April 2020
Whatcom Waterway Phase 2 Site Cleanup

ANCHOR QEA

Design Evaluation Memorandum

Prepared for Port of Bellingham

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Prepared for
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ABBREVIATIONS

ASB	Aerated Stabilization Basin
BST	Bellingham Shipping Terminal
CDF	confined disposal facility
City	City of Bellingham
cy	cubic yards
D/F	dioxins/furans
DNR	Washington Department of Natural Resources
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
GP West	Georgia-Pacific West, Inc.
Memorandum	Design Evaluation Memorandum
mg/kg	milligram per kilogram
MLLW	mean lower low water
MNR	monitored natural recovery
MTCA	Model Toxics Control Act (WAC 173-340)
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbon
Port	Port of Bellingham
Project	Whatcom Waterway Cleanup in Phase 2 Site Units Project
RAU	remedial action unit
RMC	residuals management cover
SEPA	State Environmental Policy Act (WAC 197-11)
Site	Whatcom Waterway Site
SQS	Sediment Quality Standard
USACE	U.S. Army Corps of Engineers
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife

GLOSSARY

Aerated Stabilization Basin (ASB)	The Aerated Stabilization Basin was constructed by GP West in 1978 for treatment of process wastewater from pulp and tissue mill operations and remains in use by the Port of Bellingham (Port) for treatment of stormwater and legacy process wastewaters.
Central Waterfront Shoreline	The upland properties located between Whatcom Waterway and I & J Waterway and between Roeder Avenue and the ASB (i.e., wastewater treatment lagoon). The Central Waterfront Shoreline includes the properties within and outside of the Central Waterfront Site.
Central Waterfront Site	The MTCA cleanup site located on certain properties between Whatcom Waterway and I & J Waterway. A Cleanup Action Plan for the Central Waterfront Site was completed in 2020 under an MTCA Agreed Order.
Chlor-Alkali RAU	The Chlor-Alkali RAU comprises the western portion of the GP West Site adjacent to the Log Pond and Cornwall Avenue.
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.
GP West Site	The MTCA cleanup 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.
Inner Whatcom 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 Whatcom Waterway includes Site Units 2 and 3 of the Whatcom Waterway Site.
Log Pond	Site Unit 4 of the Whatcom Waterway Site. The Log Pond is located between the Whatcom Waterway Site and the GP West Site. The Log Pond was capped in 2001 as part of an Interim Action. Additional capping was completed in 2016 as part of the Whatcom Waterway Phase 1 cleanup work.
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 Site Units, and they are subject to long-term compliance monitoring requirements.
Outer Whatcom Waterway	The outer portion of Whatcom Waterway, extending from Waterway Station 29+00 into deep water. The Outer Whatcom 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 Whatcom Waterway.

Phase 1 Site Units	Whatcom Waterway Site Units 3B, 2A, and 4, and portions of Units 1C and 2C. Cleanup of these Site Units has been completed in accordance with Consent Decree No. 07-2-02257-7, as amended.
Phase 2 Site Units	Whatcom Waterway Site Units 1A, 1B, 2B, and 8, and portions of Units 1C, 2C, 5B, 6B, and 6C. These Site Units will be cleaned up as part of a future phase of construction, consistent with the First Amendment to the Whatcom Waterway Consent Decree.
Pulp and Tissue Mill RAU	The Pulp and Tissue Mill RAU comprises the eastern portion of the GP West Site adjacent to Whatcom Waterway and Roeder Avenue.
Whatcom Waterway	The physical waterway extending from Roeder Avenue to deep water. Whatcom Waterway includes both the Inner Whatcom Waterway and Outer Whatcom Waterway areas.
Whatcom Waterway Cleanup in Phase 1 Site Units	The construction and monitoring activities completed to implement the cleanup of Phase 1 Site Units of the Whatcom Waterway Site.
Whatcom Waterway Cleanup in Phase 2 Site Units (Project)	The construction and monitoring activities completed to implement the cleanup of Phase 2 Site Units of the Whatcom Waterway Site.
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 historical mercury discharges from the former Georgia-Pacific chlor-alkali plant wastewater discharges. The Site includes both Phase 1 and Phase 2 cleanup Site Units and additional areas being addressed by monitored natural recovery.

1 Introduction

This Design Evaluation Memorandum (Memorandum) was prepared for the Port of Bellingham (Port) by Anchor QEA, LLC, in association with WSP USA. This Memorandum summarizes the current remedial approach as specified in the Whatcom Waterway Site (Site) First Amendment to Consent Decree (No. 07-2-02257-7; Ecology 2011) and presents a pre-design evaluation that results in recommendations for modifying the cleanup of Phase 2 Site Units of the Site.

1.1 Site Background

The Site includes sediments that have been impacted by mercury discharges from the former Georgia-Pacific West, Inc. (GP West) chlor-alkali plant. Other Site-associated contaminants include wood waste and degradation products from historical log rafting activities, and phenolic compounds from pulp mill wastewater discharges.

The Site boundary shown in Figure 1 was established based on the extent of potentially significant surface and subsurface mercury contamination in sediments as determined during the Remedial Investigation and Feasibility Study (Anchor Environmental and Hart Crowser 2000; RETEC 2006) process and during subsequent pre-remedial design investigations that began in 2008 (Anchor QEA 2010).

The Port assumed leadership of the cleanup of the Site in 2005 after purchasing GP West's waterfront properties. Project cleanup requirements for the Site are defined in a 2007 Consent Decree executed by the Port, Washington State Department of Ecology (Ecology), Washington Department of Natural Resources (DNR), the City of Bellingham (City), and a private party, Meridian Pacific, LLC. The Consent Decree was initially executed in 2007 (Ecology 2007a) and was amended in 2011 (Ecology 2011). It defines requirements for the Site cleanup action in compliance with the requirements of the Model Toxics Control Act (MTCA; Washington Administrative Code [WAC] 173-340) and Sediment Management Standards (WAC 173-204) regulations.

Cleanup at the Site is being implemented in two project phases, each addressing specific Site Units. The Phase 1 project was completed between late 2015 and early 2016. Project work elements included cleanup construction in the Inner Whatcom Waterway, the Log Pond, and areas near the Bellingham Shipping Terminal (BST) (see Phase 1 Site Units; Figure 2). Major activities included dredging, capping, containment wall installation, structure removal, structure replacement, and nearshore habitat improvements.

Results of the Phase 1 Site cleanup and of associated Year 0 monitoring are documented in the Phase 1 As-Built Report (Anchor QEA 2018). Monitoring events performed in 2017 and 2019 have shown that the cleanup is performing within expectations (Anchor QEA 2019, 2020).

1.2 Purpose of this Memorandum

This Memorandum is the first of several design and permitting steps for implementation of required cleanup actions in the Phase 2 Site Units (Figure 3). This Memorandum includes the following:

- Presents the cleanup standards and approach for Phase 2 Site Units as specified in the 2011 Consent Decree (i.e., current remedial approach).
- Presents a pre-design evaluation to inform potential engineering recommendations to modify the current remedial approach for each Site Unit (i.e., modified remedial approach). These recommendations are based on the following elements:
  - Physical Site conditions, as represented by recent Site surveys, including a Site-wide bathymetric survey and updated topographic surveys completed in late 2019/early 2020 by Wilson Engineering and Northwest Hydro
  - Current marine structural conditions as defined by Port-provided designs, record drawings, and recent structural assessments for existing waterfront infrastructure, including infrastructure that has been installed, repaired, or maintained subsequent to the 2007 Consent Decree
  - Review of available environmental and geotechnical data for the Site and vicinity
  - Consideration of established remedial technologies for cleanup of contaminated sediments for Site-related contaminants
  - Port land-use considerations and market conditions, including existing land use and navigation requirements affecting each Site Unit
  - Existing Port commitments to sustainable design practices and alignment of Site remediation with habitat restoration and enhancement objectives for Bellingham Bay
  - Completion of value engineering analyses for work in each Site Unit, based on the foregoing criteria
- Provides a cost estimate for the modified remedial approach and for comparison purposes, an updated cost estimate for the current remedial approach, as described in the 2011 Consent Decree.
- Identifies pre-remedial design data gaps that should be addressed to support detailed remedial design activities.
- Outlines anticipated steps and schedule for completion of Phase 2 design, permitting, and construction activities.

This Memorandum is not a final, detailed remedial design. As such, the remedial approaches and costs presented in this document are preliminary and subject to change.

2 Phase 2 Cleanup Standards and Current Remedial Approach

This section provides an overview of the cleanup standards and current remedial approach for Phase 2 Site Units.

2.1 Sediment Cleanup Standards

Cleanup standards for the Site sediments are defined in the Consent Decree (Ecology 2007a). Sediment cleanup levels address both the protection of benthic organisms (sediment-dwelling organisms that provide food for fish and other animals higher on the aquatic food chain) and the protection of human health, as follows:

- **Cleanup levels for benthic protection:** Sediment cleanup levels for the protection of benthic organisms were set at the Sediment Quality Standard (SQS). The SQS includes both numeric criteria and requirements for confirmational bioassays that must be performed when these numeric criteria are exceeded. For mercury, the SQS is 0.41 milligram per kilogram (mg/kg). Confirmational bioassays are defined in the Sediment Management Standards (WAC 173-204) and associated guidance.
- **Cleanup levels for human health protection:** Mercury is a bioaccumulative compound, and it can pose risks to people who eat fish or shellfish from contaminated areas. Monitoring has shown that mercury levels in crab and flatfish tissue in Bellingham Bay have decreased significantly since control of mercury discharges was implemented, and since completion of both the Log Pond Interim Action (2001) and the Phase 1 Site cleanup (2016). Crab and flatfish mercury levels measured in 2019 were not significantly different from those in the clean Samish Bay reference area (Anchor QEA 2020). To maintain protectiveness to human health, the Consent Decree (Ecology 2007a) includes an upper limit of 1.2 mg/kg on mercury concentrations in surface sediments. That limit is referred to as the bioaccumulation screening level.

These sediment cleanup levels must be met in the sediment bioactive zone. The bioactive zone in Bellingham Bay is the upper 12 centimeters of the sediment. Requirements for deeper sediments are based on evaluations of sediment stability, including consideration of both natural and anthropogenic disturbances. Where contained subsurface sediments cannot be shown to be stable under anticipated conditions, additional actions must be performed to achieve compliance with Site cleanup levels over the long term.

Dioxin/furan (D/F) compounds are also 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 and 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, historical and ongoing stormwater and wastewater discharges, and atmospheric deposition.

Since execution of the First Amendment to the Consent Decree in 2011, 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. The Phase 1 cleanup actions were designed to comply with the regional background level, and this is also assumed for Phase 2 Site cleanup actions. Flatfish tissue monitoring performed in 2019 showed that D/F concentrations in fish tissue are not significantly different than those in clean reference areas of Samish Bay.

2.2 Overview of Phase 2 Current Remedial Approach

In general the Phase 2 current remedial approach includes the following elements:

- Dredging, offloading, handling, and off-Site transportation and upland disposal of the accumulated soft sediments within the Aerated Stabilization Basin (ASB)
- Dredging of ASB transition sands from the base of the ASB, offloading, handling, and off-Site transportation and upland disposal
- Removal of ASB clean sands and temporary transport to a stockpile area for re-use in Phase 2 placement activities; re-use of the remaining clean sands will be conducted under separate Port projects
- Construction of a confined disposal facility (CDF) within the bottom of the ASB (approximately 24 acres)
- Dredging of federal navigation channel and berth areas within the Outer Whatcom Waterway Site Units; dredged contaminated sediments will be placed in the CDF and residuals management cover (RMC) will be placed in these Site Units
- Limited dredging and capping of multiple areas within the Inner Whatcom Waterway; dredged contaminated sediments will be placed in the CDF
- Dredging and clean backfill to address a localized scour area located on the shoulder of the ASB; dredged contaminated sediment will be placed in the CDF
- Placement of an anti-scour layer in the berth areas next to the rail span structure at BST

As described above, the contaminated sediments to be dredged from the Phase 2 Site Units are to be placed in a CDF constructed beneath the floor of the ASB. Construction of the CDF facility requires dredging of accumulated soft sediments, transition sands, and clean sand layer underlying the ASB in order to achieve the desired CDF capacity. After dredged sediments from waterway areas are placed in the CDF, a final clean cap is to be placed on top. The cap would be designed to be protective under future marina uses that were anticipated for the ASB. Water depths within the ASB

would be constructed to approximately 14 to 15 feet below mean lower low water (MLLW), a common maximum working depth for marinas.

2.3 Phase 2 Current Remedial Approach by Site Unit

This section provides a synopsis of the current remedial approach for the Phase 2 Site cleanup. Figure 3 illustrates the current required dredging and material placement activities to be conducted during Phase 2 Site cleanup. For the current remedial approach, Tables 1a and 2a summarize the design criteria assumptions and the anticipated dredging and material placement volumes by Site Unit, respectively.

2.3.1 Outer Whatcom Waterway (Unit 1)

The Outer Whatcom Waterway includes portions of the Site located offshore of the BST. An active federal navigation channel exists within these areas and has a project depth 30 feet below MLLW.

Unit 1 is sub-divided into three units:

- Units 1A and 1B: These open-water units are located offshore of the BST, connect the outer portions of the Whatcom Waterway to deep-water areas of Bellingham Bay, and are within the existing Whatcom Waterway federal navigation channel. The Phase 1 cleanup did not include any work within Units 1A or 1B.
- Unit 1C: This portion of the Whatcom Waterway is located immediately adjacent to the BST. This unit includes both open-water areas located within the existing Whatcom Waterway federal navigation channel and berths, and under-dock areas located beneath the BST wharf. A portion of Unit 1C was remediated by dredging during the Phase 1 cleanup. The Phase 2 Site cleanup will address the remaining areas of Unit 1C.

The current remedial approach includes dredging of open-water portions of Units 1A, 1B, and 1C, and placement of RMC afterwards. Contaminated sediments located beneath the BST wharf are to be removed to the extent practicable, with placement of clean backfill within the dredged area. Dredged materials from all areas are to be placed in the CDF to be constructed within the ASB.

2.3.2 Inner Whatcom Waterway (Units 2 and 3)

The Inner Whatcom Waterway extends from the BST to the head of the Whatcom Waterway at Roeder Avenue. There is no federal navigation channel within the Inner Whatcom Waterway. The Inner Whatcom Waterway consists of State-owned aquatic lands managed by DNR. The Port has a use authorization with DNR to utilize portions of the Inner Whatcom Waterway.

The Phase 1 Site cleanup addressed the innermost portion of the Inner Whatcom Waterway, extending from the Roeder Avenue bridge to approximately Laurel Street. The area was remediated

by dredging and capping, as well as installation of source control structures. Remaining portions of the Inner Whatcom Waterway are to be remediated by capping during the Phase 2 Site cleanup.

As shown in Figure 3, the Inner Whatcom Waterway has been subdivided into two units, designated as Unit 2 and Unit 3. Each of these Site Units has been further subdivided as follows (presented in order, moving from the Roeder Avenue Bridge out toward the BST):

- Unit 3A consists of an emergent tide-flat area located at the head of the Whatcom Waterway, adjacent to the Roeder Avenue Bridge. This is a monitored natural recovery (MNR) area. The current Phase 2 Site cleanup does not include planned work in this area.
- Units 3B and 2A were dredged and capped during Phase 1 of the Site cleanup. No further work in these areas is planned as part of the Phase 2 Site cleanup.
- Unit 2B is located between the Inner Whatcom Waterway and the ASB. It has been considered for future construction of an access channel to support future aquatic reuse of the ASB. The location and boundaries of Unit 2B are approximate and will be finalized during remedial design. The Phase 2 Site cleanup includes dredging and capping in this Site Unit.
- Unit 2C includes portions of the Inner Whatcom Waterway located between Unit 2A and Unit 1C. It extends upslope to the edge of the existing Log Pond cap and up to the edge of the future ASB access channel in Unit 2B. The current Phase 2 Site cleanup includes capping in this area, with an anticipated working water depth of 18 to 20 feet below MLLW in Inner Whatcom Waterway areas following cap placement. Some structure modifications at BST are planned to allow the Unit 2C cap to be extended upslope to the edge of the Log Pond cap.

2.3.3 Log Pond (Unit 4)

The Log Pond area was remediated as part of an Interim Remedial Action, which was completed by GP West in 2000 and early 2001. The Log Pond action included placement of a sediment cap to remediate Unit 4 sediments, as well as additional actions to enhance nearshore aquatic habitat in that area. Additional shoreline remediation, including slope stabilization and the placement of cap materials, was conducted as part of Phase 1 of the Site cleanup in 2016. No additional actions are anticipated inside the Log Pond during Phase 2 Site cleanup.

2.3.4 Area Offshore of the ASB (Unit 5)

The area offshore of the ASB is designated as Unit 5. It consists of a relatively shallow-water area, the majority of which has not been dredged previously for navigation uses. Unit 5 is subdivided into three units:

- Unit 5A includes deeper-water areas, offshore of the ASB. Surface sediments within this area are designated for MNR and comply with cleanup standards.
- Unit 5B is a localized high-energy nearshore area located on the "shoulder" of the ASB. Some surface sediments within this area have mercury concentrations that remain above cleanup

standards and are not expected to recover naturally within a reasonable restoration time frame. Phase 2 Site cleanup includes dredging and clean backfill in Unit 5B.

- Unit 5C includes shallow-water areas along the southeastern shoulder of the ASB, adjacent to the Inner Whatcom Waterway. This area is designated for MNR and complies with cleanup standards. Eelgrass has been observed growing in several areas within Unit 5C. The Phase 1 Site cleanup did not include any cleanup work within Unit 5C.

During Phase 2 Site cleanup, sediments from within a portion of Unit 5B will be dredged and clean sediments will be placed as backfill within the dredged area to maintain existing water depths and habitat conditions. The removed sediments will be placed within the CDF.

2.3.5 Areas Near Bellingham Shipping Terminal (Unit 6)

Unit 6 consists of the aquatic lands to the south and southeast of the Whatcom Waterway and BST. It includes a mixture of Port-owned and State-owned aquatic lands. This area has been subdivided into three units:

- Unit 6A includes deep-water areas of Unit 6 that comply with sediment cleanup standards.
- Units 6B and 6C consist of sediment areas located near the Port's rail span facility (i.e., barge dock). Sediments in this area comply with cleanup standards. However, previous design evaluations (Anchor QEA 2012) showed that sediments in these areas are likely unstable under anticipated propwash forces. Additional actions are required during Phase 2 Site cleanup to ensure long-term stability of contaminated sediments remaining at depth in these areas.

2.3.6 Aerated Stabilization Basin (Unit 8)

Unit 8 consists of the interior of the ASB. This facility was constructed by GP West in 1978 for treatment of process wastewater from pulp and tissue mill operations and remains in use by the Port for treatment of stormwater and legacy process wastewaters. Under the current design approach, the ASB footprint would be used for construction of a CDF for on-Site management of sediments removed from other areas of the Site. Construction of the CDF would require the following:

- Dredging, offloading, handling, and off-Site transportation and upland disposal of the accumulated soft sediments within the ASB
- Dredging of ASB transition sands from the base of the ASB, offloading, handling, and either conditional re-use as subgrade fill or off-Site disposal
- Removal of ASB clean sands and temporary transport to a stockpile area for re-use in Phase 2 placement activities; re-use of the remaining clean sands will be conducted under separate Port projects

After construction, the CDF would have the following characteristics:

- CDF footprint: approximately 24 acres at depth
- Capacity: approximately 330,000 cubic yards (cy)
- Anticipated future land use: marina
- Future working water depth: 14 to 15 feet below MLLW
- Access channel (opening the ASB berm to marine areas): located near Unit 2B (Figure 3); future depths 15 to 18 feet below MLLW

Following disposal of sediments removed from other areas of the Site, Unit 8 would be capped with clean material. At the conclusion of the work, the area would be subject to institutional controls and monitoring to ensure that the sediments within the CDF remain contained. Marina operations would occur over the top of the facility, with periodic maintenance dredging and piling/float replacement.

2.3.7 Remaining Area of the Site (Units 7 and 9)

Units 7 and 9 extend to the outer boundaries of the Site. These areas comply with Site cleanup standards and are being managed through MNR and institutional controls. No dredging or capping work is anticipated in either area during the Phase 2 Site cleanup. Characteristics of Units 7 and 9 include the following:

- Unit 7 (Starr Rock area) consists of a historical sediment disposal area used for management of sediments dredged from the Whatcom Waterway and adjacent berth areas during the late 1960s. The area is located in submerged offshore areas near the natural Starr Rock navigation obstruction. Surface sediments within this area comply with Site cleanup standards.
- Unit 9 consists of the remaining areas of the Site (beyond the boundaries of Units 1 through 8) that contain low-level subsurface mercury contamination. Surface sediments within this area comply with Site cleanup standards. Some portions of Unit 9 that overlap with adjacent cleanup sites contain exceedances of cleanup levels for other contaminants not associated with the Whatcom Waterway Site. Those areas are being remediated by the Port, City, and other parties as part of ongoing cleanup work at the I & J Waterway site, Cornwall Avenue Landfill site, R.G Haley site, and the South State Street Manufactured Gas Plant site (Figure 1).

3 Design Evaluation and Modification Recommendations for Phase 2 Site Cleanup

Port planning efforts have resulted in a re-evaluation of land-use decisions with a focus on a variety of marine trade uses. In response, the design team evaluated potential reconfigurations of the CDF that would address the Port's long-term goals, while sustaining or improving environmental performance of the CDF and achieving overall cost-effectiveness of the Phase 2 Site cleanup. This section describes recommendations to modify the current remedial approach for each of the Phase 2 Site Units. These recommendations address existing remediation requirements identified in Section 2 and have considered the following elements:

- Physical Site conditions as represented by recently completed bathymetric and topographic surveys completed in late 2019/early 2020
- Available environmental and geotechnical information for the Site and vicinity
- Current marine structural conditions as defined by Port-provided designs, record drawings, and recent structural assessments for existing waterfront infrastructure, including infrastructure that has been installed, repaired, or maintained subsequent to the 2007 Consent Decree
- Port land-use considerations and market conditions, including current anticipated land use and navigation requirements affecting each Site Unit
- Current proven technologies for remediation of sediments containing mercury, polycyclic aromatic hydrocarbon (PAH), and D/F compounds and other Site-related contaminants
- Existing Port commitments to sustainable design practices and alignment of Site remediation with habitat restoration and enhancement objectives for Bellingham Bay
- Completion of value engineering analyses for work in each Site Unit, based on the foregoing criteria

Figure 4 illustrates anticipated dredging and demolition activities, and Figure 5 illustrates material placement and structure modification activities to be conducted during Phase 2 Site cleanup. Table 1b lists the design criteria assumptions for the modified remedial approach shown in these figures, and Table 2b includes a summary of anticipated dredging and material placement volumes by Site Unit; both tables are provided for comparison of design assumptions and quantities with the current remedial approach. Figure 6 illustrates the proposed retaining structure for construction of the reconfigured CDF in the ASB; the final selection of a retaining structure approach should be made after further design and land use evaluations. Figure 7 illustrates a conceptual rendering of the reconfigured CDF as it may appear at the conclusion of Site cleanup activities. The reconfiguration results in a smaller CDF footprint, removes the CDF from aquatic areas, and reduces the encumbrances on future navigation depths within aquatic areas inside the ASB.

