FINAL CLEANUP ACTION REPORT – SEASON 1
PORT GAMBLE BAY CLEANUP PROJECT

Prepared for

Pope Resources, LP/OPG Properties, LLC

Prepared by

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December 2016

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LIST OF ACRONYMS AND 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 State Department of Natural Resources
Ecology	Washington State Department of Ecology
EDR	*Engineering Design Report*
EMNR	enhanced monitored natural recovery
H:V	horizontal:vertical
lf	linear feet
Mill Site	Former forest products manufacturing facility
MLLW	mean lower low water
MSS	Marine Sampling Systems, Inc.
MTCA	Model Toxics Control Act
O&M	operation and maintenance
OMCI	Orion Marine Contractors, Inc.
P&T	Pope & Talbot, Inc.
PR/OPG	Pope Resources, LP/OPG Properties, LLC
RD	remedial design
RI/FS	remedial investigation/feasibility study
RMC	residuals management cover
SCO	sediment cleanup objective
Site	Port Gamble Bay Cleanup Project Site
SMA	Sediment Management Area
SMS	Sediment Management Standards
SPI	sediment profile imaging

sy	square yards
TEQ	toxic equivalents
TVS	total volatile solids
USACE	U.S. Army Corps of Engineers
WAC	Washington Administrative Code
Work Plan	Adaptive Management Work Plan

EXECUTIVE SUMMARY

This Season 1 Cleanup Action Report summarizes construction activities completed during the first year of the Port Gamble Bay Cleanup Project. Work was completed under Consent Decree (CD) 13-2-02720-0 between the Washington State Department of Ecology (Ecology) and Pope Resources, LP/OPG Properties, LLC (PR/OPG), entered in December 2013.

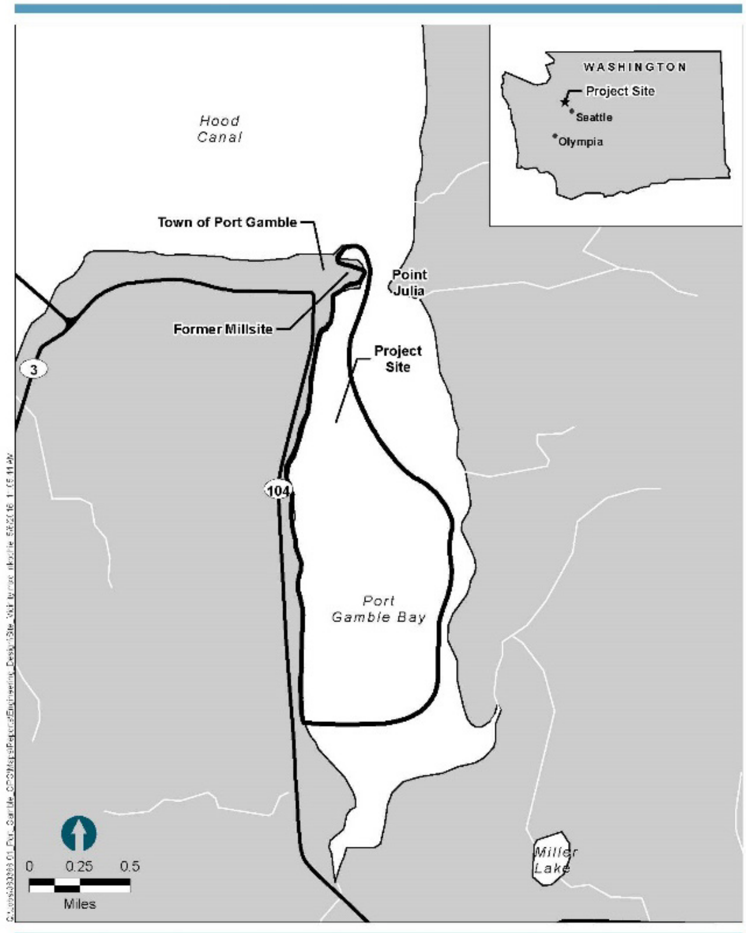

Figure ES-1 – Vicinity Map

This Season 1 Cleanup Action Report documents the work completed, discusses performance standards and construction quality control, and summarizes lessons learned to inform Season 2 work planning. Season 1 in-water construction was conducted between September 28, 2015, and January 19, 2016. Completion of the cleanup construction will require working in a second season; Season 2 activities will be documented in a subsequent Season 2 Cleanup Action Report.

Season 1 construction activities were implemented in accordance with the Ecology-approved design presented in the Engineering Design Report (EDR; Anchor QEA 2015), project Technical Specifications, 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 (cPAH) toxic equivalents (TEQ), dioxin/furan TEQ, and cadmium, as described in the Cleanup Action Plan (CAP; Ecology 2013).

Final approval and issuance of the required project permits occurred on August 14, 2015. PR/OPG subsequently contracted with Orion Marine Contractors, Inc. (OMCI) to rapidly initiate construction activities. Season 1 construction activities primarily occurred in Sediment Management Area 2 (SMA-2) with limited construction activity in SMA-1 and SMA-3. Construction activities performed and quantities completed during Season 1 are summarized in Table ES-1. 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 (CQAP). Construction activities were tracked to verify progress and best management practices (BMPs) throughout construction.

Table ES-1
Summary of Season 1 Construction Activities

Construction Activity	Location(s)	Description/ Quantity Completed
Demolition	SMA-2; SMA-5	Alder Chip Pier; Eastern Wharf; Pier 5; Breakwater; Overhead Chip Conveyor (46,000 square feet)
Pile Removal	SMA-2; SMA-5	3,314 piles
Intertidal excavation and capping	SMA-2	1,650 linear feet of shoreline (16,000 square yards)
Subtidal dredging	SMA-2	19,078 cubic yards
Subtidal capping	SMA-2	2.8 acres (26,860 cubic yards)
Subtidal cover	SMA-2	6.9 acres (7,058 cubic yards)

Figure ES-2 – Demolition of Eastern Wharf

Anchor QEA coordinated appropriate modifications to the Ecology-approved design as necessitated by field conditions, to meet the overall objectives of the project. Ecology oversaw the remedial activities, with regular site visits to observe construction activities.

PR/OPG and Ecology performed outreach and coordination during Season 1 to keep the public informed about the work. Anchor QEA performed environmental monitoring to ensure compliance with the approved design and permits. Table ES-2 summarizes the various outreach, coordination, and monitoring efforts performed and conducted by PR/OPG and Anchor QEA.

There were several lessons learned during Season 1 that are discussed in more detail in this report. Table ES-3 provides a high-level summary of the key lessons, which are being used during planning for Season 2.

Figure ES-3 – Subtidal Dredging in SMA-2

Table ES-2
Season 1 Outreach, Coordination, and Environmental Monitoring

• Vessel management coordination • Water quality monitoring • Noise monitoring • Archaeological monitoring • Shellfish tissue monitoring • Sediment verification sampling • Weekly updates with Ecology • Social media and weekly updates for the public

Figure ES-4 – Subtidal EMNR Placement

Table ES-3
Season 1 Lessons Learned

Issue	Issue	Lessons Learned
Pile removal	There were initial concerns with the ability to extract piles intact. Broken piles could lead to increased release of creosote to the environment.	Vibratory extraction methods tested during an initial pilot project proved effective at removing piles regardless of pile condition. Just two of the piles broke during extraction, and none required cutting and capping.
Risk for dive work	A tragic and fatal diver accident occurred on October 19, 2015. The police investigation report has not been released, but the cause of the accident does not appear to have been site-related.	Work demands being placed on divers should be minimized for their safety.
Night work and noise should have been permitted	Due to the fall construction and required "In the Dry" work, intertidal excavation was conducted during the lowest tides—at night. Kitsap County's noise ordinance exempts construction but only during the day. Construction noise exceeded the low 45 decibel (dB) standard for nighttime noise.	Because the affected area was within the property of the project proponent, Kitsap County determined that the project is exempt from the noise ordinance (Kitsap County Code Chapter 10.28 Sections 040 and 145). The specific exemption from the County was cited by the County as follows: *The following shall be exempt from all provisions of Sections 10.28.040 and 10.28.145:* *(6) Sounds created by emergency equipment and work necessary in the interests of law enforcement or for health, safety or welfare of the community;*
Subtidal dredging	Progress in subtitle dredging was delayed by the presence of debris. Greater consideration should have been given to switching to the clamshell bucket, which is a more effective tool in this circumstance.	Regularly assess progress and ensure adaptive management is responsive to ongoing conditions and schedule. Ecology has requested metrics and reporting requirements to address this issue in Season 2.

