniline				340 U			350 U			340 U						
4,6-Dinitro-2-Methylphenol				690 U			710 U			690 U						
N-Nitrosodiphenylamine				69 U			71 U			69 U						
4-Bromophenyl-phenylether				69 U			71 U			69 U						
Hexachlorobenzene				69 U			71 U			69 U						
Pentachlorophenol				340 U			350 U			340 U						
Phenanthrene				69 U			71 U			69 U						
Carbazole				69 U			71 U			69 U						
Anthracene				69 U			71 U			69 U						
Di-n-Butylphthalate				69 U			71 U			69 U						
Fluoranthene				69 U			71 U			69 U						
Pyrene				69 U			71 U			69 U						
Butylbenzylphthalate				69 U			71 U			69 U						
3,3'-Dichlorobenzidine				340 U			350 U			340 U						
Benzo(a)anthracene				69 U			71 U			69 U						
bis(2-Ethylhexyl)phthalate				69 U			71 U			69 U						
Chrysene				69 U			71 U			69 U						
Di-n-Octyl phthalate				69 U			71 U			69 U						
Benzo(b)fluoranthene				69 U			71 U			69 U						
Benzo(k)fluoranthene				69 U			71 U			69 U						
Benzo(a)pyrene				69 U			71 U			69 U						
Indeno(1,2,3-cd)pyrene				69 U			71 U			69 U						
Dibenz(a,h)anthracene				69 U			71 U			69 U						
Benzo(g,h,i)perylene				69 U			71 U			69 U						
PCBs (µg/kg)																
Method 8082																
Aroclor 1016				34 U			35 U			34 U						
Aroclor 1242				34 U			35 U			34 U						
Aroclor 1248				34 U			35 U			34 U						
Aroclor 1254				34 U			35 U			34 U						
Aroclor 1260				34 U			35 U			34 U						
Aroclor 1221				69 U			71 U			69 U						
Aroclor 1232				34 U			35 U			34 U						
Total PCBs				69 U			71 U			69 U						

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a): Sample Depth (ft BGS) Date Collected:	SB-33 5-7.5 1/21/1998	Drum Area 1 surface 1/23/1998	Drum Area 2 surface 1/23/1998	DA101-0.75 BW26A 7/12/2000	DA101-2.5 BW26B 7/12/2000	DA101-8.0 BW26C 7/12/2000	DA102-0.75 BW26D 7/12/2000	DA102-3.0 BW26E 7/12/2000	DA102-8.0 BW26F 7/12/2000	DA103-0.5 BW26G 7/12/2000	DA103-2.5 BW26H 7/12/2000	DA103-8.0 BW26I 7/12/2000	SB-601A 0.0-1.5' CA23A 8/17/2000	SB-601B 1.5-3.0' CA23B 8/17/2000	UST-A CQ31A 1/4/2001	UST-B CQ31B 1/4/2001
PAHs (µg/kg)																
SW8270-SIM																
Naphthalene																
2-Methylnaphthalene																
1-Methylnaphthalene																
Total naphthalene																
Benzo(a)anthracene																
Chrysene																
Benzo(b)fluoranthene																
Benzo(k)fluoranthene																
Benzo(a)pyrene																
Indeno(1,2,3-cd)pyrene																
Dibenz(a,h)anthracene																
TEF																

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	UST-C	DI-1	CB-2	MW-5-10-11.5	MW-6-5-6.5	MW-9-5-5.5	SB-34	SB-35	SB-36	SB-37B	SB-37	SB-38	SB-39	SB-40
Sample Depth (ft BGS)	CQ31C	CQ31D	CQ31E	EK21A	EK21B	EK21C	JI67A	JI67B	JI67C	JI67D	JI67E	JI67F	JI67G	JI67H
Date Collected:	1/4/2001	1/4/2001	1/4/2001	5/22/2002	5/23/2002	5/22/2002	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006
TOTAL PETROLEUM HYDROCARBONS (mg/kg)														
Method WA HCID														
Gas Range	20 U	41												
Diesel Range	50 U	70												
Oil Range	100 U	100 U												
NWTPHg														
Gasoline Range Hydrocarbons				2300	5.4 U									
TOTAL PETROLEUM HYDROCARBONS (mg/kg)														
Method NWTPHd														
Gas Range							20	210	1900	550	730	720	1800	31
Diesel Range (f)			2500			940								
Oil Range (f)			1600			1000								
Method WTPHg														
Gas Range														
BTEX (mg/kg)														
Method 8020														
Benzene														
Toluene														
Ethylbenzene														
m,p-Xylene														
o-Xylene														
Total Xylenes														
PRIORITY POLLUTANT METALS (mg/kg)														
Antimony (6010)														
Arsenic (6010)	5 U		8											
Beryllium (6010)														
Cadmium (6010)	0.3		0.8											
Chromium (6010)	16.5		24.7											
Copper (6010)	20.1		186											
Lead (6010)	14		55	32	3									
Mercury (7471)	0.04 U		0.29											
Nickel (6010)	16		24											
Selenium (6010)														
Silver (6010)														
Thallium (6010)														
Zinc (6010)														
VOLATILES (µg/kg)														
EPA Method SW8260														
Chloromethane			5.4 U											
Bromomethane			5.4 U											
Vinyl Chloride			5.4 U											
Chloroethane			5.4 U											
Methylene Chloride			16 U											
Acetone			27 U											
Carbon Disulfide			5.4 U											
1,1-Dichloroethene			5.4 U											
1,1-Dichloroethane			5.4 U											
trans-1,2-Dichloroethene			5.4 U											
cis-1,2-Dichloroethene			5.4 U											
Chloroform			5.4 U											
1,2-Dichloroethane			5.4 U	1600 U										
2-Butanone			27 U											
1,1,1-Trichloroethane			5.4 U											
Carbon Tetrachloride			5.4 U											
Vinyl Acetate			27 U											
Bromodichloromethane			5.4 U											
1,2-Dichloropropane			5.4 U											
cis-1,3-Dichloropropene			5.4 U											
Trichloroethene			5.4 U											
Dibromochloromethane			5.4 U											

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	UST-C	DI-1	CB-2	MW-5-10-11.5	MW-6-5-6.5	MW-9-5-5.5	SB-34	SB-35	SB-36	SB-37B	SB-37	SB-38	SB-39	SB-40
Sample Depth (ft BGS)	CQ31C	CQ31D	CQ31E	EK21A	EK21B	EK21C	JI67A	JI67B	JI67C	JI67D	JI67E	JI67F	JI67G	JI67H
Date Collected:	1/4/2001	1/4/2001	1/4/2001	5/22/2002	5/23/2002	5/22/2002	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006
1,1,2-Trichloroethane			5.4 U											
Benzene			5.4 U	44,000	1.1 U									
trans-1,3-Dichloropropene			5.4 U											
2-Chloroethylvinylether			27 U											
Bromoform			5.4 U											
4-Methyl-2-Pentanone (MIBK)			27 U											
2-Hexanone			27 U											
Tetrachloroethene			5.4 U											
1,1,2,2-Tetrachloroethane			76 U											
Toluene			9.2	61,000	1.5									
Chlorobenzene			5.4 U											
Ethylbenzene			810	63,000	1.1 U									
Styrene			5.4 U											
Trichlorofluoromethane			5.4 U											
1,1,2-Trichlorotrifluoroethane			5.4 U											
m,p-Xylene			70	400,000	1.1 U									
o-Xylene			37	130,000	1.1 U									
Total Xylene				530,000	1.1 U									
1,2-Dichlorobenzene			5.4 U											
1,3-Dichlorobenzene			5.4 U											
1,4-Dichlorobenzene			5.4 U											
Acrolein			270 U											
Methyl Iodide			5.4 U											
Bromoethane			11 U											
Acrylonitrile			27 U											
1,1-Dichloropropene			5.4 U											
Dibromomethane			5.4 U											
1,1,1,2-Tetrachloroethane			5.4 U											
1,2-Dibromo-3-chloropropane			27 U											
1,2,3-Trichloropropane			11 U											
trans-1,4-Dichloro-2-butene			27 U											
1,3,5-Trimethylbenzene			86											
1,2,4-Trimethylbenzene			220											
Hexachlorobutadiene			27 U											
Ethylene Dibromide			5.4 U	1600 U										
Bromochloromethane			5.4 U											
2,2-Dichloropropane			5.4 U											
1,3-Dichloropropane			5.4 U											
Isopropylbenzene			17											
n-Propylbenzene			18 M											
Bromobenzene			5.4 U											
2-Chlorotoluene			5.4 U											
4-Chlorotoluene			5.4 U											
tert-Butylbenzene			5.4 U											
sec-Butylbenzene			13 M											
4-Isopropyltoluene			24											
n-Butylbenzene			49 U											
1,2,4-Trichlorobenzene			27 U											
Naphthalene			140											
1,2,3-Trichlorobenzene			27 U											
Methyl tert-Butyl Ether				1600 U										
SEMIVOLATILES (µg/kg)														
EPA Method SW8270														
Phenol														
Bis-(2-Chloroethyl) Ether														
2-Chlorophenol														
1,3-Dichlorobenzene														
1,4-Dichlorobenzene														
Benzyl Alcohol														
1,2-Dichlorobenzene														
2-Methylphenol														
2,2'-Oxybis(1-Chloropropane)														
4-Methylphenol														
N-Nitroso-Di-N-Propylamine														
Hexachloroethane														

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	UST-C	DI-1	CB-2	MW-5-10-11.5	MW-6-5-6.5	MW-9-5-5.5	SB-34	SB-35	SB-36	SB-37B	SB-37	SB-38	SB-39	SB-40
Sample Depth (ft BGS)	CQ31C	CQ31D	CQ31E	EK21A	EK21B	EK21C	JI67A	JI67B	JI67C	JI67D	JI67E	JI67F	JI67G	JI67H
Date Collected:	1/4/2001	1/4/2001	1/4/2001	5/22/2002	5/23/2002	5/22/2002	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006
Nitrobenzene														
Isophorone														
2-Nitrophenol														
2,4-Dimethylphenol														
Benzoic Acid														
bis(2-Chloroethoxy) Methane														
2,4-Dichlorophenol														
1,2,4-Trichlorobenzene														
Naphthalene														
4-Chloroaniline														
Hexachlorobutadiene														
4-Chloro-3-methylphenol														
2-Methylnaphthalene														
Hexachlorocyclopentadiene														
2,4,6-Trichlorophenol														
2,4,5-Trichlorophenol														
2-Chloronaphthalene														
2-Nitroaniline														
Dimethylphthalate														
Acenaphthylene														
3-Nitroaniline														
Acenaphthene														
2,4-Dinitrophenol														
4-Nitrophenol														
Dibenzofuran														
2,6-Dinitrotoluene														
2,4-Dinitrotoluene														
Diethylphthalate														
4-Chlorophenyl-phenylether														
Fluorene														
4-Nitroaniline														
4,6-Dinitro-2-Methylphenol														
N-Nitrosodiphenylamine														
4-Bromophenyl-phenylether														
Hexachlorobenzene														
Pentachlorophenol														
Phenanthrene														
Carbazole														
Anthracene														
Di-n-Butylphthalate														
Fluoranthene														
Pyrene														
Butylbenzylphthalate														
3,3'-Dichlorobenzidine														
Benzo(a)anthracene														
bis(2-Ethylhexyl)phthalate														
Chrysene														
Di-n-Octyl phthalate														
Benzo(b)fluoranthene														
Benzo(k)fluoranthene														
Benzo(a)pyrene														
Indeno(1,2,3-cd)pyrene														
Dibenz(a,h)anthracene														
Benzo(g,h,i)perylene														
PCBs (µg/kg)														
Method 8082														
Aroclor 1016														
Aroclor 1242														
Aroclor 1248														
Aroclor 1254														
Aroclor 1260														
Aroclor 1221														
Aroclor 1232														
Total PCBs														

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	UST-C	DI-1	CB-2	MW-5-10-11.5	MW-6-5-6.5	MW-9-5-5.5	SB-34	SB-35	SB-36	SB-37B	SB-37	SB-38	SB-39	SB-40
Sample Depth (ft BGS)	CQ31C	CQ31D	CQ31E	EK21A	EK21B	EK21C	JI67A	JI67B	JI67C	JI67D	JI67E	JI67F	JI67G	JI67H
Date Collected:	1/4/2001	1/4/2001	1/4/2001	5/22/2002	5/23/2002	5/22/2002	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006
PAHs (µg/kg)														
SW8270-SIM														
Naphthalene						190								
2-Methylnaphthalene						330								
1-Methylnaphthalene						200								
Total naphthalene						720								
Benzo(a)anthracene						84								
Chrysene						140 J								
Benzo(b)fluoranthene						97								
Benzo(k)fluoranthene						90								
Benzo(a)pyrene						69								
Indeno(1,2,3-cd)pyrene						30								
Dibenz(a,h)anthracene						21 U								
TEF						100.5								

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-41	SB-42	SB-43	SB-44-0-1	SB-44-1-2	SB-45-0-1	SB-45-1-2	SB-45-2-3	SB-46-0-1	SB-47-0-1	SB-47-1-2	SB-47-2-3	SB-48-0-1	SB-48-1-2
Sample Depth (ft BGS)	JI67I	JI67J	JI67K	JJ63A	JQ77E	JJ63B	JQ77F	JT24A	JJ63C	JJ63D	JQ77G	JT24B	JO52A	JQ77H
Date Collected:	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	6/29/2006	6/29/2006
TOTAL PETROLEUM HYDROCARBONS (mg/kg)														
Method WA HCID														
Gas Range														
Diesel Range														
Oil Range														
NWTPHg														
Gasoline Range Hydrocarbons														
TOTAL PETROLEUM HYDROCARBONS (mg/kg)														
Method NWTPHd														
Gas Range	9.8	2400	830											
Diesel Range (f)														
Oil Range (f)														
Method WTPHg														
Gas Range														
BTEX (mg/kg)														
Method 8020														
Benzene														
Toluene														
Ethylbenzene														
m,p-Xylene														
o-Xylene														
Total Xylenes														
PRIORITY POLLUTANT METALS (mg/kg)														
Antimony (6010)														
Arsenic (6010)				10 U		5 U			5 U	6			5 U	
Beryllium (6010)														
Cadmium (6010)														
Chromium (6010)														
Copper (6010)				545	37.5	50.8	17.1		13.9	126	49.5	101	43.3	25.7
Lead (6010)				1140	16	6			9	27			17	
Mercury (7471)				0.44	0.04 UJ	0.05 U			0.04 U	0.05			0.04 U	
Nickel (6010)				41		19			22	24			27	
Selenium (6010)														
Silver (6010)														
Thallium (6010)														
Zinc (6010)				1160	51.9	206	114	33.6	39.6	91.2			50.2	
VOLATILES (µg/kg)														
EPA Method SW8260														
Chloromethane														
Bromomethane														
Vinyl Chloride														
Chloroethane														
Methylene Chloride														
Acetone														
Carbon Disulfide														
1,1-Dichloroethene														
1,1-Dichloroethane														
trans-1,2-Dichloroethene														
cis-1,2-Dichloroethene														
Chloroform														
1,2-Dichloroethane														
2-Butanone														
1,1,1-Trichloroethane														
Carbon Tetrachloride														
Vinyl Acetate														
Bromodichloromethane														
1,2-Dichloropropane														
cis-1,3-Dichloropropene														
Trichloroethene														
Dibromochloromethane														