Appendix A illustrates the extents of recent bathymetric and topographic surveys that were conducted to inform the recommendations in this Memorandum. Pre-design information supporting the recommendation for the modified remedial approach is included in Appendices B and C. Appendix B provides additional detailed figures, and Appendix C presents the pre-design itemized cost estimate for the modified remedial approach. A summarized version of the Appendix C itemized cost estimate for the modified remedial approach is presented in Table 3.

Appendix D contains an updated itemized cost estimate for the current remedial approach. Under the current remedial approach, the larger CDF footprint below aquatic areas would be constructed, and the aquatic areas of the ASB would be limited to depths of 14 to 15 feet below MLLW following construction. The ASB access channel would have depths of 15 to 18 feet, and the Inner Whatcom Waterway would not be deepened beyond a working water depth of 18 to 20 feet. Other project design elements would remain unchanged. A summarized version of the Appendix D itemized cost estimate for the current remedial approach is presented in Table 3.

3.1 Outer Whatcom Waterway (Units 1A, 1B, and 1C)

No modification to the current remedial approach is recommended for the Outer Whatcom Waterway. Work will include both open-water and under-pier dredging activities.

3.1.1 Dredging in Open-Water Areas

Contaminated sediments within open-water areas of the Outer Whatcom Waterway would be removed by dredging, which would remove contaminated sediments to the base of the contamination.

Based on updated surveys and the estimated base of the contaminated layer, approximately 214,100 cy of contaminated sediment would be removed from the open-water areas in Units 1A and 1B, and in the portion of Unit 1C that was not previously dredged during the Phase 1 cleanup. This estimated dredge volume in the open-water areas of the Outer Whatcom Waterway includes the following (Table 2b):

- 35,200 cy from Unit 1A
- 82,600 cy from Unit 1B
- 96,300 cy from a portion of Unit 1C

Generated residuals from dredging would be managed using applicable best management practices. These would include using sampling to confirm that dredging has reached the base of contamination (i.e., that there is no missed inventory) and that generated residuals are not thicker or more contaminated than expected. Contingency re-dredging would be used to address missed inventory or excessive levels of generated residuals. A thin layer of clean sandy material would then be placed (RMC) to mix with and control the generated residuals. Testing would be performed to ensure that

project chemical performance criteria have been met. These measures were used successfully during Phase 1 dredging in Unit 1C open-water areas.

Sediments from open-water areas of Units 1A, 1B, and 1C are assumed to be dredged mechanically, transported by barge to the ASB, and transloaded over the ASB berm by pumping in an enclosed line. The sediments would be placed in the lower portion of the reconfigured CDF (see Section 3.4) using a spreader bar or similar equipment.

3.1.2 Dredging in Under-Pier Areas

Dredging would also be performed in the under-pier footprint of the BST within Unit 1C. The estimated dredge volume from the under-pier area would be approximately 8,000 cy (Table 2b), assuming removal of between 2 and 4 feet of contaminated material from the slope. Given the presence of overhead structures, the dredging would be more complex, slower, and more costly than the dredging in open-water areas of Unit 1C. Dredging would also be more limited in effectiveness by the proximity to overhead structures and by the slope geometry of the area. Detailed design assumptions and anticipated methods and limitations will be further developed during remedial design, including but not limited to engineering techniques to maintain the design depths over the long term that comply with navigational requirements.

Dredged materials removed from the under-pier areas at the BST would be transported by barge to the ASB and transloaded over the ASB berm by pumping in an enclosed line. The sediments would be placed in the lower portion of the reconfigured CDF (see Section 3.4) using a spreader bar or similar equipment.

Following completion of under-pier dredging, a clean cap would be placed in the under-pier dredged footprint. The final composition and thickness of the material would be determined during remedial design.

3.1.3 Clean Material Placement

The volume of placed clean materials in Units 1A, 1B, and 1C for the modified remedial approach is estimated at 48,500 cy (Table 2b). This includes an estimated thickness of 6 to 12 inches of RMC placed in open-water areas, and a thick cap layer of clean material placement in the BST under-dock area.

3.2 Area Offshore of the ASB (Unit 5B)

No modification to the current remedial approach is recommended for the area offshore of the ASB. Consistent with the current remedial approach, contaminated sediments within Unit 5B that exceed surface cleanup standards would be removed by dredging. Dredging is anticipated to be performed mechanically, with removal depths to the base of the contamination or at least 3 feet below the

existing mudline surface. To avoid destabilizing slopes and structures, no dredging would be performed immediately adjacent to the ASB berm or the buried outfall structure.

The total volume of dredging within Unit 5B is estimated to be 14,500 cy (Table 2b). These sediments would be dredged mechanically, transported by barge to the ASB, and transloaded over the ASB berm by pumping in an enclosed line. The sediments would be placed in the lower portion of the reconfigured CDF (see Section 3.4) using a spreader bar or similar equipment.

After completion of dredging, Unit 5B would be capped with clean materials (approximately 15,500 cy; Table 2b). The clean materials would be either clean sandy sediments generated during work in other Site Units, or clean import materials from a commercial quarry. Quarry materials containing sand, gravel, and cobbles would be preferred for this area, given the higher wave energies the sediments are exposed to.

3.3 Areas Near Bellingham Shipping Terminal (Units 6B and 6C)

A modified remedial approach is recommended for the areas near the BST. Further work is required to address shoaling in the rail span area and protect against future propwash erosion and resulting recontamination in portions of Units 6B and 6C located near the rail span (i.e., barge dock).

The Port anticipates that the rail span structure will be retained but that the adjacent "chemical dock" used by GP West and some no-longer-needed portions of the rail span may be removed. The rail span structure was designed to support vessel drafts of up to 15 feet below MLLW, and continued use of the structure is required to support Port operations. These depths support typical barge loading/unloading operations.

Recent surveys show that extensive shoaling has occurred within the berth adjacent to the rail span. To sustain planned operations, this shoaling would need to be removed by dredging to permit placement of a sediment cap or anti-erosion layer. The thickness and composition of this layer will be determined during remedial design.

Modified design assumptions call for removal of approximately 11,300 cy of sediment (Table 2b). This sediment would be dredged mechanically, transported by barge to the ASB, and transloaded over the ASB berm by pumping in an enclosed line. The sediments would be placed in the lower portion of the reconfigured CDF (see Section 3.4) using a spreader bar or similar equipment.

Following dredging to required depths, a sediment cap or anti-erosion layer would be placed as necessary to contain any underlying contaminated sediment and resist potential propwash erosion effects. The minimum placement thickness is assumed to be 3 feet. This results in an estimated placement volume of 10,100 cy (Table 2b) in this area.

3.4 Aerated Stabilization Basin and Access Channel (Units 8, 2B, and a Portion of 2C)

A modified remedial approach is recommended for the ASB and access channel, as detailed in this section. The current remedial approach includes construction of a 24-acre CDF beneath the floor of the ASB (Ecology 2011). Under the current CDF design, the water depths within the ASB aquatic areas would be constructed to depths of 14 to 15 feet below MLLW to support future use as a marina.

Current land uses for the ASB area are specified as Marine Trades in the City of Bellingham's Sub-Area Plan. Some of the uses contemplated for the ASB and vicinity would be precluded or limited by the current remedial approach. In response, the design team evaluated potential reconfigurations of the CDF that would resolve these limitations, while sustaining or improving environmental performance of the CDF and achieving overall cost-effectiveness of the Phase 2 Site cleanup.

The findings of the reconfigured CDF evaluation have been incorporated into the design team's recommendations for Unit 8, Unit 2B, and adjacent portions of Unit 2C. The reconfiguration of the CDF under the modified remedial approach is described in the following subsections.

3.4.1 Reconfiguration of Confined Disposal Facility

The design team recommends that the current CDF be reconfigured to better align with anticipated land use and navigation requirements. The reconfigured CDF is illustrated in Figures 4, 5, and 7. This reconfiguration is expected to result in the following benefits:

- **Reduction of CDF footprint:** Pre-design evaluations indicate that the CDF footprint could be reduced from 24 acres to approximately 12 to 14 acres under the modified remedial approach. This could be achieved by consolidating the sediment placement within the footprint portion of the ASB located closest to Roeder Avenue, bringing the height of the CDF above current water levels, and capping the CDF footprint. The final surface elevation can be adjusted based on planned future uses and consideration of expected sea-level rise.
- **Elimination of sediment disturbance risks:** The current CDF design assumes that the aquatic basin would be used for a small boat marina over the top of the CDF. A sediment cap is included to protect the CDF from sediment propwash and other erosional forces. In contrast, the reconfigured CDF under the modified remedial approach removes all contaminated sediments from the aquatic areas of the ASB. This eliminates propwash and other sediment disturbances as concerns for the CDF.
- **Support to a wider range of aquatic uses:** Under the reconfigured CDF for the modified remedial approach, water depths within the ASB would not be limited by the presence of a CDF beneath the basin. This means that a wider range of aquatic uses could be supported, facilitating development of marine trades activities consistent with current land use planning.

Because contaminated materials would be fully removed from the ASB aquatic areas, use of these aquatic areas would not be restricted by institutional controls.

- **Better support for planned upland uses:** Under the modified remedial approach, the reconfigured CDF would continue to support the public access and habitat objectives considered previously. In addition, the reconfigured CDF would result in approximately 12 to 14 acres of upland that could be used to support community land use objectives.
- **Improved CDF capacity:** The capacity of the current CDF is limited by the footprint of the ASB, the thickness of clean sands beneath the ASB, and the navigation requirements of the future marina basin. The reconfigured CDF under the modified remedial approach has an improved capacity that would be able to manage all of the sediments dredged during the Phase 2 Site cleanup. In addition, the reconfigured CDF would provide on-Site management and disposal of dredged sediments from within the ASB prior to CDF construction, and would eliminate the need for their offloading, off-Site transportation, and upland disposal; in addition, the reconfigured CDF would accommodate additional materials that may be generated during deepening of the Whatcom Waterway and access channel (see Section 3.4.2). The reconfigured CDF and basin footprints shown for the modified remedial approach in Figures 4, 5, and 7 are preliminary and are based on current planning assumptions. These may be adjusted during detailed remedial design and permitting.
- **Improved cost-effectiveness:** The increase in CDF capacity under the reconfigured CDF and the on-Site management of the soft sediments are expected to result in significant cost savings to the Phase 2 Site cleanup. Overall project costs may be reduced by more than $54 million (2020 dollars), despite improving environmental performance of the CDF and improving navigation and land use opportunities for the completed cleanup (see comparison of summary costs in Table 3 of the current and modified remedial approaches; Appendices C and D contain the itemized cost estimates for both approaches). A portion of these cost savings is associated with managing the soft ASB sediments (estimated volume 320,700 cy) within the reconfigured CDF, rather than managing these sediments through off-Site disposal (Table 2a).
- **Shortened construction schedule:** The best-case construction schedule for Phase 2 Site cleanup with the CDF design under the current remedial approach is 4 years. The reconfigured CDF under the modified remedial approach supports a faster cleanup schedule, between 2 and 3 years.

Under the modified remedial approach, a retaining structure would be constructed at the approximate alignment shown in Figure 5. The form of the structure will depend on final detailed remedial design evaluations but could consist of an earthen berm or a vertical wall with a core of earth contained by metal structures. Costs for the modified remedial approach in Appendix C assume the use of a cofferdam type of structure constructed with vertical metal walls containing an inner

clean earthen core. The walls could be placed either in parallel (e.g., a classic cofferdam structure) or using a set of circular cells, as shown in Figure 6. Construction of a reconfigured CDF per the modified remedial approach (e.g., vertical earthen/structural wall retaining structure) would generally include the following steps:

- Metal sheets would be installed within the proposed alignment using floating equipment located within the ASB.
- Contaminated sediments within the retaining structure footprint would be removed by dredging and would be consolidated within the CDF.
- Clean soil/sediment would be placed within the retaining structure.
- The CDF would be completed in-shore of the retaining structure, and basin dredging would be completed offshore of the retaining structure.
- A final working surface would be placed over the top of the retaining structure, with the working surface designed to support proposed land uses.

Costs in Appendix C for the reconfigured CDF under the modified remedial approach assume that the vertical retaining structure is used and that the basin depth adjacent to it has a depth of approximately 25 feet below MLLW. An earthen berm option could be used in place of the vertical retaining structure, but this approach would not support some Marine Trades uses.

Following initial placement of the retaining structure, dredged sediments would be placed within the interior of the CDF. This would include the sediments from the offshore footprint of the ASB, as well as sediments from other Phase 2 Site Units. Current volume estimates of sediments to be managed in the reconfigured CDF under the modified remedial approach are shown in Table 2b. To facilitate the transfer of material from the other Site Units to the CDF, eight mooring dolphins will be installed along the southeast exterior face of the ASB to secure transport barges during transfer activities.

Once contaminated materials have been removed from the basin portion of the ASB and confined within the CDF, the basin will be deepened to the desired depth. Clean sands generated during this step are assumed to be reused within the cleanup project for filling of the retaining structure, capping of the CDF, and/or placing environmental caps in other Site Units. Assuming a target basin working depth of 25 feet below MLLW, the total clean sand removed from the basin and access channel is estimated to be more than 209,000 cy (Table 2b), including clean sands to be reused within the Site cleanup.

After all project material has been placed in the CDF, the upland area will be capped with a minimum of 2 feet of clean material. A final working surface can then be placed above the cap elevation to support future land uses. The current estimated cap elevation is 16 feet above MLLW. The minimum final working surface for the ASB upland would be approximately 2 feet above that. This elevation could be adjusted upward if desired by placement of additional fill materials above the CDF. The

surrounding ASB berms and the ground surface adjacent to the former GP West Warehouse are at an elevation of approximately 24 feet above MLLW.

3.4.2 Reconfigured Basin Access Channel

The current cleanup requirements specify that an access channel be created into the ASB (e.g., through the berm) in the vicinity of Unit 2B. Under the modified remedial approach, the access channel would be adjusted slightly as shown in Figures 4, 5, and 7. Costs for the modified remedial approach in Appendix C assume that the access channel will be constructed to support a working water depth of 25 feet below MLLW, consistent with the assumed working water depth of the aquatic areas of the ASB.

The reconfigured basin access channel will also require deepening within adjacent portions of Unit 2C to allow safe vessel ingress and egress between the federal navigation channel and the ASB. Costs for the modified remedial approach in Appendix C assume that the area between the access channel and the federal navigation channel will be deepened to a final working depth of 25 feet below MLLW. This includes an estimated 66,700 cy of additional dredging, followed by capping (Table 2b). Materials removed by this additional dredging would be consolidated within the CDF. Dredged areas would be capped as described in Section 3.5.

In addition to providing vessel access to the ASB, the modified remedial approach could also incorporate the construction of a fish passage structure in the northwestern portion of the ASB berm. This structure would allow free passage of juvenile salmonids and other fish between the ASB nearshore areas and the eelgrass flat located just north of the ASB. This fish passage would improve the fish migration corridors through the project area and optimize the value of any newly created aquatic habitat within the ASB basin. The final detailed design of the fish passage structure will need to consider wave action in the project area, sediment depths outside the ASB basin, and numerous other factors.

3.5 Inner Whatcom Waterway Area (Portion of Unit 2C)

No modification to the current remedial approach is recommended for the contaminated sediments in the remaining portions of Unit 2C (those inshore of the ASB access channel), which are to be remediated by construction of an engineered sediment cap. Cap thickness is expected to vary between approximately 3 and 6 feet in thickness. The specific cap dimensions and cap material types will be defined during detailed remedial design.

Total cap volumes for Unit 2C are currently estimated at 110,400 cy (Table 2b). Clean sands generated from dredging activities completed within Unit 8 are assumed to be beneficially reused for a portion of the required cap materials in Unit 2C. Some new quarry-derived materials will also be

required to provide coarse materials (e.g., gravel and cobbles) that will be stable under anticipated navigation uses.

Based on recently completed bathymetric surveys, localized areas of dredging may be required to facilitate placement of engineered sediment cap materials below the working waterway depths of 18 to 20 feet below MLLW. Areas of shoaling within the Inner Whatcom Waterway are estimated to require approximately 12,300 cy (Table 2b) of dredging. These sediments will be placed in the CDF along with other dredged materials generated during the Phase 2 Site cleanup.

Capping is required along the shoreline of the GP West Site. A cap placement volume of 15,500 cy (Table 2b) is assumed for this area. Considerations for capping in this area include the following:

- Access to this area is currently restricted by the presence of the GP West dock structure. Whether the old industrial structure is to be removed, retained, or modified is the subject of ongoing land use planning. Costs for the modified remedial approach in Appendix C assume that capping in this area is completed at a time when physical access to the area is available without restriction. If capping is to be completed with the existing industrial structure in place, costs are anticipated to be significantly higher compared to completing the work after the removal of the existing industrial structure.
- Cost estimates for the modified remedial approach in Appendix C for capping along the GP West shoreline also conservatively includes a dredging allowance of 15,500 cy (Table 2b). The need for this dredging will be dictated by final cap elevations and associated waterway geometries (Inner Whatcom Waterway working depths and channel boundaries). Integrated planning of Site remediation and future shoreline infrastructure is recommended to optimize the alignment and cost-effectiveness of Phase 2 Site cleanup actions in this area.

The current remedial approach addresses similar access restrictions on Unit 2C capping at the northeastern end of the BST pier. Placement of sediment cap and armor materials are required in this area to seat the Unit 2C cap into the edge of the existing Log Pond cap. The current remedial approach addresses these restrictions with the following planned actions:

- Remove the existing pier section extending from BST into the Log Pond.
- Conduct capping operations along the Unit 2C/Log Pond transition.
- Maintain vessel berthing capability with the placement of a berthing dolphin, catwalk and catwalk support piling adjacent to the Log Pond, and two berthing dolphins and a catwalk on the other end of the BST.

4 Estimated Schedule for Design, Permitting, and Construction

This section discusses the anticipated schedule and steps for Phase 2 remediation activities, assuming the cleanup work follows the modified remedial approach from the present through the projected completion of construction.

4.1 Pre-Design Data Needs

Regardless of the selected remedial approach, additional pre-design data collection will be required prior to completion of the 30% design and development of the MTCA Engineering Design Report (EDR). Anticipated testing activities would be performed consistent with the requirements of a U.S. Army Corps of Engineers (USACE) Nationwide 6 Permit. Key pre-design data needs, as understood at this time, include the following:

- **Sediment coring:** Sediment coring is recommended within proposed dredge areas where necessary to confirm the transitions between contaminated materials and clean underlying sediments. Currently, core sampling is recommended for the Outer Whatcom Waterway dredge areas (Units 1A, 1B, and 1C, to supplement existing core information), the proposed ASB access channel (Unit 2B), and areas near the BST (the rail span area; Units 6B and 6C).
- **Supplemental under-pier surveys:** Phase 2 Site cleanup actions include work in two under-pier areas at the GP West dock and BST. Additional bathymetric surveys, visual inspections, and jet probing surveys are recommended to verify physical conditions in these areas. The bathymetric surveys would be performed using conventional survey equipment to eliminate survey data gaps. Visual inspections would be performed to confirm existing structural conditions and encumbrances on remediation planning. Jet probe surveys would be used to confirm the locations and depths of armor stone and to confirm the locations and thicknesses of contaminated sediments located on top of the armor.
- **Physical testing of ASB sediments:** During construction of the CDF, some of the existing sediments inside the ASB will need to be relocated and consolidated. The physical properties of these sediments are different than those of other waterway sediments and warrant further evaluation to estimate sediment handling and consolidation properties. Collection of samples from the ASB for physical testing is recommended to optimize detailed design evaluations.
- **Supplemental structural assessments:** Some additional structural assessments may be required in the GP West dock, BST, and rail span areas to support detailed remedial design. These assessments should build upon existing documentation. The extent of these assessments in the GP West dock area will depend on future plans for this area.
- **Supplemental geotechnical testing:** In most cases, existing geotechnical testing appears suitable to support the proposed work. However, additional information may be required in the BST under-pier area (Unit 1C), the GP West dock areas (Unit 2C), and in the alignment of the proposed CDF retaining structure (Unit 8).

- **Eelgrass surveys:** Consistent with current agency guidance and best practices, current eelgrass surveys will be needed in project nearshore work areas. These are currently anticipated along the BST work areas (Units 1C and 6B/C), along the edges of the ASB (Units 2B, 5B, and 5), and along the edges of Unit 2C near the ASB, Log Pond, and GP West dock areas.
- **Consultation with Puget Sound Pilots and other agencies:** Vessel pilots will be consulted to inform design decisions related to vessel movements/navigation requirements and dredging maintenance at and along facilities within the Project cleanup footprint.

4.2 Engineering Design

Under the recommended modified remedial approach, an amendment to the existing Consent Decree (Ecology 2007a, 2011) will likely be required. The amendment and the associated public review process should be performed in parallel with initiation of pre-design data collection, as the pre-design data collection is required regardless of which remedial approach is pursued for the Unit 8 CDF. The Consent Decree amendment is assumed to be completed during 2020.

The key pre-construction deliverable required under the Consent Decree is the EDR. This report is typically prepared at the 30% design level and defines the basis of design for all cleanup project activities and sets performance expectations for the work. The EDR development will need to await completion of most pre-design data collection. Submittal of the EDR to Ecology could be completed in mid-2021, provided that the pre-design data collection and the Consent Decree amendment are performed in parallel during 2020.

