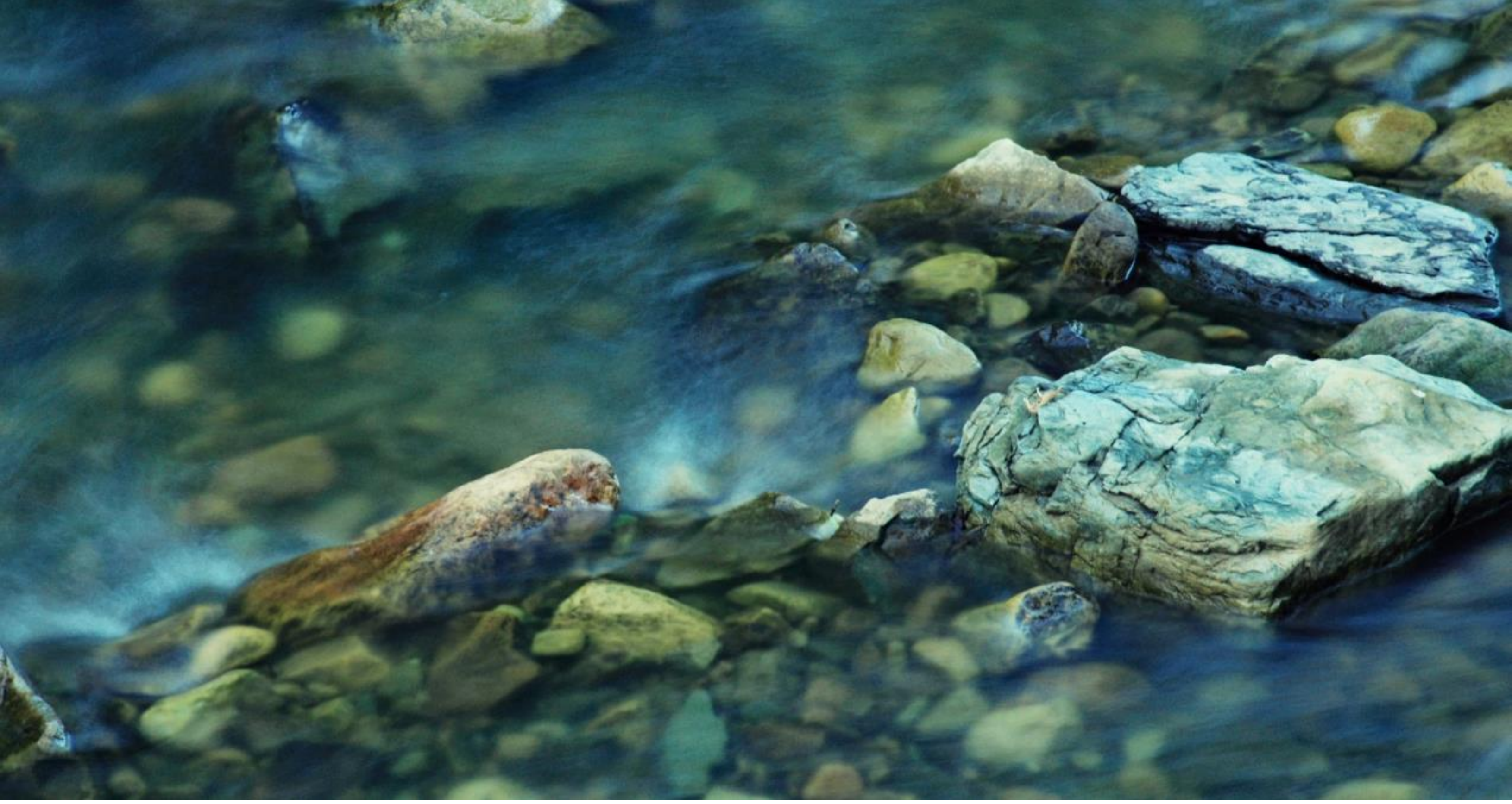

February 2018
Port Gamble Bay and Mill Site Cleanup Project

Final Cleanup Action Report – Season 2

Prepared for Pope Resources, LP/OPG Properties, LLC

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ABBREVIATIONS

BMP	best management practice
CAP	Cleanup Action Plan
CAR	Cleanup Action Report
CD	Consent Decree
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CQAP	Construction Quality Assurance Plan
CU	certification unit
cy	cubic yards
DGPS	differential global positioning system
DNR	Washington Department of Natural Resources
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EMNR	enhanced monitored natural recovery
FLTF	Former Log Transfer Facility
H:V	horizontal to vertical
Mill Site	Pope & Talbot sawmill facility
MLLW	mean lower low water
MSS	Marine Sampling Systems, Inc.
MTCA	Model Toxics Control Act
NWP	Nationwide Permit
OHW	ordinary high water
OMCI	Orion Marine Contractors, Inc.
OMMP	Operations, Maintenance, and Monitoring Plan
P&T	Pope & Talbot
PR/OPG	Pope Resources, LP/OPG Properties, LLC
RMC	residuals management cover
SCO	sediment cleanup objective
Site	Port Gamble Bay
SMA	sediment management area
SMS	sediment management standards
sy	square yards
TEQ	toxic equivalents
TVS	total volatile solids
USACE	U.S. Army Corps of Engineers
WAC	Washington Administrative Code

Executive Summary

This Season 2 Cleanup Action Report (CAR) summarizes construction activities completed during the second year of the Port Gamble Bay and Mill Site Cleanup Project. Work was completed at the direction of the Washington State Department of Ecology (Ecology) and under Consent Decree 13-2-02720-0 between Ecology and Pope Resources, LP/OPG Properties, LLC (PR/OPG), entered in December 2013.

This Season 2 CAR documents the work completed, discusses performance standards and construction quality control. Season 2 in-water construction activities were initiated on June 13, 2016, and finished on January 14, 2017; no further in-water construction activities are required for the Port Gamble Bay and Mill Site Cleanup Project.

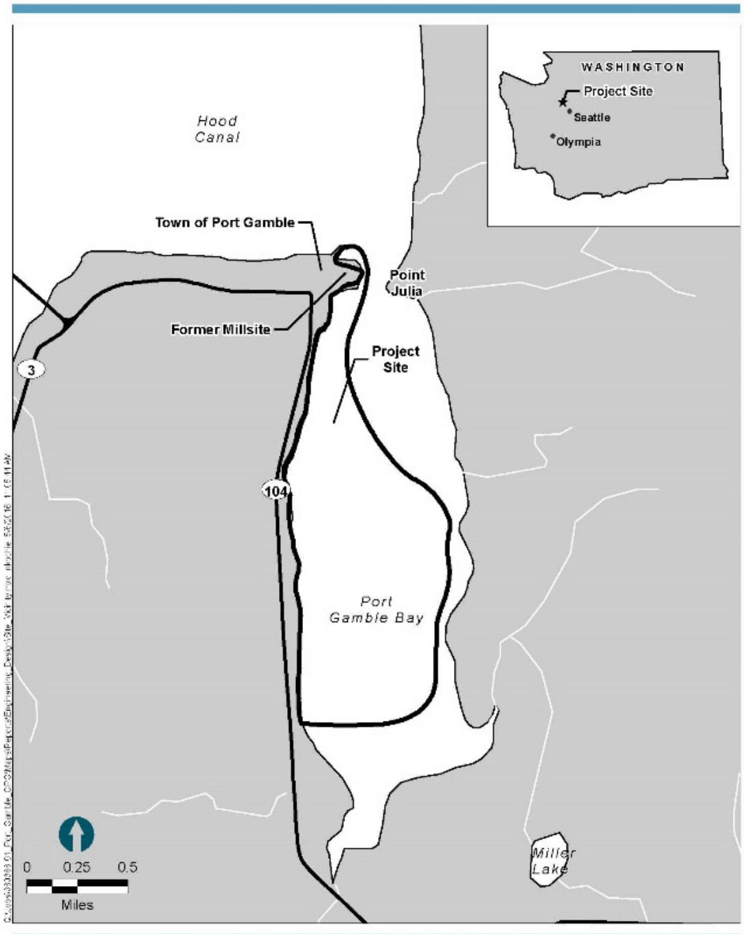

Figure ES-1 – Vicinity Map

Season 2 construction activities were implemented in accordance with the Ecology-approved Engineering Design Report (Anchor QEA 2015), project Technical Specifications and Drawings, and associated permitting requirements. The work was performed to achieve sediment cleanup standards for Port Gamble Bay ("Site"), addressing wood waste, carcinogenic polycyclic aromatic hydrocarbon toxic equivalents (TEQ), dioxin/furan TEQ, and cadmium, as described in the Cleanup Action Plan (Ecology 2013).

Final approval and issuance of the required project permits occurred on August 14, 2015. PR/OPG rapidly contracted with Orion Marine Contractors, Inc., to initiate in-water construction several weeks later. Season 1 in-water construction activities are summarized in the Season 1 CAR. Season 2 construction activities were completed in Sediment Management Area 1 (SMA-1), SMA-2, SMA-3, and SMA-5. Table ES-1 summarizes Season 1 and 2 construction activities performed and quantities during each season. Construction oversight was performed by Anchor QEA to verify that construction activities were performed in accordance with project Technical Specifications and Drawings and to implement the Construction Quality Assurance Plan. Construction activities were tracked to verify progress and best management practices throughout construction.

Table ES-1
Summary of Construction Activities for Seasons 1 and 2

Construction Activity	Season	Location(s)	Description and Quantity Completed	Total Quantity
Demolition	1	SMA-2 SMA-5	Alder Chip Pier; Eastern Wharf; Pier 5; Breakwater; Overhead Chip Conveyor (46,000 sf)	56,500 sf
	2	SMA-1 SMA-2 SMA-5	Log Transfer Dock, Former Log Transfer Facility, Pier 4, and SMA-1 Conveyor Pier (10,500 sf)	
Piling Removal	1	SMA-2 SMA-5	3,314 pilings	8,592 pilings
	2	SMA-1 SMA-2 SMA-5	5,278 pilings	
Intertidal Excavation and Capping	1	SMA-2	1,650 lf of shoreline (16,000 sy)	3,485 lf (26,104 sy capping; 33,240 cy excavation)
	2	SMA-1 SMA-2	1,835 lf of shoreline (10,104 sy)	
Subtidal Dredging	1	SMA-2	19,078 cy	77,297 cy
	2	SMA-1 SMA-2	19,757 cy (SMA-1); 38,462 cy (SMA-2) (58,219 cy Season 2 Total)	
Subtidal Capping	1	SMA-2	2.8 acres	7.9 acres
	2	SMA-1 SMA-2	5.1 acres	
Subtidal Cover (EMNR)	1	SMA-2	6.9 acres (7,058 cy)	79.2 acres (113,342 cy)
	2	SMA-1 SMA-2 SMA-3	72.3 acres (106,284 cy)	
Beach Cleanup	2	Areas 4a, 4b, & 1	1,400 lf	1,400 lf

Notes:
cy – cubic yards
EMNR – enhanced monitored natural recovery
lf – linear feet
sf – square feet
sy – square yards
SMA – Sediment Management Area

Anchor QEA and Ecology coordinated on appropriate modifications to project design as necessitated by field conditions to meet the agency's overall objectives for the project. Table ES-2 summarizes the increased quantities that resulted from these design modifications. Ecology also oversaw remedial activities, with regular site visits to observe construction activities.

Figure ES-2 – Aerial view of Upland Stockpiles, SMA-1 cap material conveyor, and water-based capping equipment in SMA-1 and SMA-2

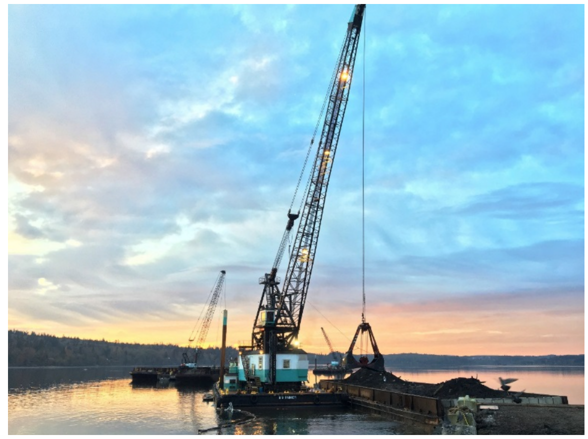

Figure ES-3 – Subtidal dredging in SMA-2

Table ES-2
Summary of Increased Piling Removal, Dredging, Excavation, Backfill, and Work Shift Quantities

Description	Planned Quantity	Actual Quantity	Increase from Planned Quantity	Report Section Reference
Piling Removal – Season 1 and 2 (each)	5,500	8,592	3,092	3.1.2
Diver Assisted Pile Removal – Season 1 and 2 (days)	16	31	15	3.1.2
Dredging – Season 1 and 2 (cubic yards)	46,800	77,297	30,497	3.2.3 & 3.2.6
Intertidal Excavation – Season 1 and 2 (cubic yards)	23,900	33,240	9,340	3.3.2.1
Angular Backfill Material – Season 2 (tons)	0	19,202	19,202	3.2.9
Work Shifts During Dredge Work Window – Season 2 (each)	61	136	75	3.2

Note: See Section 2.3 for a summary of changes from the original design

1 Introduction

This Season 2 Cleanup Action Report (CAR) summarizes construction and quality assurance activities performed during Season 2 remedial actions in Port Gamble Bay ("the Site"). Season 2 construction activities were implemented in accordance with the cleanup design approved by the Washington State Department of Ecology (Ecology), as well as project permitting requirements. The cleanup design is detailed in the Engineering Design Report (EDR; Anchor QEA 2015), which describes the approach and criteria for the engineering design of sediment cleanup actions at the Site, as set forth in the Final Cleanup Action Plan (CAP; Ecology 2013), and in accordance with the requirements of Consent Decree (CD) 13-2-02720-0 between Ecology and Pope Resources, LP/OPG Properties, LLC (PR/OPG), entered in December 2013.

Construction and quality assurance activities performed during Season 1 are summarized in the Ecology-approved Season 1 CAR (Anchor QEA 2016a). The remedial activities described in this Season 2 CAR were performed by PR/OPG under Ecology oversight, consistent with CD requirements and the requirements of the Model Toxics Control Act (MTCA), Chapter 70.105D in the Revised Code of Washington, as administered by Ecology under the MTCA Cleanup Regulation, Chapter 173-340 of the Washington Administrative Code (WAC). Remedial activities performed at the Site also comply with the Sediment Management Standards (SMS) Chapter 173-204 WAC.

The term "Season 2" describes the second in-water work period defined by the project permits. The Season 1 CAR covered work completed between September 9, 2015, and February 4, 2016. This Season 2 CAR covers additional investigation and design work completed between Season 1 and Season 2, as well as construction work completed between June 13, 2016, and January 14, 2017. All in-water work was completed in Season 2 by Orion Marine Contractors, Inc. (OMCI).

Upland sparging (rinsing with freshwater) and characterization of stockpiled sediments and leachate was completed in August 2017. The results of the stockpile sediment characterization confirmed all but one area, stockpile PG-SP-67, met Kitsap Public Health Department suitability criteria for placement in the Limited Purpose Landfill at the Model Airplane Field. Material from stockpile PG-SP-67 was transported off site between July 12 and 20, 2017, for disposal at the Wasco County Landfill in The Dalles, Oregon. The remaining stockpiled material was subsequently moved off site and permanently disposed of at a permitted Limited Purpose Landfill at the Model Airplane Field.

Construction activities performed at the Site during Season 2 included the following:

- Demolition and removal of creosote-treated structures and pilings, and non-creosote treated pilings
- Beach debris removal
- Intertidal excavation and placement of sediments into stockpiles located on the former Pope & Talbot (P&T) sawmill facility (Mill Site)

- Subtidal dredging
- Receipt and stockpiling clean capping, armoring, and habitat materials
- Placement of backfill material to flatten subtidal slopes
- Intertidal and subtidal capping
- Placement of habitat substrate material
- Subtidal placement of enhanced monitored natural recovery (EMNR) material
- Transloading of dredge sediments onto the Mill Site and into stockpiles
- Removal of derelict vessel and historical fill at Former Log Transfer Facility
- Removal of concrete debris from south side of jetty and replacement with clean rock

1.1 Site Location and Environmental Setting

Port Gamble Bay is located in Kitsap County and encompasses more than 2 square miles of subtidal and shallow intertidal habitat just south of the Strait of Juan de Fuca. Figure 1 presents the Site vicinity and location features, and Figure 2 presents the Site boundary and the location of sediment management areas (SMAs) 1 through 5, as defined in the CAP. The Mill Site is located adjacent to SMA-1 and SMA-2.

The Mill Site is located in Township 27 North, Range 2 East, Section 5, at the foot of a steep bluff on a peninsula bounded by Hood Canal to the north and west (Figure 1). Prior to the cleanup project, the shoreline at the Mill Site contained aging creosote-treated-piling-supported structures and derelict pilings. Pre-project bank slopes were relatively steep and armored with large rock and concrete riprap. A more detailed discussion of the environmental setting is presented in the EDR (Anchor QEA 2015).

1.2 Operational History

P&T and/or its corporate predecessors continuously operated a sawmill in Port Gamble from 1853 until 1995. Operations during that time included a succession of sawmill buildings, two chip loading facilities, a log transfer facility, and log rafting and storage areas. Some operations took place on aquatic lands that were managed by the Washington Department of Natural Resources (DNR). A portion of the aquatic lands used for P&T's operations were subject to various lease agreements with DNR, including lands located within and adjacent to SMA-4. This 72-acre portion that P&T leased from DNR was known as the Former Lease Area and was used from 1974 to 2001 for the storage and transfer of logs. The majority of log rafting ceased in 1995, when the sawmill closed. P&T removed some pilings from the Former Lease Area in 1996.

PR was formed in 1985 when P&T spun off its timberland, real estate, and development branch into a separate independent company. PR took the timberlands and acquired ownership of the uplands and adjacent tidelands as part of that spin off. P&T continued to operate the mill and wood products facilities until 1995, under a lease with PR. Mill operations ceased in 1995. The sawmill facility was dismantled and mostly removed in 1997.

1.3 Summary of Previous Interim Actions

In 1998, Olympic Property Group (OPG) was formed as a subsidiary of PR for real estate development and management. Between 2002 and 2005, PR/OPG excavated approximately 26,310 tons of contaminated soils from the Mill Site, and in 2003, P&T dredged approximately 13,500 cubic yards (cy) of sediment containing wood waste from a 1.8-acre area. Excavated upland soils and the 2003 wood waste dredge material were disposed of at approved upland facilities.

In early 2007, DNR and Ecology dredged an additional 17,500 cy of wood waste from a 1-acre area adjacent to the 2003 dredging action and placed a 6-inch layer of clean sand over a portion of the newly dredged area. In cooperation with this agency-led project, P&T took over the day-to-day management of the dredged material once it was transferred to shore, and subsequently removed salt from the material, utilizing an on-site upland holding cell and freshwater washing system, to facilitate upland beneficial reuse of these materials. Unsuitable solid waste materials were segregated and disposed of at an approved off-site landfill facility. All soil segregation, disposal, treatment, and relocation tasks were completed in the spring of 2009, in accordance with Kitsap County Grading Permit 08-52323.

In November 2007, P&T filed for bankruptcy (Delaware Case No. 07-11738).

2 Cleanup Action Background

This section summarizes the background for sediment cleanup actions at the Site.

2.1 Basis for the Cleanup Action

There are two distinct elements that form the basis for the cleanup action: 1) site-specific cleanup standards; and 2) the locations and media requiring cleanup action. Each of these elements is described below.

2.1.1 Cleanup Standards

Cleanup standards consist of: 1) cleanup levels that are protective of human health and the environment; and 2) the point of compliance at which the cleanup levels must be met.

2.1.1.1 Cleanup Levels

Ecological risk-based cleanup levels for sediments were based on SMS biological criteria, using bioassay results as summarized in the CAP. The Site-specific biological criteria identified in the CAP is the sediment cleanup objective (SCO), which was used to delineate SMAs as described in the EDR (Anchor QEA 2015).

Human health-based sediment cleanup levels were developed for carcinogenic polycyclic aromatic hydrocarbon (cPAH) toxic equivalents (TEQ), dioxin/furan TEQ, and cadmium.

Table 1 summarizes site-specific sediment cleanup levels from the CAP.

2.1.1.2 Point of Compliance

Under MTCA, the point of compliance is the point or location on a site where the cleanup levels must be attained. For marine sediments, the point of compliance for protection of the environment is surface sediments within the biologically active zone. The biologically active zone is not specified by rule, but represents the depth in surface sediments within which benthic organisms at the Site are found. The point of compliance identified in the EDR for deeper subtidal sediments in SMA-2 is a 3-foot-thick biologically active zone to provide habitat for geoduck. The point of compliance identified in the EDR for intertidal and shallow subtidal sediments is a 2-foot-thick biologically active zone to control contaminant exposure for humans and the environment (Anchor QEA 2015).

2.1.2 Locations Requiring Cleanup Action

This section summarizes the SMAs in Port Gamble Bay identified in the EDR as exceeding site-specific cleanup standards. Additional information regarding these areas is presented in the EDR (Anchor QEA 2015).

- **North Mill (SMA-1):** An approximately 6-acre area located in the embayment north of the former Mill Site, SMA-1 contained localized deposits of subtidal wood waste (primarily wood chips) located near the former chip loading area.
- **South Mill (SMA-2):** An approximately 20-acre area located immediately south and east of (adjacent to) the former Mill Site, SMA-2 also contained localized deposits of subtidal wood waste (including sawdust, chips, and bark), particularly adjacent to the former alder mill chip loading area.
- **Central Bay (SMA-3):** An approximately 61-acre area located in the south-central portion of Port Gamble Bay, SMA-3 exceeded SCO biological (i.e., bioassay toxicity) criteria, attributable at least in part to the presence of wood waste breakdown products in sediments.
- **cPAH Background Area (SMA-5):** An approximately 600-acre area that encompasses all of the other SMAs (including the former SMA-4, which previously exhibited bioassay toxicity but passed SCO biological criteria in 2014). The boundary of SMA-5 was developed based on surface sediment cPAH TEQ concentrations exceeding site-specific cleanup levels. It also includes an area of elevated dioxin/furan TEQ near SMA-3, as well as one station with elevated sediment cadmium concentrations.

2.2 Summary of Design Basis

The design basis for the excavation, dredging, and engineered cap construction at the Site is presented in the EDR (Anchor QEA 2015). The bottom of the dredge prism was designed to correspond to elevations where sediment total volatile solids (TVS) concentrations are below 15%. Engineered caps were designed to control contaminant exposure to humans and the environment and to provide habitat as practicable for benthic organisms, shellfish, and forage fish. Cap designs were developed using upper-bound estimates of subsurface contaminant (especially cPAH) concentrations, including creosote-treated pilings.

2.3 Observations and Lessons Learned

The following sections summarize lessons learned and general observations.

2.3.1 Subtidal Dredging Production Rates

The Season 1 dredging production rates were lower than expected due to the presence of debris and the use of the closed Young bucket. For Season 2, a larger derrick (the D.B. Rainer) and clamshell bucket were used in areas where debris was encountered. This equipment was more effective for handling debris and achieving the production rate needed to maintain the construction schedule.

2.3.2 Subtidal Dredging and Buried Piling

As discussed in Section 4.1, 2,634 buried pilings were encountered during dredging. While it was anticipated that there would be some pilings encountered during dredging activities, this quantity far exceeded what was expected. The use of the larger derrick and clamshell bucket allowed for these pilings to be removed during the dredging activities. Although the presence of these pilings slowed dredging production rates, smaller equipment would not have been able to dredge these areas to the required depths.

2.3.3 Shellfish Monitoring

Shellfish monitoring of biotoxins and chemicals of concern was performed to evaluate potential short-term construction-related effects of the cleanup, consistent with project permit requirements. Shellfish monitoring was performed as a collaborative effort between PR/OPG, the Port Gamble S'Klallam Tribe, and the Washington State Department of Health. Shellfish monitoring data collected during Port Gamble Bay cleanup activities were compared with baseline data collected prior to cleanup, using equivalent methods and procedures. The results of the shellfish monitoring, which are detailed in Appendix A, are summarized below:

- Biotoxin levels in shellfish tissue remained below health advisory criteria throughout in-water construction.
- While some small localized increases in polycyclic aromatic hydrocarbon concentrations in shellfish tissue and water column passive samplers were detected, levels in shellfish tissue remained below health advisory criteria throughout in-water construction, and localized increases were less than had been anticipated pre-construction.

2.3.4 Water Quality Monitoring

The dredging and capping best management practices (BMPs) implemented during Season 1 were successful and were maintained throughout Season 2. Turbidity exceedances in Season 1 were primarily associated with placement of clean cap and cover materials, as anticipated during design (clean capping material that includes fines has potential habitat benefits, but is likely to increase turbidity). As discussed in Section 3.4, only a single localized, short-term exceedance of the turbidity standard occurred during Season 2.

2.3.5 Scheduling Contingencies

To ensure the remaining remedial action work was completed on schedule, by the end of Season 2, the following contingencies were identified after Season 1 and implemented during Season 2:

- Increase the duration of the permitted in-water work window. Following Season 1 PR/OPG and Anchor QEA obtained a permit modification to allow dredging to begin on October 17, 2016.
- Additional, larger, dredging equipment (i.e., DB Rainier) was deployed to address debris encountered during Season 1 and maintain production rates necessary to meet the schedule.

- Scheduled work hours (both longer shifts and weekend shifts) were scheduled from the start of dredging activities to prevent the work from falling behind schedule. During the subtidal dredging work window, crews often worked around the clock and, in this very constrained work window, the number of shifts were increased by 123%
- Progress was tracked daily and assessed each week to ensure adaptive management was responsive to conditions and schedule. Target production rates were set and longer or additional shifts were used to meet target production rates as needed.

As a result of these contingencies, the initially planned dredging work was completed ahead of schedule. The additional work required to address wood waste at Pier 4 (Section 2.4.3 and 2.4.4) was also able to be completed by the end of Season 2 because of the aggressive schedule contingency measures implemented at the beginning of Season 2 dredging.

2.3.6 Transload Facility Improvements

In addition to the scheduling contingencies identified above in Section 2.3.5, the transloading operation was identified as a potential limiting factor to production rates if more dredging shifts or hours were added. As discussed in Section 3, significant improvements were made to the off-loading facility. These improvements allowed for dredge material barge off-loading to occur during much lower tides so shifts or hours could be added to the transloading operation as needed to keep up with the dredging operations. If these improvements had not been made, the dredging production rates would have been limited by the off-loading rate and resulting availability of material barges. These improvements also resulted in better site management BMPs (e.g., cleaner transload, transport, and stockpile operations).

2.4 Summary of Deviations from Design

Season 2 construction activities were implemented in general accordance with the cleanup design detailed in the EDR, (Anchor QEA 2015); however, the following modifications were required and approved by Ecology to address conditions encountered in the field during construction:

- Revisions to the SMA-2 dredge prism and buttressing of the resulting dredge cut slopes with angular gravel backfill material
- Placement of habitat substrate over angular backfill material placed in the SMA-2 dredge cut slopes
- Concrete removal and subsequent replacement with clean rock, to facilitate piling removal from SMA-1 jetty
- Additional wood waste removal from the slope and upland area adjacent to the former Pier 4 in SMA-2 (approximately 8,000 cy)
- Capping wood waste material remaining in the former Pier 4 area slope, after removal of wood waste to the extent practicable

- Modification to the SMA-1 intertidal cap to address movement of cap material observed at two locations: one on the north and one on the south end of the Type 1 intertidal cap
- Placement of EMNR material in the former eelgrass bed along the SMA-1 jetty, where eelgrass was no longer present at the onset of Season 2
- Additional removal of wood waste and capping of wood waste remaining at depth, in a portion of the SMA-1 intertidal excavation area
- Additional armoring of the shoreline in areas of the Site where erosion was observed between Season 1 and Season 2 construction activities

PR/OPG and Anchor QEA worked closely with Ecology on the development of these design changes. Feedback from Ecology on draft submittals and design alternates was incorporated into revised designs, and frequent meetings between PR/OPG, Ecology, and Anchor QEA were held to address these changes expeditiously and allow construction to proceed on schedule. The conditions that triggered these changes during construction were not known when the EDR was written and although these changes were determined to deviate from the EDR, Ecology concluded that they remained consistent with the intent of the CAP and Consent Decree. PR/OPG, Anchor QEA, and OMCI made the necessary contractual modifications to ensure that the increased work resulting from these design changes could be completed within the original contract timeframe. Collaboratively, the project team arrived at final design revisions that were consistent with the performance standards identified in the EDR and met the overall objectives of the project. These design revisions are discussed below. Table 2 summarizes the increased quantities that resulted from these design modifications.