Table ES-3
Season 1 Lessons Learned

Issue	Issue	Lessons Learned
Water quality	Turbidity exceedances 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.	Similar turbidity exceedances are anticipated during Season 2. BMPs will continue to be used to manage water quality as practicable.
Intertidal cap	Storm events disrupted the intertidal cap, resulting in two effects: 1) Habitat material was displaced before it was integrated within the interstices of the armor layer. 2) Migration of armor material and compromise of the armor layer in the most exposed portions of the cap required replacement of armor material and monitoring to confirm the integrity of the cap.	Post-construction monitoring of designed structures, including the caps, is necessary for confirmation of design adequacy. When a test section of the cap received an additional layer of habitat substrate, it was observed by Ecology to infiltrate the interstitial spaces in the armor layer.
Soft sediment compression under cap material	Due to compression of sediment under the cap, there were questions as to the accuracy of bathymetric survey data in verifying cap depth. A different verification approach than identified in the EDR is necessary.	Through discussions, no single line of evidence provided strong proof that the design cap thickness was achieved. A process is being developed to address this for season 2.
Cleanup pass re-dredging	Due to prevalence of large wood debris at depth in the dredge prism, the vertical extent of wood waste could not be characterized accurately during design, requiring additional cleanup passes to remove wood waste, reducing overall dredge production rates.	Additional characterization data proved necessary. Supplemental jet boring performed during the off-season provided additional information to refine the dredge prisms, which should make remaining dredging more efficient.
Site Management BMPs	There is a continual need for housekeeping measures to control the loss of material from transloading, transport, stockpiling and road management, and to recover spilled material (based on the presence of dredged material spilled on portions of the site where trucks received and transported dredged sediments to the stockpile area).	Additional housekeeping measures should have been incorporated into a regularly scheduled maintenance routine. Season 2 construction will include additional emphasis on site housekeeping measures.

Table ES-3
Season 1 Lessons Learned

Issue	Issue	Lessons Learned
Constrained Season 1 schedule	The time available to dredge in Season 1 was limited by down time due to weather, equipment breakdown or reconfiguration, equipment present on site, staff and shifts available, and the need to sustain safe operating conditions.	The schedule for Season 2 must incorporate appropriate contingencies to ensure completion of the work and demobilization of the facilities as anticipated. Metrics must be established to compare estimated rates in the schedule with actual rates and initiate corrective measures. Quantities are to be tracked daily and will be summarized and presented to Ecology on a weekly basis in the weekly progress reports. Should actual production rates lag behind estimated rates, extra hours or work shifts will be added to maintain the estimated schedule.

1 INTRODUCTION

This Season 1 Cleanup Action Report summarizes construction and quality assurance activities performed during Season 1 remedial actions in Port Gamble Bay (the Site). Season 1 construction activities were implemented in accordance with the cleanup design and associated 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 the Washington State Department of Ecology (Ecology) and Pope Resources, LP/OPG Properties, LLC (PR/OPG), entered in December 2013.

The remedial activities described in this Season 1 Cleanup Action Report 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) WAC Chapter 173-204.

The term "Season 1" describes the in-water work period defined by the project permits. This report covers work completed between September 9, 2015, and February 4, 2016. Work in SMA-2 was targeted for completion in Season 1. Delays in acquiring permits, mobilizing equipment, and during construction resulted in deferring the completion of SMA-2 until Season 2. This required Pope Resources to request a Consent Decree schedule extension from Ecology. Additional sparging (rinsing with freshwater) and characterization of the stockpiled sediments and leachate continued between seasons. Completion of construction will require work in a second season; Season 2 work will be documented in a subsequent Season 2 Cleanup Action Report.

Construction activities performed at the Site during Season 1 included the following:

- Demolition and removal of creosote-treated structures and piles
- Intertidal excavation
- Subtidal dredging

- Intertidal and subtidal capping
- Placement of habitat substrate material
- Subtidal placement of enhanced monitored natural recovery (EMNR) material
- Construction of an eelgrass mitigation habitat bench
- Transloading of dredge sediments onto the former Pope & Talbot (P&T) sawmill facility (Mill Site) and into stockpiles

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 was 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). The pre-construction shoreline at the Mill Site contained aging creosote-treated-pile-supported structures and derelict piles. Pre-construction 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. Many of these operations took place on aquatic lands owned, operated, and/or 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 pilings from the Former Lease Area in 1996.

In 1986, PR was formed as a separate company as a result of the spinoff of certain timberlands from P&T. PR took the timberlands and acquired ownership of the uplands and adjacent tidelands subject to a $22.5 million mortgage, the proceeds of which P&T kept. P&T continued to operate the mill and wood products facilities until 1995, under a lease with PR. Mill operations ceased in 1995, and the sawmill facility was dismantled and mostly removed in 1997.

1.3 Summary of Previous Interim Actions

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

Additional standards were developed based on the highest of human health risk-based concentrations, natural background levels, and practical quantitation limits. Standards 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 as exceeding Site-specific cleanup standards in the EDR. 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 has 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 has 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 exceeding 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 suitable habitat for benthic organisms, shellfish, and forage fish. As such, engineered caps were designed to ensure that surface cap materials are maintained below Site-specific sediment cleanup levels. Cap designs were developed using upper-bound estimates of subsurface contaminant (especially cPAH) concentrations, including creosote-treated piles.

2.3 Summary of Deviations from Design

Season 1 construction activities were implemented in accordance with the cleanup design detailed in the EDR, (Anchor QEA 2015); however due to delays in acquiring permits, mobilization and construction were delayed approximately 10 weeks. Consequently, dredging and capping of wood waste in SMA-2 that had been scheduled for Season 1 was not completed. This was the subject of Pope Resource's request for a schedule extension, carrying this work over into Season 2. While performing subtidal dredging in SMA-2, additional wood waste material below the design elevation was encountered on the western slope of the dredge prism. In this area, sawdust-type wood waste was encountered at depths greater than the required dredge elevation on the 3 horizontal:1 vertical (H:V) slope. Additional investigations to delineate the extent of the remaining wood waste in this area is currently underway and the dredge prism in this area will be revised, in consultation with Ecology, to address this condition during Season 2. Completion of Season 1 construction activities will be accomplished during Season 2.

While not a deviation from the design, an additional requirement for the habitat substrate material type was added by Ecology during Season 1. The technical specifications defined the gradation for the habitat substrate material but did not specify that the material be rounded. It was Ecology's request that this material be rounded, as opposed to the angular material proposed by the contractor, Orion Marine Contractors, Inc. (OMCI). As such, PR/OPG directed OMCI to use a material from an alternate source to the originally proposed supplier in order to meet this request. Some of the rounded habitat substrate was redistributed during subsequent tide cycles, and Ecology requested PR/OPG to place additional material.