The formal engineering design process after the EDR will include development of a 60% design in late 2021, a 90% design in early 2022, and a final 100% design by the end of 2022. Assuming procurement of applicable permits, this would allow bidding and implementation of the project beginning in 2023.

Ideally, the resolution of future plans for the GP West dock area will be resolved during 2020 so that implementation of required cleanup in that area can be aligned with those plans. Otherwise, cleanup in that area may require a separate phasing at a higher cost.

4.3 Permitting

Permitting will address Phase 2 remediation activities associated with dredging, capping, removal and modification of certain marine structures, construction of a CDF within the ASB, and enhancing habitat conditions. Permitting effort for this remediation project is discussed separately from permitting of future waterfront redevelopment activities to be conducted after cleanup.

Initial permitting activities will involve pre-permit outreach during 2020 and early 2021. Permit applications and supporting documentation will be submitted for agency review in mid-2021 following completion of pre-design investigations and development of the 30% design. Permitting is anticipated to require at least 18 months to complete. This could support initiation of construction as early as 2023. Permitting schedules may be extended, depending on the time required to address agency requirements and coordination between the Port and other stakeholders.

Cleanup actions at the Site are anticipated to require the following permits:

- **Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act for discharge of dredged, excavated, or fill material to waters of the United States:** An Individual Section 10/404 permit will be issued by the USACE for Phase 2 Site cleanup. The federal permitting process includes review of issues relating to wetlands, tribal treaty rights, threatened and endangered species, habitat impacts, historic/archaeological resources, dredged material management, environmental impacts, and other factors. The time required to complete federal permitting and associated regulatory reviews can vary from one to several years, and it will include review under the Endangered Species Act, Section 106 of the National Historic Preservation Act, Coastal Zone Management Act, National Environmental Policy Act, and use or alteration of a civil works projects under 33 United States Code 408. As work beyond standard maintenance dredging is included within federal navigation channel areas of Units 1A, 1B, and 1C, a Section 408 approval will likely be required.
- **Section 401 water quality certification:** If an individual Section 10/404 permit is issued by USACE, Ecology may require a Section 401 water quality certification. This certification ensures that the 404 permitted actions will comply with State water quality standards and other aquatic resource protection requirements under Ecology's authority. Ecology may not require a formal 401 water quality certification if a Nationwide 38 permit is issued, in which case water quality issues will be addressed by Ecology as part of the EDR review and approval.
- **National Pollutant Discharge Elimination System (NPDES) permitting:** Stormwater and construction process water will be appropriately managed for all upland materials transloading, stockpiling, and rehandling. Management of stormwater and water from dredge material management is allowed under the existing NPDES permit maintained by the Port for the ASB and the associated GP West-owned outfall. Depending on proposed discharge activities determined during design, the NPDES permit for the ASB and associated outfall may be modified to incorporate necessary construction requirements. The construction work may also require a construction stormwater general permit for certain activities not otherwise covered under the existing NPDES permit or the Section 401 water quality review. At the conclusion of the Site cleanup work, the existing ASB NPDES permit is anticipated to be terminated because the ASB would likely no longer be used for stormwater treatment.

- **Washington State scientific collection permit:** Long-term monitoring following completion of Phase 2 Site cleanup may include ongoing crab tissue collection and analysis. The Washington Department of Fish and Wildlife (WDFW) issues this permit as part of their management and protection of the resource.

Because the work will be conducted under an MTCA Consent Decree, the project is exempt from the procedural requirements of most state and local permits (Revised Code of Washington 70.105D.090). However, MTCA requires compliance with the substantive provisions of these regulatory programs. The substantive requirements of the following approvals, known at this time to be applicable to the cleanup, will be addressed during design and permitting:

- **Hydraulic project approval:** The project will not require a formal hydraulic project approval. This approval is issued by WDFW and defines State requirements for construction activities in order to avoid unnecessary disturbance to fish, shellfish, and wildlife. The Port and Ecology will work with WDFW to ensure protection of fish, shellfish, and wildlife during project construction.
- **Shoreline Management Act permitting:** Shoreline regulations defer to Ecology for Site-specific review of cleanup actions conducted under MTCA. Ecology will consider the substantive provisions of the City's Shoreline Master Program as part of the EDR process, but no shoreline permit will be required.
- **Critical Areas Ordinance:** The substantive provisions of the City's Critical Areas Ordinance will be considered by Ecology as part of the EDR process, but a critical areas permit will not be required.
- **Development permits:** Projects within the City limits that include fill and grade activities and construction of new infrastructure require permits for these activities. Grading and building permits are issued by the City and include requirements to protect the environment and human health and safety. Portions of the CDF construction are expected to be subject to these substantive requirements.

WDFW and the City will be consulted as part of cleanup design and permitting to identify applicable substantive requirements and to ensure that these requirements are addressed as part of the cleanup. A written description of their substantive permit requirements will be included in the EDR.

The Phase 2 Site cleanup was previously evaluated under State Environmental Policy Act (SEPA) regulations (WAC 197-11). Additional SEPA review is not anticipated at this time because the recommended work is within the scope of alternatives previously evaluated in the Final Environmental Impact Statement (Ecology 2007b).

The placement of caps on State-owned aquatic lands managed by DNR will involve development of appropriate agreements (e.g., easement agreements) consistent with the planned remedial action.

The Port and DNR have an existing interagency agreement supporting completion of the Whatcom Waterway cleanup project. The Port will work with DNR to coordinate development of final agreements required for project construction and implementation of institutional controls required under the project.

The Port anticipates generating mitigation credits as part of the cleanup. The cleanup is expected to generate more credits than are required for the cleanup project itself. The Port may choose to reserve these credits for future use in advance of planned Port projects. Advance mitigation credits may be documented in Memoranda of Agreements with each local, state, and federal organization. The Port could alternatively elect to develop a mitigation bank to manage these habitat credits. Use of a mitigation bank approach would involve additional agency agreements and could extend the time required for project permitting.

4.4 Construction

Based on pre-design evaluations, the construction of the reconfigured CDF under the modified remedial approach will require 2 or 3 years to complete. This duration is less than the expected 4-year construction period for the current remedial approach described in Appendix D. Construction phasing is currently assumed to be as follows:

- Initial construction activities would be performed inside the ASB prior to connection of the ASB basin to the Whatcom Waterway. These activities would not be subject to typical "fish windows" that limit the dates of in-water construction activities.
- The first construction season would include development of the CDF inside the ASB. This work would include Site preparation, construction of the reconfigured CDF retaining structure, consolidation of the ASB soft sediments within the CDF, and excavation of clean sands from the other portion of the ASB for use within the Phase 2 placement activities.
- The second (and possibly third) construction seasons will include dredging and capping activities within the remaining Phase 2 Site Units, placing dredged materials within the reconfigured CDF, placing clean materials (sediment caps, backfill, and RMC), capping the reconfigured CDF, and modifying marine structures.

The duration of construction activities will be further assessed during final detailed remedial design and permitting.

5 Summary and Next Steps

The modified design presented in this Memorandum is the approach recommended by the design team after completion of design review, supplemental surveys, and value engineering effort. Significant observations regarding the modified design approach include the following:

- The modified design approach fulfills the remediation commitments contained in the Consent Decree (Ecology 2007a, 2011), with full removal of contaminated sediments from federal navigation channel areas of the Whatcom Waterway and dredging and capping of other areas of sediment requiring remediation.
- It continues to use a CDF for management of sediments within portions of the ASB as called for in the First Amendment to the Consent Decree (Ecology 2011), but it reconfigures the CDF to reduce its footprint, optimize its environmental performance, and align the remedy with land use requirements for the ASB and associated marine trades areas.
- The modified remedial approach can be implemented more quickly than the current remedial approach, reducing construction durations by 1 to 2 years.
- The reconfigured CDF improves CDF capacity and overall cost-effectiveness of the remedy, providing a cost reduction of roughly $54 million in 2020 dollars. This is achieved despite providing improved operating depths within the completed ASB basin (25 feet versus 14 to 15 feet below MLLW) and the adjacent areas of the Inner Whatcom Waterway (25 feet versus 18 to 20 feet below MLLW).
- Several project scoping decisions remain to be made prior to finalization of the design, including the following:
  - **Type of CDF retaining structure:** The cost estimate for the modified remedial approach assumes the use of a vertical earth-filled retaining structure to separate the CDF from the aquatic portions (e.g., basin) of the ASB. An earthen berm option would further reduce remedy costs but may not be supportive of some marine trades uses. The final selection of retaining structure design should be made after further consideration of potential land uses for the reconfigured CDF and aquatic portion of the ASB.
  - **Timing for remediation in the GP West dock area:** The timing for completion of sediment capping in the GP West dock area of Unit 2C is dependent on decisions regarding the future of the dock structure. Costs are included for completing sediment capping in the GP West dock area of Unit 2C. However, physical access to this area is currently very limited. If the dock structure is to be replaced in the future by an updated better structure aligned with planned land uses, then remediation should be phased so that capping in this area can be completed when the structure is upgraded.

Immediate next steps include the following:

- **Initiation of pre-design investigations:** Pre-design sampling and testing are needed to fill the data needs identified in Section 4.1.
- **Amendment of the Consent Decree:** The modified remedial approach will likely require a second amendment of the Consent Decree. This update can be performed in parallel with pre-design investigations. The amendment should also update the project schedule and address Ecology's desire to formally incorporate its regional background value for D/F as a cleanup standard for D/F compounds.
- **Confirmation of land use assumptions:** As described above, the project design will benefit from confirmation of planned uses within the ASB and from definition of future plans for the GP West dock area (so that phasing of remediation in that area may be better defined).
- **Initiation and completion of partner and stakeholder outreach:** The Port will begin engagement with key partners and stakeholders to communicate the Project and key elements. Outreach will commence in 2020 prior to the start of 30% engineering design and permit application submittal and will continue throughout the design and construction implementation phases of the Project.

Following completion of these activities, detailed remedial design and permitting activities may be initiated. Under current expectations, a construction start date of 2023 is feasible. The anticipated construction duration is 2 to 3 years.

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Tables

Table 1a

Current Design Assumptions by Site Unit

Unit	Current Design Assumptions					
	Final/Target Elevation	Future Maintenance Dredging Buffer	Material Placement Assumptions	Required Dredging Elevation/Thickness	Overdredge Allowance	Final Dredge Elevation/Thickness[a,b]
1A	-36 ft MLLW	--	Dredge to clean; no cap needed	-36 ft MLLW	1 ft	**-37 ft MLLW**
1B	-36 ft MLLW	--	Dredge to clean; no cap needed	-36 ft MLLW	1 ft	**-37 ft MLLW**
1C - West	-40 ft MLLW	--	Dredge to clean; no cap needed	-40 ft MLLW	1 ft	**-41 ft MLLW**
1C - East	-36 ft MLLW	--	Dredge to clean; no cap needed	-36 ft MLLW	1 ft	**-37 ft MLLW**
BST under-pier[c]	2-ft cut	--	2-ft cap	2-ft cut	1 ft	**3-ft cut**
2B	-18 ft MLLW	2 ft	Engineered cap of varying thickness	-24 ft MLLW	1 ft	**-25 ft MLLW**
2C	-18 ft MLLW	2 ft	Engineered cap of varying thickness	-24 ft MLLW	1 ft	**-25 ft MLLW**
5B	--	--	Backfill to existing	3-ft cut	1 ft	**4-ft cut**
8	-12 ft MLLW (approx.)	2 ft	Contain contaminated sediments in CDF	Varies; into transition sands	1 ft	**Transition sands + 1 ft**
6A, 6B, 6C	N/A	--	--	--	--	**--**
GP West Dock Area	N/A	--	--	--	--	**--**

Footnotes:

a. All side slopes are assumed to be 2H:1V (horizontal to vertical).

b. Final dredge elevation/thickness includes overdredge allowance.

c. Dredging associated with BST under-pier includes only contaminated sediments located in the footprint beneath the BST wharf, to be removed to the extent practicable (2- to 4-ft thickness removal).

--: not applicable BST: Bellingham Shipping Terminal ft: foot/feet GP West: Georgia-Pacific West, Inc. MLLW: mean lower low water

Table 1b

Modified Design Assumptions by Site Unit

Unit	Modified Design Assumptions					
	Final/Target Elevation	Future Maintenance Dredging Buffer	Material Placement Assumptions	Required Dredging Elevation/Thickness	Overdredge Allowance	Final Dredge Elevation/Thickness[a,b]
1A	-36 ft MLLW	--	Dredge to clean; no cap needed	-36 ft MLLW	1 ft	**-37 ft MLLW**
1B	-36 ft MLLW	--	Dredge to clean; no cap needed	-36 ft MLLW	1 ft	**-37 ft MLLW**
1C - West	-40 ft MLLW	--	Dredge to clean; no cap needed	-40 ft MLLW	1 ft	**-41 ft MLLW**
1C - East	-36 ft MLLW	--	Dredge to clean; no cap needed	-36 ft MLLW	1 ft	**-37 ft MLLW**
BST under-pier[c]	2-ft cut	--	2-ft cap	2-ft cut	1 ft	**3-ft cut**
2B	-25 ft MLLW	2 ft	Dredge to clean; no cap needed	-27 ft MLLW	1 ft	**-28 ft MLLW**
2C - West	-25 ft MLLW	2 ft	Place between 4 and 6 feet of material	-33 ft MLLW	1 ft	**-34 ft MLLW**
2C - East	-18 ft MLLW	2 ft	3-ft cap	-24 ft MLLW	1 ft	**-25 ft MLLW**
5B	--	--	Backfill to existing	3-ft cut	1 ft	**4-ft cut**
8	Hard bottom plus 2 ft (plus 4 ft on slopes)	--	Contain contaminated sediments in CDF	Hard bottom plus 2 ft (plus 4 ft on slopes)	1 ft	**Hard bottom plus 2 ft (plus 4 ft on slopes)**
	-25 ft MLLW	2 ft	--	-27 ft MLLW	1 ft	**-28 ft MLLW**
6A, 6B, 6C	-15 ft MLLW	2 ft	3-ft cap plus 1-ft overplacement	-21 ft MLLW	1 ft	**-22 ft MLLW**
GP West Dock Area[d]	3-ft cut	--	--	3-ft cut	1 ft	**4-ft cut**

Notes:

1. Pre-design target elevations for the modified remedial approach shown on Figure 4 have been developed to define remediation requirements for the project. Final elevations will be determined during remedial design to account for facility functionality and structural stability considerations.

Footnotes:

a. All side slopes are assumed to be 2H:1V (horizontal to vertical).

b. Final dredge elevation/thickness includes overdredge allowance.

c. Dredging associated with BST under-pier includes only contaminated sediments located in the footprint beneath the BST wharf, to be removed to the extent practicable (2- to 4-ft thickness removal).

d. Limited dredging associated with GP West Dock includes only contaminated sediments located in the footprint beneath the GP West dock structure, to support placement of a cap. The timing for completion of sediment capping in the GP West dock area is dependent on decisions regarding the future of the dock structure.

--: not applicable BST: Bellingham Shipping Terminal ft: foot/feet GP West: Georgia-Pacific West, Inc. MLLW: mean lower low water

Table 2a

Dredging and Material Placement Volumes for Current Remedial Approach

Unit	Contaminated Sediment Dredging Volume (cy)	Clean Sand Dredging Volume (cy)	Clean Material Placement Volume (cy)
1A	124,400	--	18,200
1B		--	
1C	60,000	--	8,500
BST under-pier	7,800	--	6,100
2B	11,500	23,000	--
2C	2,200	--	104,500
GP West under-pier	--	--	--
5B	18,000	--	18,000
6B and 6C	--	--	3,100
8	350,500	528,100	164,600
Total	**574,400**	**551,100**	**323,000**

Notes:
--: not applicable
BST: Bellingham Shipping Terminal
cy: cubic yard
GP West: Georgia-Pacific West, Inc.

Table 2b

Dredging and Material Placement Volumes for Modified Remedial Approach

Unit	Contaminated Sediment Dredging Volume (cy)	Clean Sand Dredging Volume (cy)	Clean Material Placement Volume (cy)
1A	35,200	--	9,800
1B	82,600	--	18,000
1C	96,300	--	12,700
BST under-pier	8,000	--	8,000
2B	12,300	77,500	3,800
2C	66,700	--	110,400
GP West under-pier	15,500	--	15,500
5B	14,500	--	15,500
6B and 6C	11,300	--	10,100
8	195,000	132,290	14,500
Total	**537,400**	**209,790**	**218,300**

Notes:
--: not applicable
BST: Bellingham Shipping Terminal
cy: cubic yard
GP West: Georgia-Pacific West, Inc.

Table 3

Summary Costs for Current and Modified Remedial Approaches

Task Description	Current Remedial Approach Probable Total Cost ($)	Modified Remedial Approach Probable Total Cost ($)
Season 1 Construction		
Mobilization/Demobilization	$ 950,000.00	$ 950,000.00
Site Preparation	$ 2,008,427.66	$ 1,498,412.04
Surveys	$ 309,963.83	$ 173,000.00
Dredging and Disposal/Management of ASB Materials	$ 59,757,036.77	--
Construction of CDF Retaining Structure in Unit 8	--	$ 10,447,454.11
Dredging Within Unit 8 (West of CDF Retaining Structure)	--	$ 6,408,530.60
Sediment Placement within CDF	--	$ 1,856,376.00
ASB Discharge Structure Decommissioning	$ 250,000.00	$ 250,000.00
Season 1 Construction - Subtotal Costs	**$ 63,275,428.26**	**$ 21,583,772.76**
Sales Tax (8.7%)	$ 5,504,962.26	$ 1,877,788.23
Season 1 Construction - Subtotal Costs (Including Sales Tax)	**$ 68,780,000.00**	**$ 23,462,000.00**
Season 2 Construction		
Mobilization/Demobilization	$ 950,000.00	$ 950,000.00
Surveys	$ 743,000.00	$ 743,000.00
Structural Work	$ 1,838,231.70	$ 1,838,229.19
Dredging Within Remaining Whatcom Waterway Phase II Units and In-water Transportation	$ 4,879,665.22	$ 8,134,897.19
Sediment Placement within CDF	$ 2,486,379.85	$ 4,418,433.55
Sediment Capping, Armoring, and RMC Placement	$ 8,436,515.32	$ 7,074,843.19
Season 2 Construction - Subtotal Costs	**$ 19,333,792.08**	**$ 23,159,403.12**
Sales Tax (8.7%)	$ 1,682,039.91	$ 2,014,868.07
Season 2 Construction - Subtotal Costs (Including Sales Tax)	**$ 21,016,000.00**	**$ 25,174,000.00**
Total Construction Costs (Including Sales Tax)	**$ 89,796,000.00**	**$ 48,636,000.00**
Project Contingency (30%)	$ 26,938,800.00	$ 14,590,800.00
Total Project Construction Costs (Including Sales Tax)	**$ 116,735,000.00**	**$ 63,227,000.00**

Notes:

1. Probable total costs for the current and modified remedial approaches are presented in year 2020 dollars.
2. Costs presented are preliminary and subject to change; they are based on the pre-design evaluation conducted in this Memorandum and for planning purposes only.
3. Itemized cost estimates for the current and modified remedial approaches are presented in Appendices D and C, respectively, along with associated lower and upper probable costs.

