June 2020
Whatcom Waterway Cleanup in Phase 1 Site Areas

Year 3 Compliance Monitoring Report

Prepared for Port of Bellingham

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ABBREVIATIONS

µg/L	microgram per liter
µm	micron
AFDW	ash-free dry weight
ASB	Aerated Stabilization Basin
BST	Bellingham Shipping Terminal
cm	centimeter
CSL	cleanup screening level
D/F	dioxins/furans
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
GP West	Georgia-Pacific West, Inc.
mg/kg	milligram per kilogram
mg/L	milligram per liter
MNR	monitored natural recovery
MTCA	Model Toxics Control Act
ng/kg	nanogram per kilogram
NMDS	nylon mesh diffusion sampler
PAH	polycyclic aromatic hydrocarbon
Port	Port of Bellingham
ppt	parts per thousand
PQL	practical quantification limit
Project	Whatcom Waterway Cleanup in Phase 1 Site Areas Project
RAU	remedial action unit
Report	Whatcom Waterway Year 3 Compliance Monitoring Report
RI/FS	Remedial Investigation and Feasibility Study
SCO	sediment cleanup objective
Site	Whatcom Waterway Site
SMS	Sediment Management Standards
SQAPP	Sampling and Quality Assurance Project Plan for Compliance Monitoring
SVOC	semivolatile organic compound
SWAC	surface-weighted average concentration
TEQ	toxic equivalency quotient

GLOSSARY

Whatcom Waterway Site (Site)	The overall Model Toxics Control Act (MTCA) cleanup site addressed by the Whatcom Waterway Consent Decree. This area includes both Whatcom Waterway and adjacent aquatic lands impacted by historic mercury discharges from the former Georgia-Pacific chlor-alkali plant wastewater discharges. The Site includes both Phase 1 and Phase 2 cleanup areas and additional areas being addressed by monitored natural recovery.
Whatcom Waterway	The physical waterway extending from Roeder Avenue to deep water. Whatcom Waterway includes both the Inner Waterway and Outer Waterway areas.
Inner Waterway	The inner portion of Whatcom Waterway, extending from Roeder Avenue to the beginning of the federal navigation channel at Waterway Station 29+00. The Inner Waterway includes Site Units 2 and 3 of the Whatcom Waterway Site.
Outer Waterway	The outer portion of Whatcom Waterway, extending from Station 29+00 into deep water. The Outer Waterway includes Site Units 1A, 1B, and 1C of the Whatcom Waterway Site. The federal navigation channel that was updated in 2007 is located within the Outer Waterway.
Federal Navigation Channel	The Whatcom Waterway federal navigation project as currently authorized in existing Water Resources Development Act legislation. The authorized project includes a 30-foot-deep navigation channel (plus applicable over-dredge allowances) extending from Station 29+00 of Whatcom Waterway into deep water. The Federal Navigation Channel is maintained by coordinated actions of the U.S. Army Corps of Engineers and the Port of Bellingham as the local sponsor.
Central Waterfront Site	The MTCA site located on certain properties between Whatcom Waterway and I & J Waterway. A Cleanup Action Plan for the Central Waterfront site has been completed under an MTCA Agreed Order.
GP West Site	The MTCA site located on upland property on the south side of Whatcom Waterway. The Georgia-Pacific West, Inc. (GP West), Site is divided into two remedial action units (RAUs), the Pulp and Tissue Mill RAU and the Chlor-Alkali RAU. The RAUs are in different stages of the cleanup process under MTCA.

Log Pond	Site Unit 4 of the Whatcom Waterway Site. The Log Pond is located between Whatcom Waterway and the GP West Site. The Log Pond was capped in 2001 as part of an Interim Action. Additional capping was completed as part of the Whatcom Waterway Phase 1 cleanup work.
Chlor-Alkali Remedial Action Unit	The Chlor-Alkali RAU comprises the western portion of the GP West Site adjacent to the Log Pond and Cornwall Avenue. A draft Cleanup Action Plan is currently under development.
Pulp and Tissue Mill Remedial Action Unit	The Pulp and Tissue Mill RAU comprises the eastern portion of the GP West Site adjacent to Whatcom Waterway and Roeder Avenue. The final cleanup of this RAU was completed in 2016.
Whatcom Waterway Cleanup in Phase 1 Site Areas (Project)	The construction and monitoring activities completed to implement the final cleanup of Phase 1 Areas of the Whatcom Waterway Site.
Phase 1 Site Areas	Whatcom Waterway Site Units 3B, 2A, and 4, and portions of Units 1C and 2C. Cleanup of these units has been completed.
Phase 2 Site Areas	Whatcom Waterway Site Units 1A, 1B, 2B, and 8, and portions of Units 1C, 2C, 5B, 6B, and 6C. These areas will be cleaned up as part of a future phase of construction, consistent with the requirements of the First Amendment to the Whatcom Waterway Consent Decree.
Monitored Natural Recovery Areas (MNR Areas)	Whatcom Waterway Site Units 3A, 5A, 5C, 6A, 7, and 9, and portions of Units 5B, 6B, and 6C. Clean sediment is naturally accumulating in these areas, and they are subject to long-term compliance monitoring requirements.
Central Waterfront Shoreline	The upland properties located between Whatcom Waterway and I & J Waterway and between Roeder Avenue and the aerated stabilization basin (wastewater treatment lagoon). The Central Waterfront Shoreline includes the properties within and outside of the Central Waterfront Site.
South Shoreline	The length of shoreline located along the GP West Site from the former GP West dock to the west end of the Central Avenue pier.

1 Introduction

This Whatcom Waterway Year 3 Compliance Monitoring Report (Report) summarizes Year 3 compliance monitoring activities performed by the Port of Bellingham (Port) as part of long-term monitoring for the Whatcom Waterway Cleanup in Phase 1 Site Areas (Project). Year 3 monitoring activities were performed between August 2019 and October 2019 in accordance with the Sampling and Quality Assurance Project Plan (SQAPP; Anchor QEA 2016) approved by the Washington State Department of Ecology (Ecology).

The Whatcom Waterway Site (Site) location and vicinity are shown in Figure 1. The Site includes sediments that have been impacted by mercury discharges from the former Georgia-Pacific West, Inc. (GP West), chlor-alkali plant. The Site boundary shown in Figure 1 was drawn based on the extent of potentially significant surface and subsurface mercury contamination in sediments as determined during the Remedial Investigation and Feasibility Study (RI/FS; Anchor Environmental and Hart Crowser 2000) process and during subsequent pre-remedial design investigations conducted in 2008 (Anchor QEA 2010).

Other site-associated contaminants include wood waste and degradation products from historical log rafting activities, and phenolic compounds from pulp mill wastewater discharges.

The Project included cleanup construction in the Inner Waterway area, the Log Pond, and the Bellingham Shipping Terminal (BST) area (Phase 1 site areas; Figure 2). Major activities included remedial dredging, engineered capping, containment wall installation, structure removal, structure replacement, and ancillary nearshore habitat improvements.

Project construction was completed in 2016 in accordance with requirements of the Ecology-approved Final Engineering Design Report (EDR; Anchor QEA 2015) and applicable permits and approvals. Details on completed construction activities and associated monitoring during the Project are documented in the As-built Report (Anchor QEA 2018a). That report has been reviewed and approved by Ecology.

This cleanup action was performed in compliance with the requirements of the Model Toxics Control Act (MTCA) and Sediment Management Standards (SMS) regulations. Compliance monitoring requirements subject to permit conditions include monitoring during and after the cleanup action in Phase 1 site areas. The SQAPP (Anchor QEA 2016) describes the sampling and analysis plan for compliance monitoring conducted during and immediately following cleanup construction actions (performance monitoring) as well as long-term (compliance) monitoring at the Site. Compliance monitoring is required in Years 1, 3, 5, 10, 20, and 30. Year 1 monitoring was completed in 2017.

Results of Year 3 monitoring activities are described in this Report. The Year 3 monitoring activities were performed between August and October 2019 and include the following:

- Bathymetric surveys in cap areas
- Shoreline visual surveys in cap and containment wall areas
- Surface sediment monitoring within cap and natural recovery areas
- Monitoring of mercury in adult crab and juvenile crab tissue
- Monitoring of mercury and dioxin/furans (D/F) in benthic fish (flatfish)
- Monitoring of porewater in Unit 4

2 Methods

Sample collection and processing for each program was conducted according to field, laboratory, and quality assurance and quality control methods detailed in the SQAPP (Anchor QEA 2016). Site environmental monitoring stations are shown in Figure 3, and reference monitoring stations are shown in Figure 4.

2.1 Work Performed

The environmental monitoring data described in this Report were collected between August 2019 and October 2019 in accordance with the SQAPP (Anchor QEA 2016) as approved by Ecology.

The sections of this Report present the data collected during the following monitoring activities:

- Bathymetric surveys to evaluate the in-water extents of the engineered cap in Units 2A, 3B, and 4, and the capped transition area between Units 1C and 2C, and to document conditions in the natural recovery area at the head of Whatcom Waterway (Unit 3A)
- Visual surveys to document physical condition of the above-water portions of engineered sediment caps, and exposed portions of the Central Waterfront containment walls and Maple Street Bulkhead
- Water quality testing of seepage waters at the Maple Street Bulkhead
- Collection and analysis of surface sediment at 11 locations within Phase 1 remediation areas and 11 monitored natural recovery (MNR) locations to document effectiveness of remediation
- Testing of tissue mercury levels in adult Dungeness crabs (*Metacarcinus magister*) collected from the Site and from the Samish Bay clean reference area to evaluate changes over time
- Testing of tissue mercury levels in juvenile Dungeness crabs collected from the Log Pond and from a clean reference area to provide information on potential short-term impacts to the aquatic food chain from source control and dredging activities
- Testing of tissue mercury and D/F levels in benthic fish tissue from locations within the Site and collection of corresponding data from the Samish Bay reference area to assess contaminant bioavailability
- Porewater monitoring in Unit 4 (Log Pond) to assess groundwater as a potential source of sediment recontamination.

2.2 Deviations from SQAPP

All activities and methods were performed as indicated in the SQAPP.

One additional activity was added at the request of Ecology. It included collection of seep water from the Maple Street bulkhead.

3 Surveys

This section describes the results of bathymetric and visual surveys conducted in Phase 1 capping and shoreline material placement areas.

Several different cap types were constructed during the Project using varying combinations and thicknesses of sand, filter, and stone or cobble armoring materials. Engineered sediment caps were constructed both on dredged surfaces and on existing grade where no dredging occurred. Therefore, varying rates of consolidation of the engineered capping materials and settlement of underlying materials were anticipated at the time of design and construction. The Year 3 physical surveys were conducted to monitor these different processes and evaluate the amount of potential settlement that has occurred since the Year 0 post-construction and Year 1 monitoring conditions. Bathymetric and visual shoreline surveys were conducted in parallel to monitor in-water and intertidal capping and material placement areas, respectively.

3.1 Bathymetric Survey

A multi-beam bathymetric survey was conducted to evaluate the in-water extent of the engineered cap in Units 2A, 3B, and 4, and the capped transition area between Units 1C and 2C. Collection of Year 3 survey data was performed on October 24, 2019, by Northwest Hydro Inc., during high tide conditions to maximize the bathymetric survey coverage area. Appendix A shows the survey coverage area.

Bathymetric survey activities were performed in accordance with the SQAPP (Anchor QEA 2016). After data collection, survey data were then compared with post-construction and Year 1 survey data to verify physical integrity of capped areas. The 2019 Year 3 monitoring bathymetric survey data are described in detail in the following sections for the BST, Log Pond, and Inner Waterway areas.

3.1.1 Bellingham Shipping Terminal (Unit 1C)

An engineered sediment cap consisting of stone armor was constructed in the BST at the transition between Unit 1C and Unit 2C, as shown in Figure 5a. The cap is built mainly on dredged surface but was tied into the undredged portion of the channel located toward the head of Whatcom Waterway from the BST. Upon comparison with post-construction data, the current mudline in the majority of the engineered cap placement is not significantly different (from 0.5 feet higher to 0.5 feet lower) from the post-construction surface, with localized areas up to 1.5 feet lower than post-construction conditions (Figure 5b).

Areas where the present-day mudline is between 0.5 feet and 1.5 feet lower than the post-construction mudline are indicative of consolidation of the underlying sediments due to the load from the engineering cap materials following completion of material placement activities.

Consolidation/settlement analyses were performed as part of the Whatcom Waterway Final EDR (Anchor QEA 2015). The observed values are consistent with estimated cap consolidation in other areas of the waterway. Comparing bathymetric data from Year 1 to Year 3 monitoring events, the rate of consolidation of the engineered sediment cap materials appears to have decreased significantly since year 1 as expected (Figure 5c).

The portion of the engineered cap immediately adjacent to the BST Dock shows greater than 1.0 feet of material accumulation from Year 0 to Year 3. During construction, dredging was conducted up to the face of the dock, but no underpier material removal occurred; therefore, this observation is likely due to existing underpier material sloughing into the dredged area over time. Underpier areas are to be addressed as part of future Phase 2 cleanup activities.

3.1.2 Log Pond (Unit 4)

Engineered sediment caps were constructed in the Log Pond area to meet remediation goals. The Log Pond cap placed in 2001 encompasses the majority of Unit 4, as shown in Figure 6a. The stone armored cap was constructed on the existing surface (i.e., no dredging took place) and placed at varying thicknesses based on existing bathymetry.

Most of the bathymetric data collected in the Log Pond area is outside the extent of the cap placed as part of the Project, as shown in Figure 6b. Between the Year 0 post-construction and Year 3 survey, bathymetric data that does lie within the cap placement boundary generally varies from 0.5 feet higher to 1.5 feet lower than the post-construction mudline, which is consistent with the consolidation values estimated in the Final EDR. Comparing Year 1 and Year 3 monitoring surveys shows that the rate of consolidation appears to have decreased, with elevation changes varying from 0.5 feet higher to 0.5 feet lower than the post-construction mudline (Figure 6c).

The bathymetric survey coverage area covers a section of Unit 4 that was not capped as part of the Project but was capped during an interim action completed in 2001. The bathymetric data in this area show that, although there are some active dynamics causing small changes to the cap, no major scour or other disturbances have taken place between Year 0 and Year 3 monitoring events (Figure 6b). Some minor accretion of material (i.e., up to 1 foot) has occurred in a few point locations.

Some larger elevation differences observed near the limits of the survey appear to be artifacts. These can be attributed to a lower density of data points leading to jumps in the survey surface. These areas, along with areas too shallow for completion of an in-water bathymetric survey, were addressed with the intertidal visual survey as described in Section 3.2.

3.1.3 Inner Waterway (Unit 2A, 3B, and Portion of Unit 2C)

The Inner Waterway was capped using two different caps, as shown in Figure 7a. In general, the waterway and offshore areas were capped with cobble armor, while the shoreline areas (South Shoreline and Central Waterfront Shoreline) were capped with stone armor. Caps were constructed in areas where dredging occurred and areas where no dredging occurred. The dredging that occurred varied greatly, from very thin to very thick cuts, to meet remedial objectives. Because of these different factors, a wide range of consolidation and settlement was expected.

Differences in cap surface elevation between Year 0 and Year 3 monitoring events are shown in Figure 7b. Some of the general trends observed in the comparison of the post-construction survey with the Year 3 monitoring survey include the following:

- Some accretion of material is observed at the head of the waterway and is consistent with historical accumulation of material in this area due to loading from Whatcom Creek.
- Minimal settlement and consolidation have occurred in the flat portion of the Inner Waterway where dredge cuts were thickest. The thick dredge cuts exposed materials less prone to consolidation. More settlement was observed in the flat portion of the waterway where only thin cuts or no dredging was performed, and cap materials were placed on existing softer sediments.
- A moderate amount of settlement and consolidation was observed along the shoreline slopes. The stone armored engineered cap was placed in these areas (South Shoreline and Central Waterfront Shoreline). Placement of this heavier material has resulted in more consolidation of the underlying capping materials and subgrade.

Between Year 1 and Year 3 monitoring events, similar trends occur in the same areas (Figure 7c). However, the rates of settlement and consolidation appear to have decreased, consistent with expectations.

3.2 Visual Survey (Intertidal Shoreline Inspection)

A visual survey was conducted within the intertidal shoreline areas of the Inner Waterway and the Log Pond, during periods of optimal low tide, to document the physical condition of the engineered sediment caps and the exposed portions of the Central Waterfront containment walls and Maple Street Bulkhead.

Intertidal engineered sediment caps were visually inspected during periods of low tide over a 2-day duration (October 8 to 9, 2019). Inspections took place both by boat and on foot depending on access to the cap area, as shown in Figures 8a and 8b. Photomaps and corresponding photographs showing the general conditions of the above-water engineered caps are included in Appendix B.

Continuous inspections were conducted in cap areas to look for indications of erosion and settlement, presence of potential contamination and debris, or other disturbances or signs of impact to the integrity and function of the cap. Inspections in containment wall areas were conducted to look for indications of corrosion, groundwater seepage, and other disturbances or signs of impact to the integrity and function of the remedial wall structure. Any disturbance found was documented (i.e., location, description, and apparent cause if known) and photographed.

3.2.1 Engineered Caps

In general, the engineered sediment caps along the Central Waterfront, South Shoreline, and Log Pond shoreline were found to be in good condition:

- There was no evidence of significant erosion, settlement, or debris accumulation.
- There were no signs of contamination or significant groundwater seepage observed during the survey. As noted during Year 1 monitoring, some growth of algae and colonization by marine organisms (e.g., barnacles) were observed.
- Some apparent recently deposited sediment was observed on top of the engineered cap at a few locations within the Log Pond.

3.2.2 Containment Walls

The Central Waterfront and Maple Street Bulkhead containment walls were inspected during the visual survey. This included a survey of the Central Waterfront containment wall on October 9, 2019, and a survey of the Maple Street Bulkhead containment wall on October 24, 2019. The Maple Street Bulkhead containment wall survey occurred on a separate date due to a barge moored against the wall, blocking access during the initial visual survey.

Both containment walls were observed to be in good condition with no signs of corrosion or other disturbances.

In addition to a visual survey of the walls, Norton Corrosion performed an inspection of the Maple Street Bulkhead cathodic protection system on September 6, 2019. The inspection by Norton Corrosion confirmed that the Maple Street Bulkhead containment wall is receiving adequate protection, consistent with their design recommendations. No corrective actions were recommended.

During construction of the Maple Street Bulkhead containment wall, wall obstructions and hard-driving conditions were encountered. This resulted in damage to the joint sealant and groundwater seepage from portions of the wall. The damaged joints were repaired through diver-assisted welding and application of sealant to the exterior of the wall, and placement of sealant at tie-back locations. During Year 1 monitoring, it was confirmed that the repair had been successful as no seeps were observed along the sheetpile joints. However, during that inspection several areas of seepage were observed at the tie-back penetrations of the wall. Subsequently, the Port performed additional investigation and repair work to address the observed seeps at the tie-back anchor holes.

Repair work, which occurred in 2017, included injection of foam sealant until seeps were no longer observed. During the October 24, 2019 inspection of the Maple Street Bulkhead, no seeps were observed at previously repaired locations, but seeps were encountered at other tie-back anchor locations.

As requested by Ecology, water samples were collected at two of the seeps, at tie-back anchor locations 16 and 24. Samples were analyzed for total petroleum hydrocarbons, heavy metals (total and dissolved), polycyclic aromatic hydrocarbons (PAHs), and volatile organic hydrocarbons. Results of this analysis and appropriate screening levels are shown in Table 1. All detections were below groundwater cleanup levels established in the Final Cleanup Action Plan for the Central Waterfront site (Ecology 2020).

The Port is performing an ongoing inspection and evaluation for additional repair options at the current observed seep locations, as described in Section 7.

4 Sediment Testing

This section describes surface sediment testing conducted during Year 3 compliance monitoring activities. Sample locations described in this section are shown in Figure 3. Chemistry results are presented in Table 2, bioassay criteria are listed in Table 3, and bioassay results are presented in Table 4. Laboratory analytical reports are included in Appendix C, and data validation reports are included in Appendix D.

4.1 Surface Sediment Quality

Surface sediment monitoring included the following sample locations:

- Six locations in Phase 1 capping areas
- Three locations in Log Pond areas previously capped
- Two locations within Phase 1 dredging areas of the Outer Waterway
- Eleven locations within MNR areas

4.1.1 Sediment Distribution in Cap Areas

Within the Phase 1 cap placement areas, sufficient sediment had deposited since construction to allow for chemical testing at seven of eight locations. Sediment deposition of accepted grabs ranged between 9.5 and 18 centimeters (cm), averaging 15.1 cm. Samples were collected from 0 to 12 cm depth at six of the seven locations, and one sample from one location was collected from 0 to 2 cm depth. Photographs of the material encountered at stations where sufficient material for full testing was collected are included in Appendix F.

Insufficient sediment had deposited to allow for chemical testing at location P1CM-06. Ten attempts were made, but an insufficient sample was recovered for testing. Based on the absence of accumulated sediment, no chemical or biological testing was performed at this location. Sediment testing will be performed at this location in the future once sufficient sediment has accumulated to support testing.

4.1.2 Surface Sediment Mercury and PAH Concentrations

Chemical testing was performed (in compliance with the SQAPP) on 22 samples collected from 21 stations at which sediment was available for testing. Samples were collected from 0 to 12 cm depth at 20 of the 21 stations, and samples from both the 0 to 12 cm and 0 to 2 cm depth intervals were collected at the 22nd station. Two field duplicates were also collected. These samples were tested for metals, semivolatile organic compounds (SVOCs), PAHs, and D/F, consistent with the SQAPP (Anchor QEA 2016).

Table 2 summarizes the chemical testing data. Figure 9 illustrates the mercury concentrations detected in surface sediment. Results are presented as follows:

- Mercury concentrations were below the site cleanup level for protection of human health and ecological receptors (1.2 milligrams per kilogram [mg/kg]).
- At six testing stations, measured mercury concentrations exceeded 0.41 mg/kg and conformational bioassays were performed. These included the following samples:
  - Two locations in the Log Pond near the former GP West dock, P1CM-04 and P1CM-05
  - Two locations in MNR areas located offshore of the Aerated Stabilization Basin (ASB), MNR-06 and MNR-07
  - One location along the Central Waterfront shoreline, P1CM-08
  - One location in the inner waterway MNR area, MNR-11, had a mercury concentration of 0.502 mg/kg.
- Bioassay testing was also triggered at one additional location along the GP West shoreline (P1CM-09) due to the detection of fluoranthene (a PAH compound) in excess of the numeric screening criteria.
- Sediment from these seven testing stations was subjected to confirmational bioassay testing consistent with the SQAPP (see Section 4.1.4). All samples passed biological testing.

Results demonstrate that detected mercury and PAH concentrations comply with site cleanup levels established in the Consent Decree for protection of benthic organisms and protection of human health and ecological receptors (Ecology 2011).

The surface-weighted average concentration (SWAC) of mercury in Site surface sediments is currently estimated at 0.39 mg/kg. This is intermediate between the SQS and natural background levels. The SWAC estimate was higher than that measured during Year 1 monitoring (0.24 mg/kg) due to increases in concentrations noted at several of the offshore MNR monitoring stations (e.g., MNR-03, MNR-04 and MNR-05). The increases were likely due to increased wave-induced mixing and resuspension of the harbor floor sediments in during winter storm events. The natural background concentration for mercury in Puget Sound sediments has been established by Ecology as 0.20 mg/kg (Ecology 2017). Concentrations at the deeper, outlying MNR stations (MNR-01 and MNR-02) averaged 0.20 mg/kg, consistent with natural background levels.

4.1.3 Surface Sediment Dioxin/Furan Concentrations

D/F are known to be present in surface and subsurface sediments throughout most of Bellingham Bay and other urban bays within Puget Sound. The full range of sources for these compounds in Bellingham Bay has not yet been determined but may include contributions from many sources throughout the bay, including former combustion sources, former GP West pulp and paper mill operations, former wood-treating facilities, historic and ongoing stormwater and wastewater discharges, and atmospheric deposition.

Since execution of the First Amendment to the Consent Decree, Ecology conducted work to determine if regional background concentrations of certain bioaccumulative chemicals existed in Bellingham Bay (Ecology 2015). That work identified a regional background D/F concentration of 15 nanograms per kilogram toxic equivalency quotient (ng/kg TEQ).

Chemical testing for D/F was performed at 13 locations. Results are presented in Table 2 and in Figure 10. The locations included the following:

- Five MNR locations offshore of the ASB and Outer Waterway areas (MNR-03, MNR-04, MNR-05, MNR-07, and MNR-09)
- One location within the Phase 1 dredging area of the Outer Waterway, adjacent to BST (WW-P1CM-02)
- One location within the Unit 4 capping area (WW-P1CM-04)
- Two locations within Phase 1 capping areas near the Laurel Street cutback (WW-P1CM-09 and WW-P1CM-11)
- Two locations within Inner Waterway dredging areas adjacent to the Central Waterfront (WW-P1CM-08 and WW-P1CM-10)
- Two MNR locations located at the head of the Inner Waterway, adjacent to Roeder Avenue (MNR-10 and MNR-11). One additional location within the Phase 1 capping area had been designated in the SQAPP for D/F testing. However, insufficient sediment accumulation was collected at location P1CM-06 to support sediment chemical testing (see Section 4.1.1).

Most measured D/F concentrations during Year 3 were below the regional background value (15 ng/kg), including all of the samples from the harbor floor, the Outer Waterway dredging areas, and the Log Pond.

During Year 1 monitoring, D/F concentrations in excess of the regional background value (15 ng/kg) were noted at station WW-MNR-11. Results from Year 3 monitoring were 7% lower at this location. However, elevated D/F concentrations were noted in the thin layer of sediments accumulating over the cap and armor surface in adjacent areas (locations WW-P1CM-08, WW-P1CM-10, and WW-P1CM-11). Results suggest that either an ongoing contaminant source may be present in upstream portions of Whatcom Creek, or redistribution of D/F-containing sediments from the tideflat area may be occurring, with deposition of these sediments in the Phase 1 cap areas.

An estimated surface-weighted average concentration (SWAC) for D/F was developed based on Year 3 monitoring data and recent data collected as part of investigations at the I & J Waterway Site and the RG Haley site. The current estimated SWAC is 11 ng/kg TEQ, which is below the regional background concentration of 15 ng TEQ/kg . The SWAC has increased slightly from a SWAC of 9 ng/kg following the Year 1 monitoring event. The increase was caused by the detections of dioxin/furans in the surface sediment accumulations within the Inner Waterway.

4.1.4 Confirmational Bioassay Testing

Confirmational bioassay testing was performed on seven surface sediment samples that contained mercury and/or PAH concentrations in excess of site cleanup levels. This testing was performed by EcoAnalysts, Inc., in Port Gamble, Washington.