3 SEASON 1 CONSTRUCTION ACTIVITIES

Prior to issuance of the project permits by the U.S. Army Corps of Engineers (USACE), PR/OPG conducted a pilot pile-removal demonstration project in July 2015. Details on this element of the work are provided in Section 3.1.1.

On April 28, 2015, PR/OPG issued a Request for Qualifications to pre-qualify potential contractors and expedite the final selection process. PR/OPG submitted the Final EDR and Technical Specifications to Ecology on May 22, 2015. Ecology issued a National Pollutant Discharge Elimination System Construction Stormwater General Permit on May 28, 2015, and on June 18, 2015, USACE approval of the Nationwide Permit 38 (NWS-2013-1270) was received. On June 23, 2015, Requests for Proposals were issued to the pre-qualified contractors, followed by a pre-bid meeting and site walk on July 1, 2015, and bids were received on July 31, 2015. Ecology provided final review comments on the EDR and Technical Specifications on July 31, 2015, and PR/OPG received final approval from Ecology on the Technical Specifications on August 4, 2015. On August 7, 2015, revised final Technical Specifications incorporating Ecology's final review comments were issued to the bidders so they could adjust their bids accordingly. DNR approved the Sediment Remediation Easement on August 10, 2015. PR/OPG evaluated bids and awarded the contract on August 14, 2015, the same day that DNR approved the Right-of-Entry Agreement, which was the final required project permit. PR/OPG contracted with OMCI to perform the construction activities required to implement the remedial action in accordance with the Port Gamble Bay Cleanup Project Technical Specifications and Drawings. A fully executed contract between PR/OPG and OMCI was in place on September 4, 2015, and OMCI began to mobilize equipment to the Site on September 9, 2015. OMCI prepared the required work plan submittals, mobilized to the Site, and commenced site preparation activities. OMCI's work plans were sequentially reviewed and approved by Ecology. Site preparation activities performed to support the contract work included the following:

- Installation of temporary erosion and sediment controls
- Conduct pre-construction survey
- Setup of a contained creosote processing area
- Installation of a conveyor system in SMA-1 for loading clean capping material onto barges

- Construction of a temporary shoreline bulkhead for transloading material from barges to the upland stockpile area
- Setup of the upland stockpile area and perforation of impervious surfaces within the stockpile area to facilitate infiltration of stormwater and stockpile leachate
- Assembly and installation of on-Site truck scales
- Construction of a truck wheel wash
- Installation of marine access floats in SMA-1
- Stockpiling of clean capping materials

Figure 3 presents representative photos of the site preparation activities. The remedial action construction work performed during Season 1 is described in Sections 3.1 through 3.8. A timeline of the remedial action construction activities is shown on Table 2.

3.1 Structure Demolition and Pile Removal

For the demolition phase of construction, existing creosote and non-creosote-treated piles, dolphins, and structures were removed from both intertidal and subtidal areas of SMA-2 and the Eastern Wharf. Demolition work areas were enclosed within containment and sorbent booms during demolition and pile removal operations. Material barges used eco-block containment walls and plastic liners to contain creosote piles, timbers, and other debris. Fallen debris was removed from within the containment as work progressed.

Water quality monitoring was performed by Anchor QEA in accordance with the Water Quality Monitoring Plan, Appendix H of the Contract Specifications. The results of the water quality monitoring during Season 1 demolition and pile removal are included in the March 8, 2016, Port Gamble Bay Cleanup Project Water Quality Monitoring Season 1 Monitoring Results Memorandum, (Appendix A).

The following structures and areas were demolished as part of the Season 1 work:

- Intertidal piles in SMA-2
- The Alder Chip Pier
- Subtidal piles in SMA-2
- The Eastern Wharf

- Pier 5
- The Breakwater
- The Overhead Chip Conveyor

Table 3 summarizes the demolition timeline and equipment. Figure 4 presents representative photos of the demolition and pile removal activities. The demolition and pile removal work performed during Season 1 is described in Sections 3.1.1 through 3.1.5.

3.1.1 Pile Removal Pilot Demonstration and Requirements

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, reliability, ability to remove pilings intact, 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. During Season 1, no piles where encountered that could not be extracted using vibratory extraction methods; therefore, no piles were cut at depth below the mudline, and no amended cap material placement was required. During Season 1, 3,312 of the 3,314 pilings were removed intact.

3.1.2 Demolition and Pile Removal Equipment

The following equipment was used to conduct demolition and pile removal in SMA-2 and the Eastern Wharf during Season 1:

Water-based Equipment

- 100-ton Manitowoc 3900 Series 1 Crawler Crane
- KRS 110-54 Crane Barge (110-foot length, 54-foot width, and 11-foot draft)
- ICE Vibratory Hammer – Model 22 with a Paco Timber boot and ICE 300 Power Unit (on the Manitowoc 3900 Crane for pulling subtidal piles)

- 1,200-horsepower Redwood City Tug Boat (to position barges)
- KRS 181-2 Material Barge (180-foot length, 50-foot width, and 12-foot draft)
- KRS 110-4 Material Barge (110-foot length, 30-foot width, and 7-foot draft)

Land-based Equipment

- PC490 Komatsu Excavator
- ICE Vibratory Hammer – Model 14D and ICE Power Unit (with the PC490 for pulling intertidal piles)
- Hitachi EX300LC Excavator
- Light plants for low tide nighttime work

Processing Equipment

- A30C Volvo off-road dump trucks (hauling material to processing area)
- PC270 Komatsu Excavator (creosote processing area)
- Waratah Log Attachment – Model HTH 622 (on the PC270) for cutting piles to length
- Hitachi 245LC w/Breaker (breaking and processing concrete)
- John Deere 700 Dozer

3.1.3 Intertidal Pile Removal

Intertidal pile removal work started in the northern portion of the SMA-2 intertidal area in order to provide access from land to the nearshore Alder Chip Pier. A portion of this work was conducted during nighttime shifts to take advantage of the lowest tides. Following the demolition of the nearshore portions of the Alder Chip Pier, OMCI moved to the intertidal pile removal areas south of the Alder Chip Pier within SMA-2. Pile removal in both of these intertidal areas was performed prior to, and to facilitate, intertidal excavation and capping. Visible piles within the SMA-2 intertidal excavation footprint were removed prior to excavation. Some areas within this footprint had numerous piles not visible at the surface that needed to be removed after they were encountered during excavation. Overall, approximately 40% of the 990 intertidal piles removed from SMA-2 were not visible at the surface and were encountered during excavation, resulting in slower progress.

3.1.4 Pier and Breakwater Demolition

Decking and pier timbers accessible from the upland portions of the Site were removed using land-based excavators. Intertidal support pilings were removed during nighttime low tides using a land-based excavator and vibratory hammer. Subtidal support pilings were removed with the water-based crane and vibratory hammer. Portions of the pier decking were also removed by cutting the support piles with a chain saw and lifting the section of decking onto a material barge using the water-based crane. The breakwater was demolished by first cutting the horizontal timbers and then extracting the piles with the Manitowoc 3900 Crane and vibratory hammer. Skiffs and hand-held nets were used to remove small pieces of floating debris from the surface of the water.

3.1.5 Overhead Chip Conveyor Demolition

The conveyor structure and connected elevated pier sections were prepared and rigged for demolition; then the conveyor structure and connected elevated pier sections were demolished by toppling. The structures were rigged to land-based equipment (dozers and off-road dump trucks) and pulled toward land after support structures at the foundation were cut. Once the structures had been toppled, land-based excavators and the water-based crane were used to remove fallen sections of the structure from the water and shoreline. Skiffs and hand-held nets were used to remove small pieces of floating debris from the surface of the water. The removed sections of the structure were stockpiled in the upland processing area for subsequent disposal. Harbor Offshore, Inc., divers performed a final sweep of the area and assisted with removal of the remaining submerged conveyor debris.