2.4.1 SMA-2 Dredge Plan Revision

During the Season 1 subtidal dredging activities performed in SMA-2, additional wood waste material below the original design elevation was encountered on the western slope of the northern dredge prism. In this area, sawdust-type wood waste was encountered at depths greater than the required dredge elevation on the design 3 horizontal to 1 vertical (H:V) cut slope. Additional investigations to delineate the extent of the remaining wood waste in this area were conducted between Season 1 and Season 2. These investigations involved the use of diver-assisted jet probing, and follow-up diver assisted jet probing, to further delineate the vertical extent of wood waste. This method provided additional data in areas where traditional pre-design sampling methods had encountered refusal. The jet probing was conducted on a more closely spaced grid than the previous characterization samples, allowing for the new data, combined with existing information, to be used to refine the dredge prism design. The refined dredge prism was designed to meet the same performance standards identified in the EDR. The revised dredge design also included steeper dredge cut slopes to accomplish additional removal of wood waste, within geotechnical and coastal engineering constraints and erosion limitations that helped define how far into the slope wood waste deposits could be dredged without destabilizing the area. Additional details of the revised dredge prism and jet probe data collection were included in a June 13, 2016, *Revisions to Sediment Management Area 2 Dredge Prism Design Port Gamble Bay Cleanup Project Memorandum* (Anchor QEA 2016b). The final selected design for the SMA-2 dredge prism is presented in the October 17, 2016 *Revised Final Design Memorandum – SMA 2 Dredge Plan Modifications* (Appendix B)

Following discussions and feedback from Ecology, Anchor QEA conducted additional slope stability evaluations. The slope stability evaluation presented in the EDR was revisited to confirm the protectiveness of the refined SMA-2 dredge prism presented in the June 13, 2016, memorandum. The revised SMA-2 dredge prism required removal of a portion of the intertidal cap constructed in Season 1, and the steepened dredge cut slope of the revised dredge prism was immediately adjacent to the remaining intertidal cap. Therefore, a buttress of backfill for the steeper dredge cut slope was designed and incorporated to ensure the long-term stability of the slope, also meeting design criteria presented in the EDR. The results of this updated slope stability evaluation were summarized in a June 27, 2016 memorandum *Summary of Slope Stability Evaluations, SMA-2 Dredge Plan Revisions, Port Gamble Bay Cleanup Project* (Anchor QEA 2016c).

To evaluate measures to protect the intertidal cap above the revised dredge cut slope in SMA-2, Anchor QEA conducted additional engineering evaluations of the design refinements to the SMA-2 dredge prism. These evaluations including further geotechnical assessments of slope stability, and a coastal engineering assessment of erosion protection measures. Several alternative SMA-2 dredge prism designs were considered and evaluated based on discussions with Ecology. Alternative 1 was the original revision described in the June 13 memorandum, and Alternative 2 was developed to provide increased slope stability over Alternative 1, yet still included slopes that were steeper than those presented in the EDR. The geotechnical slope stability evaluation and coastal engineering evaluations presented in the EDR were revisited to evaluate the protectiveness of the refined SMA-2 dredge prism considered under Alternative 2. The slope stability evaluations for Alternative 2 and the coastal engineering evaluation (including recommended scour protection measures) are summarized in an August 1, 2016 memorandum *Revised SMA-2 Dredge Plan and Scour Apron Design Refinements, Port Gamble Bay Cleanup Project* (Anchor QEA 2016d).

Ultimately, multiple alternative designs were prepared and considered for the revised SMA-2 dredge prism. These alternative designs were based on feedback from Ecology, and collaborative discussions between PR/OPG, Ecology, and Anchor QEA, throughout the spring and summer of 2016 leading up to the start of Season 2 dredging. The final revised design prepared by Anchor QEA and approved by Ecology provides for protectiveness (e.g. slope stability) and also incorporates additional measures needed to address Ecology’s concern for habitat improvements (e.g., flatter slopes and placement of habitat substrate material).

The final design also incorporated provisions for contingency subtidal capping within the dredge prism for areas dredged to -35 feet mean lower low water (MLLW) where wood waste remained, backfill buttressing with angular gravel on post-dredge cut slopes steeper than 2H:1V, and conferring with Ecology in the event that localized additional dredging to remove encountered wood waste would over-steepen slopes and destabilize the top of bank. The final selected design for the SMA-2 dredge prism is presented in the October 17, 2016 *Revised Final Design Memorandum – SMA-2 Dredge Plan Modifications* (Appendix B), approved by Ecology on October 20, 2016. The October 17, 2016 memorandum superseded prior design memoranda on the subject.

2.4.2 SMA-1 Jetty Concrete Removal

After the start of Season 2 construction activities, and based on a closer inspection of the area, Ecology oversaw and provided direction on additional concrete debris removal to facilitate piling removal within the SMA-1 jetty. Creosote-treated pilings and several large pieces of concrete debris in the jetty south of the crest, as well as untreated piles in the jetty south of the crest and below ordinary high water (OHW), were removed. This work is discussed further in Section 3.1.6.

2.4.3 Additional Removal – Bank and Nearshore Slope, Former Pier 4 Area

During the Season 2 dredging in SMA-2, a wood waste deposit was encountered within the bank and nearshore slope adjacent to the former Pier 4 area. The specific measures taken to remove this material are discussed in Section 3.2.7. A discussion of the design revisions implemented to address this condition during construction is provided below.

On November 20, 2016, an upland test pit was excavated adjacent to the dredge cut slope where the wood waste deposit appeared to extend landward. The presence of wood waste in this test pit confirmed that complete removal of the wood waste in this area could not be performed without over-steepening the slope, destabilizing the top of the bank, and removing a portion of the upland area beyond the top of the bank. In accordance with the October 17, 2016 *Revised Final Design Memorandum – SMA-2 Dredge Plan Modifications* (Appendix B), PR/OPG and Anchor QEA initiated discussions with Ecology on how to address this wood waste deposit. Ecology oversaw and provided direction on further removal and excavation into the upland area. Consistent with Ecology's direction, PR/OPG and Anchor QEA proposed an excavation/dredging design that, when completed, would remove approximately 8,000 cy of material from the upper portion of the bank in the Pier 4 area. The design was based on three objectives:

1. Target wood waste removal in shallow subtidal and intertidal areas (defined as elevation -10 feet MLLW up to +2 feet, which was the highest elevation where wood waste was encountered)
2. Remove an additional quantity of 6,000 to 7,000 cy beyond the quantity that had already been removed

3. Remove the wood waste deposit, into the upland area, as far as the existing stockpile containment berm could be relocated

The revised design targeted wood waste deposits in the shallow subtidal and intertidal areas above elevation -10 feet MLLW with a removal prism that included a flat bench at -10 feet MLLW and a 3H:1V slope up from the bench into the uplands. This revised dredge/excavation prism resulted in over 7,000 cy of additional removal, and the 3H:1V slope did not extend beyond the proposed location for the relocated stockpile containment berm. Ecology approved this revised dredge/excavation design; however, the proposed cap would be further refined following the additional removal and confirmation sampling. The final former Pier 4 area cap design is discussed below in Section 2.4.4.

2.4.4 Former Pier 4 Area Capping

Sediment core samples were collected after the additional excavation and dredging in the former Pier 4 Area. The samples confirmed that no wood waste remained on the flat bench at elevation -10 feet MLLW, or the slope between the elevation -10 feet MLLW bench, and the lower bench at elevation -29 feet MLLW. Therefore, only the zone above the elevation -10 feet MLLW bench required a cap. The slope below the flat bench at elevation -10 feet MLLW required backfill/buttressing for stability of the slope and the cap above it, because it was steeper than 2H:1V. The final Pier 4 cap design was developed collaboratively with Ecology and included the following:

- Buttressing the slope below the elevation -10 feet MLLW bench with angular backfill to create a 2.5H:1V slope, similar to the other subtidal slope backfill/buttress areas to east and west, where removal of wood waste resulted in steepened dredge cut slopes.
- Capping the area above the elevation -10 feet MLLW bench (between elevation -10 and +2 feet MLLW), where wood waste remained in place after removal to the extent practicable. Cap material was higher-fine content[1] angular 3-inch minus backfill material. A minimum 10-foot horizontal thickness of the cap was also included between elevation +2 and -10 feet MLLW. The cap was designed with a 5H:1V slope at the top of bank, transitioning to 3H:1V at +4 feet MLLW.
- The higher-fines content 3-inch minus cap was armored with 18 to 21 inches of Type 2 armor down to elevation -5 feet MLLW.
- Rounded habitat substrate material was placed in the Pier 4 cap and the angular gravel backfill buttress areas on the SMA-2 dredge cut slopes. The habitat substrate layer lift thickness was

[1] As directed by Ecology, the fines content of the angular backfill was increased so that the resulting gradation would have a permeability similar to the sand material that was used elsewhere for caps. Angular backfill material was used for improved constructability and stability on the steep-sloped dredge cut surface.

12 inches down to elevation -10 feet MLLW and 6 inches below elevation -10 feet MLLW to the toe of the slope at the lower extent of 3-inch minus backfill placement.

The SMA-2 former Pier 4 area capping is discussed further in Section 3.3.2.2.

2.4.5 SMA-1 Intertidal Cap Modification

Modifications were made to the SMA-1 intertidal cap at two locations, as described below.

2.4.5.1 South Portion of Type 1 Cap Adjacent to Type 2 Cap

Cap repairs were performed within a portion of the SMA-1 Type 1 armor and filter layers that were damaged during construction (potentially by propeller wash and/or localized groundwater seepage), resulting in undermining of the toe of the 3H:1V constructed cap and exposing portions of the underlying filter material. The damaged cap areas were initially backfilled with larger salvaged armor rock to restore the 3H:1V slope, creating a buttress to provide additional stability. Wave modeling (Appendix C) was also performed to address the potential for wave induced scour associated with changes to the jetty breakwater. The wave modeling evaluation concluded that within the area of cap erosion (approximately 2,500 square yards [sy]), replacement of the original Type 1 armor with Type 2 armor would provide appropriate additional protection for this areas of SMA-1.

Following the initial placement of salvaged rock, 6 to 12 inches of angular 3-inch minus material and 18 to 21 inches of Type 2 armor were placed over the entire slope and extended east to connect to the existing Type 2 armor and down the slope to elevation -8 feet MLLW to account for possible wave scour at the toe of slope (based on guidance from the Coastal Engineering Manual; USACE 2002). SMA-1 capping activities are discussed further in Section 3.3.2.1.

2.4.5.2 North Portion of Type 1 Cap at End of Jetty

A small area of erosion within the Type 1 intertidal cap was identified at the end of the SMA-1 jetty. Within this localized erosion area, the cap had eroded beyond the depth of the required excavation and eight untreated pilings were exposed (below the excavation limits and within the Type 1 cap footprint). Following discussions and collaboration with Ecology to arrive at an appropriate cap modification for this area, it was agreed that the repair would consist of a 12-inch-thick angular backfill gravel layer (3-inch minus material) with higher-fines content, and a 2- to 3-foot-thick Type 2 armor layer over the 3-inch minus material. This repair is discussed further in Section 3.3.2.1.

2.4.6 SMA-1 EMNR Area

EMNR material placement in SMA-1 was not required in the EDR or project Technical Specifications. In June 2016, prior to the start of Season 2 in-water work, eelgrass surveys performed by Grette and Associates confirmed that no eelgrass was present in either of the SMA-1 eelgrass bed areas (the bed within the dredge prism to be harvested or the bed near the jetty to be protected). Because the area near the SMA-1 jetty no longer contained eelgrass, Ecology oversaw and provided direction on EMNR material placement in this area. Anchor QEA and PR/OPG subsequently requested a modification of the Nationwide Permit (NWP) 38 from the U.S. Army Corps of Engineers (USACE). The modification also requested revisions to the eelgrass mitigation performance criteria considering the reduced quantity of eelgrass in SMA-1. The USACE approved this permit modification on October 31, 2016.

2.4.7 SMA-1 Additional Intertidal Excavation and Wood Waste Removal

During the final section of SMA-1 intertidal excavation, a yellow, sawdust-type wood waste material was observed at and below the design elevation in the area of the Log Transfer Dock and the OMCI clean material conveyor. Per previous Ecology-required protocol, Anchor QEA directed OMCI to over-excavate this area and fully remove the wood waste. During the over-excavation activities in this area, all visible wood waste was removed down to clean native sand, and the final excavation depths ranged from 7 to 11 feet below the design elevation. Over-excavation and capping proceeded from the southern edge, where wood waste was first encountered, to the northern extent that tied in to the previously constructed intertidal cap along the jetty. At the northern extent of the over-excavation area, a thin band of wood waste was observed in the sidewall of the excavation and was observed to extend laterally beneath previously constructed cap and into the upland portions of the Site.

PR/OPG, Anchor QEA, and Ecology met on January 13, 2017 to discuss the observed wood waste deposit remaining at depth beneath the SMA-1 intertidal cap. The remaining wood waste did not extend closer than 30 feet horizontally from the waterside edge of the final cap, and at its shallowest point, the wood waste deposit was 5 to 8 feet below the final constructed cap (i.e., 5 to 8 vertical feet or more of clean native sand between the wood waste and the bottom of the intertidal cap). Because this wood waste deposit was visually confirmed to be isolated at depth, as described above, Ecology agreed that further excavation and removal of the previously constructed intertidal cap was not required. SMA-1 excavation activities are discussed further in Section 3.3.2.1.

2.4.8 Shoreline Erosion Area Armoring

Localized movement of relatively small areas of the shoreline armor rock within the existing SMA-2 cap armor was caused by several extreme wind events that occurred in March 2016, between Season 1 and Season 2 construction activities. In addition to the observed armor movement, areas of the unarmored shorelines outside and adjacent to SMA-1 and SMA-2, where structures were removed during Season 1, were eroded during subsequent storm events in mid-October 2016. The shoreline observations, review of storm wind conditions, and evaluation of design solutions to address erosion issues, where necessary, were detailed in a technical memorandum submitted to Ecology on December 12, 2016 (Appendix D). Appendix D provides details of the specific design recommendations for six areas of concern (Areas 1, 2A, 2B, 3, 4, and 5). In general, recommendations to repair or add additional shoreline protection included placement of additional armor rock to backfill erosion in Areas 1 through 4 to prevent future erosion from occurring.

Area 4 is located within the SMA-2 cleanup boundary and was originally capped with Type 2 armor rock; however, some of the rock was displaced in the upper intertidal zone due to wave impact from the storm events. Ecology expressed concerns with re-armoring Area 4 with the same armor size (Type 2 armor); therefore, larger salvaged armor rock was placed in Area 4 using a "zero damage" armor design factor (i.e., assuming no movement of rock) in the armor sizing calculations. Only localized movement of armor rock was observed in Area 5 that is more typical and acceptable coverage of armor rock over the filter material; therefore, no cap repair work was performed in Area 5. Like other caps constructed in Port Gamble Bay, shoreline armor placed in Areas 4 and 5 will be monitored under the long-term *Operations, Maintenance, and Monitoring Plan* (OMMP) to ensure protectiveness (see Appendix F of the EDR; Anchor QEA 2015).

3 Season 2 Construction Activities

PR/OPG contracted with OMCI to perform the cleanup construction activities during Season 1 and Season 2. OMCI initially mobilized equipment to the Site in September 2015 for the Season 1 work. Between Season 1 and Season 2, OMCI demobilized the marine equipment and the majority of the upland equipment but maintained some equipment and personnel on site to provide security, monitor and maintain stormwater BMPs, and plan and prepare for Season 2 work. The required work plans and material submittals were prepared at the onset of Season 1 and covered work activities for both seasons. Site preparation activities performed to support the Season 2 contract work included the following:

- Maintenance of temporary erosion and sediment controls
- Installation of temporary moorage pilings at the clean capping material loading conveyor system in SMA-1 (a spud barge was used to moor barges while loading during Season 1; however, use of a spud barge in Season 2 was not possible because of space limitations for simultaneous dredging, capping, and barge loading during Season 2.)
- Installation of temporary pilings and a trestle platform extension at the shoreline bulkhead transload facility, constructed during Season 1, to provide additional barge draft for transloading material to upland stockpile area
- Setup of the Season 2 upland stockpile area and placement of interior containment berms using Season 1 intertidal sediment to contain Season 2 subtidal sediments (intertidal sediments used for the interior containment berm had been approved by Ecology after chemical testing had taken place)
- Re-installation of marine access floats in SMA-2
- Stockpiling of clean capping materials

The installation of temporary mooring pilings in SMA-1 and the temporary pilings and trestle platform at the transload facility required a modification to the NWP 38. This modification was requested on March 29, 2016 and approved by USACE on August 11, 2016. The remedial action construction work performed during Season 2 is described in Sections 3.1 through 3.8. A timeline of the remedial action construction activities is shown on Table 3. Table 4 summarizes Season 1 and 2 construction activities performed and quantities during each season.

3.1 Structure Demolition and Piling Removal

Creosote- and non-creosote-treated pilings, dolphins, structures, and debris were removed from both intertidal and subtidal areas of SMA-1, SMA-2, and SMA-5. Work areas were enclosed within containment and sorbent booms during demolition and piling removal operations. Material barges used eco-block containment walls and plastic liners to contain creosote pilings, timbers, and other debris. Fallen debris was immediately removed from within the containment booms as work progressed.

Water quality monitoring was performed by Anchor QEA in accordance with the Water Quality Monitoring Plan, Appendix H of the project Technical Specifications. There were no water quality monitoring exceedances associated with structure demolition or piling removal activities during Season 2. The results of the water quality monitoring during Season 2 demolition and piling removal are included in the March 8, 2017, *Water Quality Monitoring, Season 2 Monitoring Results Memorandum* (Appendix E).

Demolition and piling and debris removal of the following structures and areas were included as part of the Season 2 work:

- Pilings in SMA-1, SMA-2, and SMA-5
- Piling in the Eastern Wharf Area
- Former Log Transfer Facility (FLTF) Demolition and Vessel Removal
- Debris removal from former Landfill Area 4 (4a/4b) and Beach Area 1
- The Eastern Wharf Concrete and Asphalt Removal
- SMA-1 Jetty Concrete and Piling Removal
- Pier 4 Demolition and Piling Removal
- SMA-1 Log Transfer Dock Demolition and Piling Removal

Figures 3a through 3d present representative photos of the demolition and piling removal activities. The demolition and piling removal work performed during Season 2 is described in Sections 3.1.1 through 3.1.9.

3.1.1 Demolition and Piling Removal Equipment

The following equipment was used to conduct demolition and piling and debris removal during Season 2:

- Water-based Equipment
  - 1901 Barge (190-foot length and 48-foot width)
  - 165-ton American 9299 Crawler Crane
  - Clamshell Bucket 5 cy
  - 152 Material Barge (150-foot length, 42-foot width, and 9.3-foot draft)
  - 1,200-horsepower Cowlitz Tug Boat
  - ITB 196 Sediment Barge (196-foot length, 50-foot width, and 10-foot draft)
  - ICE Vibratory Hammer – Model 14D and ICE Power Unit
  - 1,200-horsepower Redwood City Tug Boat

- Land-based Equipment
  - Hitachi EX300LC Excavator
  - Cat 966K Loader
  - John Deere 225 Excavator
  - John Deere 650 Dozer
  - Mini Excavator
  - PC290 Komatsu Excavator
  - PC360 Komatsu Excavator
  - PC400 Komatsu Excavator
  - Komatsu HM300 Off-road Truck (two)
  - ICE Vibratory Hammer – Model 14D and ICE Power Unit
  - Light plants for low tide nighttime work
  - Marooka (rubber-tracked dump truck)
- Processing Equipment
  - John Deere 650 Dozer
  - Waratah Log Attachment – Model HTH 622 (on the PC270) for cutting pilings to length
  - PC270 Komatsu Excavator
  - PC360 Komatsu Excavator
  - Komatsu HM300 Off-road Truck (two)

3.1.2 Piling Removal

Piling removal activities occurred in SMA-1, SMA-2, SMA-5, the Eastern Wharf, and the FLTF at various intervals over the course of Season 2, as shown on the construction timeline (Table 3). Piling removal was performed using the water- and land-based equipment described in Section 3.1.1. Piling removal in these areas was performed prior to and during excavation, dredging, capping, and other construction activities.

A pile removal pilot demonstration was conducted prior to the initiation of the full-scale cleanup project. This work was performed by a separate contractor and is detailed in the July 15, 2015 memorandum prepared by Anchor QEA and included as Appendix L of the Port Gamble Cleanup Project Technical Specifications. The purpose of the pile removal pilot demonstration was to evaluate aggressive pile removal methods for effectiveness and practicability. The use of vibratory pile extraction methods was identified as the most effective removal method and, as such, was included as a requirement for the full-scale cleanup project. Requirements for cut-off depth and placement of an amended cap were also specified for piles that could not be practicably removed and needed to be cut. Only six piling were encountered that could not be extracted using vibratory extraction methods. These pilings were cut at depth below the mudline, and capped with amended cap material as discussed in Section 4.1.

Some areas within the construction footprints had numerous pilings not visible at the surface that were not anticipated at the start of the project but needed to be removed after they were encountered. In many cases pilings were buried beneath the design dredge or excavation surface elevations, and were encountered during dredging or excavation operations.

Water-based removal of visible pilings included partially extracting pilings with the vibratory hammer from a barge-mounted crane and then pulling the pilings with a choker and staging on barges. Pilings that were not visible at the surface and were encountered during dredging and excavation activities were removed with excavation or dredging equipment.

Divers were utilized to locate and assist with extracting submerged pilings that were identified on the Project Drawings, and other locations as identified by Ecology during construction as potential pile locations. The divers were also able to inspect adjacent areas for any additional pilings that had not been previously identified. Divers would guide the crane operator while placing the vibratory hammer or the choker on the underwater pilings to extract them. The need for diver assistance was more extensive than anticipated, and the additional work resulted in 15 more days of diver-assisted pile removal than were initially anticipated. This was a result of additional pilings being identified by dive crews during removal. In total, 920 pilings were removed using diver assistance (291 during Season 1 and 629 during Season 2).

Land-based removal of visible pilings included partially extracting pilings with the vibratory hammer and then pulling with an excavator. Pilings that were not visible at the surface, and were encountered during excavation activities, were removed in the same manner.

3.1.2.1 SMA-1 Piling Removal

Piling removal activities in SMA-1 occurred from June 2016 through January 2017 (Table 3). Piling removal was performed using both water- and land-based equipment (Section 3.1.1) during excavation, dredging, and demolition activities. In SMA-1, numerous piling that were not visible at the surface needed to be removed after they were encountered during excavation or dredging. Some of the piling removal in SMA-1 was conducted during nighttime shifts to take advantage of the lowest tides during excavation and demolition activities.

3.1.2.2 SMA-2 Piling Removal

Piling removal activities in SMA-2 occurred from October 2016 through January 2017 (Table 3). Piling removal in SMA-2 included pilings that were not visible at the surface and were removed by the DB Rainier and clamshell bucket during dredging activities (Section 3.2). Additional pilings in the sensitive-habitat area were identified at the onset of Season 2. Removal of these pilings required an additional 3 days of diver assistance. Prior to construction, 70 pilings were identified in the sensitive habitat area; however, 108 were removed in Season 1, and following observations by divers during the summer extreme low tides, an additional 40 were subsequently identified and removed in

Season 2. Some of the piling removal in SMA-2 was conducted during nighttime shifts necessary to complete dredging activity before closure of the in-water work window on January 16, 2017.

3.1.2.3 SMA-5 Piling Removal

Piling removal activities in SMA-5 occurred from July through August 2016 (Table 3). The piling removal in SMA-5 was performed with water-based equipment (Section 3.1.1). Pilings were partially extracted with the vibratory hammer from a barge-mounted crane, pulled with a choker, and staged on barges. Diver assistance was used to verify additional target locations identified by Ecology, and locate and assist with the extraction of submerged pilings, as Ecology oversaw and provided direction. Two additional days of diver-assisted pile removal were required to verify and remove piling at the additional target locations identified by Ecology.

3.1.2.4 Eastern Wharf Area Piling Removal

Piling removal activities in the Eastern Wharf Area occurred from June through September 2016 (Table 3) using both water- and land-based equipment (Section 3.1.1). Divers were used to locate and assist with the extraction of submerged pilings. During the diver-assisted piling removal, divers visually identified 465 pilings (most lying horizontally). These pilings had not been previously identified, and 10 days of additional dive time was required to remove them.

3.1.3 FLTF Demolition and Vessel Removal

The FLTF demolition and vessel removal occurred in July 2016 using both water- and land-based equipment. Crane mats and skip boxes were placed in the intertidal area for land-based demolition using excavators. Demolition debris was placed in skip boxes and loaded onto material barges with a barge-mounted crane, for transport to the Site. Decking was cut from support pilings in large sections, lifted with a barge-mounted crane, and placed on barges. Pilings were removed with a barge-mounted crane using the vibratory hammer and choker chain. Debris removal from the beach and intertidal areas occurred in the dry during both daytime and nighttime low tides. The derelict vessel was removed with the barge-mounted crane and a clamshell bucket.

Crews returned to complete additional removal of the sunken vessel at the FLTF during the week of August 22 through 26 using the barge-mounted crane and clamshell bucket. After additional inspection, crews returned again, and final removal of the last remaining pieces of the sunken vessel was completed on December 5, 2016.

Additional excavation of the 1V:1H slope remaining where the FLTF bulkhead was previously removed occurred from October 3 to 7, 2017. The excavation, using land-based equipment, was voluntarily completed by PR/OPG to create a more stable 7H:1V slope considering the future use of this area for public access. Additional demolition material was exposed and removed during the slope excavation, including concrete anchors, a creosote-treated bulkhead structure, creosote-treated timber material, and other debris material such as concrete pieces, steel cables, rebar, and bricks.

3.1.4 Former Landfill 4a and 4b Debris Removal

Debris removal at the Former Landfill 4a and 4b area occurred on various days between July 18 and August 5, 2016 (Table 3) using land- and water-based equipment (Section 3.1.1). Debris such as wood timbers was collected with a mini excavator, and material was placed in skip boxes. Small pieces of debris such as bricks were removed by hand. Demolition debris placed in skip boxes was loaded onto material barges with a barge-mounted crane, for transport to the Mill Site. Debris removal also included removal of pieces of a derelict wooden barge, with the barge-mounted crane.

Cleanup and demolition occurred during low tides, and the removal of skip boxes full of debris with the crane occurred during high tides so that the skip boxes could be reached by the crane. Surficial debris, mostly brick materials recovered from the Former Landfill 4b area, was placed on timber floats and transferred from shore, at high tide, using the skiff and crane. On September 12, 2016, PR/OPG's landscaping crews removed additional small brick and asphalt pieces by hand. Ecology inspected the area on September 13, 2016, and oversaw and provided direction on the removal of some additional anthropogenic debris (mostly small asphalt and concrete pieces); this additional removal was performed by PR/OPG landscaping crews on September 19, 2016. Ecology performed a final inspection of the beach cleanup Area 4 (4a/4b) on September 20, 2016, and on the following day confirmed that debris removal in the Former Landfill 4a/4b area was complete.

3.1.5 Eastern Wharf Concrete and Asphalt Removal

Removal of asphalt and concrete debris from the Eastern Wharf area occurred in August 2016 (Table 3) using land-based equipment (Section 3.1.1). Several pilings were exposed during the asphalt and concrete removal that were subsequently removed (Section 3.1.2.4). Existing armor rock at the top of the slope was left in place. Exposed areas from the asphalt and concrete removal (above the existing armor rock) were covered with a 1-foot-thick layer of Type 3 armor, followed by large salvaged riprap.

3.1.6 SMA-1 Jetty Concrete and Piling Removal

During Season 2 site inspections, several large pieces of concrete debris and additional creosote-treated piles were identified in the jetty, located south of the crest. Ecology provided direction on the removal of these pilings and pieces of concrete. To maintain the function of the jetty and remove the large concrete debris, it was agreed that on-site stockpiled riprap would be re-used to replace the concrete removed from the jetty and maintain the overall average elevation of the existing jetty crest. This work occurred during in August 2016 (Table 3) using land-based equipment (Section 3.1.1). Several untreated piles in the jetty south of the crest and below OHW were also removed.

3.1.7 Pier 4 Demolition

The Pier 4 demolition and piling removal occurred in November 2016 (Table 3) using both water- and land-based equipment (Section 3.1.1). Decking and pier timbers accessible from the upland portions of the Mill Site were removed using land-based excavators. Pilings removed with water-based equipment included extracting pilings with the vibratory hammer from a barge-mounted crane and then pulling the pilings with a choker. Portions of the pier decking were removed by cutting the support pilings with a chain saw and lifting the section of decking onto a material barge with the water-based crane. Skiffs and hand-held nets were used to remove small pieces of floating debris from the water surface.

3.1.8 Beach Area 1 Debris Removal

Beach Area 1 debris removal activities occurred in early January 2017 (Table 3). Most of the debris consisted of bricks, asphalt, and small pieces of concrete. Debris was picked off the beach with the mini-excavator, bobcat, and/or by hand, and placed in a Marooka for transport to the on-site debris stockpiling area. Ecology inspected this beach cleanup area on January 5, 2017 (upper portion of the shoreline up to OHW), and again on January 10, 2017 (lower portion of the shoreline down to elevation -2 feet MLLW). Ecology verified that debris removal in the Beach Cleanup Area 1 was complete during the January 10, 2017 inspection and sent their approval in an email dated January 19, 2017.

3.1.9 SMA-1 Log Transfer Dock Demolition and Piling Removal

Demolition of the Log Transfer Dock also occurred in early January 2017 (Table 3) using land-based equipment (Section 3.1.1). Prior to demolition, the conveyor used for loading clean capping material onto barges was disassembled and removed from the dock. Demolition and debris removal occurred in the dry when tide levels allowed access and at low tides during nighttime shifts. Log Transfer Dock demolition also required removal of large sections of the metal support structure, which were stockpiled on the Mill Site. Piling removal activities were performed concurrently with the demolition using both water- and land-based equipment (Section 3.1.1). Land-based piling removal occurred in the dry at low tides during nighttime shifts. Several pilings that were not visible at the surface needed to be removed after they were encountered during the subsequent intertidal excavation and over-excavation in this area (Section 3.3.2).

3.2 Subtidal Dredging and Residuals Management Cover Placement

Subtidal dredging (sediment removal below elevation 0 feet MLLW) was performed using the water-based dredging equipment described in Section 3.2.1. OMCI used a hydraulically actuated, fully enclosed Young bucket as the primary dredging technology, with provisions to use alternate equipment if they were unable to achieve the required dredge grade with the hydraulically actuated closed bucket.