Testing included two acute toxicity tests (the 10-day amphipod survival test and the benthic larval development test) and one chronic toxicity test (20-day polychaete survival and growth test). The 10-day amphipod and 96-hour echinoderm tests were initiated on October 16, and the 20-day juvenile polychaete was initiated on October 18, all within the 56-day holding time. One sample initially exhibited mean mortality that exceeded criteria in the 10-day amphipod test, and native worms (predatory organisms) were observed at the test termination. This test was reconducted after press-sieving the sediment through a 0.5-millimeter sieve to remove indigenous organisms. The retest was initiated on November 8, 2019 (16 days past the 8-week holding time) and met performance criteria. Given these results concur with the other bioassay tests, and that all other performance criteria were met, results from the retest for P1CM-08 were determined to be suitable for making management decisions.

The seven sediment samples were tested against clean reference samples collected from Carr Inlet by EcoAnalysts. Test methods followed guidance provided by the Puget Sound Estuary Program (PSEP 1995), the Sediment Cleanup User's Manual II (Ecology 2017), and the various updates presented during the Sediment Management Annual Review Meetings. The following describes the tests and species used, along with key observations from data validation. For additional details regarding bioassay testing, refer to Appendix E.

4.1.4.1 10-Day Amphipod Mortality (Ampelisca abdita)

Water quality conditions were maintained to ensure optimal health of the organisms and were within acceptable limits throughout the testing duration. Temperature, dissolved oxygen (DO), salinity, and pH from one replicate per treatment were monitored daily. Water quality parameters were within the acceptable limits throughout the duration of both tests, with the exception of salinity. The salinity reached 30 parts per thousand (ppt) on days 9 and/or 10 in samples CR20, CR022 (both tests), MNR-07, and PICM-09, above the recommended range of 28 ± 1 ppt. This salinity is well within the tolerance range of the organisms; therefore, it is not expected to have affected the results. Additionally, ammonia and sulfide concentrations were measured in both porewater and overlying water at the beginning and termination of testing. Concentrations were below trigger values, indicating mortality due to ammonia and/or sulfide was unlikely.

The test met the survival acceptability criteria specified in the test protocol with 7% mean mortality in the control and 4% to 11% mean mortality for reference samples, within the performance criteria. The reference toxicant test was conducted using total ammonia, resulting in a median lethal concentration of 85.8 milligrams per liter (mg/L), and was within the laboratory acceptability range of 32.3 to 91.7 mg/L.

The amphipod test was rerun for test sediment P1CM-08 due to presence of native polychaeta worms and poor survival in the initial test. The second test was conducted 16 days beyond hold time. Despite the test rerun at P1CM-08 being outside of the recommended hold time, it met performance criteria. No problems were found with the test organisms or the testing procedure, and it was concluded that the test developed fully acceptable data for use in management decisions.

All project sediments pass the sediment cleanup objective (SCO) and cleanup screening level (CSL) criteria.

4.1.4.2 Bivalve Larval Development (Mytilus galloprovincialis)

The bivalve larval development test was conducted with the mussel, *Mytilus galloprovincialis*. Adult organisms were obtained from Taylor Shellfish in Shelton, Washington, and were held under flowing natural seawater at 14 ± 2 °C prior to spawning induction. Testing was initiated on October 11, 2019, within the appropriate holding time. Water quality conditions were maintained to ensure optimal health of the organisms and were within acceptable limits throughout the testing duration.

- Temperature, DO, salinity, and pH from one replicate per treatment were monitored daily.
- Water quality parameters were within protocol-specified ranges throughout the duration of the tests.
- Ammonia and sulfide concentrations were measured in overlying water at the beginning and termination of testing. Ammonia concentrations observed in the M. galloprovincialis test were below the no observed effect concentration value derived from the concurrent ammonia reference-toxicant test (3.52 mg/L total ammonia; Bioassay Testing Results, Table 3-18 [EcoAnalysts, Inc. 2019]). Initial total sulfide concentrations for all three reference samples, and test samples MNR-06, MNR-07, P1CM- 05, and P1CM-08, were above the trigger value of 0.009 mg/L; however, the undissociated hydrogen sulfide measurement was above the hydrogen sulfide trigger value of 0.003 mg/L for sample MNR-07 only (0.004 mg/L; Inouye 2015). This indicates that ammonia concentrations within the sediment samples should not have contributed to any adverse biological effects observed in the test treatments. However, there is a possibility that sulfide concentrations may have adversely affected larvae exposed to MNR-07.
- The test met the survival acceptability criteria specified in the test protocol with 87.9% and 100.1% normal survivorship in the seawater and sediment controls, respectively.

- Reference sediment also met acceptability criteria, with mean normal survival between 79% and 102% of the sediment control response.
- The reference toxicant test was conducted using total and unionized ammonia. For total ammonia, the mean effective concentration of 7.52 was within the laboratory acceptability range of 3.92 to 14.451 mg/L. For unionized ammonia, the mean effective concentration of 0.113 was within the laboratory acceptability range of 0.050 to 0.256 mg/L.

No problems were found with the test organisms or the testing procedure, and it was concluded that the test developed fully acceptable data for use in management decisions. All project sediments pass the SCO and CSL criteria.

4.1.4.3 20-Day Juvenile Polychaete Survival and Growth (Neanthes arenaceodentata)

The test organisms were obtained from Aquatic Toxicology Support in Bremerton, Washington. Testing was initiated on October 11, 2019, within the appropriate holding time. Water quality conditions were maintained to ensure optimal health of the organisms and were within acceptable limits throughout the testing duration.

- Temperature, DO, salinity, and pH from one replicate per treatment were monitored daily.
- Ammonia and sulfide concentrations were measured in both porewater and overlying water at the beginning and termination of testing. Concentrations were below trigger values, indicating mortality due to ammonia and/or sulfide was unlikely.
- The test met the acceptability criteria specified in the test protocol. No mortality was observed in the control treatment, and mean individual growth rates as dry weight and AFDW were 0.761 and 0.480 milligram (mg) per individual per day, respectively. Mean mortality in reference treatments were 0% for all reference samples. Mean individual growth rates ranged from 0.650 to 0.764 mg per individual per day dry weight and 0.440 to 0.565 mg per individual per day AFDW.
- The reference toxicant test was conducted using total ammonia, resulting in a mean lethal concentration of 189 mg/L, and was within the laboratory acceptability range of 135 to 264.6 mg/L.

No problems were found with the test organisms or the testing procedure, and it was concluded that the test developed fully acceptable data for use in management decisions.

All project sediments pass the SCO and CSL criteria when evaluated on a dry weight and AFDW basis.

5 Seafood Tissue Monitoring

This section describes post-construction tissue monitoring performed in accordance with the SQAPP (Anchor QEA 2016). This monitoring was conducted during August and September 2019 and included the following activities:

- Testing of tissue mercury levels in adult Dungeness crabs collected from the Site and from the Samish Bay clean reference area
- Testing of tissue mercury levels in juvenile Dungeness crabs collected from the Log Pond and from a clean reference area within Bellingham Bay
- Testing of tissue mercury and D/F levels in benthic fish from multiple locations within the Site and collection of corresponding data from the Samish Bay reference area

Locations of samples described in this section are presented in Figure 3 (Site samples) and Figure 4 (reference area samples). Laboratory analytical reports are included in Appendix C, and data validation reports are included in Appendix D. Results were analyzed graphically, and statistics were calculated to compare Site and reference area findings (Appendix G).

5.1 Adult Dungeness Crab

Adult crabs were collected using crab traps deployed at three locations within the Site (Figure 3) and at two locations within the Samish Bay reference areas (Figure 4). Four to five adult male Dungeness crabs with a carapace width of 14.75 cm or greater were collected at each station. Adequate numbers of crabs of sufficient size were not collected after 24 hours of collection attempts, so crabs less than the SQAPP-required 16.5-cm minimum size were collected and processed. Two replicate samples for each Site station and three replicate samples for each reference station were created by homogenizing sternal plate, leg, and claw muscle tissue, resulting in a total of six composite samples from the Site and six composite samples from the Samish Bay reference area.

Adult Dungeness crabs utilize a large home range (estimated at approximately 10 square kilometers, which is larger than the Site). Therefore, the adult Dungeness crab collected at any one station within the Site are representative of the overall Site and not the individual sampling station. Similarly, the adult crabs collected at either of the Samish Bay reference areas are representative of the overall reference area and not the individual sampling station.

Table 5 and Figure 11 summarize the tissue monitoring data collected for adult crab for both the Site and the reference area stations. Mercury concentration trends in adult crab tissue are presented in Table 6 and summarized as follows:

- Tissue mercury levels detected in Site crab were well below those measured previously in 1991 and 1997 and were also lower than Year 0 and Year 1 compliance monitoring concentrations.

- The tissue mercury concentrations from the Site remain well below the U.S. Environmental Protection Agency's consumption guideline for seafood tissue (0.3 mg/kg wet weight), and they are more than 69% lower than the tissue concentration identified as protective of tribal seafood consumption (0.18 mg/kg wet weight) (Anchor Environmental and Hart Crowser 2000).
- The average Site crab tissue mercury level continues to experience a steady decrease in concentrations, consistent with an exponential (first-order) rate of decrease. This is consistent with natural recovery modeling expectations.
- The average tissue mercury concentration in reference crab was similar to the previously measured average concentration in 1997 and to the average Year 1 compliance monitoring concentration.
- Results of tissue testing showed no significant difference between the Site testing locations and the reference locations.
  - Results demonstrate that the remediation in Phase 1 dredging and capping areas has been successful in preventing bioavailability to benthic organisms.
  - Likewise, results demonstrate that the mercury in MNR areas is not bioavailable, despite differences in sediment total mercury concentrations (see Table 1).
- Tissue mercury concentrations were compared statistically between the Site and reference areas (Appendix G). The Site tissue mercury concentrations were not significantly different than those collected from the reference areas.

Consistent with the SQAPP, adult crab tissue monitoring will continue in Year 5. The SQAPP specifies that adult crab monitoring will be discontinued when Site samples are not significantly different than reference samples for a second consecutive sampling event.

5.2 Juvenile Crab

Juvenile Dungeness crab were collected using crab traps deployed along the shoreline of the Log Pond (Figure 3) and at a reference site located near Brant and Portage Islands (Figure 4). Juvenile crab tissue from these locations was previously sampled for mercury concentrations during 2001, 2002, and 2005 after completion of the Log Pond Interim Action, as well as during Year 0 and Year 1 monitoring (Anchor QEA 2018b, 2019) immediately following implementation of the cleanup in Phase 1 Site areas.

Crab were collected using baited ring nets deployed from a vessel. Juvenile Dungeness crabs ranged in carapace length from 6 to 10.2 cm, indicating that the individuals were between 1 and 2 years old (Pauley et al. 1986). Five juvenile crabs were collected at each location and used to form two whole-body composite samples.

Tissue samples were created from whole-body composites prior to analysis at the laboratory. Each composite was submitted to the chemical testing laboratory for analysis of total solids, lipids, and mercury concentrations (Table 5). At the Site and reference location, two replicate samples were created from the two individual juvenile crabs with the largest carapace width and submitted for testing. At the Site and reference locations, three replicate samples were created from the three individual juvenile crabs with the smallest carapace width. Four replicates from each area were run, while one composite was placed on hold. Reanalyses were as performed on composites from the reference area. Testing (in the final composite) and reanalyses were initiated on September 30, 2019, slightly outside target hold times (refer to Appendix D for data validation information).

Mercury concentration data for the juvenile crab are summarized in Table 7 and Figure 12. Mercury concentration trends in juvenile crab tissue are presented in Table 8 and summarized as follows:

- Composites from the reference area were all run in duplicate to assess reproducibility of results. The relative percent difference was calculated for each sample and for the mean. The relative percent difference averaged 20% (range from -2% to 27%).
- Juvenile crab tissue mercury levels within the Site were 42% and 19% lower than Year 0 and Year 1 concentrations, respectively.
- Tissue mercury concentrations were compared statistically between the Site and reference locations (Appendix G). Mercury levels in the Site juvenile crab were not significantly different from those of the reference area juvenile crab.

5.3 Benthic Fish

Benthic fish were collected using a trawl from a vessel at the locations shown in Figures 3 and 4. A trawl net was deployed from a boom while the vessel was underway. The trawl was towed at a speed of 1.0 meter per second for about 5 to 15 minutes. At the end of the prescribed trawl, the net was retrieved and brought on board the vessel, the cod-end was opened, and the catch was deposited into a tub. The catch was then released to the scientific crew for sorting and processing. Bycatch was identified, enumerated, and released. Target fish were temporarily held in a live well on the boat until sufficient trawls to collect the required number of fish were completed.

The target benthic fish species for monitoring was English sole (*Parophrys vetulus*). Consistent with the SQAPP, starry flounder (*Platichthys stellatus)* was collected as an alternate species because few English sole were identified during trawling. The target species were identified and separated for processing by Anchor QEA staff trained in fish identification. Individual fish of the selected target species were rinsed in water from the collection location to remove any foreign material from the external surface. Target fish were measured for length and physically dispatched and then wrapped in aluminum foil, labeled, and placed on ice.

Specimens of target species that did not meet size requirements were counted, their lengths were approximated, and they were returned to the water. As required by the Washington Department of Fish and Wildlife, specimens of non-target species were identified to the lowest practical taxon and their numbers estimated. Special care was taken to return non-target organisms to the water quickly, with minimal handling.

Five composite samples of five fish were prepared for each test area. Composite samples were created to contain fish of similar sizes. The composite samples of skin-off fillets were prepared in the field after review of the species and size data and sent to Analytical Resources, Inc., for homogenization and analyses.

Each composite was submitted for analysis of lipids, mercury, and D/F concentrations. Mercury and D/F concentration data for the benthic fish composites are summarized in Table 9 and Figures 13a and 13b and summarized as follows:

- Mercury results for the Site areas ranged from 0.041 to 0.097 mg/kg wet weight, averaging 0.066 mg/kg wet weight. Mercury results for reference areas ranged from 0.044 to 0.089 mg/kg wet weight, averaging 0.064 mg/kg wet weight. Results from the Site and reference areas were evaluated statistically (Appendix G). The mercury levels were not significantly different between the Site and reference samples.
- D/F detection limits and reporting limits for fish tissue were better than (less than) those published in the Sediment Cleanup User's Manual II (Ecology 2017; estimated tissue practical quantification limit (PQL) 4.2 ng TEQ/kg). D/F were not detected in the majority of the fish tissue samples. One or more D/F congeners were detected in one sample from the Site and in three samples from the reference areas. Results were compared between the Site and reference area samples in two ways, both with non-detected results set equal to zero, and again using non-detected results set equal to one-half the method detection limit. In both cases, the Site results were less than those from the reference area. Results were also compared statistically (Appendix G). Results for the Site were not significantly different than those from the reference area.

6 Porewater Monitoring in Unit 4

Porewater monitoring was conducted at two nearshore stations in the Log Pond to assess groundwater as a source of potential sediment recontamination.

Porewater samples were collected from each of two sampling stations (see Figure 3). A set of nylon mesh diffusion samplers (NMDSs) were deployed at each test location to measure porewater mercury concentrations and results are summarized as follows:

- The NMDS deployment methodology was consistent with methods used by the U.S. Geological Survey and U.S. Environmental Protection Agency (Zimmerman et al. 2005).
- Samplers were constructed using 250-milliliter glass jars fitted with 22-micron (μm) mesh and screw-on lids.
- Samplers were buried 10 cm into the sediment and left in situ to equilibrate.
- Samplers were retrieved after 15 days of equilibration.
- Porewater samples were analyzed for total and dissolved mercury.
- Turbidity was observed in the unfiltered samples, indicating that unfiltered results are suitable for quantitative use.

Results of Log Pond porewater testing are shown in Table 10:

- Dissolved mercury was detected in low concentrations in both samples. These results, along with Year 1 data, support the theory that mercury concentrations in shoreline porewater are not bioavailable.
- Dissolved mercury concentrations were well below the Log Pond interpretive framework value of 0.0594 μg/L dissolved mercury. That value was established as part of remedial activities at the GP West Chlor-Alkali Remedial Action Unit and set to be protective of the sediment quality standard (0.41 mg/kg).

Results demonstrate that shoreline groundwater is not an ongoing source of sediment recontamination.

7 Summary and Recommendations

The results of Year 3 compliance monitoring are summarized as follows:

- Phase 1 capping areas are performing within expectations, with no areas of erosion or cap damage noted during Year 3 bathymetric and visual surveys. Observed ranges of sediment consolidation have decreased since Year 1 and are within expectations.
- Sediment containment walls are in good condition, with no observations of corrosion or other damage. Several small areas of seepage are still observed at some tie-back penetrations. Samples of seepage water were chemically analyzed, and all results complied with applicable cleanup levels for Central Waterfront Site groundwater (Ecology 2020).
- Mercury levels in surface sediments comply with levels protective of benthic organisms and human health and ecological receptors. Results confirm the performance of the remedy within both the Phase 1 capping and Site MNR areas.
- Average D/F concentrations remain below the regional background concentration for Bellingham Bay, though localized detections in excess of background concentrations were noted in sediments depositing on top of the engineered cap and monitored natural recovery area at the head of the Inner Waterway. Follow-up testing will be conducted during 2020 to evaluate the source of the D/F in this area. This work will be performed in parallel with planned pre-remedial design testing for the cleanup in Phase 2 Site areas.
- Mercury levels in adult crab tissue have continued to decrease from Year 0 and Year 1. Year 3 mercury concentrations in adult crab tissue from the Site were not significantly different than mercury in crab tissue collected from the reference area.
- Mercury levels in juvenile Dungeness crab collected from the Log Pond have further decreased between Year 1 and Year 3 and are now not significantly different from reference area juvenile crab tissue concentrations.
- Testing of benthic fish (flatfish) showed that mercury levels in fish tissues collected from the Site were not significantly different from fish tissues collected from clean reference areas. The same finding was observed for D/F compounds. D/F compounds were below the PQL in fish tissue from both the Site and the reference area, and Site samples were not significantly different than those from the reference area.

The next scheduled monitoring event is Year 5 (2021). That work should be performed consistent with the SQAPP (Anchor QEA 2016). Planned testing includes bathymetric and visual surveys, surface sediment testing (chemistry and contingent bioassay testing), Log Pond porewater testing, and testing of mercury in adult crab tissue. Because benthic fish tissue were found to be no different than reference area fish tissue, no further testing of benthic fish is called for under the SQAPP.

The Port is currently developing a plan to address the localized areas of seepage that continue to be observed at some of the tie-back anchor locations along the face of the Maple Street Bulkhead.

Testing data show that this seepage water complies with applicable criteria. The plan will summarize all actions implemented to date to assess and address all containment wall seeps, and it describes future activities that will be implemented to further assess and address the remaining seep locations. The plan will also include a schedule for implementation of the remaining repair activities. The updated plan will be submitted to Ecology for review and approval prior to implementing the remaining work.

8 Year 5 Compliance Monitoring

Year 5 monitoring will be performed in 2021. Consistent with the SQAPP (Anchor QEA 2016) and recommendations based on Year 3 results (see Section 7), the scope of monitoring will include the following:

- Bathymetric surveys
- Visual surveys
- Surface sediment testing
- Porewater monitoring in Unit 4
- Seafood tissue monitoring for adult Dungeness crab

Fieldwork will be conducted from June through August 2021. Field sampling for seafood tissue monitoring will be prioritized, before surveys and surface sediment sampling, to comply with the time frame specified in the SQAPP. Analytical results from chemical and biological testing and data validation are expected to be complete in November 2021. Completion of the Year 5 Compliance Monitoring Report is anticipated by February 2022. Data will be submitted to the Ecology Environmental Information Management database by March 1, 2022.

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Tables

Table 1
Maple Street Bulkhead Seep Contaminant Wall Seep Sampling Results

	Analysis Method	Groundwater Cleanup Level from CWF Draft CAP[1] (μg/L)		Samples					
		Value	Basis[1]	CWF-SEEP-16-191024		CWF-SEEP-24-191024		CWF-SEEP-1024-191024 (Duplicate of SEEP-24)	
Conventionals (μS/cm)									
Conductivity	SM 2510 B-97	--	--	**1,460**		**15,000**		**14,700**	
Total Petroleum Hydrocarbons (TPH)									
Gasoline Range Hydrocarbons	NWTPHG	800	*(sw-a)*	100	U	100	U	100	U
Diesel Range Hydrocarbons	NWTPHDx	500	*(sw-a)*	100	U	**142**		**127**	
Oil Range Hydrocarbons	NWTPHDx	500	*(sw-a)*	200	U	200	U	200	U
Total Diesel and Oil Hydrocarbons[2]	--	500	(sw-a)	300	U	**242**	U[2]	**227**	U[2]
Heavy Metals (Dissolved)									
Arsenic	SW6020A	5	*(back)*	**2.45**		**3.41**		**3.45**	
Cadmium	SW6020A	8.8	*(ma-cwa)*[3]	0.3	U	0.3	U	0.3	U
Chromium (III)	SW6020A	93,700	*(sw-b)*	**1.98**	J	**16.1**		**16.2**	
Chromium (VI)	SW7196A	50[3]	*(ma-wac)*[3]	--[5]		--[5]		--[5]	
Copper	SW6020A	3.1	*(ma-wac)*[3,4]	1.7	U[6]	1.7	U[6]	1.7	U[6]
Lead	SW6020A	8.1	*(ma-wac)*[3]	0.68	U	0.68	U	0.68	U
Mercury	SW7470A	0.059	*(sed)*	**0.02**	J	**0.017**	J	0.013	U
Nickel	SW6020A	8.2	*(ma-wac)*[3]	0.5	U	**1.03**	J	**0.94**	J
Selenium	SW6020A	71	*(ma-wac)*[3]	4.4	U	4.4	U	**4.87**	
Silver	SW6020A	1.9	*(ma-wac)*[3]	0.17	U	0.17	U	0.17	U
Zinc	SW6020A	81	*(ma-wac)*[3]	**14.1**	J	8.2	U	8.2	U
Heavy Metals (Total)									
Arsenic	SW6020A	5	*(back)*	**2.62**		**3.9**		**4.13**	
Cadmium	SW6020A	--[3]	*(ma-cwa)*	0.3	U	0.3	U	0.3	U
Chromium (Total)	SW6020A	260	*(sed)*	**2.84**	**J**	**17.3**		**17.7**	
Chromium (VI)	SW7196A	--[3]	*(ma-wac)*	13	U	13	U	13	U
Copper	SW6020A	--[3]	*(ma-wac)*[4]	**3.18**		1.7	U[6]	1.7	U[6]
Lead	SW6020A	--[3]	*(ma-wac)*	**1.06**		0.68	U	0.68	U
Mercury	SW7470A	0.059	*(sed)*	0.013	U	0.013	U	0.013	U
Nickel	SW6020A	--[3]	*(ma-wac)*	**0.9**	J	**1.35**	J	**1.48**	J
Selenium	SW6020A	--[3]	*(ma-wac)*	4.4	U	**4.53**	J	**6.12**	
Silver	SW6020A	--[3]	*(ma-wac)*	0.17	U	0.17	U	0.17	U
Zinc	SW6020A	--[3]	*(ma-wac)*	8.2	U	8.2	U	**8.56**	J
Volatile Organic Compounds									
Benzene	SW8260C	2.4	*(vi-b)*	0.2	U	**0.04**	J	**0.04**	J
Polycyclic Aromatic Hydrocarbons (PAHs)									
Acenaphthene	SW8270D-SIM	3.3	*(sed)*	**0.014**		**0.016**		**0.015**	
Anthracene	SW8270D-SIM	9.6	*(sed)*	**0.017**		**0.019**		**0.019**	
Fluoranthene	SW8270D-SIM	3.3	*(sed)*	**0.402**		**0.217**		**0.211**	
Fluorene	SW8270D-SIM	3	*(sed)*	**0.036**		**0.024**		**0.023**	
Naphthalene	SW8270D-SIM	83	*(sed)*	**0.046**		**0.06**		**0.047**	
Pyrene	SW8270D-SIM	15	*(sed)*	**0.235**		**0.122**		**0.118**	
Benz(a)anthracene	SW8270D-SIM	0.02	*(pql)*	**0.013**		**0.007**		**0.007**	
Benzo(a)pyrene	SW8270D-SIM	0.02	*(pql)*	0.002	U	0.002	U	**0.003**	J
Benzo(b)fluoranthene	SW8270D-SIM	0.02	*(pql)*	**0.005**		**0.004**		**0.003**	
Benzo(k)fluoranthene	SW8270D-SIM	0.02	*(pql)*	0.003	U	0.003	U	0.003	U
Chrysene	SW8270D-SIM	0.02	*(pql)*	**0.015**		**0.009**	J	**0.009**	J
Dibenzo(a,h)anthracene	SW8270D-SIM	0.02	*(pql)*	0.001	U	0.001	U	0.001	U
Indeno(1,2,3-cd)pyrene	SW8270D-SIM	0.02	*(pql)*	0.001	U	0.001	U	0.001	U
Total cPAHs TEQ[7]	--	0.02	*(pql)*	**0.005**		**0.005**		**0.007**	
Other Semivolatile Organics									
Bis(2-ethylhexyl) phthalate	SW8270D	1	*(pql)*	0.2	U	0.2	U	0.2	U

Note:

Samples were collected October 24, 2019.