3.2 Subtidal Dredging and Residuals Management Cover Placement

Subtidal dredging (elevations below +0 foot MLLW [mean lower low water]) was performed using the water-based dredging equipment described in Section 3.2.1. The contractor was required to dredge using a hydraulically actuated, fully enclosed Young bucket as the primary technology, with provisions to use alternate equipment if unable to achieve the required dredge grade with the hydraulically actuated closed bucket. Dredging was generally sequenced from higher elevations to lower elevations and working from south to north across SMA-2. Dredge material barges were equipped with sideboards and scuppers.

Scuppers were covered with filter fabric and hay bales, as required, to prevent discharge of unfiltered water. A turbidity curtain was deployed during all dredging activities.

Water quality monitoring was performed by Anchor QEA in accordance with the Water Quality Monitoring Plan, Appendix H of the Contract Specifications. The results of the water quality monitoring during Season 1 dredging in SMA-2 are included in the March 8, 2016, Port Gamble Bay Cleanup Project Water Quality Monitoring Season 1 Monitoring Results Memorandum (Appendix A).

3.2.1 Subtidal Dredging Equipment

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

- Komatsu PC 400 excavator with a 3.5 cy hydraulic Young bucket working off of the White Horse spud barge
- 100-ton Manitowoc 3900 Series 1 Crawler Crane with a 2.5 cy clamshell bucket working off of the Orion Crane Barge
- 1,200-horsepower Redwood City Tug Boat
- ITB 168 Sediment Barge (159-foot length, 50-foot width, and 11-foot draft)
- ITB 135 Sediment Barge (135-foot length, 34-foot width, and 9-foot draft)

During site preparation, a temporary transload bulkhead was installed to facilitate offload of the dredge material barges. The bulkhead was constructed of two Conex containers stacked on top of each other. The containers and the area behind them were backfilled with imported 2-inch minus fill material and rock from the SMA-2 shoreline. The exposed shoreline area along the sides of the transload facility was protected with armor rock removed from the shoreline in the southern area of SMA-2 and reused.

3.2.2 SMA-2 Subtidal Dredging

Subtidal dredging in SMA-2 began on November 6, 2015, using the Komatsu PC 400 excavator and 3.5 cy hydraulic Young bucket, working off of the White Horse spud barge. The SMA-2 dredge plan is shown on Figure 5. Work started in certification unit (CU)-1 at the southernmost end of SMA-2, and was generally sequenced from south to north across the site. A significant amount of larger wood debris and log rounds were encountered throughout CU-5 and the 2-foot cut area to the north of CU-5. In CU-10, sawdust-type wood waste was encountered at depths greater than the required dredge elevation on the 3H:1V slope. In one location, dredging indicated that the wood waste was significantly deeper than the design elevation. (See Section 2.3 for a discussion of additional delineation of wood waste deposits in this area.) A second Manitowoc 3900 crawler crane with a 2.5 cy clamshell bucket was mobilized to the site on December 4, 2015, and on December 18, 2015, it started dredging as a second rig in debris areas. Prior to being used for dredging as a second rig in debris areas, the 3900 crawler crane placed subtidal cap material in SMA-2, replacing the Rainer, which was demobilized from the Site on December 2, 2015. Continued reliance on the Young bucket in the presence of significant debris resulted in low production rates. The problem should have been identified and addressed earlier in the dredging window by switching to a cable-operated clamshell bucket in a timely manner.

3.2.3 SMA-2 Contingency Re-dredging

Following initial dredging and survey verification that required dredging elevations had been met for a CU, Anchor QEA and their subcontractor Marine Sampling Systems, Inc. (MSS), mobilized to the site to conduct post-dredging confirmation sampling within each CU and determine whether additional dredging was required. The details of the confirmatory sampling area discussed in Section 4.2.

Contingency re-dredging in areas identified by confirmatory samples was conducted from December 22, 2015, to January 5, 2016, by the PC400 Excavator and from December 29, 2015, to January 5, 2016, by the Manitowoc 3900 Crane. Out of the nine CUs dredged in Season 1, all but one CU (CU-3) required re-dredging (Table 4).

Table 4 summarizes the initial and contingency dredging timeline. A total of 19,078 cy of sediment were dredged during Season 1 (15,386 cy initial dredging and 3,691 cy contingency re-dredging). The average dredging production rate was approximately 477 cy per day during Season 1, with a maximum daily production of 912 cy.

3.2.4 SMA-2 Residuals Management Cover Placement

An average 6-inch-thick layer of residuals management cover (RMC) was placed over dredged CUs within SMA-2 as soon as practicable after final dredging. Placement of RMC began on December 23, 2015, and continued until January 11, 2016 (including 8 days of construction work). RMC placement within each dredged CU began following Anchor QEA's review and approval of post-dredge surveys and confirmatory sample data. The Manitowoc 3900 Crane and 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 11,769 square yards (sy) of RMC were placed during Season 1. The RMC placement rate averaged approximately 1,470 sy per day during Season 1. Figure 6 presents representative photos of the subtidal dredging and RMC placement.

3.3 Intertidal Excavation and Capping Activities

Intertidal excavation (above elevation +0 foot MLLW) was performed using land-based excavating equipment described in Section 3.3.1. The contractor 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 site. Although work was performed in the dry, a turbidity curtain was deployed in the water adjacent to excavation activities.

Water quality monitoring was performed during the first incoming tide covering the recently excavated and capped area. Anchor QEA conducted the water quality monitoring in accordance with the Water Quality Monitoring Plan, Appendix H of the Contract Specifications. The results of the water quality monitoring during Season 1 intertidal excavation in SMA-2 are included in the March 8, 2016, Port Gamble Bay Cleanup Project Water Quality Monitoring Season 1 Monitoring Results Memorandum (Appendix A).

3.3.1 Intertidal Excavation and Capping Equipment

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

- John Deere 650 Dozer
- John Deere 700 Dozer

- Komatsu PC490 Excavator
- Komatsu PC360 Excavator
- Komatsu 320 Loader
- Cat 966K Loader
- Komatsu HM300 Off-road Truck
- Volvo A30C Off-road Truck
- Volvo A30C Off-road Truck

3.3.2 Intertidal Excavation and Capping

Intertidal excavation and capping activities began on October 6, 2105, with removal and stockpiling of large riprap from the SMA-2 intertidal shoreline. On October 26, 2015, following the removal of riprap from the shoreline, OMCI began intertidal excavation and capping in SMA-2. All of the required intertidal excavation and capping in SMA-2 was completed during Season 1, with the exception of a small area in the footprint of Pier 4 and within a 25-foot buffer on each side of Pier 4. Pier 4 is the contingency transload location for Season 2 and will not be removed until the end of Season 2, when it is no longer needed. As such, intertidal excavation and capping in this area will be completed following the removal of the Pier.

Intertidal areas above elevation +0 foot MLLW were excavated “in the dry” using land-based equipment. To accomplish this, work shifts were scheduled during nighttime low tides in October, November, and December of 2015. Intertidal excavation progressed from south to north within SMA-2. Concrete and pile removal and demolition of intertidal structures occurred prior to excavation. Intertidal capping was completed concurrently with the excavation. At a minimum, the initial 6-inch 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 for filter material and armor was constructed within 2 days of excavation, generally within the same day or during the following work shift. Intertidal excavation and capping for Season 1 was completed on December 29, 2015.

Equipment used for the intertidal excavation work was land-based and included: excavators to excavate to the required depth, 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. Any equipment working on or hauling clean cap material was either kept off of the excavated material or decontaminated by pressure washing when transitioning to use on 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. Figure 7 presents representative photos of the intertidal excavation and capping.