Extensive debris and subsurface pilings were identified in the SMA-2 northern dredge prism when dredging ended during Season 1. Therefore, dredging with a clamshell bucket was initiated in this area at the start of Season 2. Debris was encountered consistently throughout SMA-2 during Season 2, and the clamshell was needed for all SMA-2 dredging in Season 2. Dredging was generally sequenced from higher elevations to lower elevations, working from west to east across both SMA-1 and SMA-2.

Dredge-material barges were equipped with sideboards and scuppers. Scuppers were covered with filter fabric and hay bales, as required by the EDR and USACE permit, to prevent discharge of unfiltered water. A turbidity curtain was deployed during all dredging activities. To ensure all in-water work could be completed during Season 2, OMCI worked two daily shifts and added weekend shifts during the initial design dredging, and as needed to maintain the overall construction schedule during contingency re-dredging in both SMA-1 and SMA-2.

Initially, there were 61 work shifts planned during dredging (Monday through Friday from October 17, 2016 to January 14, 2017). To complete the additional piling removal, dredging, excavation, and angular backfill placement required to meet the cleanup objectives, OMCI worked an additional 75 evening and weekend shifts from October 17, 2016 to January 14, 2017. Figure 6 presents representative photos of the subtidal dredging, residuals management cover (RMC) placement, and backfill placement. Daily dredge quantities are shown on Table 5.

Water quality monitoring was performed by Anchor QEA in accordance with the Water Quality Monitoring Plan, Appendix H of the project Technical Specifications. There were no water quality monitoring exceedances associated with subtidal dredging activities during Season 2. The results of the water quality monitoring during Season 2 dredging in SMA-1 and SMA-2 are included in the March 8, 2017, *Water Quality Monitoring, Season 2 Monitoring Results Memorandum* (Appendix E).

3.2.1 Subtidal Dredging Equipment

The following equipment was used to conduct the subtidal dredging in SMA-1 and SMA-2 during Season 2:

- Komatsu PC 400 excavator with a 3.5 cy hydraulic Young bucket working off the White Horse spud barge (SMA-1 dredging)
- 145-ton DB Rainier Derrick Barge with a 5-cy clamshell bucket (SMA-2 dredging)
- 125-ton American 9260 Crawler Crane working off the 1201 spud barge (120-foot length and 44-foot width; RMC and 3-inch minus gravel backfill placement)

- 165-ton American 9299 Crawler Crane working off the 1901 spud barge (190-foot length and 48-foot width; RMC and 3-inch minus gravel backfill placement)
- 1,200-horsepower Redwood City Tug Boat
- ITB 196 Material Barge (196-foot length, 50-foot width, and 10-foot draft)
- ITB 1801 Material Barge (196-foot length, 50-foot width, and 10-foot draft)
- ITB 166 Material Barge (159-foot length, 50-foot width, and 11-foot draft)
- ITB 135 Material Barge (135-foot length, 34-foot width, and 9-foot draft)

During Season 2 site preparation, the Season 1 temporary transload bulkhead was retrofitted with a trestle and platform extending further offshore and allowing for increased barge draft and the ability to offload dredge-material barges during all but the lowest tide elevations. This improvement to the transload facility allowed for increased production during Season 2. The increased capacity for offloading barges was necessary to support simultaneous SMA-1 and SMA-2 dredging operations that were working double shifts.

3.2.2 SMA-1 Subtidal Dredging

Subtidal dredging in SMA-1 began in mid-October 2016 using the Komatsu PC 400 excavator and 3.5 cy hydraulic Young bucket, and worked from the White Horse spud barge. The SMA-1 dredge plan is shown on Figure 4a. Work started in certification unit (CU)-1 at the southwest corner of SMA-1, and progressed from higher elevations to lower elevations, working from west to east across the SMA. In some locations, wood waste was observed at the design elevation by both the Komatsu PC 400 dredge operator and the Anchor QEA site representative. To minimize the amount of time required to complete contingency re-dredging, Anchor QEA directed OMCI to remove additional material in the areas where a visibly clean contact was not observed at the design elevations. The initial pass of dredging in SMA-1 was completed in early November 2016.

3.2.3 SMA-1 Contingency Re-dredging

Following initial dredging and bathymetric surveys verifying that the design dredging elevations had been achieved, Anchor QEA and their subcontractor Marine Sampling Systems, Inc. (MSS) performed post-dredging confirmation sampling within each CU to determine whether additional dredging was required. The details of the confirmatory sampling are discussed in Section 4.2.

Contingency re-dredging was conducted in late November 2016 using the Komatsu PC 400 Excavator. Of the eight SMA-1 CUs, three (CU-1, -2, and -3) required re-dredging (Table 6).

Table 6 summarizes the initial and contingency dredging timeline. A total of 19,757 cy of sediment was dredged from SMA-1. OMCI worked 39 ten-hour shifts to complete SMA-1 dredging and contingency dredging. The average dredging production rate was approximately 500 cy per shift, with a maximum daily (single-shift) production of 900 cy. This production rate was similar to the average rate from Season 1 using the same equipment, and was consistent with the estimate used during planning for Season 2 work.

3.2.4 SMA-1 Residuals Management Cover Placement

An average 6-inch-thick layer of RMC was placed over dredged CUs within SMA-1 as soon as practicable after final dredging. Placement of RMC was performed in late November and early December 2016. RMC placement began following Anchor QEA's review and approval of post-dredge surveys and confirmatory sample data. The American 9299 Crane and 4 cy clamshell bucket were used to place RMC by slightly opening the bucket and spreading the material over the area to be covered, releasing it above the water surface. A total of 6,454 sy of RMC was placed in SMA-1 during Season 2. With the additional Pier 4 capping activities, resources (material barges) were pulled from the placements of RMC in SMA-1, resulting in down-time for crews and other equipment originally allocated to RMC placement. In spite of this, the production rate was higher than the average rate from Season 1, due in part to the use of a larger crane and clamshell bucket. The RMC placement rate averaged approximately 2,150 sy per day during Season 2. Production rates varied from day to day based on the availability of material barges. The Season 2 average production rate for RMC placement also exceeded the estimate used during planning for Season 2 work. There were no water quality exceedances measured during RMC placement in SMA-1.

3.2.5 SMA-2 Subtidal Dredging

Subtidal dredging in SMA-2 began in mid-October 2016 using the DB Rainier Derrick Barge and a 5-cy clamshell bucket. The SMA-2 dredge plan is shown on Figure 5a. Work started in CU-10 at the southernmost end of the northern SMA-2 dredge prism, and progressed from higher elevations to lower elevations, working from west to east across the SMA. In some locations wood waste was observed at the design elevation by both the DB Rainier operator and the Anchor QEA site representative. To minimize the amount of time required to complete the dredging/contingency re-dredging, Anchor QEA directed OMCI to remove additional material in the areas where wood waste was visually confirmed at the design elevations. The initial pass of dredging in SMA-2 was completed in early November 2016.

3.2.6 SMA-2 Contingency Re-dredging

Following initial dredging and survey verification that required dredging elevations had been met, Anchor QEA and their subcontractor MSS conducted post-dredging confirmation sampling within each CU and determined whether additional dredging was required. The details of the confirmatory sampling are discussed in Section 4.2.

Contingency re-dredging was performed from late November through early December 2016 by the DB Rainier. Of the eight SMA-2 CUs dredged in Season 2, four (CU-12, -14, -15, and -17) required re-dredging. In addition, the former Pier 4 area required dredging below the (revised) design elevation to remove wood waste along subtidal and intertidal slopes (Table 6).

Table 6 summarizes the initial and contingency dredging timeline. A total of 58,219 cy of sediment was dredged from SMA-2. OMCI worked 26 ten-hour shifts to complete the SMA-2 dredging and contingency dredging. The average dredging production rate was approximately 1,020 cy per shift, with a maximum daily (single-shift) production of 2,690 cy. This production rate was higher than the average rate from Season 1, largely due to the use of the higher capacity DB Rainier. The Season 2 average production rate for dredging was below the estimate used during planning for Season 2 work, due in part to the large quantity of buried pilings encountered during SMA-2 dredging.

3.2.7 SMA-2 Former Pier 4 Area Additional Wood Waste Removal

As work progressed in SMA-2, OMCI encountered areas where wood waste deposits extended deeper than the (revised) SMA-2 dredge prism design elevations. A discussion of the design revisions implemented to address this condition during construction is included Section 2.4.3.

To minimize the amount of time required to complete the dredging and contingency re-dredging, Anchor QEA directed OMCI to remove additional material in the areas where wood waste was visually confirmed at or below the design elevations. In CU-15, wood waste was encountered below the design elevation -20 feet MLLW bench. Anchor QEA directed OMCI to dredge this area down to elevation -29 feet MLLW, below visible indications of wood waste. In an area adjacent to and partially within CU-15 and CU-17, off-shore from the former Pier 4 location, wood waste extended into the subtidal slope along the shoreline. At the direction of Ecology, Anchor QEA directed OMCI to remove wood waste in the slope up to the point that any further over-steepening of the dredge cut slope threatened to destabilize the top of the bank and adjacent shoreline. In late November 2016, Anchor QEA directed OMCI to excavate a test pit at the top of the bank in the adjacent upland slope. Wood waste was encountered in the upland test pit starting at approximately elevation +2 feet MLLW and extending below 0 feet MLLW. This test pit confirmed that the wood waste deposit extended into the upland portion of the Mill Site. Unlike other wood waste deposits encountered, this deposit of wood waste could not be fully removed without the risk of destabilizing the adjacent upland and shoreline.

The offshore area of the deposit, below elevation -10 feet MLLW, was removed after multiple rounds of re-dredging conducted in mid-November through early December 2016; however, wood waste remained in the intertidal and shallow subtidal slope between elevations +2 and -10 feet MLLW. Initially, this wood waste was removed using the DB Rainier using water-based subtidal dredging equipment. Ecology subsequently oversaw and provided direction on additional removal of upland wood waste deposits that consisted of: 1) the removal of materials above 0 feet MLLW, which was performed from November 28 to December 1, 2016, using the land-based intertidal excavation equipment described in Section 3.3.1; and 2) the removal of wood waste below 0 feet MLLW, which was performed from December 2 to 19, 2016, using the DB Rainier and other water-based dredging equipment. Following completion of excavation/dredging, Ecology oversaw and provided direction on the immediate construction of a cap on the slope. Figure 5a shows the former Pier 4 removal area. Placement of the intertidal portion of former Pier 4 area cap is discussed in Section 3.3.2.2, and placement of the subtidal portion is discussed in Section 3.4.5.

3.2.8 SMA-2 Residuals Management Cover Placement

An average 6-inch-thick layer of RMC was placed over dredged CUs within SMA-2 as soon as practicable after final dredging. Placement of RMC occurred from mid-November through mid-December 2016. RMC placement within each dredged CU began following Anchor QEA's review and approval of post-dredge surveys and confirmatory sample data. The American 9299 and 9260 Crawler Cranes with 4 cy clamshell buckets were used to place RMC by slightly opening the bucket and spreading the material over the area to be covered, releasing it above the water surface. A total of 3,694 sy of RMC were placed in SMA-2 during Season 2. The RMC placement rate averaged approximately 1,230 sy per day during Season 2. The production rate for RMC placement in SMA-2 during Season 2 exceeded the estimate used for Season 2 planning. There were no water quality exceedances measured during RMC placement in SMA-2.

3.2.9 SMA-2 Slope Area Backfill Placement

Buttressing the 2H:1V dredge cut slopes with angular gravel backfill was a requirement of the final SMA-2 dredge prism design presented in the October 17, 2016 *Revised Final Design Memorandum – SMA-2 Dredge Plan Modifications* (Appendix B), as discussed in Section 2.3.1. Following review of the final dredge cut slopes in the SMA-2 dredge prism, Anchor QEA provided OMCI with the final design surface for areas requiring backfill. The backfill surface final slope design was 2.5H:1V and was required in areas where post-dredging slopes were steeper than 2.5H:1V. An angular gravel backfill material consisting of 3-inch minus gravel was used to build the 2.5H:1V slope.

Placement of the angular backfill material was performed from early December 2016 through early January 2017. The American 9299 Crawler Crane and skip box were used to place the angular backfill. Using the John Deere 544K loader working from the material barge, the skip box was loaded with backfill material and then lowered into the water, just above the slope surface, where material was placed directly onto the slope being constructed.

As portions of the buttress slope were completed, Anchor QEA reviewed the progress survey data to confirm the required final slope had been achieved and approved sections for placement of the rounded habitat substrate layer on the surface of the backfill. Ecology oversaw and provided direction on the placement of rounded habitat substrate in a 12-inch-thick lift from the upper extent of the backfill placement down to elevation -10 feet MLLW, and a 6-inch-thick lift was placed from elevation -10 feet MLLW down to the toe of the slope at the lower offshore extent of the backfill placement.

A total of 8,120 cy of angular backfill were placed in SMA-2 during Season 2. The angular backfill placement rate averaged approximately 400 cy per day during Season 2. The production rate for angular backfill placement in SMA-2 was similar to general material placement estimates used for Season 2 planning; however, the volume of backfill material required (based on final dredge cut slopes) exceeded planning estimates from the dredge plan revision development phase. The SMA-2 backfill placement area is shown on Figure 5a, and cross-sections through the backfill placement area are shown on Figures 5b and 5c.

3.3 Intertidal Excavation and Capping Activities

Intertidal excavation (above elevation 0 feet MLLW) was performed using land-based excavating equipment described in Section 3.3.1. OMCI was required to perform this work in the dry to the extent practicable. Excavation was generally sequenced from higher elevations to lower elevations and working from south to north across the Mill Site. A turbidity curtain was also deployed in the water adjacent to excavation activities.

Water quality monitoring was performed during the first incoming tide following intertidal excavation and capping. Anchor QEA conducted the water quality monitoring in accordance with the Water Quality Monitoring Plan, Appendix H of the project Technical Specifications. There were no water quality monitoring exceedances associated with intertidal excavation and capping activities during Season 2. The results of the water quality monitoring during Season 2 intertidal excavation in SMA-1 and SMA-2 are included in the March 8, 2017, *Water Quality Monitoring, Season 2 Monitoring Results Memorandum* (Appendix E). Figure 7 presents representative photos of the intertidal excavation and capping.

3.3.1 Intertidal Excavation and Capping Equipment

The following equipment was used to conduct the intertidal excavation and capping in SMA-1 and SMA-2 during Season 2:

- John Deere 650 Dozer
- John Deere 550 Dozer
- Komatsu 39 Dozer
- Komatsu PC400 Excavator
- Komatsu PC360 Excavator
- John Deere 470 Excavator
- CT 966K Loader

- Komatsu HM300 Off-road Trucks (two)
- CAT 740B Off-road Truck

3.3.2 Intertidal Excavation and Capping

Intertidal excavation and capping activities in SMA-1 began in late July 2016 following the removal of riprap from the shoreline. All intertidal excavation and capping in SMA-1 was completed during Season 2. Most of the intertidal excavation and capping in SMA-2 had been previously completed during Season 1, except for a small area in the footprint of Pier 4 and within a 25-foot buffer on each side of Pier 4, which was completed in Season 2. As discussed in Section 2.4.3, wood waste was encountered during Season 2 subtidal dredging in the slope area offshore and adjacent to Pier 4. Ecology oversaw and provided direction on additional removal of this wood waste into the upland portions of the Mill Site in this area. The intertidal excavation and capping in this area was completed as part of the former Pier 4 area additional wood waste removal described in Section 3.2.7, and the former Pier 4 area capping described in Sections 3.3.2.2 and 3.4.5.

Intertidal areas above elevation 0 feet MLLW were excavated in the dry using land-based equipment. To accomplish this, work shifts were scheduled during daytime low tides in late July and August 2016 (SMA-1) and (for locations that needed to be sequenced late in the project) nighttime low tides in late November and December 2016 (former Pier 4 area). Intertidal excavation progressed from south to north within SMA-1 and the former Pier 4 area. Concrete removal, piling removal, and demolition of intertidal structures were conducted prior to excavation.

Intertidal capping was completed concurrently with the excavation. At a minimum, the initial 6-inch-thick layer of filter material was placed over the excavated area during the same tide cycle that the excavation occurred, prior to the incoming tide. The complete cap thickness of filter material and armor was constructed within 2 days of excavation, generally within the same day or during the following work shift.

Equipment used for the intertidal excavation work included excavators, off-road dump trucks to haul excavated material to stockpiles and haul capping materials to the areas being capped, and dozers to place the filter and armor cap materials. Equipment conducting excavation or hauling excavated material was kept separate from equipment hauling or placing cap material to prevent potential cross-contamination between excavated sediments and cap materials. Any equipment working on or hauling clean cap material was either kept off of the excavated material surface or decontaminated by pressure washing when transitioning for use with cap materials. Stockpiles of clean cap materials and excavated intertidal material were kept separate from each other to avoid cross-contamination. During excavation, a grade checker was used to confirm that the required excavation depth was achieved, and the excavated areas were surveyed to provide as-built data.

3.3.2.1 SMA-1 Intertidal Excavation and Capping

Most of the Season 2 intertidal excavation and capping in SMA-1 was completed between late July and early September 2016. On August 4, 2016, a relatively large seep was exposed on the SMA-1 shoreline slope. The seep was in an area starting at the transition between the Type 1 and Type 2 intertidal cap in SMA-1, and extended to the west approximately 100 feet. As a protective measure, Anchor QEA directed OMCI to place some of the large salvaged armor rock as backfill into the excavation. The armor rock stabilized the slope and re-established the grade within the excavation. The placement of stabilizing armor rock and the initial lift of filter material was completed prior to the incoming tide and equipment working on excavated intertidal sediment was cleaned prior to use for placing cap material, consistent with Ecology direction.

On December 16, 2016, erosion of the previously constructed SMA-1 intertidal cap was identified in the area of the seep that was observed during intertidal excavation. As discussed in Section 2.4.5.1, Anchor QEA proposed a cap design modification in this area to ensure this area remained protective. The cap modification included backfilling over-steepened sections of the intertidal slope with large salvage rock, substituting the Type 1 armor throughout this area with larger Type 2, and placing angular gravel backfill buttress material on the lower portion of the subtidal slope.

Ecology approved the cap modification in this area, and OMCI began placing the angular backfill in the subtidal portion of the slope on January 2, 2017. The same equipment and placement methods used to place the angular gravel backfill buttress material in SMA-2 were also used in SMA-1 (Section 3.2.9). The placement of angular gravel was completed on January 7. On January 9, 2017, after confirmation that the required backfill surface had been achieved, placement of the Type 2 armor began. The barge-mounted crane was used to place the lower portion of the Type 2 armor down to -8 feet MLLW. The higher elevation portions above 0 feet MLLW were placed with the same land-based equipment and methods used for placing the other areas of intertidal cap. Details of this modification to the SMA-1 intertidal cap are shown on Figures 4a and 4d.

A small, localized area of erosion within the previously installed Type 1 intertidal cap was identified at the end of the SMA-1 jetty. The cap modification and repair of this area was completed during the nighttime low tide on January 13, 2017, as discussed in Section 2.4.5.2. SMA-1 capping activities are discussed further in Section 3.3.2. The location of this repair is shown on Figure 4a.

The final section of SMA-1 intertidal excavation was completed at the end of the in-water work window, after capping activities were complete. This sequence allowed the clean cap material loading conveyor, which was installed on the log transfer dock, to be used for loading barges until capping work was complete. The demolition of the log transfer dock and subsequent intertidal excavation and capping was completed from January 2 to January 13, 2017. As discussed in Section 2.4.7 wood waste was encountered and removed from the intertidal excavation in this area. A thin layer of deeper wood waste was contained beneath the SMA-1 intertidal cap (Figures 4a and 4b).

3.3.2.2 SMA-2 Former Pier 4 Area Capping

Following the additional excavation and dredging at the Former Pier 4 area described in Section 3.2.7, sediment core samples confirmed that wood waste had been removed from the bench at -10 feet MLLW, and from the slope between elevation -10 feet MLLW and elevation -29 feet MLLW. Accordingly, only the zone above the bench at -10 feet MLLW required a cap. OMCI constructed the cap in accordance with the design parameters discussed in Section 2.4.3.

Construction of the Pier 4 cap above elevation 0 feet MLLW was performed from late November 2016 through early January 2017. Angular gravel backfill (3-inch minus material) was placed above +4 feet MLLW (following the intertidal excavation). This was followed by placement of the higher-fines content angular backfill from +4 to 0 feet MLLW (oversight and direction provided by Ecology), Type 2 armor (down to elevation -5 feet MLLW) and habitat substrate using the land-based equipment described in Section 3.3.1 and procedures described in Section 3.3.2. Construction of the lower portion of the Pier 4 cap from elevation 0 feet MLLW to -10 feet MLLW occurred from late December 2016 through early January 2017 using the water-based equipment described in Section 3.4.1 and procedures described in Section 3.4.5.

3.4 Subtidal Cap, Enhanced Monitored Natural Recovery, and Former Pier 4 Area Cap Material Placement

Subtidal capping and EMNR material placement, including capping within the Former Pier 4 area below 0 feet MLLW, were performed using the water-based capping equipment described in Section 3.4.1. In accordance with the project Technical Specifications, OMCI completed placement of the 4-foot-thick subtidal cap in areas of SMA-2 identified on plan sheet C-09 (placement started in Season 1). OMCI also completed placement of the average 6-inch thickness of clean EMNR silt/sand material over subtidal sediment in the remaining area of SMA-2 identified on the drawings (placement started in Season 1).

The subtidal cap in SMA-1 was constructed in Season 2. In accordance with the project Technical Specifications, this cap consisted of a 12- to 15-inch-thick filter layer and a 6- to 9-inch-thick Type 1 armor layer. The EDR and project Technical Specifications did not include areas of EMNR material placement in SMA-1. However, as discussed in Section 2.4.6, Ecology oversaw and provided direction on the placement of EMNR material in the northernmost SMA-1 eelgrass bed area, at the tip of the jetty, as eelgrass was not present in that area at the time of construction. The former Pier 4 area cap consisted of higher-fines content angular gravel (3-inch minus) material and an 18- to 21-inch-thick Type 2 armor layer down to -5 feet MLLW. The Pier 4 cap extended from -10 to +2 feet MLLW with a minimum 10-foot horizontal thickness.

Capping and EMNR material placement was generally sequenced from south to north across the Site; however, a buffer area of approximately 50 feet was maintained between the dredge activity and cap footprint to minimize the potential for dredge residual contamination of placed caps, as discussed in the EDR. A buffer was similarly maintained around existing eelgrass meadows to ensure that these areas remained undisturbed. Cap material barges were loaded using the temporary conveyor system constructed in SMA-1 during Season 1. Figure 8 presents representative photos of the subtidal capping, EMNR material placement, and former Pier 4 area cap material placement.

Water quality monitoring was performed by Anchor QEA in accordance with the Water Quality Monitoring Plan, Appendix H of the project Technical Specifications. A single localized, short-term exceedance of the turbidity standard occurred in SMA-1 during subtidal capping activities on January 12, 2017, shortly before the end of in-water construction. After the turbidity exceedance was confirmed, the contractor and Ecology were notified of the exceedance, and the contractor was instructed to modify their operations to meet turbidity standards. Modifications to the capping operations included slowing down the placement rate and adjusting the silt curtain. No exceedances of the pH criteria were observed.

There were no other water quality monitoring exceedances associated with subtidal capping or EMNR material placement during Season 2. The results of the water quality monitoring during Season 2 subtidal capping, EMNR, and Pier 4 cap material placement in SMA-1 and SMA-2 are included in the March 8, 2017, *Water Quality Monitoring, Season 2 Monitoring Results Memorandum* (Appendix E).

3.4.1 Subtidal Capping, EMNR, and Former Pier 4 Area Cap Placement Equipment

The following equipment was used to conduct the subtidal capping, EMNR material placement, and Former Pier 4 Area Capping in SMA-1 and SMA-2 during Season 2:

- 145-ton DB Rainier Derrick Barge
- 125-ton American 9260 Crawler Crane working off the 1201 spud barge (120-foot length and 44-foot width)
- 165-ton American 9299 Crawler Crane working off the 1901 spud barge (190-foot length and 48-foot width)
- John Deere 544K Loaders (three) stationed on each cap material barge
- ITB 196 Material Barge (196-foot length, 50-foot width, and 10-foot draft)
- ITB 1801 Material Barge (196-foot length, 50-foot width, and 10-foot draft)
- ITB 166 Material Barge (159-foot length, 50-foot width, and 11-foot draft)
- ITB 135 Material Barge (135-foot length, 34-foot width, and 9-foot draft)

3.4.2 SMA-1 Subtidal Cap Placement

Subtidal cap placement in SMA-1 was completed in two phases. The first phase occurred from late September to mid-October 2016. During this initial phase, the subtidal capping was completed in SMA-1, except for the buffer area adjacent to the SMA-1 dredge prism. The second phase of the SMA-1 subtidal cap placement occurred from mid-November to mid-December 2016, and covered the buffer area adjacent to completed portions of the dredge prism.

The American 9299 and 9260 Crawler Cranes with 4 cy clamshell buckets were used to place both the filter and armor layers of the SMA-1 subtidal cap. These materials were placed by slightly opening the bucket and spreading the material over the area to be covered, releasing it above the water surface. A total of approximately 15,500 sy of cap were placed in SMA-1 during Season 2. This area includes a portion of the deeper intertidal SMA-1 cap, below 0 feet MLLW, which was placed with water-based equipment.

The SMA-1 subtidal cap placement rate averaged approximately 570 sy per day during Season 2, similar to and slightly lower than the estimate of 640 sy per day assumed during Season 2 planning. SMA-1 capping progress was also affected when equipment was reallocated to complete the unanticipated former Pier 4 area additional wood waste removal.

3.4.3 SMA-1 EMNR Material Placement

Placement of EMNR material in SMA-1 was conducted on December 20, 2016 using the 9260 Crawler Crane and clamshell bucket. Material was placed by slightly opening the bucket and spreading the material over the area to be covered, releasing it above the water surface. The required placement area was 1,228 sy and was completed in a single day.

3.4.4 SMA-2 Subtidal Cap Placement

Season 2 subtidal cap placement in SMA-2 was completed in multiple phases. The first phase occurred from late September to mid-October 2016, and included capping that did not have to follow completed areas of subtidal dredging. During this initial phase, subtidal capping was completed in most of SMA-2, except for the buffer area adjacent to the SMA-2 dredge prism.

The second phase of the SMA-2 subtidal cap placement was completed in early November 2016, and covered the buffer area adjacent to completed portions of the dredge prism. On December 6 and December 7, 2016, areas between the original SMA-2 dredge prism limits and the revised SMA-2 dredge prism limits were capped to tie-in the final SMA-2 subtidal cap with the final SMA-2 dredge prism.

Lastly, from December 15 to 19, OMCI placed the contingency cap, as described in the October 17, 2016 *Revised Final Design Memorandum – SMA-2 Dredge Plan Modifications* (Appendix B). The contingency cap was placed in an area where deep wood waste was encountered below elevation -35 feet MLLW at the toe of the cut slope in the southeast portion of the SMA-2 dredge prism. The contingency cap was constructed to be contiguous with the adjacent portion of the completed SMA-2 subtidal cap.

Subtidal cap placement in SMA-2 was conducted using the DB Rainier and Bombay box, a 4.5 cy box with doors that open on the bottom, that was lowered to several feet above the mudline and then opened to place material.

A total of approximately 13,400 sy of cap were placed in SMA-2 during Season 2. The SMA-2 subtidal cap placement rate averaged approximately 500 sy per day during Season 2, similar and slightly higher than the 470 sy per day placement rate assumed during Season 2 planning.

3.4.5 Former Pier 4 Area Subtidal Cap and Backfill

As discussed in Section 3.3.2.2, the former Pier 4 area cap was constructed from elevation +2 down to -10 feet MLLW. This portion of the cap was constructed with the higher-fines content 3-inch minus angular backfill material. The slope below -10 feet MLLW was backfilled with the 3-inch minus angular gravel to flatten the slope face, as described previously. Construction of the lower portion of the Pier 4 Cap from elevation 0 to -10 feet MLLW started on December 22 and continued from December 28, 2016, to January 13, 2017, using the water-based equipment described in Section 3.4.1.

The American 9299 Crawler Crane and skip box were used to place 3-inch minus backfill, similar to the backfill placement in other areas of the SMA-2 dredge prism. The skip box was loaded with backfill material using a John Deere 544K loader working off the material barge, and lowered into the water, just above the slope surface, where material was placed directly onto the slope.

Following Anchor QEA's review of progress survey data and confirmation that the required final slope had been achieved, OMCI placed the rounded habitat substrate layer. A total of 540 cy of higher-fines content angular backfill were placed from water-based equipment in the Pier 4 cap area. The angular backfill placement rate was similar to the placement rate for angular backfill in the other areas of SMA-2, as discussed in Section 3.2.9. The former Pier 4 area cap and backfill placement area is shown on Figure 5a, and cross-sections through the backfill placement area are shown on Figure 5b.

3.4.6 SMA-2 EMNR Material Placement

Season 2 EMNR material placement in SMA-2 was completed in multiple phases. The first phase occurred in late September 2016. During this initial phase, EMNR material placement was completed in most of the SMA-2 EMNR areas that remained from Season 1, except for the buffer area adjacent to the SMA-2 dredge prism. The second phase of the SMA-2 EMNR placement was completed in late November 2016, and covered the buffer area adjacent to completed portions of the dredge prism.

On December 12, 2016, the remaining area between the original SMA-2 dredge prism limits and the revised SMA-2 dredge prism limits received EMNR material to tie-in the final SMA-2 EMNR area with the final SMA-2 dredge prism. The EMNR material placement in SMA-2 was performed with the 9260 and 9299 Crawler Cranes and clamshell buckets. Material was placed by slightly opening the bucket and spreading the material over the area to be covered, releasing it above the water surface.

A total of approximately 11,600 sy of EMNR material was placed in SMA-2 during Season 2. The SMA-2 EMNR material placement rate averaged approximately 1,940 sy per day during Season 2, similar to the 2,300 sy per day placement rate assumed during Season 2 planning.