1. Groundwater cleanup levels are from the draft Cleanup Action Plan (Ecology, February 2019) for the Central Waterfront Site and represent the most stringent value identified from all exposure pathways.
2. Total petroleum hydrocarbons (TPHs) calculated by adding diesel and oil-range organics as recommended in *Revised Guidance for Remediation of Petroleum Contaminated Sites* (Ecology 2016). A value equal to half of the reporting limit is used for non-detect results in calculating Total Diesel and Oil TPH.
3. Cleanup levels for these metals are based on applicable water quality criteria for the dissolved metals fraction.
4. Cleanup level is based on WAC 173-201A chronic water quality criteria, which are expressed for dissolved copper as a 4-day average limit not to be exceeded once every 3 years on average.
5. Total chromium VI was less than the criteria applicable to dissolved chromium VI; therefore, no additional dissolved chromium VI test was performed.
6. Dissolved copper was not detected in any samples. The method reporting limit was 2.5 μg/L. The method detection limit was 1.7 μg/L.
7. Calculated according to methods outlined in *Evaluating the Human Health Toxicity of Carcinogenic PAHs (cPAHs) Using Toxicity Equivalency Factors (TEFs)* (Ecology 2015) with non-detected values equal to one-half method detection limit.

bold: **detected result**
--: not applicable
(back): Natural Background
(ma-cwa): Surface Water, Marine Aquatic Life, Clean Water Act §304
(ma-wac): Surface Water, Marine Aquatic Life, Ch. 173-201A WAC
(pql): Applicable Practical Quantitation Level
(sed): Calculated Porewater Concentration Protective of Marine Sediment
(sw-a): Surface Water, Method A, Most Restrictive
(sw-b): Surface Water, Method B, Most Restrictive, Adjusted for Fish Consumption Rate
(vi-b): Vapor Intrusion, Method B for Unrestricted Land Use
μg/L: microgram per liter
μS/cm: microsiemen per centimeter
CAP: Cleanup Action Plan
CWF: Central Waterfront
cPAH: carcinogenic polycyclic aromatic hydrocarbon
Ecology: Washington State Department of Ecology
J: estimated value
TEQ: toxic equivalent quotient
U: compound analyzed but not detected above detection limit
WAC: Washington Administrative Code

Table 2
Surface Sediment Analytical Results

						Task	WWY3_Compliance	WWY3_Compliance	WWY3_Compliance
						Location ID	WW-MNR-01	WW-MNR-02	WW-MNR-03
						Sample ID	WW-MNR-01-SS-190827	WW-MNR-02-SS-190827	WW-MNR-03-SS-190827
						Sample Date	8/27/2019	8/27/2019	8/27/2019
						Depth	0 - 12 cm	0 - 12 cm	0 - 12 cm
						Sample Type	N	N	N
						Matrix	SE	SE	SE
						X	1236588.92	1236337.84	1237327.87
						Y	641690.52	636673.58	643042.49
		SMS_Marine_SCO_SCUMII	SMS_Marine_CSL_SCUMII	AET_Marine_SCO_SCUMII	AET_Marine_CSL_SCUMII	Other			
Conventional Parameters (pct)									
Total organic carbon	Plumb 1981						**1.57**	**1.65**	**1.54**
Total Solids	SM2540G						**48.7**	**38.08**	**49.2**
Grain Size (pct)									
Gravel	PSEP-PS						--	--	--
Sand, very coarse	PSEP-PS						--	--	--
Sand, coarse	PSEP-PS						--	--	--
Sand, medium	PSEP-PS						--	--	--
Sand, fine	PSEP-PS						--	--	--
Sand, very fine	PSEP-PS						--	--	--
Silt, coarse	PSEP-PS						--	--	--
Silt, medium	PSEP-PS						--	--	--
Silt, fine	PSEP-PS						--	--	--
Silt, very fine	PSEP-PS						--	--	--
Clay, coarse	PSEP-PS						--	--	--
Clay, medium	PSEP-PS						--	--	--
Clay, fine	PSEP-PS						--	--	--
Metals (mg/kg)									
Copper	SW6020A	390	390	390	390		**45.5**	**48.1**	**40.1**
Mercury	SW7471B	0.41	0.59	0.41	0.59	1.2[1]	**0.212**	**0.191**	**0.319**
Zinc	SW6020A	410	960	410	960		**90.7**	**97.8**	**80.1**
Semivolatile Organics (µg/kg)									
2,4-Dimethylphenol	SW8270DSIM	29	29	29	29		20 U	20 U	**5.6 J**
2-Methylphenol (o-Cresol)	SW8270DSIM	63	63	63	63		**2.4 J**	5 U	**5.7 J**
4-Methylphenol (p-Cresol)	SW8270DSIM	670	670	670	670		**34.4**	**285**	**47.7**
Pentachlorophenol	SW8270DSIM	360	690	360	690		20 UJ	20 UJ	**4.3 J**
Phenol	SW8270DSIM	420	1,200	420	1,200		**52**	**72.3**	**27.1**
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)									
2-Methylnaphthalene	SW8270D	38	64				**0.7962 J**	**1.0788 J**	**7.078**
Acenaphthene	SW8270D	16	57				1.2739 U	1.2121 U	**0.7532 J**
Acenaphthylene	SW8270D	66	66				1.2739 U	**0.4667 J**	**0.9416 J**
Anthracene	SW8270D	220	1,200				1.2739 U	**0.6364 J**	**1.3247 J**
Benzo(a)anthracene	SW8270D	110	270				**0.7134 J**	**1.1515 J**	**2.5714**
Benzo(a)pyrene	SW8270D	99	210				**0.7707 J**	**1.3636**	**2.2403**
Benzo(g,h,i)perylene	SW8270D	31	78				1.2739 U	1.2121 U	1.6299 UJ
Chrysene	SW8270D	110	460				**0.9554 J**	**1.9818**	**4.2857**
Dibenzo(a,h)anthracene	SW8270DSIM	12	33				0.3185 U	**0.2424 J**	**0.3312 J**
Fluoranthene	SW8270D	160	1,200				**2.2229**	**5.0606**	**9.481**
Fluorene	SW8270D	23	79				**0.3503 J**	**0.7091 J**	**1.8896**
Indeno(1,2,3-c,d)pyrene	SW8270D	34	88				1.2739 U	**0.497 J**	**0.7013 J**
Naphthalene	SW8270D	99	170				**0.7898 J**	**2.8788**	**2.5584**
Phenanthrene	SW8270D	100	480				**1.4713**	**3.4121**	**5.6753**
Pyrene	SW8270D	1,000	1,400				**1.8217**	**3.8242**	**7.922**
Total Benzofluoranthenes (b,j,k) (U = 0)		230	450				**1.5159 J**	**3.1333**	**5.0195**
Total HPAH (SMS) (U = 0)		960	5,300				**8 J**	**17.2545 J**	**32.5519 J**
Total LPAH (SMS) (U = 0)		370	780				**2.6115 J**	**8.103 J**	**13.1429 J**

Table 2
Surface Sediment Analytical Results

		SMS_Marine_SCO_SCUMII	SMS_Marine_CSL_SCUMII	AET_Marine_SCO_SCUMII	AET_Marine_CSL_SCUMII	Other			
Task							WWY3_Compliance	WWY3_Compliance	WWY3_Compliance
Location ID							WW-MNR-01	WW-MNR-02	WW-MNR-03
Sample ID							WW-MNR-01-SS-190827	WW-MNR-02-SS-190827	WW-MNR-03-SS-190827
Sample Date							8/27/2019	8/27/2019	8/27/2019
Depth							0 - 12 cm	0 - 12 cm	0 - 12 cm
Sample Type							N	N	N
Matrix							SE	SE	SE
X							1236588.92	1236337.84	1237327.87
Y							641690.52	636673.58	643042.49
Polycyclic Aromatic Hydrocarbons (µg/kg)									
2-Methylnaphthalene	SW8270D			670	670		**12.5 J**	**17.8 J**	**109**
Acenaphthene	SW8270D			500	500		20 U	20 U	**11.6 J**
Acenaphthylene	SW8270D			1300	1,300		20 U	**7.7 J**	**14.5 J**
Anthracene	SW8270D			960	960		20 U	**10.5 J**	**20.4 J**
Benzo(a)anthracene	SW8270D			1300	1,600		**11.2 J**	**19 J**	**39.6**
Benzo(a)pyrene	SW8270D			1600	1,600		**12.1 J**	**22.5**	**34.5**
Benzo(b,j,k)fluoranthenes	SW8270D						**23.8 J**	**51.7**	**77.3**
Benzo(g,h,i)perylene	SW8270D			670	720		20 U	20 U	25.1 UJ
Chrysene	SW8270D			1400	2,800		**15 J**	**32.7**	**66**
Dibenzo(a,h)anthracene	SW8270DSIM			230	230		5 U	**4 J**	**5.1 J**
Fluoranthene	SW8270D			1,700	2,500		**34.9**	**83.5**	**146**
Fluorene	SW8270D			540	540		**5.5 J**	**11.7 J**	**29.1**
Indeno(1,2,3-c,d)pyrene	SW8270D			600	690		20 U	**8.2 J**	**10.8 J**
Naphthalene	SW8270D			2,100	2,100		**12.4 J**	**47.5**	**39.4**
Phenanthrene	SW8270D			1,500	1,500		**23.1**	**56.3**	**87.4**
Pyrene	SW8270D			2,600	3,300		**28.6**	**63.1**	**122**
Total Benzofluoranthenes (b,j,k) (U = 0)				3,200	3,600		**23.8 J**	**51.7**	**77.3**
Total HPAH (SMS) (U = 0)				12,000	17,000		**125.6 J**	**284.7 J**	**501.3 J**
Total LPAH (SMS) (U = 0)				5,200	5,200		**41 J**	**133.7 J**	**202.4 J**
Dioxin Furans (ng/kg)									
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B						--	--	**0.464 J EMPC**
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B						--	--	**1.8**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B						--	--	**3.11**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B						--	--	**8.93**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B						--	--	**4.8**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B						--	--	**224**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B						--	--	**1870**
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B						--	--	**117**
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B						--	--	**90.3**
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B						--	--	**199**
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B						--	--	**448**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B						--	--	**3.44**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B						--	--	**0.996 J**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B						--	--	**0.788 J**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B						--	--	**2.43 J**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B						--	--	**1.03**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B						--	--	**0.732 J**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B						--	--	**0.838 J**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B						--	--	**37.2**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B						--	--	**2.06**
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B						--	--	**124**
Total Tetrachlorodibenzofuran (TCDF)	E1613B						--	--	**17.8**
Total Pentachlorodibenzofuran (PeCDF)	E1613B						--	--	**12.6**
Total Hexachlorodibenzofuran (HxCDF)	E1613B						--	--	**45.1**
Total Heptachlorodibenzofuran (HpCDF)	E1613B						--	--	**139**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC = U)						15[2]	--	--	**8.06 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC = U)						15[2]	--	--	**7.828 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC included)						15[2]	--	--	**8.292 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC included)						15[2]	--	--	**8.292 J EMPC**

Table 2
Surface Sediment Analytical Results

		WWY3_Compliance WW-MNR-03 WW-MNR-1003-SS-190827 8/27/2019 0 - 12 cm FD SE 1237327.87 643042.49	WWY3_Compliance WW-MNR-04 WW-MNR-04-SS-190827 8/27/2019 0 - 12 cm N SE 1237147.24 639909.8	WWY3_Compliance WW-MNR-05 WW-MNR-05-SS-190827 8/27/2019 0 - 12 cm N SE 1237855.46 638099.79	WWY3_Compliance WW-MNR-06 WW-MNR-06-SS-190828 8/28/2019 0 - 12 cm N SE 1239204.01 642296.34	WWY3_Compliance WW-MNR-06 WW-MNR-1006-SS-190828 8/28/2019 0 - 12 cm FD SE 1239204.01 642296.34	WWY3_Compliance WW-MNR-07 WW-MNR-07-SS-190828 8/28/2019 0 - 12 cm N SE 1238782.16 641481.25
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	**1.56**	**1.53**	**1.66**	**7.56**	**7.76**	**2.08**
Total Solids	SM2540G	**49.68**	**45.15**	**44.46**	**43.02**	**43.09**	**43.36**
Grain Size (pct)							
Gravel	PSEP-PS	--	--	--	**2.48**	--	0.1 U
Sand, very coarse	PSEP-PS	--	--	--	**3.12**	--	0.1 U
Sand, coarse	PSEP-PS	--	--	--	**4.64**	--	**1.36**
Sand, medium	PSEP-PS	--	--	--	**6.85**	--	**1.16**
Sand, fine	PSEP-PS	--	--	--	**8.8**	--	**1.11**
Sand, very fine	PSEP-PS	--	--	--	**8.29**	--	**1.45**
Silt, coarse	PSEP-PS	--	--	--	**4.64**	--	**7.87**
Silt, medium	PSEP-PS	--	--	--	**10.87**	--	**12.58**
Silt, fine	PSEP-PS	--	--	--	**12.89**	--	**21.05**
Silt, very fine	PSEP-PS	--	--	--	**10.31**	--	**16.79**
Clay, coarse	PSEP-PS	--	--	--	**6.59**	--	**9.39**
Clay, medium	PSEP-PS	--	--	--	**2.74**	--	**3.28**
Clay, fine	PSEP-PS	--	--	--	**17.77**	--	**23.82**
Metals (mg/kg)							
Copper	SW6020A	**47.8**	**50**	**48.1**	**40.6**	**45**	**46.8**
Mercury	SW7471B	**0.371**	**0.384**	**0.397**	**1.32 J**	**0.98 J**	**1.07 J**
Zinc	SW6020A	**98.2**	**98.5**	**100**	**74**	**80.9**	**91**
Semivolatile Organics (µg/kg)							
2,4-Dimethylphenol	SW8270DSIM	**6.8 J**	20 U	20 U	**4.9 J**	**6.3 J**	**5.4 J**
2-Methylphenol (o-Cresol)	SW8270DSIM	**5 J**	**6.2**	**4.2 J**	5 U	**5.9**	**6.1**
4-Methylphenol (p-Cresol)	SW8270DSIM	**36.7**	**64.4**	**80.1**	**135**	**159**	**93.2**
Pentachlorophenol	SW8270DSIM	**6.1 J**	**2.7 J**	**3.9 J**	**6 J**	**13.7 J**	**7.7 J**
Phenol	SW8270DSIM	**24**	**20.8**	**34.1**	**42.5**	**49.5**	**22**
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270D	**1.5962**	**1.4183**	**1.2289**	**0.4749**	**0.4265**	**1.7837**
Acenaphthene	SW8270D	**0.3782 J**	1.3072 U	**0.4096 J**	**0.254 J**	**0.2474 J**	**0.7692 J**
Acenaphthylene	SW8270D	**0.5128 J**	**0.4706 J**	**0.6084 J**	**0.2011 J**	**0.2101 J**	**0.8558 J**
Anthracene	SW8270D	**0.7436 J**	**0.6275 J**	**0.8133 J**	**0.4643**	**0.5129**	**1.7404**
Benzo(a)anthracene	SW8270D	**2.0833**	**1.0719 J**	**1.3012**	**0.5688**	**0.7912**	**2.8558**
Benzo(a)pyrene	SW8270D	**1.7885**	**1.1438 J**	**1.6145**	**0.6429**	**0.6611**	**2.5288**
Benzo(g,h,i)perylene	SW8270D	**1.2372 J**	**1.2418 J**	**1.3253**	**0.4259**	**0.4472**	**1.8125**
Chrysene	SW8270D	**3.2179**	**2.1373**	**2.1084**	**0.9762**	**1.2693**	**3.9375**
Dibenzo(a,h)anthracene	SW8270DSIM	**0.359**	**0.2222 J**	**0.247 J**	**0.0939**	**0.1173**	**0.4087**
Fluoranthene	SW8270D	**7.244**	**5.719**	**6.386**	**2.434**	**2.461**	**8.606**
Fluorene	SW8270D	**0.9487 J**	**0.7908 J**	**0.9458 J**	**0.3664**	**0.3312**	**1.3894**
Indeno(1,2,3-c,d)pyrene	SW8270D	**1.0962 J**	**0.9085 J**	**0.8494 J**	**0.3466**	**0.4085**	**1.5**
Naphthalene	SW8270D	**2.1154**	**3.1961**	**3.4819**	**1.468**	**1.495**	**4.3173**
Phenanthrene	SW8270D	**3.9038**	**4.183**	**4.6205**	**1.429**	**1.585**	**4.904**
Pyrene	SW8270D	**6.3269**	**4.268**	**5.3916**	**2.606**	**2.706**	**7.548**
Total Benzofluoranthenes (b,j,k) (U = 0)		**4.3526**	**3.0719**	**3.3614**	**1.442**	**1.688**	**6.25**
Total HPAH (SMS) (U = 0)		**27.7051 J**	**19.7843 J**	**22.5843 J**	**9.5357**	**10.5503**	**35.4471**
Total LPAH (SMS) (U = 0)		**8.6026 J**	**9.268 J**	**10.8795 J**	**4.1825 J**	**4.3814 J**	**13.976 J**

Table 2
Surface Sediment Analytical Results

		WWY3_Compliance WW-MNR-03 WW-MNR-1003-SS-190827 8/27/2019 0 - 12 cm FD SE 1237327.87 643042.49	WWY3_Compliance WW-MNR-04 WW-MNR-04-SS-190827 8/27/2019 0 - 12 cm N SE 1237147.24 639909.8	WWY3_Compliance WW-MNR-05 WW-MNR-05-SS-190827 8/27/2019 0 - 12 cm N SE 1237855.46 638099.79	WWY3_Compliance WW-MNR-06 WW-MNR-06-SS-190828 8/28/2019 0 - 12 cm N SE 1239204.01 642296.34	WWY3_Compliance WW-MNR-06 WW-MNR-1006-SS-190828 8/28/2019 0 - 12 cm FD SE 1239204.01 642296.34	WWY3_Compliance WW-MNR-07 WW-MNR-07-SS-190828 8/28/2019 0 - 12 cm N SE 1238782.16 641481.25
Polycyclic Aromatic Hydrocarbons (µg/kg)							
2-Methylnaphthalene	SW8270D	**24.9**	**21.7**	**20.4**	**35.9**	**33.1**	**37.1**
Acenaphthene	SW8270D	**5.9 J**	20 U	**6.8 J**	**19.2 J**	**19.2 J**	**16 J**
Acenaphthylene	SW8270D	**8 J**	**7.2 J**	**10.1 J**	**15.2 J**	**16.3 J**	**17.8 J**
Anthracene	SW8270D	**11.6 J**	**9.6 J**	**13.5 J**	**35.1**	**39.8**	**36.2**
Benzo(a)anthracene	SW8270D	**32.5**	**16.4 J**	**21.6**	**43**	**61.4**	**59.4**
Benzo(a)pyrene	SW8270D	**27.9**	**17.5 J**	**26.8**	**48.6**	**51.3**	**52.6**
Benzo(b,j,k)fluoranthenes	SW8270D	**67.9**	**47**	**55.8**	**109**	**131**	**130**
Benzo(g,h,i)perylene	SW8270D	**19.3 J**	**19 J**	**22**	**32.2**	**34.7**	**37.7**
Chrysene	SW8270D	**50.2**	**32.7**	**35**	**73.8**	**98.5**	**81.9**
Dibenzo(a,h)anthracene	SW8270DSIM	**5.6**	**3.4 J**	**4.1 J**	**7.1**	**9.1**	**8.5**
Fluoranthene	SW8270D	**113**	**87.5**	**106**	**184**	**191**	**179**
Fluorene	SW8270D	**14.8 J**	**12.1 J**	**15.7 J**	**27.7**	**25.7**	**28.9**
Indeno(1,2,3-c,d)pyrene	SW8270D	**17.1 J**	**13.9 J**	**14.1 J**	**26.2**	**31.7**	**31.2**
Naphthalene	SW8270D	**33**	**48.9**	**57.8**	**111**	**116**	**89.8**
Phenanthrene	SW8270D	**60.9**	**64**	**76.7**	**108**	**123**	**102**
Pyrene	SW8270D	**98.7**	**65.3**	**89.5**	**197**	**210**	**157**
Total Benzofluoranthenes (b,j,k) (U = 0)		**67.9**	**47**	**55.8**	**109**	**131**	**130**
Total HPAH (SMS) (U = 0)		**432.2 J**	**302.7 J**	**374.9 J**	**720.9**	**818.7**	**737.3**
Total LPAH (SMS) (U = 0)		**134.2 J**	**141.8 J**	**180.6 J**	**316.2 J**	**340 J**	**290.7 J**
Dioxin Furans (ng/kg)							
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	0.132 U	**0.481 J EMPC**	**0.509 J EMPC**	--	--	0.145 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	**1.02**	**2.41**	**2.3**	--	--	**2.13**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	**1.94**	**6.41**	**7.06**	--	--	**5.6**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	**5.82**	**11**	**11.7**	--	--	**12.1**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	**3.11**	**7.66**	**7.83**	--	--	**6.76**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	**156**	**211**	**278**	--	--	**407**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B	**1530**	**1520**	**2540**	--	--	**4,100 J**
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	**65.9**	**336**	**316**	--	--	**218**
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	**48.6**	**273**	**287**	--	--	**154**
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	**121**	**483**	**513**	--	--	**353**
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	**317**	**399**	**521**	--	--	**848**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B	**2.11**	**6.67**	**6.87**	--	--	**5.17**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	**0.68 J**	**1.04 J**	**1.03 EMPC**	--	--	**1.28**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	**0.453 J EMPC**	**0.799 J EMPC**	**0.841 J**	--	--	**1.06**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	**1.53**	**1.91 J**	**2.06 J**	--	--	**3.66**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	**0.678 J EMPC**	**0.9 J EMPC**	**0.896 J**	--	--	**1.44**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B	**0.568 J**	**0.614 J EMPC**	**0.749 J**	--	--	**1.19**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	**0.551 J**	**1.34 J**	**0.604 J**	--	--	**1.13 EMPC**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B	**23.5**	**30**	**35.5**	--	--	**54**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B	**1.4 EMPC**	**1.71**	**2.19**	--	--	**3.67**
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B	**90.2**	**113**	**151**	--	--	**210**
Total Tetrachlorodibenzofuran (TCDF)	E1613B	**9.15**	**28.4**	**24.3**	--	--	**22.1**
Total Pentachlorodibenzofuran (PeCDF)	E1613B	**5.81**	**7.96**	**10.9**	--	--	**15.8**
Total Hexachlorodibenzofuran (HxCDF)	E1613B	**27.4**	**33.2**	**41.2**	--	--	**62.2**
Total Heptachlorodibenzofuran (HpCDF)	E1613B	**90.7**	**117**	**149**	--	--	**215**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC = U)		**5.059 J EMPC**	**9.293 J EMPC**	**10.563 J EMPC**	--	--	**12.147 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC = U)		**4.884 J EMPC**	**8.857 J EMPC**	**10.293 J EMPC**	--	--	**12.018 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC included)		**5.168 J EMPC**	**9.729 J EMPC**	**10.833 J EMPC**	--	--	**12.204 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC included)		**5.102 J EMPC**	**9.729 J EMPC**	**10.833 J EMPC**	--	--	**12.131 J EMPC**

Table 2
Surface Sediment Analytical Results

		WWY3_Compliance WW-MNR-08 WW-MNR-08-SS-190827 8/27/2019 0 - 12 cm N SE 1239015.65 639146.73	WWY3_Compliance WW-MNR-09 WW-MNR-09-SS-190827 8/27/2019 0 - 12 cm N SE 1240189.2 640237.84	WWY3_Compliance WW-MNR-10 WW-MNR-10-SS-190827 8/27/2019 0 - 12 cm N SE 1241831.21 643446.12	WWY3_Compliance WW-MNR-11 WW-MNR-11-SS-190827 8/27/2019 0 - 12 cm N SE 1241959.22 643289.54	WWY3_Compliance WW-P1CM-01 WW-P1CM-01-SS-190828 8/28/2019 0 - 12 cm N SE 1239682.53 641221.06	WWY3_Compliance WW-P1CM-02 WW-P1CM-02-SS-190828 8/28/2019 0 - 12 cm N SE 1239870.73 641386.3
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	**1.87**	**3.64**	**1.27**	**4.16**	**2.28**	**2.25**
Total Solids	SM2540G	**39.83**	**58.09**	**64.78**	**39.67**	**31.66**	**27.26**
Grain Size (pct)							
Gravel	PSEP-PS	--	--	--	**0.86**	--	--
Sand, very coarse	PSEP-PS	--	--	--	**3.78**	--	--
Sand, coarse	PSEP-PS	--	--	--	**1.75**	--	--
Sand, medium	PSEP-PS	--	--	--	**1.13**	--	--
Sand, fine	PSEP-PS	--	--	--	**1.67**	--	--
Sand, very fine	PSEP-PS	--	--	--	**5.86**	--	--
Silt, coarse	PSEP-PS	--	--	--	**8.37**	--	--
Silt, medium	PSEP-PS	--	--	--	**14.6**	--	--
Silt, fine	PSEP-PS	--	--	--	**16.17**	--	--
Silt, very fine	PSEP-PS	--	--	--	**13.31**	--	--
Clay, coarse	PSEP-PS	--	--	--	**7.35**	--	--
Clay, medium	PSEP-PS	--	--	--	**3.82**	--	--
Clay, fine	PSEP-PS	--	--	--	**21.33**	--	--
Metals (mg/kg)							
Copper	SW6020A	**54**	**23.4**	**15.4**	**70.2**	**55.1**	**53.1**
Mercury	SW7471B	**0.301 J**	**0.336 J**	**0.0568 J**	**0.502 J**	**0.359**	**0.305**
Zinc	SW6020A	**105**	**51**	**60.9**	**183**	**114**	**112**
Semivolatile Organics (µg/kg)							
2,4-Dimethylphenol	SW8270DSIM	**4.8 J**	**5.5 J**	**1.3 J**	**5.9 J**	20 U	**3 J**
2-Methylphenol (o-Cresol)	SW8270DSIM	**8.7**	**12.1**	**2.6 J**	**8.5**	**4.3 J**	5 U
4-Methylphenol (p-Cresol)	SW8270DSIM	**153**	**578**	**10.4**	**143**	**40.7**	**31.5**
Pentachlorophenol	SW8270DSIM	**16 J**	**23.2 J**	**4 J**	**26.3 J**	**30.6 J**	**6.8 J**
Phenol	SW8270DSIM	**28.4**	**58.4**	**30.9**	**35.1**	**16.8**	**15**
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270D	**2.3262**	**3.874**	**1.7717**	**1.6827**	**1.1447**	**0.7511 J**
Acenaphthene	SW8270D	1.5936 U	**2.3599**	**0.7323 J**	**1.1346**	**0.6754 J**	**0.2933 J**
Acenaphthylene	SW8270D	**0.9412 J**	**2.885**	0.874 U	**1.1803**	**0.4649 J**	**0.3067 J**
Anthracene	SW8270D	**1.8021**	**4.121**	**1.9213**	**4.255**	**2.4605**	**1.8044**
Benzo(a)anthracene	SW8270D	**3.754**	**4.341**	**4.2677**	**8.558**	**5.439**	**3.4178**
Benzo(a)pyrene	SW8270D	**3.1979**	**2.995**	**4.252**	**8.077**	**4.0395**	**2.68**
Benzo(g,h,i)perylene	SW8270D	**2.5508**	**1.6978**	**2.3307**	**2.837**	**1.8991**	**1.2711**
Chrysene	SW8270D	**5.455**	**6.786**	**5.7559**	**14.351**	**7.939**	**5.911**
Dibenzo(a,h)anthracene	SW8270DSIM	**0.6096**	**0.3654**	**0.8504**	**1.0048**	**0.7193**	**0.44**
Fluoranthene	SW8270D	**12.086**	**20.742**	**12.362 J**	**19.063**	**13.333**	**6.667**
Fluorene	SW8270D	**1.5508 J**	**2.5989**	**0.8346 J**	**1.5601**	**1.4956**	**0.7156 J**
Indeno(1,2,3-c,d)pyrene	SW8270D	**1.9412**	**1.2418**	**2.4173**	**2.861**	**2.0132**	**0.8222 J**
Naphthalene	SW8270D	**4.9626**	**27.473**	**1.9213**	**3.87**	**0.8684 J**	**0.7156 J**
Phenanthrene	SW8270D	**5.775**	**13.681**	**4.3465**	**7.5**	**5.833**	**2.24**
Pyrene	SW8270D	**10.588**	**23.187**	**9.685 J**	**25.24**	**11.535**	**5.556**
Total Benzofluoranthenes (b,j,k) (U = 0)		**8.075**	**6.484**	**8.504**	**24.014**	**9.561**	**6.444**
Total HPAH (SMS) (U = 0)		**48.2567**	**67.8379**	**50.4252 J**	**106.0048**	**56.4781**	**33.2089 J**
Total LPAH (SMS) (U = 0)		**15.0321 J**	**53.1181**	**9.7559 J**	**19.5**	**11.7982 J**	**6.0756 J**