3.4 Subtidal Capping, Enhanced Monitored Natural Recovery, and Eelgrass Bench Material Placement

Subtidal capping, EMNR material placement, and eelgrass bench material placement were performed using the water-based capping equipment described in Section 3.4.1. In accordance with the Contract Specifications, OMCI was required to place a 4-foot-thick subtidal sediment cap in areas of SMA-2 identified on the drawings. The contractor was also required to place an average 6-inch thickness of clean EMNR silt/sand material over subtidal sediment in the remaining area of SMA-2 identified on the drawings.

Capping was generally sequenced from south to north across the site; however, a buffer area was maintained between the dredge activity and cap footprint to minimize the potential for impacts to the clean cap material resulting from materials resuspended by dredging activities and for eelgrass to remain undisturbed. Cap material barges were loaded using the temporary conveyor system constructed in SMA-1 during site preparation.

Water quality monitoring was performed by Anchor QEA in accordance with the Water Quality Monitoring Plan, Appendix H of the Contract Specifications. The results of the water quality monitoring during Season 1 subtidal capping and EMNR material placement in SMA-2 are included in the March 8, 2016, Port Gamble Bay Cleanup Project Water Quality Monitoring Season 1 Monitoring Results Memorandum Season 1 (Appendix A).

3.4.1 Subtidal Capping, EMNR, and Eelgrass Bench Placement Equipment

The following equipment was used to conduct the subtidal capping, EMNR material placement, and eelgrass bench material placement in SMA-2 during Season 1:

- 165-ton DB Rainier Derrick Barge
- 100-ton Manitowoc 3900 Series 1 Crawler Crane working off of the ITB 104 Spud Barge (104-foot length, 36-foot width, and 9-foot draft)
- 4.5 cy Bombay Box
- Westar 204 Sand Barge (200-foot length, 45-foot width, and 14-foot draft)
- ITB 166 Sand Barge (159-foot length, 50-foot width, and 11-foot draft)

3.4.2 SMA-2 Subtidal Cap Placement

Subtidal cap placement in SMA-2 began on November 12, 2015, using the DB Rainier and Bombay box. The Bombay box is a 4.5 cy box with doors that open on the bottom. It is lowered into the water a few feet above the mudline and opened to place material. The DB Rainier was used for cap placement until December 1, 2015 (12 days), when it was demobilized from the site. On December 7, 2015, the Manitowoc 3900 Crane began placing subtidal cap using the Bombay box and continued until December 22, 2015 (12 days). A total of 11,312 sy of cap were placed during Season 1. Cap placement rate averaged approximately 470 sy per day during Season 1.

3.4.3 SMA-2 EMNR Material Placement

Placement of EMNR material in SMA-2 began on November 6, 2015, using the DB Rainier and Bombay box. The DB Rainier was used for EMNR placement until November 11, 2015 (4 days), before the DB Rainier began placing the 4-foot SMA-2 subtidal cap. On December 28, 2015, the Manitowoc 3900 Crane began placement of the EMNR material. The Manitowoc 3900 Crane placed EMNR with the clamshell bucket by slightly opening the bucket and spreading the material over the area to be covered, releasing it above the water surface. EMNR placement with the Manitowoc 3900 Crane continued until January 19, 2016 (8 days). A total of 21,677 sy of cap were placed during Season 1. The EMNR placement rate averaged approximately 1,800 sy per day during Season 1 overall for both placement methods and averaged approximately 2,300 sy per day using the clamshell bucket. Figure 8 presents representative photos of the subtidal capping, EMNR material placement, and eelgrass bench material placement.

3.4.4 Eelgrass Habitat Bench Material Placement

Placement of eelgrass habitat bench material began on October 27, 2015, using the DB Rainier and Bombay box. Material was placed working from the offshore portion of the bench toward shore and from south to north. The initial placement of eelgrass bench material using the DB Rainier was completed on November 4, 2015. In accordance with the Contract Specifications, the eelgrass bench was placed as early as possible to allow for maximum settlement and consolidation time in order to improve the likelihood of successful eelgrass growth. From December 29 to 31, 2015, OMCI leveled the surface of the eelgrass bench using the PC400 excavator working off of the White Horse barge with an I-beam. The surface of the bench was leveled to minimize depressions where organic material accumulations may inhibit eelgrass growth. The weight of the sand material compressed the underlying surface and required additional material to reach the -10 foot MLLW target elevation. OMCI placed additional material in the eelgrass bench on January 12, 13, and 18, 2016, as required to bring the area up to -10 feet MLLW.

3.5 Material Transload and Stockpiling

The following equipment was used for material transloading and stockpiling during Season 1:

- Komatsu HM300 Off-road Truck
- Volvo A30C Off-road Truck
- Volvo A30C Off-road Truck
- Liebherr Material Handler (off-loading barges at transload)
- Komatsu PC350 Long-reach Excavator (replaced Liebherr for off-loading)

Dredged material, piling, and demolition debris were offloaded at the temporary transload area described in Section 3.2.1. Dredge material was directly loaded into off-road dump trucks using the material handler or long-reach excavator and transferred to the temporary stockpile area in the southern portion of the Mill Site. 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 being offloaded and the upland side of the transload bulkhead where off-road dump trucks were loaded. Any material leaked from the material handler or long-reach excavator was contained on the spill apron. Regular maintenance of the spill apron was performed to remove accumulated material and place 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 9 presents representative photos of the transload and stockpiling.

3.6 Material Reuse

A portion of the large rock material removed from the SMA-2 shoreline was reused as temporary shoreline protection at the temporary transload facility bulkhead and at Pier 4. This material was not suitable for reuse as intertidal cap armor material due to its large size. No other materials were reused during Season 1 construction.

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

Daily construction oversight was performed by Anchor QEA to verify that construction activities were performed in accordance with the plans and specifications and to implement the construction quality assurance requirements of the Construction Quality Assurance Plan (CQAP). Construction activities were tracked to verify progress and the various best management practices (BMPs) required throughout construction were monitored and inspected. Daily inspection reports, including night work inspections, were prepared documenting progress, identifying any deficiencies, and corrective actions as needed.

Contractor submittals were reviewed and weekly construction progress meetings were held on site.

Anchor QEA's construction oversight also included identification of any field conditions that warranted deviation from the Ecology-approved design documents, and coordinating with the design team and Ecology to identify and agree upon 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 on site to discuss safety, environmental concerns, work progress and schedule, vessel traffic coordination, and other project concerns, as needed. Weekly summary progress reports were prepared and submitted to Ecology. Copies of the weekly reports are included in Appendix B. Ecology also provided oversight of the remedial activities, with regular site visits to observe the construction activities.

Anchor QEA conducted the sediment verification sampling in accordance with the requirements of the CQAP; the results of the sediment verification are discussed in Section 4.2.1. Environmental monitoring for water quality was performed in accordance with the Water Quality Monitoring Plan, Appendix H of the Contract Specifications. The results of the water quality monitoring during Season 1 are included in the March 8, 2016, Port Gamble Bay Cleanup Project Water Quality Monitoring Season 1 Monitoring Results Memorandum (Appendix A). 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 1 are included in the Archaeological Monitoring Report for Season 1 (Appendix C). Shellfish monitoring was performed in accordance with the Shellfish Monitoring Plan, Appendix N of the EDR. The results of the shellfish monitoring during Season 1 are included in the Shellfish Monitoring Report for Season 1 (Appendix D).