--: not applicable

ASB: Aerated Stabilization Basin

CDF: confined disposal facility

RMC: residuals management cover

Figures

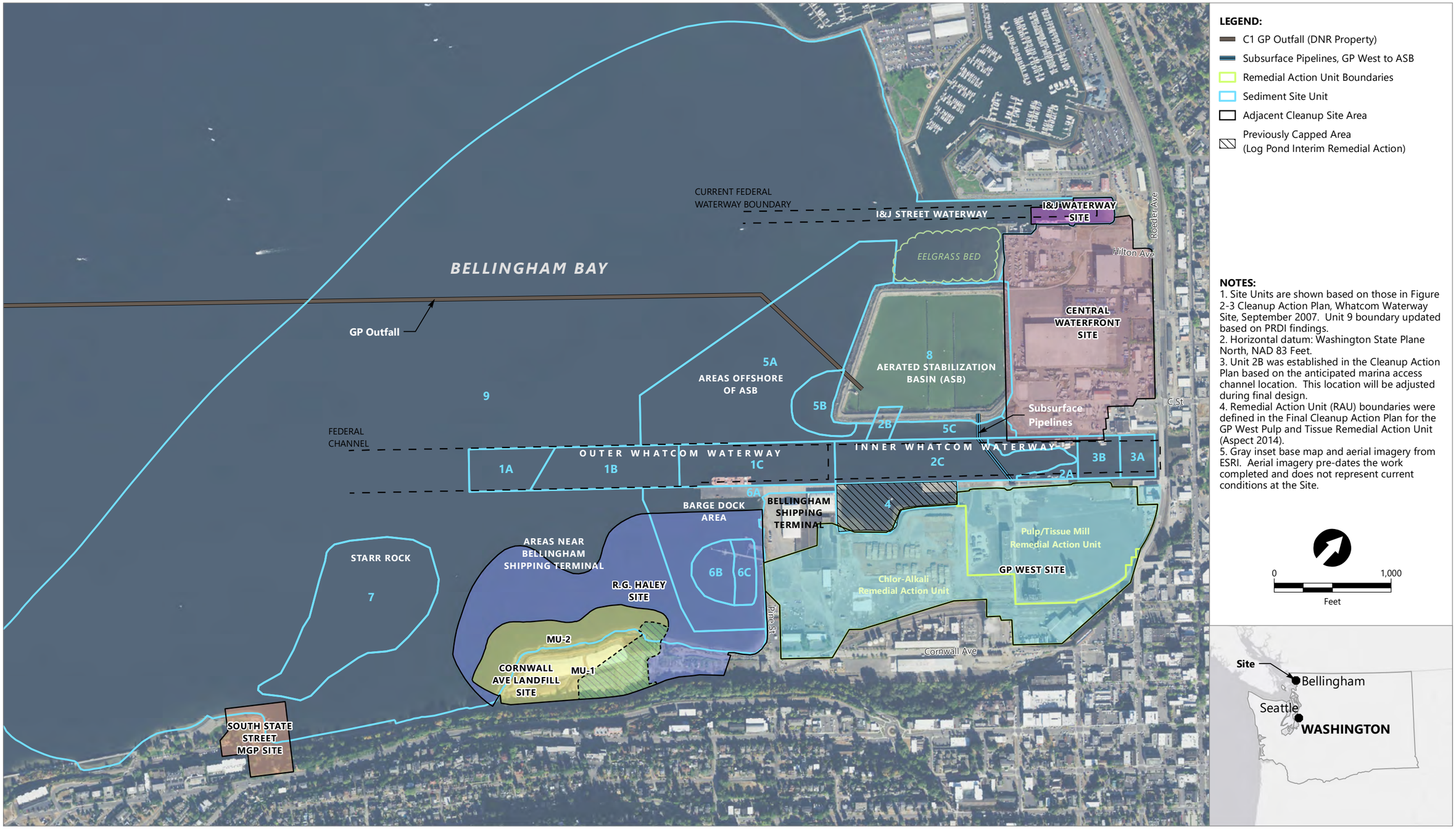

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Figure 1
Site Vicinity Map
Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup

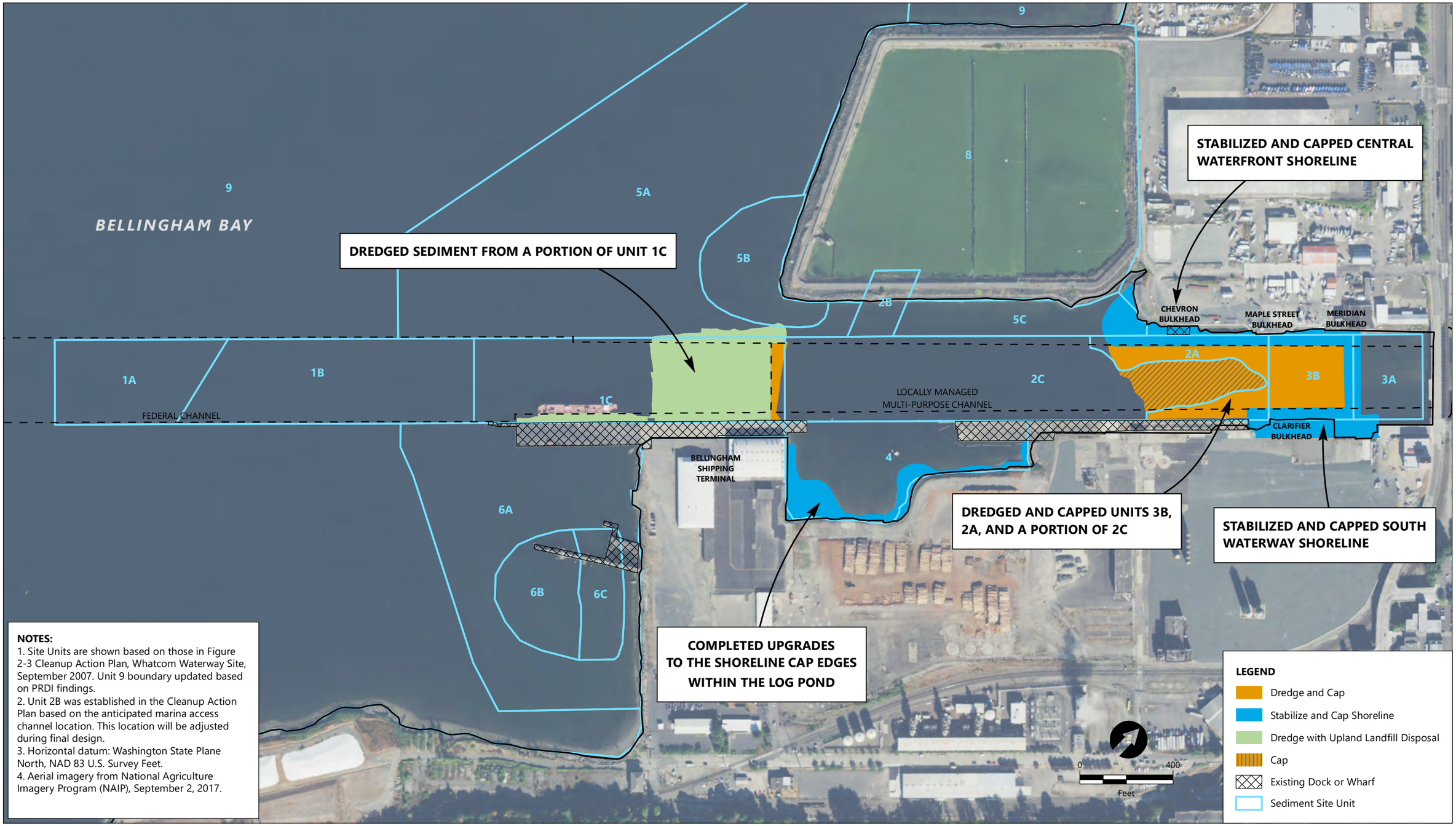

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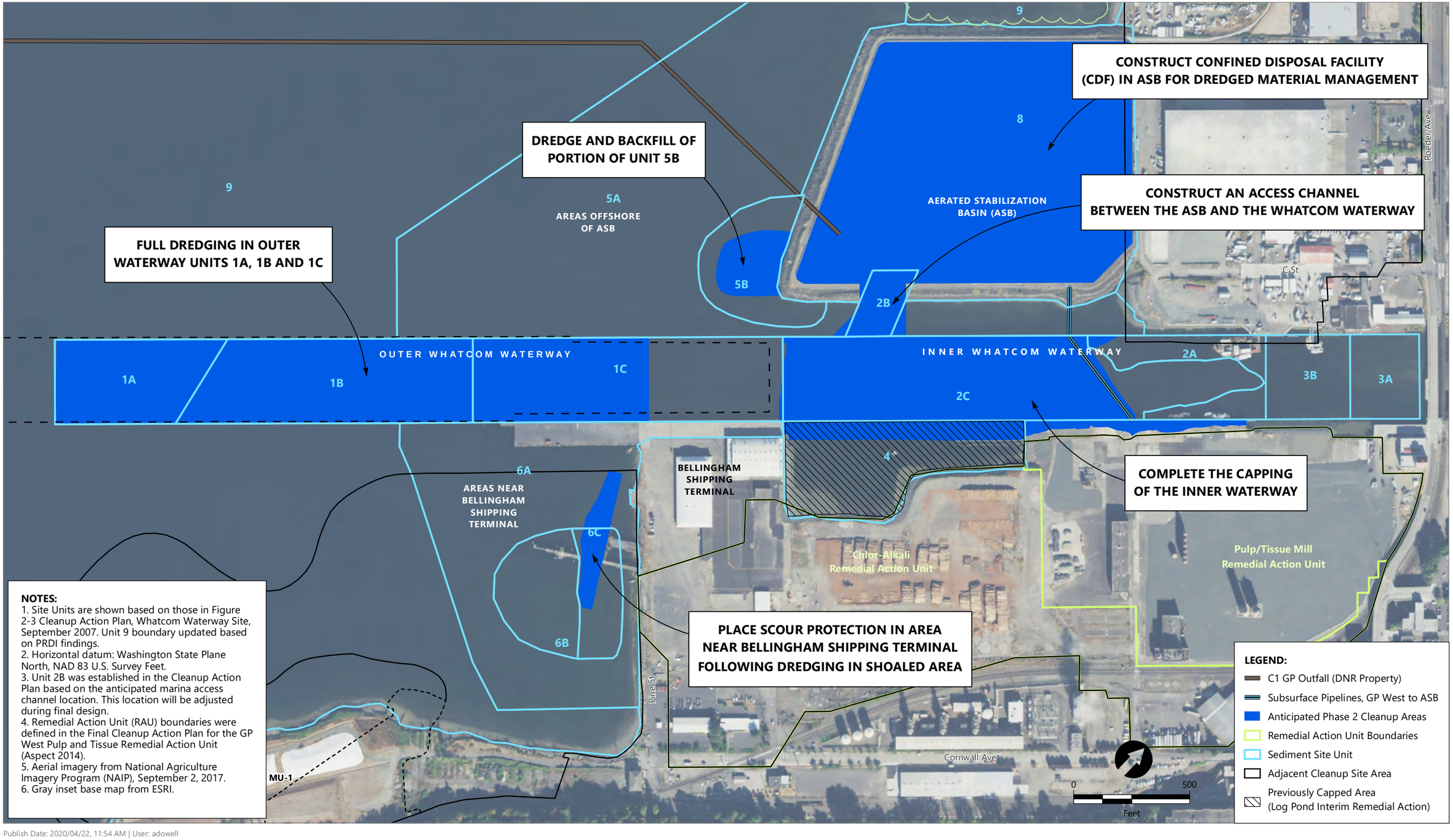
Figure 2
Completed Cleanup in Phase 1 Site Units
Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



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 U.S. Survey 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. Aerial imagery from National Agriculture Imagery Program (NAIP), September 2, 2017.
6. Gray inset base map from ESRI.

Publish Date: 2020/04/22, 11:54 AM | User: adowell
Filepath: \\orcas\gis\Jobs\080007-01_Whatcom_Waterway\Maps\Phase2\AQ_Fig3_ICP_Phase2_Areas.mxd

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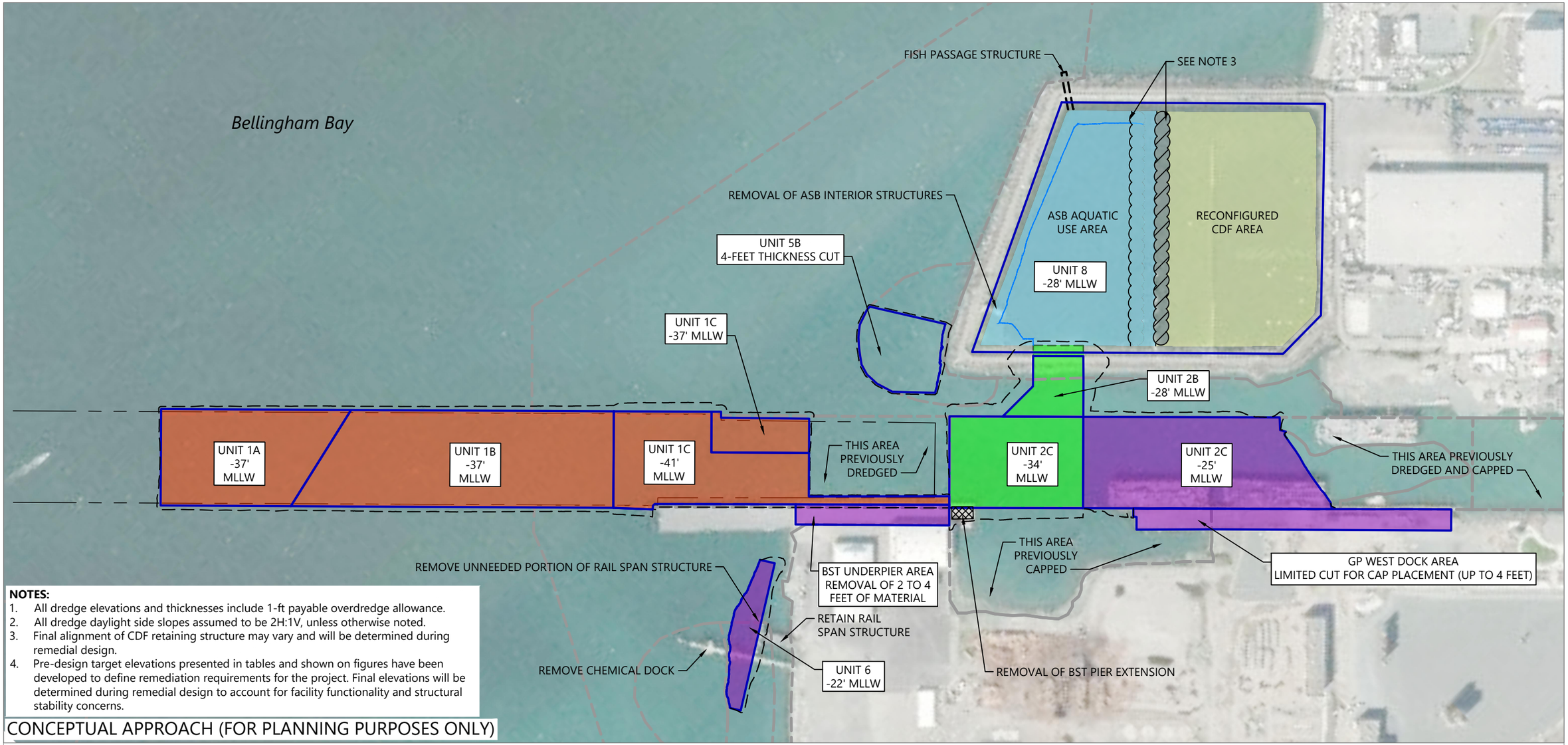
Figure 3
Required Cleanup in Phase 2 Site Units
Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



NOTES:
1. All dredge elevations and thicknesses include 1-ft payable overdredge allowance.
2. All dredge daylight side slopes assumed to be 2H:1V, unless otherwise noted.
3. Final alignment of CDF retaining structure may vary and will be determined during remedial design.
4. Pre-design target elevations presented in tables and shown on figures have been developed to define remediation requirements for the project. Final elevations will be determined during remedial design to account for facility functionality and structural stability concerns.

CONCEPTUAL APPROACH (FOR PLANNING PURPOSES ONLY)

SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019. Image from ESRI.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)

LEGEND:
- Federal Navigation Channel
- Dredge Area - Toe of Cut
- Dredge Area Daylight
- Site Unit
- ASB Working Depth (-25' MLLW)
- Sediment Placement Area (CDF)
- Removal of ASB Sediments and Portion of Clean Sand
- Approximate Location and Extent of CDF Retaining Structure (See Note 3)
- Access Channel Deepening Followed by Capping
- Full Dredge to Clean Contact
- Limited Dredge to Support Placement of Cap or Anti-Erosion Layer

0 400 Feet

Publish Date: 2020/04/22 10:46 AM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-013 (Dredge Units).dwg Figure 4 (Large Scale)

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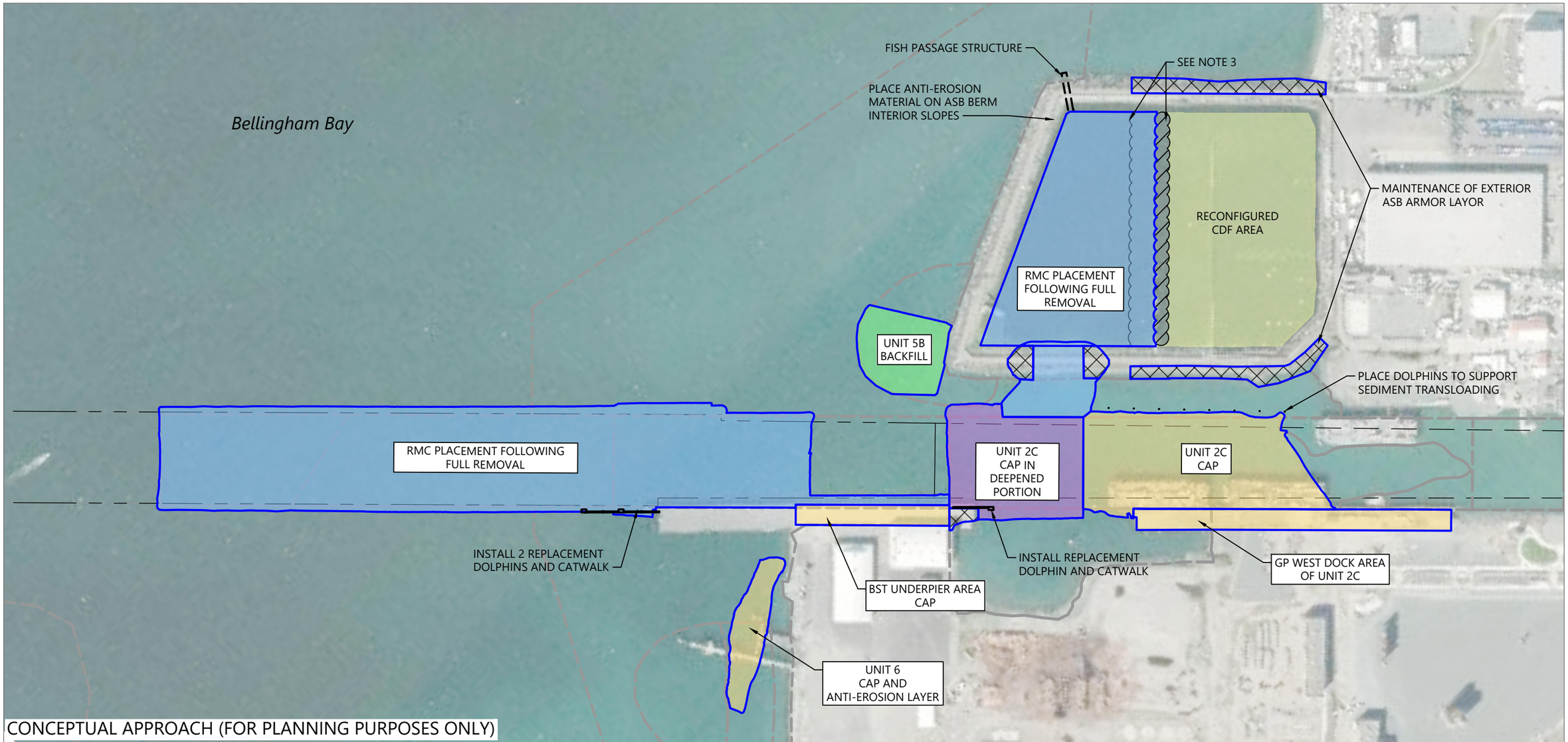
Figure 4
Modified Remedial Approach: Demolition and Dredging
Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



CONCEPTUAL APPROACH (FOR PLANNING PURPOSES ONLY)

SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019. BST structural design from KPFF, dated January 2020. Image from Bing Maps.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)
NOTES:
1. All material placement thicknesses will include payable overdredge allowances.
2. All material placement on side slopes assumed to be 3H:1V, unless otherwise noted.
3. Final alignment of CDF retaining structure may vary and will be determined during remedial design.

LEGEND:
- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Material Placement Area
- Site Unit
- Approximate Location and Extent of CDF Retaining Structure (See Note 3)

LEGEND (BACKFILL):
- RMC (6" Sandy Material)
- 3-ft Backfill with Clean Material (Plus Overplacement Allowance)
- 3-ft Cap Placement (Plus Overplacement Allowance)
- 4-ft to 6-ft Cap Placement (Plus Overplacement Allowance)
- Armor Rock Placement Following Capping

0 400
Feet

Publish Date: 2020/04/22 10:43 AM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-012 (Backfill).dwg Figure 5 (Large Scale)

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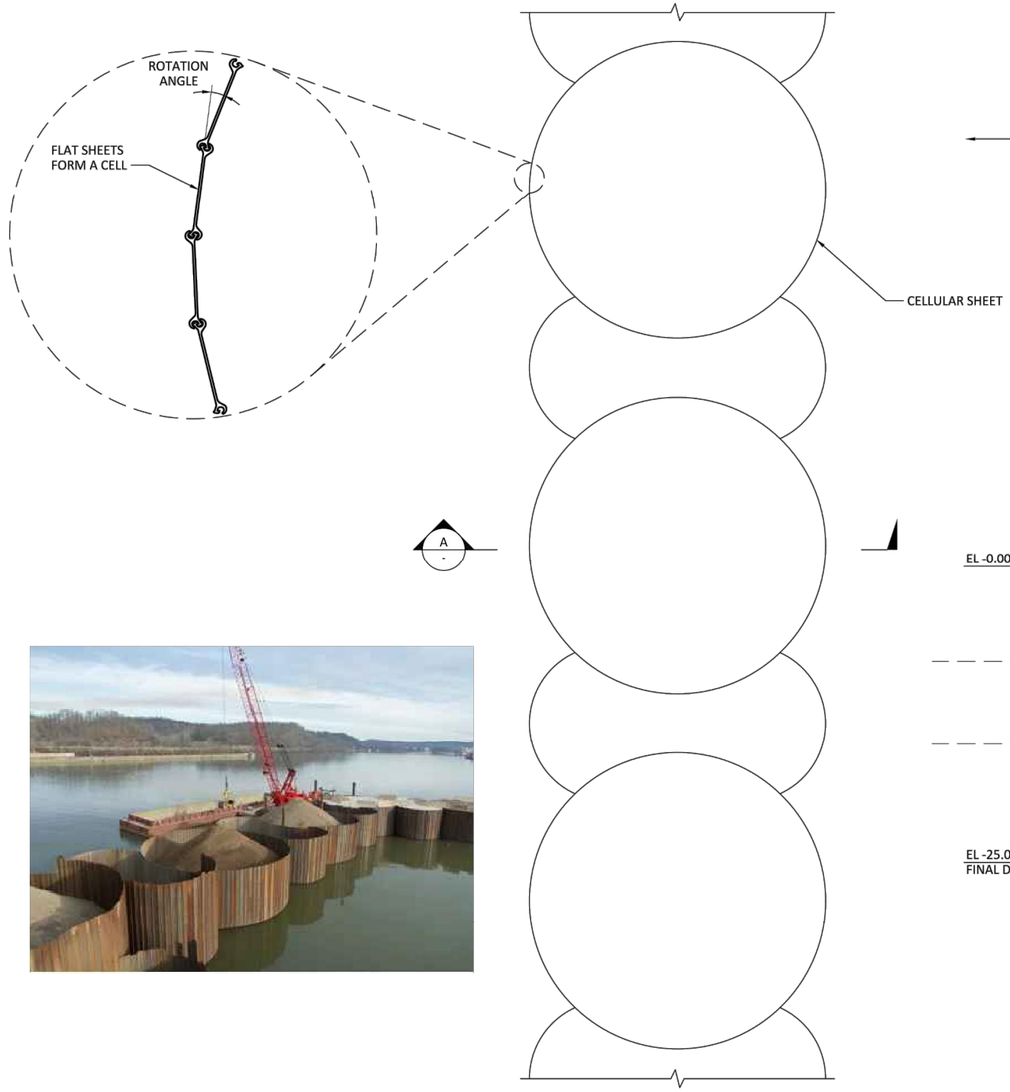
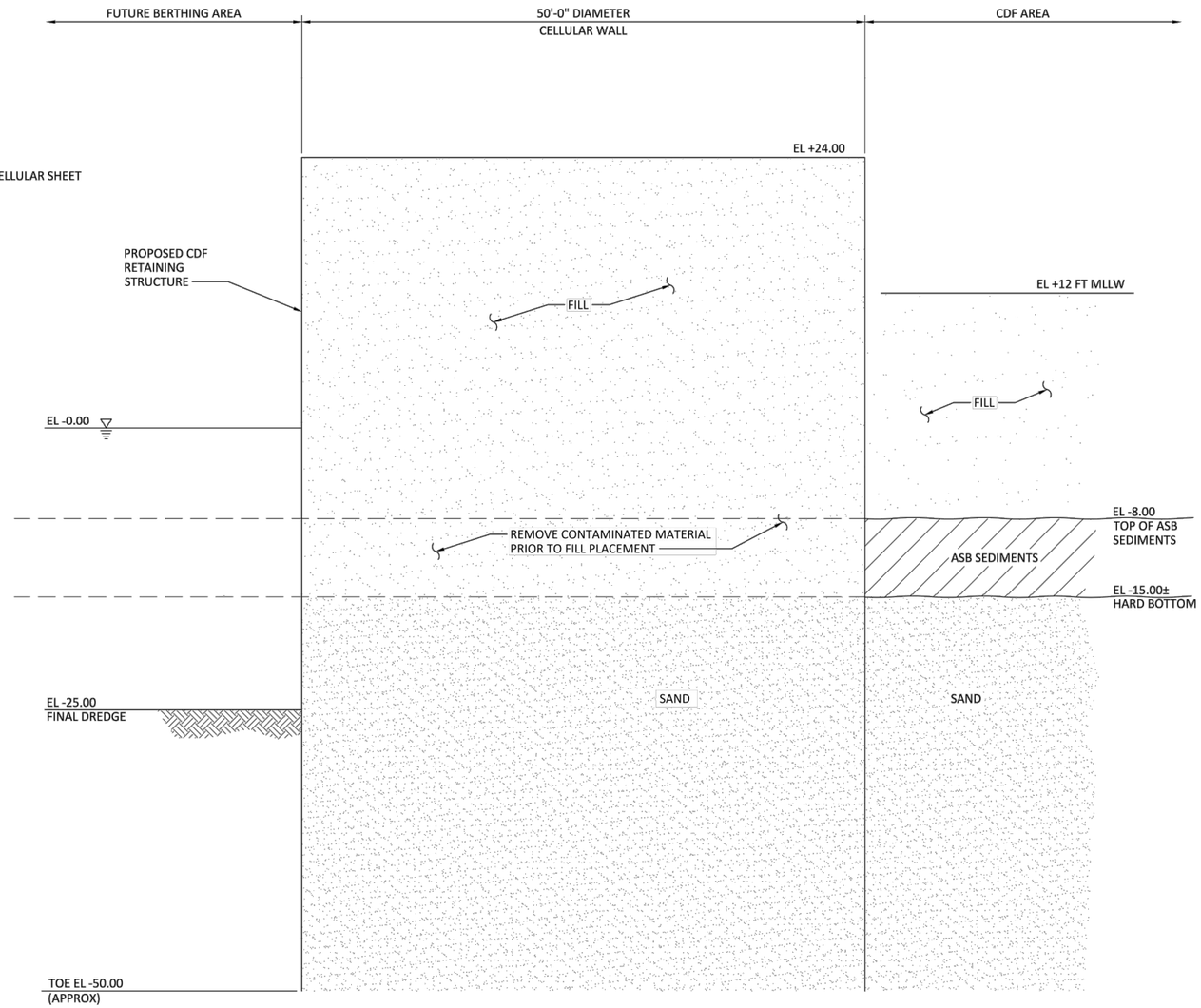
Figure 5
Modified Remedial Approach: Material Placement and Structural Modifications