Table 2
Surface Sediment Analytical Results

		WWY3_Compliance WW-MNR-08 WW-MNR-08-SS-190827 8/27/2019 0 - 12 cm N SE 1239015.65 639146.73	WWY3_Compliance WW-MNR-09 WW-MNR-09-SS-190827 8/27/2019 0 - 12 cm N SE 1240189.2 640237.84	WWY3_Compliance WW-MNR-10 WW-MNR-10-SS-190827 8/27/2019 0 - 12 cm N SE 1241831.21 643446.12	WWY3_Compliance WW-MNR-11 WW-MNR-11-SS-190827 8/27/2019 0 - 12 cm N SE 1241959.22 643289.54	WWY3_Compliance WW-P1CM-01 WW-P1CM-01-SS-190828 8/28/2019 0 - 12 cm N SE 1239682.53 641221.06	WWY3_Compliance WW-P1CM-02 WW-P1CM-02-SS-190828 8/28/2019 0 - 12 cm N SE 1239870.73 641386.3
Polycyclic Aromatic Hydrocarbons (μg/kg)							
2-Methylnaphthalene	SW8270D	**43.5**	**141**	**22.5**	**70**	**26.1**	**16.9 J**
Acenaphthene	SW8270D	29.8 U	**85.9**	**9.3 J**	**47.2**	**15.4 J**	**6.6 J**
Acenaphthylene	SW8270D	**17.6 J**	**105**	11.1 U	**49.1**	**10.6 J**	**6.9 J**
Anthracene	SW8270D	**33.7**	**150**	**24.4**	**177**	**56.1**	**40.6**
Benzo(a)anthracene	SW8270D	**70.2**	**158**	**54.2**	**356**	**124**	**76.9**
Benzo(a)pyrene	SW8270D	**59.8**	**109**	**54**	**336**	**92.1**	**60.3**
Benzo(b,j,k)fluoranthenes	SW8270D	**151**	**236**	**108**	**999**	**218**	**145**
Benzo(g,h,i)perylene	SW8270D	**47.7**	**61.8**	**29.6**	**118**	**43.3**	**28.6**
Chrysene	SW8270D	**102**	**247**	**73.1**	**597**	**181**	**133**
Dibenzo(a,h)anthracene	SW8270DSIM	**11.4**	**13.3**	**10.8**	**41.8**	**16.4**	**9.9**
Fluoranthene	SW8270D	**226**	**755**	**157 J**	**793**	**304**	**150**
Fluorene	SW8270D	**29 J**	**94.6**	**10.6 J**	**64.9**	**34.1**	**16.1 J**
Indeno(1,2,3-c,d)pyrene	SW8270D	**36.3**	**45.2**	**30.7**	**119**	**45.9**	**18.5 J**
Naphthalene	SW8270D	**92.8**	**1000**	**24.4**	**161**	**19.8 J**	**16.1 J**
Phenanthrene	SW8270D	**108**	**498**	**55.2**	**312**	**133**	**50.4**
Pyrene	SW8270D	**198**	**844**	**123 J**	**1050**	**263**	**125**
Total Benzofluoranthenes (b,j,k) (U = 0)		**151**	**236**	**108**	**999**	**218**	**145**
Total HPAH (SMS) (U = 0)		**902.4**	**2,469.30**	**640.4 J**	**4,409.80**	**1,287.70**	**747.2 J**
Total LPAH (SMS) (U = 0)		**281.1 J**	**1,933.50**	**123.9 J**	**811.2**	**269 J**	**136.7 J**
Dioxin Furans (ng/kg)							
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	--	**0.388 J EMPC**	**0.929 J**	**1.02 EMPC**	--	**0.542 J EMPC**
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	--	**1.94**	**8.53**	**8.37**	--	**1.9**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	--	**3.12**	**5.08**	**13.6 J**	--	**4.05**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	--	**16.4**	**12.7**	**68**	--	**14.4**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	--	**5.96**	**10.8**	**36.3**	--	**7.53**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	--	**493**	**325**	**1,860**	--	**518**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B	--	**4,310 J**	**2,760**	**17,300**	--	**5110 J**
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	--	**44.4**	**40.4**	**139**	--	**132**
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	--	**47.6**	**49.3**	**147**	--	**114**
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	--	**136**	**132**	**646**	--	**268**
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	--	**1,010**	**693**	**4,300**	--	**1160**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B	--	**2.58**	**2.75 J**	**5.32**	--	**3.82**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	--	**1.28 EMPC**	**1.18**	**3.32 J**	--	**1.38 EMPC**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	--	**1.32**	**1.36**	**2.75**	--	**1.14**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	--	**5.53**	**3.77**	**12.2**	--	**4.18**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	--	**1.88**	**2.36**	**6.63**	--	**1.62**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B	--	**1.79**	**1.23**	**3.73 J**	--	**1.49**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	--	**1.69**	**3.72**	**5.64 J**	--	**1.14**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B	--	**77.3**	**60.8**	**224 J**	--	**59.5**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B	--	**4.49**	**3.1**	**11.9 J**	--	**3.87**
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B	--	**258**	**156**	**735**	--	**223**
Total Tetrachlorodibenzofuran (TCDF)	E1613B	--	**22.3**	**16.5**	**37.4**	--	**16.3**
Total Pentachlorodibenzofuran (PeCDF)	E1613B		**20.3**	**35.3**	**72.9**	--	**15.6**
Total Hexachlorodibenzofuran (HxCDF)	E1613B	--	**125**	**86.5**	**325**	--	**82.5**
Total Heptachlorodibenzofuran (HpCDF)	E1613B	--	**301**	**173**	**745**	--	**223**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC = U)		--	**13.563 J EMPC**	**18.907 J**	**51.32 J EMPC**	--	**13.77 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC = U)		--	**13.349 J EMPC**	**18.907 J**	**50.81 J EMPC**	--	**13.479 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC included)		--	**13.776 J EMPC**	**18.907 J**	**51.83 J EMPC**	--	**14.062 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC included)		--	**13.776 J EMPC**	**18.907 J**	**51.83 J EMPC**	--	**14.062 J EMPC**

Table 2
Surface Sediment Analytical Results

		WWY3_Compliance WW-P1CM-03 WW-P1CM-03-SS-190827 8/27/2019 0 - 12 cm N SE 1240532.800 641249.100	WWY3_Compliance WW-P1CM-04 WW-P1CM-04-SS-190827 8/27/2019 0 - 12 cm N SE 1240693.400 641391.500	WWY3_Compliance WW-P1CM-05 WW-P1CM-05-SS-190827 8/27/2019 0 - 12 cm N SE 1240810.46 641873.52	WWY3_Compliance WW-P1CM-07 WW-P1CM-07-SS-190828 8/28/2019 0 - 9 cm N SE 1241335.79 642997.93	WWY3_Compliance WW-P1CM-08 WW-P1CM-08-SS-190828 8/28/2019 0 - 12 cm N SE 1241154.78 642780.37	WWY3_Compliance WW-P1CM-09 WW-P1CM-09-SS-190827 8/27/2019 0 - 12 cm N SE 1241709.32 643042.36
Conventional Parameters (pct)							
Total organic carbon	Plumb 1981	**2.44**	**1.33**	**0.94**	**3.18**	**4.22**	**4.36**
Total Solids	SM2540G	**40.07**	**63.31**	**61.4**	**35.9**	**27.86**	**35.34**
Grain Size (pct)							
Gravel	PSEP-PS	--	**2.61**	**0.18**	--	**0.5**	**0.12**
Sand, very coarse	PSEP-PS	--	**3**	**0.96**	--	**4.4**	**0.56**
Sand, coarse	PSEP-PS	--	**3.46**	**6.97**	--	**2.02**	**5.09**
Sand, medium	PSEP-PS	--	**11.11**	**41.22**	--	**2.02**	**4.13**
Sand, fine	PSEP-PS	--	**16.88**	**16.91**	--	**2.28**	**4.68**
Sand, very fine	PSEP-PS	--	**8.08**	**1.6**	--	**3.9**	**8.31**
Silt, coarse	PSEP-PS	--	**26.57**	**2.6**	--	**3.88**	**5.2**
Silt, medium	PSEP-PS	--	**9.65**	**6.35**	--	**12.33**	**19.12**
Silt, fine	PSEP-PS	--	**6.33**	**5.02**	--	**20.09**	**20.02**
Silt, very fine	PSEP-PS	--	**3.15**	**4.63**	--	**12.23**	**8.24**
Clay, coarse	PSEP-PS	--	**2.01**	**3.48**	--	**8.72**	**4.95**
Clay, medium	PSEP-PS	--	**0.82**	**1.15**	--	**4.19**	**2.04**
Clay, fine	PSEP-PS	--	**6.33**	**8.92**	--	**23.45**	**17.54**
Metals (mg/kg)							
Copper	SW6020A	**47.9**	**28.3**	**26.3**	**67**	**99.5**	**70.5**
Mercury	SW7471B	**0.365**	**1.17**[3]	**0.474**	**0.345**	**0.895**	**0.387**
Zinc	SW6020A	**106**	**67.1**	**66.4**	**143**	**186**	**173**
Semivolatile Organics (µg/kg)							
2,4-Dimethylphenol	SW8270DSIM	20 U	20 U	19.9 U	**2.6 J**	**4.2 J**	**3 J**
2-Methylphenol (o-Cresol)	SW8270DSIM	**3.4 J**	**2.6 J**	**2.8 J**	**5.2**	**5.6**	**4.7 J**
4-Methylphenol (p-Cresol)	SW8270DSIM	**24**	**10.1**	**15.1**	**66**	**58**	**73.9**
Pentachlorophenol	SW8270DSIM	**7 J**	**3.1 J**	**5.1 J**	**18.4 J**	**46.2 J**	**17.2 J**
Phenol	SW8270DSIM	**11.9**	**7.8**	**7.6**	**25.7**	**21.2**	**21.7**
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)							
2-Methylnaphthalene	SW8270D	**0.6311 J**	**1.3383 J**	**1.4468 J**	**0.7925**	**0.7773**	**0.6514**
Acenaphthene	SW8270D	**0.3197 J**	**0.5263 J**	**0.8511 J**	**0.7013**	**1.0782**	**0.7225**
Acenaphthylene	SW8270D	**0.3402 J**	1.5038 U	**1.3617 J**	**0.5252 J**	**0.8886**	**0.6032**
Anthracene	SW8270D	**1.123**	**1.2105 J**	**3.9894**	**1.5692**	**5.782**	**2.2041**
Benzo(a)anthracene	SW8270D	**2.541**	**2.2331**	**10.5532**	**4.371**	**17.725**	**5.344**
Benzo(a)pyrene	SW8270D	**2.3197**	**1.7218**	**9.117**	**3.994**	**9.005**	**4.748**
Benzo(g,h,i)perylene	SW8270D	**1.7213**	**0.5639 J**	**2.8085**	**2.3899**	**2.417**	**2.2431**
Chrysene	SW8270D	**5.533**	**3.7293**	**17.66**	**7.484**	**21.967**	**7.5**
Dibenzo(a,h)anthracene	SW8270DSIM	**0.4631**	**0.3158 J**	**1.5957**	**0.6415**	**1.2109**	**9.22**
Fluoranthene	SW8270D	**8.648**	**9.925**	**21.702**	**12.83**	**84.834**	**13.876**
Fluorene	SW8270D	**0.623 J**	**1.0827 J**	**1.5638 J**	**0.9843**	**1.3768**	**0.9702**
Indeno(1,2,3-c,d)pyrene	SW8270D	**1.4672**	1.5038 U	**4.9149**	**2.2075**	**2.725**	**1.8349**
Naphthalene	SW8270D	**0.5533 J**	**0.9925 J**	**1.6064 J**	**1.4214**	**1.6232**	**1.383**
Phenanthrene	SW8270D	**2.4631**	**3.2782**	**5.7447**	**3.491**	**4.526**	**4.243**
Pyrene	SW8270D	**6.27**	**7.3233**	**24.149**	**11.541**	**41.469**	**12.362**
Total Benzofluoranthenes (b,j,k) (U = 0)		**6.557**	**5.5188**	**26.702**	**12.358**	**22.346**	**12.89**
Total HPAH (SMS) (U = 0)		**35.5205**	**31.3308 J**	**119.2021**	**57.8176**	**203.6991**	**70.0183**
Total LPAH (SMS) (U = 0)		**5.4221 J**	**7.0902 J**	**15.117 J**	**8.6918 J**	**15.2749**	**10.1261**

Table 2
Surface Sediment Analytical Results

		WWY3_Compliance WW-P1CM-03 WW-P1CM-03-SS-190827 8/27/2019 0 - 12 cm N SE 1240532.800 641249.100	WWY3_Compliance WW-P1CM-04 WW-P1CM-04-SS-190827 8/27/2019 0 - 12 cm N SE 1240693.400 641391.500	WWY3_Compliance WW-P1CM-05 WW-P1CM-05-SS-190827 8/27/2019 0 - 12 cm N SE 1240810.46 641873.52	WWY3_Compliance WW-P1CM-07 WW-P1CM-07-SS-190828 8/28/2019 0 - 9 cm N SE 1241335.79 642997.93	WWY3_Compliance WW-P1CM-08 WW-P1CM-08-SS-190828 8/28/2019 0 - 12 cm N SE 1241154.78 642780.37	WWY3_Compliance WW-P1CM-09 WW-P1CM-09-SS-190827 8/27/2019 0 - 12 cm N SE 1241709.32 643042.36
Polycyclic Aromatic Hydrocarbons (µg/kg)							
2-Methylnaphthalene	SW8270D	**15.4 J**	**17.8 J**	**13.6 J**	**25.2**	**32.8**	**28.4**
Acenaphthene	SW8270D	**7.8 J**	**7 J**	**8 J**	**22.3**	**45.5**	**31.5**
Acenaphthylene	SW8270D	**8.3 J**	20 U	**12.8 J**	**16.7 J**	**37.5**	**26.3**
Anthracene	SW8270D	**27.4**	**16.1 J**	**37.5**	**49.9**	**244**	**96.1**
Benzo(a)anthracene	SW8270D	**62**	**29.7**	**99.2**	**139**	**748**	**233**
Benzo(a)pyrene	SW8270D	**56.6**	**22.9**	**85.7**	**127**	**380**	**207**
Benzo(b,j,k)fluoranthenes	SW8270D	**160**	**73.4**	**251**	**393**	**943**	**562**
Benzo(g,h,i)perylene	SW8270D	**42**	**7.5 J**	**26.4**	**76**	**102**	**97.8**
Chrysene	SW8270D	**135**	**49.6**	**166**	**238**	**927**	**327**
Dibenzo(a,h)anthracene	SW8270DSIM	**11.3**	**4.2 J**	**15**	**20.4**	**51.1**	**402**
Fluoranthene	SW8270D	**211**	**132**	**204**	**408**	**3,580**	**605**
Fluorene	SW8270D	**15.2 J**	**14.4 J**	**14.7 J**	**31.3**	**58.1**	**42.3**
Indeno(1,2,3-c,d)pyrene	SW8270D	**35.8**	20 U	**46.2**	**70.2**	**115**	**80**
Naphthalene	SW8270D	**13.5 J**	**13.2 J**	**15.1 J**	**45.2**	**68.5**	**60.3**
Phenanthrene	SW8270D	**60.1**	**43.6**	**54**	**111**	**191**	**185**
Pyrene	SW8270D	**153**	**97.4**	**227**	**367**	**1750**	**539**
Total Benzofluoranthenes (b,j,k) (U = 0)		**160**	**73.4**	**251**	**393**	**943**	**562**
Total HPAH (SMS) (U = 0)		**866.7**	**416.7 J**	**1,120.50**	**1,838.60**	**8,596.10**	**3,052.80**
Total LPAH (SMS) (U = 0)		**132.3 J**	**94.3 J**	**142.1 J**	**276.4 J**	**644.6**	**441.5**
Dioxin Furans (ng/kg)							
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	--	0.143 U	--	--	**0.708 J EMPC**	**1.07**
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	--	**1.05**	--	--	**5.06**	**7.54**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	--	**1.86**	--	--	**8.95**	**13.2**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	--	**6.81**	--	--	**28.6**	**41.2**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	--	**3.57**	--	--	**18.9**	**26.9**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	--	**199**	--	--	**860**	**1240**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B	--	**1710**	--	--	**7,530 J**	**10,100 J**
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	--	**12.6**	--	--	**174**	**212**
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	--	**14.1**	--	--	**136**	**147**
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	--	**63.6**	--	--	**392**	**518**
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	--	**466**	--	--	**1,750**	**2,530**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B	--	**1.49**	--	--	**5.14 J**	**5.34**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	--	**1.78 EMPC**	--	--	**2.17**	**2.83 EMPC**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	--	**0.745 J**	--	--	**1.85 EMPC**	**2.4 EMPC**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	--	**3.89**	--	--	**6.68**	**8.73**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	--	**1.46**	--	--	**3.84**	**5.07**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B	--	**1.01**	--	--	**1.95 J**	**2.84**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	--	**1.5**	--	--	**3.29 EMPC**	**7.99**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B	--	**25.4**	--	--	**130**	**177**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B	--	**1.98**	--	--	**7.24**	**9.68**
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B	--	**62.9**	--	--	**425**	**613**
Total Tetrachlorodibenzofuran (TCDF)	E1613B	--	**3.72**	--	--	**29.9**	**40.7**
Total Pentachlorodibenzofuran (PeCDF)	E1613B	--	**8.53**	--	--	**38.9**	**53**
Total Hexachlorodibenzofuran (HxCDF)	E1613B	--	**41.2**	--	--	**172**	**243**
Total Heptachlorodibenzofuran (HpCDF)	E1613B	--	**80.3**	--	--	**414**	**566**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC = U)		--	**6.326 J EMPC**	--	--	**25.686 J EMPC**	**37.62 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC = U)		--	**6.228 J EMPC**	--	--	**24.89 J EMPC**	**37.22 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC included)		--	**6.353 J EMPC**	--	--	**26.482 J EMPC**	**38.02 J EMPC**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC included)		--	**6.282 J EMPC**	--	--	**26.482 J EMPC**	**38.02 J EMPC**

Table 2
Surface Sediment Analytical Results

		WWY3_Compliance WW-P1CM-10 WW-P1CM-10-SS-190827 8/27/2019 0 - 12 cm N SE 1241581.44 643184.7	WWY3_Compliance WW-P1CM-11-A WW-P1CM-11-SS-0-12-190828 8/28/2019 0 - 12 cm N SE 1240832.28 642741.24	WWY3_Compliance WW-P1CM-11-B WW-P1CM-11-SS-0-2-190828 8/28/2019 0 - 2 cm N SE 1240829.64 642740.01
Conventional Parameters (pct)				
Total organic carbon	Plumb 1981	**5.53**	**1.24**	**1.99**
Total Solids	SM2540G	**35.73**	**60.83**	**49.67**
Grain Size (pct)				
Gravel	PSEP-PS	--	--	--
Sand, very coarse	PSEP-PS	--	--	--
Sand, coarse	PSEP-PS	--	--	--
Sand, medium	PSEP-PS	--	--	--
Sand, fine	PSEP-PS	--	--	--
Sand, very fine	PSEP-PS	--	--	--
Silt, coarse	PSEP-PS	--	--	--
Silt, medium	PSEP-PS	--	--	--
Silt, fine	PSEP-PS	--	--	--
Silt, very fine	PSEP-PS	--	--	--
Clay, coarse	PSEP-PS	--	--	--
Clay, medium	PSEP-PS	--	--	--
Clay, fine	PSEP-PS	--	--	--
Metals (mg/kg)				
Copper	SW6020A	**66.4**	**44.6**	**58.7**
Mercury	SW7471B	**0.305**	**0.174**	**0.275**
Zinc	SW6020A	**172**	**97**	**120**
Semivolatile Organics (µg/kg)				
2,4-Dimethylphenol	SW8270DSIM	**2.2 J**	20 U	20 U
2-Methylphenol (o-Cresol)	SW8270DSIM	**5.1**	**2.9 J**	**3.4 J**
4-Methylphenol (p-Cresol)	SW8270DSIM	**54**	**50.1**	**38.9**
Pentachlorophenol	SW8270DSIM	**22.6 J**	**5.9 J**	**10.5 J**
Phenol	SW8270DSIM	**29.6**	**18.9**	**13.8**
Polycyclic Aromatic Hydrocarbons (mg/kg-OC)				
2-Methylnaphthalene	SW8270D	**0.4665**	**1.629**	**1.4874**
Acenaphthene	SW8270D	**0.3996**	**0.8629 J**	**0.8241 J**
Acenaphthylene	SW8270D	**0.3309 J**	**0.6371 J**	**0.995 J**
Anthracene	SW8270D	**1.826**	**2.0887**	**2.6382**
Benzo(a)anthracene	SW8270D	**3.816**	**4.7661**	**4.9648**
Benzo(a)pyrene	SW8270D	**3.291**	**4.5081**	**5.578**
Benzo(g,h,i)perylene	SW8270D	**1.3761**	**2.3306**	**2.6281**
Chrysene	SW8270D	**7.125**	**7.2661**	**8.141**
Dibenzo(a,h)anthracene	SW8270DSIM	**0.519**	**0.6532**	**0.7337**
Fluoranthene	SW8270D	**9.892**	**12.661**	**13.216**
Fluorene	SW8270D	**0.698**	**1.2339 J**	**1.2211**
Indeno(1,2,3-c,d)pyrene	SW8270D	**1.3273**	**2.1774**	**2.1709**
Naphthalene	SW8270D	**0.7324**	**2.3065**	**3.3668**
Phenanthrene	SW8270D	**3.526**	**5.1532**	**5.779**
Pyrene	SW8270D	**8.626**	**13.387**	**15.075**
Total Benzofluoranthenes (b,j,k) (U = 0)		**9.042**	**12.097**	**13.719**
Total HPAH (SMS) (U = 0)		**45.0127**	**59.8468**	**66.2261**
Total LPAH (SMS) (U = 0)		**7.5136 J**	**12.2823 J**	**14.8241 J**

Table 2
Surface Sediment Analytical Results

		WWY3_Compliance WW-P1CM-10 WW-P1CM-10-SS-190827 8/27/2019 0 - 12 cm N SE 1241581.44 643184.7	WWY3_Compliance WW-P1CM-11-A WW-P1CM-11-SS-0-12-190828 8/28/2019 0 - 12 cm N SE 1240832.28 642741.24	WWY3_Compliance WW-P1CM-11-B WW-P1CM-11-SS-0-2-190828 8/28/2019 0 - 2 cm N SE 1240829.64 642740.01
Polycyclic Aromatic Hydrocarbons (µg/kg)				
2-Methylnaphthalene	SW8270D	25.8	20.2	29.6
Acenaphthene	SW8270D	22.1	10.7 J	16.4 J
Acenaphthylene	SW8270D	18.3 J	7.9 J	19.8 J
Anthracene	SW8270D	101	25.9	52.5
Benzo(a)anthracene	SW8270D	211	59.1	98.8
Benzo(a)pyrene	SW8270D	182	55.9	111
Benzo(b,j,k)fluoranthenes	SW8270D	500	150	273
Benzo(g,h,i)perylene	SW8270D	76.1	28.9	52.3
Chrysene	SW8270D	394	90.1	162
Dibenzo(a,h)anthracene	SW8270DSIM	28.7	8.1	14.6
Fluoranthene	SW8270D	547	157	263
Fluorene	SW8270D	38.6	15.3 J	24.3
Indeno(1,2,3-c,d)pyrene	SW8270D	73.4	27	43.2
Naphthalene	SW8270D	40.5	28.6	67
Phenanthrene	SW8270D	195	63.9	115
Pyrene	SW8270D	477	166	300
Total Benzofluoranthenes (b,j,k) (U = 0)		500	150	273
Total HPAH (SMS) (U = 0)		2,489.20	742.1	1317.9
Total LPAH (SMS) (U = 0)		415.5 J	152.3 J	295 J
Dioxin Furans (ng/kg)				
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	1.14	0.461 J EMPC	0.735 J EMPC
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	8.11	2.37 EMPC	4.83
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	12.8	4.38	8.85
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	40.7	13.2	29.2
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	28.3	8.62	19.6
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	1210	390	793
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B	10,800 J	3,250	6,330 J
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	116	53.4	69
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	143	42.6	82.5
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	451	142	270
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	2,520	732	1,480
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B	5.08	1.62	2.56
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	3.39	0.966 J	1.62 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	3.19	0.887 J EMPC	1.48
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	11.3	4.06	7.15
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	6.93	2.01	4.62
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B	2.75	1.3	1.81
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	5.66	1.53	4.45
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B	208	62.3	148
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B	10.3	3.5	6.99
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B	592	170	356
Total Tetrachlorodibenzofuran (TCDF)	E1613B	37.1	9.83	17.6
Total Pentachlorodibenzofuran (PeCDF)	E1613B	89.8	14.4	37.6
Total Hexachlorodibenzofuran (HxCDF)	E1613B	266	86.6	197
Total Heptachlorodibenzofuran (HpCDF)	E1613B	589	193	421
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC = U)		39.36 J	10.834 J EMPC	25 J EMPC
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC = U)		39.36 J	9.285 J EMPC	24.632 J EMPC
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2) (EMPC included)		39.36 J	12.382 J EMPC	25.367 J EMPC
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0) (EMPC included)		39.36 J	12.382 J EMPC	25.367 J EMPC

Table 2
Surface Sediment Analytical Results

Notes:

TOC in range (0.5% - 3.5%)

Detected concentration is greater than SMS_Marine_SCO_SCUMII screening level

Detected concentration is greater than SMS_Marine_CSL_SCUMII screening level

TOC out of range

Detected concentration is greater than AET_Marine_SCO_SCUMII screening level

Detected concentration is greater than AET_Marine_CSL_SCUMII screening level

Exceeds other/site-specific screening level, independent of total organic carbon concentration

Bold: detected result

1. Site-specific bioaccumulation screening level (1.2 mg mercury/kg dry weight) for mercury in the Whatcom Waterway Site
2. Value is based on assessment of anti-degradation provisions based on final data report documenting regional background concentration of dioxin/furans in Bellingham Bay (Ecology 2015).
3. Sample analyzed twice for mercury. Average result presented.