3.5 Material Transload and Stockpiling

The following equipment was used for material transloading and stockpiling during Season 2:

- Komatsu HM300 Off-road Trucks (two)
- CAT 740B Off-road Truck
- Liebherr LH50 Material Handler (off-loading barges at transload)
- JD 554K Loader

Dredged material, piling, and demolition debris were offloaded at the temporary transload area constructed during Season 1 and improved prior to Season 2, as described in Section 3.2.1. Dredge material was directly loaded into off-road dump trucks using the material handler and transferred to the temporary stockpile area. Off-road dump trucks were equipped with sealed tailgates to prevent spillage. A steel spill apron was constructed to span the gap between the material barge and the trestle where off-road dump trucks were loaded. Filter fabric was also placed on and around the spill apron, within the swing radius of the material handler. Any material that spilled from the material handler or long-reach excavator was contained on the apron/filter fabric to facilitate cleanup.

Regular maintenance and housekeeping were performed at the transload area each time a barge was off-loaded. Any accumulated material was removed and placed in the upland stockpile area. Pier 4 was used as an alternate transload location for extracted piling. Piling and other demolition debris were transferred to the creosote processing area using either off-road trucks or excavators. Figure 9a presents representative photos of the transload and stockpiling and Figure 9b shows the locations of the temporary upland stockpiles.

3.6 Material Reuse

The large salvage rock removed from the SMA-1 and SMA-2 shoreline was reused as armor material for work performed to address shoreline erosion in accordance with the Port Gamble Bay Cleanup

Project *Coastal Engineering Evaluation of Shoreline Erosion memorandum* (Anchor QEA 2016e). The salvaged armor rock was supplemented with imported Type 2 armor to complete the shoreline armoring.

3.7 Construction Monitoring

On behalf of PR/OPG, Anchor QEA provided daily construction oversight and environmental monitoring during the construction activities. The following tasks were performed as part of this work:

- On-site construction management and engineering support
- Dredge sediment verification sampling
- Water quality monitoring
- Archeological monitoring
- Shellfish monitoring
- Marine Mammal monitoring

Daily construction oversight was performed by Anchor QEA to observe construction activities and to implement the requirements of the Construction Quality Assurance Plan (CQAP). Construction activities were tracked to assess progress, and the various BMPs required throughout construction were monitored and inspected. Daily inspection reports, including night work inspections, were prepared to document construction progress, identifying any deficiencies and/or corrective actions as needed. Contractor submittals were reviewed, and weekly construction progress meetings were held at the Mill Site.

Anchor QEA's construction oversight also included identification of any field conditions that warranted discussion of potential deviations from the Ecology-approved design documents, and coordinating with the design team and Ecology to obtain agreement of any necessary changes to meet the overall objectives of the project. Anchor QEA worked with OMCI to resolve construction issues and address questions and requests for information. Anchor QEA also coordinated with regulatory agencies as needed during construction.

Weekly agency progress meetings were held at the town site to discuss safety, environmental concerns, work progress and schedule, vessel traffic coordination, and other project concerns, as needed. Weekly summary progress reports (Appendix F) were prepared and submitted to Ecology. Ecology also provided oversight of the remedial activities, with regular site visits to observe the construction activities.

Anchor QEA conducted sediment verification sampling in accordance with the requirements of the CQAP; the results of the sediment verification are discussed in Section 4.2.1.

Water quality monitoring was performed in accordance with the Water Quality Monitoring Plan, Appendix E of the EDR. The results of the water quality monitoring during Season 2 are included in the March 8, 2017 *Water Quality Monitoring, Season 2 Monitoring Results Memorandum* (Appendix E).

Archeological monitoring was performed in accordance with the Archaeological Monitoring Plan and Inadvertent Discovery Plan (Appendix L of the EDR; Anchor QEA 2015). The results of the archeological monitoring during Season 2 are included in the *Archaeological Monitoring Report* for Season 2 (Appendix G).

Shellfish monitoring was performed in accordance with the Shellfish Monitoring Plan (Appendix N of the EDR). The results of the shellfish monitoring during Season 2 are included in the *Shellfish Monitoring Report* for Season 2 (Appendix A).

3.8 Season 2 Demobilization

The Temporary Transload Facility was removed in mid- to late December 2016 (Table 3) using both water- and land-based equipment (Section 3.1.1). All components were removed, including the offload platform, temporary steel pilings installed during Season 2, backfill material behind the container bulkhead, and the Conex boxes. The temporary pilings were removed with the vibratory hammer from a barge-mounted crane. Following removal of the facility, the area was armored with a layer of 3-inch minus angular backfill and salvaged riprap with habitat material overlain on top.

On January 16, 2017, following the closure of the in-water work window, OMCI began demobilizing equipment from the Site. Upland equipment was decontaminated by pressure washing. Material barges were decontaminated using a loader to remove the majority of residual material, followed by sweeping with a Bobcat skid steer and street sweeper attachment. Water-based equipment (e.g., barges, cranes, tug boat, etc.) and upland equipment were demobilized from the Site, with the exception of the Hitachi EX300LC excavator and Cat 966K loader. The equipment remaining on site was retained for the remaining upland demobilization activities (e.g., stockpile maintenance, Site cleanup, remaining off-site disposal of debris, removal of the creosote processing area, and maintenance of temporary erosion and sediment controls). The truck scale and portions of the wheel-wash were left in place for potential use for off-site transportation of stockpiled dredge and intertidal excavation materials.

4 Performance Standards and Construction Quality Control

This section describes performance objectives established in the CQAP for the various remedial action tasks and how these objectives were achieved during construction. A complete set of As-built Drawings is included in Appendix H.

4.1 Demolition and Piling Removal Quality Control

The demolition and piling removal performance objectives defined in the CQAP include the following:

- Remove creosote-treated pilings and structures from the Site to the maximum extent practicable
- Minimize potential residual contamination from creosote-treated piling removal
- Ensure that upland post-extraction processing of creosote-treated timber and pilings minimizes spread of sawdust or creosote residues
- Avoid impacts to existing eelgrass beds during demolition work, including no disturbance by spudding, anchoring, dredging, and material placement

OMCI counted and tracked all pilings removed as part of daily site management. To the extent practicable, pilings in intertidal areas were pulled in the dry.

Prior to the start of Season 1, a pilot demonstration established vibratory extraction as the most effective means for removing pilings. As a result, of the 5,278 attempted piling removals in Season 2, six were unsuccessful, a 99.9% success rate. These six pilings in the Pier 4 area were untreated "barkys" that were cut off 4 feet below the final excavation grade and capped with amended sand, in accordance with project Technical Specifications.

Demolition and piling removal occurred before extraction, dredging, and capping. This minimized the spread of residual contamination. Outside of SMA-1 and SMA-2 excavation and capping areas, habitat substrate was placed over the extraction areas soon after their removal.

Water-based equipment was equipped with a differential global positioning system (DGPS) and Hypack software. The DGPS and software were used by the operator to identify and track pilings and structures to be demolished per the construction plans. The DGPS and software also showed the operators the location of eelgrass beds to ensure that construction equipment avoided these sensitive areas; this technology was successful in helping the contractor maintain protective buffers and preventing spudding in eelgrass areas.

Pilings at all target locations identified on the construction plans, as well as additional pilings identified by Ecology, PR/OPG, Anchor QEA, and/or OMCI, were removed per Ecology oversight and direction. On February 18, 2016, Ecology provided additional survey coordinates for pilings in SMA-5 that had not been previously identified. Anchor QEA provided OMCI with these coordinates and OMCI removed the pilings at each location in early August 2016. Water-based piling removal equipment and divers were used to remove an additional 23 pilings from these locations.

Divers assisted with locating and extracting submerged pilings, including multiple co-located pilings and additional unidentified piling stubs. These inspections were conducted throughout SMA-1 and SMA-2. At the Eastern Wharf, an additional 465 submerged pilings were removed. These inspections were performed during high visibility conditions to confirm all known and/or visible submerged pilings had been removed. Numerous unexpected pilings were encountered as part of the Season 2 dredging activities in SMA-1 and SMA-2. The majority of these pilings were buried beneath the pre-dredge mudline elevation. Some pilings were also buried beneath the design dredge surface elevation, encountered during contingency re-dredging. An additional 2,634 buried pilings were encountered and removed during dredging and contingency re-dredging (574 in SMA-1 and 2,060 in SMA-2). Although most of these buried pilings were non-creosote treated, they were handled in the same manner as the creosote pilings.

Creosote-treated pilings and timbers were processed in the contained creosote processing area located on the uplands. An excavator with a Waratah log processing attachment was used to cut pilings into 4-foot, or shorter, lengths. Regular inspections and housekeeping were conducted to address any sawdust or other creosote residues identified outside of the containment. Piles were cut either by holding the piling over the disposal container such that the sawdust would be collected in the container, or in a location of the containment that would prevent sawdust from getting beyond the containment.

As part of the daily construction oversight performed by Anchor QEA, the demolition and piling removal activities were observed for conformance with the project Drawings and Technical Specifications. Piling removal activities were tracked to verify progress; piling removal tracking data are presented on Table 7. The BMPs required during demolition, piling removal, and creosote processing were monitored and inspected. Daily inspection reports were prepared documenting progress, identifying any deficiencies and corrective actions as needed. Proper disposal of demolition materials was tracked and monitored. A tracking summary for Season 2 Certificates of Disposal for creosote and debris at the Columbia Ridge Landfill is included on Table 8.

4.2 Dredging and Excavation Quality Control

The dredging and excavation performance objectives defined in the CQAP include the following:

- Achieve the required dredge elevation or excavation thickness over 95% of the work area
- Control excavation and dredging residuals by placing an average 6-inch-thick RMC over excavation and dredge areas that will not otherwise be capped

- Avoid impacts to existing eelgrass beds during excavation and dredging work, including no disturbance by spudding, anchoring, dredging, and material placement

Methods to achieve these performance objectives for subtidal dredging and intertidal excavation are described below.

4.2.1 Subtidal Dredging Quality Control

OMCI utilized an excavator and dredge derrick equipped with GPS for accurate positioning of equipment during subtidal dredging. The Komatsu PC400 dredging excavator was equipped with a real-time kinematic GPS, and the DB Rainier derrick barge was equipped with a DGPS. Hypack software provided the operator with real-time tracking for horizontal positioning of the barge and bucket relative to the design dredge prism, project stationing, and other site features. Eelgrass areas were identified on the Hypack software, allowing the operators to avoid spudding, anchoring, dredging, and material placement in eelgrass beds and their protective buffers. The vertical position of the dredge bucket was tracked using an on-site Tide Trac electronic tide gauge, a GPS base-station and bucket tilt-sensors (on the Komatsu PC400 dredging excavator), and bucket wire marks (on the DB Rainier) to provide positioning information to the equipment operator. A tide board was also surveyed and installed on Pier 4 to provide redundant visual confirmation of the electronic equipment measurements.

In addition to the positioning methods used to control the dredging work, regular single-beam progress surveys were conducted to monitor dredging progress. Barge displacements were measured and, in conjunction with 1-cubic-foot sample weights from each barge, the volume of dredged material on each barge was calculated.

As part of the daily construction oversight performed by Anchor QEA, the subtidal dredging activities were observed for conformance with the project Drawings and Technical Specifications. The BMPs required during dredging were monitored and inspected. Daily inspection reports were prepared documenting progress, identifying any deficiencies and corrective actions, as needed.

Following dredging to the design grade and survey verification that design dredging elevations had been met for a CU, Anchor QEA and their subcontractor MSS conducted post-dredging confirmation sampling. Sediment core samples were collected to facilitate visual estimates and laboratory testing of TVS.

Sediment cores were collected using vibratory methods at Ecology-approved sample target locations. At each location, cores were advanced to the full length of the core barrel or to refusal so that the target core depth of at least 2 feet below mudline was captured. Following collection, each core was removed from the coring device and prepared for processing in accordance with the Sampling and Analysis Plan (Attachment 1 of Appendix E of the EDR, Anchor QEA 2015). At 11 locations in SMA-1 and 3 locations in SMA-2 the vibratory sampling method could not penetrate and/or retain samples of the post-dredge surface. At these locations, a Van Veen power grab sampler was successfully used for confirmatory sample collection.

Core acquisition information including drive penetration and sample recovery was recorded on field data sheets. Cores were cut into manageable sections and stored vertically on the vessel until delivery to the shore-based core processing area. Cores were processed and sub-sampled at the shore-based processing area. Each core was placed horizontally on the core cutting table, and cores were split on two sides using a circular saw set at a depth that did not cut into the sediment inside the core. Split cores were laid out on the sampling table and opened for visual core characterization, photographed, and sub-samples collected.

Where missed inventory remained in the dredge area (i.e., undisturbed residuals with greater than 15% TVS over a thickness of 6 inches or greater), an additional cleanup pass was performed prior to RMC placement. Additional contingency re-dredging to remove missed inventory was required in three of the eight SMA-1 CUs (CU-1, -2, and -3) and four of the eight SMA-2 CUs (CU-12, -14, -15, and -17) dredged during Season 2. The final confirmatory sampling and TVS analysis results are summarized on Table 9 documenting successful removal; sample locations are shown on Figures 10 and 12.

After the completion of the contingency re-dredging (if needed) and confirmation that post-dredge TVS criteria were met, Anchor QEA provided OMCI with approval to place RMC material as discussed in Sections 3.2.4 and 3.2.8. The quality control measures implemented for the placement of RMC are discussed in Section 4.3.2.

4.2.2 Intertidal Excavation Quality Control

OMCI used a grade-checker during all excavation work to document that the required excavation depth was achieved. Excavated areas were surveyed as they were excavated to the required depth, using a GPS rover that communicated with an upland reference base-station to provide as-built data. At a minimum, the initial 6-inch-thick layer of filter material was placed over excavated areas during the same tide cycle that the excavation occurred, prior to the tide coming in. The complete cap thickness for filter material and armor was constructed within 2 days of excavation, generally within the same day or during the very next work shift.

Intertidal excavation work was conducted in the dry. A silt curtain was deployed in the water adjacent to intertidal excavation as an added measure to protect water quality. The SMA-1 intertidal cap areas completed in Season 2 are shown on Figures 4b through 4d, and SMA-2 intertidal cap cross-sections are shown on Figures 5b through 5d.

As part of the daily construction oversight performed by Anchor QEA, the intertidal excavation activities were observed for conformance with the project Drawings and Technical Specifications. Intertidal excavation progress was tracked, and as-built survey data provided by OMCI were reviewed. The BMPs required during intertidal excavation were monitored and inspected. Daily inspection reports were prepared documenting progress, identifying any deficiencies and corrective actions, as needed.

4.3 Subtidal Cap Construction, EMNR, and RMC Quality Control

The cap construction, EMNR material placement, and RMC material placement performance objectives defined in the CQAP include the following:

- For caps and EMNR areas, ensure that the minimum design thickness has been achieved for at least 95% of the cap surface area
- Control excavation and dredging residuals by placing average 6-inch-thick RMC over excavation and dredge areas that will not otherwise be capped
- Avoid impacts to existing eelgrass beds during cap construction and EMNR material placement work, including no disturbance by spudding, anchoring, and material placement

Methods to achieve these performance objectives for cap construction, EMNR material placement, and RMC material placement are described below.

4.3.1 Subtidal Cap, EMNR, and RMC Material Source Quality Control Testing

Material source quality control testing was completed prior to the start of work in Season 1. A discussion of this quality control testing and the associated quality control data are presented in the Season 1 CAR.

4.3.2 Subtidal Cap, EMNR, and RMC Material Placement Quality Control

For subtidal cap construction, EMNR material placement, and RMC material placement, OMCI utilized cranes equipped with DGPS to confirm the positioning of equipment. Hypack software provided the crane operator with real-time tracking for horizontal positioning of the barge and bucket relative to the cap, EMNR area, or dredge prism RMC area. Eelgrass beds were identified on the Hypack software, allowing the operators to avoid spudding, anchoring, and placement of material in eelgrass beds and their protective buffers.

The vertical position of the capping bucket (either clamshell or Bombay box) was determined using an on-site Tide Trac electronic tide gauge and bucket wire marks. A tide board was also surveyed and installed on Pier 4 to provide redundant visual confirmation of the electronic equipment measurements. For each bucket of material placed, the location of the actual bucket placement was logged in the Hypack software to track progress and minimize overlapping placement or gaps in placement patterns.

Single-beam progress surveys were conducted to monitor capping progress, and measurement of barge drafts were made and used in conjunction with 1-cubic-foot sample weights of capping and EMNR material to calculate and track the volume of cap material placed. Daily subtidal cap and RMC material placement volume and area measurements based on the barge displacements and bucket placement logs for SMA-1 are presented on Tables 10and 11. Placement of EMNR material in SMA-1 was completed in 1 day (December 20, 2016). OMCI placed 226 cy of sand over a 1,228 sy area, resulting in an average volumetric thickness of 6.6 inches over the area.

Daily subtidal cap, EMNR, and RMC material placement volume and area measurements based on the barge displacements and bucket placement logs for SMA-2 are presented on Tables 12, 13, and 14. Daily EMNR material placement volume and area measurements based on the barge displacements and bucket placement logs for SMA-3 are presented on Table 15.

As part of the daily construction oversight performed by Anchor QEA, the subtidal cap construction, EMNR material placement, and RMC material placement activities were observed for conformance with the project Drawings and Technical Specifications. The BMPs required during capping were monitored and inspected. Daily inspection reports were prepared documenting progress, identifying any deficiencies and corrective actions, as needed. Following completion of subtidal cap, EMNR, and RMC areas, progress surveys were reviewed to evaluate compliance with material placement thickness requirements. Additionally, material volume and area measurements were compared to theoretical quantities. A summary of the average placed thickness of material placed is presented on Table 16.

4.3.3 Additional Subtidal Cap and EMNR Placement Confirmation Measures

In some areas, initial comparisons of pre- and post-placement bathymetric surveys provided information that appeared inconsistent with the placed thicknesses summarized above. Subtidal sediments were observed to be extremely soft, and it was anticipated that discrepancies were likely due to subgrade settlement under the weight of the new material, and/or the accuracy of the bathymetric survey methods, additional thickness confirmation measures were implemented as appropriate, consistent with Ecology direction. Such measures included more detailed reviews of the bathymetric surveys, and collection of additional probing data to further confirm that the required cap or EMNR thickness had been met, as discussed below.

As discussed above, the SMA-1 subtidal cap consists of a filter layer and an overlying armor layer. A steel probe was used to measure as-built thickness by advancing the probe through either the filter or armor layer of the cap, and measuring the thickness of the layer from the surface to the probe-determined contact with the underlying material.

Confirmatory probe locations were developed collaboratively with Ecology, and targeted areas of the cap where bathymetric surveys indicated potentially thinner placement. For SMA-1, 33 push probe locations were advanced to confirm the filter layer thickness, and 35 push probe locations were advanced to confirm the armor layer thickness. Figure 11 presents locations within the SMA-1 subtidal cap where filter and armor layer thickness verification measurements were performed by probing. The SMA-1 subtidal cap thickness verification measurements are summarized on Table 17. Based on these measurements, the required cap layer thicknesses were verified in SMA-1.

As in Season 1, a steel probe was also advanced in subtidal SMA-2 cap areas to verify as-built thickness, measuring the thickness of the cap from the surface to the probe-determined contact with underlying sediment. Confirmatory probe locations were developed collaboratively with Ecology, and targeted areas of the cap where bathymetric surveys suggested potentially thinner placement.

For SMA-2, 13 push probe locations were advanced to confirm cap thickness. Figure 13 presents probe locations within the SMA-2 subtidal cap where thickness verification measurements were performed by probing. The SMA-2 subtidal cap thickness verification measurements are summarized on Table 18. Based on these measurements, the required cap thickness was verified in SMA-2.

Similarly, a steel probe was also advanced in EMNR placement areas of SMA-2 and SMA-3 to verify as-built thickness, measuring the thickness from the surface to the probe-determined contact with the underlying sediment. Confirmatory probe locations were developed collaboratively with Ecology, and targeted relatively thinner areas of the EMNR placement, as determined from bathymetric surveys.

For SMA-2, 10 push probe locations were advanced to confirm EMNR material thickness and, for SMA-3, 14 push probe locations were advanced to confirm EMNR material thickness. Figure 14 and 15 present probe locations within SMA-2 and SMA-3, where EMNR thickness verification measurements were performed by probing. The EMNR thickness verification measurements are summarized on Tables 19 and 20. Based on these measurements, the required EMNR material placement thickness in areas of SMA-2 and SMA-3 completed during Season 2 was verified.

4.3.4 Intertidal Cap Construction Quality Control

Intertidal capping was completed concurrently with the excavation, as described in Section 3.3.2. OMCI used grade-stakes during placement of each cap layer to verify that the required cap layer thickness was achieved. Cap layers were surveyed as they were placed to the required thickness. Intertidal capping work was conducted in the dry when possible, and a silt curtain was deployed in the water adjacent to intertidal cap material placement to protect nearby eelgrass beds. In accordance with the design, a buffer area between the intertidal cap and adjacent eelgrass bed was maintained during construction. The SMA-1 intertidal cap areas completed in Season 2 are shown on Figures 4b through 4d, and SMA-2 intertidal cap cross-sections are shown on Figures 5b through 5d.

As part of the daily construction oversight performed by Anchor QEA, the intertidal cap construction activities were observed for conformance with the project Drawings and Technical Specifications. Intertidal cap construction progress was tracked and as-built survey data provided by OMCI were reviewed. Pre- and post-construction aerial photographs of the mill site and shoreline areas are shown on Figure 16. The BMPs required during intertidal capping were monitored and inspected. Daily inspection reports were prepared documenting progress, identifying any deficiencies, and corrective actions, as needed.

5 Operations, Maintenance, and Monitoring

The OMMP (Appendix F of the EDR; Anchor QEA 2015) describes long-term monitoring and adaptive management of engineered caps to ensure their long-term integrity and protectiveness, and document recovery of sediments throughout the Site. Separate requirements for eelgrass monitoring are being performed by PR/OPG under USACE's NWP 38 (NWS-2013-1270), as amended.

6 Cleanup Action Contacts

The cleanup action contact information is listed below:

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7 Engineer's Certification

"To the best of my knowledge, information, and belief, the undersigned, registered professional engineer in good standing in the State of Washington, hereby certify that the remedial action conducted in Port Gamble Bay (the Site) under Consent Decree No. 13-2-02720-0 was performed in accordance with current professional industry standards. The undersigned also hereby certifies that this Report and all attachments and appendices were prepared under my direction and supervision and fulfill the requirements of the Washington Administrative Code (WAC), Section 173-340-400(6)(b). As to the portions of this Report for which cannot be personally verified for their truth and accuracy, the undersigned certify to the best of his or her knowledge and belief that the collection and submission of information is true and accurate and was performed by qualified personnel under his or her direct supervision."

John Laplante, P.E.
Anchor QEA, LLC

8 References

Anchor QEA (Anchor QEA, LLC), 2015. *Engineering Design Report – Port Gamble Bay Cleanup Project*. Prepared for Pope Resources, LP/OPG Properties, LLC. May 2015.

Anchor QEA, 2016a. *Season 1 Cleanup Action Report*. Prepared for Pope Resources, LP/OPG Properties, LLC. December 2016.

Anchor QEA, 2016b. *Revisions to Sediment Management Area 2 Dredge Prism Design Port Gamble Bay Cleanup Project Memorandum*. Prepared for Washington State Department of Ecology. June 2016.

Anchor QEA, 2016c. *Summary of Slope Stability Evaluations, SMA-2 Dredge Plan Revisions Memorandum, Port Gamble Bay Cleanup Project*. Prepared for Washington State Department of Ecology. June 2016.

Anchor QEA, 2016d. *Revised SMA-2 Dredge Plan and Scour Apron Design Refinements Memorandum, Port Gamble Bay Cleanup Project*. Prepared for Washington State Department of Ecology. August 2016.

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Ecology (Washington State Department of Ecology), 2013. *Final Cleanup Action Plan*. Exhibit A to the Port Gamble Bay Consent Decree No. 13-2-02720-0.

USACE (U.S. Army Corps of Engineers), 2002. *Coastal Engineering Manual*. Publication Number EM 1110-2-1100. April 2002.

Tables

Table 1
Sediment Cleanup Levels

Chemical of Concern	Site-specific Cleanup Level
Toxicity due to wood waste breakdown products	SCO biological standards described in WAC 173-204-320(3)
cPAH TEQ	16 μg/kg dry weight
Dioxin/furan TEQ	5 ng/kg dry weight
Cadmium	3 mg/kg dry weight

Notes:
cPAH: carcinogenic polycyclic aromatic hydrocarbons
μg/kg: micrograms per kilogram
mg/kg: milligrams per kilogram
ng/kg: nanograms per kilogram
SCO: sediment cleanup objective
TEQ: toxic equivalents
WAC: Washington Administrative Code

Table 2
Summary of Increased Piling Removal, Dredging, Excavation, Backfill, and Work Shift Quantities

Description	Planned Quantity	Actual Quantity	Increase from Planned Quantity	Report Section Reference
Piling Removal – Season 1 and 2 (each)	5,500	8,592	3,092	3.1.2
Diver Assisted Pile Removal – Season 1 and 2 (days)	16	31	15	3.1.2
Dredging – Season 1 and 2 (cubic yards)	46,800	77,297	30,497	3.2.3 & 3.2.6
Intertidal Excavation – Season 1 and 2 (cubic yards)	23,900	33,240	9,340	3.3.2.1
Angular Backfill Material – Season 2 (tons)	0	19,202	19,202	3.2.9
Work Shifts During Dredge Work Window – Season 2 (each)	61	136	75	3.2

Note:
See Section 2.3 for a summary of changes from the original design

Table 3
Season 2 Construction Timeline

	June	July	August	September	October	November	December	January	February
Equipment Mobilization and Site Preparation									
Mobilize and Demobilize Marine Equipment									
Mobilize and Demobilize Upland Equipment									
Install Temporary Pilings at Transload									
Install Temporary Pilings at SMA-1									
Construct Interior Containment Berms									
Construct Offload Platform at Transload									
Demolition and Piling Removal									
Pull SMA-1 Pilings									
Pull SMA-2 Pilings									
Pull Eastern Wharf Pilings									
Pull SMA-5 Pilings									
Demolish and Pull Pilings SMA-1 Conveyor/Pier									
Process Creosote									
Demolish Log Transfer Dock and Conveyor									
Demolish and Vessel Removal FLTF									
Demolish Former Landfill 4A/4B									
Demolish and Pull Pilings Pier 4									
Demolish Transload Facility									
Beach Area 1 Debris Removal									
SMA-1 Jetty Concrete Removal									
Eastern Wharf Concrete and Asphalt Removal									
Dredging and Excavation									
Initial Dredging in SMA-1									
Initial Dredging in SMA-2									
Contingency Dredging in SMA-1									
Contingency Dredging in SMA-2									
Intertidal Excavation SMA-1									
FLTF - Additional Slope Excavation									
Former Pier 4 Area Additional Dredging and Excavation									
Capping, EMNR, and Backfill Material Placement									
Capping Intertidal SMA-1									
Capping Intertidal SMA-2									
Capping Subtidal SMA-1									
Capping Subtidal SMA-2									
Capping Eastern Wharf									
EMNR Placement SMA-1									
EMNR Placement SMA-2									
EMNR Placement SMA-3									
RMC Placement SMA-1									
RMC Placement SMA-2									
Backfill Placement SMA-1									
Backfill Placement SMA-2									
Former Pier 4 Additional Removal Area Capping									
SMA-1 Intertidal Cap Repair/Revision									
Erosion Area Armoring									
Capping SMA-1 Jetty									

Table 4
Summary of Construction Activities for Seasons 1 and 2

Construction Activity	Season	Location(s)	Description and Quantity Completed	Total Quantity
Demolition	1	SMA-2 SMA-5	Alder Chip Pier; Eastern Wharf; Pier 5; Breakwater; Overhead Chip Conveyor (46,000 sf)	56,500 sf
	2	SMA-1 SMA-2 SMA-5	Log Transfer Dock, Former Log Transfer Facility, Pier 4, and SMA-1 Conveyor Pier (10,500 sf)	
Piling Removal	1	SMA-2 SMA-5	3,314 pilings	8,592 pilings
	2	SMA-1 SMA-2 SMA-5	5,278 pilings	
Intertidal Excavation and Capping	1	SMA-2	1,650 lf of shoreline (16,000 sy)	3,485 lf (26,104 sy capping; 33,240 cy excavation)
	2	SMA-1 SMA-2	1,835 lf of shoreline (10,104 sy)	
Subtidal Dredging	1	SMA-2	19,078 cy	77,297 cy
	2	SMA-1 SMA-2	19,757 cy (SMA-1); 38,462 cy (SMA-2) (58,219 cy Season 2 Total)	
Subtidal Capping	1	SMA-2	2.8 acres	7.9 acres
	2	SMA-1 SMA-2	5.1 acres	
Subtidal Cover (EMNR)	1	SMA-2	6.9 acres (7,058 cy)	79.2 acres (113,342 cy)
	2	SMA-1 SMA-2 SMA-3	72.3 acres (106,284 cy)	
Beach Cleanup	2	Areas 4a, 4b, & 1	1,400 lf	1,400 lf

Notes:
cy: cubic yards
EMNR: enhanced monitored natural recovery
lf: linear feet
sf: square feet
sy: square yards
SMA: Sediment Management Area