3.8 Season 1 Demobilization

On January 20, 2016, following the closure of the in-water work window, OMCI began demobilizing equipment for Season 1. 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.) was demobilized from the site, with the exception of the marine access floats in SMA-1. Upland equipment was demobilized from the site, with the exception of the Hitachi EX300LC and Komatsu PC400 excavators, and CAT 966K loader. The equipment remaining on site was retained for any general site maintenance required during the off-season. OMCI performed housekeeping in the creosote processing area, re-worked stockpiles into higher piles, and conducted maintenance on temporary erosion and sediment controls for the off-season. The material conveyor system in SMA-1, shoreline transload bulkhead, truck scale, and wheel-wash were left in place for use during Season 2.

4 PERFORMANCE STANDARDS AND CONSTRUCTION QUALITY CONTROL

The following section describes performance objectives established in the CQAP for the various remedial action tasks and describe how these objectives were achieved during construction.

4.1 Demolition and Pile Removal Quality Control

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

- Remove creosote-treated piles and structures from the Site to the maximum extent practicable
- Minimize potential residual contamination from creosote-treated pile removal
- Ensure that upland post-extraction processing of creosote-treated timber and piles 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

In order to achieve these performance objectives, OMCI counted and tracked all piles removed. To the extent practicable, piles in intertidal areas were pulled in the dry.

As discussed in Section 3.1.1, a pile removal pilot demonstration was conducted to identify the most effective method for extracting piles. The vibratory extraction methods identified during the pilot project, as well as the equipment sizes and types selected for use by OMCI, resulted in only two piles, 0.06% of the piles removed, breaking during piling extraction, and all piles being completely removed—a 100 percent success rate for pile extractions during Season 1.

Demolition and pile removal activities were sequenced to occur close in time to excavation, dredging, and capping activities, such that any residual impacts would be minimized and capped within a short timeframe. In areas outside of SMA-2 excavation and capping areas, habitat substrate material was placed over pile extraction areas shortly after piles were removed, generally during the same or following work shift.

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 piles and structures to be demolished per the construction plans. The DGPS and software also showed the operators the location of eelgrass beds to avoid any potential impacts to them.

Submerged piles were identified on the plans, and divers were utilized to locate and assist with extracting these piles. Additionally, the divers were able to determine the presence of multiple co-located piles and inspect the adjacent areas for any additional unidentified pile stubs.

Processing of creosote-treated piles and timbers was performed in the contained creosote processing area located on the uplands. Regular inspections and housekeeping were conducted to address any sawdust or other creosote residues identified outside of the containment. Cutting of piles was done either by holding the pile 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 pile removal activities were inspected for conformance with the plans and specifications. Pile removal activities were tracked to verify progress; pile removal tracking data are presented on Table 5. The BMPs required during demolition, pile 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 1 Certificates of Disposal for creosote and debris at the Columbia Ridge Landfill is included on Table 6.

4.2 Dredging and Excavation Quality Control

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

- Achieve the required dredge elevation or excavation thickness over 95% of the work 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 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

For subtidal dredging, OMCI utilized an excavator and crane equipped with GPS for accurate positioning of equipment. The Komatsu PC400 dredging excavator was equipped with a real-time kinematic global positioning system and the Manitowoc 3900 Crane was equipped with a differential global positioning system (DGPS). Hypack software was used to provide the operator a means of real-time tracking for horizontal positioning of the barge and bucket relative to the 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 or adjacent to eelgrass beds. The vertical position of the dredge bucket was determined 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 Manitowoc 3900 Crane) to provide positioning information to the equipment operator. A tide board was also surveyed and installed on Pier 4 to serve as a visual check of the electronic equipment.

In addition to the positioning methods used to control the dredging work, regular single-beam progress surveys were preformed to monitor dredging progress. Measurement of barge displacements were made and used in conjunction with 1 cubic foot sample weights from each barge to calculate the volume of dredged material excavated.

As part of the daily construction oversight performed by Anchor QEA, the subtidal dredging activities were inspected for conformance with the plans and 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 mobilized to the site to conduct post-dredging confirmation sampling. Sediment cores were collected to document the thickness, if any, of missed inventory or generated wood waste residuals in the dredging area. Where missed inventory (i.e., undisturbed residuals with greater than 15% TVS, at a thickness of 6 inches or greater) remained in the dredge area, an additional cleanup pass was performed prior to RMC placement.

Sediment cores were collected using vibratory methods at pre-determined 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).

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 for sample collection 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.

Additional dredging (contingency re-dredging) to remove missed inventory was required in eight of the nine CUs dredged during Season 1; the exception was CU-3. The final TVS results for z-layer samples are presented in Table 7 and the sample locations are shown on Figure 10.

After the completion of the contingency re-dredging and confirmation of z-layer samples with less than 15% TVS, Anchor QEA provided OMCI with approval to place RMC material as discussed in Section 3.2.4. 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 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 work to avoid impacts to nearby eelgrass beds. In accordance with the design, a buffer area between the intertidal excavation and adjacent eelgrass bed was maintained during construction. The SMA-2 intertidal cap area completed in Season 1 is shown on Figure 5a and SMA-2 intertidal cap cross-sections are shown on Figures 5b and 5c.

As part of the daily construction oversight performed by Anchor QEA, the intertidal excavation activities were inspected for conformance with the plans and 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 noted, 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

Sources of suitable cap and cover sediment material were not available from regional navigation maintenance dredging projects during Season 1, primarily because of USACE's reluctance to allow use of clean federal maintenance dredging materials at MTCA/SMS cleanup sites. Instead, upland commercial sources were used by OMCI; sampling results for the proposed materials were submitted to Anchor QEA for approval prior to use. Testing included chemical analysis per Table 352026-1 of the Project Specifications, in situ moisture content (ASTM method D2216), and grain size distribution (ASTM method D422-63). The following materials and material sources met the suitability criteria described in the Project Specifications, and were approved for use:

- Filter Material (Pyramid Materials – Silverdale, Washington)
- Type 1 Armor Material (New Shine Quarry – Hood Canal, Washington)
- Type 2 Armor Material (New Shine Quarry – Hood Canal, Washington)
- Type 3 Armor Material (New Shine Quarry – Hood Canal, Washington)
- Habitat Substrate (Pyramid Materials – Silverdale, Washington)
- SMA-2 Subtidal Cap, RMC, and EMNR sand (Zimmer Gravel Pit – Poulsbo, Washington)

In addition to the pre-construction testing, visual observations of the materials were made as part of the daily construction oversight performed by Anchor QEA. No notable changes in the type of materials being used for capping and EMNR were identified during Season 1.

OMCI initially submitted a habitat substrate material from New Shine Quarry. This material met the requirements of the technical specifications; however, the material was not "rounded"; Ecology required a rounded habitat substrate material. As such, OMCI was redirected to use the alternate, rounded material identified above. Material source testing results are included in Appendix E.

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 for accurate positioning of equipment. Hypack software was used to provide 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 or adjacent to eelgrass beds. 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 serve as a visual check of the electronic equipment. 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, EMNR, and RMC material placement volume and area measurements, based on the barge displacements and bucket placement logs, are presented on Tables 8, 9, and 10.

As part of the daily construction oversight performed by Anchor QEA, the subtidal cap construction, EMNR material placement, and RMC material placement activities were inspected for conformance with the plans and 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 determine compliance with material placement thickness requirements.