--: not applicable
CD: Consent Decree
cm: centimeter
CSL: Cleanup Screening Level
EDR: Engineering Design Report
EMPC: estimated maximum possible concentration
HPAH: high-molecular-weight polycyclic aromatic hydrocarbon
J: estimated value
kg: kilogram
LPAH: low-molecular-weight polycyclic aromatic hydrocarbon
µg: microgram
mg: milligram
N: normal sample
ng: nanogram
OC: organic carbon
pct: percent
SCO: Sediment Cleanup Objective
SE: sediment
SMS: Sediment Management Standards
SQS: Sediment Quality Standards
TEQ: toxic equivalency
U: compound analyzed but not detected above detection limit
UJ: compound analyzed but not detected above estimated detection limit

Table 3
Summary of Consent Decree Biological Effects Criteria

Biological Test Endpoint	Performance Standard		Sediment Quality Standard[3]	Minimum Cleanup Level[3]
	Control[1]	Reference[2]		
Ampelisca abdita				
10-day mortality	M_C < 10%	M_R < 25%	$M_T - M_C$ > 25% and M_T vs. M_R SD (p = 0.05)	$M_T - M_C$ > 30% and M_T vs. M_R SD (p = 0.05)
Neanthes arenaceodentata				
20-day growth and mortality	M_C < 10% and MIG_F > 0.72 mg/individual·day	MIG_R/MIG_C > 0.80	MIG_T/MIG_R < 0.85 and MIG_T/MIG_R SD (p = 0.05)	MIG_T/MIG_R < 0.50 and MIG_T/MIG_R SD (p = 0.05)
Mytilus galloprovencialis				
Larval Development	N_C /I > 0.70	$N_R/N_C \geq 0.65$	N_T/N_R < 0.85 and N_T vs. N_R SD (p = 0.10)	N_T/N_R < 0.70 and N_T vs. N_R SD (p = 0.10)

Notes:

Source: Ecology 2015

1. Laboratory control

2. Collected reference samples

3. Performance standards as articulated at the time of the Consent Decree. These values are consistent with the current sediment cleanup objective/sediment quality standards and cleanup screen level/minimum cleanup level values contained in SCUM II (Ecology 2017).

C: control

F: final

I: stocking density

M: mortality

mg: milligram

MIG: mean individual growth at time final

N:

R: reference

SD: significant difference

T: test

Table 4
Summary of Bioassay Testing Results

Sample ID	Applicable Reference	*Ampelisca abdita* 10-Day Mortality (%)		*Neanthes arenaceodentata* 20-Day Growth (mg/individual/day)[1]		*Mytilus galloprovencialis* Mean Normal Survival[2,3] (%)	
Seawater Control	--	--	--	--	--	234.4	Pass QA
Sediment Control	--	7	Pass QA	0.480	Pass QA	204.2	Pass QA
Reference CR20 (32% fines)	--	4	Pass QA	0.952	Pass QA	205.0	Pass QA
Reference CARR20 (47% fines)	--	4	Pass QA	0.917	Pass QA	208.8	Pass QA
Reference CR022 (80% fines)	--	11	Pass QA	1.177	Pass QA	160.6	Pass QA
WW-MNR-06-SS-190828	CARR20	12	Pass SQS	0.461	Pass SQS	212.8	Pass SQS
WW-MNR-07-SS-190828	CR022	13	Pass SQS	0.536	Pass SQS	209.4	Pass SQS
WW-MNR-11-SS-190829	CR022	7	Pass SQS	0.474	Pass SQS	183.4	Pass SQS
WW-P1CM-04-SS-190827	CARR20	5	Pass SQS	0.551	Pass SQS	218.2	Pass SQS
WW-P1CM-05-SS-190827	CR20	10	Pass SQS	0.547	Pass SQS	219.4	Pass SQS
WW-P1CM-08-SS-190828	CR022	2	Pass SQS[4]	0.412	Pass SQS	201.0	Pass SQS
WW-P1CM-09-SS-190828	CARR20	12	Pass SQS	0.453	Pass SQS	168.0	Pass SQS

Notes:

Bioassay results were screened using SQS and MCUL criteria as defined in the Consent Decree and Table 2.

A summary of bioassay results, including all supporting laboratory reports and a QA summary, is included in Appendix E.

1. Growth as measured by ash-free dry weight. See bioassay laboratory report for full details.
2. Compared to Sediment Control
3. All mean sample survivals are not significantly different than Sediment Control mean survivals (p = 0.10)
4. Initial test results failed SCO criteria (Treatment Mean Mortality >25% and statistically different from reference). The 10-day mortality test was repeated due to suspected interference with mortality counts from native polychaetes observed in the treatment chambers. The sample was sieved prior to retest to remove native polychaete worms.

-- : not applicable
MCUL: minimum cleanup level
mg: milligram
QA: quality assurance
SCO: Sediment Cleanup Objective
SQS: Sediment Quality Standards

Table 5
Adult Crab Tissue Monitoring Data

Station ID	Sample ID	Number of Individuals in Composite	Mean Carapace Length (cm)	Mean Organism Weight (g)	Mercury (mg/kg ww)
Whatcom Waterway Site Areas					
MNR-03	WW-MNR-03-CM-COMP1-190830	5	16.2	699.6	0.069
	WW-MNR-03-CM-COMP2-191830				0.075
MNR-04	WW-MNR-04-CM-COMP1-191830	5	16.4	686.0	0.053
	WW-MNR-04-CM-COMP2-191830				0.052
MNR-07	WW-MNR-07-CM-COMP1-191830	4	16.6	747.8	0.042
	WW-MNR-07-CM-COMP2-191830				0.040
	Site Area Mean	**4.7**	**16.4**	**711.1**	**0.055**
Samish Bay Reference Areas					
REF-01	WW-REF-01-CM-COMP1-191830	5	15.9	698.2	0.045
	WW-REF-01-CM-COMP2-191830				0.048
	WW-REF-01-CM-COMP3-191830				0.049
REF-05	WW-REF-05-CM-COMP1-191830	5	15.4	578.0	0.047
	WW-REF-05-CM-COMP2-191830				0.049
	WW-REF-05-CM-COMP3-191830				0.048
	Reference Area Mean	**5**	**15.6**	**638.1**	**0.048**

Notes:
cm: centimeter
g: gram
kg: kilogram
mg: milligram
ww: wet weight

Table 6
Mercury Concentration Trends in Adult Crab Tissue

Location	Whatcom Waterway Site Areas					Samish Bay Reference			
Sampling Year	**1991**	**1997**	**2016**	**2017**	**2019**	**1997**	**2016**	**2017**	**2019**
Adult Crab Mercury Tissue Concentration	0.160	0.100	0.070	0.054	0.0687	0.081	0.045	0.040	0.0449
	0.15	0.119	0.077	0.0477	0.0752	0.027	0.05	0.0386	0.0478
	--	0.211	0.075	0.064	0.0532	0.031	0.047	0.038	0.0493
	--	0.204	0.073	0.0602	0.0515	--	0.068	0.0539	0.0466
	--	0.100	0.098	0.067	0.0419	--	0.060	0.056	0.0488
	--	0.108	0.111	0.0711	0.0401	--	0.072	0.0527	0.0483
Summary Statistics									
Average Total Mercury (mg/kg ww)	0.155	0.140	0.084	0.061	0.055	0.046	0.057	0.046	0.048
Standard Deviation (mg/kg ww)	0.007	0.053	0.017	0.009	0.014	0.030	0.011	0.008	0.002
n per sampling event	2	6	6	6	6	3	6	6	6
Multi-Year Average (reference; mg/kg ww)	--					0.050			

Notes:
--: not applicable
kg: kilogram
mg: milligram
n: number
ww: wet weight

Table 7
Juvenile Crab Tissue Monitoring Data

Station ID	Sample ID	Number of Individuals in Composite	Mean Carapace Width (cm)	Mean Organism Weight (g)	Mercury (mg/kg ww) Initial Test Results	Mercury (mg/kg ww) Triggered and Rerun Test Results	Average Mercury Results (mg/kg ww)	Relative Percent Difference
Log Pond								
P1CM-12	P1CM-12-CM-COMP1-190917	2	8.75	111	0.016	--	0.016	--
	P1CM-12-CM-COMP2-190917				0.017	--	0.017	--
	P1CM-12-CM-COMP3-190917	3	6.3	44.7	0.015	--	0.015	--
	P1CM-12-CM-COMP4-190917				0.016	--	0.016	20%
	P1CM-12-CM-COMP5-190917				--	0.024	0.024	
Mean Log Pond		**2.5**	**7.5**	**77.8**	**0.016**	**0.024**	**0.018**	--
Reference Area								
REF-06	WW-REF-06-CM-COMP1-190913	3	9.0	96.7	0.011	0.018	0.014	22%
	WW-REF-06-CM-COMP2-190913				0.011	0.017	0.014	21%
	WW-REF-06-CM-COMP3-190913				--	0.013	0.016	17%
					--	0.018		
	WW-REF-06-CM-COMP4-190913	2	10.2	153.5	0.011	0.010	0.010	-2%
	WW-REF-06-CM-COMP5-190913				0.012	0.021	0.017	27%
Mean Reference Area		**2.5**	**9.6**	**125.1**	**0.011**	**0.016**	**0.014**	**14%**

Notes:
--: not applicable
cm: centimeter
g: gram
kg: kilogram
mg: milligram
MNR: monitored natural recovery
ww: wet weight

Table 8
Mercury Concentration Trends in Juvenile Crab Tissue

Location	Log Pond Construction Area						Lummi Island Reference			
Sampling Year	**2001**	**2002**	**2005**	**2016**	**2017**	**2019**	**2002**	**2016**	**2017**	**2019[1]**
Juvenile Crab Tissue Mercury Concentrations	0.015	0.010	0.038	0.032	0.028	0.016	0.037	0.024	0.018	0.014
	0.017	0.014	0.036	0.032	0.031	0.017	0.020	0.024	0.017	0.014
	0.017	0.015	0.035	0.031	0.024	0.015	--	0.023	0.016	0.016
	0.018	0.019	0.029	0.030	0.024	0.016	--	0.024	0.020	0.010
	0.021	0.022	0.028	0.030	0.017	0.024	--	0.023	0.018	0.017
	0.024	0.022	0.023	--	--	--	--	--	--	--
	0.024	0.023	0.023	--	--	--	--	--	--	--
	0.026	0.029	0.021	--	--	--	--	--	--	--
	0.049	0.029	0.019	--	--	--	--	--	--	--
Summary Statistics										
Average Total Mercury (mg/kg ww)	0.023	0.020	0.028	0.031	0.025	0.018	0.028	0.024	0.018	0.014
Standard Deviation (mg/kg ww)	0.010	0.006	0.007	0.001	0.006	0.004	0.012	0.001	0.002	0.002
n per sampling event	9	9	9	5	5	5	2	5	5	5
Multi-Year Average (reference; mg/kg ww)	--						0.020			

Notes:

1. Results values shown are average of initial and confirmatory testing of mercury concentrations in reference tissue samples.

--: not applicable

kg: kilogram

mg: milligram

n: number

ww: wet weight

Table 9
Mercury and Dioxin/Furan Concentrations in Flatfish Tissue

Location	Number of Individuals in Composite	Total Length of Individuals in Composite (cm)			Weight of Whole Fish Individuals in Composite (g)			Monitoring Parameters and Units		
									Total Dioxin/Furan TEQ 2005 (Mammal) (ng/kg)	
		Minimum	Maximum	Average	Minimum	Maximum	Average	Mercury (mg/kg ww)	(U = 0) (EMPC included)	(U = 1/2) (EMPC included)
Phase 1 MNR Areas										
WW-P1CM-COMP1-BF-190821	5	24	28	26.8	160	240	222	0.043	0.000	0.116
WW-P1CM-COMP2-BF-190821	5	26	34	29.8	240	500	362	0.041	0.000	0.143
WW-P1CM-COMP3-BF-190821	5	34	40	36.4	500	850	628	0.055	0.003	0.167
WW-P1CM-COMP5-BF-190821	5	38	39	38.6	660	740	724	0.093	0.000	0.152
WW-P1CM-COMP4-BF-190821	5	38	40	39.2	750	2,080	1,210	0.097	0.000	0.256
Summary Statistics										
Average for All Phase 1 MNR Area Individuals	**5.0**	**32**	**36**	**34**	**462**	**882**	**629**	**0.066**	**0.001**	**0.167**
Standard Deviation	--	6.6	5.2	5.6	256.9	709.7	381.9	0.027	0.001	0.053
Reference Areas										
WW-REF-COMP4-BF-190821	5	26	32	29.4	220	450	354.0	0.052	0.000	0.166
WW-REF-COMP5-BF-190821	4	29	33	30.5	300	560	400.0	0.084	0.032	0.194
WW-REF-COMP3-BF-190821	5	31	35	32.8	370	530	458.0	0.089	0.000	0.224
WW-REF-COMP2-BF-190821	5	35	38	36.8	570	860	692.0	0.044	0.005	0.209
WW-REF-COMP1-BF-190821	5	42	51	44.4	1,130	1,940	1,332.0	0.051	0.002	0.223
Summary Statistics										
Average for All Reference Area Individuals	**4.8**	**33**	**38**	**35**	**518**	**868**	**647**	**0.064**	**0.008**	**0.203**
Standard Deviation	--	6.2	7.7	6.1	365.9	619.1	404.3	0.021	0.014	0.024

Notes:
cm: centimeter
EMPC: estimated maximum possible concentration
g: gram
kg: kilogram
mg: milligram
MNR: monitored natural recovery
ng: nanogram
TEQ: toxic equivalency
ww: wet weight

Table 10
Mercury Concentration in Log Pond Porewater

	Location ID	WW-P1CM-03-PW_19	WW-P1CM-04-PW_19
	Sample ID	WW-P1CM-03-PW-190910	WW-P1CM-04-PW-1790910
	Sample Date	9/10/2019	9/10/2019
	Depth	6 - 12 cm	6 - 12 cm
Mercury (porewater) (µg/L)			
Dissolved Mercury	SW7470	0.012 J	0.019 J
Total Mercury (Qualitative Use Only) [1]	SW7470	0.319	0.776

Notes:

1. Porewater samples were collected using nylon mesh diffusion samplers. Total metals results for porewater analyzed by this technique are subject to a turbidity bias, and they are not equivalent to either groundwater samples collected from a groundwater monitoring well, or a groundwater seep analysis. Total metals results are valid for qualitative use only, after considering the turbidity bias. Porewater analysis should be based on quantitative use of the dissolved mercury data.

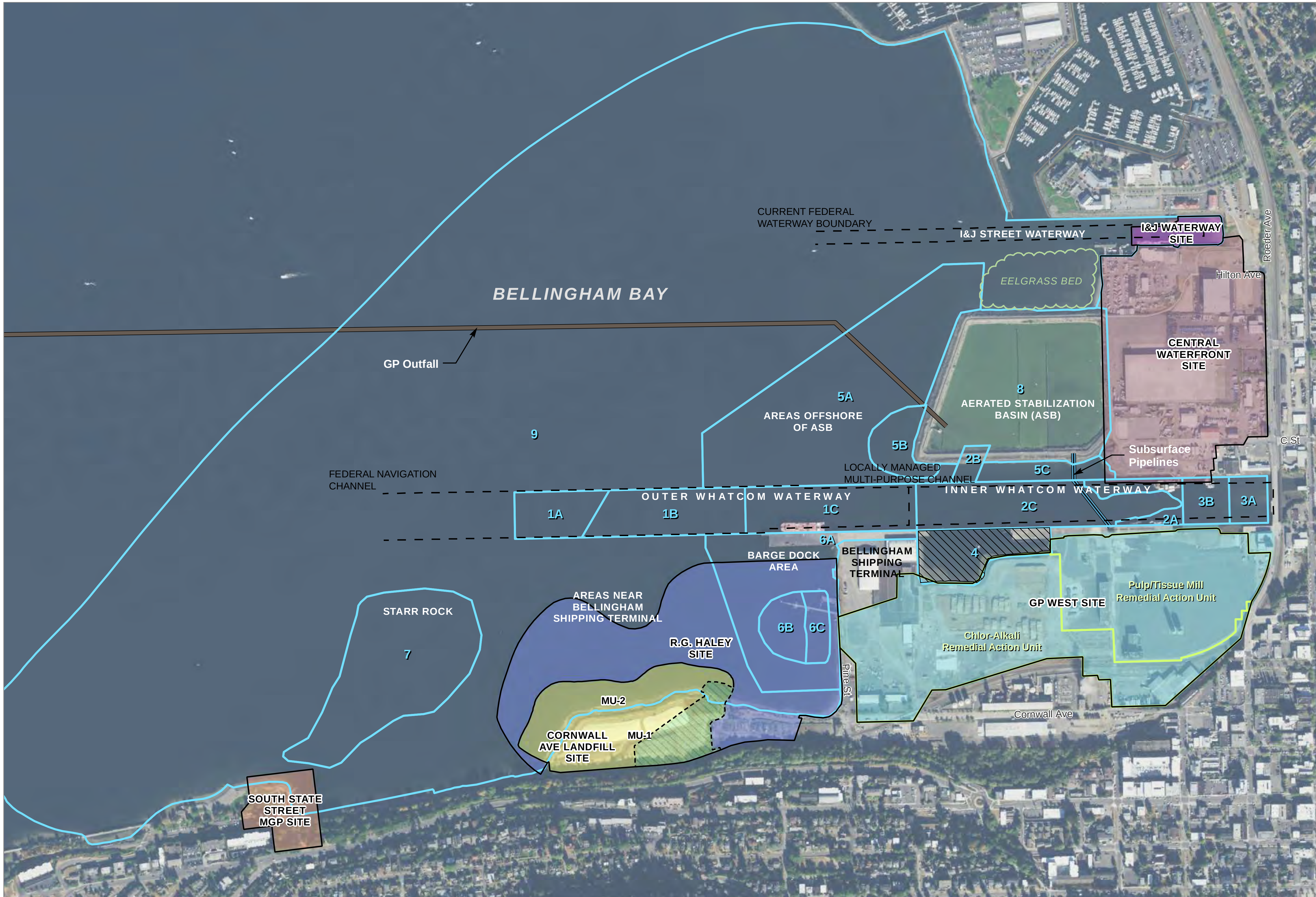
µg: microgram

cm: centimeter

J: estimated value

L: liter

Figures



LEGEND:

- Outfall
- Subsurface Pipeline
- Remedial Action Unit Boundaries
- Sediment Site Unit
- Adjacent Cleanup Site Area
- Previously Capped Area (Log Pond Interim Remedial Action)

NOTES:

1. Site units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Site, September 2007. Unit 9 boundary updated based on PRDI findings.
2. Horizontal datum: Washington State Plane North, NAD 83 Feet.
3. Unit 2B was established in the Cleanup Action Plan based on the anticipated marina access channel location. This location will be adjusted during final design.
4. Remedial Action Unit (RAU) boundaries were defined in the Final Cleanup Action Plan for the GP West Pulp and Tissue Remedial Action Unit (Aspect 2014).
5. Gray inset base map and aerial imagery from ESRI. Aerial imagery pre-dates the work completed and does not represent current conditions at the site.

Publish Date: 2020/06/19, 3:48 PM | User: epipkin
Filepath: Q:\Jobs\080007-01_Whatcom_Waterway\Maps\Year3Monitoring\AQ_Fig1_SiteMap.mxd

ANCHOR QEA

Figure 1
Site Vicinity Map
Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas

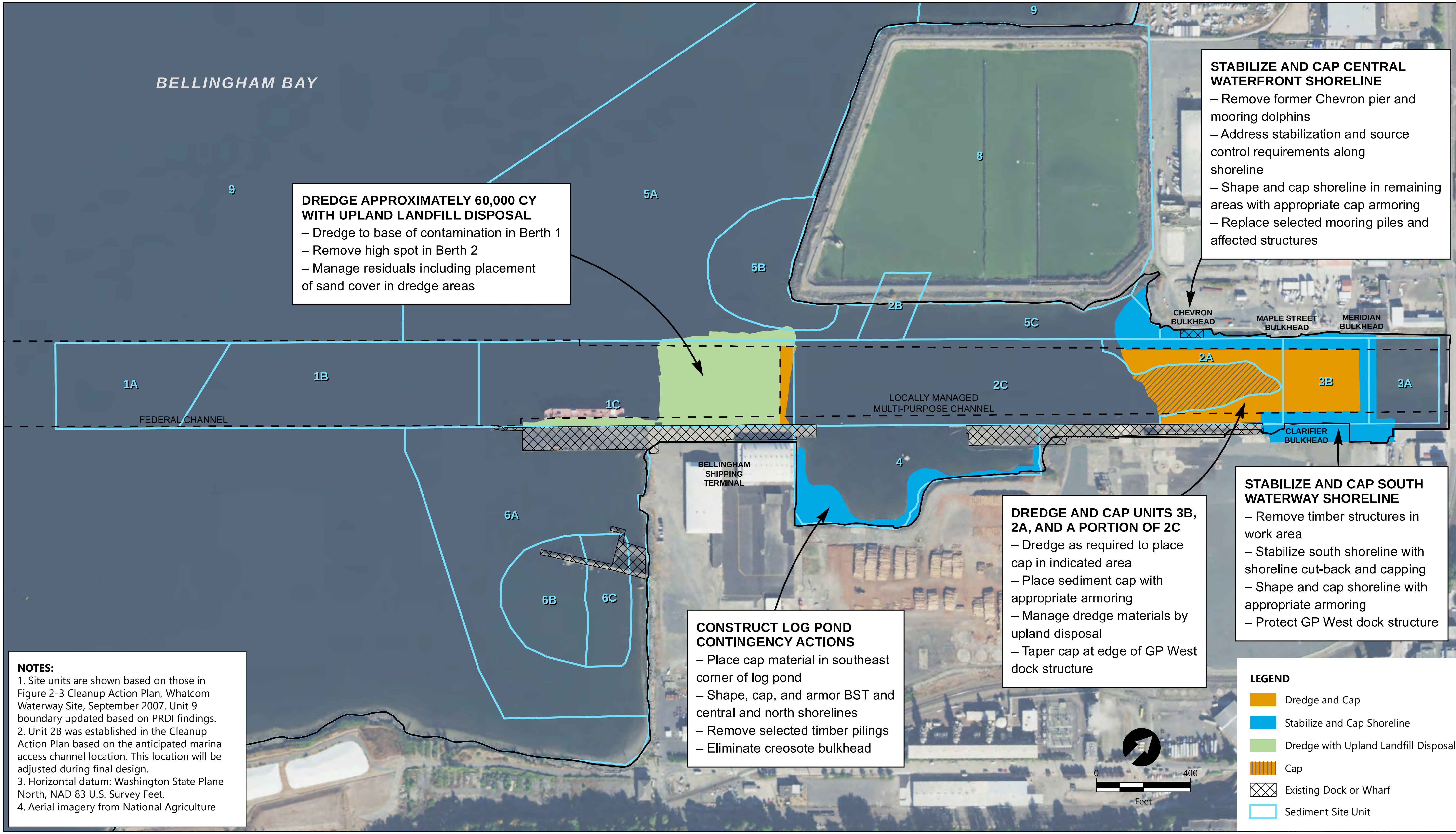


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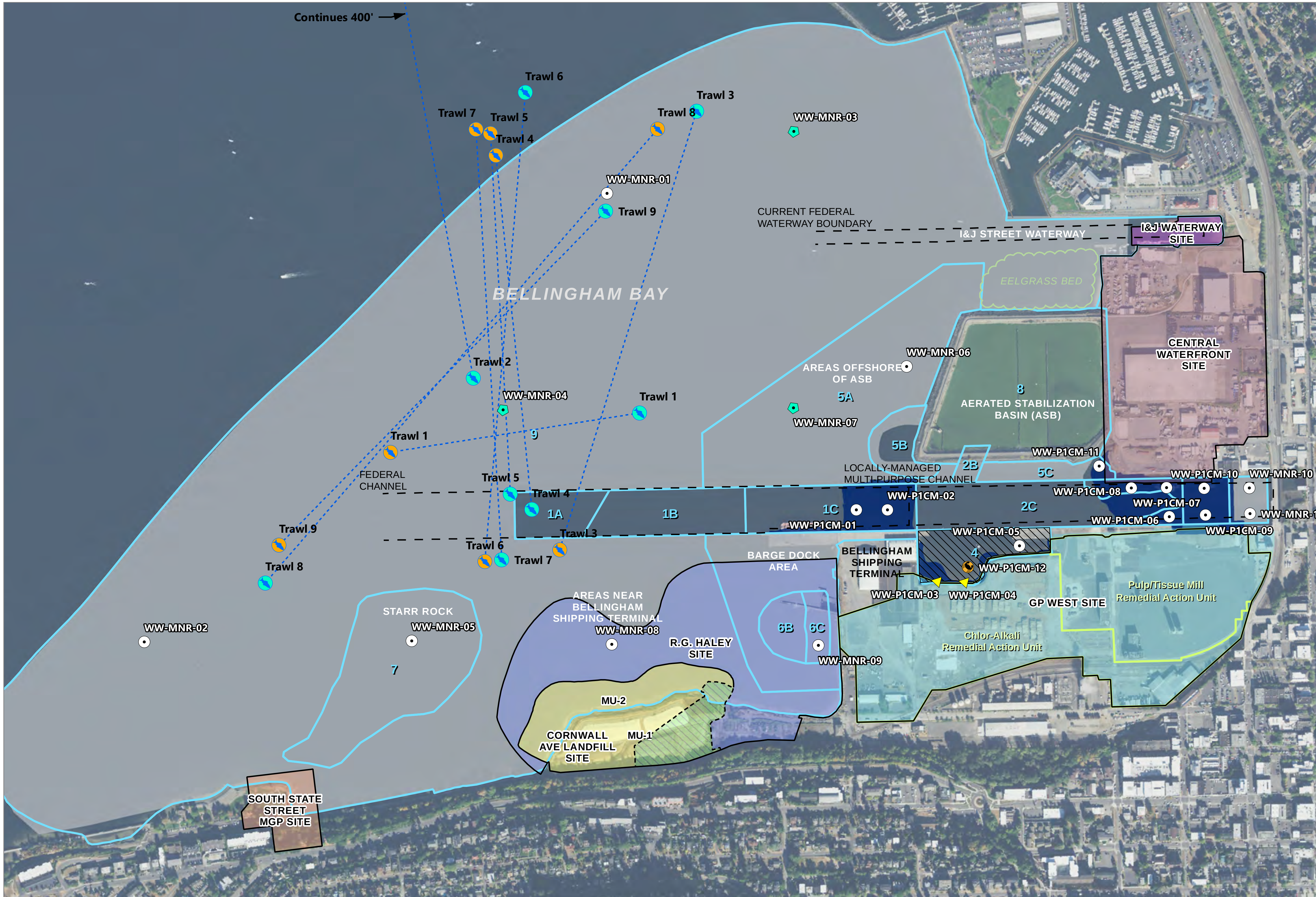
Figure 2
Completed Cleanup in Phase 1 Site Areas
Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



LEGEND:

- Juvenile Crab Location
- Surface Sediment Location
- Surface Sediment and Crab Tissue
- Surface Sediment and Porewater Location
- Fish Trawl - Start Set
- Fish Trawl - End Set
- Fish Trawl Path
- Remedial Action Unit Boundaries
- Sediment Site Unit
- Previously Capped Area (Log Pond Interim Remedial Action)
- Phase 1 MNR Area
- Phase 1 Dredging or Capping

NOTES:

1. Site units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Site, September 2007. Unit 9 boundary updated based on Pre-remedial Design Investigation findings.
2. Horizontal datum: Washington State Plane North, North American Datum 1983 (NAD83) Feet.
3. Vertical datum: Mean Lower Low Water (MLLW).
4. Unit 2B was established in the Cleanup Action Plan based on the anticipated marina access channel location. This location will be adjusted during final design.
5. Trawl stations represent actual start and end points of each individual trawl.
6. Remedial Action Unit (RAU) boundaries were defined in the Final Cleanup Action Plan for the GP West Pulp and Tissue Remedial Action Unit (Aspect 2014).
7. Gray inset base map and aerial imagery from ESRI. Aerial imagery pre-dates the work completed and does not represent current conditions at the site.