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



1 - **PLAN - CELL WALL OPTION**
SCALE:



A - **SECTION - CELL WALL OPTION**
SCALE:
1" = 6'
5 0 5 10
scale feet

NOTE: Figure prepared by WSP.

CONCEPTUAL APPROACH (FOR PLANNING PURPOSES ONLY)

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Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-014 (CDF Retaining Structure - By WSP).dwg Figure 6

CONCEPTUAL APPROACH (FOR PLANNING PURPOSES ONLY)

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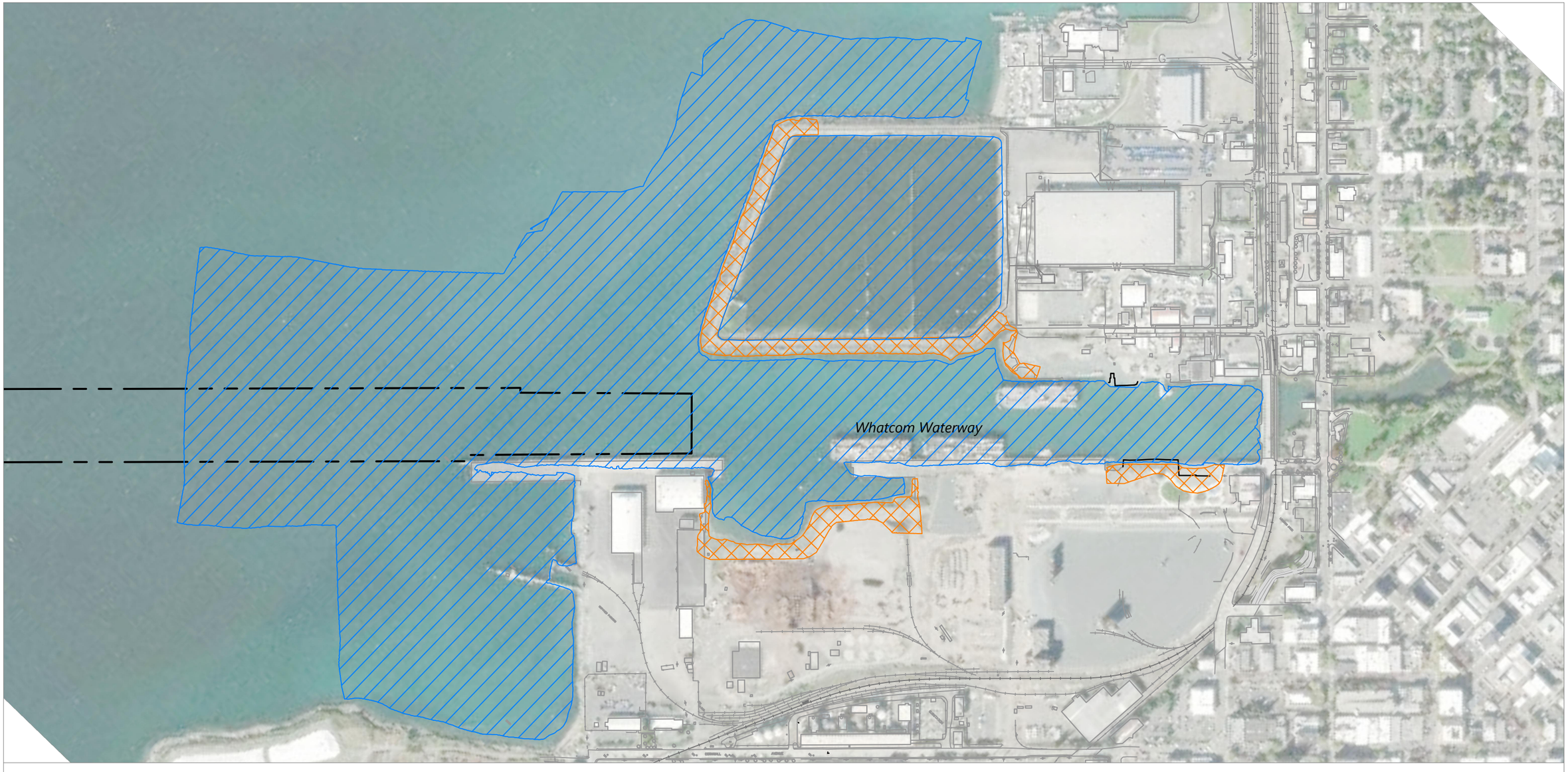
Figure 7
Illustration of Reconfigured CDF and Aquatic Use Area at Completion
Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup

Appendix A
Updated Survey Coverage



SOURCE: Aerial image from ESRI.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

Federal Navigation Channel

Bathymetric Survey Coverage (NW Hydro, October-November, 2019)

Topographic Survey Coverage (Wilson, November 2019)

0 500
Feet

Publish Date: 2020/03/26 5:09 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-005 (Bathy Coverage).dwg Figure A-1

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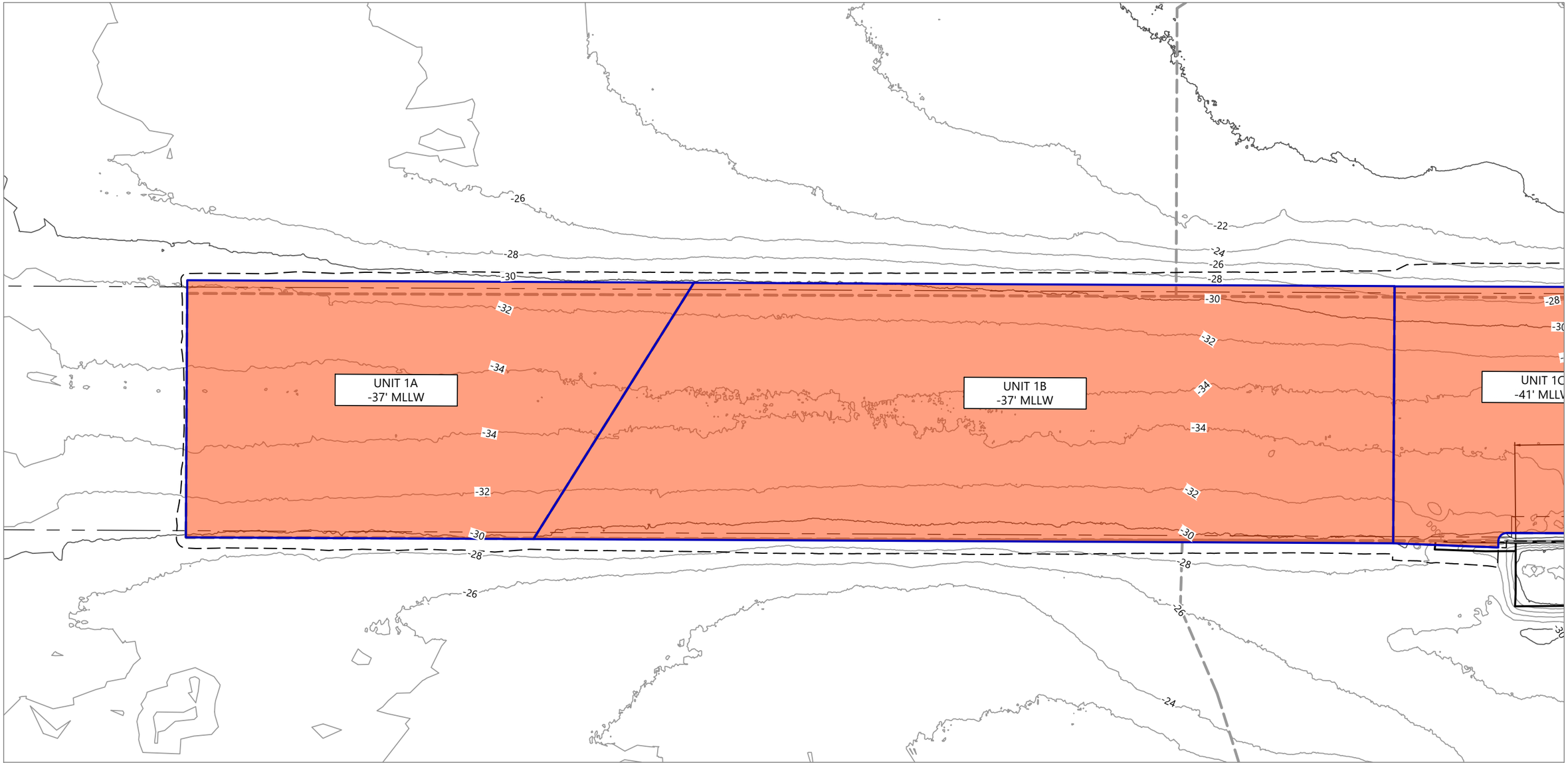
Figure A-1
Survey Coverage

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup

Appendix B
Detailed Figures for Modified Remedial Approach



SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)
NOTES:
1. All dredge elevations and thicknesses include 1-ft payable overdredge allowance.
2. All dredge daylight side slopes assumed to be 2H:1V, unless otherwise noted.

LEGEND:

- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Dredge Area - Toe of Cut
- Dredge Area Daylight
- Site Unit
- Full Dredge to Clean Contact

0 150
Feet

Publish Date: 2020/04/22 12:50 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-013 (Dredge Units).dwg Figure B-1

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Figure B-1
Dredging Within Units 1A and 1B - Plan View

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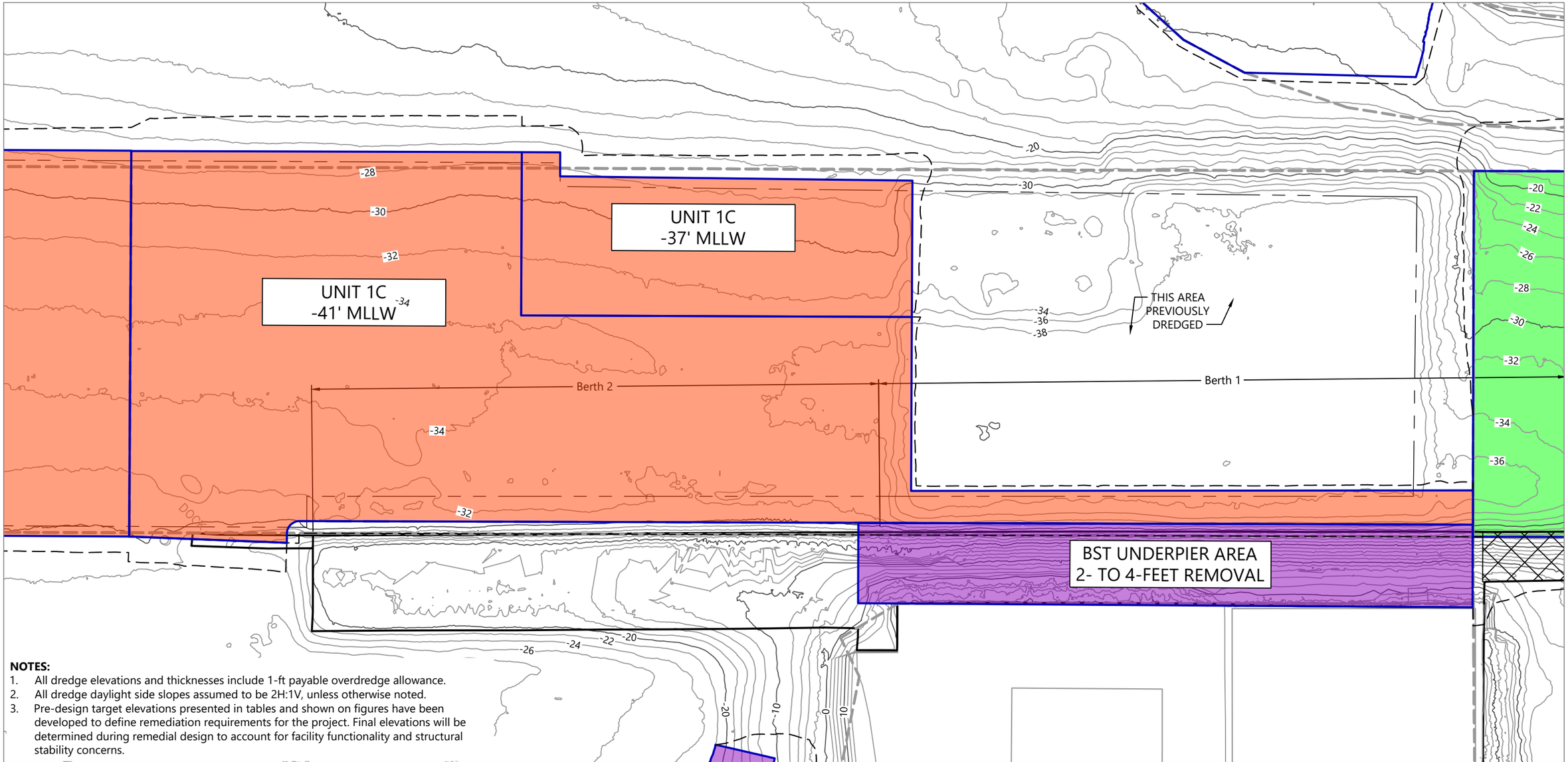
Whatcom Waterway Phase 2 Cleanup



NOTES:

1. All dredge elevations and thicknesses include 1-ft payable overdredge allowance.
2. All dredge daylight side slopes assumed to be 2H:1V, unless otherwise noted.
3. Pre-design target elevations presented in tables and shown on figures have been developed to define remediation requirements for the project. Final elevations will be determined during remedial design to account for facility functionality and structural stability concerns.

SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)

LEGEND:

- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Dredge Area - Toe of Cut
- Dredge Area Daylight
- Site Unit
- Access Channel Deepening Followed by Capping
- Full Dredge to Clean Contact
- Limited Dredge to Support Placement of Cap or Anti-Erosion Layer

0 100
Feet

Publish Date: 2020/04/22 12:50 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-013 (Dredge Units).dwg Figure B-2

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Figure B-2
Dredging Within Unit 1C - Plan View

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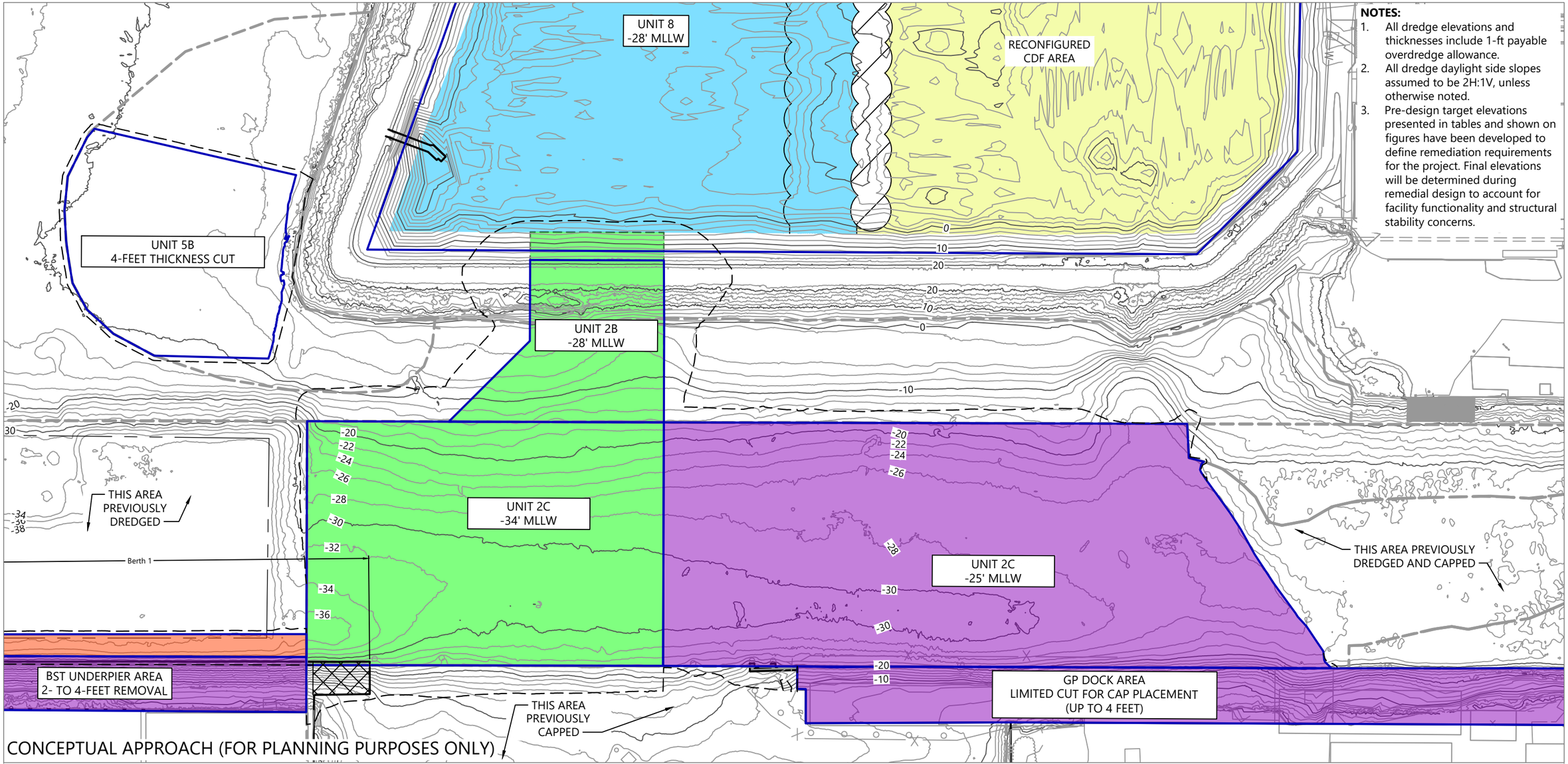
Whatcom Waterway Phase 2 Cleanup



NOTES:

1. All dredge elevations and thicknesses include 1-ft payable overdredge allowance.
2. All dredge daylight side slopes assumed to be 2H:1V, unless otherwise noted.
3. Pre-design target elevations presented in tables and shown on figures have been developed to define remediation requirements for the project. Final elevations will be determined during remedial design to account for facility functionality and structural stability concerns.

SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)

LEGEND:

- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Dredge Area - Toe of Cut
- Dredge Area Daylight
- Site Unit
- Sediment Placement Area (CDF)
- Removal of ASB Sediments and Portion of Clean Sand
- Approximate Location and Extent of CDF Retaining Structure
- Access Channel Deepening Followed by Capping
- Existing Structure to be Demolished
- Full Dredge to Clean Contact
- Limited Dredge to Support Placement of Cap or Anti-Erosion Layer

0 150
Feet

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Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-013 (Dredge Units).dwg Figure B-3

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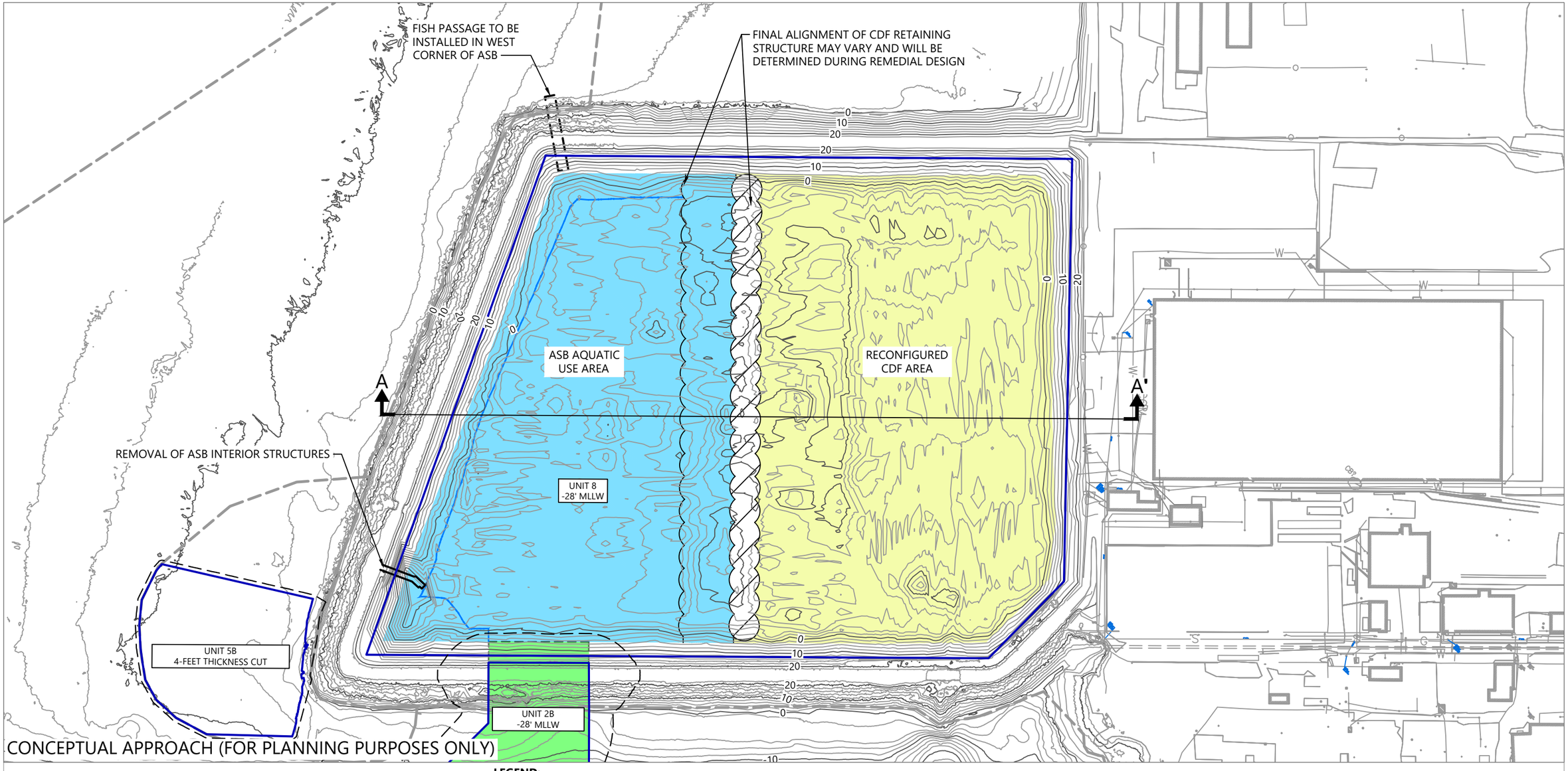
Figure B-3
Dredging Within Units 2B, 2C, and 5B - Plan View

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)
NOTES:
1. All dredge elevations and thicknesses include 1-ft payable overdredge allowance.
2. All dredge daylight side slopes assumed to be 2H:1V, unless otherwise noted.
3. See Figure B-5 for cross section A-A'.

LEGEND:

- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Dredge Area - Toe of Cut
- Dredge Area Daylight
- Site Unit
- Sediment Placement Area (CDF)
- Removal of ASB Sediments and Portion of Clean Sand
- Approximate Location and Extent of CDF Retaining Structure
- Access Channel Deepening Followed by Capping
- ASB Working Depth (-25' MLLW)

0 200 Feet

Publish Date: 2020/04/22 12:51 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-013 (Dredge Units).dwg Figure B-4

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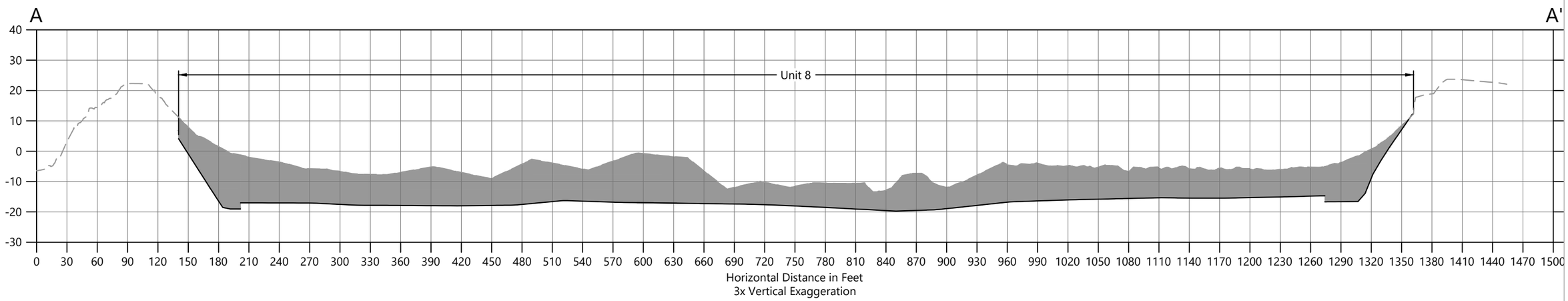
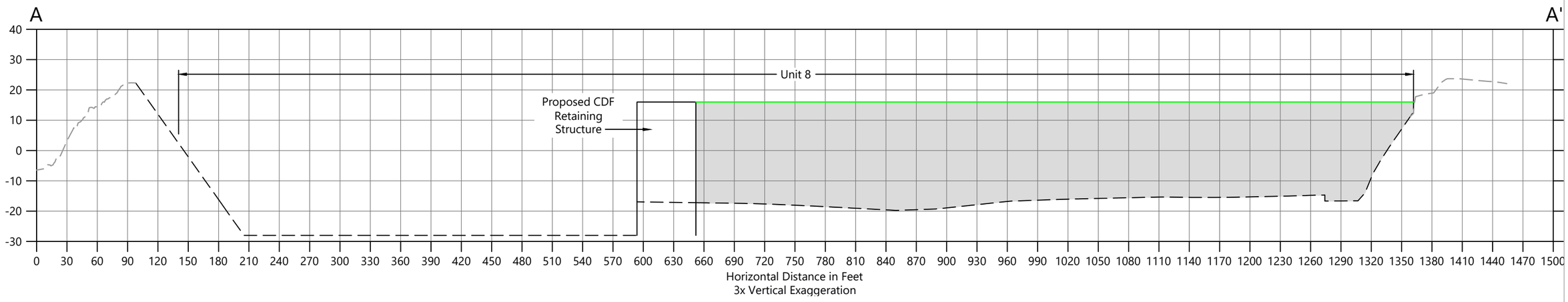
Figure B-4
Dredging Within Unit 8 - Plan View

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



Pre-construction Conditions



Post-construction Conditions

SOURCE: Existing bathymetry provided by NW Hydro, dated October, 2019 and Wilson Engineering, dated November 2019.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)
NOTES:
1. All dredge elevations and thicknesses include 1-ft payable overdredge allowance.
2. All dredge daylight side slopes assumed to be 2H:1V unless otherwise noted.

LEGEND:
- Existing Grade (October 2019)
- Contaminated Material Design Dredge Elevation
- Final Dredge Elevation
- Final Post-construction Elevation (CDF)
- ASB Sediments
- Contaminated Fill Material

0 100
Feet

CONCEPTUAL APPROACH (FOR PLANNING PURPOSES ONLY)

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Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-013 (Dredge Units).dwg Figure B-5

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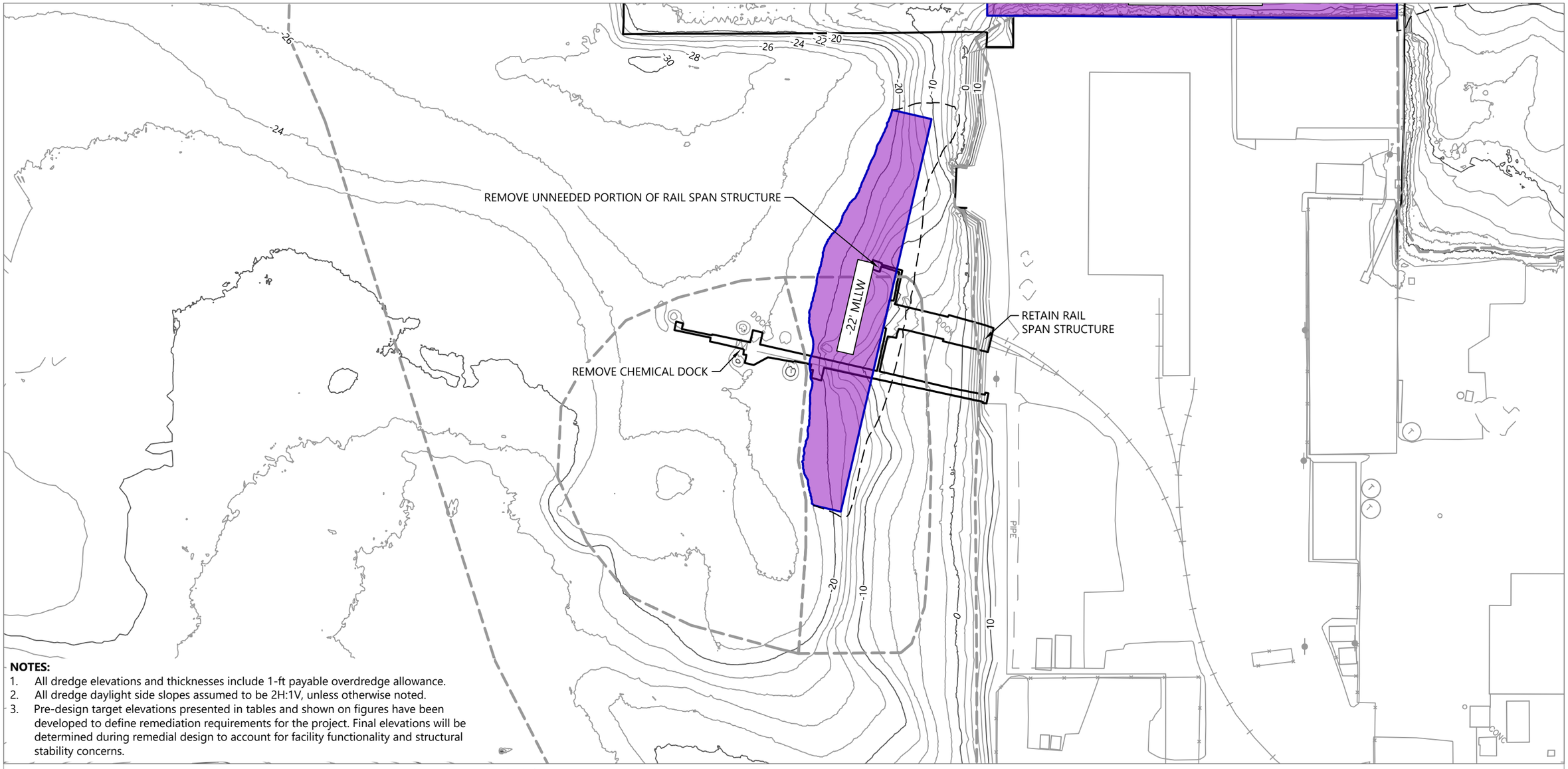
Figure B-5
ASB Cross Section A-A'

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



NOTES:

1. All dredge elevations and thicknesses include 1-ft payable overdredge allowance.
2. All dredge daylight side slopes assumed to be 2H:1V, unless otherwise noted.
3. Pre-design target elevations presented in tables and shown on figures have been developed to define remediation requirements for the project. Final elevations will be determined during remedial design to account for facility functionality and structural stability concerns.

SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)

LEGEND:

- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Dredge Area - Toe of Cut
- Dredge Area Daylight
- Site Unit
- Limited Dredge to Support Placement of Cap or Anti-Erosion Layer

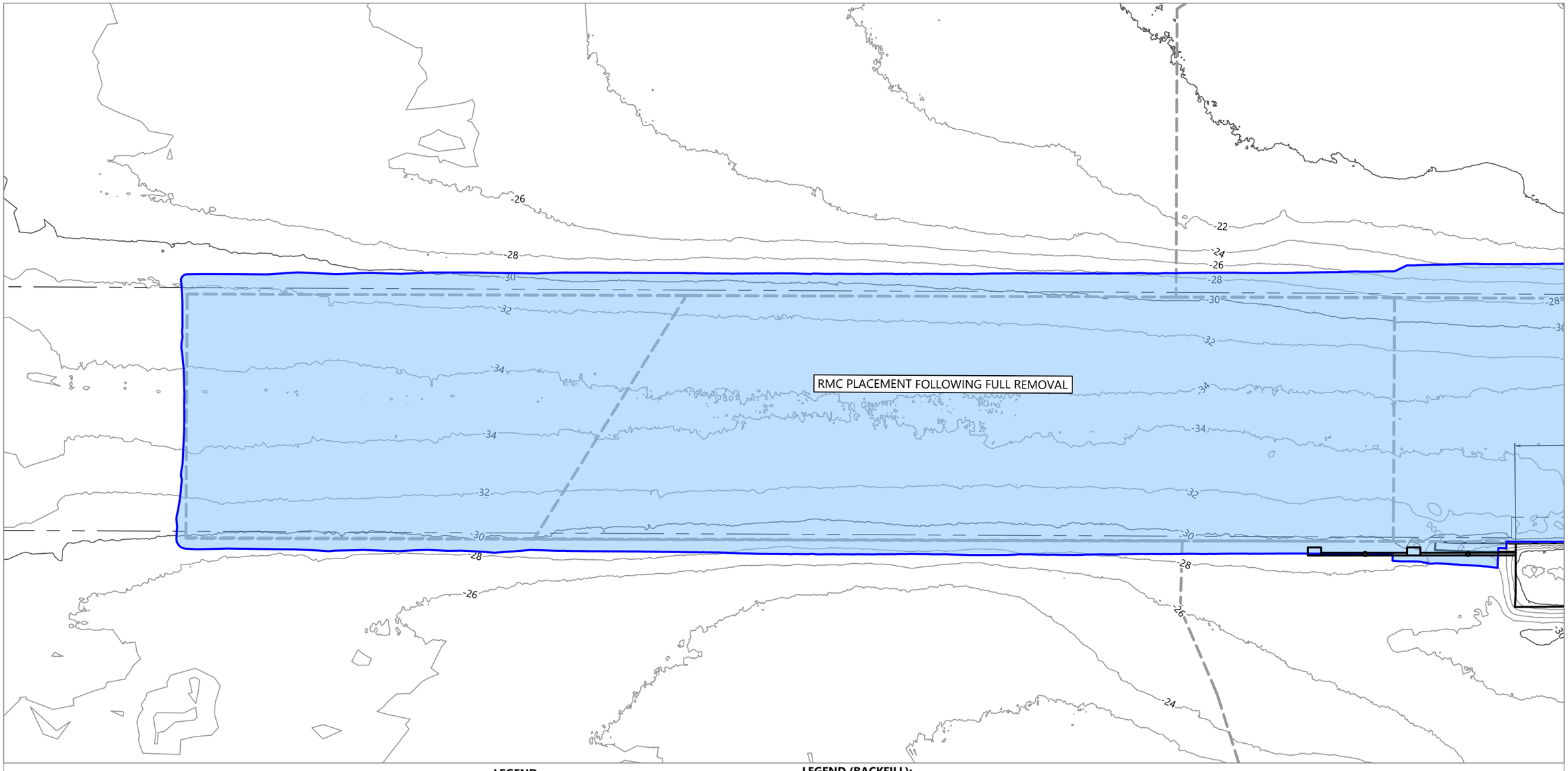
0 150
Feet

Publish Date: 2020/04/22 12:51 PM | User: chewett
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-013 (Dredge Units).dwg Figure B-6

ANCHOR QEA

Figure B-6
Dredging Within Units 6A, 6B, and 6C - Plan View

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)
NOTES:
1. All material placement thicknesses will include payable overdredge allowances.
2. All material placement on side slopes assumed to be 3H:1V, unless otherwise noted.

LEGEND:
- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Material Placement Area
- Site Unit

LEGEND (BACKFILL):
- RMC (6" Sandy Material)

0 150
Feet

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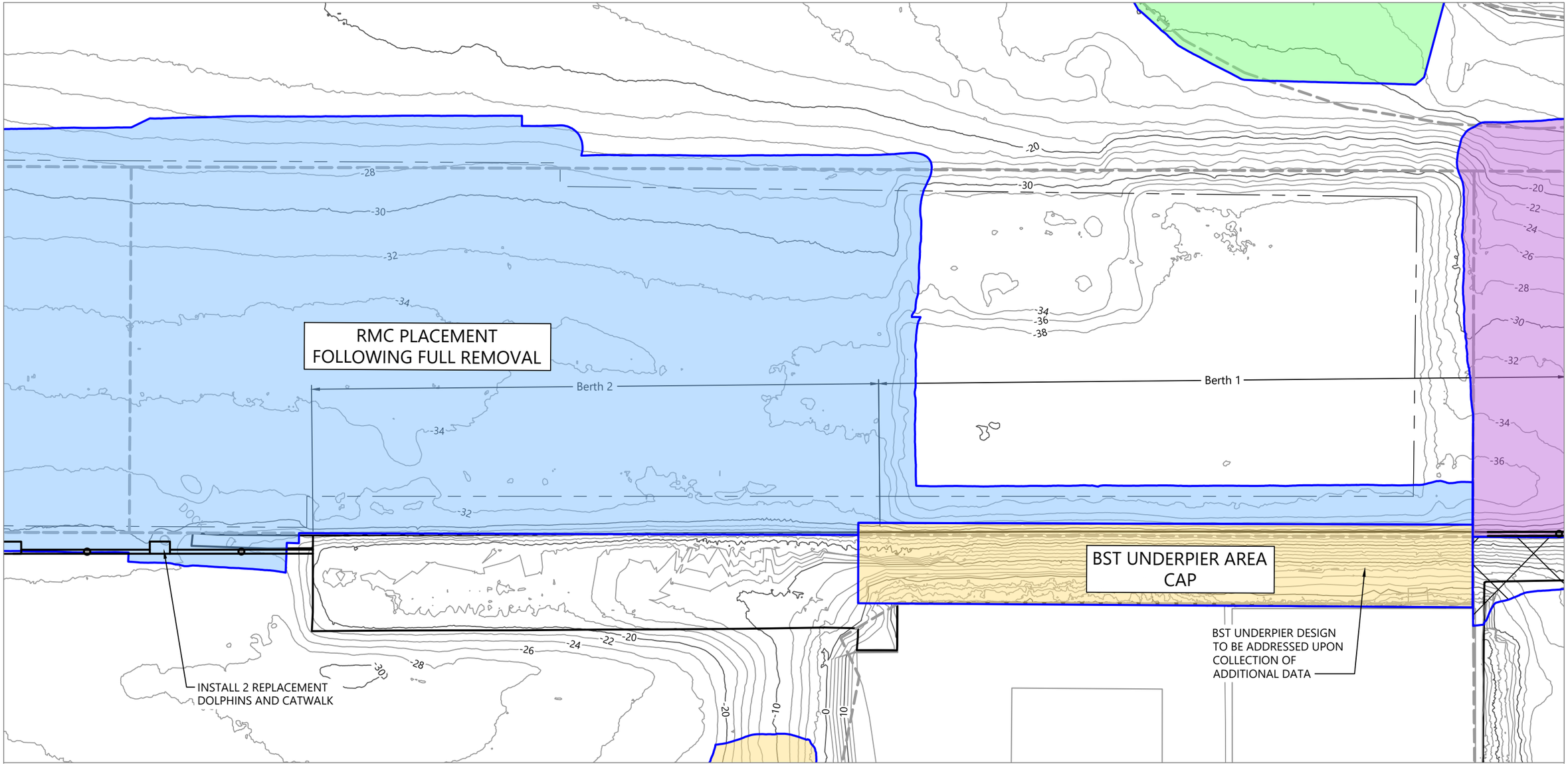
Filepath: K:\Projects\0007-Port of Bellingham\Whatcom Waterway Phase 2 Cleanup\0007-RP-012 (Backfill).dwg Figure B-7

ANCHOR QEA

Figure B-7
Material Placement Within Units 1A and 1B - Plan View

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019. BST structural design from KPFF, dated January 2020.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)
NOTES:
1. All material placement thicknesses will include payable overdredge allowances.
2. All material placement on side slopes assumed to be 3H:1V, unless otherwise noted.