Table 5
Summary of Daily Dredge Quantities - Season 2

Date	SMA-1	SMA-2
	CY	
10/17/16	487	706
10/18/16	1,568	1,598
10/19/16	1,477	1,542
10/20/16	1,341	2,522
10/21/16	1,802	2,369
10/22/16	1,436	2,821
10/23/16	1,560	3,481
10/24/16	918	2,797
10/25/16	920	821
10/26/16	1,137	818
10/27/16	831	1,838
10/28/16	352	3,564
10/29/16	0	4,031
10/31/16	343	1,354
11/1/16	1,027	542
11/2/16	535	0
11/3/16	481	1,293
11/4/16	273	1,208
11/5/16	633	1,309
11/7/16	310	0
11/8/16	320	0
11/9/16	115	0
11/10/16	33	0
11/11/16	350	0
11/14/16	265	0
11/15/16	65	1,167
11/16/16	0	2,831
11/17/16	0	4,905
11/18/16	0	2,202
11/19/16	0	3,324
11/21/16	462	0
11/22/16	627	0
11/23/16	0	550
11/28/16	0	151
12/2/16	0	1,843
12/8/16	0	1,153
12/9/16	0	1,858
12/10/16	0	30

Note:
cy: cubic yards (based on barge displacement, final reported quantities corrected using survey data)

Table 6
Summary of Season 2 Initial and Contingency Subtidal Dredging Timelines

SMA-1

Location	Dredge Pass	Equipment	Date Started	Date Completed
CU-1	Initial Dredging	PC400 Excavator	10/17/16	10/25/16
CU-2	Initial Dredging	PC400 Excavator	10/18/16	10/25/16
CU-3	Initial Dredging	PC400 Excavator	10/20/16	11/02/16
CU-4	Initial Dredging	PC400 Excavator	10/19/16	11/02/16
CU-5	Initial Dredging	PC400 Excavator	10/19/16	11/09/16
CU-6	Initial Dredging	PC400 Excavator	10/21/16	11/07/16
CU-7	Initial Dredging	PC400 Excavator	10/20/16	11/04/16
CU-8	Initial Dredging	PC400 Excavator	10/20/16	10/31/16
Deep Intertidal Zone (below 0 feet MLLW)	Initial Dredging	PC400 Excavator	10/17/16	11/11/16
CU-1	Re-dredging	PC400 Excavator	11/14/16	11/16/16
CU-2	Re-dredging	PC400 Excavator	11/14/16	11/16/16
CU-3	Re-dredging	PC400 Excavator	11/17/16	11/29/16
Deep Intertidal (adjacent to CU-1)	Re-dredging	PC400 Excavator	11/17/16	11/29/16

Notes:
CU: certification unit
MLLW: mean lower low water

SMA-2

Location	Dredge Pass	Equipment	Date Started	Date Completed
CU-10	Initial Dredging	DB Rainier	10/17/16	10/25/16
CU-11	Initial Dredging	DB Rainier	10/17/16	10/25/16
CU-12	Initial Dredging	DB Rainier	10/19/16	10/25/16
CU-13	Initial Dredging	DB Rainier	10/19/16	10/29/16
CU-14	Initial Dredging	DB Rainier	10/20/16	11/01/16
CU-15	Initial Dredging	DB Rainier	10/21/16	11/06/16
CU-16	Initial Dredging	DB Rainier	10/21/16	11/04/16
CU-17	Initial Dredging	DB Rainier	10/23/16	11/05/16
CU-12	Re-dredging	DB Rainier	11/16/16	11/17/16
CU-14	Re-dredging	DB Rainier	11/15/16	11/16/16
CU-15	Re-dredging	DB Rainier	11/15/16	11/16/16
CU-17	Re-dredging	DB Rainier	11/15/16	11/28/16
CU-17	Re-dredging	DB Rainier	12/08/16	12/10/16
Pier 4 Area	Re-dredging	DB Rainier	11/18/16	11/19/16
Pier 4 Area	Re-dredging	DB Rainier/Upland Equipment	11/28/16	12/10/16

Note:
CU: certification unit

Table 7

Season 2 Pile Removal Tracking

Date	Cut Off Piles	Daily Total
01/13/17	0	0
06/15/16	0	44
06/16/16	0	66
06/17/16	0	72
06/20/16	0	52
06/21/16	0	10
06/22/16	0	40
06/23/16	0	72
06/24/16	0	58
06/27/16	0	30
06/28/16	0	92
06/29/16	0	40
06/30/16	0	60
07/01/16	0	8
07/05/16	0	30
07/06/16	0	36
07/07/16	0	22
07/08/16	0	40
07/11/16	0	16
07/12/16	0	0
07/13/16	0	0
07/14/16	0	12
07/15/16	0	34
07/18/16	0	96
07/19/16	0	124
07/20/16	0	63
07/21/16	0	64
07/22/16	0	15
07/25/16	0	0
07/26/16	0	2
07/27/16	0	9
07/28/16	0	111
07/29/16	0	120
08/01/16	0	80
11/01/16	0	59
11/02/16	0	28
11/03/16	0	150
11/04/16	0	136
11/05/16	0	29
08/02/16	0	47
08/03/16	0	65
08/04/16	0	31
08/05/16	0	104
08/08/16	0	16
08/09/16	0	100
08/10/16	0	62
08/11/16	0	99
08/12/16	0	59
08/15/16	0	16
08/16/16	0	91
08/17/16	0	26
08/18/16	0	35
08/19/16	0	25
08/22/16	0	25
08/23/16	0	1
08/24/16	0	3
08/25/16	0	1
08/26/16	0	0
08/29/16	0	3
08/30/16	0	4
08/31/16	0	8
09/01/16	0	0
09/02/16	0	0
09/05/16	0	0
09/06/16	0	0
09/07/16	0	0
09/08/16	0	3
09/09/16	0	0
09/12/16	0	0
09/13/16	0	0
09/14/16	0	0
09/15/16	0	0
09/16/16	0	0
12/10/16	0	2
12/12/16	0	0
12/13/16	0	0
12/14/16	0	0
12/15/16	0	11
09/19/16	0	0
09/20/16	0	0
09/21/16	0	0
09/22/16	0	0
09/23/16	0	0
09/26/16	0	0
09/27/16	0	0
09/28/16	0	0
09/29/16	0	0
09/30/16	0	0
10/03/16	0	0
10/04/16	0	0
10/05/16	0	0
10/06/16	0	0
10/07/16	0	0
10/10/16	0	0
10/11/16	0	0
10/12/16	0	0
10/13/16	0	0
10/14/16	0	0
10/17/16	0	68
10/18/16	0	153
10/19/16	0	39
10/20/16	0	65
10/21/16	0	73
10/22/16	0	89
10/23/16	0	179
10/24/16	0	68
10/25/16	0	42
10/26/16	0	90
10/27/16	0	77
10/28/16	0	77
10/29/16	0	94
10/31/16	0	148

Table 7

Season 2 Pile Removal Tracking

Date	Cut Off Piles	Daily Total
11/07/16	0	4
11/08/16	0	16
11/09/16	0	104
11/10/16	0	0
11/11/16	0	0
11/12/16	0	0
11/13/16	0	0
11/14/16	0	0
11/15/16	0	64
11/16/16	0	166
11/17/16	0	152
11/18/16	0	90
11/19/16	0	44
11/20/16	0	70
11/21/16	0	54
11/22/16	0	40
11/23/16	0	5
11/28/16	0	0
11/29/16	0	64
11/30/16	0	108
12/01/16	0	16
12/02/16	0	60
12/03/16	0	67
12/04/16	0	0
12/05/16	0	0
12/06/16	0	0
12/07/16	0	1
12/08/16	0	12
12/09/16	0	20
12/16/16	0	0
12/17/16	0	0
12/19/16	0	0
12/20/16	0	0
12/21/16	0	0
12/22/16	0	0
12/23/16	0	0
12/26/16	0	0
12/27/16	0	5
12/28/16	0	0
12/29/16	6	0
12/30/16	0	0
01/02/17	0	0
01/03/17	0	0
01/04/17	0	0
01/05/17	0	0
01/06/17	0	8
01/07/17	0	29
01/08/17	0	0
01/09/17	0	0
01/10/17	0	0
01/11/17	0	17
01/12/17	0	34
Total	**6**	**5,278**

Table 8

Season 2 Columbia Ridge Landfill Certificate of Disposal Tracking

Disposal Date	Waste Type	Container Number	Landfill (tons)	Disposal Certificate
7/12/2016	Creosote	483067	27.17	Yes
7/12/2016	Creosote	483238	27.29	Yes
7/12/2016	Creosote	483332	27.09	Yes
7/13/2016	Creosote	480528	27.3	Yes
7/13/2016	Creosote	483221	26.81	Yes
7/14/2016	Creosote	480563	28.26	Yes
7/14/2016	Creosote	480655	29.84	Yes
7/14/2016	Creosote	483385	28.93	Yes
7/15/2016	Creosote	483063	27.54	Yes
7/15/2016	Creosote	483148	27.47	Yes
7/18/2016	Creosote	480592	27.49	Yes
7/18/2016	Creosote	483184	27.4	Yes
7/18/2016	Creosote	483134	27.95	Yes
7/19/2016	Creosote	480630	27.65	Yes
7/25/2016	Creosote	483001	26.7	Yes
7/25/2016	Creosote	483132	27.64	Yes
7/25/2016	Creosote	483309	27.14	Yes
7/27/2016	Creosote	483307	27.62	Yes
7/27/2016	Creosote	483402	26.61	Yes
7/29/2016	Creosote	483405	27.39	Yes
8/2/2016	Creosote	480565	28.62	Yes
8/2/2016	Creosote	483088	26.81	Yes
8/9/2016	Creosote	480432	27.95	Yes
8/9/2016	Creosote	483058	27.61	Yes
8/9/2016	Creosote	483077	27.21	Yes
8/12/2016	Creosote	483132	27.65	Yes
8/12/2016	Creosote	490016	27.69	Yes
8/17/2016	Creosote	480630	27.63	Yes
8/18/2016	Creosote	480411	27.87	Yes
8/18/2016	Creosote	483081	27.13	Yes
8/18/2016	Creosote	483281	27.32	Yes
8/22/2016	Creosote	483067	27.37	Yes
8/22/2016	Creosote	483072	27.14	Yes
8/22/2016	Creosote	483173	27.87	Yes
8/23/2016	Creosote	483098	27.53	Yes
8/23/2016	Creosote	483120	27.32	Yes
8/23/2016	Creosote	483204	27.33	Yes
8/24/2016	Creosote	483221	27.22	Yes
8/29/2016	Creosote	483113	27.44	Yes
8/29/2016	Creosote	483385	27.6	Yes
8/30/2016	Creosote	480598	29.01	Yes
8/30/2016	Creosote	483095	27.34	Yes
8/30/2016	Creosote	483298	27.87	Yes
8/31/2016	Creosote	480426	28.47	Yes
8/31/2016	Creosote	483243	28.20	Yes
8/31/2016	Creosote	483495	28.19	Yes
9/2/2016	Creosote	483033	27.53	Yes
9/2/2016	Creosote	483038	27.52	Yes
9/2/2016	Creosote	483242	27.73	Yes
9/2/2016	Creosote	483281	27.61	Yes
9/6/2016	Creosote	480560	27.79	Yes
9/9/2016	Creosote	480569	28.19	Yes
9/9/2016	Creosote	483122	27.65	Yes
9/9/2016	Creosote	483237	27.77	Yes

Table 8

Season 2 Columbia Ridge Landfill Certificate of Disposal Tracking

Disposal Date	Waste Type	Container Number	Landfill (tons)	Disposal Certificate
9/9/2016	Creosote	483352	28.07	Yes
9/10/2016	Creosote	480546	28.41	Yes
9/10/2016	Creosote	483466	28.22	Yes
9/13/2016	Creosote	483058	27.58	Yes
9/13/2016	Creosote	483527	27.48	Yes
9/26/2016	Creosote	483095	27.03	Yes
9/26/2016	Creosote	483298	27.71	Yes
9/28/2016	Creosote	480592	27.91	Yes
11/1/2016	Creosote	483029	27.07	Yes
11/1/2016	Creosote	483230	26.74	Yes
11/1/2016	Creosote	483356	26.43	Yes
11/1/2016	Creosote	490014	26.39	Yes
11/4/2016	Creosote	480500	28.54	Yes
11/9/2016	Creosote	483308	28.40	Yes
11/9/2016	Creosote	483355	24.19	Yes
11/9/2016	Creosote	483456	19.38	Yes
11/10/2016	Creosote	480624	28.68	Yes
11/10/2016	Creosote	490006	27.88	Yes
11/10/2016	Creosote	480432	27.07	Yes
11/11/2016	Creosote	483127	28.16	Yes
11/11/2016	Creosote	483142	28.71	Yes
11/14/2016	Creosote	483466	27.41	Yes
11/14/2016	Creosote	480518	27.38	Yes
11/14/2016	Creosote	483518	28.99	Yes
11/14/2016	Creosote	483585	28.58	Yes
11/14/2016	Creosote	483428	28.49	Yes
11/15/2016	Construction Debris	480648	28.59	Yes
11/15/2016	Construction Debris	483451	27.85	Yes
11/22/2016	Construction Debris	483190	27.73	Yes
11/22/2016	Construction Debris	483317	28.77	Yes
11/22/2016	Construction Debris	483561	28.86	Yes
11/22/2016	Construction Debris	483642	28.02	Yes
11/30/2016	Construction Debris	490006	28.06	Yes
12/1/2016	Construction Debris	480530	28.84	Yes
12/1/2016	Construction Debris	483506	28.03	Yes
12/8/2016	Construction Debris	480547	29.21	Yes
12/8/2016	Construction Debris	483099	26.04	Yes
12/8/2016	Construction Debris	483466	26.96	Yes
12/11/2016	Creosote	483281	27.8	Yes
12/11/2016	Creosote	483518	28.79	Yes
12/13/2016	Construction Debris	483088	27.74	Yes
12/13/2016	Construction Debris	490011	28.62	Yes
12/20/2016	Construction Debris	480649	29.09	Yes
12/20/2016	Construction Debris	483064	28.47	Yes
12/20/2016	Construction Debris	483368	28.38	Yes
1/10/2017	Creosote	480568	29.2	Yes
1/10/2017	Creosote	483040	28.07	Yes
1/10/2017	Creosote	483391	27.82	Yes
1/11/2017	Creosote	483433	28.9	Yes
1/11/2017	Creosote	483438	29.06	Yes
1/11/2017	Creosote	483463	26.45	Yes
1/11/2017	Creosote	483522	28.67	Yes
1/12/2017	Creosote	483356	28.53	Yes
1/12/2017	Creosote	483468	27.45	Yes

Table 8

Season 2 Columbia Ridge Landfill Certificate of Disposal Tracking

Disposal Date	Waste Type	Container Number	Landfill (tons)	Disposal Certificate
1/12/2017	Creosote	483615	29.21	Yes
1/13/2017	Creosote	483415	30.65	Yes
1/13/2017	Creosote	483660	26.27	Yes
1/16/2017	Creosote	480440	28.89	Yes
1/16/2017	Creosote	480549	27.65	Yes
1/16/2017	Creosote	480658	31.97	Yes
1/16/2017	Creosote	483235	28.4	Yes
1/16/2017	Creosote	483548	27.1	Yes
1/17/2017	Creosote	480646	25.32	Yes
1/17/2017	Creosote	480648	26.37	Yes
1/17/2017	Creosote	483662	28.38	Yes
1/18/2017	Creosote	483367	27.81	Yes
1/25/2017	Creosote	480509	29.01	Yes
1/25/2017	Creosote	480571	28.76	Yes
1/25/2017	Creosote	480654	20.39	Yes
1/25/2017	Creosote	483346	19.24	Yes
1/25/2017	Creosote	483355	19.82	Yes
1/25/2017	Creosote	483522	28.99	Yes
1/25/2017	Creosote	490016	28.1	Yes
1/26/2017	Creosote	480517	20.63	Yes
1/26/2017	Creosote	483391	29.39	Yes
1/26/2017	Creosote	483463	23.1	Yes
		Total Creosote	3,099.56	
		Total Construction Debris	479.26	

Table 9
Final Total Volatile Solids Results for Season 2 Z-layer Samples

Core Location	Post-dredge Depth (feet below mudline)	Wood Waste Visual Estimate (% volume)[1]	Wet Sieve (% wood waste)[1]	TVS (% dw)
SMA-1 Intertidal				
PG-EG-17	0-0.3	0%	--	0.6
PG-EG-18	0-0.6	0%	--	1.1
PG-EG-19	0-0.7	<10%	--	0.9
PG-EG-20	0-0.7	0%	--	0.7
PG-EG-21	0-0.4	--	29%	7.7
PG-EG-22	0-0.6	<10%	15%	9.6
PG-EG-23	0-0.7	<10%	1%	1.1
PG-EG-24	0-0.5	<10%	--	0.5
PG-EG-25	0-0.7	0%	--	0.6
PG-EG-26	0-0.7	<10%	--	3.9
PG-EG-27	0-0.3	0%	--	2.0
SMA-1 Subtidal				
PG-SC-52	0-0.3	0%	0%	0.7
PG-SC-53	0.2-0.7	0%	0%	0.1
PG-SC-54	0-0.5	0%	0%	1.1
PG-SC-55	0-0.5	>50%	8%	5.5
PG-SC-56	0-0.5	0%	0%	0.2
PG-SC-57	0-0.5	0%	0%	0.5
PG-SC-58	0-0.5	<30%	10%	4.8
PG-SC-59	0-0.5	0%	0%	0.9
PG-SC-60	0-0.5	0%	0%	0.3
PG-SC-61	0-0.5	0%	1%	0.3
PG-SC-62	0-0.5	<30%	8%	6.9
PG-SC-63	0-0.5	>50%	15%	4.7
PG-SC-64	0-0.5	<50%	15%	8.0
PG-SC-65	0-0.5	>50%	34%	0.5
PG-SC-66	0-0.5	<30%	7%	2.8
PG-SC-67	0-0.5	0%	0%	0.3
PG-SC-68	0-0.5	<30%	23%	6.8
PG-SC-69	0.5-1	0%	0%	1.4
PG-SC-70	0-0.5	>50%	27%	9.3
PG-SC-71	0-0.5	<30%	4%	1.3
PG-SC-72	0-0.5	<50%	39%	13.6
PG-SC-73	0.5-1.0	<30%	12%	4.9
PG-SC-74	0-0.5	>50%	33%	10.9
PG-SC-75	0.5-1	<30%	7%	7.8
PG-SC-76	0-0.7	<15%	--	0.4
PG-SC-77	0-0.7	--	32%	7.4
PG-SC-78	0-0.3	--	28%	13.1

Table 9
Final Total Volatile Solids Results for Season 2 Z-layer Samples

Core Location	Post-dredge Depth (feet below mudline)	Wood Waste Visual Estimate (% volume)[1]	Wet Sieve (% wood waste)[1]	TVS (% dw)
SMA-2 Intertidal				
PG-EC-11	0-0.5	0%	0%	1.1
PG-EC-12	0-0.5	<30%	27%	12.5
PG-EC-13	0-0.5	0%	12%	0.5
PG-EC-30	0-0.5	0%	0%	1.0
PG-EC-31	0-0.5	0%	0%	0.9
PG-EC-32	0-0.5	0%	0%	1.6
SMA-2 Subtidal				
PG-EC-14	0-0.5	<50%	17%	14.2
PG-EC-15 (PG-EC-28)	0-0.5	<30%	56%	12.5
PG-EC-16	0-0.5	<50%	39%	11.5
PG-EC-29	0-0.5	0%	4%	6.8
PG-SC-36	0-0.5	0%	2%	0.6
PG-SC-37	0-0.5	30 to 50%	31.0%	13.9
PG-SC-38	0-0.5	<30%	6.0%	2.4
PG-SC-39	0-0.5	0%	3.0%	3.4
PG-SC-40	0-0.5	0%	0.0%	0.1
PG-SC-42*	0-0.5	>50%	45.0%	38.3
PG-SC-43*	0-0.5	>50%	33.0%	24.1
PG-SC-44	0-0.5	0%	0.0%	0.4
PG-SC-45	0-0.5	0%	0.0%	0.2
PG-SC-46	0-0.5	<30%	--	1.2
PG-SC-47	0.5-1.0	0%	2.0%	0.1
PG-SC-48	0-0.5	<30%	18.0%	7.4
PG-SC-49	0-0.5	20%	--	10.3
PG-SC-50	0-0.5	<30%	5.0%	0.9
PG-SC-51	0-0.5	0%	0.0%	0.5

Notes:
1. Field estimate may be high due to presence of shell fragments
* Area covered with 4-foot-thick contingency sand cap
dw: dry weight
SMA: sediment management area
TVS: total volatile solids

Table 10
SMA-1 Subtidal Cap Quantities - Season 2

Date	Material Type	Bucket Mark Area (sy)	Barge Volume (cy)	Volumetric Thickness (in)	Minimum Design Thickness (in)	Met Minimum Design Thickness
09/29/16	Filter	1,703	821.0	17.4	12.0	Yes
09/30/16	Filter	1,532	762	17.9	12.0	Yes
10/03/16	Filter	1,818	884	17.5	12.0	Yes
10/04/16	Filter	708	397	20.2	12.0	Yes
10/07/16	Armor	3,109	620	7.2	6.0	Yes
10/10/16	Armor	2,716	679	9.0	6.0	Yes
10/13/16	Filter	294	129	15.8	12.0	Yes
11/14/16	Filter	1,171	675	20.8	12.0	Yes
11/15/16	Filter	275	173	22.6	12.0	Yes
11/18/16	Filter	1,143	469	14.8	12.0	Yes
11/22/16	Filter	1,216	731	21.6	12.0	Yes
11/23/16	Filter	889	499	20.2	12.0	Yes
11/28/16	Filter	435	343	28.4	12.0	Yes
11/29/16	Filter	1,280	657	18.5	12.0	Yes
12/03/16	Armor	1,266	405	11.5	6.0	Yes
12/05/16	Armor	1,600	509	11.4	6.0	Yes
12/06/16	Armor	446	104	8.4	6.0	Yes
12/07/16	Armor	848	229	9.7	6.0	Yes
12/12/16	Armor	1,207	246	7.3	6.0	Yes
12/06/16	Filter	1,044	418	14.4	12.0	Yes
12/07/16	Filter	445	216	17.5	12.0	Yes
12/07/16	Armor	848	229	9.7	6.0	Yes
12/08/16	Filter	615	278	16.3	12.0	Yes
12/09/16	Filter	886	364	14.8	12.0	Yes
12/12/16	Armor	1,207	246	7.3	6.0	Yes
12/15/16	Armor/3-in minus	795	153	6.9	6.0	Yes
12/16/16	Armor/3-in minus	343	115	12.1	6.0	Yes
12/19/16	Armor/3-in minus	1,200	360	10.8	6.0	Yes

Notes:

cy: cubic yards

in: inches

sy: square yards

Table 11
SMA-1 Post-dredging RMC Quantities - Season 2

Date	Bucket Mark Area (sy)	Barge Volume (cy)	Volumetric Thickness (in)	Minimum Design Thickness (in)	Met Minimum Design Thickness
11/30/16	1,569	322	7.4	4.0	Yes
12/01/16	3,324	865	9.4	4.0	Yes
12/02/16	1,561	304	7.0	4.0	Yes

Notes:

cy: cubic yards

in: inches

sy: square yards

Table 12
SMA-2 Subtidal Cap Quantities - Season 2

Date	Bucket Mark Area (sy)	Barge Volume (cy)	Volumetric Thickness (ft)	Minimum Design Thickness (ft)	Met Minimum Design Thickness
09/26/16	106	169	4.8	4.0	Yes
09/27/16	564	1076	5.7	4.0	Yes
09/28/16	527	797	4.5	4.0	Yes
09/29/16	558	1450	7.8	4.0	Yes
09/30/16	530	1268	7.2	4.0	Yes
10/03/16	314	687	6.6	4.0	Yes
10/04/16	615	1488	7.3	4.0	Yes
10/05/16	714	1598	6.7	4.0	Yes
10/06/16	712	1678	7.1	4.0	Yes
10/07/16	544	1209	6.7	4.0	Yes
10/10/16	691	1464	6.4	4.0	Yes
10/11/16	768	1705	6.7	4.0	Yes
10/12/16	600	1422	7.1	4.0	Yes
10/13/16	587	1447	7.4	4.0	Yes
10/14/16	291	536	5.5	4.0	Yes
11/07/16	202	507	7.5	4.0	Yes
11/08/16	549	1137	6.2	4.0	Yes
11/09/16	324	661	6.1	4.0	Yes
11/10/16	568	1241	6.6	4.0	Yes
11/11/16	540	1074	6.0	4.0	Yes
11/12/16	762	1559	6.1	4.0	Yes
11/14/16	791	1556	5.9	4.0	Yes
11/15/16	231	546	7.1	4.0	Yes
12/06/16	267	675	7.6	4.0	Yes
12/07/16	363	990	8.2	4.0	Yes
12/15/16	124	260	6.3	4.0	Yes
12/19/16	600	951	4.8	4.0	Yes

Notes:

cy: cubic yards

ft: feet

sy: square yards

Table 13
SMA-2 Thin Layer EMNR Quantities - Season 2

Date	Bucket Mark Area (sy)	Barge Volume (cy)	Volumetric Thickness (in)	Minimum Design Thickness (in)	Met Minimum Design Thickness
09/27/16	5,288	621	4.2	4.0	Yes
09/28/16	1,604	292	6.6	4.0	Yes
11/16/16	1,294	384	10.7	4.0	Yes
11/29/16	1,043	299	10.3	4.0	Yes
11/30/16	906	214	8.5	4.0	Yes
12/14/16	1,506	310	7.4	4.0	Yes

Notes:
cy: cubic yards
in: inches
sy: square yards

Table 14
SMA-2 Post-dredging RMC Quantities - Season 2

Date	Bucket Mark Area (sy)	Barge Volume (cy)	Volumetric Thickness (in)	Minimum Design Thickness (in)	Met Minimum Design Thickness
11/16/16	1,440	427	10.7	6.0	Yes
11/29/16	747	214	10.3	6.0	Yes
12/14/16	1,506	310	7.4	6.0	Yes

Notes:
cy: cubic yards
in: inches
sy: square yards

Table 15
SMA-3 Thin Layer EMNR Quantities - Season 2

Date	Bucket Mark Area (sy)	Barge Volume (cy)	Volumetric Thickness (in)	Minimum Design Thickness (in)	Met Minimum Design Thickness
07/18/16	1,524	218	5.1	4.0	Yes
07/19/16	3,478	488	5.1	4.0	Yes
07/20/16	3,637	446	4.4	4.0	Yes
07/21/16	5,111	629	4.4	4.0	Yes
07/22/16	1,932	217	4.0	4.0	Yes
07/25/16	4,454	496	4.0	4.0	Yes
07/26/16	4,545	504	4.0	4.0	Yes
07/27/16	2,630	311	4.3	4.0	Yes
07/28/16	4,200	464	4.0	4.0	Yes
07/29/16	4,728	529	4.0	4.0	Yes
01/08/16	5,119	651	4.6	4.0	Yes
02/08/16	3,321	422	4.6	4.0	Yes
03/08/16	4,628	575	4.5	4.0	Yes
04/08/16	5,919	756	4.6	4.0	Yes
05/08/16	5,674	633	4.0	4.0	Yes
08/08/16	2,940	501	6.1	4.0	Yes
08/09/16	5,456	854	5.6	4.0	Yes
08/10/16	4,970	766	5.5	4.0	Yes
08/11/16	4,107	600	5.3	4.0	Yes
08/12/16	4,870	771	5.7	4.0	Yes
08/15/16	4,617	663	5.2	4.0	Yes
08/16/16	4,482	728	5.8	4.0	Yes
08/17/16	5,715	871	5.5	4.0	Yes
08/18/16	5,483	840	5.5	4.0	Yes
08/19/16	4,952	756	5.5	4.0	Yes
08/22/16	2,971	501	6.1	4.0	Yes
08/23/16	4,883	802	5.9	4.0	Yes
08/24/16	4,278	682	5.7	4.0	Yes
08/25/16	4,284	685	5.8	4.0	Yes
08/26/16	1,542	286	6.7	4.0	Yes
08/29/16	10,288	1,805	6.3	4.0	Yes
08/30/16	9,944	1,887	6.8	4.0	Yes
08/31/16	7,178	1,305	6.5	4.0	Yes
09/01/16	10,061	1,788	6.4	4.0	Yes
09/02/16	3,791	683	6.5	4.0	Yes
09/06/16	8,308	1,621	7.0	4.0	Yes
09/07/16	5,476	1,073	7.1	4.0	Yes
09/08/16	9,850	1,758	6.4	4.0	Yes
09/09/16	10,670	1,807	6.1	4.0	Yes
09/12/16	8,939	1,424	5.7	4.0	Yes
09/13/16	9,714	1,877	7.0	4.0	Yes
09/14/16	10,137	1,758	6.2	4.0	Yes
09/15/16	10,130	1,645	5.8	4.0	Yes
09/16/16	9,641	1,510	5.6	4.0	Yes

Table 15
SMA-3 Thin Layer EMNR Quantities - Season 2

Date	Bucket Mark Area (sy)	Barge Volume (cy)	Volumetric Thickness (in)	Minimum Design Thickness (in)	Met Minimum Design Thickness
09/19/16	11,259	1,765	5.6	4.0	Yes
09/20/16	9,145	1,309	5.2	4.0	Yes
09/21/16	7,144	965	4.9	4.0	Yes
09/22/16	6,474	1,023	5.7	4.0	Yes
09/23/16	6,025	999	6.0	4.0	Yes
09/26/16	4,917	718	5.3	4.0	Yes

Notes:

cy: cubic yards

EMNR: enhanced monitored natural recovery
in: inches
sy: square yards

Table 16
Summary of Season 2 Material Placement Thickness

Area	Layer/Type	Average Placed Thickness[1] (inches)	Minimum Design Thickness (inches)	Met Minimum Design Thickness (inches)
SMA-1	Filter	19	12	Yes
SMA-1	Armor	8	6	Yes
SMA-1	EMNR	7	4	Yes
SMA-1	RMC	9	6	Yes
SMA-2	Subtidal Cap	78	48	Yes
SMA-2	EMNR	7	4	Yes
SMA-2	RMC	10	6	Yes
SMA-3	EMNR	6	4	Yes