0 1,600
Feet

Publish Date: 2020/02/27, 12:08 PM | User: adowell
Filepath: \\orcas\gis\Jobs\080007-01_Whatcom_Waterway\Maps\Year3Monitoring\AQ_Fig3_WW_Proposed_Sampling_2019.mxd

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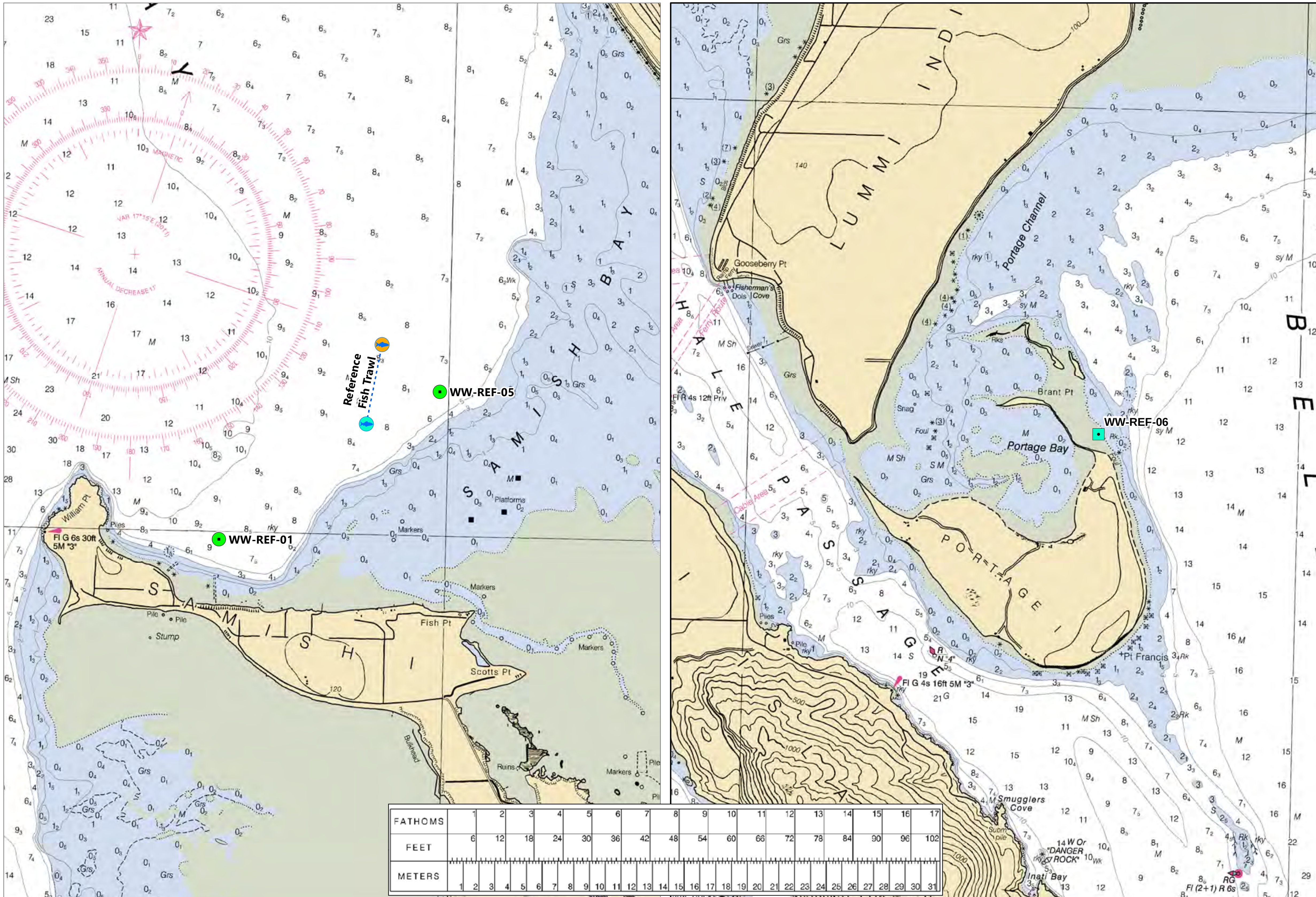
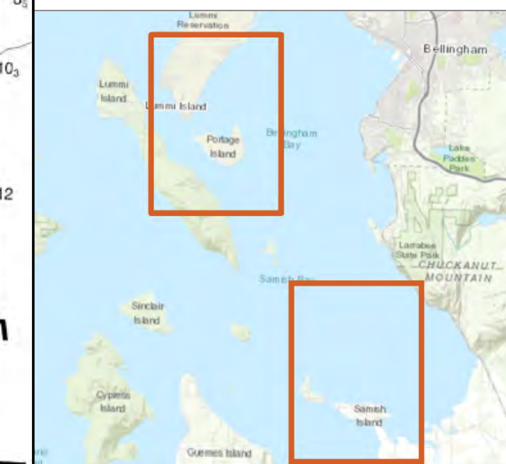
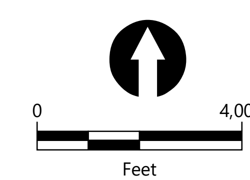
Figure 3
Site Locations for Year 3 Environmental Monitoring
Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup Phase 1 Site Areas







LEGEND:

- Adult Crab Tissue Station
- Juvenile Crab Tissue Station
- Fish Trawl - Start Set
- Fish Trawl - End Set
- Fish Trawl Path

NOTES:

1. Site units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Site, September 2007. Unit 9 boundary updated based on Pre-remedial Design Investigation findings.
2. Horizontal datum: Washington State Plane North, North American Datum 1983 (NAD83) Feet.
3. Vertical datum: Mean Lower Low Water (MLLW).

Publish Date: 2020/02/27, 12:07 PM | User: adowell
Filepath: \\orcas\gis\Jobs\080007-01_Whatcom_Waterway\Maps\Year3Monitoring\AQ_Fig4_Proposed_RefArea_Sampling_2019.mxd

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Figure 4
Reference Area Sampling Locations for Year 3 Monitoring
Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas

SOURCE: 2016 Post-construction surveys by NW Hydro compiled into surface labeled "Whatcom Post Construction_Combined_03-29-16.xml". 2017 Year 1 survey by NW Hydro dated 8/10/17. 2019 Year 3 survey by NW Hydro, dated October 2019, and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

10 — NW Hydro Year 3 Survey (2-ft intervals, October-November 2019)

2016 Post-Construction Dredge Boundary

2016 Post-Construction Cap Placement Boundary

Sediment Site Unit

2016 Stone Armored Cap

0 60
Feet

Publish Date: 2019/12/24 11:45 AM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-004-Y3 Isopach.dwg Figure 5a

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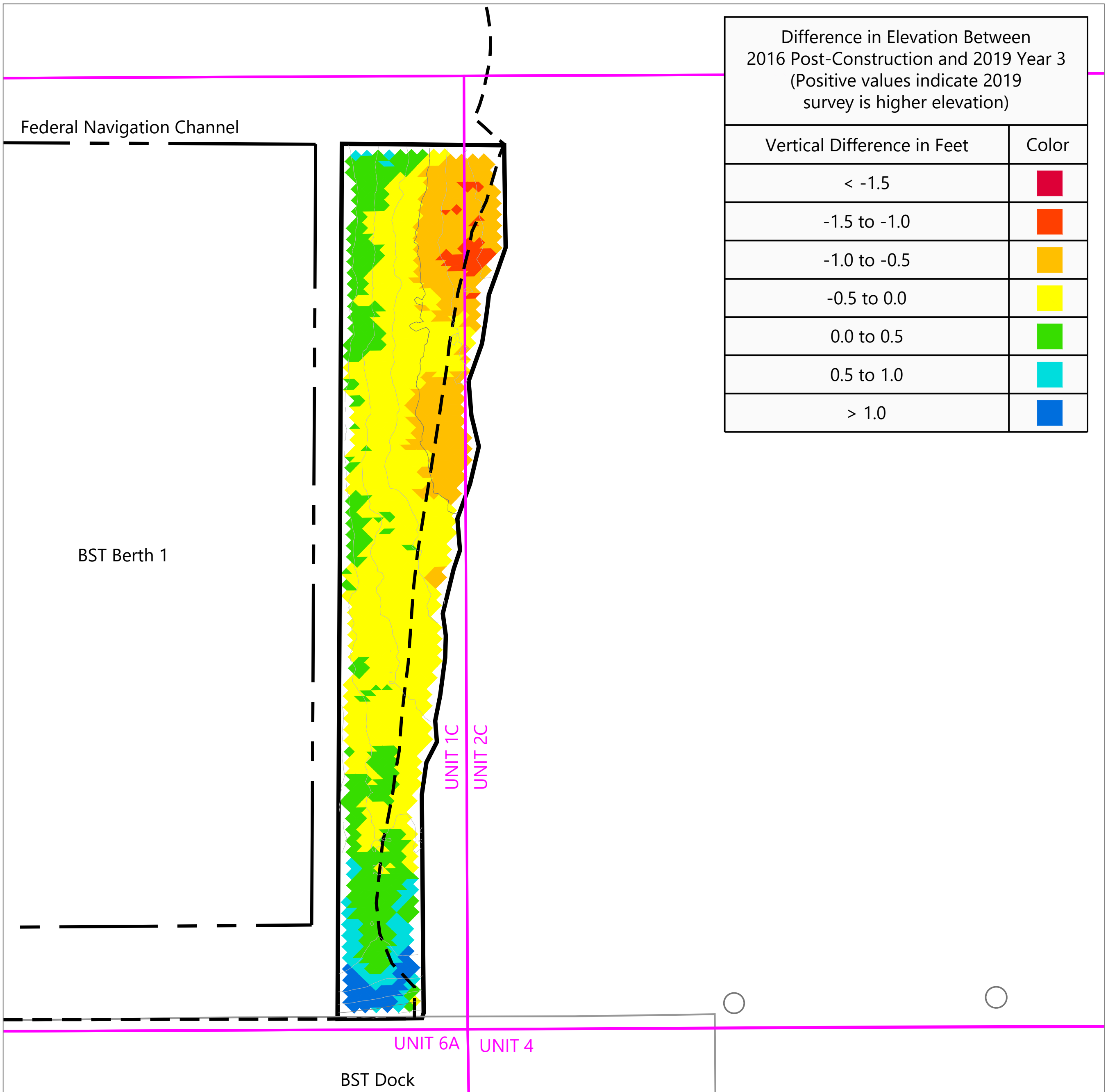
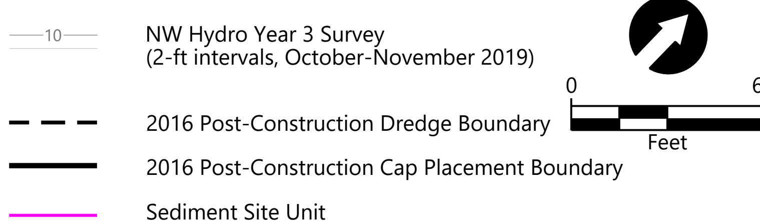
Figure 5a
Engineered Sediment Cap - BST

Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



SOURCE: 2016 Post-construction surveys by NW Hydro compiled into surface labeled "Whatcom Post Construction_Combined_03-29-16.xml". 2017 Year 1 survey by NW Hydro dated 8/10/17. 2019 Year 3 survey by NW Hydro, dated October 2019, and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:



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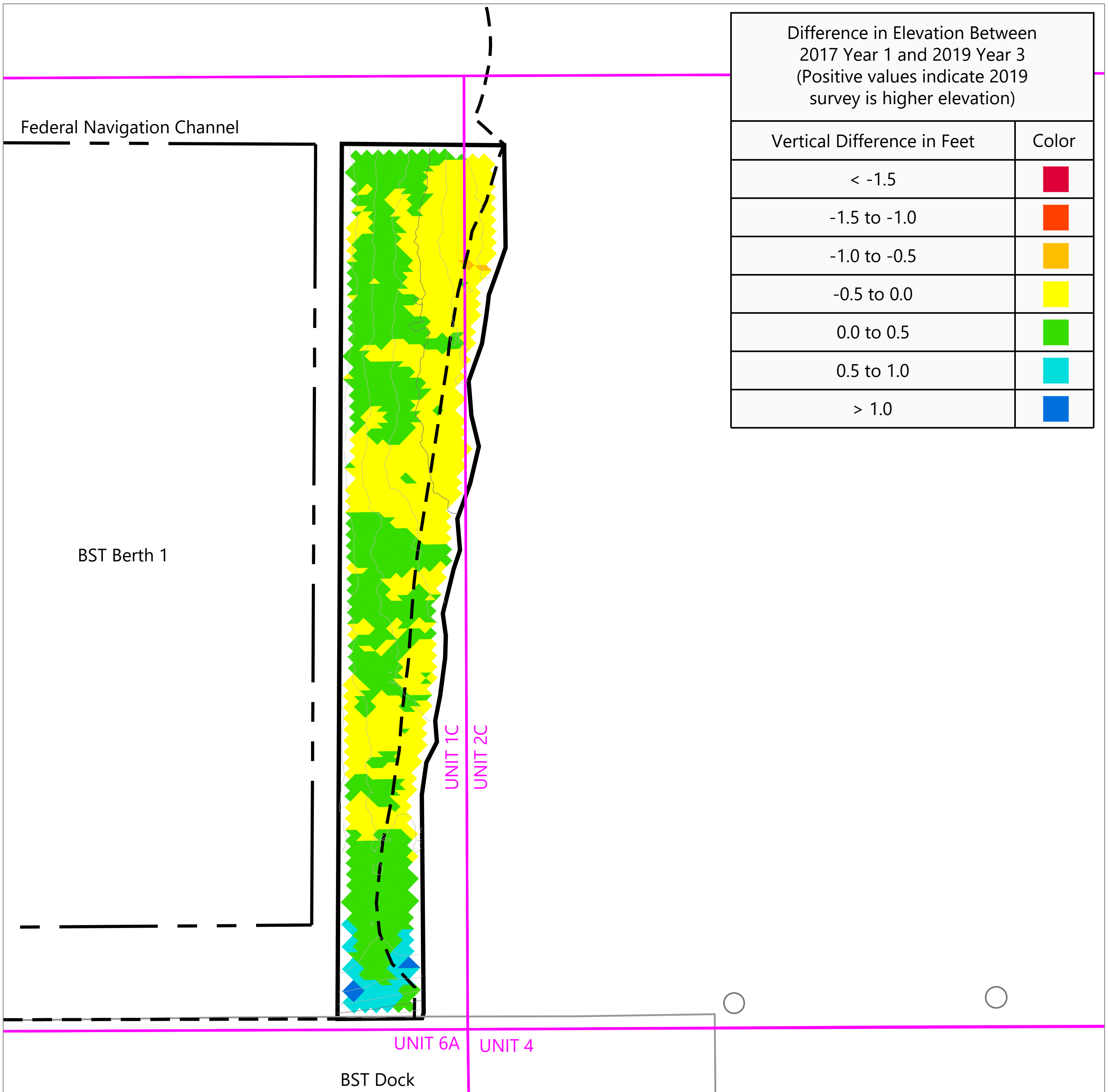
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-004-Y3 Isopach.dwg Figure 5b

Figure 5b
Isopach for BST: 2016 Post-Construction vs. 2019 Year 3 Survey

Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



SOURCE: 2016 Post-construction surveys by NW Hydro compiled into surface labeled "Whatcom Post Construction_Combined_03-29-16.xml". 2017 Year 1 survey by NW Hydro dated 8/10/17. 2019 Year 3 survey by NW Hydro, dated October 2019, and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

10 — NW Hydro Year 3 Survey (2-ft intervals, October-November 2019)

2016 Post-Construction Dredge Boundary

2016 Post-Construction Cap Placement Boundary

Sediment Site Unit

0 60
Feet

Publish Date: 2020/02/07 12:23 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-004-Y3 Isopach.dwg Figure 5c

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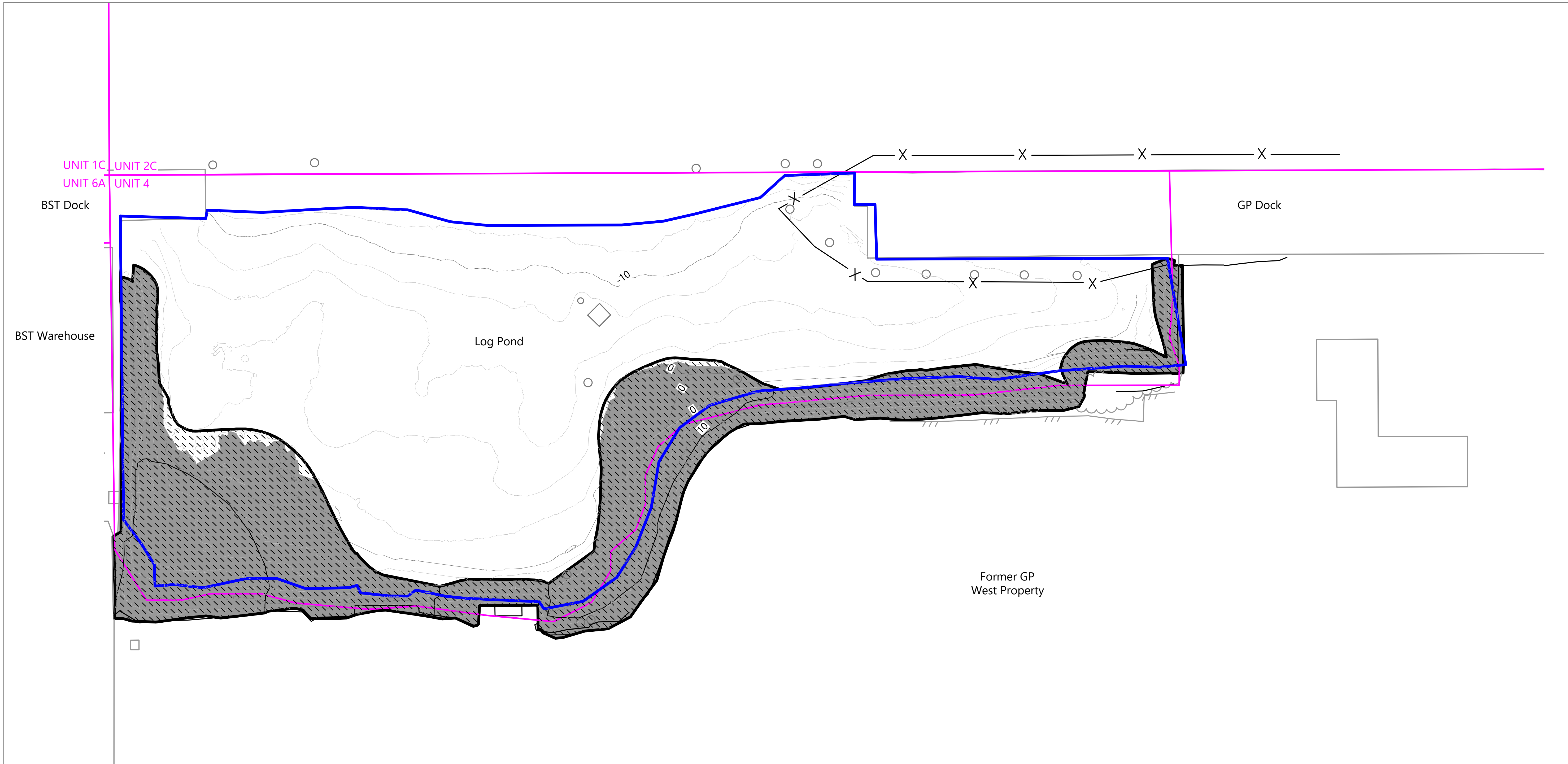
Figure 5c
Isopach for BST: 2017 Year 1 Survey vs. 2019 Year 3 Survey



SOURCE: 2016 Post-construction surveys by NW Hydro compiled into surface labeled "Whatcom Post Construction_Combined_03-29-16.xml". 2017 Year 1 survey by NW Hydro dated 8/10/17. 2019 Year 3 survey by NW Hydro, dated October 2019, and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- 10 NW Hydro Year 3 Survey (2-ft intervals, October-November 2019)
- 2016 Post-Construction Cap Placement Boundary
- Sediment Site Unit
- Approximate Tidal Range of Visual Inspection
- 2001 Log Pond Cap
- 2016 Stone Armored Cap

0 100
Feet

Publish Date: 2019/12/24 11:45 AM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-004-Y3 Isopach.dwg Figure 6a

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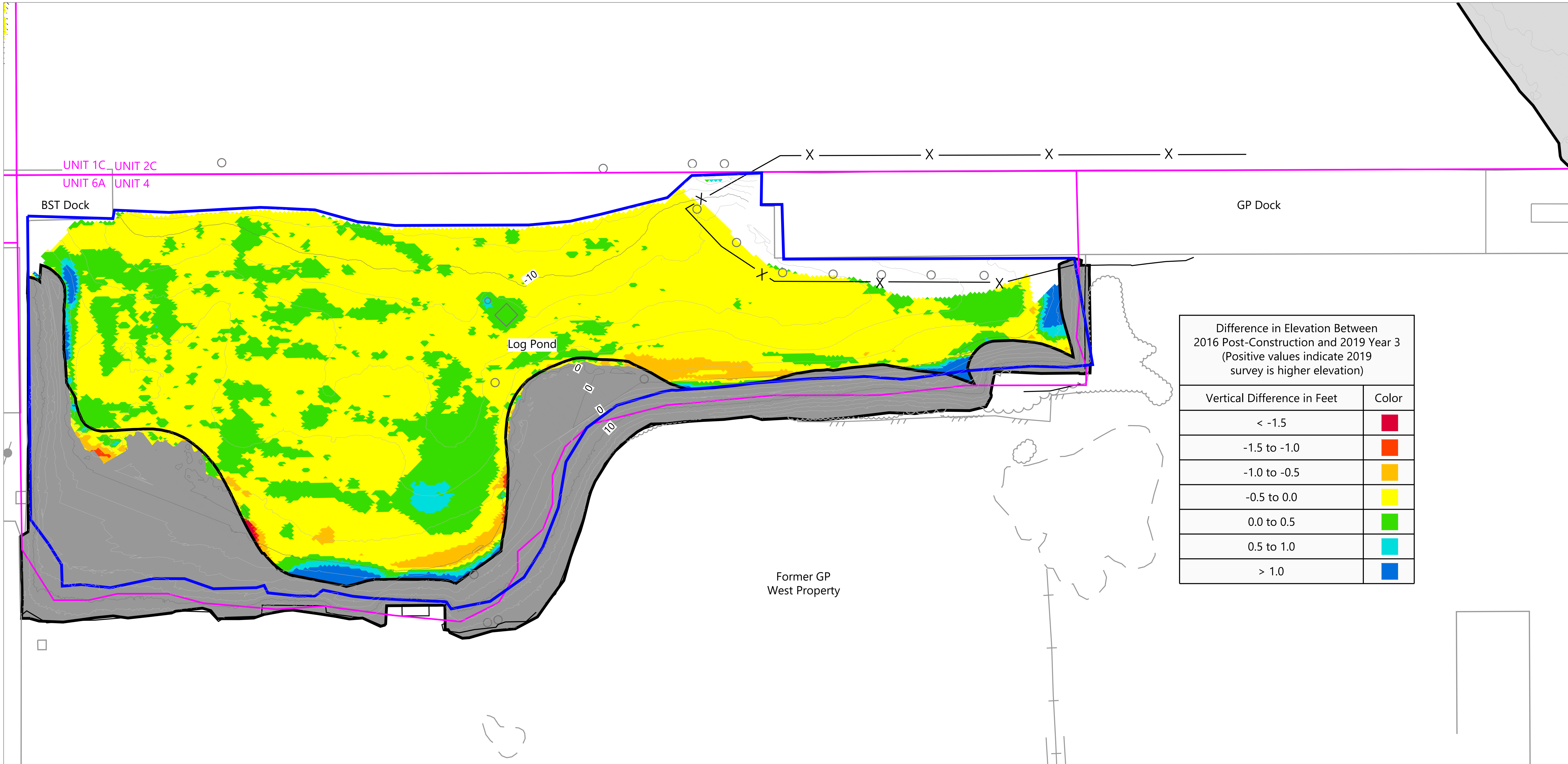
Figure 6a
Engineered Sediment Cap - Log Pond
Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



SOURCE: 2016 Post-construction surveys by NW Hydro compiled into surface labeled "Whatcom Post Construction_Combined_03-29-16.xml". 2017 Year 1 survey by NW Hydro dated 8/10/17. 2019 Year 3 survey by NW Hydro, dated October 2019, and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

10 NW Hydro Year 3 Survey (2-ft intervals, October-November 2019)

2016 Post-Construction Cap Placement Boundary

Sediment Site Unit

Approximate Tidal Range of Visual Inspection

2001 Log Pond Cap

0 100
Feet

Publish Date: 2020/02/07 12:24 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-004-Y3 Isopach.dwg Figure 6b