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-41	SB-42	SB-43	SB-44-0-1	SB-44-1-2	SB-45-0-1	SB-45-1-2	SB-45-2-3	SB-46-0-1	SB-47-0-1	SB-47-1-2	SB-47-2-3	SB-48-0-1	SB-48-1-2
Sample Depth (ft BGS)	JI67I	JI67J	JI67K	JJ63A	JQ77E	JJ63B	JQ77F	JT24A	JJ63C	JJ63D	JQ77G	JT24B	JO52A	JQ77H
Date Collected:	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	6/29/2006	6/29/2006
1,1,2-Trichloroethane														
Benzene														
trans-1,3-Dichloropropene														
2-Chloroethylvinylether														
Bromoform														
4-Methyl-2-Pentanone (MIBK)														
2-Hexanone														
Tetrachloroethene														
1,1,2,2-Tetrachloroethane														
Toluene														
Chlorobenzene														
Ethylbenzene														
Styrene														
Trichlorofluoromethane														
1,1,2-Trichlorotrifluoroethane														
m,p-Xylene														
o-Xylene														
Total Xylene														
1,2-Dichlorobenzene														
1,3-Dichlorobenzene														
1,4-Dichlorobenzene														
Acrolein														
Methyl Iodide														
Bromoethane														
Acrylonitrile														
1,1-Dichloropropene														
Dibromomethane														
1,1,1,2-Tetrachloroethane														
1,2-Dibromo-3-chloropropane														
1,2,3-Trichloropropane														
trans-1,4-Dichloro-2-butene														
1,3,5-Trimethylbenzene														
1,2,4-Trimethylbenzene														
Hexachlorobutadiene														
Ethylene Dibromide														
Bromochloromethane														
2,2-Dichloropropane														
1,3-Dichloropropane														
Isopropylbenzene														
n-Propylbenzene														
Bromobenzene														
2-Chlorotoluene														
4-Chlorotoluene														
tert-Butylbenzene														
sec-Butylbenzene														
4-Isopropyltoluene														
n-Butylbenzene														
1,2,4-Trichlorobenzene														
Naphthalene														
1,2,3-Trichlorobenzene														
Methyl tert-Butyl Ether														
SEMIVOLATILES (µg/kg)														
EPA Method SW8270														
Phenol														
Bis-(2-Chloroethyl) Ether														
2-Chlorophenol														
1,3-Dichlorobenzene														
1,4-Dichlorobenzene														
Benzyl Alcohol														
1,2-Dichlorobenzene														
2-Methylphenol														
2,2'-Oxybis(1-Chloropropane)														
4-Methylphenol														
N-Nitroso-Di-N-Propylamine														
Hexachloroethane														

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-41	SB-42	SB-43	SB-44-0-1	SB-44-1-2	SB-45-0-1	SB-45-1-2	SB-45-2-3	SB-46-0-1	SB-47-0-1	SB-47-1-2	SB-47-2-3	SB-48-0-1	SB-48-1-2
Sample Depth (ft BGS)	JI67I	JI67J	JI67K	JJ63A	JQ77E	JJ63B	JQ77F	JT24A	JJ63C	JJ63D	JQ77G	JT24B	JO52A	JQ77H
Date Collected:	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	6/29/2006	6/29/2006
Nitrobenzene														
Isophorone														
2-Nitrophenol														
2,4-Dimethylphenol														
Benzoic Acid														
bis(2-Chloroethoxy) Methane														
2,4-Dichlorophenol														
1,2,4-Trichlorobenzene														
Naphthalene														
4-Chloroaniline														
Hexachlorobutadiene														
4-Chloro-3-methylphenol														
2-Methylnaphthalene														
Hexachlorocyclopentadiene														
2,4,6-Trichlorophenol														
2,4,5-Trichlorophenol														
2-Chloronaphthalene														
2-Nitroaniline														
Dimethylphthalate														
Acenaphthylene														
3-Nitroaniline														
Acenaphthene														
2,4-Dinitrophenol														
4-Nitrophenol														
Dibenzofuran														
2,6-Dinitrotoluene														
2,4-Dinitrotoluene														
Diethylphthalate														
4-Chlorophenyl-phenylether														
Fluorene														
4-Nitroaniline														
4,6-Dinitro-2-Methylphenol														
N-Nitrosodiphenylamine														
4-Bromophenyl-phenylether														
Hexachlorobenzene														
Pentachlorophenol														
Phenanthrene														
Carbazole														
Anthracene														
Di-n-Butylphthalate														
Fluoranthene														
Pyrene														
Butylbenzylphthalate														
3,3'-Dichlorobenzidine														
Benzo(a)anthracene														
bis(2-Ethylhexyl)phthalate														
Chrysene														
Di-n-Octyl phthalate														
Benzo(b)fluoranthene														
Benzo(k)fluoranthene														
Benzo(a)pyrene														
Indeno(1,2,3-cd)pyrene														
Dibenz(a,h)anthracene														
Benzo(g,h,i)perylene														
PCBs (µg/kg)														
Method 8082														
Aroclor 1016														
Aroclor 1242														
Aroclor 1248														
Aroclor 1254														
Aroclor 1260														
Aroclor 1221														
Aroclor 1232														
Total PCBs														

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-41	SB-42	SB-43	SB-44-0-1	SB-44-1-2	SB-45-0-1	SB-45-1-2	SB-45-2-3	SB-46-0-1	SB-47-0-1	SB-47-1-2	SB-47-2-3	SB-48-0-1	SB-48-1-2
Sample Depth (ft BGS)	JI67I	JI67J	JI67K	JJ63A	JQ77E	JJ63B	JQ77F	JT24A	JJ63C	JJ63D	JQ77G	JT24B	JO52A	JQ77H
Date Collected:	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	5/8/2006	6/29/2006	6/29/2006
PAHs (µg/kg)														
SW8270-SIM														
Naphthalene														
2-Methylnaphthalene														
1-Methylnaphthalene														
Total naphthalene														
Benzo(a)anthracene														
Chrysene														
Benzo(b)fluoranthene														
Benzo(k)fluoranthene														
Benzo(a)pyrene														
Indeno(1,2,3-cd)pyrene														
Dibenz(a,h)anthracene														
TEF														

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-49-0-1	SB-50-0-1	SB-50-1-2	SB-51-0-1	SB-53-9-10	SP-54-9-10	SB-55-10-11	SB-57-10-11	SB-59-10-11	SB-61-10-11	SB-62-10-11	SB-63-9-10	SB-64-9.5-10.5
Sample Depth (ft BGS)	JO52D	JO52N	JQ77I	JO52Q	JO51A	JO51B	JO51C	JO51D	JO51E	JO51F	JO51G	JO51H	JO51I
Date Collected:	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006
TOTAL PETROLEUM HYDROCARBONS (mg/kg)													
Method WA HCID													
Gas Range													
Diesel Range													
Oil Range													
NWTPHg													
Gasoline Range Hydrocarbons													
TOTAL PETROLEUM HYDROCARBONS (mg/kg)													
Method NWTPHd													
Gas Range					180	220	15,000	59	78	86	24	120	28
Diesel Range (f)													
Oil Range (f)													
Method WTPHg													
Gas Range													
BTEX (mg/kg)													
Method 8020													
Benzene					390	1,100	900 U	290	170	73	11 U	810	58
Toluene					2,000	5,000	27,000	1,400	840	460	49	3,800	330
Ethylbenzene					980	2,000	31,000	620	540	290	31	1,500	200
m,p-Xylene					3,000	6,400	73,000	2,300	1,900	1,100	96	5,200	680
o-Xylene					1,600	3,100	13,000	1,200	750	490	55	2,600	380
Total Xylenes					4,500	9,500	85,000	3,400	2,600	1,600	150	7,800	1,100
PRIORITY POLLUTANT METALS (mg/kg)													
Antimony (6010)													
Arsenic (6010)	5 U	6 U		10 U									
Beryllium (6010)													
Cadmium (6010)													
Chromium (6010)													
Copper (6010)	19.2	53.2	11.1	102									
Lead (6010)	4	36		871									
Mercury (7471)	0.08	0.13	0.04 UJ	0.50									
Nickel (6010)	24	30		32									
Selenium (6010)													
Silver (6010)													
Thallium (6010)													
Zinc (6010)	61.7	145	31.6	246									
VOLATILES (µg/kg)													
EPA Method SW8260													
Chloromethane													
Bromomethane													
Vinyl Chloride													
Chloroethane													
Methylene Chloride													
Acetone													
Carbon Disulfide													
1,1-Dichloroethene													
1,1-Dichloroethane													
trans-1,2-Dichloroethene													
cis-1,2-Dichloroethene													
Chloroform													
1,2-Dichloroethane													
2-Butanone													
1,1,1-Trichloroethane													
Carbon Tetrachloride													
Vinyl Acetate													
Bromodichloromethane													
1,2-Dichloropropane													
cis-1,3-Dichloropropene													
Trichloroethene													
Dibromochloromethane													

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a): Sample Depth (ft BGS) Date Collected:	SB-49-0-1 JO52D 6/29/2006	SB-50-0-1 JO52N 6/29/2006	SB-50-1-2 JQ77I 6/29/2006	SB-51-0-1 JO52Q 6/29/2006	SB-53-9-10 JO51A 6/30/2006	SP-54-9-10 JO51B 6/30/2006	SB-55-10-11 JO51C 6/30/2006	SB-57-10-11 JO51D 6/30/2006	SB-59-10-11 JO51E 6/30/2006	SB-61-10-11 JO51F 6/30/2006	SB-62-10-11 JO51G 6/30/2006	SB-63-9-10 JO51H 6/30/2006	SB-64-9.5-10.5 JO51I 6/30/2006
1,1,2-Trichloroethane													
Benzene													
trans-1,3-Dichloropropene													
2-Chloroethylvinylether													
Bromoform													
4-Methyl-2-Pentanone (MIBK)													
2-Hexanone													
Tetrachloroethene													
1,1,2,2-Tetrachloroethane													
Toluene													
Chlorobenzene													
Ethylbenzene													
Styrene													
Trichlorofluoromethane													
1,1,2-Trichlorotrifluoroethane													
m,p-Xylene													
o-Xylene													
Total Xylene													
1,2-Dichlorobenzene													
1,3-Dichlorobenzene													
1,4-Dichlorobenzene													
Acrolein													
Methyl Iodide													
Bromoethane													
Acrylonitrile													
1,1-Dichloropropene													
Dibromomethane													
1,1,1,2-Tetrachloroethane													
1,2-Dibromo-3-chloropropane													
1,2,3-Trichloropropane													
trans-1,4-Dichloro-2-butene													
1,3,5-Trimethylbenzene													
1,2,4-Trimethylbenzene													
Hexachlorobutadiene													
Ethylene Dibromide													
Bromochloromethane													
2,2-Dichloropropane													
1,3-Dichloropropane													
Isopropylbenzene													
n-Propylbenzene													
Bromobenzene													
2-Chlorotoluene													
4-Chlorotoluene													
tert-Butylbenzene													
sec-Butylbenzene													
4-Isopropyltoluene													
n-Butylbenzene													
1,2,4-Trichlorobenzene													
Naphthalene													
1,2,3-Trichlorobenzene													
Methyl tert-Butyl Ether													
SEMIVOLATILES (µg/kg)													
EPA Method SW8270													
Phenol													
Bis-(2-Chloroethyl) Ether													
2-Chlorophenol													
1,3-Dichlorobenzene													
1,4-Dichlorobenzene													
Benzyl Alcohol													
1,2-Dichlorobenzene													
2-Methylphenol													
2,2'-Oxybis(1-Chloropropane)													
4-Methylphenol													
N-Nitroso-Di-N-Propylamine													
Hexachloroethane													

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a): Sample Depth (ft BGS) Date Collected:	SB-49-0-1 JO52D 6/29/2006	SB-50-0-1 JO52N 6/29/2006	SB-50-1-2 JQ77I 6/29/2006	SB-51-0-1 JO52Q 6/29/2006	SB-53-9-10 JO51A 6/30/2006	SP-54-9-10 JO51B 6/30/2006	SB-55-10-11 JO51C 6/30/2006	SB-57-10-11 JO51D 6/30/2006	SB-59-10-11 JO51E 6/30/2006	SB-61-10-11 JO51F 6/30/2006	SB-62-10-11 JO51G 6/30/2006	SB-63-9-10 JO51H 6/30/2006	SB-64-9.5-10.5 JO51I 6/30/2006
Nitrobenzene													
Isophorone													
2-Nitrophenol													
2,4-Dimethylphenol													
Benzoic Acid													
bis(2-Chloroethoxy) Methane													
2,4-Dichlorophenol													
1,2,4-Trichlorobenzene													
Naphthalene													
4-Chloroaniline													
Hexachlorobutadiene													
4-Chloro-3-methylphenol													
2-Methylnaphthalene													
Hexachlorocyclopentadiene													
2,4,6-Trichlorophenol													
2,4,5-Trichlorophenol													
2-Chloronaphthalene													
2-Nitroaniline													
Dimethylphthalate													
Acenaphthylene													
3-Nitroaniline													
Acenaphthene													
2,4-Dinitrophenol													
4-Nitrophenol													
Dibenzofuran													
2,6-Dinitrotoluene													
2,4-Dinitrotoluene													
Diethylphthalate													
4-Chlorophenyl-phenylether													
Fluorene													
4-Nitroaniline													
4,6-Dinitro-2-Methylphenol													
N-Nitrosodiphenylamine													
4-Bromophenyl-phenylether													
Hexachlorobenzene													
Pentachlorophenol													
Phenanthrene													
Carbazole													
Anthracene													
Di-n-Butylphthalate													
Fluoranthene													
Pyrene													
Butylbenzylphthalate													
3,3'-Dichlorobenzidine													
Benzo(a)anthracene													
bis(2-Ethylhexyl)phthalate													
Chrysene													
Di-n-Octyl phthalate													
Benzo(b)fluoranthene													
Benzo(k)fluoranthene													
Benzo(a)pyrene													
Indeno(1,2,3-cd)pyrene													
Dibenz(a,h)anthracene													
Benzo(g,h,i)perylene													
PCBs (µg/kg)													
Method 8082													
Aroclor 1016													
Aroclor 1242													
Aroclor 1248													
Aroclor 1254													
Aroclor 1260													
Aroclor 1221													
Aroclor 1232													
Total PCBs													