LEGEND:
- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Material Placement Area
- Site Unit

LEGEND (BACKFILL):
- RMC (6" Sandy Material)
- 3-ft Backfill with Clean Material (Plus Overplacement Allowance)
- 3-ft Cap Placement (Plus Overplacement Allowance)
- 4-ft to 6-ft Cap Placement (Plus Overplacement Allowance)
- Armor Rock Placement Following Capping

0 100
Feet

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Figure B-8
Material Placement Within Unit 1C - Plan View

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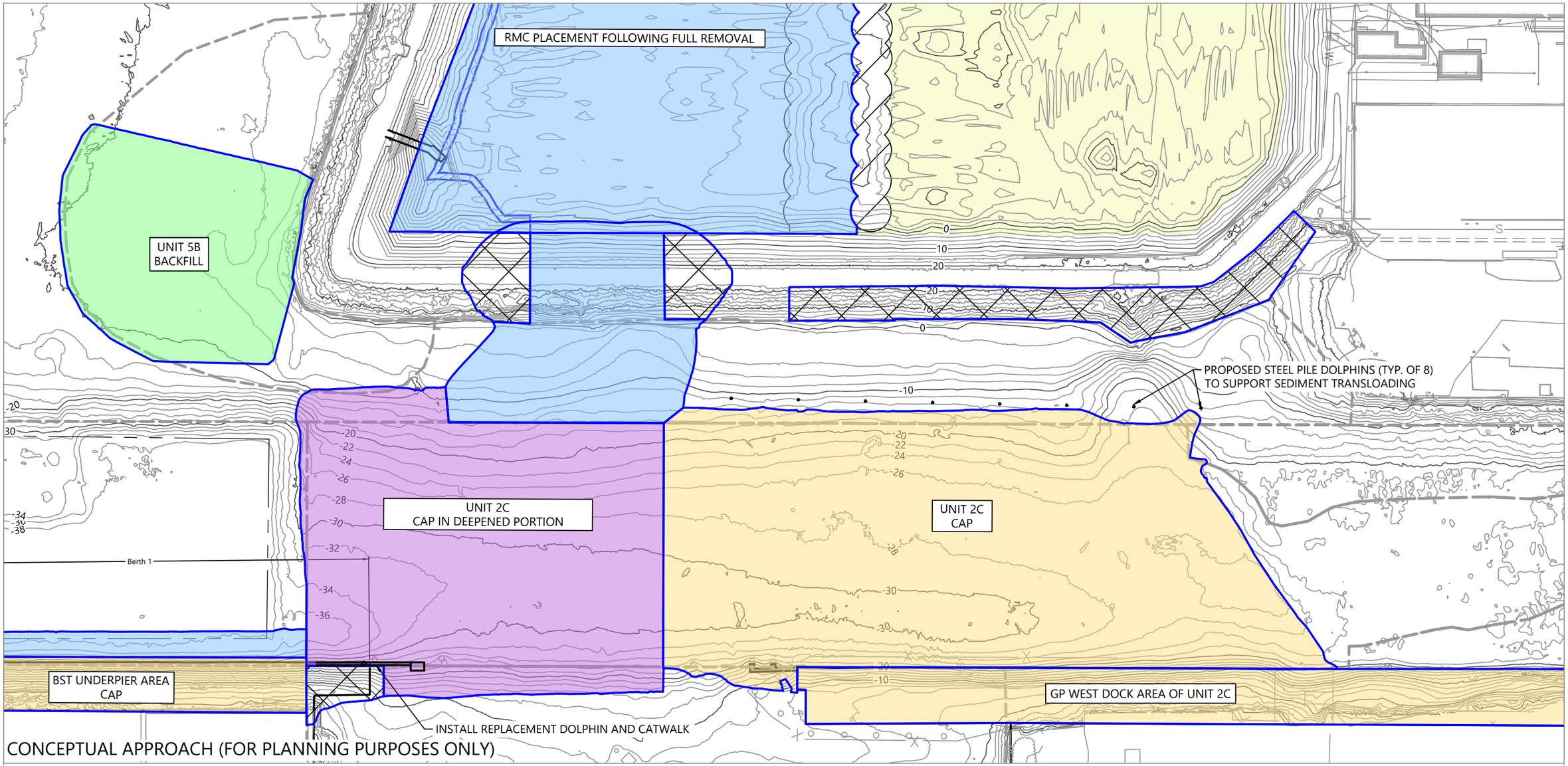
Whatcom Waterway Phase 2 Cleanup



SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019. BST structural design from KPFF, dated January 2020.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)
NOTES:
1. All material placement thicknesses will include payable overdredge allowances.
2. All material placement on side slopes assumed to be 3H:1V, unless otherwise noted.

LEGEND:
- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Material Placement Area
- Site Unit
- Approximate Location and Extent of CDF Retaining Structure

LEGEND (BACKFILL):
- RMC (6" Sandy Material)
- 3-ft Backfill with Clean Material (Plus Overplacement Allowance)
- 3-ft Cap Placement (Plus Overplacement Allowance)
- 4-ft to 6-ft Cap Placement (Plus Overplacement Allowance)
- Armor Rock Placement Following Capping

0 150 Feet

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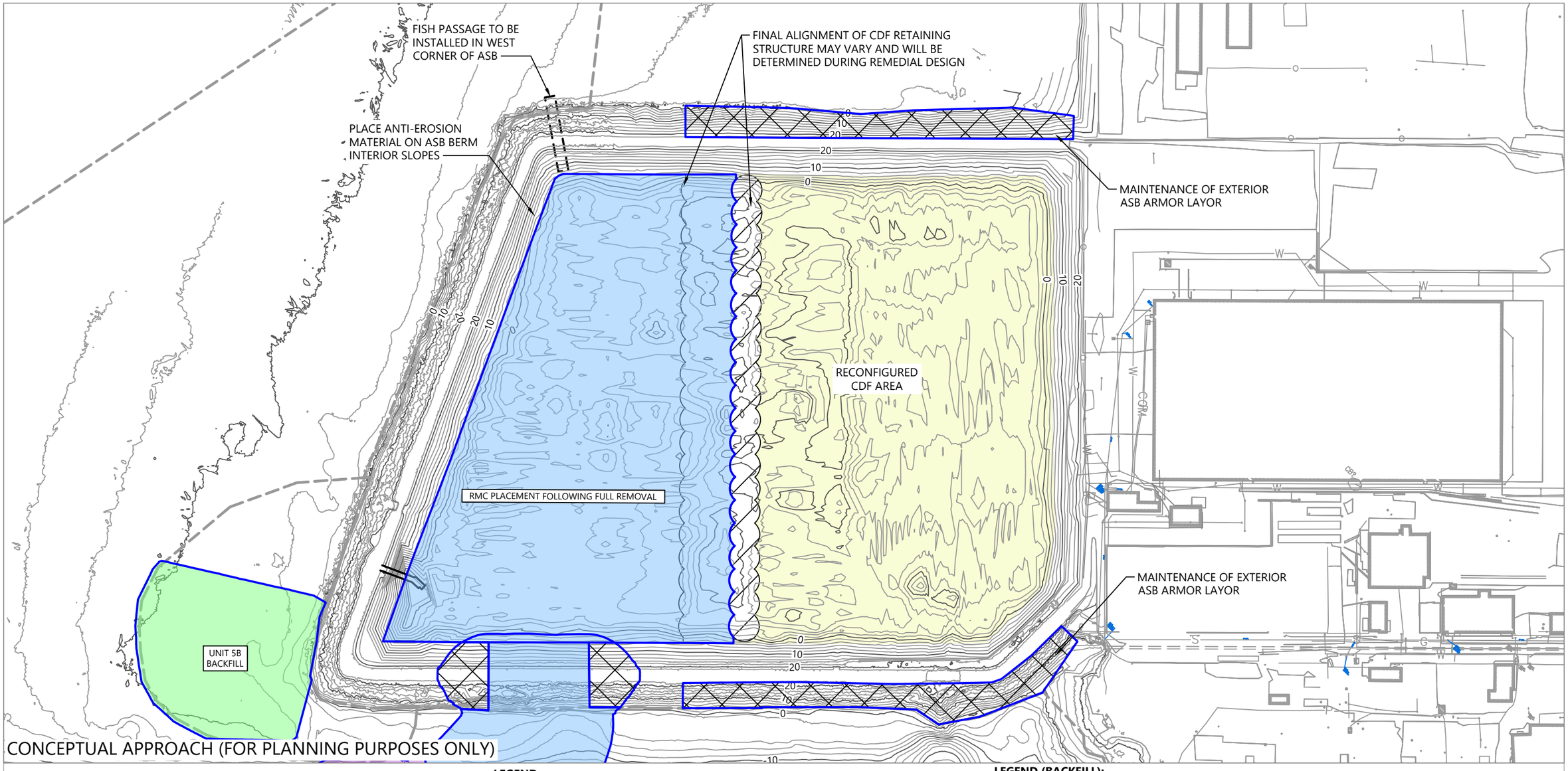
ANCHOR QEA

Figure B-9
Material Placement Within Units 2B, 2C, and 5B - Plan View

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)
NOTES:
1. All material placement thicknesses will include payable overdredge allowances.
2. All material placement on side slopes assumed to be 3H:1V, unless otherwise noted.

LEGEND:
- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Material Placement Area
- Site Unit
- Approximate Location and Extent of CDF Retaining Structure

LEGEND (BACKFILL):
- RMC (6" Sandy Material)
- 3-ft Backfill with Clean Material (Plus Overplacement Allowance)
- 3-ft Cap Placement (Plus Overplacement Allowance)
- Armor Rock Placement Following Capping

0 200 Feet

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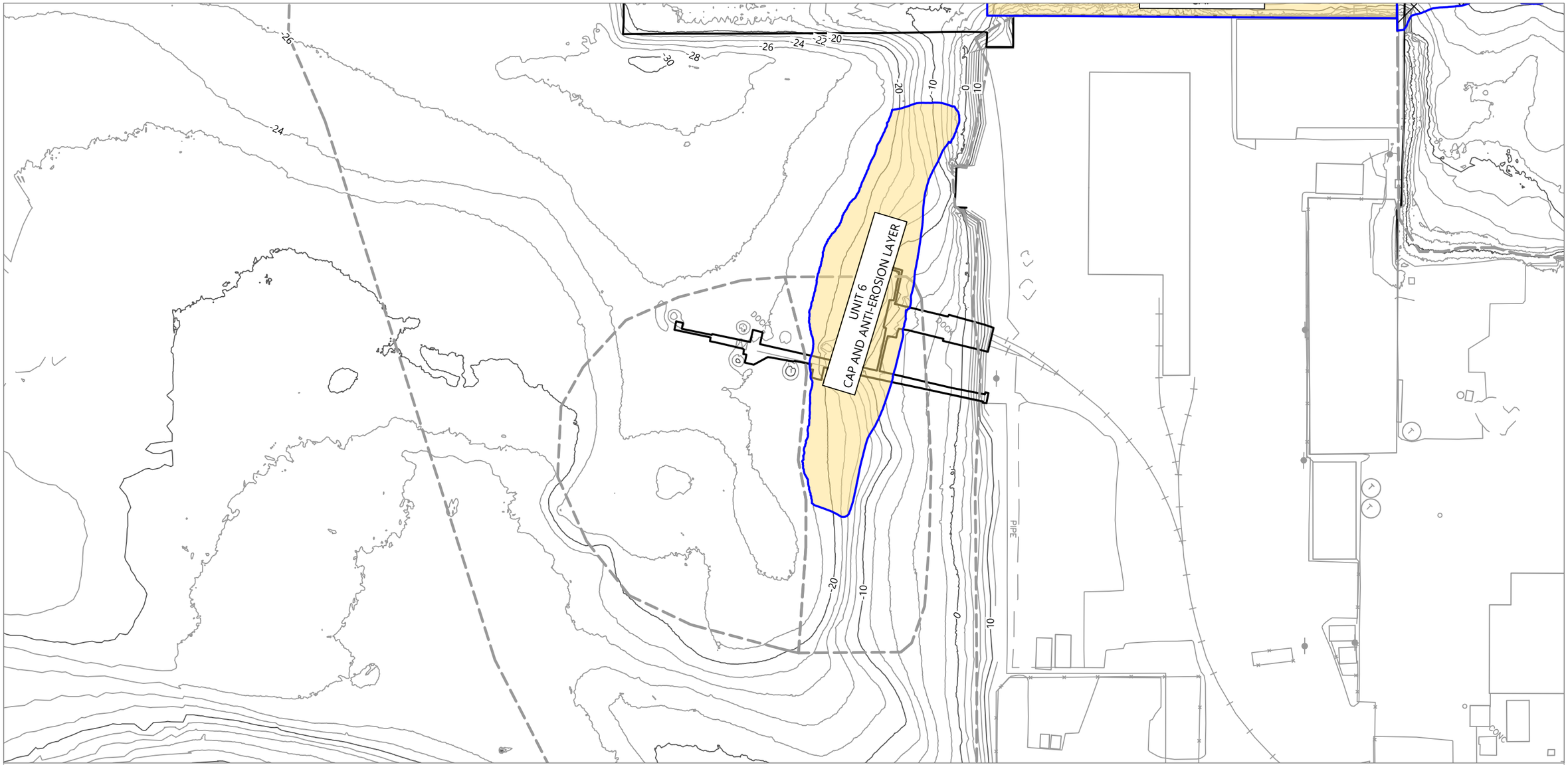
ANCHOR QEA

Figure B-10
Material Placement Within Unit 8 - Plan View

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup



SOURCE: Existing bathymetry dated July 2008, March 2016, and October-November 2019.
HORIZONTAL DATUM: Washington State Plane North Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)
NOTES:
1. All material placement thicknesses will include payable overdredge allowances.
2. All material placement on side slopes assumed to be 3H:1V, unless otherwise noted.

LEGEND:
- Contours (2' and 10' Intervals)
- Federal Navigation Channel
- Material Placement Area
- Site Unit

LEGEND (BACKFILL):
- 3-ft Cap Placement (Plus Overplacement Allowance)

0 150
Feet

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ANCHOR QEA

Figure B-11
Material Placement Within Units 6A, 6B, and 6C - Plan View

Design Evaluation Memorandum
Whatcom Waterway Phase 2 Cleanup

Appendix C
Itemized Cost Estimate for Modified Remedial Approach

Table C-1
Itemized Cost Estimate for Modified Remedial Approach

		Deep Basin Scenario							
Task ID	Task Description	Quantity	Unit	Lower Probable Unit Cost ($)	Probable Unit Cost ($)	Upper Probable Unit Cost ($)	Lower Probable Total Cost ($)	Probable Total Cost ($)	Upper Probable Total Cost ($)
Season 1 Construction									
1	**Mobilization/Demobilization**								
1 a	Dredge and Ancillary Equipment	1	LS	$810,000.00	$900,000.00	$1,080,000.00	$ 810,000.00	$ 900,000.00	$ 1,080,000.00
1 b	Procedural Costs, Workplans	1	LS	$45,000.00	$50,000.00	$60,000.00	$ 45,000.00	$ 50,000.00	$ 60,000.00
2	**Site Preparation**								
2 a	Installation of Staging Dolphins (Mono-Pile)	8	EA	$57,387.19	$63,763.54	$76,516.25	$ 459,097.50	$ 510,108.33	$ 612,130.00
2 b	Demolition of Existing ASB Equipment/Miscellaneous Items	1	LS	$392,490.00	$436,100.00	$523,320.00	$ 392,490.00	$ 436,100.00	$ 523,320.00
2 c	Procurement of Armor Rock for Existing ASB Berm Slope Maintenance (N & S Exterior)	7,166	TON	$18.00	$20.00	$24.00	$ 128,982.98	$ 143,314.43	$ 171,977.31
2 d	Loading of Armor Rock for Existing ASB Berm Slope Maintenance (N & S Exterior)	4,777	CY	$6.30	$7.00	$8.40	$ 30,093.35	$ 33,437.06	$ 40,124.47
2 e	Placement of Armor Rock for Existing ASB Berm Slope Maintenance (N & S Exterior)	4,777	CY	$25.52	$28.36	$34.03	$ 121,907.00	$ 135,452.23	$ 162,542.67
2 f	Stockpile Area (Clean Sands and Other Materials for Project/Future Placement)	1	LS	$216,000.00	$240,000.00	$288,000.00	$ 216,000.00	$ 240,000.00	$ 288,000.00
3	**Surveys**								
3 a	Contractor Daily Progress Surveys	143	DAY	$900.00	$1,000.00	$1,200.00	$ 128,700.00	$ 143,000.00	$ 171,600.00
3 b	Pre-Construction Survey (Unit 8)	1	EA	$9,000.00	$10,000.00	$12,000.00	$ 9,000.00	$ 10,000.00	$ 12,000.00
3 c	Dredge Post-Construction Survey (Unit 8)	2	EA	$9,000.00	$10,000.00	$12,000.00	$ 18,000.00	$ 20,000.00	$ 24,000.00
4	**Construction of CDF Retaining Structure in Unit 8**								
4 a	Procurement and Installation of Cells	1	LS	$8,394,123.15	$9,326,803.50	$11,192,164.20	$ 8,394,123.15	$ 9,326,803.50	$ 11,192,164.20
4 b	Dredging of ASB Soft Sediments from Within Cells Footprint	15,908	CY	$19.82	$22.03	$26.43	$ 315,353.74	$ 350,393.05	$ 420,471.66
4 c	Dredging of ASB Transition Sands from Within Cells Footprint	3,933	CY	$13.80	$15.33	$18.40	$ 54,269.68	$ 60,299.65	$ 72,359.57
4 d	Fill Cells with Clean Sands	75,031	CY	$7.20	$8.00	$9.60	$ 540,223.20	$ 600,248.00	$ 720,297.60
4 e	Procurement of Top Base/Sub-base Layer for Cells Footprint (2-ft Thickness)	5,960	TON	$9.90	$11.00	$13.20	$ 59,002.12	$ 65,557.91	$ 78,669.50
4 f	Placement of Top Base/Sub-base Layer for Cells Footprint (2-ft Thickness)	3,679	CY	$10.80	$12.00	$14.40	$ 39,736.80	$ 44,152.00	$ 52,982.40
5	**Dredging Within Unit 8 (West of CDF Retaining Structure)**								
5 a	ASB Soft Sediments	141,866	CY	$19.82	$22.03	$26.43	$ 2,812,294.08	$ 3,124,771.20	$ 3,749,725.44
5 b	ASB Transition Sands	33,340	CY	$13.80	$15.33	$18.40	$ 460,043.52	$ 511,159.47	$ 613,391.36
5 c	Clean Sand Material	132,290	CY	$13.80	$15.33	$18.40	$ 1,825,409.64	$ 2,028,232.93	$ 2,433,879.52
5 d	In-water Transportation of Excess Clean Sands Removed from Unit 8	57,259	CY	$2.70	$3.00	$3.60	$ 154,599.30	$ 171,777.00	$ 206,132.40
5 e	Stockpiling/Handling of Excess Clean Sands for Future Placement	57,259	CY	$9.00	$10.00	$12.00	$ 515,331.00	$ 572,590.00	$ 687,108.00
6	**Sediment Placement within CDF**								
6 a	Purchase of Flocculant (TBD)	0	TON	$0.00	$0.00	$0.00	$ -	$ -	$ -
6 b	Toyo Pump, Crane Barge, and Spreader Barge	1	LS	$266,400.00	$296,000.00	$355,200.00	$ 266,400.00	$ 296,000.00	$ 355,200.00
6 c	Transfer of ASB Soft Sediments/Transition Sand Materials to CDF	195,047	CY	$7.20	$8.00	$9.60	$ 1,404,338.40	$ 1,560,376.00	$ 1,872,451.20
6 d	Dewatering (TBD)	0	LS	$0.00	$0.00	$0.00	$ -	$ -	$ -
7	**ASB Discharge Pipe Decommissioning**								
7 a	Plug/Grout ASB Stormwater Discharge Pipe	1	LS	$90,000.00	$100,000.00	$120,000.00	$ 90,000.00	$ 100,000.00	$ 120,000.00
7 b	Demo and Dispose ASB Outfall Building	1	LS	$135,000.00	$150,000.00	$180,000.00	$ 135,000.00	$ 150,000.00	$ 180,000.00
	Season 1 Construction - Subtotal Costs						**$ 19,425,395.48**	**$ 21,583,772.76**	**$ 25,900,527.31**
8	**Sales Tax**	8.70	%		-		$ 1,690,009.41	$ 1,877,788.23	$ 2,253,345.88
	Season 1 Construction - Subtotal Costs (Including Sales Tax)						**$ 21,115,404.89**	**$ 23,461,560.99**	**$ 28,153,873.18**
Season 2 Construction									
9	**Mobilization/Demobilization**								
9 a	Dredge and Ancillary Equipment	1	LS	$810,000.00	$900,000.00	$1,080,000.00	$ 810,000.00	$ 900,000.00	$ 1,080,000.00
9 b	Procedural Costs, Workplans	1	LS	$45,000.00	$50,000.00	$60,000.00	$ 45,000.00	$ 50,000.00	$ 60,000.00
10	**Surveys**								
10 a	Contractor Daily Progress Surveys	533	DAY	$900.00	$1,000.00	$1,200.00	$ 479,700.00	$ 533,000.00	$ 639,600.00
10 b	Pre-Construction Survey	1	EA	$11,700.00	$13,000.00	$15,600.00	$ 11,700.00	$ 13,000.00	$ 15,600.00
10 c	Dredge Post-Construction Bathy Survey (Units 1A, 1B, 1C, 2B, 2C, 5B, 6A/6B/6C, BST Underpier, GP underpier)	9	EA	$9,000.00	$10,000.00	$12,000.00	$ 81,000.00	$ 90,000.00	$ 108,000.00
10 d	Placement Post-Construction Bathy Survey (Units 1A, 1B, 1C, 2B, 2C, 5B, 6A/6B/6C, 8, BST Underpier, GP underpier)	10	EA	$9,000.00	$10,000.00	$12,000.00	$ 90,000.00	$ 100,000.00	$ 120,000.00
10 e	Placement Post-Construction Topo Survey (Reconfigured CDF Area)	1	EA	$6,300.00	$7,000.00	$8,400.00	$ 6,300.00	$ 7,000.00	$ 8,400.00
11	**Structural Work**								
11 a	Demo of BST Dock Eastern End	4,000	SF	$25.65	$28.50	$34.20	$ 102,600.00	$ 114,000.00	$ 136,800.00