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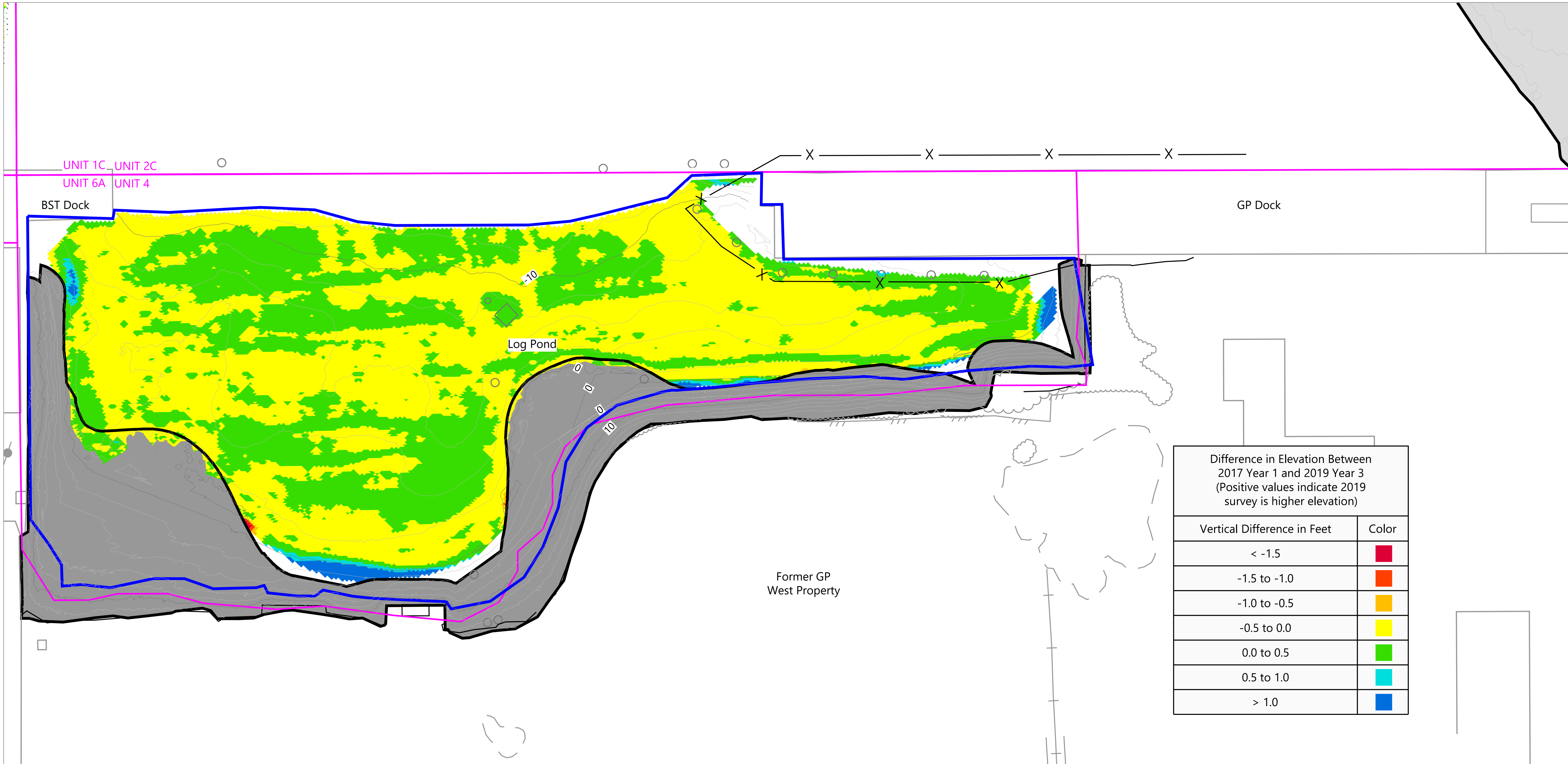
Figure 6b
Isopach for Log Pond: 2016 Post-construction vs. 2019 Year 3 Survey



Difference in Elevation Between 2017 Year 1 and 2019 Year 3 (Positive values indicate 2019 survey is higher elevation)	
Vertical Difference in Feet	Color
< -1.5	red
-1.5 to -1.0	orange-red
-1.0 to -0.5	orange
-0.5 to 0.0	yellow
0.0 to 0.5	green
0.5 to 1.0	cyan
> 1.0	blue

SOURCE: 2016 Post-construction surveys by NW Hydro compiled into surface labeled "Whatcom Post Construction_Combined_03-29-16.xml". 2017 Year 1 survey by NW Hydro dated 8/10/17. 2019 Year 3 survey by NW Hydro, dated October 2019, and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

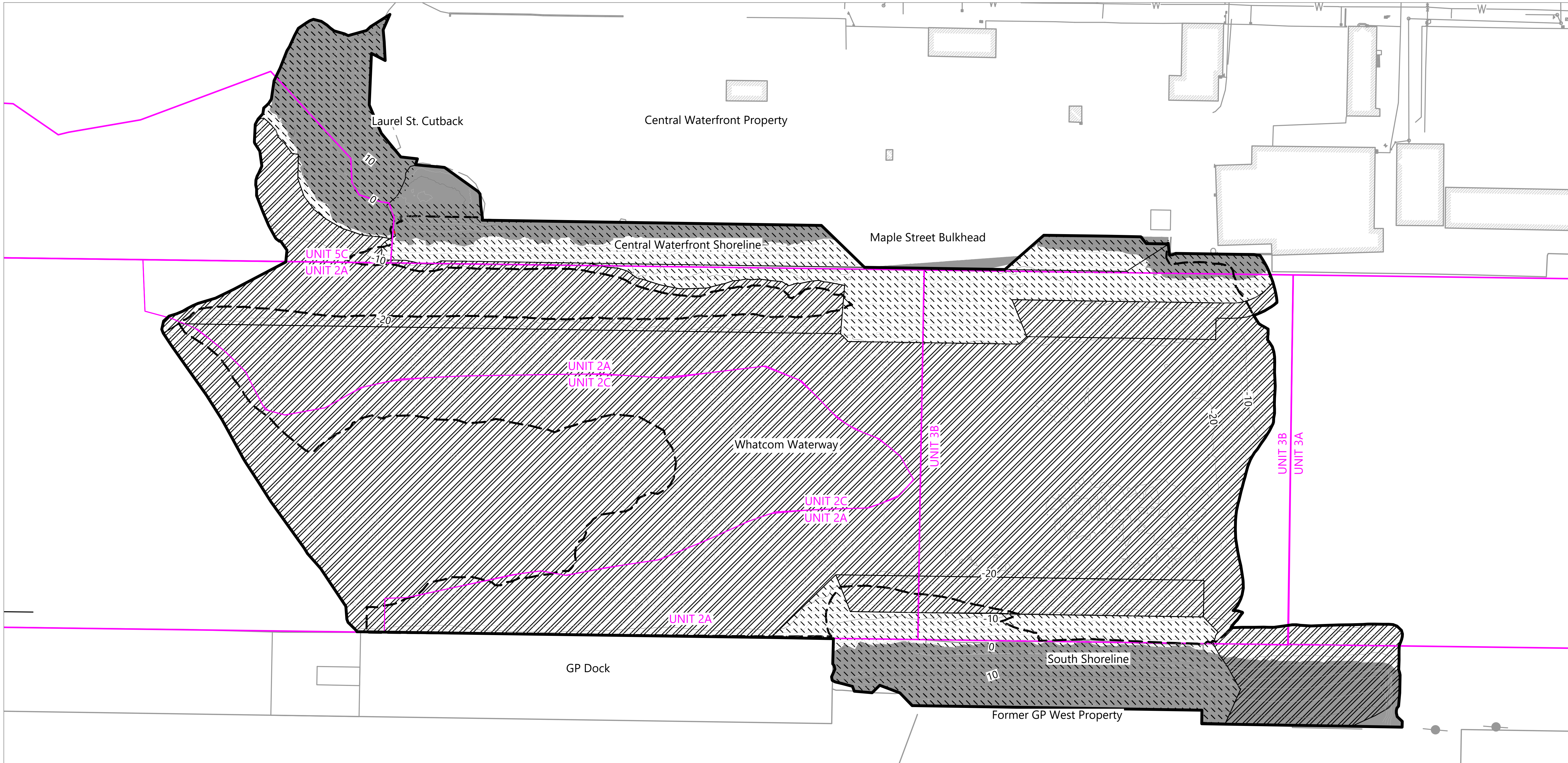
- 10 — NW Hydro Year 3 Survey (2-ft intervals, October-November 2019)
- 2016 Post-Construction Cap Placement Boundary
- Sediment Site Unit
- Approximate Tidal Range of Visual Inspection
- 2001 Log Pond Cap

0 100
Feet

Publish Date: 2020/02/07 12:24 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-004-Y3 Isopach.dwg Figure 6c

ANCHOR QEA

Figure 6c
Isopach for Log Pond: 2017 Year 1 Survey vs. 2019 Year 3 Survey



SOURCE: 2016 Post-construction surveys by NW Hydro compiled into surface labeled "Whatcom Post Construction_Combined_03-29-16.xml". 2017 Year 1 survey by NW Hydro dated 8/10/17. 2019 Year 3 survey by NW Hydro, dated October 2019, and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

10 NW Hydro Year 3 Survey (2-ft intervals, October-November 2019)
2016 Post-Construction Dredge Boundary
2016 Post-Construction Cap Placement Boundary
Sediment Site Unit
Approximate Tidal Range of Visual Inspection
2016 Cobble Armored Cap
2016 Stone Armored Cap

0 100
Feet

Publish Date: 2020/04/03 12:10 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-004-Y3 Isopach.dwg Figure 7a

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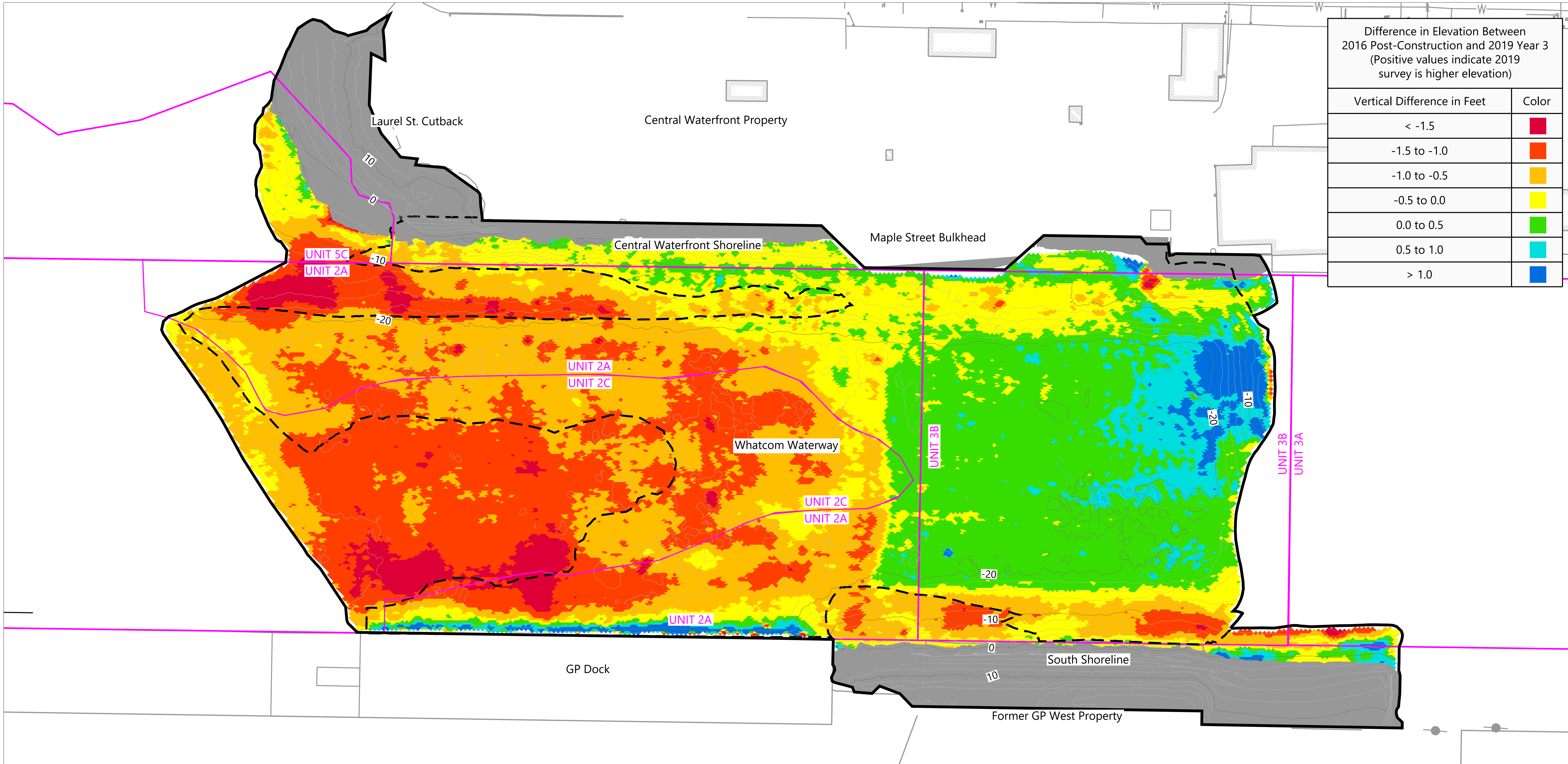
Figure 7a
Engineered Sediment Cap - Inner Waterway
Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



SOURCE: 2016 Post-construction surveys by NW Hydro compiled into surface labeled "Whatcom Post Construction_Combined_03-29-16.xml". 2017 Year 1 survey by NW Hydro dated 8/10/17. 2019 Year 3 survey by NW Hydro, dated October 2019, and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

10 NW Hydro Year 3 Survey (2-ft intervals, October-November 2019)

2016 Post-Construction Dredge Boundary

2016 Post-Construction Cap Placement Boundary

Sediment Site Unit

Approximate Tidal Range of Visual Inspection

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Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-004-Y3 Isopach.dwg Figure 7b

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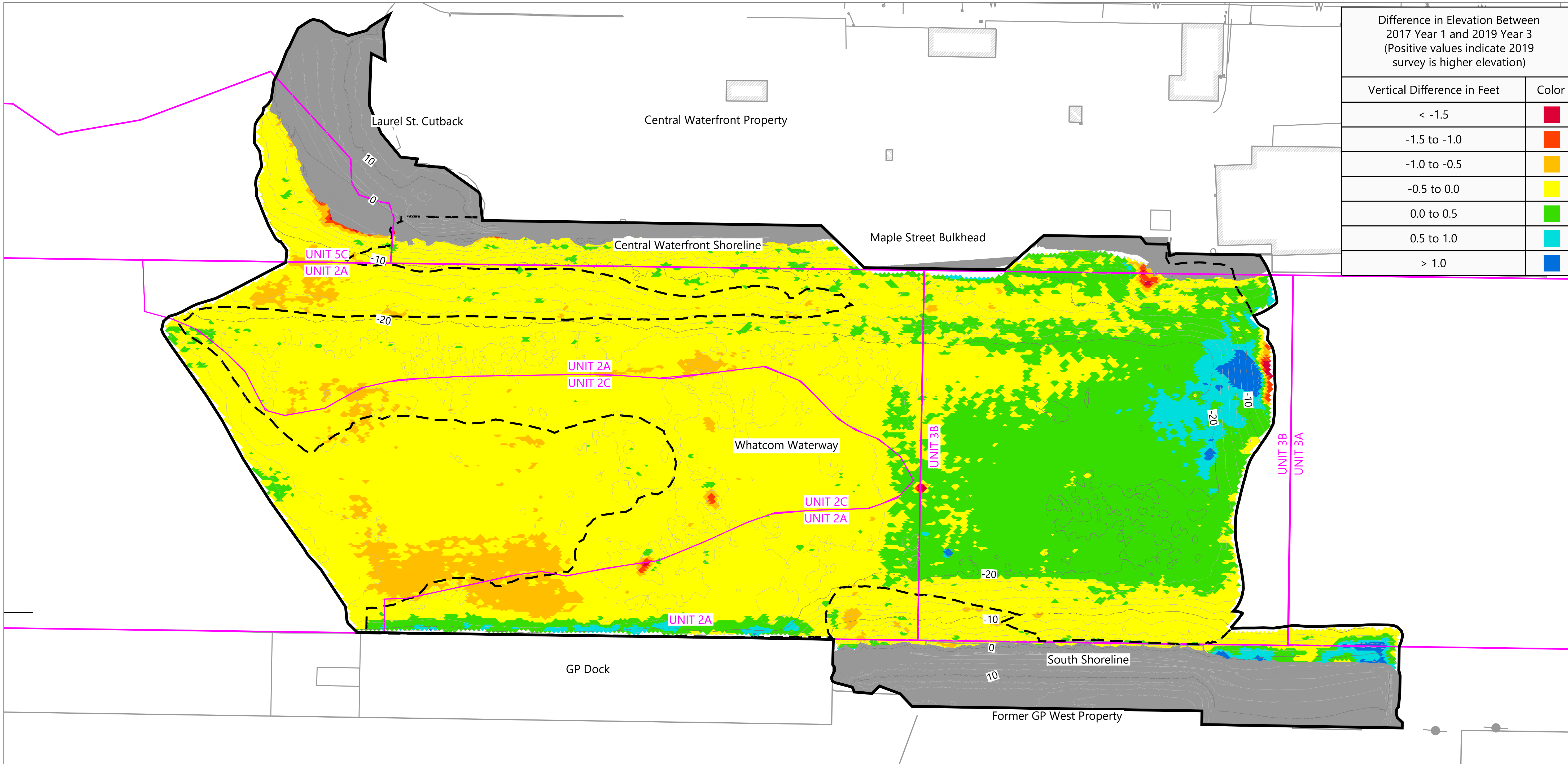
Figure 7b
Isopach for Inner Waterway: 2016 Post-construction vs. 2019 Year 3 Survey



SOURCE: 2016 Post-construction surveys by NW Hydro compiled into surface labeled "Whatcom Post Construction_Combined_03-29-16.xml". 2017 Year 1 survey by NW Hydro dated 8/10/17. 2019 Year 3 survey by NW Hydro, dated October 2019, and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

10 NW Hydro Year 3 Survey (2-ft intervals, October-November 2019)

2016 Post-Construction Dredge Boundary

2016 Post-Construction Cap Placement Boundary

Sediment Site Unit

Approximate Tidal Range of Visual Inspection

0 100 Feet

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Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-004-Y3 Isopach.dwg Figure 7c

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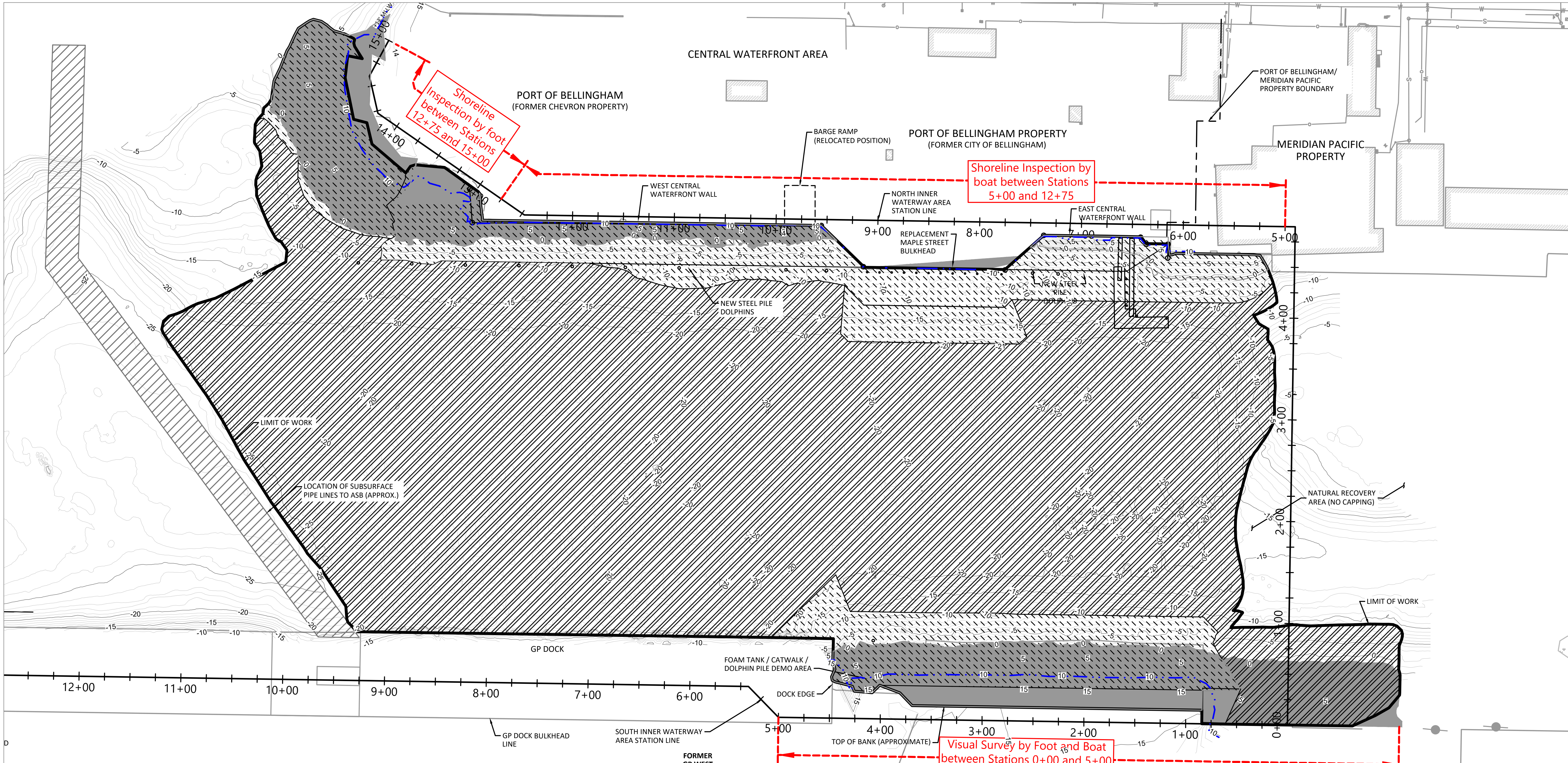
Figure 7c
Isopach for Inner Waterway: 2017 Year 1 Survey vs. 2019 Year 3 Survey



SOURCE: Bathymetric survey from 2016 provided by Northwest Hydro, Inc.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Post-construction Bathymetry
- Approximate Tidal Range of Visual Inspection
- OHWL (Elevation 10.2 ft MLLW)
- 2016 Post-Construction Cap Placement Boundary
- 2016 Cobble Armored Cap
- 2016 Stone Armored Cap

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Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-022-Survey Coverage.dwg Figure 8a

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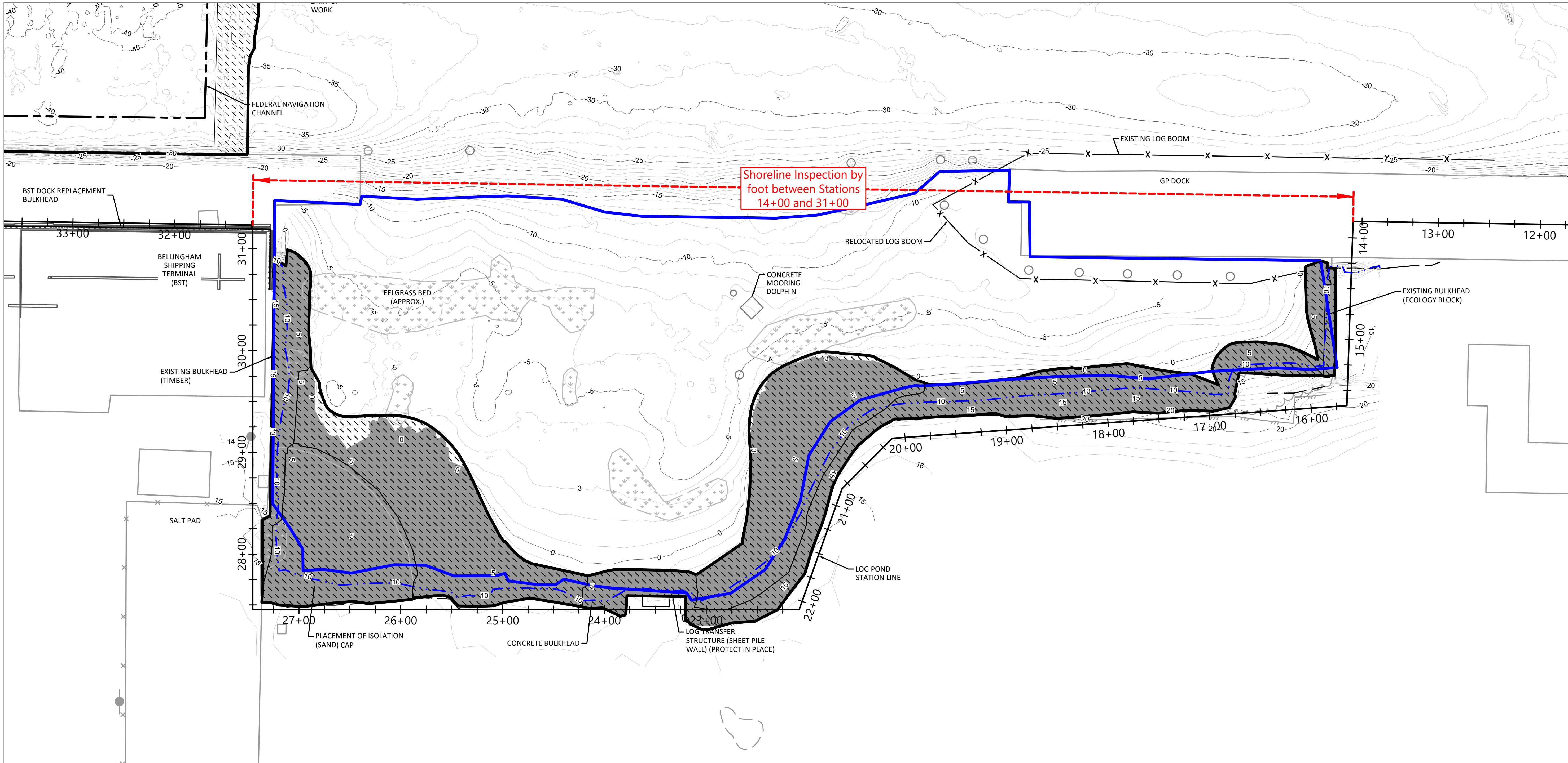
Figure 8a
Visual Survey Coverage - Inner Waterway

Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



SOURCE: Bathymetric survey from 2016 provided by Northwest Hydro, Inc.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