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-49-0-1	SB-50-0-1	SB-50-1-2	SB-51-0-1	SB-53-9-10	SP-54-9-10	SB-55-10-11	SB-57-10-11	SB-59-10-11	SB-61-10-11	SB-62-10-11	SB-63-9-10	SB-64-9.5-10.5
Sample Depth (ft BGS)	JO52D	JO52N	JQ77I	JO52Q	JO51A	JO51B	JO51C	JO51D	JO51E	JO51F	JO51G	JO51H	JO51I
Date Collected:	6/29/2006	6/29/2006	6/29/2006	6/29/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006	6/30/2006
PAHs (µg/kg)													
SW8270-SIM													
Naphthalene													
2-Methylnaphthalene													
1-Methylnaphthalene													
Total naphthalene													
Benzo(a)anthracene													
Chrysene													
Benzo(b)fluoranthene													
Benzo(k)fluoranthene													
Benzo(a)pyrene													
Indeno(1,2,3-cd)pyrene													
Dibenz(a,h)anthracene													
TEF													

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-65-9-10	Dup of SB-65-9-10 SB-66-9-10	SB-67-10.5-11.5	MW-9	SB-68	SB-69
Sample Depth (ft BGS)	JO51J	JO51L	JO51K	LU53F	LU53C	LU53E
Date Collected:	6/30/2006	6/30/2006	6/30/2006	10/22/2007	10/22/2007	10/22/2007
TOTAL PETROLEUM HYDROCARBONS (mg/kg)						
Method WA HCID						
Gas Range						
Diesel Range						
Oil Range						
NWTPHg						
Gasoline Range Hydrocarbons						
TOTAL PETROLEUM HYDROCARBONS (mg/kg)						
Method NWTPHd						
Gas Range	57	66	64	0.25 U	0.25 U	0.25 U
Diesel Range (f)				0.25 U		
Oil Range (f)				0.50 U		
Method WTPHg						
Gas Range						
BTEX (mg/kg)						
Method 8020						
Benzene	450	330	230			
Toluene	2,000	1,600	1,200			
Ethylbenzene	840	780	580			
m,p-Xylene	2,800	2,400	2,100			
o-Xylene	1,300	1,200	1,100			
Total Xylenes	4,100	3,600	3,200			
PRIORITY POLLUTANT METALS (mg/kg)						
Antimony (6010)						
Arsenic (6010)						
Beryllium (6010)						
Cadmium (6010)						
Chromium (6010)						
Copper (6010)				0.7	0.5 U	1.8
Lead (6010)				1 U	1 U	1 U
Mercury (7471)				0.1 U	0.1 U	0.1 U
Nickel (6010)				2.1	1.8	2.9
Selenium (6010)						
Silver (6010)						
Thallium (6010)				4 U	6	12
Zinc (6010)						
VOLATILES (µg/kg)						
EPA Method SW8260						
Chloromethane				0.2 U	0.2 U	0.2 U
Bromomethane				0.2 U	0.2 U	0.2 U
Vinyl Chloride				0.2 U	0.2 U	0.2 U
Chloroethane				0.2 U	0.2 U	0.2 U
Methylene Chloride				0.3 U	0.3 U	0.3 U
Acetone				3.0 U	3.0 U	3.0 U
Carbon Disulfide				0.2 U	0.2 U	0.2 U
1,1-Dichloroethene				0.2 U	0.2 U	0.2 U
1,1-Dichloroethane				0.2 U	0.2 U	0.2 U
trans-1,2-Dichloroethene				0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene				0.2 U	0.2 U	0.2 U
Chloroform				0.2 U	0.2 U	0.2 U
1,2-Dichloroethane				0.2 U	0.2 U	0.2 U
2-Butanone				1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane				0.2 U	0.2 U	0.2 U
Carbon Tetrachloride				0.2 U	0.2 U	0.2 U
Vinyl Acetate				0.2 U	0.2 U	0.2 U
Bromodichloromethane				0.2 U	0.2 U	0.2 U
1,2-Dichloropropane				0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene				0.2 U	0.2 U	0.2 U
Trichloroethene				0.2 U	0.2 U	0.2 U
Dibromochloromethane				0.2 U	0.2 U	0.2 U

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-65-9-10	Dup of SB-65-9-10 SB-66-9-10	SB-67-10.5-11.5	MW-9	SB-68	SB-69
Sample Depth (ft BGS)	JO51J	JO51L	JO51K	LU53F	LU53C	LU53E
Date Collected:	6/30/2006	6/30/2006	6/30/2006	10/22/2007	10/22/2007	10/22/2007
1,1,2-Trichloroethane				0.2 U	0.2 U	0.2 U
Benzene				0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene				0.2 U	0.2 U	0.2 U
2-Chloroethylvinylether				0.5 U	0.5 U	0.5 U
Bromoform				0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone (MIBK)				1.0 U	1.0 U	1.0 U
2-Hexanone				3.0 U	3.0 U	3.0 U
Tetrachloroethene				0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane				0.2 U	0.2 U	0.2 U
Toluene				0.2 U	0.2 U	0.2 U
Chlorobenzene				0.2 U	0.2 U	0.2 U
Ethylbenzene				0.2 U	0.2 U	0.2 U
Styrene				0.2 U	0.2 U	0.2 U
Trichlorofluoromethane				0.2 U	0.2 U	0.2 U
1,1,2-Trichlorotrifluoroethane				0.2 U	0.2 U	0.2 U
m,p-Xylene				0.4 U	0.4 U	0.4 U
o-Xylene				0.2 U	0.2 U	0.2 U
Total Xylene				0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene				0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene				0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene				5.0 U	5.0 U	5.0 U
Acrolein				0.2 U	0.2 U	0.2 U
Methyl Iodide				0.2 U	0.2 U	0.2 U
Bromoethane				1.0 U	1.0 U	1.0 U
Acrylonitrile				0.2 U	0.2 U	0.2 U
1,1-Dichloropropene				0.2 U	0.2 U	0.2 U
Dibromomethane				0.2 U	0.2 U	0.2 U
1,1,1,2-Tetrachloroethane				0.5 U	0.5 U	0.5 U
1,2-Dibromo-3-chloropropane				0.5 U	0.5 U	0.5 U
1,2,3-Trichloropropane				1.0 U	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene				0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene				0.2 U	0.2 U	0.2 U
1,2,4-Trimethylbenzene				0.5 U	0.5 U	0.5 U
Hexachlorobutadiene				0.2 U	0.2 U	0.2 U
Ethylene Dibromide				0.2 U	0.2 U	0.2 U
Bromochloromethane				0.2 U	0.2 U	0.2 U
2,2-Dichloropropane				0.2 U	0.2 U	0.2 U
1,3-Dichloropropane				0.2 U	0.2 U	0.2 U
Isopropylbenzene				0.2 U	0.2 U	0.2 U
n-Propylbenzene				0.2 U	0.2 U	0.2 U
Bromobenzene				0.2 U	0.2 U	0.2 U
2-Chlorotoluene				0.2 U	0.2 U	0.2 U
4-Chlorotoluene				0.2 U	0.2 U	0.2 U
tert-Butylbenzene				0.2 U	0.2 U	0.2 U
sec-Butylbenzene				0.2 U	0.2 U	0.2 U
4-Isopropyltoluene				0.2 U	0.2 U	0.2 U
n-Butylbenzene				0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene				0.5 U	0.5 U	0.5 U
Naphthalene				0.5 U	0.5 U	0.5 U
1,2,3-Trichlorobenzene						
Methyl tert-Butyl Ether						
SEMIVOLATILES (µg/kg)						
EPA Method SW8270						
Phenol						
Bis-(2-Chloroethyl) Ether						
2-Chlorophenol						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
Benzyl Alcohol						
1,2-Dichlorobenzene						
2-Methylphenol						
2,2'-Oxybis(1-Chloropropane)						
4-Methylphenol						
N-Nitroso-Di-N-Propylamine						
Hexachloroethane						

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

		Dup of SB-65-9-10				
Location(a):	SB-65-9-10	SB-66-9-10	SB-67-10.5-11.5	MW-9	SB-68	SB-69
Sample Depth (ft BGS)	JO51J	JO51L	JO51K	LU53F	LU53C	LU53E
Date Collected:	6/30/2006	6/30/2006	6/30/2006	10/22/2007	10/22/2007	10/22/2007
Nitrobenzene						
Isophorone						
2-Nitrophenol						
2,4-Dimethylphenol						
Benzoic Acid						
bis(2-Chloroethoxy) Methane						
2,4-Dichlorophenol						
1,2,4-Trichlorobenzene						
Naphthalene						
4-Chloroaniline						
Hexachlorobutadiene						
4-Chloro-3-methylphenol						
2-Methylnaphthalene						
Hexachlorocyclopentadiene						
2,4,6-Trichlorophenol						
2,4,5-Trichlorophenol						
2-Chloronaphthalene						
2-Nitroaniline						
Dimethylphthalate						
Acenaphthylene						
3-Nitroaniline						
Acenaphthene						
2,4-Dinitrophenol						
4-Nitrophenol						
Dibenzofuran						
2,6-Dinitrotoluene						
2,4-Dinitrotoluene						
Diethylphthalate						
4-Chlorophenyl-phenylether						
Fluorene						
4-Nitroaniline						
4,6-Dinitro-2-Methylphenol						
N-Nitrosodiphenylamine						
4-Bromophenyl-phenylether						
Hexachlorobenzene						
Pentachlorophenol						
Phenanthrene						
Carbazole						
Anthracene						
Di-n-Butylphthalate						
Fluoranthene						
Pyrene						
Butylbenzylphthalate						
3,3'-Dichlorobenzidine						
Benzo(a)anthracene						
bis(2-Ethylhexyl)phthalate						
Chrysene						
Di-n-Octyl phthalate						
Benzo(b)fluoranthene						
Benzo(k)fluoranthene						
Benzo(a)pyrene						
Indeno(1,2,3-cd)pyrene						
Dibenz(a,h)anthracene						
Benzo(g,h,i)perylene						
PCBs (µg/kg)						
Method 8082						
Aroclor 1016						
Aroclor 1242						
Aroclor 1248						
Aroclor 1254						
Aroclor 1260						
Aroclor 1221						
Aroclor 1232						
Total PCBs						

TABLE G-1
PRE-RI AND RI SOIL ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location(a):	SB-65-9-10	Dup of SB-65-9-10 SB-66-9-10	SB-67-10.5-11.5	MW-9	SB-68	SB-69
Sample Depth (ft BGS)	JO51J	JO51L	JO51K	LU53F	LU53C	LU53E
Date Collected:	6/30/2006	6/30/2006	6/30/2006	10/22/2007	10/22/2007	10/22/2007
PAHs (µg/kg)						
SW8270-SIM						
Naphthalene						
2-Methylnaphthalene						
1-Methylnaphthalene						
Total naphthalene						
Benzo(a)anthracene						
Chrysene						
Benzo(b)fluoranthene						
Benzo(k)fluoranthene						
Benzo(a)pyrene						
Indeno(1,2,3-cd)pyrene						
Dibenz(a,h)anthracene						
TEF						

U = Indicates compound was analyzed for, but was not detected at the given detection limit.
J = Estimated concentration.
M = Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match.
Boxed value indicates concentration above preliminary screening level.
Blank indicates compound was not analyzed for.
(a) No footnote a.
(b) Composite of samples from borings SB-3, SB-4, and SB-5.
(c) Composite of samples from borings SB-9, SB-10, and SB-11.
(d) Composite of samples from borings SB-12 through SB-16.
(e) Composite of samples from borings SB-21, SB-22, and SB-23.
(f) Beginning with May 2002 data, TPH samples were silica/acid cleaned.