Additionally, material volume and area measurements provided by OMCI were compared to theoretical quantities. Based on a review of the volumetric thickness of material placed:

- The SMA-2 subtidal cap average thickness placement was 5.2 feet, with no daily placement thickness calculation less than 4.3 feet
- The SMA-2 EMNR thin-layer average thickness placement was 7.1 inches, with no daily placement thickness calculation less than 4.9 inches
- The SMA-2 RMC average thickness placement was 8.4 inches, with no daily placement thickness calculation less than 4.3 inches

4.3.3 Subtidal Cap and EMNR Placement Contingency Measures

Areas where the required cap or EMNR placement thickness had been achieved (based on a comparison of pre- and post-placement bathymetric surveys, and a review of placed quantities) were approved as complete. In some areas, comparisons of pre- and post-placement bathymetric surveys did not confirm that the required cap or EMNR placement thickness had been achieved, despite documentation that more than adequate material had been placed. This was due to subgrade settlement under the weight of the new material, and/or the accuracy of the survey methods themselves. In cases where the required cap or EMNR thickness could not be confirmed using the survey information, additional confirmatory measures were implemented. Additional confirmatory measures included a review the bathymetric survey results for any indication of mounding, high spots, or other anomalies that would indicate that placement was uneven, and collection of supplemental information to confirm that the required cap or EMNR thickness had been met, as discussed below.

4.3.3.1 Subtidal Cap Construction Additional Confirmatory Measurements

Cap thickness in some areas of the SMA-2 subtidal cap could not be confirmed using bathymetric survey data alone and required collection of supplemental information to measure the cap thickness. A steel probe was used to assess as-built thickness by advancing the probe through the cap, and measuring the thickness of the cap 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 cap, as determined from bathymetric surveys. For SMA-2, 19 push probe locations were advanced to confirm cap thickness. Figure 11a presents probe locations within the SMA-2 subtidal cap where thickness verification measurements were made by probing. The SMA-2 subtidal cap thickness verification measurements are shown on Table 11. Based on these measurements, the required cap thickness in the area of SMA-2 completed during Season 1 was verified; no additional material placement in this area is required to achieve performance standards.

4.3.3.2 EMNR Material Placement Additional Confirmatory Measurements

Material placement thickness in some EMNR areas of SMA-2 could also not be confirmed using bathymetric survey data alone, requiring collection of supplemental information. A Van Veen sampler was used to collect a surface sample from EMNR areas and access the as-built thickness of the EMNR material layer. The EMNR sand layer was easily identified visually in the grab samples, and the thickness of the sand cover over the native material was physically measured in each sample. The confirmatory grab sample locations targeted the relatively thinner areas of the EMNR placement area, as determined from bathymetric surveys. For SMA-2, 13 EMNR area locations were sampled to confirm material placement thickness. Figure 11b presents the grab sample locations within the SMA-2 EMNR area. The SMA-2 EMNR thickness verification measurements are shown on Table 12. Based on these measurements, the required thickness of EMNR material in the area of SMA-2 completed during Season 1 was verified; no additional material placement in this area was required to achieve performance standards.

A revised CQAP detailing these additional cap and EMNR material placement verification contingency procedures has been submitted to Ecology and is being finalized based on Ecology comments.

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 document 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, and a silt curtain was deployed in the water adjacent to intertidal cap material placement to avoid impacts to 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-2 intertidal cap area completed in Season 1 is shown on Figure 5a, and SMA-2 Intertidal Cap Cross Sections are shown on Figures 5b and 5c.

As part of the daily construction oversight performed by Anchor QEA, the intertidal cap construction activities were inspected for conformance with the plans and specifications. Intertidal cap construction progress was tracked and as-built survey data provided by OMCI were reviewed. 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.

4.4 Eelgrass Bench Construction Quality Control

The eelgrass bench construction performance objectives include the following:

- Construct the bench elevation at approximately -10 feet MLLW
- Minimize depressions where organic material could accumulate that would inhibit eelgrass growth
- Avoid impacts to existing eelgrass beds during material placement work, including no disturbance by spudding, anchoring, dredging, and material placement

Methods to achieve these performance objectives are described below. For eelgrass bench construction material placement, OMCI utilized the DB Rainier and the Manitowoc 3900 Cranes. Initial placement was done by the DB Rainier, and subsequent placement was done by the Manitowoc 3900 Crane. Hypack software was used to provide the crane operator with real-time tracking for horizontal positioning of the barge and bucket relative to the eelgrass bench footprint, project stationing, and other site features. Eelgrass beds were identified on the Hypack software, allowing the operators to avoid spudding, anchoring, and placement of material in or adjacent to existing eelgrass beds. 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 serve as a visual check of the electronic equipment. For each bucket of eelgrass bench 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 preformed to monitor bench construction progress, and measurement of barge drafts were made and used in conjunction with 1 cubic foot sample weights of bench material to calculate and track the volume of material placed. Daily bench material volume and area measurements, based on the barge displacements and bucket placement logs, are presented on Table 13. Following the initial placement and material settlement time period, the surface of the bench was leveled to minimize depressions where organic material could accumulate that would inhibit eelgrass growth.

As part of the daily construction oversight performed by Anchor QEA, the eelgrass habitat bench construction activities were inspected for conformance with the plans and specifications. The BMPs required during material placement were monitored and inspected. Daily inspection reports were prepared documenting progress, identifying any deficiencies, and corrective actions as needed. Following completion of the initial placement of bench material, settlement/compaction timeframe, and leveling, the progress survey was reviewed to evaluate compliance with lines and grades shown on the construction drawings. Anchor QEA reviewed the post-leveling survey on January 11, 2016, and informed OMCI that additional material placement was required in areas that were below -10 MLLW. OMCI placed additional material on January 12 and 13, 2016. An updated survey was reviewed by Anchor QEA on January 15, 2016, and, while many areas had been brought up to -10 MLLW, there was still some additional material required along the offshore edge of the bench. OMCI placed additional material along the offshore edge of the bench to bring the area up to -10 MLLW on January 18, 2016. The final eelgrass bench as-built is shown on Figure 12.

5 OBSERVATIONS AND LESSONS LEARNED FROM SEASON 1

The following sections summarize lessons learned and general observations from Season 1 construction that are being used to inform the Season 2 work planning.

5.1 Night Work and Public Expectations and Communications

The intertidal excavation activities needed to be conducted at night due to the timing of low-tide events during the scheduled work. The State Environmental Policy Act permit requirements called for the work to comply with local noise ordinances. A noise variance was not obtained prior to the start of work, and noise complaints from residents could have potentially stopped work at night and significantly impacted the intertidal excavation and capping progress. The Kitsap County noise ordinance is very stringent and requires noise levels at receiving properties to be under 45 decibels for nighttime work in rural residential areas (between 10:00 pm and 7:00 am), but exempts construction work during the day. This level is a difficult to meet for any type of construction, and measurements taken during Season 1 work activities indicated a potential to exceed the Kitsap County noise ordinance. Background noise (e.g., seagulls or local traffic) also exceeds Kitsap County's nighttime noise ordinance. Kitsap County recently verified that the Season 2 construction activities are exempt from the noise ordinance per 10.28.040 and 10.28.145.

5.2 Intertidal Excavation Progress

During the planning phase of the project, there was some concern about whether there would be enough time to complete the planned Season 1 intertidal excavation during the allowable work window. The contractor conducted intertidal excavation and capping efficiently, and there were no significant unplanned delays in this work. During Season 1, 1,650 linear feet (lf) of shoreline were excavated and capped during 30 shifts, resulting in an average production rate of 55 lf of shoreline per shift. The success of completing the planned intertidal excavation on schedule is attributed in part to the contractor's experience with similar work conducted on another project in Puget Sound.

5.3 Pile Removal

Another key goal of the cleanup project is to remove as many creosote-treated piles as possible, limiting the need for cutting or breaking off piles in place to the maximum extent practicable. Given the age of the piling, and their generally deteriorated condition, it was anticipated that complete removal of some piles could pose a challenge. Challenging pile removal requiring additional time, effort, and potentially cutting and capping were anticipated during the planning stage, but the need for the planned contingencies was not encountered during Season 1 construction. While there is still potential to encounter these types of piles during Season 2, the likelihood of finding large numbers of difficult piles in Season 2 is reduced, based on the observations made in Season 1. During Season 1, 3,314 piles were extracted over 98 shifts, averaging 15 piles removed per shift from the upland, and 27 piles per shift during water-based demolition.