Table C-1
Itemized Cost Estimate for Modified Remedial Approach

		Deep Basin Scenario							
Task ID	Task Description	Quantity	Unit	Lower Probable Unit Cost ($)	Probable Unit Cost ($)	Upper Probable Unit Cost ($)	Lower Probable Total Cost ($)	Probable Total Cost ($)	Upper Probable Total Cost ($)
11 b	Procurement of Armor Rock for Slope Armoring at BST Dock Eastern End	1,150	TON	$18.00	$20.00	$24.00	$ 20,704.84	$ 23,005.38	$ 27,606.46
11 c	Loading of Armor Rock for Slope Armoring at BST Dock Eastern End	767	CY	$6.30	$7.00	$8.40	$ 4,830.70	$ 5,367.44	$ 6,440.93
11 d	Placement of Armor Rock for Slope Armoring at BST Dock Eastern End	767	CY	$25.52	$28.36	$34.03	$ 19,568.98	$ 21,743.31	$ 26,091.97
11 e	Offloading, Transportation, and Disposal of Demo Items (BST Dock Eastern End) (TBD)	1	LS	$45,000.00	$50,000.00	$60,000.00	$ 45,000.00	$ 50,000.00	$ 60,000.00
11 f	Replacement of BST Dolphins	1	LS	$1,254,701.75	$1,394,113.05	$1,672,935.66	$ 1,254,701.75	$ 1,394,113.05	$ 1,672,935.66
11 g	Box Culvert Installation for Fish Passage	1	LS	$207,000.00	$230,000.00	$276,000.00	$ 207,000.00	$ 230,000.00	$ 276,000.00
12	**Dredging Within Remaining Whatcom Waterway Phase II Units and In-Water Transportation**								
12 a	Unit 1A - Contaminated Sediment	35,159	CY	$13.80	$15.33	$18.40	$ 485,143.08	$ 539,047.86	$ 646,857.43
12 b	Unit 1B - Contaminated Sediment	82,606	CY	$13.80	$15.33	$18.40	$ 1,139,842.68	$ 1,266,491.87	$ 1,519,790.25
12 c	Unit 1C - Contaminated Sediment	96,305	CY	$13.80	$15.33	$18.40	$ 1,328,868.96	$ 1,476,521.07	$ 1,771,825.29
12 d	BST Underpier - Contaminated Sediment	8,000	CY	$41.39	$45.99	$55.19	$ 331,114.10	$ 367,904.56	$ 441,485.47
12 e	Unit 2B (Access Channel) - Contaminated Sediment	12,312	CY	$13.80	$15.33	$18.40	$ 169,890.76	$ 188,767.52	$ 226,521.02
12 f	Unit 2B (Access Channel) - Clean Sand Material	77,547	CY	$13.80	$15.33	$18.40	$ 1,070,032.77	$ 1,188,925.30	$ 1,426,710.37
12 g	Unit 2C - Contaminated Sediment	66,708	CY	$13.80	$15.33	$18.40	$ 920,473.40	$ 1,022,748.22	$ 1,227,297.87
12 h	GP Underpier Footprint - Contaminated Sediment	15,469	CY	$39.65	$44.05	$52.86	$ 613,321.46	$ 681,468.29	$ 817,761.95
12 i	Unit 5B - Contaminated Sediment	14,505	CY	$13.80	$15.33	$18.40	$ 200,147.91	$ 222,386.57	$ 266,863.88
12 j	Unit 6A/6B/6C - Contaminated Sediment	11,253	CY	$13.80	$15.33	$18.40	$ 155,275.04	$ 172,527.82	$ 207,033.38
12 k	In-water Transportation of Excess Clean Sands Removed from Unit 2B	77,547	CY	$2.70	$3.00	$3.60	$ 209,376.30	$ 232,640.33	$ 279,168.40
12 l	Stockpiling/Handling of Excess Clean Sands for Future Placement	77,547	CY	$9.00	$10.00	$12.00	$ 697,921.00	$ 775,467.78	$ 930,561.33
13	**Sediment Placement within CDF**								
13 a	Purchase of Flocculant (TBD)	0	TON	$0.00	$0.00	$0.00	$ -	$ -	$ -
13 b	Toyo Pump, Crane Barge, and Spreader Barge	1	LS	$266,400.00	$296,000.00	$355,200.00	$ 266,400.00	$ 296,000.00	$ 355,200.00
13 c	Transfer of Contaminated Sediment Materials to CDF	342,318	CY	$7.20	$8.00	$9.60	$ 2,464,687.47	$ 2,738,541.63	$ 3,286,249.96
13 d	Procurement of Top Base/Sub-base Layer for CDF Footprint (2ft Thickness)	75,178	TON	$9.90	$11.00	$13.20	$ 744,258.73	$ 826,954.14	$ 992,344.97
13 e	Placement of Top Base/Sub-base Layer for CDF Footprint (2ft Thickness)	46,411	CY	$10.80	$12.00	$14.40	$ 501,244.00	$ 556,937.78	$ 668,325.33
13 f	Ground Improvement (TBD)	1	LS	$0.00	$0.00	$0.00	$ -	$ -	$ -
14	**Sediment Capping, Armoring, and RMC Placement**								
14 a	Procurement of Sand for RMC and Caps (All Units)	28,422	TON	$9.00	$10.00	$12.00	$ 255,793.84	$ 284,215.38	$ 341,058.45
14 b	Loading Sand for RMC (Units 1A, 1B, 1C, 2B, 8-west)	58,961	CY	$0.90	$1.00	$1.20	$ 53,064.80	$ 58,960.89	$ 70,753.07
14 c	Placement Sand for RMC (Units 1A, 1B, 1C, 2B, 8-west)	58,961	CY	$17.57	$19.52	$23.43	$ 1,036,065.40	$ 1,151,183.78	$ 1,381,420.54
14 d	Loading Sand for Cap (Unit 5B)	15,499	CY	$0.90	$1.00	$1.20	$ 13,949.47	$ 15,499.41	$ 18,599.29
14 e	Placement Sand for Cap (Unit 5B)	15,499	CY	$17.57	$19.52	$23.43	$ 272,356.81	$ 302,618.68	$ 363,142.42
14 f	Procurement of Gravel for Cap (Units 2C, GP Underpier, BST Underpier, 6A/B/C)	116,619	TON	$10.80	$12.00	$14.40	$ 1,259,488.17	$ 1,399,431.30	$ 1,679,317.57
14 g	Mixing/Loading Gravel/Sand Mix for Cap (Units 2C, GP Underpier, BST Underpier, 6A/B/C)	143,992	CY	$3.60	$4.00	$4.80	$ 518,369.60	$ 575,966.22	$ 691,159.47
14 h	Placement Gravel/Sand Mix for Cap (Units 2C, GP Underpier, 6A/B/C)	135,992	CY	$17.57	$19.52	$23.43	$ 2,389,654.37	$ 2,655,171.52	$ 3,186,205.82
14 i	Placement Gravel/Sand Mix for Cap (BST Underpier)	8,000	CY	$53.06	$58.96	$70.75	$ 424,512.00	$ 471,680.00	$ 566,016.00
14 j	Procurement of Armor Rock for ASB Berm Stabilization After Breaching (Units 2B and 8)	3,675	TON	$18.00	$20.00	$24.00	$ 66,149.89	$ 73,499.88	$ 88,199.85
14 k	Loading Armor Rock for ASB Berm Stabilization After Breaching (Units 2B and 8)	2,450	CY	$6.30	$7.00	$8.40	$ 15,433.60	$ 17,148.44	$ 20,578.13
14 l	Placement Armor Rock for ASB Berm Stabilization After Breaching (Units 2B and 8)	2,450	CY	$25.52	$28.36	$34.03	$ 62,520.92	$ 69,467.69	$ 83,361.23
	Season 2 Construction - Subtotal Costs						**$ 20,843,462.81**	**$ 23,159,403.12**	**$ 27,791,283.75**
15	**Sales Tax**	8.70	%		-		$ 1,813,381.26	$ 2,014,868.07	$ 2,417,841.69
	Season 2 Construction - Subtotal Costs (Including Sales Tax)						**$ 22,656,844.08**	**$ 25,174,271.20**	**$ 30,209,125.44**
	Total Construction Costs (Including Sales Tax)						**$ 43,772,248.96**	**$ 48,635,832.18**	**$ 58,362,998.62**
16	**Project Contingency (variable)**	-	%	20	30	35	$ 8,754,449.79	$ 14,590,749.65	$ 20,427,049.52
	Total Project Construction Costs (Including Sales Tax)						**$ 52,526,698.76**	**$ 63,226,581.84**	**$ 78,790,048.14**

Notes:
1. Probable total costs for the modified remedial approach are presented in year 2020 dollars.
2. Quantities and costs presented are preliminary and subject to change; they are based on the pre-design evaluation conducted in this Memorandum and for planning purposes only.
3. Lower probable costs are calculated based on a 10% unit cost decrease from the probable unit cost.
4. Upper probable costs are calculated based on a 20% unit cost increase from the probable unit cost.

ASB: Aerated Stabilization Basin
BST: Bellingham Shipping Terminal
CDF: confined disposal facility
CY: cubic yard
EA: each
ft: foot/feet
GP: Georgia-Pacific
LS: lump sum
RMC: residuals management cover
TBD: to be determined

Appendix D
Update to Itemized Cost Estimate for Current Remedial Approach

Table D-1
Update to Itemized Cost Estimate for Current Remedial Approach

Task ID	Task Description	Quantity	Unit	Lower Probable Unit Cost ($)	Probable Unit Cost ($)	Upper Probable Unit Cost ($)	Lower Probable Total Cost ($)	Probable Total Cost ($)	Upper Probable Total Cost ($)
Season 1 Construction									
1	**Mobilization/Demobilization**								
1 a	Dredge and Ancillary Equipment	1	LS	$810,000.00	$900,000.00	$1,080,000.00	$ 810,000.00	$ 900,000.00	$ 1,080,000.00
1 b	Procedural Costs, Workplans	1	LS	$45,000.00	$50,000.00	$60,000.00	$ 45,000.00	$ 50,000.00	$ 60,000.00
2	**Site Preparation**								
2 a	Installation of Staging Dolphins (Mono-Pile)	8	EA	$57,387.19	$63,763.54	$76,516.25	$ 459,097.50	$ 510,108.33	$ 612,130.00
2 b	Demolition of Existing ASB Equipment/Miscellaneous Items	1	LS	$392,490.00	$436,100.00	$523,320.00	$ 392,490.00	$ 436,100.00	$ 523,320.00
2 c	Procurement of Armor Rock for Existing ASB Berm Slope Maintenance (N & S Exterior)	7,166	TON	$18.00	$20.00	$24.00	$ 128,982.98	$ 143,314.43	$ 171,977.31
2 d	Loading of Armor Rock for Existing ASB Berm Slope Maintenance (N & S Exterior)	4,777	CY	$6.30	$7.00	$8.40	$ 30,093.35	$ 33,437.06	$ 40,124.47
2 e	Placement of Armor Rock for Existing ASB Berm Slope Maintenance (N & S Exterior)	4,777	CY	$25.52	$28.36	$34.03	$ 121,921.06	$ 135,467.84	$ 162,561.41
2 f	Stockpile Area and Management (Clean Sands and Other Materials for Project/Future Placement)	1	LS	$675,000.00	$750,000.00	$900,000.00	$ 675,000.00	$ 750,000.00	$ 900,000.00
3	**Surveys**								
3 a	Contractor Daily Progress Surveys	290	DAY	$900.00	$1,000.00	$1,200.00	$ 260,967.45	$ 289,963.83	$ 347,956.60
3 b	Pre-Construction Survey (Unit 8)	1	EA	$9,000.00	$10,000.00	$12,000.00	$ 9,000.00	$ 10,000.00	$ 12,000.00
3 c	Dredge Post-Construction Survey (Unit 8)	1	EA	$9,000.00	$10,000.00	$12,000.00	$ 9,000.00	$ 10,000.00	$ 12,000.00
4	**Dredging and Disposal/Management of ASB Materials**								
4 a	Soft Sediments - Mechanical Dredging and Stabilization	320,700	CY	$21.31	$23.68	$28.41	$ 6,833,666.31	$ 7,592,962.57	$ 9,111,555.08
4 b	Soft Sediments - Offsite Transport and Landfill Disposal	320,700	CY	$135.00	$150.00	$180.00	$ 43,294,500.00	$ 48,105,000.00	$ 57,726,000.00
4 c	Transition Sands - Dredging and Transport to Stockpile Area	90,300	CY	$16.73	$18.59	$22.31	$ 1,511,166.78	$ 1,679,074.20	$ 2,014,889.04
4 d	Dredging Clean Sands from Unit 8 and Transport to Stockpile Area	340,000	CY	$6.30	$7.00	$8.40	$ 2,142,000.00	$ 2,380,000.00	$ 2,856,000.00
5	**ASB Discharge Structure Decommissioning**								
5 a	Plug/Grout ASB Stormwater Discharge Standpipe	1	LS	$90,000.00	$100,000.00	$120,000.00	$ 90,000.00	$ 100,000.00	$ 120,000.00
5 b	Demo and Dispose ASB Outfall Building	1	LS	$135,000.00	$150,000.00	$180,000.00	$ 135,000.00	$ 150,000.00	$ 180,000.00
	Season 1 Construction - Subtotal Costs						**$ 56,947,885.43**	**$ 63,275,428.26**	**$ 75,930,513.91**
6	**Sales Tax**	8.70	%		-		$ 4,954,466.03	$ 5,504,962.26	$ 6,605,954.71
	Season 1 Construction - Subtotal Costs (Including Sales Tax)						**$ 61,902,351.46**	**$ 68,780,390.52**	**$ 82,536,468.62**
Season 2 Construction									
7	**Mobilization/Demobilization**								
7 a	Dredge and Ancillary Equipment	1	LS	$810,000.00	$900,000.00	$1,080,000.00	$ 810,000.00	$ 900,000.00	$ 1,080,000.00
7 b	Procedural Costs, Workplans	1	LS	$45,000.00	$50,000.00	$60,000.00	$ 45,000.00	$ 50,000.00	$ 60,000.00
8	**Surveys**								
8 a	Contractor Daily Progress Surveys	533	DAY	$900.00	$1,000.00	$1,200.00	$ 479,700.00	$ 533,000.00	$ 639,600.00
8 b	Pre-Construction Survey	1	EA	$11,700.00	$13,000.00	$15,600.00	$ 11,700.00	$ 13,000.00	$ 15,600.00
8 c	Dredge Post-Construction Bathy Survey (Units 1A, 1B, 1C, 2B, 2C, 5B, 6A/6B/6C, BST Underpier, GP underpier)	9	EA	$9,000.00	$10,000.00	$12,000.00	$ 81,000.00	$ 90,000.00	$ 108,000.00
8 d	Placement Post-Construction Bathy Survey (Units 1A, 1B, 1C, 2B, 2C, 5B, 6A/6B/6C, 8, BST Underpier, GP underpier)	10	EA	$9,000.00	$10,000.00	$12,000.00	$ 90,000.00	$ 100,000.00	$ 120,000.00
8 e	Placement Post-Construction Topo Survey	1	EA	$6,300.00	$7,000.00	$8,400.00	$ 6,300.00	$ 7,000.00	$ 8,400.00
9	**Structural Work**								
9 a	Demo of BST Dock Eastern End	4,000	SF	$25.65	$28.50	$34.20	$ 102,600.00	$ 114,000.00	$ 136,800.00
9 b	Procurement of Armor Rock for Slope Armoring at BST Dock Eastern End	1,150	TON	$18.00	$20.00	$24.00	$ 20,704.84	$ 23,005.38	$ 27,606.46
9 c	Loading of Armor Rock for Slope Armoring at BST Dock Eastern End	767	CY	$6.30	$7.00	$8.40	$ 4,830.70	$ 5,367.44	$ 6,440.93
9 d	Placement of Armor Rock for Slope Armoring at BST Dock Eastern End	767	CY	$25.52	$28.36	$34.03	$ 19,571.24	$ 21,745.82	$ 26,094.98
9 e	Offloading, Transportation, and Disposal of Demo Items (BST Dock Eastern End)	1	LS	$45,000.00	$50,000.00	$60,000.00	$ 45,000.00	$ 50,000.00	$ 60,000.00
9 f	Replacement of BST Dolphins	1	LS	$1,254,701.75	$1,394,113.05	$1,672,935.66	$ 1,254,701.75	$ 1,394,113.05	$ 1,672,935.66
9 g	Box Culvert Installation for Fish Passage	1	LS	$207,000.00	$230,000.00	$276,000.00	$ 207,000.00	$ 230,000.00	$ 276,000.00
10	**Dredging Within Remaining Whatcom Waterway Phase II Units and In-water Transportation**								
10 a	Unit 1A - Contaminated Sediment	35,159	CY	$13.80	$15.33	$18.40	$ 485,143.08	$ 539,047.86	$ 646,857.43
10 b	Unit 1B - Contaminated Sediment	82,606	CY	$13.80	$15.33	$18.40	$ 1,139,842.68	$ 1,266,491.87	$ 1,519,790.25
10 c	Unit 1C - Contaminated Sediment	96,305	CY	$13.80	$15.33	$18.40	$ 1,328,868.96	$ 1,476,521.07	$ 1,771,825.29
10 d	BST Underpier - Contaminated Sediment	8,000	CY	$41.39	$45.99	$55.19	$ 331,114.10	$ 367,904.56	$ 441,485.47
10 e	Unit 2B (Access Channel) - Contaminated Sediment	5,000	CY	$13.80	$15.33	$18.40	$ 68,992.73	$ 76,658.59	$ 91,990.31
10 f	Unit 2C - Contaminated Sediment	5,000	CY	$13.80	$15.33	$18.40	$ 68,992.73	$ 76,658.59	$ 91,990.31
10 g	GP Underpier Footprint - Contaminated Sediment	15,469	CY	$39.65	$44.05	$52.86	$ 613,321.46	$ 681,468.29	$ 817,761.95
10 h	Unit 5B - Contaminated Sediment	14,505	CY	$13.80	$15.33	$18.40	$ 200,147.91	$ 222,386.57	$ 266,863.88
10 i	Unit 6A/6B/6C - Contaminated Sediment	11,253	CY	$13.80	$15.33	$18.40	$ 155,275.04	$ 172,527.82	$ 207,033.38
11	**Sediment Placement within CDF**								
11 a	Toyo Pump, Crane Barge, and Spreader Barge	1	LS	$270,000.00	$300,000.00	$360,000.00	$ 270,000.00	$ 300,000.00	$ 360,000.00
11 b	Placement of Sediments in CDF	273,297	CY	$7.20	$8.00	$9.60	$ 1,967,741.87	$ 2,186,379.85	$ 2,623,655.82

Table D-1
Update to Itemized Cost Estimate for Current Remedial Approach

Task ID	Task Description	Quantity	Unit	Lower Probable Unit Cost ($)	Probable Unit Cost ($)	Upper Probable Unit Cost ($)	Lower Probable Total Cost ($)	Probable Total Cost ($)	Upper Probable Total Cost ($)
12	**Sediment Capping, Armoring and RMC Placement**								
11 a	Loading of Backfill Sand in BST Underpier	8,000	CY	$0.90	$1.00	$1.20	$ 7,200.00	$ 8,000.00	$ 9,600.00
12 b	Placement of Backfill Sand in BST Underpier	8,000	CY	$53.06	$58.96	$70.75	$ 424,512.00	$ 471,680.00	$ 566,016.00
11 c	Loading Sand for RMC (Units 1A, 1B, 1C, 2B)	44,156	CY	$0.90	$1.00	$1.20	$ 39,740.53	$ 44,156.15	$ 52,987.38
12 d	Placement Sand for RMC (Units 1A, 1B, 1C, 2B)	44,156	CY	$17.57	$19.52	$23.43	$ 775,915.33	$ 862,128.14	$ 1,034,553.77
11 e	Loading Sand for Cap (Unit 5B)	15,499	CY	$0.90	$1.00	$1.20	$ 13,949.47	$ 15,499.41	$ 18,599.29
12 f	Placement Sand for Cap (Unit 5B)	15,499	CY	$17.57	$19.52	$23.43	$ 272,356.81	$ 302,618.68	$ 363,142.42
12 g	Procurement of Gravel for Cap (Units 2C, GP Underpier, 6A/B/C)	90,960	TON	$10.80	$12.00	$14.40	$ 982,368.00	$ 1,091,520.00	$ 1,309,824.00
12 h	Mixing/Loading Gravel/Sand Mix for Cap (Units 2C, GP Underpier, 6A/B/C)	113,700	CY	$3.60	$4.00	$4.80	$ 409,320.00	$ 454,800.00	$ 545,760.00
12 i	Placement Gravel/Sand Mix for Cap (Units 2C, GP Underpier, 6A/B/C)	113,700	CY	$17.57	$19.52	$23.43	$ 1,997,945.39	$ 2,219,939.32	$ 2,663,927.19
12 i	Placement of ASB Transition Sands (Slope)	44,500	CY	$17.57	$19.52	$23.43	$ 781,957.52	$ 868,841.69	$ 1,042,610.03
12 j	Place Thick Cap over Backfill Sediments in ASB	90,000	CY	$19.37	$21.52	$25.83	$ 1,743,487.12	$ 1,937,207.91	$ 2,324,649.49
12 k	Procurement of Armor Rock for ASB Berm Stabilization After Breaching (Units 2B and 8)	3,675	TON	$18.00	$20.00	$24.00	$ 66,149.89	$ 73,499.88	$ 88,199.85
12 l	Loading Armor Rock for ASB Berm Stabilization After Breaching (Units 2B and 8)	2,450	CY	$6.30	$7.00	$8.40	$ 15,433.60	$ 17,148.44	$ 20,578.13
12 m	Placement Armor Rock for ASB Berm Stabilization After Breaching (Units 2B and 8)	2,450	CY	$25.52	$28.36	$34.03	$ 62,528.13	$ 69,475.70	$ 83,370.84
	Season 2 Construction - Subtotal Costs						**$ 17,400,412.87**	**$ 19,333,792.08**	**$ 23,200,550.50**
13	**Sales Tax**	8.70	%		-		$ 1,513,835.92	$ 1,682,039.91	$ 2,018,447.89
	Season 2 Construction - Subtotal Costs (Including Sales Tax)						**$ 18,914,248.79**	**$ 21,015,831.99**	**$ 25,218,998.39**
	Total Construction Costs (Including Sales Tax)						**$ 80,816,600.26**	**$ 89,796,222.51**	**$ 107,755,467.01**
14	**Project Contingency**	-	%	20	30	35	$ 16,163,320.05	$ 26,938,866.75	$ 37,714,413.45
	Total Project Construction Costs (Including Sales Tax)						**$ 96,979,920.31**	**$ 116,735,089.26**	**$ 145,469,880.47**

Notes:
1. Probable total costs for the current remedial approach are presented in year 2020 dollars.
2. Quantities and costs presented are preliminary and subject to change; they are based on the pre-design evaluation conducted in this Memorandum and for planning purposes only.
3. Lower probable costs are calculated based on a 10% unit cost decrease from the probable unit cost.
4. Upper probable costs are calculated based on a 20% unit cost increase from the probable unit cost.

ASB: Aerated Stabilization Basin
BST: Bellingham Shipping Terminal
CDF: confined disposal facility
CY: cubic yard
EA: each
GP: Georgia-Pacific
LS: lump sum
RMC: residuals management cover