APPENDIX H

Pre-RI and RI Groundwater Analytical Results

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	SB-5-W	SB-8-W	SB-10-W	SB-16-W	SB-19-W	SB-24-W	SB-30-W
Lab ID	V140D	V140H	V140J	V140L	V140P	V140S	V140V
Date Collected:	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998
VOLATILES (µg/L)							
EPA Method SW8260							
Chloromethane	2.0 U		2.0 U	2.0 U	2.0 U	2.0 U	
Bromomethane	2.0 U		2.0 U	2.0 U	2.0 U	2.0 U	
Vinyl Chloride	2.0 U		2.0 U	2.0 U	2.0 U	2.0 U	
Chloroethane	2.0 U		2.0 U	2.0 U	2.0 U	2.0 U	
Methylene Chloride	2.0 U		2.0 U	2.0 U	2.0 U	2.0 U	
Acetone	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
Carbon Disulfide	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,1-Dichloroethene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,1-Dichloroethane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
trans-1,2-Dichloroethene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
cis-1,2-Dichloroethene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Chloroform	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,2-Dichloroethane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
2-Butanone	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
1,1,1-Trichloroethane	1.0 U		1.0 U	1.0 U	5.0	1.0 U	
Carbon Tetrachloride	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Vinyl Acetate	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
Bromodichloromethane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,2-Dichloropropane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
cis-1,3-Dichloropropene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Trichloroethene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Dibromochloromethane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,1,2-Trichloroethane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Benzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
trans-1,3-Dichloropropene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
2-Chloroethylvinylether	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
Bromoform	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
4-Methyl-2-Pentanone (MIBK)	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
2-Hexanone	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
Tetrachloroethene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,1,2,2-Tetrachloroethane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Toluene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Chlorobenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Ethylbenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Styrene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Trichlorofluoromethane	2.0 U		2.0 U	2.0 U	2.0 U	2.0 U	
1,1,2-Trichlorotrifluoroethane	2.0 U		2.0 U	2.0 U	2.0 U	2.0 U	
m,p-Xylene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
o-Xylene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,2-Dichlorobenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,3-Dichlorobenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,4-Dichlorobenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Acrolein	50 U		50 U	50 U	50 U	50 U	
Methyl Iodide	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Bromoethane	2.0 U		2.0 U	2.0 U	2.0 U	2.0 U	
Acrylonitrile	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
1,1-Dichloropropene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Dibromomethane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-1	MW-1-Dup	MW-1	MW-1	MW-2	MW-2
Lab ID	BX90A	BX90E	EK56A	GV31G	BX90B	EK56B
Date Collected:	07/26/00	07/26/00	5/30/2002	7/7/2004	07/26/00	5/30/2002
VOLATILES (µg/L)						
EPA Method SW8260						
Chloromethane	1.0 U	1.0 U			1.0 U	
Bromomethane	1.0 U	1.0 U			1.0 U	
Vinyl Chloride	1.0 U	1.0 U			1.0 U	
Chloroethane	1.0 U	1.0 U			1.0 U	
Methylene Chloride	2.0 U	2.0 U			2.0 U	
Acetone	5.0 U	5.0 U			5.0 U	
Carbon Disulfide	1.0 U	1.0 U			1.0 U	
1,1-Dichloroethene	1.0 U	1.0 U			1.0 U	
1,1-Dichloroethane	1.0 U	1.0 U			1.0 U	
trans-1,2-Dichloroethene	1.0 U	1.0 U			1.0 U	
cis-1,2-Dichloroethene	1.0 U	1.0 U			1.0 U	
Chloroform	1.0 U	1.0 U			1.0 U	
1,2-Dichloroethane	1.0 U	1.0 U			1.0 U	
2-Butanone	5.0 U	5.0 U			5.0 U	
1,1,1-Trichloroethane	1.0 U	1.0 U			1.0 U	
Carbon Tetrachloride	1.0 U	1.0 U			1.0 U	
Vinyl Acetate	5.0 U	5.0 U			5.0 U	
Bromodichloromethane	1.0 U	1.0 U			1.0 U	
1,2-Dichloropropane	1.0 U	1.0 U			1.0 U	
cis-1,3-Dichloropropene	1.0 U	1.0 U			1.0 U	
Trichloroethene	1.0 U	1.0 U			1.0 U	
Dibromochloromethane	1.0 U	1.0 U			1.0 U	
1,1,2-Trichloroethane	1.0 U	1.0 U			1.0 U	
Benzene	1.0 U	1.0 U			1.0 U	
trans-1,3-Dichloropropene	1.0 U	1.0 U			1.0 U	
2-Chloroethylvinylether	5.0 U	5.0 U			5.0 U	
Bromoform	1.0 U	1.0 U			1.0 U	
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U			5.0 U	
2-Hexanone	5.0 U	5.0 U			5.0 U	
Tetrachloroethene	1.0 U	1.0 U			1.0 U	
1,1,2,2-Tetrachloroethane	1.0 U	1.0 U			1.0 U	
Toluene	1.0 U	1.0 U			1.0 U	
Chlorobenzene	1.0 U	1.0 U			1.0 U	
Ethylbenzene	1.0 U	1.0 U			1.0 U	
Styrene	1.0 U	1.0 U			1.0 U	
Trichlorofluoromethane	1.0 U	1.0 U			1.0 U	
1,1,2-Trichlorotrifluoroethane	2.0 U	2.0 U			2.0 U	
m,p-Xylene	1.0 U	1.0 U			1.0 U	
o-Xylene	1.0 U	1.0 U			1.0 U	
1,2-Dichlorobenzene	1.0 U	1.0 U			1.0 U	
1,3-Dichlorobenzene	1.0 U	1.0 U			1.0 U	
1,4-Dichlorobenzene	1.0 U	1.0 U			1.0 U	
Acrolein	50 U	50 U			50 U	
Methyl Iodide	1.0 U	1.0 U			1.0 U	
Bromoethane	2.0 U	2.0 U			2.0 U	
Acrylonitrile	5.0 U	5.0 U			5.0 U	
1,1-Dichloropropene	1.0 U	1.0 U			1.0 U	
Dibromomethane	1.0 U	1.0 U			1.0 U	

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-3	MW-3	MW-3	MW-3	MW-3A	MW-3B	MW-4	MW-4	MW-4	MW-4	MW-4A
Lab ID	BX90C	EK56C	GV31E	JO52G	KJ60A	KJ60G	BX90D	EK56D	GV31B	JO52H	KJ60E
Date Collected:	07/26/00	5/30/2002	7/7/2004	6/29/2006	12/20/2006	12/20/2006	07/26/00	5/30/2002	7/7/2004	6/29/2006	12/20/2006
VOLATILES (µg/L)											
EPA Method SW8260											
Chloromethane	1.0 U						1.0 U				
Bromomethane	1.0 U						1.0 U				
Vinyl Chloride	1.0 U						1.0 U				
Chloroethane	1.0 U						1.0 U				
Methylene Chloride	2.0 U						2.0 U				
Acetone	5.0 U						5.0 U				
Carbon Disulfide	1.0 U						1.0 U				
1,1-Dichloroethene	1.0 U						1.0 U				
1,1-Dichloroethane	1.0 U						1.0 U				
trans-1,2-Dichloroethene	1.0 U						1.0 U				
cis-1,2-Dichloroethene	1.0 U						1.0 U				
Chloroform	1.0 U						1.0 U				
1,2-Dichloroethane	1.0 U						1.0 U				
2-Butanone	5.0 U						5.0 U				
1,1,1-Trichloroethane	1.0 U						1.0 U				
Carbon Tetrachloride	1.0 U						1.0 U				
Vinyl Acetate	5.0 U						5.0 U				
Bromodichloromethane	1.0 U						1.0 U				
1,2-Dichloropropane	1.0 U						1.0 U				
cis-1,3-Dichloropropene	1.0 U						1.0 U				
Trichloroethene	1.0 U						1.0 U				
Dibromochloromethane	1.0 U						1.0 U				
1,1,2-Trichloroethane	1.0 U						1.0 U				
Benzene	1.0 U						1.0 U				
trans-1,3-Dichloropropene	1.0 U						1.0 U				
2-Chloroethylvinylether	5.0 U						5.0 U				
Bromoform	1.0 U						1.0 U				
4-Methyl-2-Pentanone (MIBK)	5.0 U						5.0 U				
2-Hexanone	5.0 U						5.0 U				
Tetrachloroethene	1.0 U						1.0 U				
1,1,2,2-Tetrachloroethane	1.0 U						1.0 U				
Toluene	1.0 U						1.0 U				
Chlorobenzene	1.0 U						1.0 U				
Ethylbenzene	1.0 U						1.0 U				
Styrene	1.0 U						1.0 U				
Trichlorofluoromethane	1.0 U						1.0 U				
1,1,2-Trichlorotrifluoroethane	2.0 U						2.0 U				
m,p-Xylene	1.0 U						1.0 U				
o-Xylene	1.0 U						1.0 U				
1,2-Dichlorobenzene	1.0 U						1.0 U				
1,3-Dichlorobenzene	1.0 U						1.0 U				
1,4-Dichlorobenzene	1.0 U						1.0 U				
Acrolein	50 U						50 U				
Methyl Iodide	1.0 U						1.0 U				
Bromoethane	2.0 U						2.0 U				
Acrylonitrile	5.0 U						5.0 U				
1,1-Dichloropropene	1.0 U						1.0 U				
Dibromomethane	1.0 U						1.0 U				

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-4B	MW-5
Lab ID	KJ60I	EK56E
Date Collected:	12/20/2006	5/30/2002
VOLATILES (µg/L)		
EPA Method SW8260		
Chloromethane		
Bromomethane		
Vinyl Chloride		
Chloroethane		
Methylene Chloride		
Acetone		
Carbon Disulfide		
1,1-Dichloroethene		
1,1-Dichloroethane		
trans-1,2-Dichloroethene		
cis-1,2-Dichloroethene		
Chloroform		
1,2-Dichloroethane		
2-Butanone		
1,1,1-Trichloroethane		
Carbon Tetrachloride		
Vinyl Acetate		
Bromodichloromethane		
1,2-Dichloropropane		
cis-1,3-Dichloropropene		
Trichloroethene		
Dibromochloromethane		
1,1,2-Trichloroethane		
Benzene		
trans-1,3-Dichloropropene		
2-Chloroethylvinylether		
Bromoform		
4-Methyl-2-Pentanone (MIBK)		
2-Hexanone		
Tetrachloroethene		
1,1,2,2-Tetrachloroethane		
Toluene		
Chlorobenzene		
Ethylbenzene		
Styrene		
Trichlorofluoromethane		
1,1,2-Trichlorotrifluoroethane		
m,p-Xylene		
o-Xylene		
1,2-Dichlorobenzene		
1,3-Dichlorobenzene		
1,4-Dichlorobenzene		
Acrolein		
Methyl Iodide		
Bromoethane		
Acrylonitrile		
1,1-Dichloropropene		
Dibromomethane		

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-6	MW-6	MW-7	MW-7	MW-7-Dup	MW-7	MW-7A	MW-7B	MW-8	MW-8
Lab ID	EK56F	GV31A	EK56G	GV31D	GV31H	JO52I	KJ60C	KJ60M	EK56H	GV31F
Date Collected:	5/30/2002	7/7/2004	5/30/2002	7/7/2004	7/7/2004	6/29/2006	12/20/2006	12/21/2006	5/30/2002	7/7/2004
VOLATILES (µg/L)										
EPA Method SW8260										
Chloromethane										
Bromomethane										
Vinyl Chloride										
Chloroethane										
Methylene Chloride										
Acetone										
Carbon Disulfide										
1,1-Dichloroethene										
1,1-Dichloroethane										
trans-1,2-Dichloroethene										
cis-1,2-Dichloroethene										
Chloroform										
1,2-Dichloroethane										
2-Butanone										
1,1,1-Trichloroethane										
Carbon Tetrachloride										
Vinyl Acetate										
Bromodichloromethane										
1,2-Dichloropropane										
cis-1,3-Dichloropropene										
Trichloroethene										
Dibromochloromethane										
1,1,2-Trichloroethane										
Benzene										
trans-1,3-Dichloropropene										
2-Chloroethylvinylether										
Bromoform										
4-Methyl-2-Pentanone (MIBK)										
2-Hexanone										
Tetrachloroethene										
1,1,2,2-Tetrachloroethane										
Toluene										
Chlorobenzene										
Ethylbenzene										
Styrene										
Trichlorofluoromethane										
1,1,2-Trichlorotrifluoroethane										
m,p-Xylene										
o-Xylene										
1,2-Dichlorobenzene										
1,3-Dichlorobenzene										
1,4-Dichlorobenzene										
Acrolein										
Methyl Iodide										
Bromoethane										
Acrylonitrile										
1,1-Dichloropropene										
Dibromomethane										

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-9	MW-9	MW-9	MW-10	MW-10A	MW-10B	MW-11	MW-11A	MW-11B
Lab ID	EK56I	GV31C	LU53F	JO52M	KJ60B	KJ60H	JO52L	KJ60F	KJ60J
Date Collected:	5/30/2002	7/7/2004	10/22/2007	06/29/06	12/20/06	12/20/06	06/29/06	12/20/06	12/20/06
VOLATILES (µg/L)									
EPA Method SW8260									
Chloromethane			0.2 U						
Bromomethane			0.2 U						
Vinyl Chloride			0.2 U						
Chloroethane			0.2 U						
Methylene Chloride			0.3 U						
Acetone			3.0 U						
Carbon Disulfide			0.2 U						
1,1-Dichloroethene			0.2 U						
1,1-Dichloroethane			0.2 U						
trans-1,2-Dichloroethene			0.2 U						
cis-1,2-Dichloroethene			0.2 U						
Chloroform			0.2 U						
1,2-Dichloroethane			0.2 U						
2-Butanone			1.0 U						
1,1,1-Trichloroethane			0.2 U						
Carbon Tetrachloride			0.2 U						
Vinyl Acetate			0.2 U						
Bromodichloromethane			0.2 U						
1,2-Dichloropropane			0.2 U						
cis-1,3-Dichloropropene			0.2 U						
Trichloroethene			0.2 U						
Dibromochloromethane			0.2 U						
1,1,2-Trichloroethane			0.2 U						
Benzene			0.2 U						
trans-1,3-Dichloropropene			0.2 U						
2-Chloroethylvinylether			0.5 U						
Bromoform			0.2 U						
4-Methyl-2-Pentanone (MIBK)			1.0 U						
2-Hexanone			3.0 U						
Tetrachloroethene			0.2 U						
1,1,2,2-Tetrachloroethane			0.2 U						
Toluene			0.2 U						
Chlorobenzene			0.2 U						
Ethylbenzene			0.2 U						
Styrene			0.2 U						
Trichlorofluoromethane			0.2 U						
1,1,2-Trichlorotrifluoroethane			0.2 U						
m,p-Xylene			0.4 U						
o-Xylene			0.2 U						
1,2-Dichlorobenzene			0.2 U						
1,3-Dichlorobenzene			0.2 U						
1,4-Dichlorobenzene			0.2 U						
Acrolein			5.0 U						
Methyl Iodide			0.2 U						
Bromoethane			0.2 U						
Acrylonitrile			1.0 U						
1,1-Dichloropropene			0.2 U						
Dibromomethane			0.2 U						