Notes:

1. Calculated using daily bucket mark area and barge displacement volumes

EMNR: enhanced monitored natural recovery

RMC: residuals management cover

SMA: sediment management area

Table 17
SMA-1 Subtidal Cap Contingency Thickness Verification Measurements

Location ID	Layer (filter or armor)	Date	Easting	Northing	Measured Layer Thickness (inches)	Minimum Design Thickness (inches)	Met Minimum Design Thickness
SMA-1-Filter-1	Filter	10/6/16	1211887.06	317246.45	18	12	Yes
SMA-1-Filter-2	Filter	10/6/16	1211820.03	317319.53	12	12	Yes
SMA-1-Filter-3	Filter	10/6/16	1211850.90	317335.36	16	12	Yes
SMA-1-Filter-4	Filter	10/6/16	1211859.47	317293.67	17	12	Yes
SMA-1-Filter-5	Filter	10/6/16	1211797.70	317267.64	13	12	Yes
SMA-1-Filter-6	Filter	10/6/16	1211841.54	317264.46	17	12	Yes
SMA-1-Filter-7	Filter	10/6/16	1211838.28	317218.18	12	12	Yes
SMA-1-Filter-8	Filter	10/6/16	1211907.86	317188.36	15	12	Yes
SMA-1-Filter-9	Filter	10/6/16	1211916.94	317169.26	17	12	Yes
SMA-1-Filter-10	Filter	10/6/16	1211660.91	317338.25	15	12	Yes
SMA-1-Filter-11	Filter	10/6/16	1211706.92	317280.22	13	12	Yes
SMA-1-Filter-12	Filter	10/6/16	1211799.35	317416.19	12	12	Yes
SMA-1-Filter-13	Filter	10/6/16	1211805.87	317297.60	13	12	Yes
SMA-1-Filter-14	Filter	10/6/16	1211788.54	317242.82	15	12	Yes
SMA-1-Filter-15	Filter	11/29/16	1211877.00	317095.60	20	12	Yes
SMA-1-Filter-16	Filter	11/29/16	1211818.27	317137.36	16	12	Yes
SMA-1-Filter-17	Filter	11/29/16	1211764.22	317178.88	17	12	Yes
SMA-1-Filter-18	Filter	11/29/16	1211672.30	317218.22	19	12	Yes
SMA-1-Filter-19	Filter	11/29/16	1211544.41	317228.05	19	12	Yes
SMA-1-Filter-20	Filter	11/29/16	1211922.05	317083.24	13	12	Yes
SMA-1-Filter-21	Filter	11/29/16	1211892.57	317140.60	19	12	Yes
SMA-1-Filter-22	Filter	11/29/16	1211867.00	317162.61	17	12	Yes
SMA-1-Filter-23	Filter	12/5/16	1211373.78	317465.31	16	12	Yes
SMA-1-Filter-24	Filter	12/5/16	1211405.04	317514.86	14	12	Yes
SMA-1-Filter-25	Filter	12/5/16	1211654.90	317595.80	13	12	Yes
SMA-1-Filter-26	Filter	12/5/16	1211678.44	317613.31	17	12	Yes
SMA-1-Filter-27	Filter	12/5/16	1211651.83	317637.93	19	12	Yes
SMA-1-Filter-28	Filter	12/5/16	1211724.31	317549.71	17	12	Yes
SMA-1-Filter-29	Filter	12/5/16	1211753.98	317512.04	20	12	Yes
SMA-1-Filter-30	Filter	12/5/16	1211404.83	317295.67	17	12	Yes

Table 17
SMA-1 Subtidal Cap Contingency Thickness Verification Measurements

Location ID	Layer (filter or armor)	Date	Easting	Northing	Measured Layer Thickness (inches)	Minimum Design Thickness (inches)	Met Minimum Design Thickness
SMA-1-Filter-32	Filter	12/15/16	1211459.02	317536.48	13	12	Yes
SMA-1-Filter-33	Filter	12/14/16	1211480.55	317655.04	13	12	Yes
SMA-1-Filter-35	Filter	12/14/16	1211601.25	317602.11	14	12	Yes
SMA-1-Armor-1	Armor	11/9/16	1211874.98	317227.78	7	6	Yes
SMA-1-Armor-2	Armor	11/9/16	1211903.25	317186.03	10	6	Yes
SMA-1-Armor-3	Armor	11/9/16	1211789.94	317242.11	8	6	Yes
SMA-1-Armor-4	Armor	11/9/16	1211662.09	317296.58	8	6	Yes
SMA-1-Armor-5	Armor	11/9/16	1211732.52	317269.13	7	6	Yes
SMA-1-Armor-6	Armor	11/9/16	1211695.69	317374.15	8	6	Yes
SMA-1-Armor-7	Armor	11/9/16	1211754.50	317332.70	8	6	Yes
SMA-1-Armor-8	Armor	11/9/16	1211805.54	317298.07	8	6	Yes
SMA-1-Armor-9	Armor	11/9/16	1211819.51	317398.06	8	6	Yes
SMA-1-Armor-10	Armor	11/9/16	1211844.61	317342.05	7	6	Yes
SMA-1-Armor-11	Armor	11/9/16	1211773.34	317395.55	8	6	Yes
SMA-1-Armor-12	Armor	12/13/16	1211781.46	317168.53	18	6	Yes
SMA-1-Armor-13	Armor	12/13/16	1211835.47	317184.92	10	6	Yes
SMA-1-Armor-14	Armor	12/13/16	1211584.51	317265.28	11	6	Yes
SMA-1-Armor-15	Armor	12/13/16	1211672.38	317203.31	10	6	Yes
SMA-1-Armor-16	Armor	12/13/16	1211921.92	317103.97	13	6	Yes
SMA-1-Armor-17	Armor	12/13/16	1211909.82	317165.83	16	6	Yes
SMA-1-Armor-18	Armor	12/13/16	1211845.58	317135.58	10	6	Yes
SMA-1-Armor-19	Armor	12/14/16	1211732.31	317215.07	10	6	Yes
SMA-1-Armor-20	Armor	12/29/16	1211601.80	317311.40	8	6	Yes
SMA-1-Armor-21	Armor	12/29/16	1211644.10	317350.30	11	6	Yes
SMA-1-Armor-22	Armor	12/29/16	1211763.50	317503.80	7	6	Yes
SMA-1-Armor-23	Armor	12/29/16	1211615.20	317602.40	10	6	Yes
SMA-1-Armor-24	Armor	12/29/16	1211571.70	317589.10	7	6	Yes
SMA-1-Armor-25	Armor	12/19/16	1211546.00	317674.00	12	6	Yes
SMA-1-Armor-26	Armor	12/19/16	1211496.70	317661.60	8	6	Yes
SMA-1-Armor-27	Armor	12/19/16	1211419.70	317262.30	7	6	Yes

Table 17
SMA-1 Subtidal Cap Contingency Thickness Verification Measurements

Location ID	Layer (filter or armor)	Date	Easting	Northing	Measured Layer Thickness (inches)	Minimum Design Thickness (inches)	Met Minimum Design Thickness
SMA-1-Armor-28	Armor	12/19/16	1211467.30	317259.00	8	6	Yes
SMA-1-Armor-29	Armor	12/20/16	1211470.40	317620.50	10	6	Yes
SMA-1-Armor-30	Armor	12/20/16	1211430.50	317585.20	7	6	Yes
SMA-1-Armor-31	Armor	12/20/16	1211381.30	317532.70	10	6	Yes
SMA-1-Armor-32	Armor	12/20/16	1211350.00	317486.80	8	6	Yes
SMA-1-Armor-33	Armor	12/29/16	1211398.20	317496.50	8	6	Yes
SMA-1-Armor-34	Armor	12/29/16	1211422.90	317445.70	8	6	Yes
SMA-1-Armor-35	Armor	12/14/16	1211541.29	317570.17	10	6	Yes

Notes:

Horizontal Datum: Washington State Plane North Zone, NAD83, U.S. feet

SMA: sediment management area

Table 18
SMA-2 Subtidal Cap Contingency Thickness Verification Measurements

Location ID	Date	Easting	Northing	Measured Layer Thickness (feet)	Minimum Design Thickness (feet)	Met Minimum Design Thickness
SMA-2-1	11/10/16	1211601.69	316220.32	5.8	4.0	Yes
SMA-2-2*	11/14/16	1211652.55	316317.70	≥ 4	4.0	Yes
SMA-2-3*	11/14/16	1211476.17	316222.87	≥ 4	4.0	Yes
SMA-2-4*	11/14/16	1211480.82	316299.29	≥ 4	4.0	Yes
SMA-2-5	11/10/16	1211487.07	315981.82	4.1	4.0	Yes
SMA-2-6*	11/14/16	1211495.86	316070.26	≥ 4	4.0	Yes
SMA-2-7	11/10/16	1211422.54	316120.01	4.6	4.0	Yes
SMA-2-8	11/15/16	1211423.19	315799.45	4.4	4.0	Yes
SMA-2-9	12/14/16	1211504.30	316397.30	5.2	4.0	Yes
SMA-2-10*	12/20/16	1211576.50	316475.80	≥ 4	4.0	Yes
SMA-2-11	12/20/16	1211619.80	316531.80	4.3	4.0	Yes
SMA-2-12	12/20/16	1211690.90	316449.30	4.8	4.0	Yes
SMA-2-13*	12/20/16	1211706.90	316510.20	≥ 4	4.0	Yes

Notes:
Horizontal Datum: Washington State Plane North Zone, NAD83, U.S. Feet
* Probe refusal

Table 19
SMA-2 EMNR Contingency Thickness Verification Measurements

Location ID	Date	Easting	Northing	Measured Layer Thickness (inches)	Minimum Design Thickness (inches)	Met Minimum Design Thickness
SMA-2-EMNR-1	11/10/16	1211341.39	316155.16	23	4	Yes
SMA-2-EMNR-2	11/10/16	1211404.34	316218.31	5	4	Yes
SMA-2-EMNR-3	11/10/16	1211368.78	316239.62	17	4	Yes
SMA-2-EMNR-4	11/10/16	1211296.38	316241.30	20	4	Yes
SMA-2-EMNR-5	11/10/16	1211302.11	316303.61	10	4	Yes
SMA-2-EMNR-6	11/10/16	1211804.70	316213.30	12	4	Yes
SMA-2-EMNR-7	11/14/16	1211813.65	316298.60	10	4	Yes
SMA-2-EMNR-8	11/14/16	1211736.31	316325.60	8	4	Yes
SMA-2-EMNR-9	11/14/16	1211823.94	316404.15	6	4	Yes
SMA-2-EMNR-10	12/14/16	1211244.42	316379.21	29	4	Yes

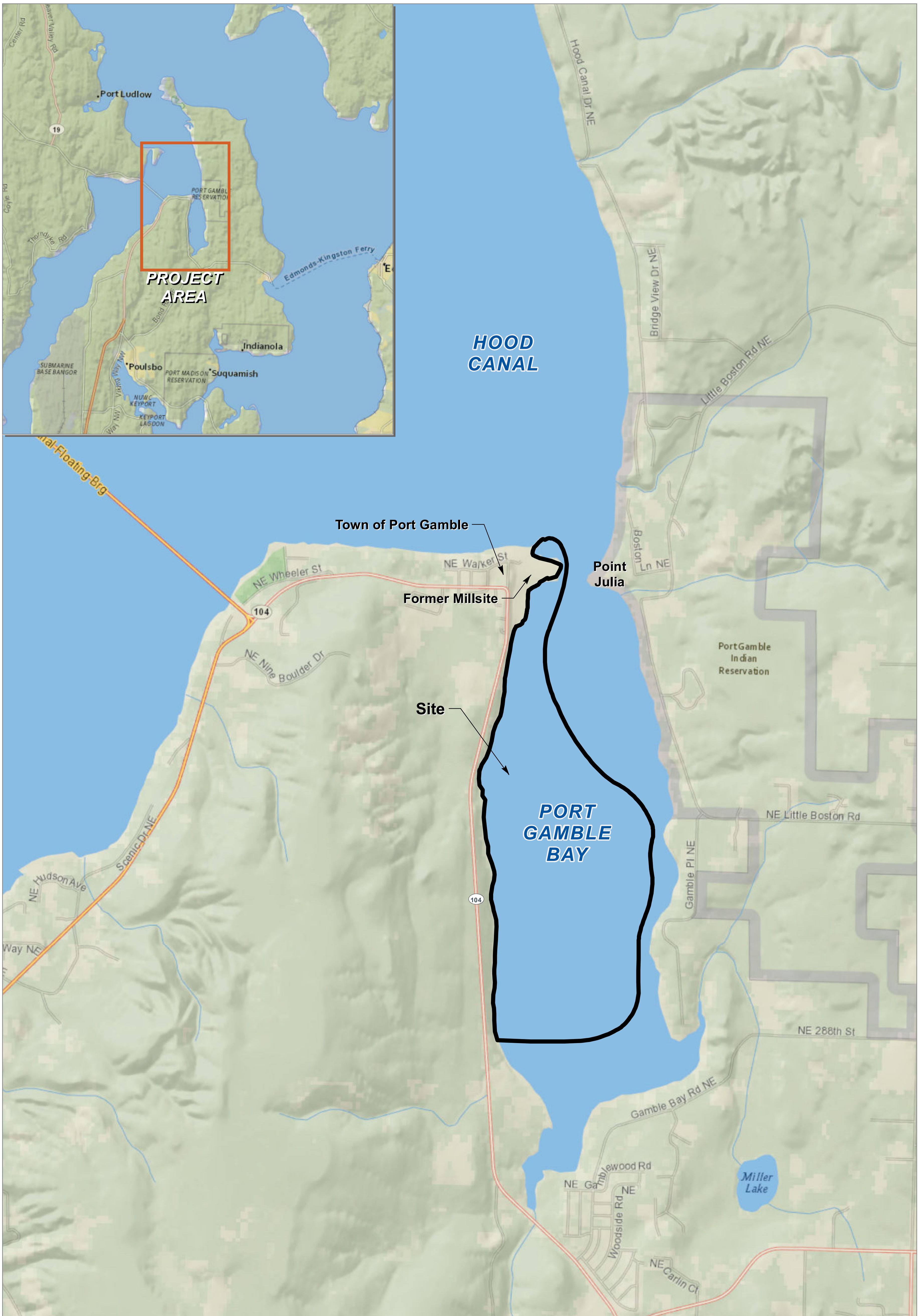
Note:
Horizontal Datum: Washington State Plane North Zone, NAD83, U.S. Feet

Table 20
SMA-3 EMNR Contingency Thickness Verification Measurements

Location ID	Date	Easting	Northing	Measured Layer Thickness (inches)	Minimum Design Thickness (inches)	Met Minimum Design Thickness
SMA-3-1	08/29/16	308800.04	1212440.21	5	4	Yes
SMA-3-2	08/29/16	308666.13	1212358.64	5	4	Yes
SMA-3-3	08/29/16	308619.04	1212152.39	7	4	Yes
SMA-3-4	08/29/16	308461.65	1212316.55	6	4	Yes
SMA-3-5	08/29/16	308378.01	1212247.73	6	4	Yes
SMA-3-6	08/29/16	308219.48	1212062.44	7	4	Yes
SMA-3-7	08/29/16	308214.78	1212312.36	7	4	Yes
SMA-3-8	08/29/16	308184.6	1212138.38	6	4	Yes
SMA-3-9	08/29/16	308180.41	1212277.89	6	4	Yes
SMA-3-10	08/29/16	308139.54	1212057.29	6	4	Yes
SMA-3-11	08/29/16	308147.02	1212363.27	5	4	Yes
SMA-3-12	08/29/16	308086.77	1212318.61	5	4	Yes
SMA-3-13	08/29/16	308064.50	1212193.62	5	4	Yes
SMA-3-14	08/29/16	307992.65	1212306.10	5	4	Yes

Note:
Horizontal Datum: Washington State Plane North Zone, NAD83, U.S. Feet

Figures



LEGEND:

Site

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Feet

Publish Date: 2017/04/04, 12:01 PM | User: eiverson
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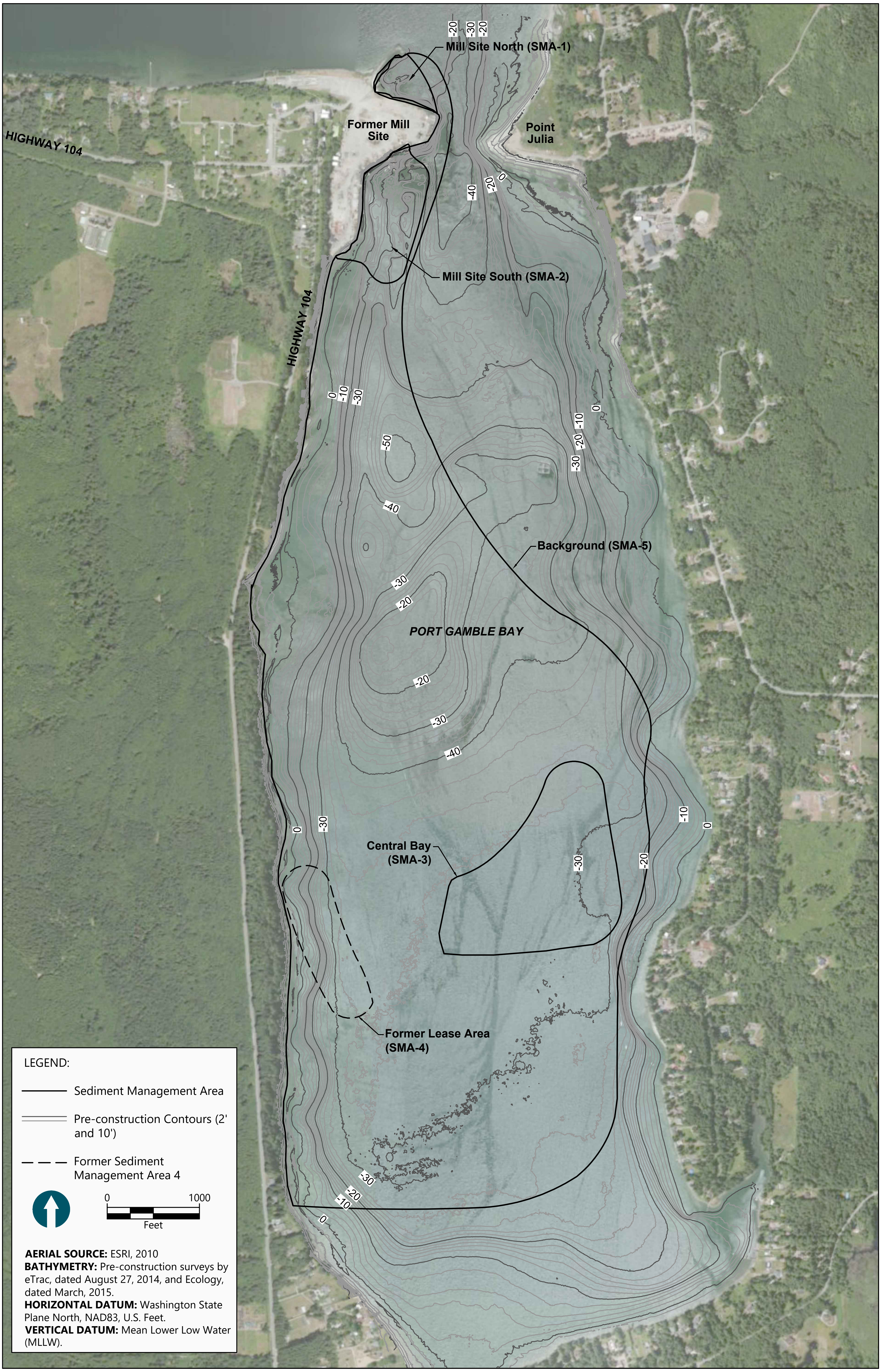
Figure 1
Site Vicinity Map
Cleanup Action Report – Season 2
Port Gamble Bay Cleanup



AERIAL SOURCE: ESRI, 2010
BATHYMETRY: Pre-construction surveys by eTrac, dated August 27, 2014, and Ecology, dated March, 2015.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

Publish Date: 2017/05/03 4:19 PM | User: chewett
Filepath: K:\Projects\0388-Pope Resources\Port Gamble Sediment Cleanup RI-FS\Engineering Design Report\0388-EDR-002.dwg F2 (Season 2 Completion)

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Figure 2
Sediment Management Areas

Cleanup Action Report - Season 2
Port Gamble Bay Cleanup Project

Demolition of Former Log Transfer Facility (FLTF) Decking

Derelict Vessel Removal at the FLTF

Beach Cleanup in Area 1

Diver-assisted Removal of Submerged Pilings at the Eastern Wharf

SMA-1 Piling Removal

Processing Creosote Pilings for Disposal

SMA-1 Jetty – Prior to Piling Removal and Capping

SMA-1 Jetty – During Piling Removal

SMA-1 Jetty – After Piling Removal and Capping

SMA-1 Conveyor Pier – Prior to Demolition and Piling Removal

SMA-1 Conveyor Pier – During Demolition and Piling Removal

SMA-1 Conveyor Pier Area – After Demolition and Piling Removal

Eastern Wharf – Prior to Asphalt Removal and Armoring

Eastern Wharf – During Asphalt Removal and Armoring

Eastern Wharf – After Asphalt Removal and Armoring

Pier 4 – Prior to Demolition and Piling Removal

Pier 4 – During Demolition and Piling Removal

Pier 4 Area – After Demolition and Piling Removal

Former Landfill Area 4b – Prior to Cleanup

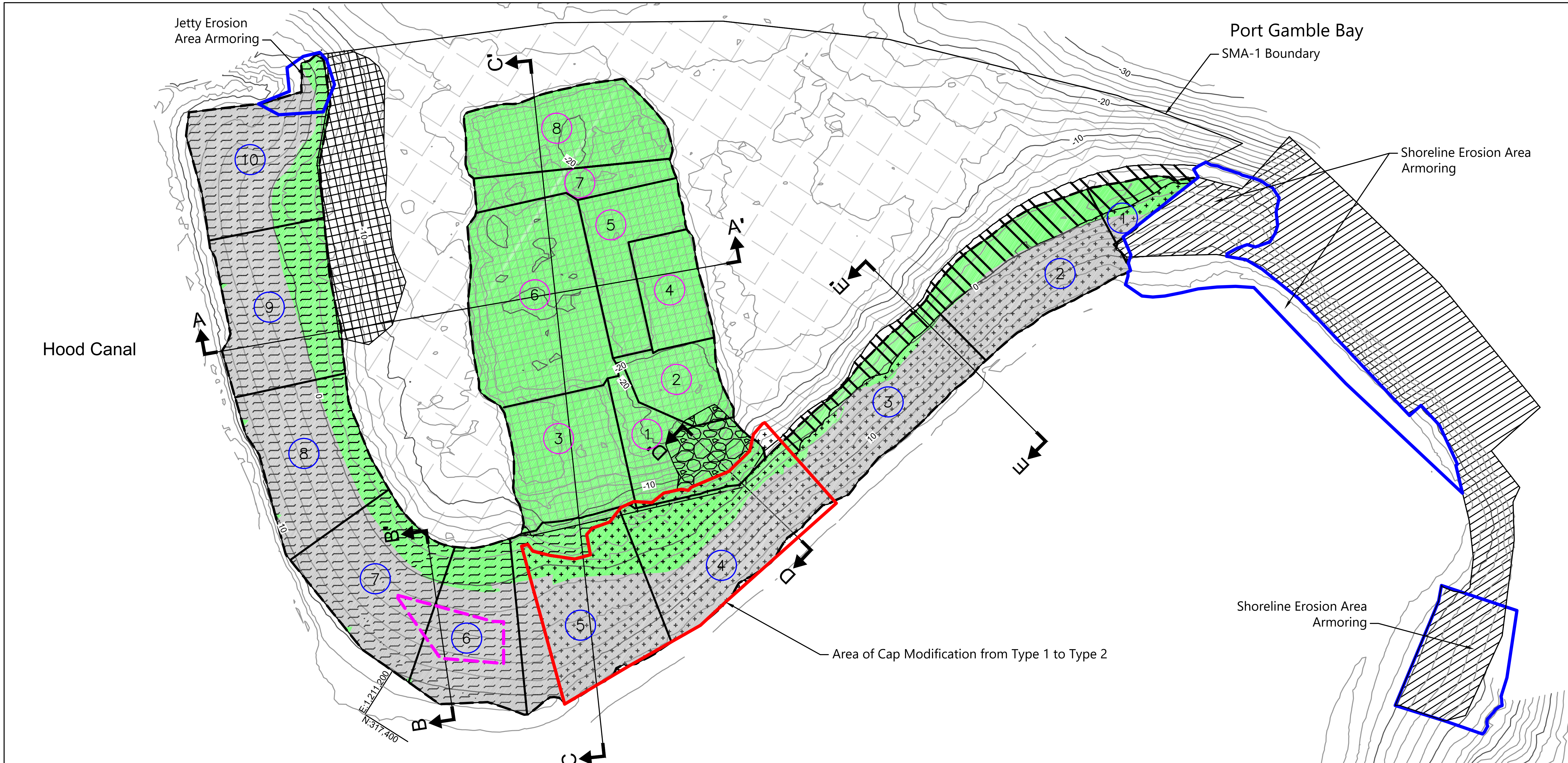
Former Landfill Area 4b – During Cleanup

Former Landfill Area 4b – After Cleanup

FLTF – Prior to Demolition and Piling Removal

FLTF – During Demolition and Piling Removal

FLTF – After Demolition and Piling Removal



SOURCE: Post-construction bathymetry from eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Post-dredge Contours (2' and 10' Interval)
- Approx. Dredge/Excavation Limits
- Approx. Overexcavation Footprint
- CU Area Boundary
- Dredging Complete (Thin Cover/Cap Complete in Intertidal Area)
- Bank Excavation Complete (Area Performed in the Dry, > Approx. Elevation 0' MLLW)
- Post-pile Removal Habitat Substrate Cover
- 5 Intertidal Confirmation Unit Designation
- 5 Subtidal Confirmation Unit Designation
- Intertidal Cap Area, Type 1
- Intertidal Cap Area, Type 2
- Intertidal Cap Area, Type 3
- Angular Backfill Area
- EMNR Placement Area
- Post-dredge Residuals Cover Management Area
- Subtidal Cap Area
- Erosion Armoring Area
- Cap Modification Area

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Feet

Publish Date: 2017/10/09 9:04 AM | User: chewett
Filepath: K:\Projects\0388-Pope Resources\Port Gamble Sediment Cleanup RI-FS\Construction Plans\CM\Season 2 Completion Report\0388-WK-002 (SMA-1).dwg F4a

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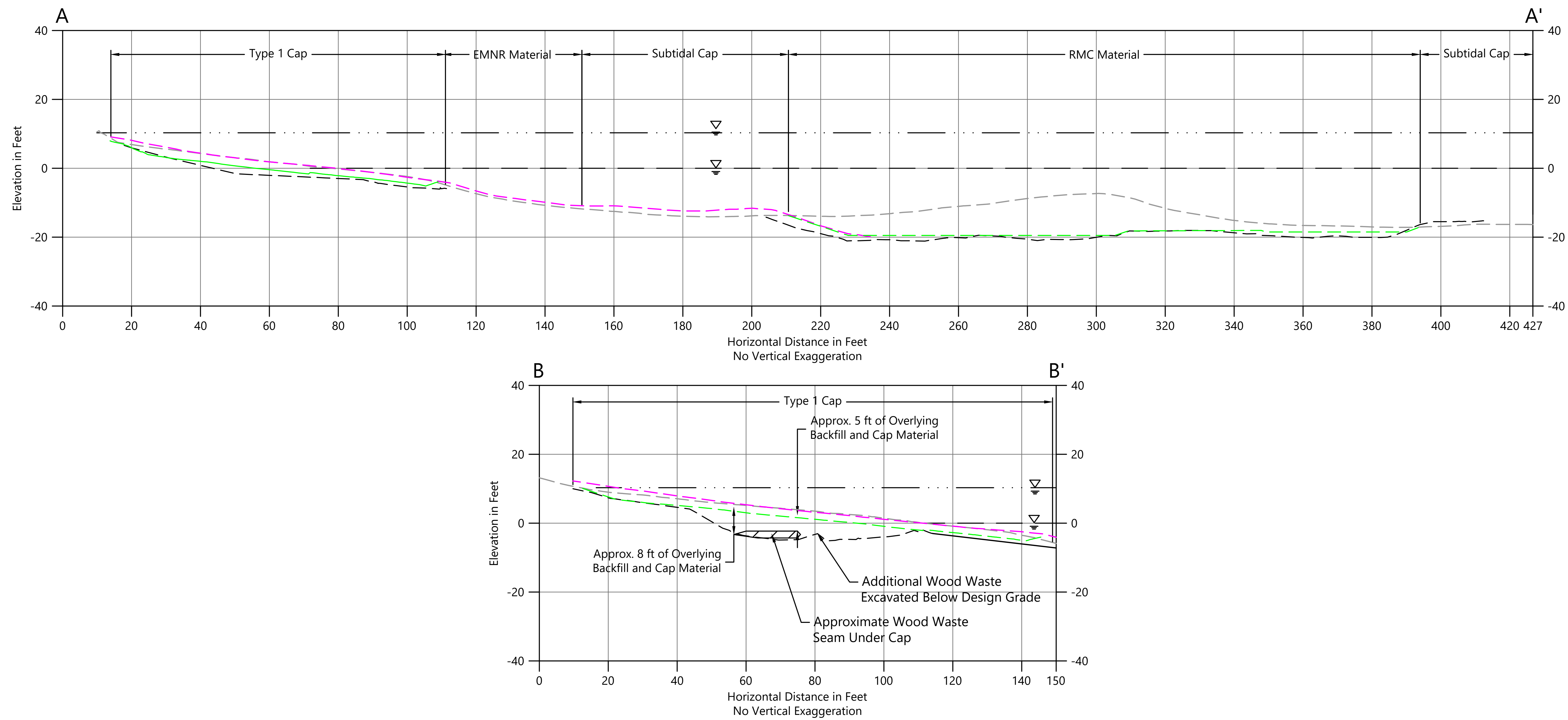
Figure 4a
SMA-1 Dredge and Material Placement Plan

Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project



SOURCE: Post-dredge bathymetry from Orion, dated November, 2016 to January, 2017. Post-construction bathymetry by eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:
- Pre-construction Mudline
- Design Dredge Grade
- Post-dredge/RMC As-built Survey
- Intertidal and Subtidal Cap As-built Survey
- Mean Higher High Water Line (Elevation 10.3' MLLW)
- Mean Lower Low Water Line (Elevation 0.0' MLLW)

0 30
Feet

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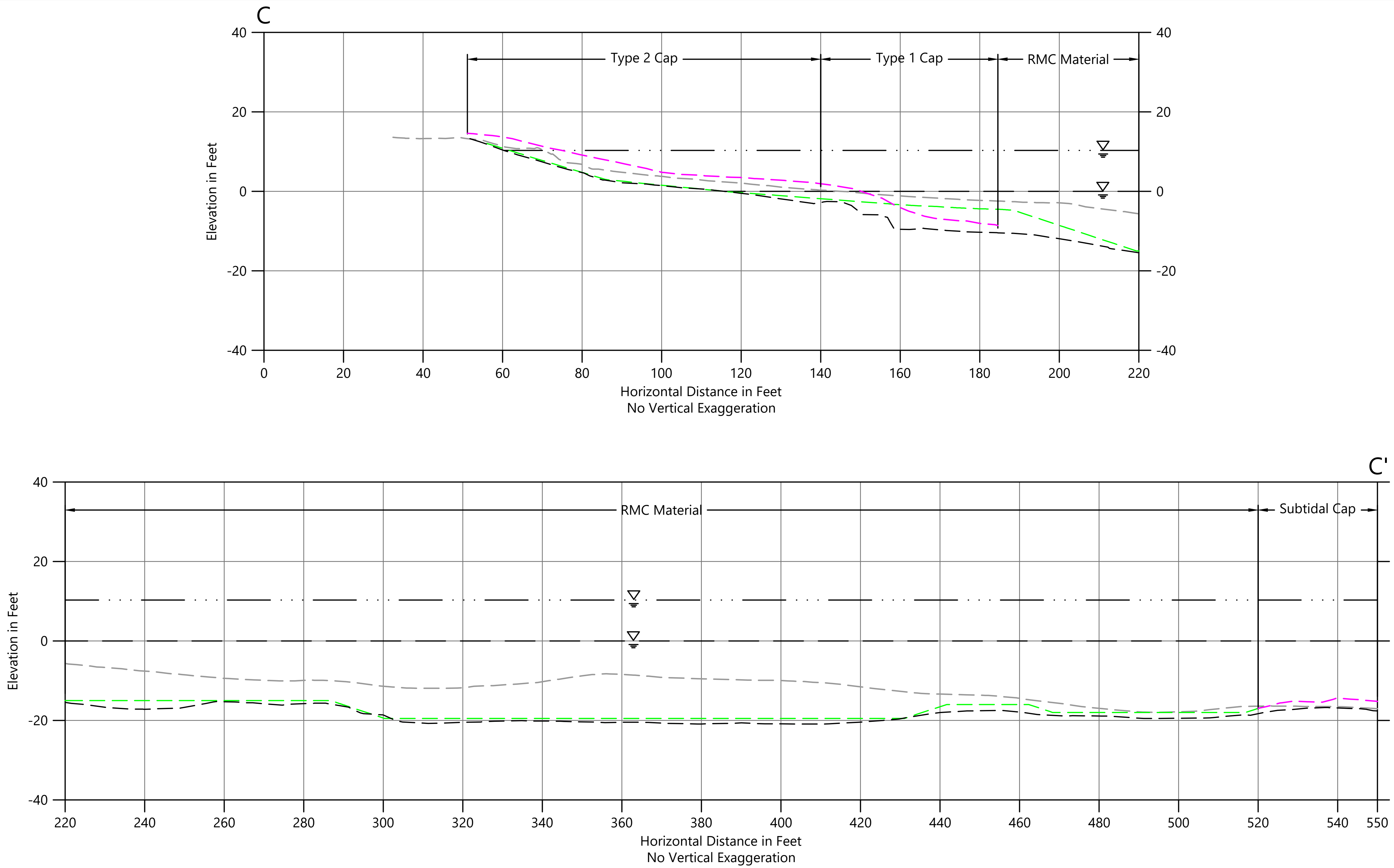
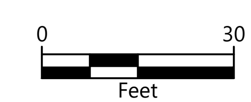
Figure 4b
SMA-1 Intertidal and Subtidal Cross-sections – Season 2





SOURCE: Post-dredge bathymetry from Orion, dated November, 2016 to January, 2017. Post-construction bathymetry by eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Pre-construction Mudline
- Design Dredge Grade
- Post-dredge/RMC As-built Survey
- Intertidal and Subtidal Cap As-built Survey
- Mean Higher High Water Line (Elevation 10.3' MLLW)
- Mean Lower Low Water Line (Elevation 0.0' MLLW)

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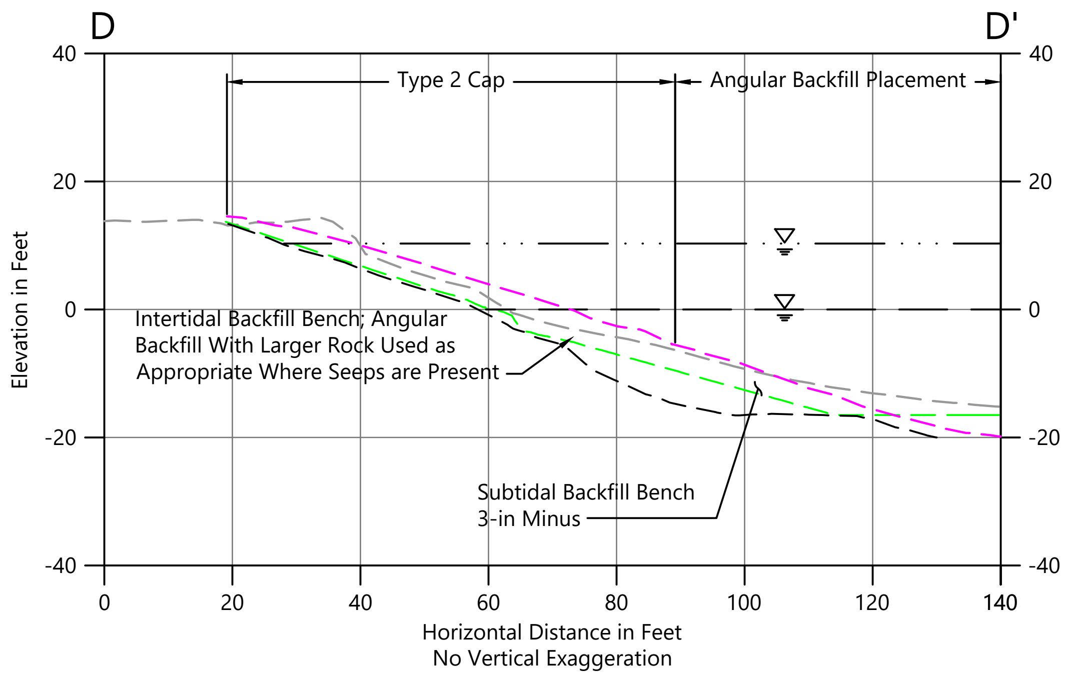
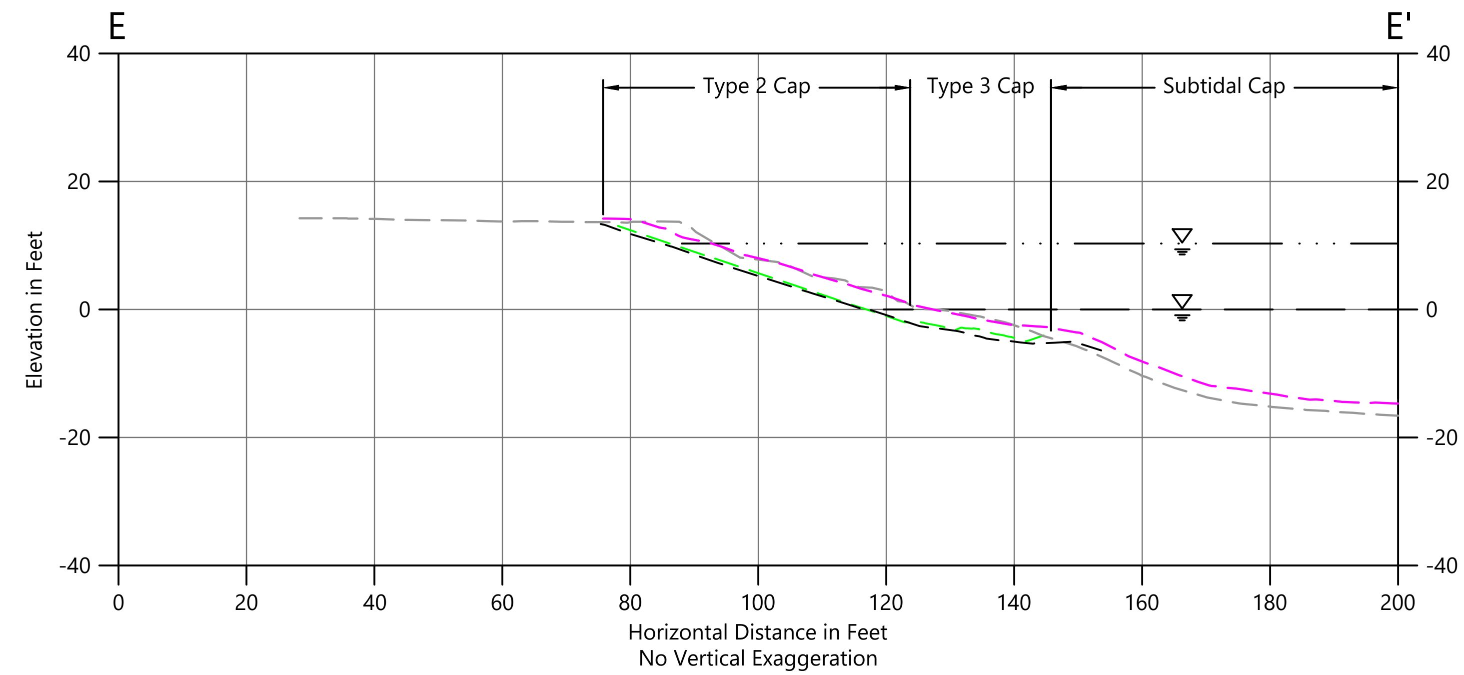
Figure 4c
SMA-1 Intertidal and Subtidal Cross-sections – Season 2

Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project





SOURCE: Post-dredge bathymetry from Orion, dated November, 2016 to January, 2017. Post-construction bathymetry by eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:
- Pre-construction Mudline
- Design Dredge Grade
- Post-dredge/RMC As-built Survey
- Intertidal and Subtidal Cap As-built Survey
- Mean Higher High Water Line (Elevation 10.3' MLLW)
- Mean Lower Low Water Line (Elevation 0.0' MLLW)

0 30
Feet

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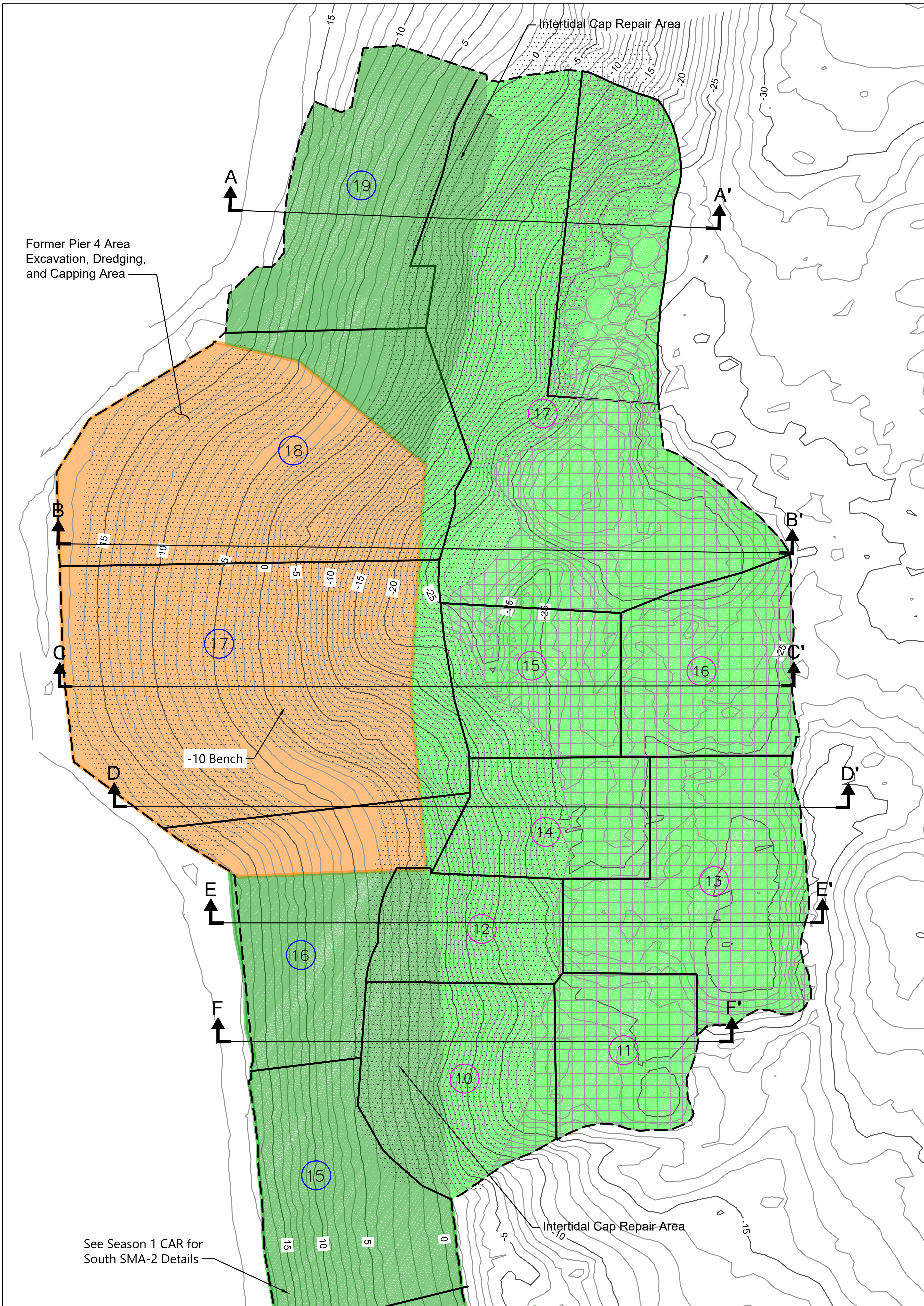
Figure 4d
SMA-1 Intertidal and Subtidal Cross-sections – Season 2



LEGEND:

SOURCE: Bathymetry from eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

- Post-work Contours (2' and 10' Interval)
- Angular Backfill Placement Area
- Approx. Dredge/Excavation Limits
- Confirmation Unit Boundary
- Season 1 Excavation Complete (See Season 1 CAR, > Approx. Elevation 0' MLLW Performed in the Dry)
- Season 2 Excavation/Dredging Complete
- Dredge Unit Elevation or Depth
- Season 2 Pier 4 Excavation/Dredging Complete (> Approx. Elevation 0' MLLW Performed in the Dry)
- Residuals Management Cover (RMC)
- Season 2 Approved 4-foot Contingent Cap

0 40
Feet

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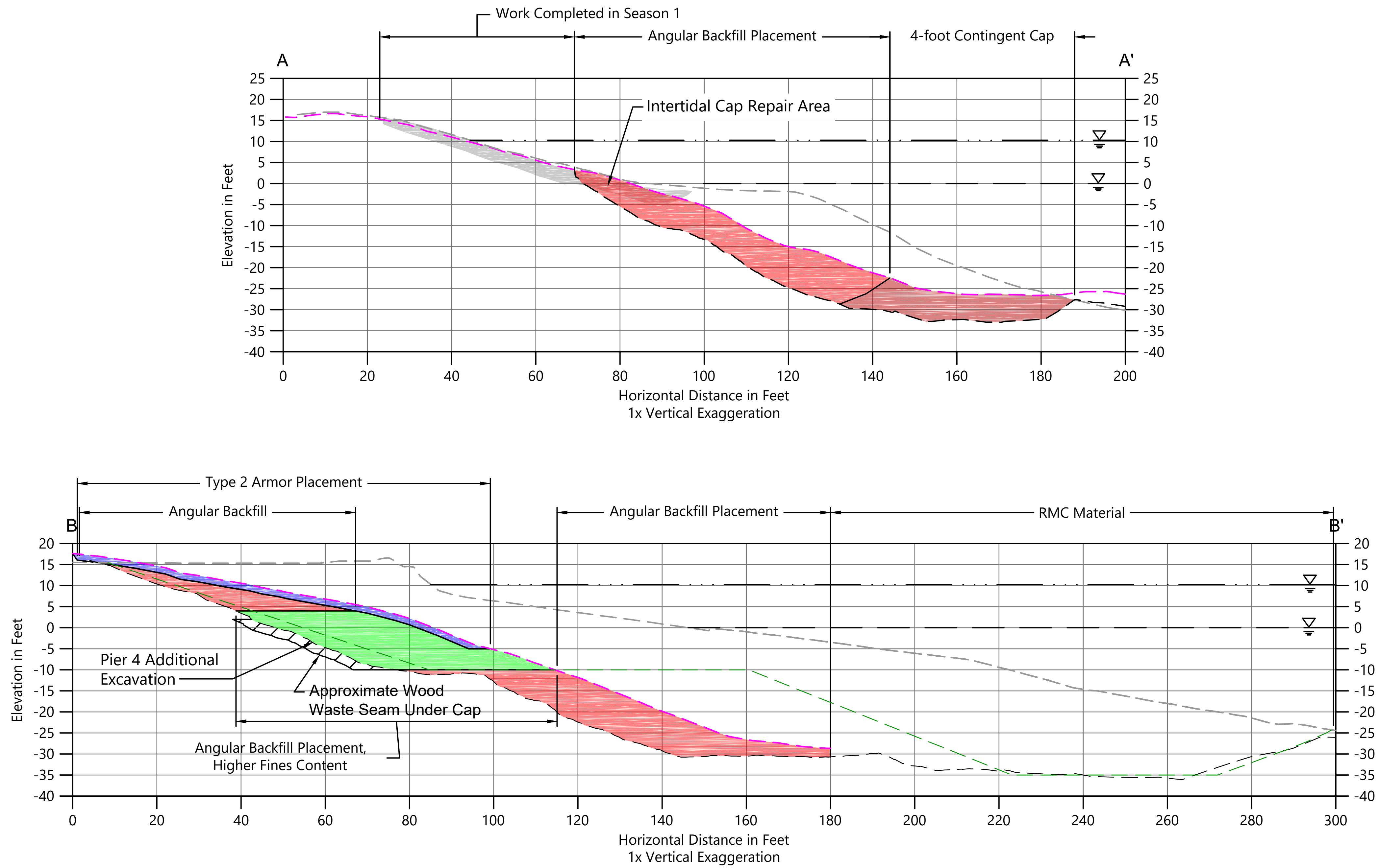
Figure 5a
SMA-2 Dredge and Material Placement Plan
Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project



SOURCE: Post-dredge bathymetry from Orion, dated November, 2016 to January, 2017. Post-construction bathymetry by eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Pre-construction Mudline
- Re-design Design Grade
- Intertidal and Subtidal Cap As-built Survey
- Post-dredge/RMC As-built Survey
- Extent of Work Completed During Season 1
- Angular Backfill
- Angular Backfill, Higher Fines Content
- Type 2 Armor Placement
- 4-foot Contingent Cap
- Mean Higher High Water Line (Elevation 10.3' MLLW)
- Mean Lower Low Water Line (Elevation 0.0' MLLW)
- Approximate Wood Waste Seam Under Cap

0 30
Feet

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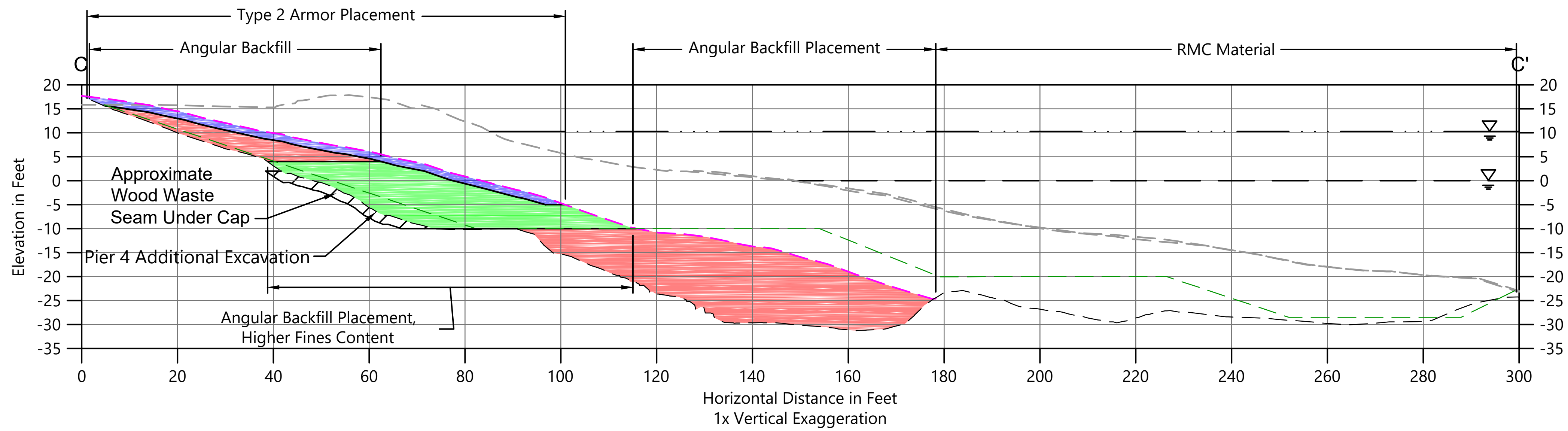
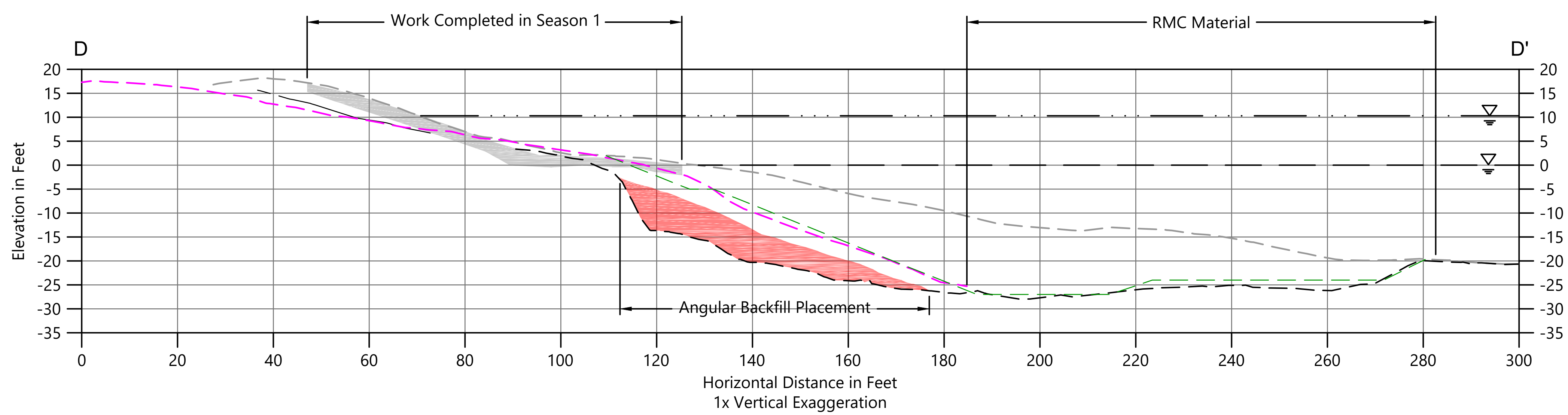
Figure 5b
SMA-2 Intertidal and Subtidal Cross-sections – Season 2





SOURCE: Post-dredge bathymetry from Orion, dated November, 2016 to January, 2017. Post-construction bathymetry by eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Pre-construction Mudline
- Re-design Design Grade
- Intertidal and Subtidal Cap As-built Survey
- Post-dredge/RMC As-built Survey
- Extent of Work Completed During Season 1
- Angular Backfill
- Angular Backfill, Higher Fines Content
- Type 2 Armor Placement
- Mean Higher High Water Line (Elevation 10.3' MLLW)
- Mean Lower Low Water Line (Elevation 0.0' MLLW)
- Approximate Wood Waste Seam Under Cap

0 30
Feet

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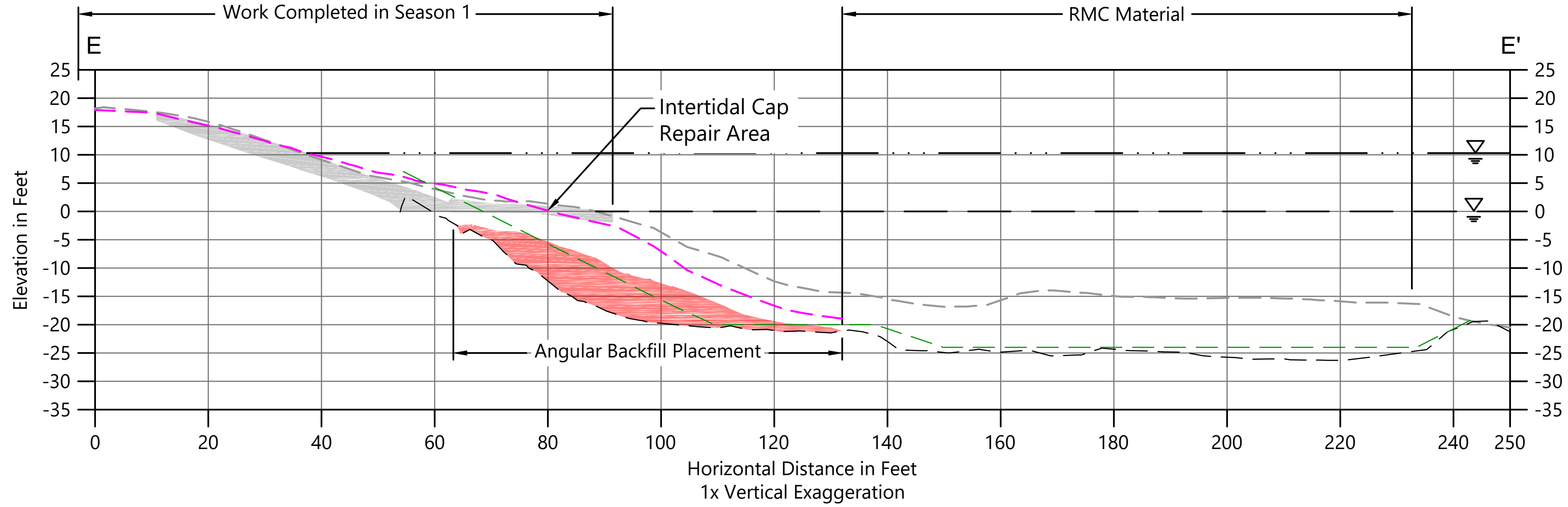
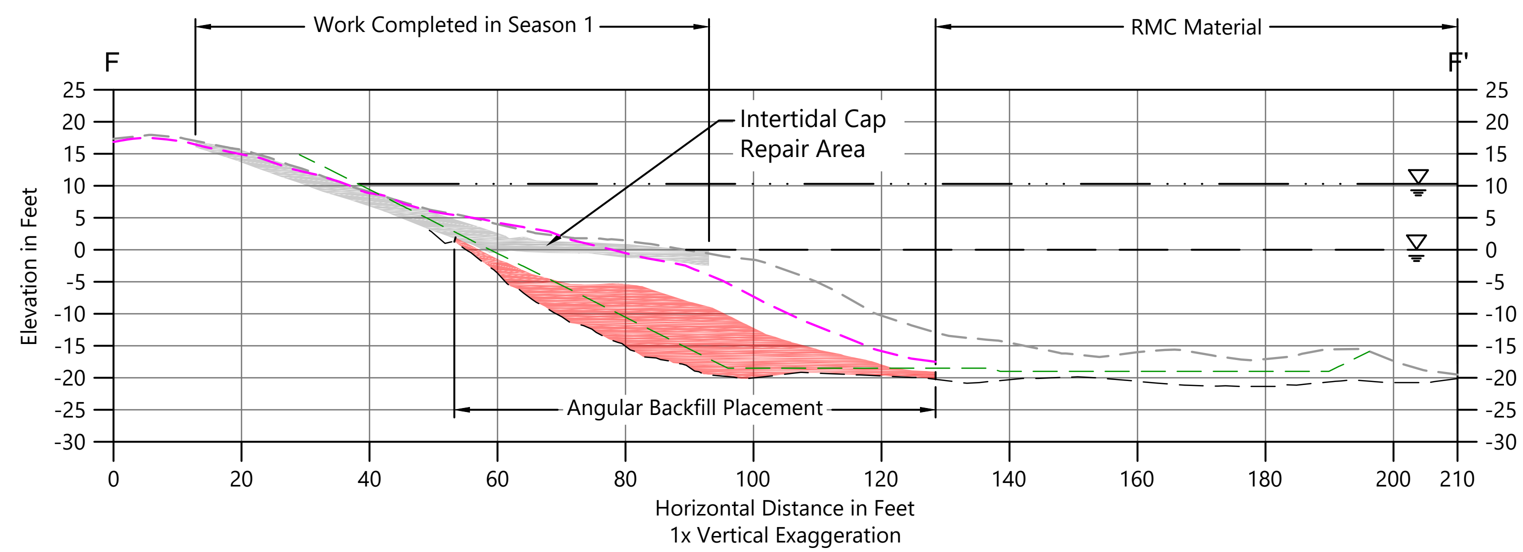
Figure 5c
SMA-2 Intertidal and Subtidal Cross-sections – Season 2

Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project





SOURCE: Bathymetry from eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Pre-construction Mudline
- Re-design Design Grade
- Intertidal and Subtidal Cap As-built Survey
- Post-dredge/RMC As-built Survey
- Extent of Work Completed During Season 1
- Angular Backfill
- Mean Higher High Water Line (Elevation 10.3' MLLW)
- Mean Lower Low Water Line (Elevation 0.0' MLLW)

0 30
Feet

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Figure 5d
SMA-2 Intertidal and Subtidal Cross-sections – Season 2

Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project

DB Rainier Dredging Area with Numerous Buried Pilings in SMA-2


DB Rainier Dredging Wood Waste in Former Pier 4 Area


PC400 and Young Bucket Dredging in SMA-1


PC400 and White Horse Spud Barge Dredging in SMA-1


Post-dredging RMC Placement with 9260 Crane and Clamshell Bucket

Placement of Angular Gravel Backfill Buttress Material in SMA-2 with 9299 Crane and Skip Box

Seep Area Encountered During SMA-1 Intertidal Excavation

SMA-1 Intertidal Cap Filter Layer Placement

SMA-1 Intertidal Excavation and Capping

Habitat Substrate Placement on SMA-1 Intertidal Cap

SMA-1 Jetty Area Intertidal Cap Filter Layer Placement

Placement of Type 2 Armor in SMA-1 Intertidal Cap Repair Area

Former Pier 4 Area Additional Wood Waste Removal Above +0 MLLW

Wood Waste Deposit in Pier 4 Excavation at +2 MLLW

3" Minus Backfill Placement – Former Pier 4 Area Cap

Type 2 Armor Placement – Former Pier 4 Area Cap

Habitat Substrate Placement – Former Pier 4 Area Cap

Post-Armor Placement Former Pier 4 Area Shoreline

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Figure 7b
Intertidal Excavation and Capping Photographs – Former Pier 4 Area
Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project

EMNR Placement in SMA-3

Subtidal Cap Filter Layer Placement in SMA-1

EMNR Placement in SMA-2

Subtidal Cap Placement in SMA-2 with DB Rainier and Bombay Box

SMA-2 Subtidal Cap Placement – Bombay Box

Subtidal Cap Placement in SMA-1 and Water Quality Monitoring

Filepath: \\fuji\anchor\Projects\Port Gamble\2015 CM Support\Season 2 Completion Report\Figures\Word files\Figure 8_SubtidalCapEMNR_Six Photos_11x17.docx

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Figure 8
Subtidal Capping and EMNR Material Placement Photographs
Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project

Installation of Temporary Pilings for Transload Extension

Completed Trestle at Transload Facility for Increased Barge Draft

Transload Facility with Trestle, Material Handler, and Spill Apron

Dredge Material Barge Offloading with Liebherr Material Handler

Removal of Transload Trestle and Temporary Pilings

Removal of Temporary Bulkhead at Transload Facility

SOURCE: Aerial image from Google Earth, dated May 22, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:
Upland Stockpile Locations

0 240
Feet

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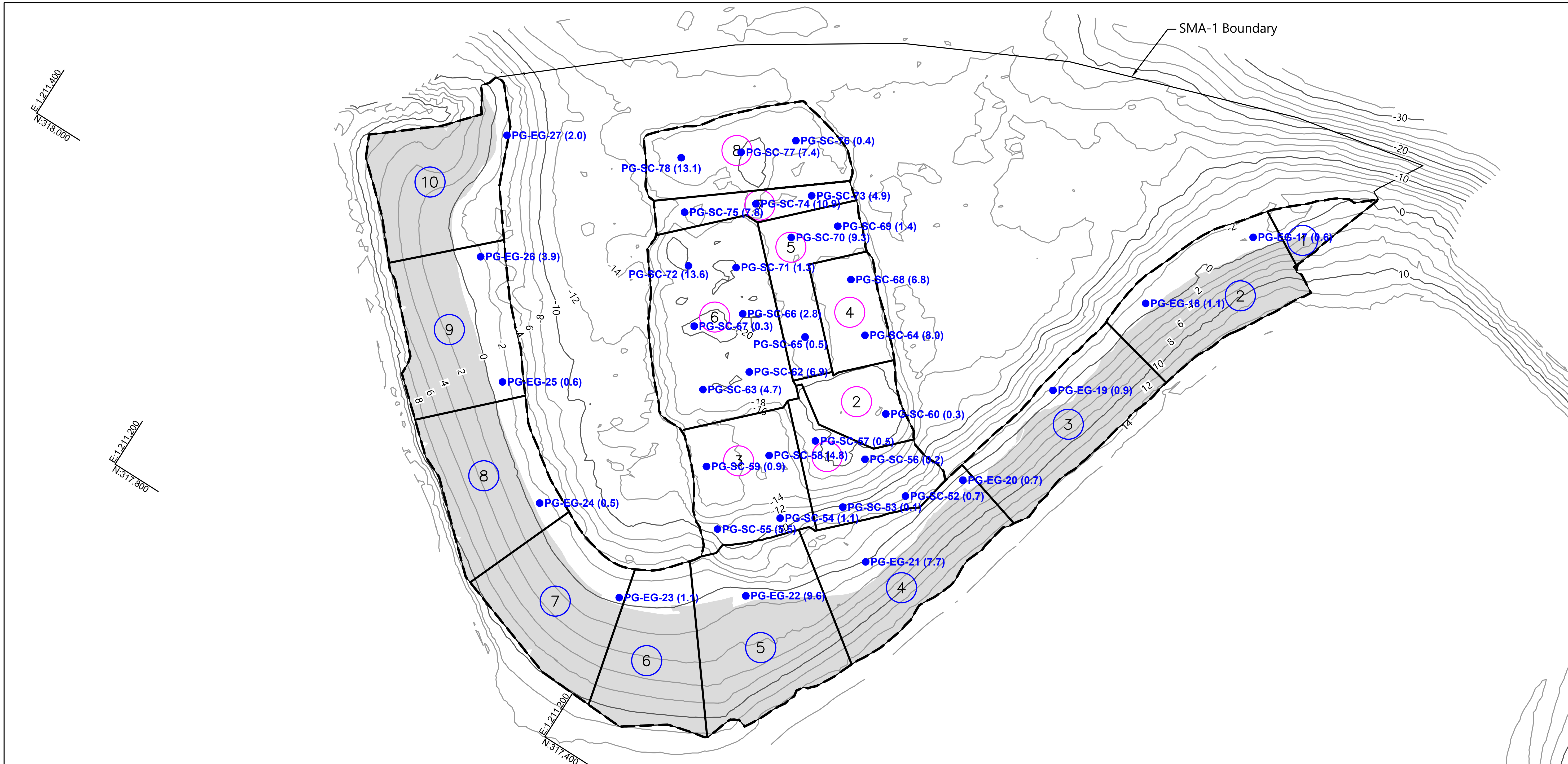
Figure 9b
Temporary Upland Stockpile Locations

Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project



SOURCE: Bathymetry from eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Post-work Contours (2' and 10' Interval)
- Approx. Dredge/Excavation Limits
- Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
- Season 2 Confirmatory Sample Location and TVS Result (% Dry Weight)
- Confirmation Unit Boundary
- 5 Intertidal Confirmation Unit Designation
- 5 Subtidal Confirmation Unit Designation

0 80
Feet

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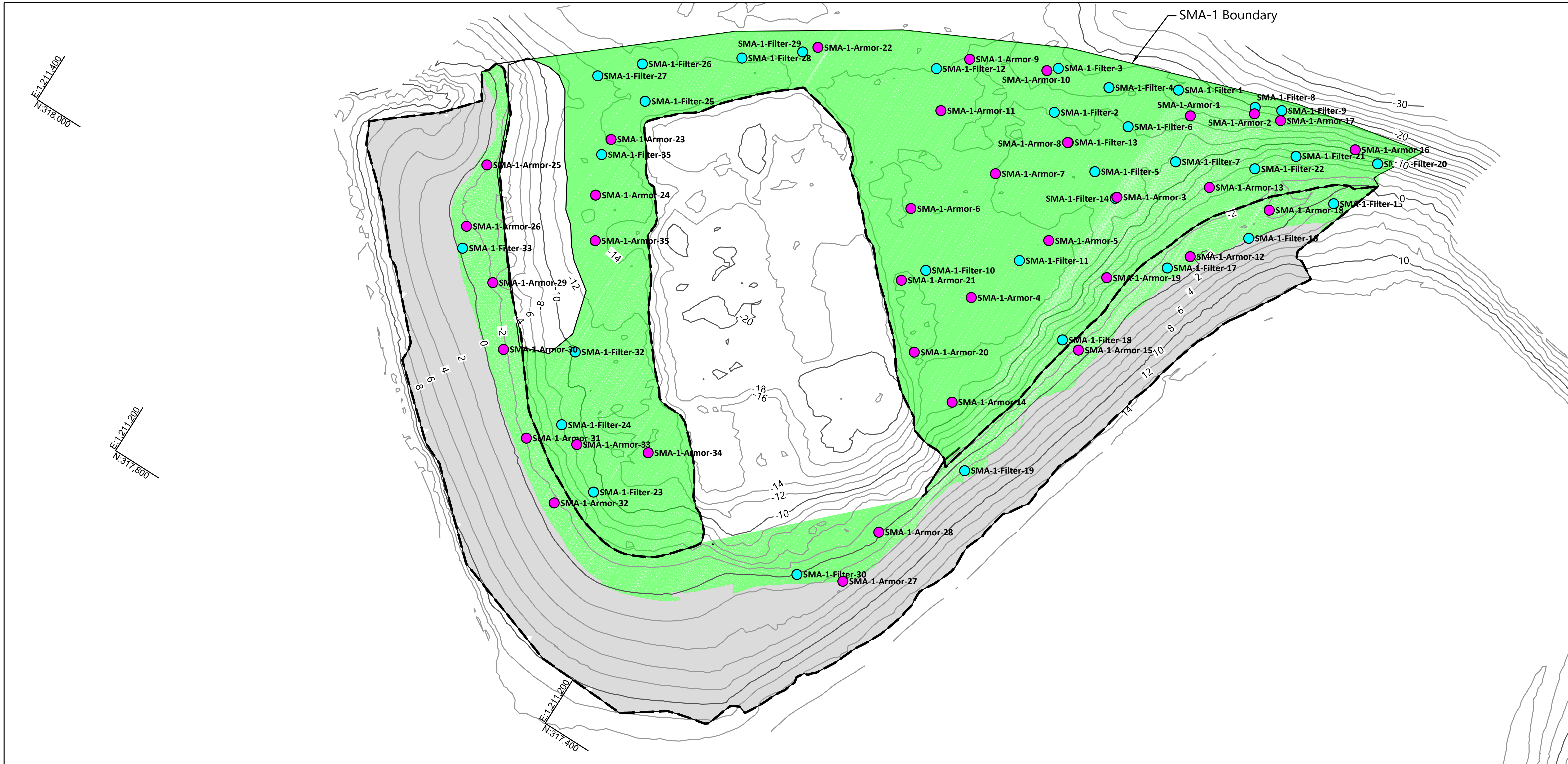
Figure 10
SMA-1 Confirmation Sample Locations
Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project



SOURCE: Bathymetry from eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Post-work Contours (2' and 10' Interval)
- Approx. Dredge/Excavation Limits
- Accepted Cap Areas
- Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
- Actual Cap Filter Probe Location
- Actual Cap Armor Probe Location

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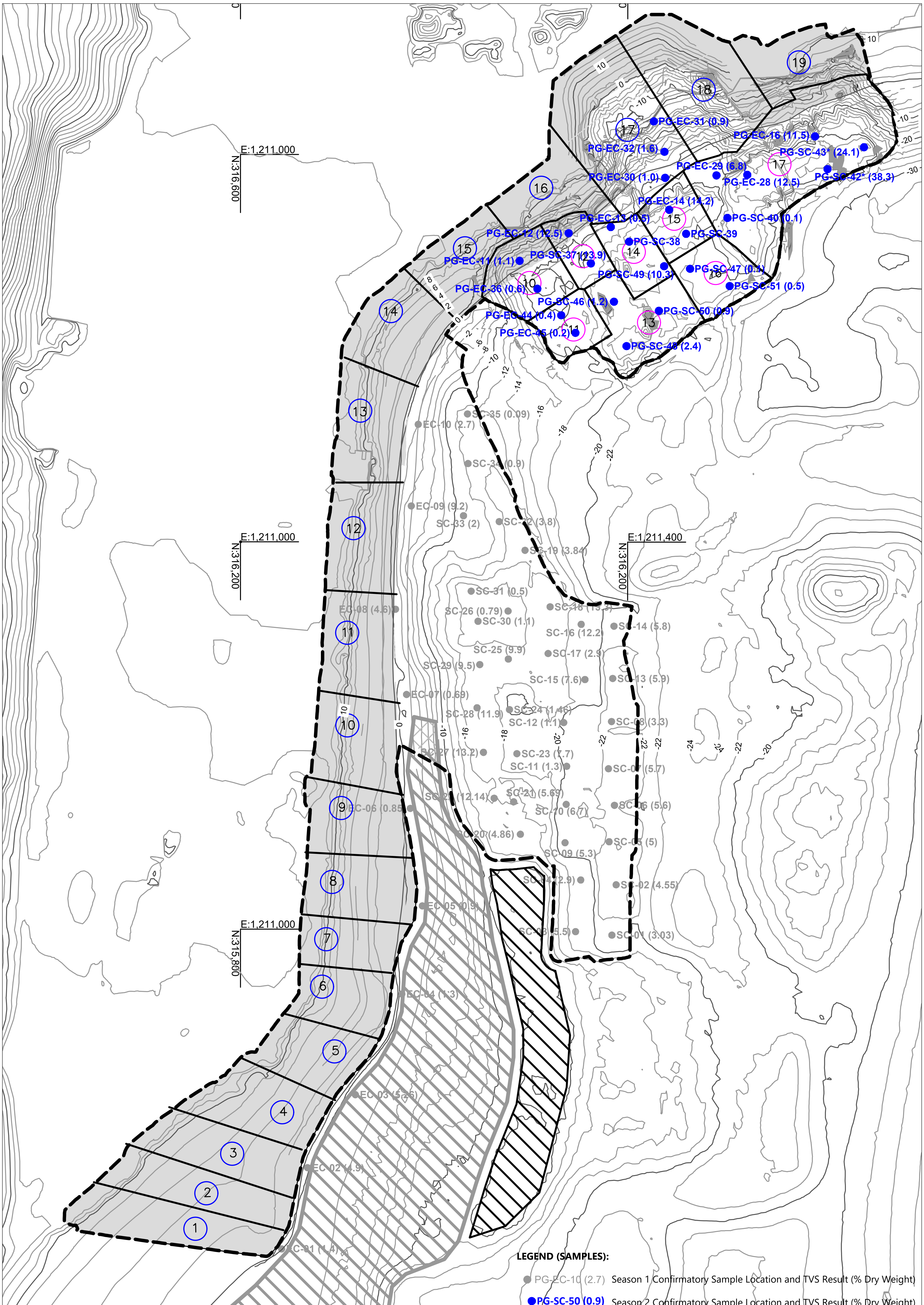
Figure 11
SMA-1 Subtidal Cap Verification Probing Locations

Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project



SOURCE: Bathymetry from eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).
NOTE: * = Area covered with 4-foot contingency sand cap.

LEGEND:

- Pre-construction Mudline Contours (5' and 25' Interval)
- Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
- Approx. Dredge/Excavation Limits
- Eelgrass Beds
- Eelgrass Bench (Constructed in Season 1)
- Confirmation Unit Boundary
- 5 Intertidal Confirmation Unit Designation
- 5 Subtidal Confirmation Unit Designation

0 100
Feet

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Filepath: K:\Projects\0388-Pope Resources\Port Gamble Sediment Cleanup RI-FS\Construction Plans\CM\Season 2 Completion Report\0388-WK-005 (SMA-2_Confirmation Sampling).dwg F12

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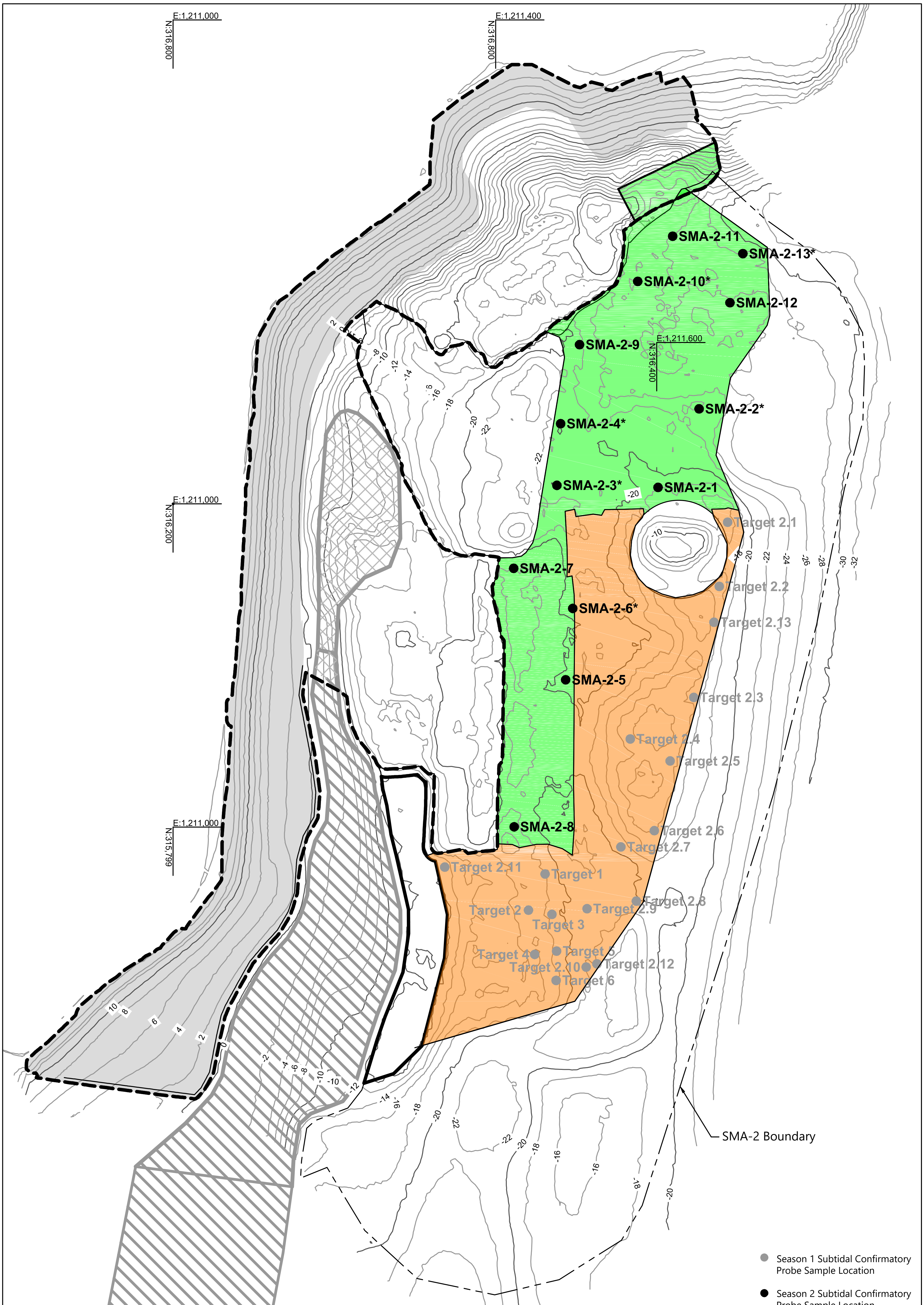
Figure 12
SMA-2 Confirmation Sample Locations



SOURCE: Bathymetry from eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Post-construction Mudline Contours (2' and 10' Interval)
- Sediment Management Area (SMA) Boundary
- Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
- Season 2Approx. Dredge/ Excavation Limits
- Transplanted Eelgrass Beds
- Eelgrass Beds
- Eelgrass Bench (Constructed in Season 1)
- Season 1 Approved Cap Area
- Season 2 Approved Cap Area

0 120
Feet

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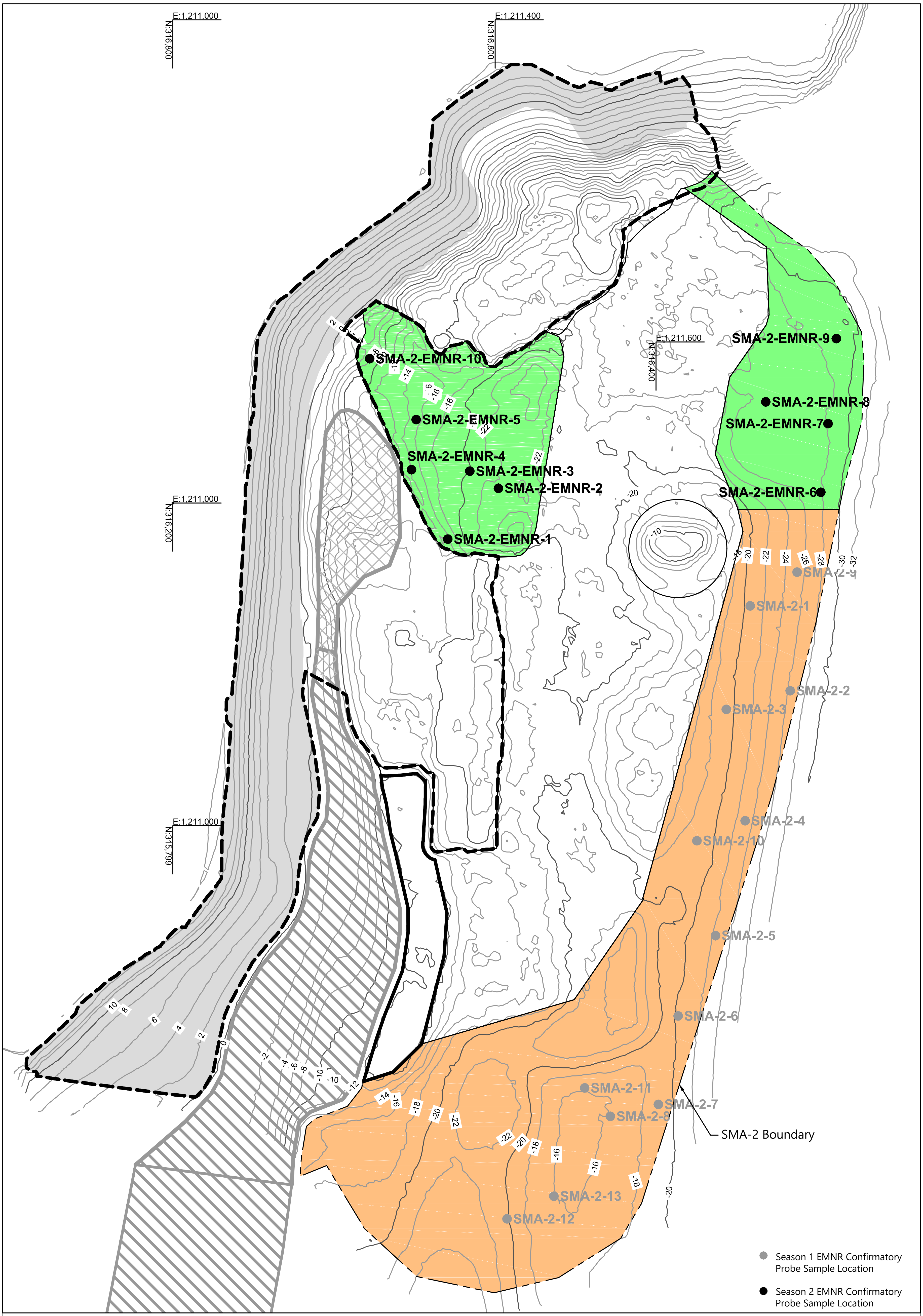
Figure 13
SMA-2 Subtidal Cap Verification Probing Locations



SOURCE: Bathymetry from eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:
- Post-construction Mudline Contours (2' and 10' Interval)
- Sediment Management Area (SMA) Boundary
- Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
- Season 2Approx. Dredge/ Excavation Limits
- Transplanted Eelgrass Beds
- Eelgrass Beds
- Eelgrass Bench (Constructed in Season 1)
- Season 1 Approved EMNR Area
- Season 2 Approved EMNR Area

0 120
Feet

Publish Date: 2017/05/03 4:22 PM | User: chewett
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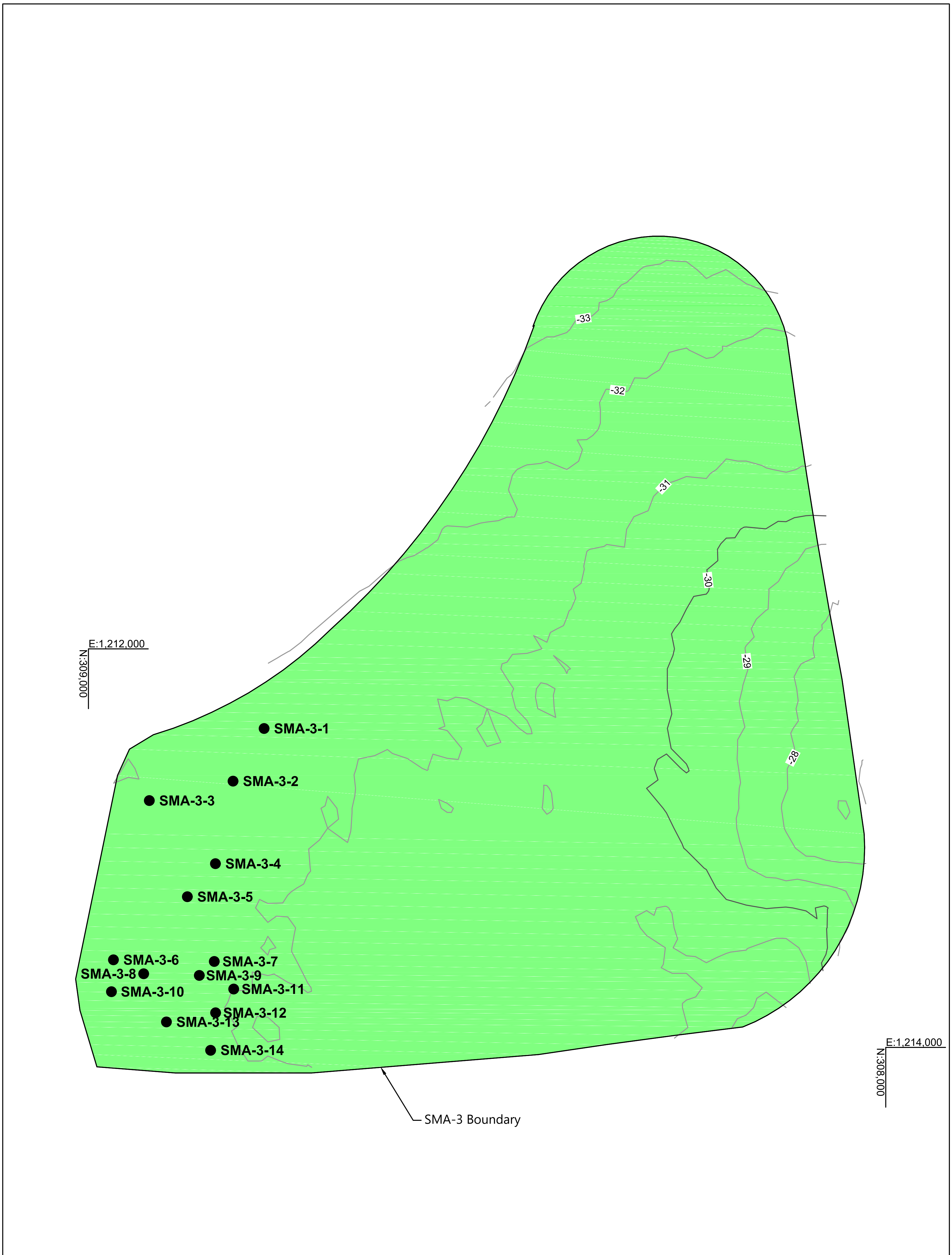
Figure 14
SMA-2 Subtidal EMNR Verification Probing Locations



SOURCE: Post-construction survey from eTrac, dated January 19, 2017.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

Post-construction Contours (2' and 10' Intervals)

Probe Sample Location

Approved EMNR Area (Verification by Probe and/or Bathymetric Survey)

0 250
Feet

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Figure 15
SMA-3 EMNR Verification Probing Locations

Cleanup Action Report – Season 2
Port Gamble Bay Cleanup Project