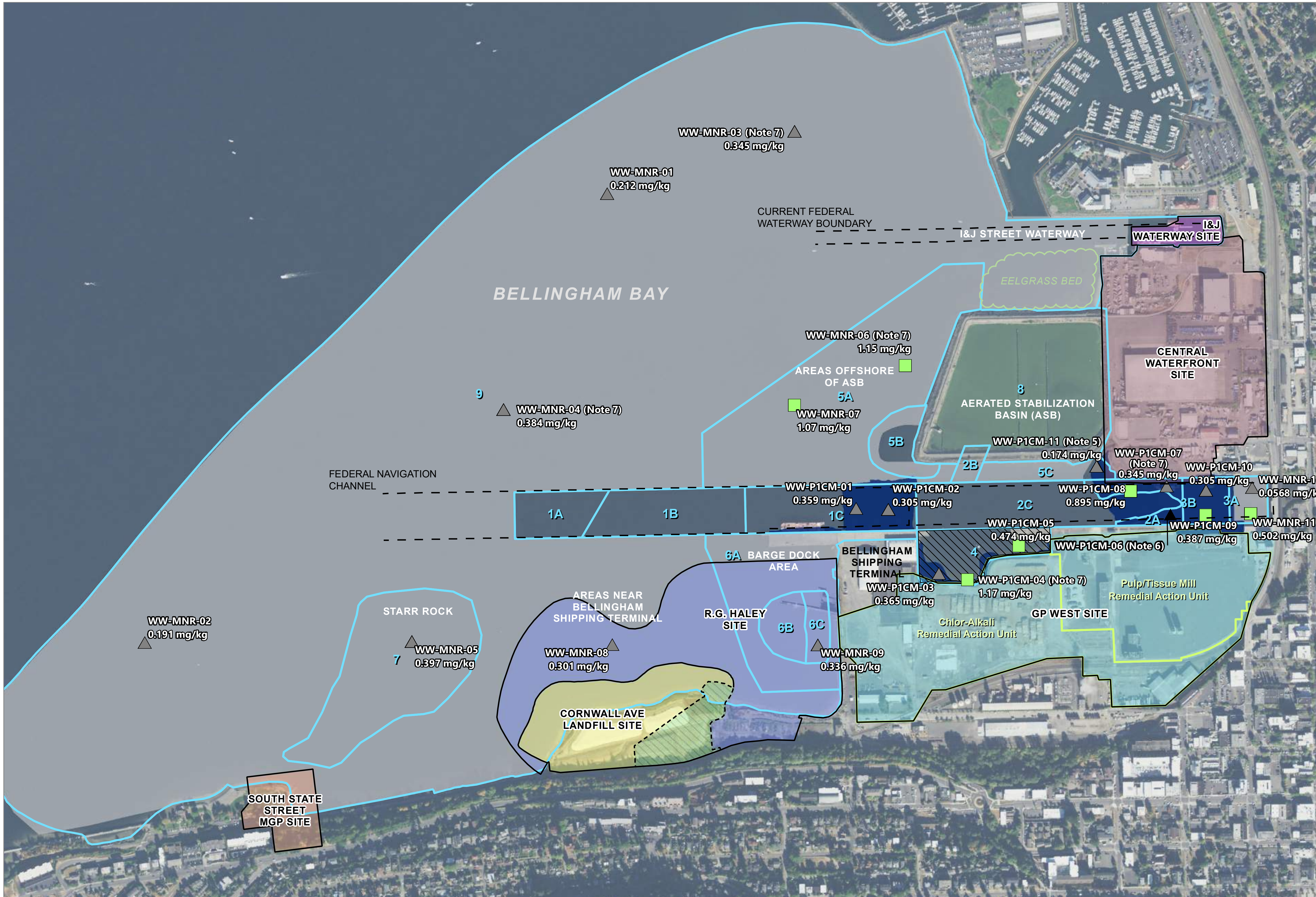
- 10 Post-construction Bathymetry
- 2001 Log Pond Cap
- 2016 Stone Armored Cap
- Approximate Tidal Range of Visual Inspection
- OHWL (Elevation 10.2 ft MLLW)

0 100
Feet

Publish Date: 2020/04/07 4:19 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr\0007-RP-022-Survey Coverage.dwg Figure 8b

Figure 8b
Visual Survey Coverage - Log Pond

Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



LEGEND:

- Bioassay Tested
- Bioassay Testing Not Performed
- No Sediment Collected[6]
- Remedial Action Unit Boundaries
- Sediment Site Unit
- Adjacent Cleanup Site Area
- Previously Capped Area (Log Pond Interim Remedial Action)
- Phase 1 MNR Area
- Phase 1 Dredging or Capping

NOTES:

1. Site units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Year 1 Monitoring Report, Whatcom Waterway Site, 2017. Unit 9 boundary updated based on PRDI findings.
2. Horizontal datum: Washington State Plane North, NAD 83 Feet.
3. Unit 2B was established in the Cleanup Action Plan based on the anticipated marina access channel location. This location will be adjusted during final design.
4. Remedial Action Unit (RAU) boundaries were defined in the Final Cleanup Action Plan for the GP West Pulp and Tissue Remedial Action Unit (Aspect 2014).
5. Mercury concentrations at WW-P1CM-11 in the 0-2 cm interval are 0.275 mg/kg.
6. No recent sediment accumulations over cap armoring at this location. No surface sediment mercury testing preformed.
7. Mercury concentration is shown as average of two results.

0 1,600
Feet

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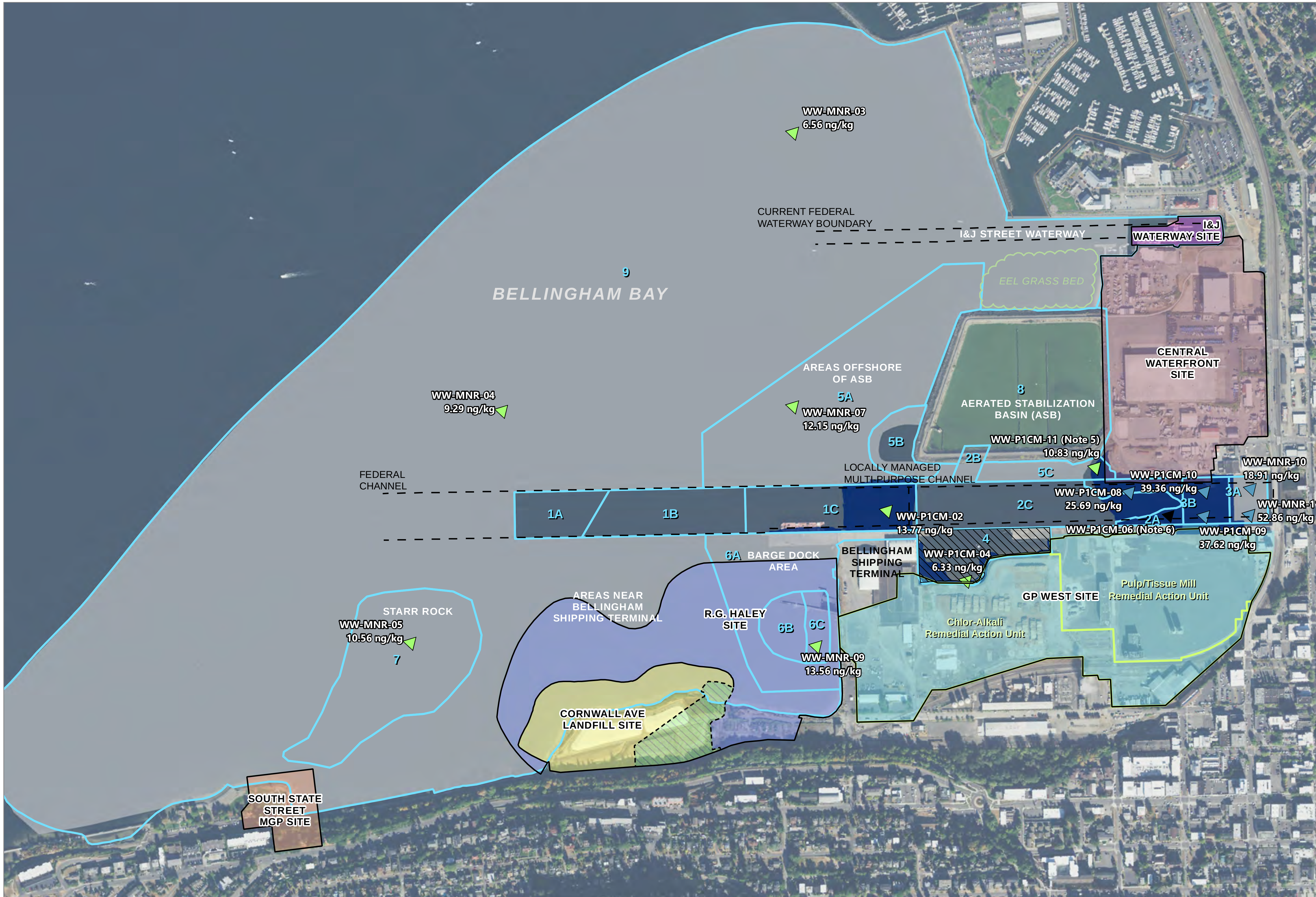
Figure 9
Surface Sediment Mercury Testing Results
Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup Phase 1 Site Areas



LEGEND:

- Result Below Regional Background (15 ng/kg TEQ)
- Result Above Regional Background (15 ng/kg TEQ)
- No Sediment Collected[6]
- Remedial Action Unit Boundaries
- Sediment Site Unit
- Adjacent Cleanup Site Area
- Previously Capped Area (Log Pond Interim Remedial Action)
- Phase 1 MNR Area
- Phase 1 Dredging or Capping

NOTES:

1. Site units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Year 1 Monitoring Report, Whatcom Waterway Site, 2017. Unit 9 boundary updated based on PRDI findings.
2. Horizontal datum: Washington State Plane North, NAD 83 Feet.
3. Unit 2B was established in the Cleanup Action Plan based on the anticipated marina access channel location. This location will be adjusted during final design.
4. Remedial Action Unit (RAU) boundaries were defined in the Final Cleanup Action Plan for the GP West Pulp and Tissue Remedial Action Unit (Aspect 2014).
5. Dioxin/furan concentrations at WW-P1CM-11 in the 0-2 cm interval are 25 ng/kg.
6. No recent sediment accumulations over cap armoring at this location. No surface sediment dioxin/furan testing preformed.
7. Dioxin/furan concentrations calculated as TEQ 2005 (mammal) (U = 1/2) (EMPC = U).
8. D/F compliance is measured on an area-wide basis. SWAC is 11.28 ng/kg TEQ.

0 1,600
Feet

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Figure 10
Surface Sediment Dioxin/Furan Testing Results
Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup Phase 1 Site Areas

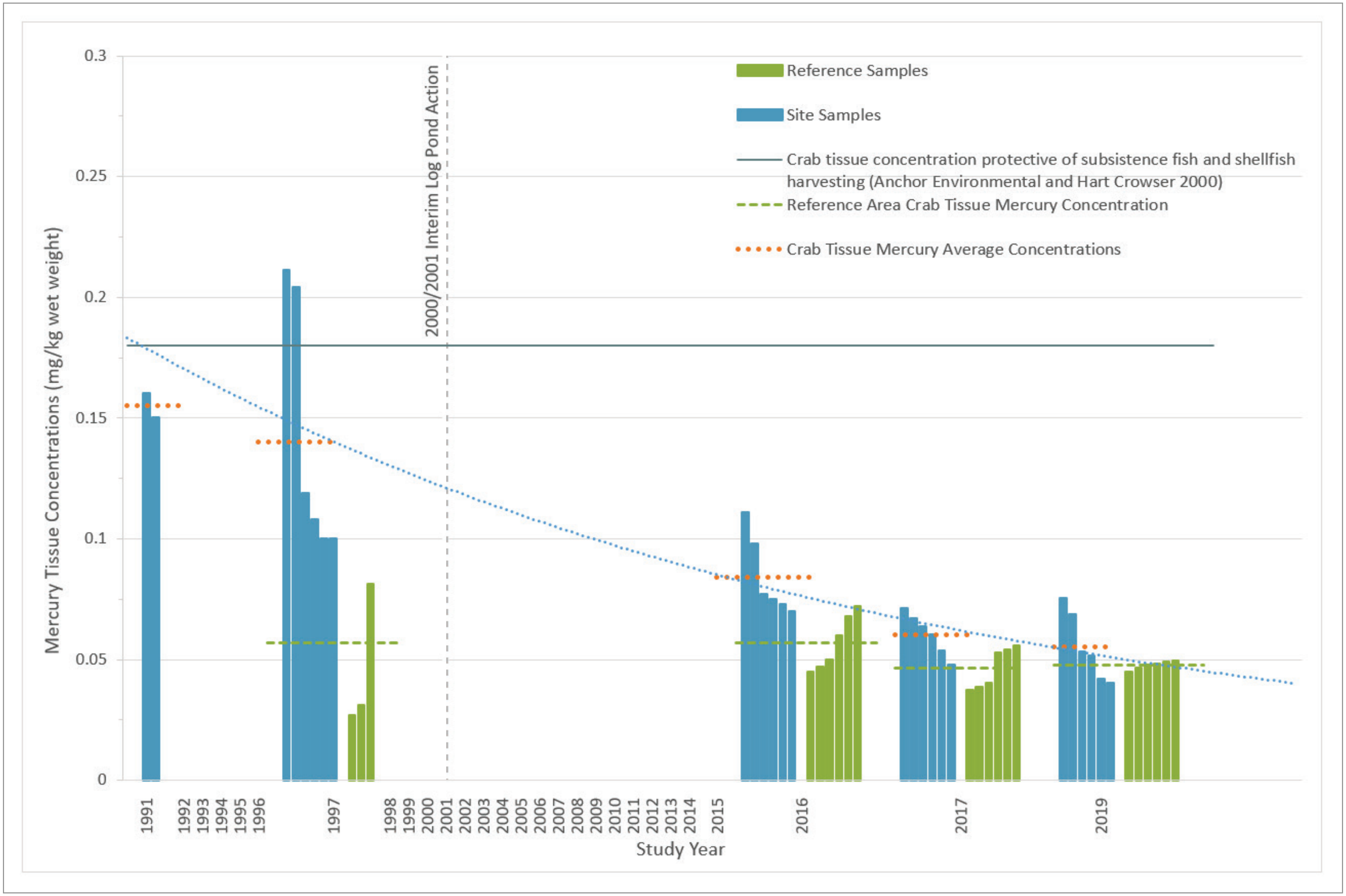

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Figure 11

Mercury Concentrations in Adult Dungeness Crab Tissue

Year 3 Compliance Monitoring Report

Whatcom Waterway Cleanup in Phase 1 Site Areas

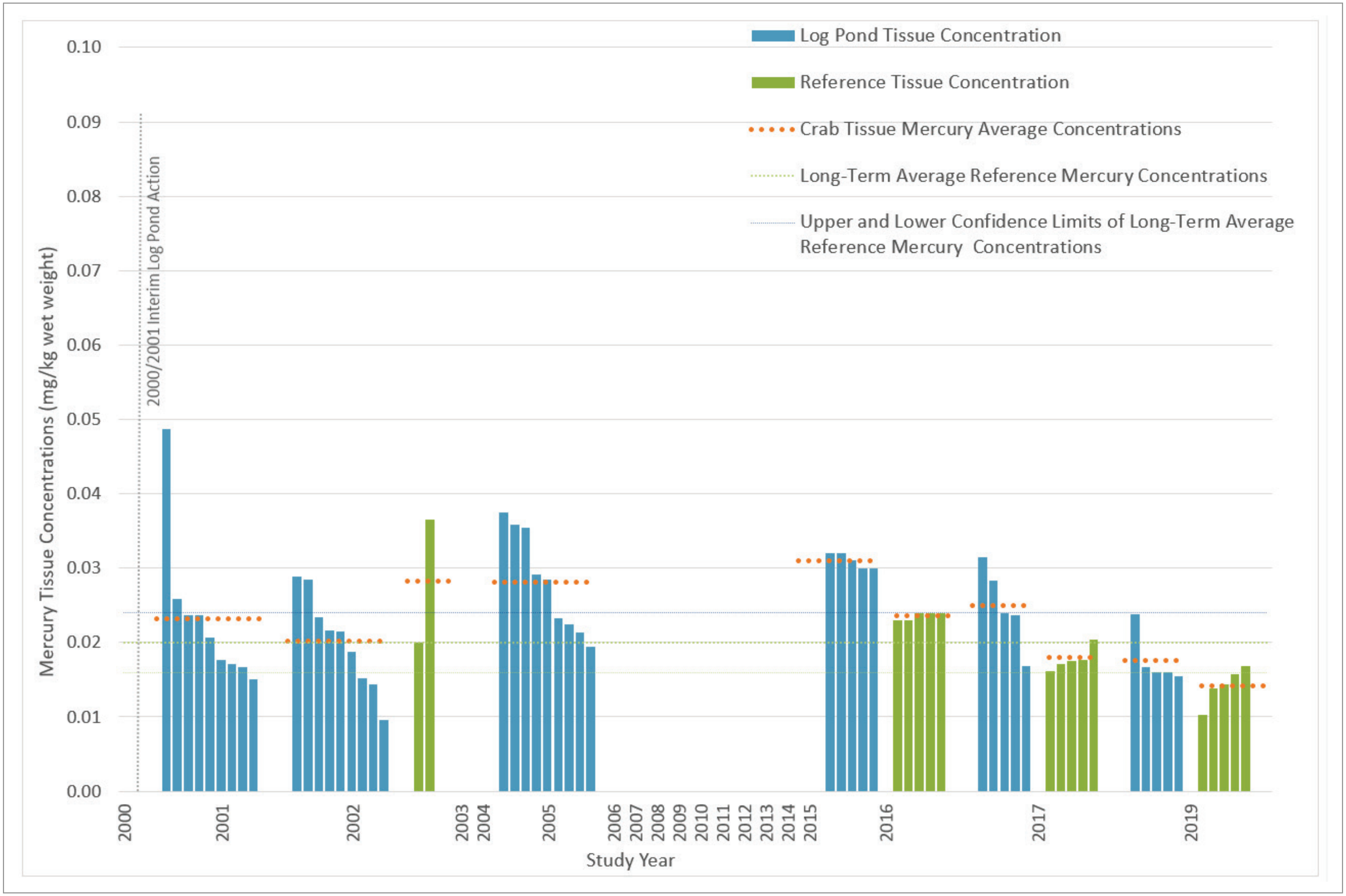

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Figure 12

Mercury Concentrations in Juvenile Dungeness Crab Tissue

Year 3 Compliance Monitoring Report

Whatcom Waterway Cleanup in Phase 1 Site Areas

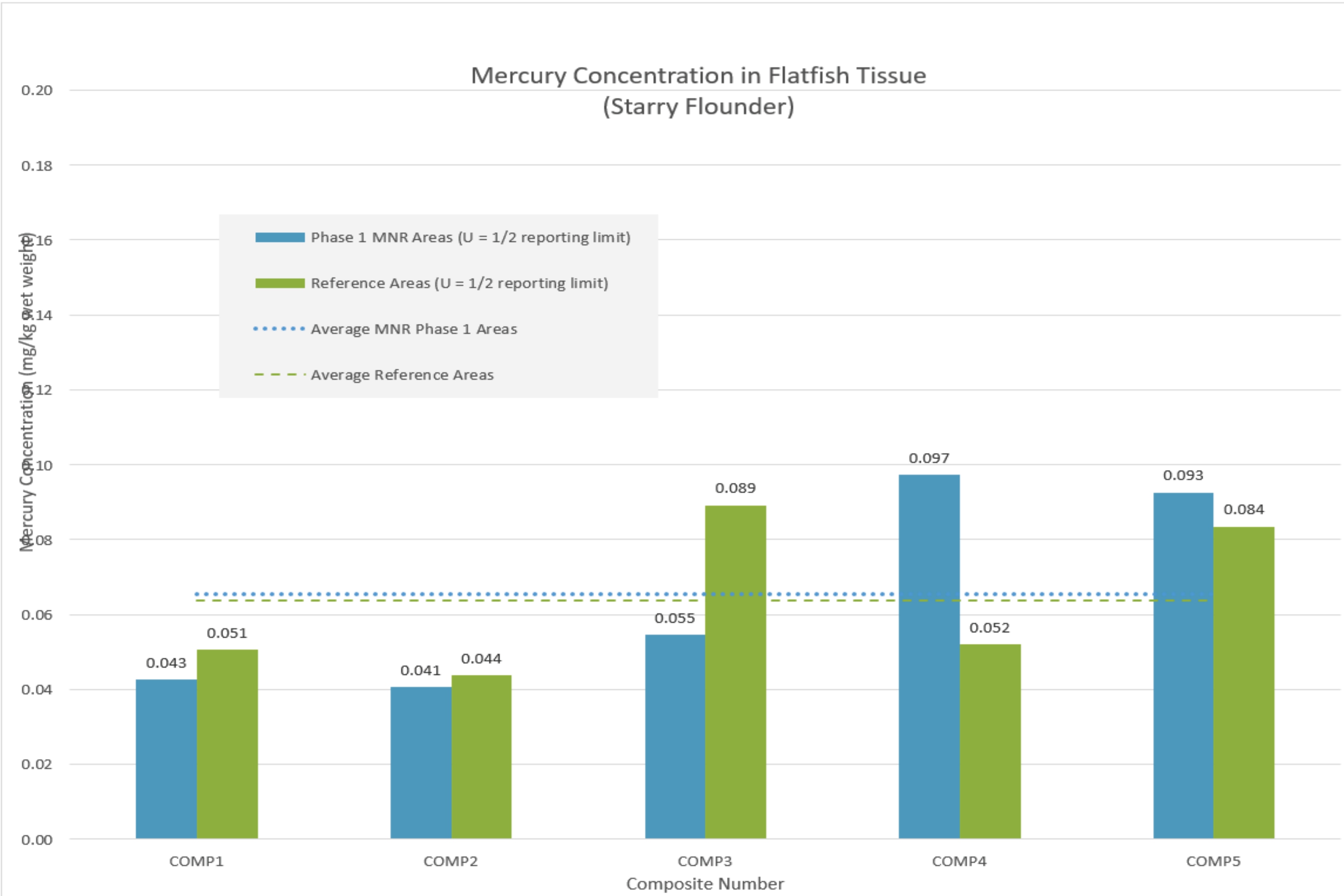

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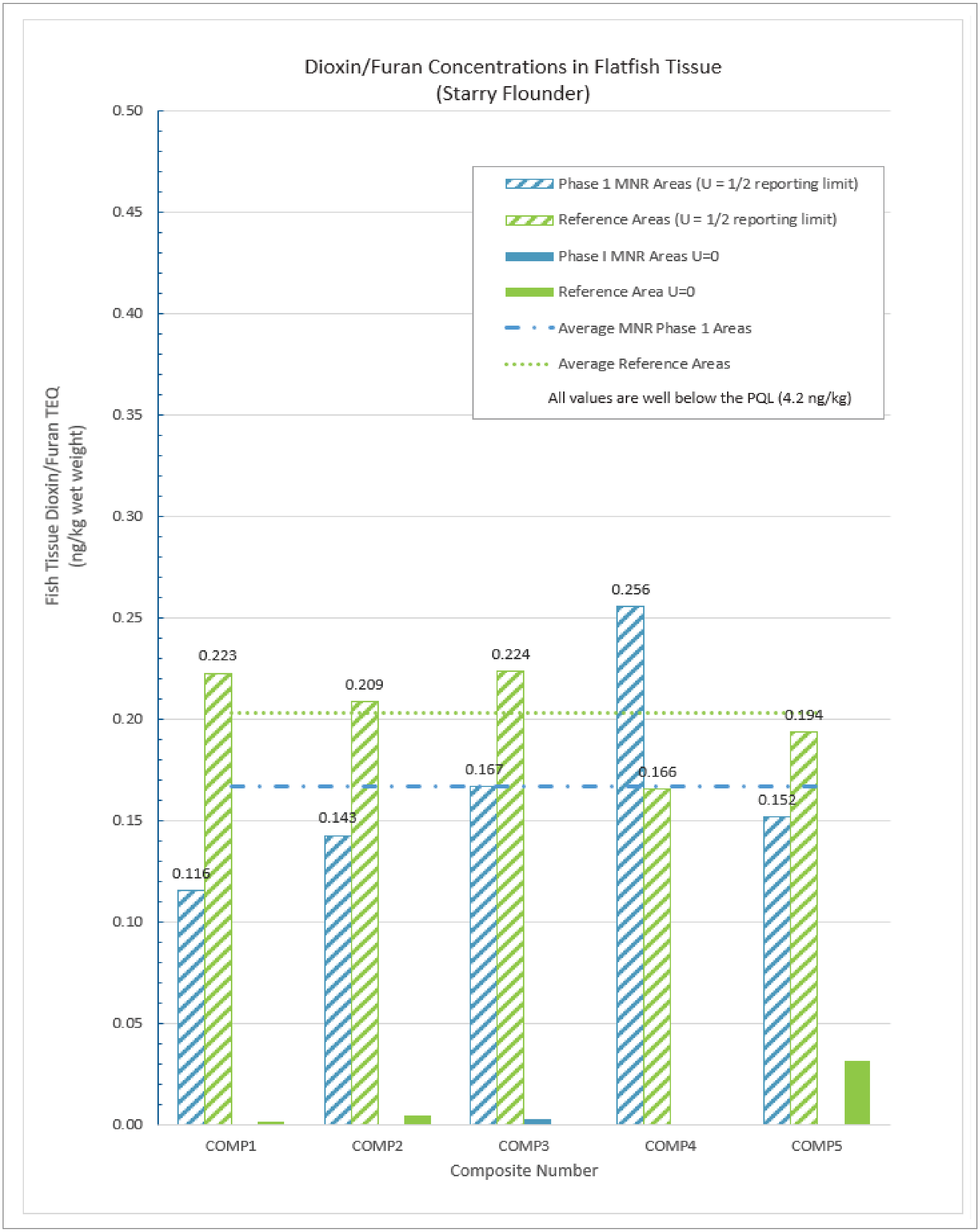
Figure 13a
Mercury Concentration in Flatfish Tissue
Year 3 Compliance Monitoring Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



Filepath: \\fuji\anchor\Projects\Port of Bellingham\190007-01.01 Whatcom Waterway Phase 2 Cleanup\5_Year 3 Monitoring and Reporting\Year 3 Report\Figures\Figure 13b_rev1.docx

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Figure 13b

Dioxin/Furan Concentrations in Flatfish Tissue

Year 3 Compliance Monitoring Report

Whatcom Waterway Cleanup in Phase 1 Site Areas

Appendix A
Bathymetric Survey Data Coverage

Appendix B

Visual Survey Photographs

Appendix C
Analytical Reports

Appendix D
Data Validation Reports

Appendix E
Bioassay Results and Validation

Appendix F
Selected Photographs of Conditions at Surface Sediment Stations Not Analyzed

Appendix G
Statistical Analysis Output