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

	Dup of MW-11B		Dup of MW-12				
Location:	MW-111	MW-12	MW-13	MW-12A	MW-12B	SB-68	SB-69
Lab ID	KJ60K	JO52J	JO52K	KJ60D	KJ60L	LU53C	LU53E
Date Collected:	12/20/06	06/29/06	06/29/06	12/20/06	12/21/06	10/22/2007	10/22/2007
VOLATILES (µg/L)							
EPA Method SW8260							
Chloromethane						0.2 U	0.2 U
Bromomethane						0.2 U	0.2 U
Vinyl Chloride						0.2 U	0.2 U
Chloroethane						0.2 U	0.2 U
Methylene Chloride						0.3 U	0.3 U
Acetone						3.0 U	3.0 U
Carbon Disulfide						0.2 U	0.2 U
1,1-Dichloroethene						0.2 U	0.2 U
1,1-Dichloroethane						0.2 U	0.2 U
trans-1,2-Dichloroethene						0.2 U	0.2 U
cis-1,2-Dichloroethene						0.2 U	0.2 U
Chloroform						0.2 U	0.2 U
1,2-Dichloroethane						0.2 U	0.2 U
2-Butanone						1.0 U	1.0 U
1,1,1-Trichloroethane						0.2 U	0.2 U
Carbon Tetrachloride						0.2 U	0.2 U
Vinyl Acetate						0.2 U	0.2 U
Bromodichloromethane						0.2 U	0.2 U
1,2-Dichloropropane						0.2 U	0.2 U
cis-1,3-Dichloropropene						0.2 U	0.2 U
Trichloroethene						0.2 U	0.2 U
Dibromochloromethane						0.2 U	0.2 U
1,1,2-Trichloroethane						0.2 U	0.2 U
Benzene						0.2 U	0.2 U
trans-1,3-Dichloropropene						0.2 U	0.2 U
2-Chloroethylvinylether						0.5 U	0.5 U
Bromoform						0.2 U	0.2 U
4-Methyl-2-Pentanone (MIBK)						1.0 U	1.0 U
2-Hexanone						3.0 U	3.0 U
Tetrachloroethene						0.2 U	0.2 U
1,1,2,2-Tetrachloroethane						0.2 U	0.2 U
Toluene						0.2 U	0.2 U
Chlorobenzene						0.2 U	0.2 U
Ethylbenzene						0.2 U	0.2 U
Styrene						0.2 U	0.2 U
Trichlorofluoromethane						0.2 U	0.2 U
1,1,2-Trichlorotrifluoroethane						0.2 U	0.2 U
m,p-Xylene						0.4 U	0.4 U
o-Xylene						0.2 U	0.2 U
1,2-Dichlorobenzene						0.2 U	0.2 U
1,3-Dichlorobenzene						0.2 U	0.2 U
1,4-Dichlorobenzene						0.2 U	0.2 U
Acrolein						5.0 U	5.0 U
Methyl Iodide						0.2 U	0.2 U
Bromoethane						0.2 U	0.2 U
Acrylonitrile						1.0 U	1.0 U
1,1-Dichloropropene						0.2 U	0.2 U
Dibromomethane						0.2 U	0.2 U

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	SB-5-W	SB-8-W	SB-10-W	SB-16-W	SB-19-W	SB-24-W	SB-30-W
Lab ID	V140D	V140H	V140J	V140L	V140P	V140S	V140V
Date Collected:	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998
1,1,1,2-Tetrachloroethane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,2-Dibromo-3-chloropropane	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
1,2,3-Trichloropropane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
trans-1,4-Dichloro-2-butene	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
1,3,5-Trimethylbenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,2,4-Trimethylbenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Hexachlorobutadiene	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
Ethylene Dibromide	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Bromochloromethane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
2,2-Dichloropropane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,3-Dichloropropane	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Isopropylbenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
n-Propylbenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
Bromobenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
2-Chlorotoluene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
4-Chlorotoluene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
tert-Butylbenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
sec-Butylbenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
4-Isopropyltoluene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
n-Butylbenzene	1.0 U		1.0 U	1.0 U	1.0 U	1.0 U	
1,2,4-Trichlorobenzene	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
Naphthalene	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
1,2,3-Trichlorobenzene	5.0 U		5.0 U	5.0 U	5.0 U	5.0 U	
TOTAL PETROLEUM HYDROCARBONS (mg/L)							
Method WA HCID							
Gas Range						10 U	
Diesel Range						10 U	
Oil Range						25 U	

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-1	MW-1-Dup	MW-1	MW-1	MW-2	MW-2
Lab ID	BX90A	BX90E	EK56A	GV31G	BX90B	EK56B
Date Collected:	07/26/00	07/26/00	5/30/2002	7/7/2004	07/26/00	5/30/2002
1,1,1,2-Tetrachloroethane	1.0 U	1.0 U			1.0 U	
1,2-Dibromo-3-chloropropane	5.0 U	5.0 U			5.0 U	
1,2,3-Trichloropropane	3.0 U	3.0 U			3.0 U	
trans-1,4-Dichloro-2-butene	5.0 U	5.0 U			5.0 U	
1,3,5-Trimethylbenzene	1.0 U	1.0 U			1.0 U	
1,2,4-Trimethylbenzene	1.0 U	1.0 U			1.0 U	
Hexachlorobutadiene	5.0 U	5.0 U			5.0 U	
Ethylene Dibromide	1.0 U	1.0 U			1.0 U	
Bromochloromethane	1.0 U	1.0 U			1.0 U	
2,2-Dichloropropane	1.0 U	1.0 U			1.0 U	
1,3-Dichloropropane	1.0 U	1.0 U			1.0 U	
Isopropylbenzene	1.0 U	1.0 U			1.0 U	
n-Propylbenzene	1.0 U	1.0 U			1.0 U	
Bromobenzene	1.0 U	1.0 U			1.0 U	
2-Chlorotoluene	1.0 U	1.0 U			1.0 U	
4-Chlorotoluene	1.0 U	1.0 U			1.0 U	
tert-Butylbenzene	1.0 U	1.0 U			1.0 U	
sec-Butylbenzene	1.0 U	1.0 U			1.0 U	
4-Isopropyltoluene	1.0 U	1.0 U			1.0 U	
n-Butylbenzene	5.0 U	5.0 U			5.0 U	
1,2,4-Trichlorobenzene	5.0 U	5.0 U			5.0 U	
Naphthalene	5.0 U	5.0 U			5.0 U	
1,2,3-Trichlorobenzene						
TOTAL PETROLEUM HYDROCARBONS (mg/L)						
Method WA HCID						
Gas Range						
Diesel Range						
Oil Range						

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-3	MW-3	MW-3	MW-3	MW-3A	MW-3B	MW-4	MW-4	MW-4	MW-4	MW-4A
Lab ID	BX90C	EK56C	GV31E	JO52G	KJ60A	KJ60G	BX90D	EK56D	GV31B	JO52H	KJ60E
Date Collected:	07/26/00	5/30/2002	7/7/2004	6/29/2006	12/20/2006	12/20/2006	07/26/00	5/30/2002	7/7/2004	6/29/2006	12/20/2006
1,1,1,2-Tetrachloroethane	1.0 U						1.0 U				
1,2-Dibromo-3-chloropropane	5.0 U						5.0 U				
1,2,3-Trichloropropane	3.0 U						3.0 U				
trans-1,4-Dichloro-2-butene	5.0 U						5.0 U				
1,3,5-Trimethylbenzene	1.0 U						1.0 U				
1,2,4-Trimethylbenzene	1.0 U						1.0 U				
Hexachlorobutadiene	5.0 U						5.0 U				
Ethylene Dibromide	1.0 U						1.0 U				
Bromochloromethane	1.0 U						1.0 U				
2,2-Dichloropropane	1.0 U						1.0 U				
1,3-Dichloropropane	1.0 U						1.0 U				
Isopropylbenzene	1.0 U						1.0 U				
n-Propylbenzene	1.0 U						1.0 U				
Bromobenzene	1.0 U						1.0 U				
2-Chlorotoluene	1.0 U						1.0 U				
4-Chlorotoluene	1.0 U						1.0 U				
tert-Butylbenzene	1.0 U						1.0 U				
sec-Butylbenzene	1.0 U						1.0 U				
4-Isopropyltoluene	1.0 U						1.0 U				
n-Butylbenzene	5.0 U						5.0 U				
1,2,4-Trichlorobenzene	5.0 U						5.0 U				
Naphthalene	5.0 U						5.0 U				
1,2,3-Trichlorobenzene											
TOTAL PETROLEUM HYDROCARBONS (mg/L)											
Method WA HCID											
Gas Range											
Diesel Range											
Oil Range											

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-4B	MW-5
Lab ID	KJ60I	EK56E
Date Collected:	12/20/2006	5/30/2002
1,1,1,2-Tetrachloroethane		
1,2-Dibromo-3-chloropropane		
1,2,3-Trichloropropane		
trans-1,4-Dichloro-2-butene		
1,3,5-Trimethylbenzene		
1,2,4-Trimethylbenzene		
Hexachlorobutadiene		
Ethylene Dibromide		
Bromochloromethane		
2,2-Dichloropropane		
1,3-Dichloropropane		
Isopropylbenzene		
n-Propylbenzene		
Bromobenzene		
2-Chlorotoluene		
4-Chlorotoluene		
tert-Butylbenzene		
sec-Butylbenzene		
4-Isopropyltoluene		
n-Butylbenzene		
1,2,4-Trichlorobenzene		
Naphthalene		
1,2,3-Trichlorobenzene		
TOTAL PETROLEUM HYDROCARBONS (mg/L)		
Method WA HCID		
Gas Range		
Diesel Range		
Oil Range		

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-6	MW-6	MW-7	MW-7	MW-7-Dup	MW-7	MW-7A	MW-7B	MW-8	MW-8
Lab ID	EK56F	GV31A	EK56G	GV31D	GV31H	JO52I	KJ60C	KJ60M	EK56H	GV31F
Date Collected:	5/30/2002	7/7/2004	5/30/2002	7/7/2004	7/7/2004	6/29/2006	12/20/2006	12/21/2006	5/30/2002	7/7/2004
1,1,1,2-Tetrachloroethane										
1,2-Dibromo-3-chloropropane										
1,2,3-Trichloropropane										
trans-1,4-Dichloro-2-butene										
1,3,5-Trimethylbenzene										
1,2,4-Trimethylbenzene										
Hexachlorobutadiene										
Ethylene Dibromide										
Bromochloromethane										
2,2-Dichloropropane										
1,3-Dichloropropane										
Isopropylbenzene										
n-Propylbenzene										
Bromobenzene										
2-Chlorotoluene										
4-Chlorotoluene										
tert-Butylbenzene										
sec-Butylbenzene										
4-Isopropyltoluene										
n-Butylbenzene										
1,2,4-Trichlorobenzene										
Naphthalene										
1,2,3-Trichlorobenzene										
TOTAL PETROLEUM HYDROCARBONS (mg/L)										
Method WA HCID										
Gas Range										
Diesel Range										
Oil Range										

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-9	MW-9	MW-9	MW-10	MW-10A	MW-10B	MW-11	MW-11A	MW-11B
Lab ID	EK56I	GV31C	LU53F	JO52M	KJ60B	KJ60H	JO52L	KJ60F	KJ60J
Date Collected:	5/30/2002	7/7/2004	10/22/2007	06/29/06	12/20/06	12/20/06	06/29/06	12/20/06	12/20/06
1,1,1,2-Tetrachloroethane			0.2 U						
1,2-Dibromo-3-chloropropane			0.5 U						
1,2,3-Trichloropropane			0.5 U						
trans-1,4-Dichloro-2-butene			1.0 U						
1,3,5-Trimethylbenzene			0.2 U						
1,2,4-Trimethylbenzene			0.2 U						
Hexachlorobutadiene			0.5 U						
Ethylene Dibromide			0.2 U						
Bromochloromethane			0.2 U						
2,2-Dichloropropane			0.2 U						
1,3-Dichloropropane			0.2 U						
Isopropylbenzene			0.2 U						
n-Propylbenzene			0.2 U						
Bromobenzene			0.2 U						
2-Chlorotoluene			0.2 U						
4-Chlorotoluene			0.2 U						
tert-Butylbenzene			0.2 U						
sec-Butylbenzene			0.2 U						
4-Isopropyltoluene			0.2 U						
n-Butylbenzene			0.2 U						
1,2,4-Trichlorobenzene			0.5 U						
Naphthalene			0.5 U						
1,2,3-Trichlorobenzene			0.5 U						
TOTAL PETROLEUM HYDROCARBONS (mg/L)									
Method WA HCID									
Gas Range									
Diesel Range									
Oil Range									

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	Dup of MW-11B MW-111	MW-12	Dup of MW-12 MW-13	MW-12A	MW-12B	SB-68	SB-69
Lab ID	KJ60K	JO52J	JO52K	KJ60D	KJ60L	LU53C	LU53E
Date Collected:	12/20/06	06/29/06	06/29/06	12/20/06	12/21/06	10/22/2007	10/22/2007
1,1,1,2-Tetrachloroethane						0.2 U	0.2 U
1,2-Dibromo-3-chloropropane						0.5 U	0.5 U
1,2,3-Trichloropropane						0.5 U	0.5 U
trans-1,4-Dichloro-2-butene						1.0 U	1.0 U
1,3,5-Trimethylbenzene						0.2 U	0.2 U
1,2,4-Trimethylbenzene						0.2 U	0.2 U
Hexachlorobutadiene						0.5 U	0.5 U
Ethylene Dibromide						0.2 U	0.2 U
Bromochloromethane						0.2 U	0.2 U
2,2-Dichloropropane						0.2 U	0.2 U
1,3-Dichloropropane						0.2 U	0.2 U
Isopropylbenzene						0.2 U	0.2 U
n-Propylbenzene						0.2 U	0.2 U
Bromobenzene						0.2 U	0.2 U
2-Chlorotoluene						0.2 U	0.2 U
4-Chlorotoluene						0.2 U	0.2 U
tert-Butylbenzene						0.2 U	0.2 U
sec-Butylbenzene						0.2 U	0.2 U
4-Isopropyltoluene						0.2 U	0.2 U
n-Butylbenzene						0.2 U	0.2 U
1,2,4-Trichlorobenzene						0.5 U	0.5 U
Naphthalene						0.5 U	0.5 U
1,2,3-Trichlorobenzene						0.5 U	0.5 U
TOTAL PETROLEUM HYDROCARBONS (mg/L)							
Method WA HCID							
Gas Range							
Diesel Range							
Oil Range							

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	SB-5-W	SB-8-W	SB-10-W	SB-16-W	SB-19-W	SB-24-W	SB-30-W
Lab ID	V140D	V140H	V140J	V140L	V140P	V140S	V140V
Date Collected:	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998
TOTAL GASOLINE-RANGE HYDROCARBONS (mg/L)							
Method WTPHg							
Gas Range		95					0.25 U
Si/Acid Cleaned NWTPHD (mg/L)							
Diesel Range Hydrocarbons							
Motor Oil							
DISSOLVED METALS (µg/L)							
Antimony (200.8)	0.2 U			0.2 U	0.2 U	0.2	
Arsenic (200.8)	0.5			0.4	0.8	0.3	
Beryllium (200.8)	0.2 U			0.2 U	0.2 U	0.2 U	
Cadmium (200.8)	0.2 U			0.2 U	0.2 U	0.2 U	
Chromium (200.8)	1 U			1 U	1 U	1 U	
Copper (200.8)	2			1	1	1 U	
Lead (200.8)	1 U			1 U	1 U	1 U	1 U
Mercury (7470)	0.1 U			0.1 U	0.1 U	0.1 U	
Nickel (200.8)	14			4	3	2	
Selenium (200.8)	2			1 U	1 U	1 U	
Silver (200.8)	0.2 U			0.2 U	0.2 U	0.2 U	
Thallium (200.8)	0.2 U			0.2 U	0.2 U	0.2 U	
Zinc (200.8)	11			8	4	4	
PAHs (µg/L)							
SW8270-SIM							
Naphthalene							
2-Methylnaphthalene							
1-Methylnaphthalene							
Total naphthalene							
Benzo(a)anthracene							
Chrysene							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(a)pyrene							
Indeno(1,2,3-cd)pyrene							
Dibenz(a,h)anthracene							
TEF							

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-1	MW-1-Dup	MW-1	MW-1	MW-2	MW-2
Lab ID	BX90A	BX90E	EK56A	GV31G	BX90B	EK56B
Date Collected:	07/26/00	07/26/00	5/30/2002	7/7/2004	07/26/00	5/30/2002
TOTAL GASOLINE-RANGE HYDROCARBONS (mg/L						
Method WTPHg						
Gas Range	0.25 U	0.25 U	0.25 U		0.25 U	0.25 U
Si/Acid Cleaned NWTPHD (mg/L)						
Diesel Range Hydrocarbons						
Motor Oil						
DISSOLVED METALS (µg/L)						
Antimony (200.8)						
Arsenic (200.8)				1 U		
Beryllium (200.8)						
Cadmium (200.8)						
Chromium (200.8)						
Copper (200.8)				2 U		
Lead (200.8)	1 U	1 U	1 U	1 U	1 U	1 U
Mercury (7470)				0.1 U		
Nickel (200.8)				10 U		
Selenium (200.8)						
Silver (200.8)						
Thallium (200.8)						
Zinc (200.8)				6 U		
PAHs (µg/L)						
SW8270-SIM						
Naphthalene						
2-Methylnaphthalene						
1-Methylnaphthalene						
Total naphthalene						
Benzo(a)anthracene						
Chrysene						
Benzo(b)fluoranthene						
Benzo(k)fluoranthene						
Benzo(a)pyrene						
Indeno(1,2,3-cd)pyrene						
Dibenz(a,h)anthracene						
TEF						

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-3	MW-3	MW-3	MW-3	MW-3A	MW-3B	MW-4	MW-4	MW-4	MW-4	MW-4A
Lab ID	BX90C	EK56C	GV31E	JO52G	KJ60A	KJ60G	BX90D	EK56D	GV31B	JO52H	KJ60E
Date Collected:	07/26/00	5/30/2002	7/7/2004	6/29/2006	12/20/2006	12/20/2006	07/26/00	5/30/2002	7/7/2004	6/29/2006	12/20/2006
TOTAL GASOLINE-RANGE HYDROCARBONS (mg/L)											
Method WTPHg											
Gas Range	0.25 U	0.25 U	0.25 U				0.25 U	0.25 U	0.25 U		
Si/Acid Cleaned NWTPHD (mg/L)											
Diesel Range Hydrocarbons											
Motor Oil											
DISSOLVED METALS (µg/L)											
Antimony (200.8)											
Arsenic (200.8)			1						1		
Beryllium (200.8)											
Cadmium (200.8)											
Chromium (200.8)											
Copper (200.8)			6	16	2 U	5			5	3	2
Lead (200.8)	1 U	1 U	1 U	1 U				1 U	1 U	1 U	NA
Mercury (7470)			0.1 U	0.1 U					0.1 U	0.1 U	NA
Nickel (200.8)			10 U	9.3	11	12			10 U	9.1	20
Selenium (200.8)											
Silver (200.8)											
Thallium (200.8)											
Zinc (200.8)			76	101	79	97			74	82	139
PAHs (µg/L)											
SW8270-SIM											
Naphthalene											
2-Methylnaphthalene											
1-Methylnaphthalene											
Total naphthalene											
Benzo(a)anthracene											
Chrysene											
Benzo(b)fluoranthene											
Benzo(k)fluoranthene											
Benzo(a)pyrene											
Indeno(1,2,3-cd)pyrene											
Dibenz(a,h)anthracene											
TEF											

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-4B	MW-5
Lab ID	KJ60I	EK56E
Date Collected:	12/20/2006	5/30/2002
TOTAL GASOLINE-RANGE HYDROCARBONS (mg/L)		
Method WTPHg		
Gas Range		22
Si/Acid Cleaned NWTPHD (mg/L)		
Diesel Range Hydrocarbons		
Motor Oil		
DISSOLVED METALS (µg/L)		
Antimony (200.8)		
Arsenic (200.8)		
Beryllium (200.8)		
Cadmium (200.8)		
Chromium (200.8)		
Copper (200.8)	2	
Lead (200.8)	NA	1 U
Mercury (7470)	NA	
Nickel (200.8)	17	
Selenium (200.8)		
Silver (200.8)		
Thallium (200.8)		
Zinc (200.8)	126	
PAHs (µg/L)		
SW8270-SIM		
Naphthalene		
2-Methylnaphthalene		
1-Methylnaphthalene		
Total naphthalene		
Benzo(a)anthracene		
Chrysene		
Benzo(b)fluoranthene		
Benzo(k)fluoranthene		
Benzo(a)pyrene		
Indeno(1,2,3-cd)pyrene		
Dibenz(a,h)anthracene		
TEF		

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-6	MW-6	MW-7	MW-7	MW-7-Dup	MW-7	MW-7A	MW-7B	MW-8	MW-8
Lab ID	EK56F	GV31A	EK56G	GV31D	GV31H	JO52I	KJ60C	KJ60M	EK56H	GV31F
Date Collected:	5/30/2002	7/7/2004	5/30/2002	7/7/2004	7/7/2004	6/29/2006	12/20/2006	12/21/2006	5/30/2002	7/7/2004
TOTAL GASOLINE-RANGE HYDROCARBONS (mg/L										
Method WTPHg										
Gas Range	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U				0.25 U	0.25 U
Si/Acid Cleaned NWTPHD (mg/L)										
Diesel Range Hydrocarbons										
Motor Oil										
DISSOLVED METALS (µg/L)										
Antimony (200.8)										
Arsenic (200.8)				2	1					
Beryllium (200.8)										
Cadmium (200.8)										
Chromium (200.8)										
Copper (200.8)				9	8	10	2 U	3		
Lead (200.8)	1 U		3	1 U	1 U	1 U	NA	NA	1 U	
Mercury (7470)				0.1 U	0.1 U	0.1 U	NA	NA		
Nickel (200.8)				10 U	10 U	3.1	2.5	2.4		
Selenium (200.8)										
Silver (200.8)										
Thallium (200.8)										
Zinc (200.8)				20	21	8	6 U	6 U		
PAHs (µg/L)										
SW8270-SIM										
Naphthalene										
2-Methylnaphthalene										
1-Methylnaphthalene										
Total naphthalene										
Benzo(a)anthracene										
Chrysene										
Benzo(b)fluoranthene										
Benzo(k)fluoranthene										
Benzo(a)pyrene										
Indeno(1,2,3-cd)pyrene										
Dibenz(a,h)anthracene										
TEF										

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-9	MW-9	MW-9	MW-10	MW-10A	MW-10B	MW-11	MW-11A	MW-11B
Lab ID	EK56I	GV31C	LU53F	JO52M	KJ60B	KJ60H	JO52L	KJ60F	KJ60J
Date Collected:	5/30/2002	7/7/2004	10/22/2007	06/29/06	12/20/06	12/20/06	06/29/06	12/20/06	12/20/06
TOTAL GASOLINE-RANGE HYDROCARBONS (mg/L									
Method WTPHg									
Gas Range	0.25 U		0.25 U						
Si/Acid Cleaned NWTPHD (mg/L)									
Diesel Range Hydrocarbons	0.25 U	0.25 U	0.25 U						
Motor Oil	0.50 U	0.50 U	0.50 U						
DISSOLVED METALS (µg/L)									
Antimony (200.8)									
Arsenic (200.8)									
Beryllium (200.8)									
Cadmium (200.8)									
Chromium (200.8)									
Copper (200.8)			0.7	15	2	3	35	5	4 U
Lead (200.8)			1 U	1 U	NA	NA	1 U	NA	NA
Mercury (7470)			0.1 U	0.1 U	NA	NA	0.1 U	NA	NA
Nickel (200.8)			2.1	19.1	37	34.0	16.6	29	27
Selenium (200.8)									
Silver (200.8)									
Thallium (200.8)									
Zinc (200.8)			4 U	113	172	190	104	200	190
PAHs (µg/L)									
SW8270-SIM									
Naphthalene	0.64								
2-Methylnaphthalene	0.27								
1-Methylnaphthalene	0.11								
Total naphthalene	1.02								
Benzo(a)anthracene	0.10 U								
Chrysene	0.10 U								
Benzo(b)fluoranthene	0.10 U								
Benzo(k)fluoranthene	0.10 U								
Benzo(a)pyrene	0.10 U								
Indeno(1,2,3-cd)pyrene	0.10 U								
Dibenz(a,h)anthracene	0.10 U								
TEF	0								

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

	Dup of MW-11B		Dup of MW-12				
Location:	MW-111	MW-12	MW-13	MW-12A	MW-12B	SB-68	SB-69
Lab ID	KJ60K	JO52J	JO52K	KJ60D	KJ60L	LU53C	LU53E
Date Collected:	12/20/06	06/29/06	06/29/06	12/20/06	12/21/06	10/22/2007	10/22/2007
TOTAL GASOLINE-RANGE HYDROCARBONS (mg/L)							
Method WTPHg							
Gas Range						0.25 U	0.25 U
Si/Acid Cleaned NWTPHD (mg/L)							
Diesel Range Hydrocarbons							
Motor Oil							
DISSOLVED METALS (µg/L)							
Antimony (200.8)							
Arsenic (200.8)							
Beryllium (200.8)							
Cadmium (200.8)							
Chromium (200.8)							
Copper (200.8)	4 U	9	9	3	3	0.5 U	1.8
Lead (200.8)	NA	5 U	5 U	NA	NA	1 U	1 U
Mercury (7470)	NA	0.1 U	0.1 U	NA	NA	0.1 U	0.1 U
Nickel (200.8)	28	12.5	13	8	7	1.8	2.9
Selenium (200.8)							
Silver (200.8)							
Thallium (200.8)							
Zinc (200.8)	180	280	280	43	45	6	12
PAHs (µg/L)							
SW8270-SIM							
Naphthalene							
2-Methylnaphthalene							
1-Methylnaphthalene							
Total naphthalene							
Benzo(a)anthracene							
Chrysene							
Benzo(b)fluoranthene							
Benzo(k)fluoranthene							
Benzo(a)pyrene							
Indeno(1,2,3-cd)pyrene							
Dibenz(a,h)anthracene							
TEF							

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	SB-5-W	SB-8-W	SB-10-W	SB-16-W	SB-19-W	SB-24-W	SB-30-W
Lab ID	V140D	V140H	V140J	V140L	V140P	V140S	V140V
Date Collected:	1/20/1998	1/20/1998	1/20/1998	1/20/1998	1/21/1998	1/21/1998	1/21/1998
BTEX (µg/L)							
Method 8020							
Benzene		3500 J					1.0 U
Toluene		7400 J					1.0 U
Ethylbenzene		1800 J					1.0 U
m,p-Xylene		9400 J					1.0 U
o-Xylene		3900 J					1.0 U
Total Xylenes		13300					1.0 U
VOLATILES (µg/L)							
SW8260							
1,2-Dichloroethane							
Ethylene Dibromide							
Methyl tert-Butyl Ether							
CONVENTIONALS (mg/L)							
Alkalinity (SM 2320) (mg/L CaCO3)							
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)							
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)							
Ferrous Iron (SM3500 FeD)							
N-Nitrate (Calculated) (mg-N/L)							
N-Nitrite (EPA 353.2) (mg-N/L)							
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)							
Sulfate (EPA 375.2)							
Total Organic Carbon (EPA 415.1)							
FIELD PARAMETERS							
pH							
Temperature (deg C)							
Conductivity (µS)							
Turbidity (NTU)							
Dissolved Oxygen (mg/L)							

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-1	MW-1-Dup	MW-1	MW-1	MW-2	MW-2
Lab ID	BX90A	BX90E	EK56A	GV31G	BX90B	EK56B
Date Collected:	07/26/00	07/26/00	5/30/2002	7/7/2004	07/26/00	5/30/2002
BTEX (µg/L)						
Method 8020						
Benzene			1.0 U			1.0 U
Toluene			1.0 U			1.0 U
Ethylbenzene			1.0 U			1.0 U
m,p-Xylene			1.0 U			1.0 U
o-Xylene			1.0 U			1.0 U
Total Xylenes			1.0 U			1.0 U
VOLATILES (µg/L)						
SW8260						
1,2-Dichloroethane						
Ethylene Dibromide						
Methyl tert-Butyl Ether						
CONVENTIONALS (mg/L)						
Alkalinity (SM 2320) (mg/L CaCO3)			450			
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)			1.0 U			
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)			450			
Ferrous Iron (SM3500 FeD)			0.18			
N-Nitrate (Calculated) (mg-N/L)			0.15			
N-Nitrite (EPA 353.2) (mg-N/L)			0.010 U			
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)			0.15			
Sulfate (EPA 375.2)			62			
Total Organic Carbon (EPA 415.1)			1.5 U			
FIELD PARAMETERS						
pH			6.92	6.68		7.35
Temperature (deg C)			11.4	13.8		9.5
Conductivity (µS)			675	410		1
Turbidity (NTU)			13	10		0
Dissolved Oxygen (mg/L)			0.15	0		0.28

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-3	MW-3	MW-3	MW-3	MW-3A	MW-3B	MW-4	MW-4	MW-4	MW-4	MW-4A
Lab ID	BX90C	EK56C	GV31E	JO52G	KJ60A	KJ60G	BX90D	EK56D	GV31B	JO52H	KJ60E
Date Collected:	07/26/00	5/30/2002	7/7/2004	6/29/2006	12/20/2006	12/20/2006	07/26/00	5/30/2002	7/7/2004	6/29/2006	12/20/2006
BTEX (µg/L)											
Method 8020											
Benzene		1.0 U	1.0 U					1.0 U	1.0 U		
Toluene		1.0 U	1.0 U					1.0 U	1.0 U		
Ethylbenzene		1.0 U	1.0 U					1.0 U	1.0 U		
m,p-Xylene		1.0 U	1.0 U					1.0 U	1.0 U		
o-Xylene		1.0 U	1.0 U					1.0 U	1.0 U		
Total Xylenes		1.0 U	1.0 U					1.0 U	1.0 U		
VOLATILES (µg/L)											
SW8260											
1,2-Dichloroethane											
Ethylene Dibromide											
Methyl tert-Butyl Ether											
CONVENTIONALS (mg/L)											
Alkalinity (SM 2320) (mg/L CaCO3)		160									
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)		1.0 U									
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)		160									
Ferrous Iron (SM3500 FeD)		0.040 U									
N-Nitrate (Calculated) (mg-N/L)		0.16			2.65	2.68				NA	0.982
N-Nitrite (EPA 353.2) (mg-N/L)		0.010 U			0.024	0.024				NA	0.014
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)		0.16			2.67	2.7				NA	0.996
Sulfate (EPA 375.2)		300			480	499				NA	850
Total Organic Carbon (EPA 415.1)		1.5 U									
FIELD PARAMETERS											
pH		6.77	6.46	6.46	6.43	6.42		6.61	6.46	6.60	6.61
Temperature (deg C)		9.7	17.6	15.8	10.8	11.0		11.4	18.7	15.1	10.3
Conductivity (µS)		6340	11900	9283	12500	12925		9500	16600	10083	22267
Turbidity (NTU)		21	12	1	5	7		0	9	0	50
Dissolved Oxygen (mg/L)		0.22	1.97	NM	10.78	27.30		1.44	2.26	0.00	2.12

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-4B	MW-5
Lab ID	KJ60I	EK56E
Date Collected:	12/20/2006	5/30/2002
BTEX (µg/L)		
Method 8020		
Benzene		680
Toluene		370
Ethylbenzene		310
m,p-Xylene		1900
o-Xylene		780
Total Xylenes		2680
VOLATILES (µg/L)		
SW8260		
1,2-Dichloroethane		20 U
Ethylene Dibromide		0.01 U
Methyl tert-Butyl Ether		20 U
CONVENTIONALS (mg/L)		
Alkalinity (SM 2320) (mg/L CaCO3)		360
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)		1.0 U
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)		360
Ferrous Iron (SM3500 FeD)		9.3
N-Nitrate (Calculated) (mg-N/L)	0.697	0.010 U
N-Nitrite (EPA 353.2) (mg-N/L)	0.012	0.010 U
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)	0.709	0.010 U
Sulfate (EPA 375.2)	748	21
Total Organic Carbon (EPA 415.1)		1.5 U
FIELD PARAMETERS		
pH	6.63	6.98
Temperature (deg C)	10.3	8.1
Conductivity (µS)	19167	532
Turbidity (NTU)	5	9
Dissolved Oxygen (mg/L)	24.70	0.00

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-6	MW-6	MW-7	MW-7	MW-7-Dup	MW-7	MW-7A	MW-7B	MW-8	MW-8
Lab ID	EK56F	GV31A	EK56G	GV31D	GV31H	JO52I	KJ60C	KJ60M	EK56H	GV31F
Date Collected:	5/30/2002	7/7/2004	5/30/2002	7/7/2004	7/7/2004	6/29/2006	12/20/2006	12/21/2006	5/30/2002	7/7/2004
BTEX (µg/L)										
Method 8020										
Benzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U
Toluene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U
Ethylbenzene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U
m,p-Xylene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U
o-Xylene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U
Total Xylenes	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U				1.0 U	1.0 U
VOLATILES (µg/L)										
SW8260										
1,2-Dichloroethane										
Ethylene Dibromide										
Methyl tert-Butyl Ether										
CONVENTIONALS (mg/L)										
Alkalinity (SM 2320) (mg/L CaCO3)	360									
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	1.0 U									
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)	360									
Ferrous Iron (SM3500 FeD)	0.47									
N-Nitrate (Calculated) (mg-N/L)	0.097						0.01 U	0.155		
N-Nitrite (EPA 353.2) (mg-N/L)	0.010 U						0.01 U	0.01 U		
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)	0.097						0.01 U	0.155		
Sulfate (EPA 375.2)	43						127	186		
Total Organic Carbon (EPA 415.1)	1.5 U									
FIELD PARAMETERS										
pH	7.06	6.37	7.08	6.34	6.34	6.76	6.96	6.87	7.36	6.74
Temperature (deg C)	10.1	13.3	12.5	17.0	17.0	15.9	12.2	12.3	10.6	14.7
Conductivity (µS)	542	160	3042	13100	13100	4526	4528	5815	449	684
Turbidity (NTU)	12	0	42	10	10	2	5	5	6	285
Dissolved Oxygen (mg/L)	0.00	0.54	0.29	0.90	0.90	0.00	114.50	52.20	1.50	1.70

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

Location:	MW-9	MW-9	MW-9	MW-10	MW-10A	MW-10B	MW-11	MW-11A	MW-11B
Lab ID	EK56I	GV31C	LU53F	JO52M	KJ60B	KJ60H	JO52L	KJ60F	KJ60J
Date Collected:	5/30/2002	7/7/2004	10/22/2007	06/29/06	12/20/06	12/20/06	06/29/06	12/20/06	12/20/06
BTEX (µg/L)									
Method 8020									
Benzene									
Toluene									
Ethylbenzene									
m,p-Xylene									
o-Xylene									
Total Xylenes									
VOLATILES (µg/L)									
SW8260									
1,2-Dichloroethane									
Ethylene Dibromide									
Methyl tert-Butyl Ether									
CONVENTIONALS (mg/L)									
Alkalinity (SM 2320) (mg/L CaCO3)									
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)									
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)									
Ferrous Iron (SM3500 FeD)									
N-Nitrate (Calculated) (mg-N/L)				NA	1.47	1.86	NA	0.699	0.945
N-Nitrite (EPA 353.2) (mg-N/L)				NA	0.016	0.020	NA	0.010 U	0.023 J
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)				NA	1.49	1.88	NA	0.699	0.968
Sulfate (EPA 375.2)				NA	622	592	NA	1390	1260
Total Organic Carbon (EPA 415.1)									
FIELD PARAMETERS									
pH	7.13	6.78		6.41	6.03	5.90	6.66	6.17	6.12
Temperature (deg C)	13.0	15.3		15.7	10.4	10.3	16.5	7.3	7.6
Conductivity (µS)	512	675		10,871	15,700	15,700	17,512	33,800	31,900
Turbidity (NTU)	9	138		1.98	0.00	1.38	0.88	3.60	2.02
Dissolved Oxygen (mg/L)	0.78	0.45		0.001	367.0	0.0	0.001	44.8	69.9

TABLE H-1
PRE-RI AND RI GROUNDWATER ANALYTICAL RESULTS
WELDCRAFT STEEL AND MARINE SITE

	Dup of MW-11B		Dup of MW-12				
Location:	MW-111	MW-12	MW-13	MW-12A	MW-12B	SB-68	SB-69
Lab ID	KJ60K	JO52J	JO52K	KJ60D	KJ60L	LU53C	LU53E
Date Collected:	12/20/06	06/29/06	06/29/06	12/20/06	12/21/06	10/22/2007	10/22/2007
BTEX (µg/L)							
Method 8020							
Benzene							
Toluene							
Ethylbenzene							
m,p-Xylene							
o-Xylene							
Total Xylenes							
VOLATILES (µg/L)							
SW8260							
1,2-Dichloroethane							
Ethylene Dibromide							
Methyl tert-Butyl Ether							
CONVENTIONALS (mg/L)							
Alkalinity (SM 2320) (mg/L CaCO3)							
Carbonate (Alkalinity) (SM 2320) (mg/L CaCO3)							
Bicarbonate (Alkalinity) (SM 2320) (mg/L CaCO3)							
Ferrous Iron (SM3500 FeD)							
N-Nitrate (Calculated) (mg-N/L)	0.968	NA	NA	0.519	0.219		
N-Nitrite (EPA 353.2) (mg-N/L)	0.010 UJ	NA	NA	0.010 U	0.010 U		
Nitrate + Nitrite (NO3+NO2) (EPA 353.2) (mg-N/L)	0.968	NA	NA	0.519	0.219		
Sulfate (EPA 375.2)	1270	NA	NA	944	620		
Total Organic Carbon (EPA 415.1)							
FIELD PARAMETERS							
pH	6.12	6.63	NM	6.33	6.58		
Temperature (deg C)	7.6	15.6	NM	9.3	11.0		
Conductivity (µS)	31,900	25,982	NM	24,300	18,800		
Turbidity (NTU)	2.01	0.70	NM	5.39	2.45		
Dissolved Oxygen (mg/L)	69.9	0.001	NM	74.6	68.7		

U = Indicates compound was analyzed for, but was not detected at the given detection limit.
J = Estimated value.
UJ = The analyte was not detected in the sample; the given reporting limit is an estimate.
Bold values indicate a detected constituent.
Blank indicates compound was not analyzed for.

APPENDIX I

Detailed Cost Estimates

TABLE I-1
ALTERNATIVES COST ESTIMATE
WELDCRAFT STEEL AND MARINE SITE

ALTERNATIVE 1: CONTAINMENT WITH SOURCE RECOVERY					
ITEM	**QUANTITY**	**UNIT**	**UNIT COST**	**TOTAL**	**COMMENTS**
Capital Direct Costs -					
Asphalt Containment Layer					
Grading	6,180	SF	$ 0.02	$ 600	Based on 2006 ECHOS estimate. Multiplied by 1.1 to account for inflation and 1.02 for cost of living adjustment.
Compaction	6,180	SF	$ 0.04	$ 400	Based on 2006 ECHOS estimate. Multiplied by 1.1 to account for inflation and 1.02 for cost of living adjustment.
Paving	19,200	SF	$ 2	$ 38,400	Based off costs from previous remediation project. Area includes additional paving to repair/replace existing pavement (estimated at 20% area of remainder of site); grading and compaction not included.
Task Subtotal				*$ 39,000*	
Intermittent Dual Phase Extraction/Passive Recovery					
Well installation	8	wells	$ 2,500	$ 20,000	Assume same rate as air sparge wells for Alt. 2.
Soil Disposal	15	drum	$ 200	$ 3,000	Cost estimate from previous remediation project. Assumes 1.5 soil drum per well with 3 water drums.
Fittings	1	LS	$ 4,000	$ 4,000	Assume half the fittings as a full dual phase extraction system.
Extraction costs - vac truck	24	mos	$ 1,000	$ 24,000	Based off of quote from Emerald for a 5,000 gal truck at $96.15/hour.
Waste disposal	24	mos	$ 450	$ 10,800	Based off of a quote form Emerald for waste disposal at $0.45/gallon. Assumed 10 gpm for 10 minutes each well.
Product bailers	0	wells	$ 900	$ -	Based on an average cost for a bailer from QED.
Oil socks	24	mos	$ 77	$ 1,800	Based on the cost of 8 socks per month from Soakease ($115/12 socks).
Dual Phase Extraction/Passive Recovery O&M	24	mos	$ 1,000	$ 24,000	Assume one 10-hour field day per month at $100/hour.
Task Subtotal				*$ 87,600*	
Passive Soil Gas Migration Control System (if needed)					Assume depressurization/vapor interception trench along northern property line north of plume to control potential offsite migration
Contractor mob/demob	1	LS	$ 2,500	$ 2,500	
Soil gas depressurization line trenching, bedding, and backfilling	150	LF	$ 40	$ 6,000	Assume one horizontal perforated line through north/south plume centerline
Horizontal depressurization line (piping and perforated line)	150	LF	$ 18	$ 2,700	
Equipment (fan/blower)	1	LS	$ 7,500	$ 7,500	Low flow fan (potential solar)
Electrical	1	LS	$ 5,000	$ 5,000	Installation
Backfill materials (pea gravel)	60	CY	$ 25	$ 1,500	
Construction oversight	5	days	$ 1,000	$ 5,000	
System monitoring and discharge air sampling	1	LS	$ 2,500	$ 2,500	Assume two discharge air sampling events and minor maintenance during first year of operation
System monitoring and maintenance	30	yr	$ 1,000	$ 20,000	Assume 30 years of minor soil vapor control system maintenance and monitoring (3% discounted rate)
Task Subtotal				*$ 53,000*	
Monitoring Network					
Install 2 gw wells; 3 vm wells					
Utility locate/clearing	1	LS	$ 500	$ 500	
Drilling/Development	5	wells	$ 3,500	$ 17,500	Includes mob/demob, tax, start card, surface completion
Baseline monitoring well sampling/analysis	4	QTR	$ 5,100	$ 20,400	6 gw wells for TPH-G/BTEX (UST Area); 3 gw samples for metals (Work Yard); quarterly for 1 year
Baseline soil vapor sampling/analysis	4	QTR	$ 2,000	$ 8,000	3 vm wells for benzene in soil vapor; quarterly for 1 year
Task Subtotal for Area				*$ 46,400*	
Subtotal for Direct Capital Costs				**$ 226,000**	
Capital Indirect Costs -					
Pre-Design Investigation/Evaluation	1	LS		$ 50,000	
Remedial Design	20	%		$ 45,200	
Project Management	6	%		$ 13,560	
Construction Management	8	%		$ 18,080	
Construction Completion Report	1	LS		$ 25,000	
Permitting and Regulatory Compliance	5	%		$ 11,300	
Ecology Oversight	5	%		$ 11,300	
Estimate of Taxes	9	%		$ 20,340	
Subtotal for Capital Indirect Costs				**$194,780**	
Subtotal for Capital Direct and Indirect Costs				$ 420,780	
Contingency for Capital Direct and Indirect Costs	25	%		$ 105,195	
Total for Direct and Indirect Capital Costs				**$ 530,000**	
Long Term Containment Maintenance and Groundwater/Soil Vapor Monitoring					Assume 30 years of containment maintenance and groundwater and soil vapor monitoring
	Discount Rate		3%		3% discount rate represents average return on investment of 6% with an assumed inflation rate of 3%
Containment monitoring and maintenance	30	YR	$ 1,000	$ 20,000	
Groundwater sampling/analysis (every 5 yrs)	30	5 YR	$ 5,100	$ 19,000	
Soil vapor sampling/analysis (every 5 yrs)	30	5 YR	$ 2,000	$ 7,000	
Reporting (5 Year Review)	30	5 YR	$ 5,000	$ 19,000	
Subtotal for Operation and Maintenance Costs				***$ 65,000***	
Contingency on Operation and Maintenance Costs	25	%		$ 16,250	
Total for Operation and Maintenance Costs				**$ 81,250**	
ALTERNATIVE 1 PRESENT WORTH				**$ 610,000**	

TABLE I-1
ALTERNATIVES COST ESTIMATE
WELDCRAFT STEEL AND MARINE SITE

ALTERNATIVE 2: CONTAINMENT WITH IN SITU TREATMENT AND SOURCE RECOVERY

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	COMMENTS
Capital Direct Costs -					
Asphalt Containment Layer					
Grading	6,180	SF	$ 0.02	$ 600	Based on 2006 ECHOS estimate. Multiplied by 1.1 to account for inflation and 1.02 for cost of living adjustment.
Compaction	6,180	SF	$ 0.04	$ 400	Based on 2006 ECHOS estimate. Multiplied by 1.1 to account for inflation and 1.02 for cost of living adjustment.
Paving	19,200	SF	$ 2	$ 38,400	Based on previous remediation project costs. Area includes additional paving to repair/replace existing pavement (estimated at 20% area of remainder of site); grading and compaction not included.
Task Subtotal				*$ 39,000*	
Air Sparging/SVE System					
Air discharge permitting	1	LS	$ 5,000	$ 5,000	
Air Sparging/SVE System Construction					
Contractor mobilization/demobilization	1	LS	$ 5,000	$ 5,000	
Sparge and vent well installation					
Sawcut Concrete for Air Sparging/SVE Trenches	13	CY	$ 110	$ 1,465	Assume trenches 2' wide, concrete 4" thick (avg)
Demo Concrete for Air Sparging/SVE Trenches	1090	LF	$ 3	$ 3,270	
Concrete Repaving Over Trenches	121	SY	$ 54	$ 6,540	
Transport and Disposal of Concrete	13	CY	$ 50	$ 650	
Air Sparging well installation	13	wells	$ 2,500	$ 32,500	
Drilling Waste	24	drums	$ 200	$ 4,800	Cost estimate from previous remediation project. Assumes 1.5 soil drum per well with 3 water drums.
Air Sparging/SVE distribution line trenching, bedding, and backfilling	545	LF	$ 40	$ 21,800	Includes trenching for both Air Sparging and SVE manifold lines
Air Sparging manifold lines (piping)	545	LF	$ 15	$ 8,175	
SVE horizontal well (manifold piping and screen)	545	LF	$ 18	$ 9,810	
Equipment (shed, blower, compressor)	1	LS	$ 20,000	$ 20,000	
Electrical	1	LS	$ 8,000	$ 8,000	Installation
Air discharge treatment					
Vapor Phase GAC	1	LS	$ 35,000	$ 35,000	Purchase price electric Cat-Ox (300 cfm) plus set-up; or vapor phase GAC units w/carbon disposal
Electrical	24	mos	$ 840	$ 20,160	Estimated average electrical consumption based on $840/mo (~20 hp of equipment)
Construction oversight	10	days	$ 1,000	$ 10,000	
Air Sparging/SVE Startup	1	LS	$ 2,500	$ 2,500	
Air Sparging/SVE Operation and maintenance	1.75	yrs	$ 30,000	$ 52,500	1.75 years because the air sparge will not be running for the first 6 months and costs will be shared with the DPE system.
Air Sparging/SVE System monitoring/reporting	1.75	yrs	$ 20,000	$ 35,000	1.75 years because the air sparge will not be running for the first 6 months and costs will be shared with the DPE system.
Task Subtotal				*$ 282,170*	
Intermittent Dual Phase Extraction/Passive Recovery					
Well installation	0	wells	$ 2,500	$ -	Using air sparge wells.
Soil Disposal	0	drum	$ 200	$ -	Using air sparge wells.
Fittings	1	LS	$ 4,000	$ 4,000	Assume half the fittings as a full dual phase extraction system.
Extraction costs - vac truck	6	mos	$ 1,000	$ 6,000	Based off of quote from Emerald for a 5,000 gal truck at $96.15/hour.
Waste disposal	6	mos	$ 450	$ 2,700	Based off of a quote form Emerald for waste disposal at $0.45/gallon. Assumed 10 gpm for 10 minutes each well.
Product bailers	0	wells	$ 900	$ -	Based on an average cost for a bailer from QED.
Oil socks	6	mos	$ 77	$ 462	Based on the cost of 10 socks per month from Soakease ($115/12 socks).
Dual Phase Extraction/Passive Recovery O&M	6	mos	$ 1,000	$ 6,000	Assume one 10-hour field day per month at $100/hour.
Task Subtotal				*$ 19,162*	
Monitoring Network					
Install 3 new gw wells					
Utility locate/clearing	1	LS	$ 500	$ 500	
Drilling	3	wells	$ 3,500	$ 10,500	Includes mob/demob, tax, start card, surface completion
Baseline monitoring/performance monitoring well sampling/analysis	12	QTR	$ 5,100	$ 61,200	6 gw wells for TPH-G/BTEX (UST Work Yard); quarterly for 3 years; metals for 1 year; GW samples for metals
Task Subtotal for Area				*$ 72,200*	
Subtotal for Direct Capital Costs				**$ 413,000**	
Capital Indirect Costs -					
Pre-Design Investigation/Evaluation	1	LS		$ 50,000	
Remedial Design	15	%		$ 61,950	
Project Management	6	%		$ 24,780	
Construction Management	8	%		$ 33,040	
Construction Completion Report	1	LS		$ 40,000	
Permitting and Regulatory Compliance	5	%		$ 20,650	
Ecology Oversight	5	%		$ 20,650	
Estimate of Taxes	9	%		$ 37,170	
Subtotal for Capital Indirect Costs				**$ 288,240**	

TABLE I-1
ALTERNATIVES COST ESTIMATE
WELDCRAFT STEEL AND MARINE SITE

Subtotal for Capital Direct and Indirect Costs					$	701,240	
Contingency for Capital Direct and Indirect Costs	25	%			$	175,310	
Total for Direct and Indirect Capital Costs					**$**	**880,000**	
Long Term Containment Maintenance and Groundwater/Soil Vapor Monitoring							Assume 30 years of containment maintenance and groundwater and soil vapor monitoring
	Discount Rate			3%			3% discount rate represents average return on investment of 6% with an assumed inflation rate of 3%
Containment monitoring and maintenance	30	YR	$	1,000	$	20,000	
Groundwater sampling/analysis (every 5 yrs)	30	5 YR	$	2,800	$	10,000	
Soil vapor sampling/analysis (every 5 yrs)	30	5 YR	$	2,000	$	7,000	
Reporting (5 Year Review)	30	5 YR	$	5,000	$	19,000	
Subtotal for Operation and Maintenance Costs					***$***	***56,000***	
Contingency on Operation and Maintenance Costs	25	%			$	14,000	
Total for Operation and Maintenance Costs					**$**	**70,000**	
ALTERNATIVE 2 PRESENT WORTH					**$**	**950,000**	

TABLE I-1
ALTERNATIVES COST ESTIMATE
WELDCRAFT STEEL AND MARINE SITE

ALTERNATIVE 3: CONTAINMENT WITH FOCUSED REMOVAL

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	COMMENTS
Capital Direct Costs -					
Source Area Remedial Excavation (UST Site Unit)					
Former UST area investigation	1	LS	$ 13,000	$ 13,000	Excavation of material at minimum within the 300 mg/kg contour and areas exhibited odor during investigation.
Contractor mobilization/demobilization	1	LS	$ 5,000	$ 5,000	
Former UST source area excavation					
Utilities management	1	LS	$ 10,000	$ 10,000	Temporary utilities
Asphalt demolition/recycling	30	CY	$ 55	$ 1,650	$35/CY demolition/loading and $20/CY transport and recycling
Concrete demolition/recycling	350	CY	$ 140	$ 49,000	$120/CY demolition/loading and $20/CY transport and recycling. 1.5' of concrete was assumed.
Shoring	0	sq ft	$ 20	$ -	if excavation extends to north, shoring may be necessary along Squalicum Way
Dewatering (incl. treatment and disposal)	1	LS	$ 10,000	$ 10,000	
Excavation	3000	cy	$ 18	$ 54,000	Assumes 5 upper feet are clean. This calculation does not include the concrete (assumed 18" thick) or asphalt.
Haul and disposal	2600	ton	$ 60	$ 156,000	$20/ton haul, $40/ton treatment/disposal (assume 1.5 tons/cy). This is the top 5', minus the concrete and asphalt.
ORC Advance	3500	lb	$ 10	$ 35,700	Applied in excavation after removal - $9.21/lb + $0.20/lb shipping + tax
Import backfill	2000	cy	$ 20	$ 40,000	This is equal to the volume hauled off and the volume of the concrete, minus 3" for asphalt.
Place and compact backfill	3200	cy	$ 6	$ 19,200	This is equal to the volume imported plus the volume of soil from the top 5'.
Re-pave surface	28300	sf	$ 2	$ 56,600	This includes both the excavated area, the North Work Yard, and assumptions for patching around the site.
Construction oversight during field work	15	days	$ 1,000	$ 15,000	
Confirmation sample analysis (TPH/BTEX analysis)	30	samples	$ 300	$ 9,000	Quick turnaround, includes data validation/management
Task Subtotal				*$ 474,150*	
Monitoring Network					
Install/replace 5 gw wells					
Utility locate/clearing	1	LS	$ 500	$ 500	
Drilling	5	wells	$ 3,500	$ 17,500	Includes mob/demob, tax, start card, surface completion
Baseline monitoring/performance monitoring well sampling/analysis	4	QTR	$ 5,100	$ 20,400	5 gw wells for TPH-G/BTEX (UST Area); 3 GW for metals (Work Yard Area); quarterly for 1 year after excavation
Task Subtotal for Area				*$ 38,400*	
Subtotal for Direct Capital Costs				**$ 513,000**	
Capital Indirect Costs -					
Pre-Design Investigation/Evaluation	1	LS		$ 50,000	
Remedial Design	15	%		$ 76,950	
Project Management	6	%		$ 30,780	
Construction Management	8	%		$ 41,040	
Construction Completion Report	1	LS		$ 40,000	
Permitting and Regulatory Compliance	5	%		$ 25,650	
Ecology Oversight	5	%		$ 25,650	
Estimate of Taxes	9	%		$ 46,170	
Subtotal for Capital Indirect Costs				**$ 336,240**	
Subtotal for Capital Direct and Indirect Costs				$ 849,240	
Contingency for Capital Direct and Indirect Costs	25	%		$ 212,310	
Total for Direct and Indirect Capital Costs				**$ 1,060,000**	
Long Term Containment Maintenance and Groundwater/Soil Vapor Monitoring					Assume 30 years of containment maintenance and groundwater and soil vapor monitoring
	Discount Rate		3%		3% discount rate represents average return on investment of 6% with an assumed inflation rate of 3%
Containment monitoring and maintenance	30	YR	$ 1,000	$ 20,000	
Groundwater sampling/analysis (every 5 yrs)	30	5 YR	$ 2,800	$ 10,000	
Reporting (5 Year Review)	30	5 YR	$ 5,000	$ 19,000	
Subtotal for Operation and Maintenance Costs				***$ 49,000***	
Contingency on Operation and Maintenance Costs	25	%		$ 12,250	
Total for Operation and Maintenance Costs				**$ 61,250**	
ALTERNATIVE 3 PRESENT WORTH				**$ 1,100,000**	

TABLE I-1
ALTERNATIVES COST ESTIMATE
WELDCRAFT STEEL AND MARINE SITE

ALTERNATIVE 4: SITE WIDE REMOVAL

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL	COMMENTS
Capital Direct Costs -					
Site Wide Remedial Excavation					
Contractor mobilization/demobilization	1	LS	$ 5,000	$ 5,000	
Utilities management	1	LS	$ 10,000	$ 10,000	Temporary utilities
Asphalt demolition/recycling	640	CY	$ 55	$ 35,200	$35/CY demolition/loading and $20/CY transport and recycling
Concrete demolition/recycling	690	CY	$ 140	$ 96,600	$120/CY demolition/loading and $20/CY transport and recycling. 1.5' of concrete was assumed.
Dewatering (incl. treatment and disposal)	1	LS	$ 10,000	$ 10,000	
Excavation (UST Site Unit)	5700	cy	$ 18	$ 102,600	Assumes 5 upper feet are clean. This calculation does not include the concrete (assumed 18" thick) or asphalt, which has been accounted for previously.
Excavation (Work Yard Site Unit)	4600	cy	$ 18	$ 82,800	Assume excavation and disposal of top 2 feet.
Haul and disposal	11700	ton	$ 60	$ 702,000	$20/ton haul, $40/ton treatment/disposal (assume 1.5 tons/cy). This is the top 5', minus the concrete and asphalt.
ORC Advance	0	lb	$ 10	$ -	
Import backfill	8400	cy	$ 20	$ 168,000	This is equal to the volume hauled off and the volume of the concrete, minus 3" for asphalt.
Place and compact backfill	10900	cy	$ 8	$ 87,200	This is equal to the volume imported plus the volume of soil from the top 5' in the UST Site Unit.
Re-pave surface	87900	sf	$ 2	$ 175,800	
Construction oversight during field work	45	days	$ 1,200	$ 54,000	
Confirmation sample analysis (TPH/BTEX and metals analysis)	100	samples	$ 400	$ 40,000	
Install 5 new wells					
Utility locate/clearing	1	LS	$ 500	$ 500	
Drilling	5	wells	$ 3,500	$ 17,500	Includes mob/demob, tax, start card, surface completion
Monitoring well sampling/analysis/reporting (4 qtrs @ 5 wells/qtr)	4	quarters	$ 5,100	$ 20,400	5 gw wells for TPH-G/BTEX and metals; quarterly for 1 year after excavation
Task Subtotal				*$ 1,607,600*	
Subtotal for Direct Capital Costs				**$ 1,608,000**	
Capital Indirect Costs -					
Pre-Design Investigation/Evaluation	1	LS		$ 50,000	
Remedial Design	15	%		$ 241,200	
Project Management	5	%		$ 80,400	
Construction Management	6	%		$ 96,480	
Construction Completion Report	1	LS		$ 40,000	
Permitting and Regulatory Compliance	3	%		$ 48,240	
Ecology Oversight	2	%		$ 32,160	
Estimate of Taxes	9	%		$ 144,720	
Subtotal for Capital Indirect Costs				**$ 733,200**	
Subtotal for Capital Direct and Indirect Costs				$ 2,341,200	
Contingency for Capital Direct and Indirect Costs	25	%		$ 585,300	
Total for Direct and Indirect Capital Costs				**$ 2,930,000**	
ALTERNATIVE 4 PRESENT WORTH				**$ 2,900,000**	

NOTES

1) Costs presented in this FS are considered to have a relative accuracy within the range of -30 to +50 percent, as shown above, and should be used primarily as a basis for comparison of costs between alternatives. More exact costs will be developed during the design and implementation phases of the cleanup.