5.4 Intertidal Excavation Buried Piling

There were a large number of buried intertidal piles that were not visible until the intertidal excavation was conducted. Although it was anticipated during project planning that there would be piling encountered that were not visible at the surface prior to excavation, the percentage of buried piles was higher than expected for SMA-2. Approximately 40% of the 990 intertidal piles removed from SMA-2 were not visible at the surface and were encountered during excavation.

5.5 Subtidal Dredging Production Rates

As a permit condition, subtidal dredging during Season 1 was limited to a very short window, and during winter weather, between November 1 and January 15. The restricted work window for subtidal dredging did not allow for sufficient time to complete the dredging in SMA-2 during a single season. During Season 1, the contractor removed 19,078 cy by subtidal dredging over 40 shifts, averaging 477 cy per shift.

PR/OPG, Anchor QEA, and OMCI are pursuing additional measures to increase dredging production in Season 2, including permit modifications to allow dredging to begin on October 17, 2016, deployment of additional dredging equipment, and increasing scheduled hours. The goal of these measures is to ensure that the remaining remedial action work is completed in Season 2.

In addition to the actions described above, PR/OPG and Orion have developed the following contingencies to maintain Schedule progress:

- **Initial production rate check-in meetings:** After 1 to 2 weeks of capping progress, and after 1 week of dredging progress, PR/OPG and the contractor will hold an initial production rate check-in meeting to compare actual observed rates with the rates assumed in the Schedule. If actual production rates are lower than expected, correction measures will be discussed and implemented if necessary.
- **Weekly production tracking:** Quantities will be tracked based on daily contractor reports, and will be summarized on a weekly basis. This information will be shared with Ecology during our weekly meetings. Cumulative production will be presented and compared to the required production necessary for completing the in-water work on schedule.
- **Shift additions:** In the event that production rates are not meeting required targets, the contractor has committed to adding hours and/or work shifts to maintain the schedule. These shifts could include night work and weekend work as necessary.

5.6 Shellfish Monitoring Observations

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 D, are summarized below:

- Biotoxin results during construction were below detection limits.
- PAH concentrations in shellfish tissue and water column passive samplers during construction were similar to or slightly elevated (within a factor of roughly two-fold)

compared to baseline levels, but were well below the intermediate-duration shellfish consumption screening criterion.

- Cadmium concentrations in shellfish tissue during construction were similar to or lower than baseline concentrations, and were also below the natural background screening criterion.
- Dioxin/furan concentrations in shellfish tissue during construction were similar to or lower than baseline concentrations, and were also below the intermediate-duration shellfish consumption screening criterion.
- Polychlorinated biphenyl concentrations in shellfish tissue during construction were similar to or lower than baseline concentrations, and were also at or below the intermediate-duration shellfish consumption screening criterion.

Building on these data, relatively minor modifications to the 2016/2017 shellfish monitoring program are recommended in Appendix D.

5.7 Water Quality Observations during Dredging

Mechanical dredging was conducted with both a hydraulically closing bucket and a wireline closing clamshell bucket. Silt curtains were deployed around the dredging operation, and water quality monitoring was conducted by Anchor QEA. The mechanical dredging equipment and associated BMPs used during Season 1 were effective at meeting water quality standards. Dredging with the clamshell bucket and crane did not have an observably different effect on water quality when compared to the hydraulically closing excavator bucket.

5.8 Subtidal Dredging in Areas with Debris

The hydraulically closing bucket was inefficient when dredging in areas where debris was encountered. The hydraulically closing bucket could not be entirely closed when larger debris, such as logs, were encountered. Provisions in Season 2 to change over to a clamshell bucket as soon as debris are encountered will improve efficiency and production rates in areas with debris. Handling and clamping down on debris with the hydraulically closing bucket also stresses the hydraulics, further reducing efficiency, with potential down-time for maintenance and break-downs.

5.9 Turbidity Exceedances from Clean Cap Material

Water quality was monitored by Anchor QEA during all in water work, in accordance with the Water Quality Monitoring Plan. In general, there were very few exceedances. Two exceedances of turbidity criteria were measured during subtidal dredging operations, and were rapidly corrected. The remainder of the water quality exceedances observed during Season 1 monitoring were associated with clean material placement. Exceedances during clean material placement were anticipated during remedial design, are consistent with experience on other projects. Consistent with expectations described in the Water Quality Monitoring Plan, similar turbidity exceedances are anticipated during Season 2 clean material placement. Anchor QEA will continue to monitor water quality and the contractor will continue to employ BMPs to minimize the potential for turbidity exceedances during Season 2.

5.10 Intertidal Cap Stability

Sections of the upper intertidal shoreline that had been capped with Type 2 armor were disturbed by storm events in March 2015, displacing both armor material and habitat substrate. The armor material was most heavily impacted on the south-facing shoreline of SMA-2, with migration of smaller armor material to the toe of the slope and some compromising of armor layer integrity at the mid- to upper-tidal elevations. Nine-inch minus material placed on the slope adjacent to the intertidal excavation areas migrated, resulting in many rocks on the beach. These areas are located west of Pier 4 and included one 20- to 30-foot-long section.

Habitat substrate was placed on the surface of the armored cap along the shoreline, in accordance with the design. Because the grain size of this material is too small to be stable under breaking waves, the design anticipated that habitat substrate material would migrate vertically and laterally within the intertidal zone. This anticipated migration of the rounded habitat material was observed along the intertidal cap slopes that were constructed in Season 1.

At the request of Ecology, an additional layer of habitat substrate was placed over a test section of cap to infiltrate interstitial spaces in the armor layer due to a storm event immediately after the initial construction. After the second placement, the habitat substrate was observed by Ecology to fill the armor layer interstices. Based on a coastal geologic reconnaissance assessment of the constructed SMA-2 shoreline, habitat substrate material appears to be moving dynamically through this area.

5.11 Subtidal Cap and EMNR Thickness Verification

Subtidal cap thickness was not verifiable in some areas using bathymetric survey data due to the consolidation of subgrade materials beneath the cap. Probing the cap with a long, small-diameter steel probe was an effective tool used as an additional measure for verifying the in-situ cap thickness.

Similar to the subtidal cap areas, the EMNR material placement was not able to be verified in some areas using bathymetric survey data either due to the consolidation of subgrade materials, and/or because of the accuracy of survey methods to measure thin cover thickness. Additional methods are being developed to use during Season 2 to verify in-situ thin layer material placement thickness.

5.12 Weather Delays

There were 4 days during the Season 1 construction season where work was completely stopped or altered due to weather conditions. There were approximately 10 additional days where production rates were reduced due to wind, but work did not stop. Similar weather delays are expected and measures including, but not limited to, additional hours or equipment are being scheduled and planned for during Season 2.

5.13 Tide Variation from Predicted Elevations

Planning of the work often used predicted tides; however, all construction activities were based on the measured actual tide using an on-site tide gage installed for the cleanup project. Significant variations between predicted and actual tides were observed at times during construction. During Season 1, there were a number of planned work-shifts targeting low-tides less than 0 MLLW where the actual tide did not get as low as predicted. In some of these cases, work needed to be canceled or cut short. Scheduling for Season 2 is including contingencies for actual versus predicted tides by conducting as much low-tide work during the summer months as possible so that there will be additional time available if needed to complete work in the dry.

6 REFERENCES

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TABLES

Table 1
Sediment Cleanup Levels

Chemical of Concern	Site-specific Cleanup Level
Toxicity due to wood waste breakdown products	SCO numeric biological standards described in WAC 172-204-320(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
Season 1 Construction Timeline

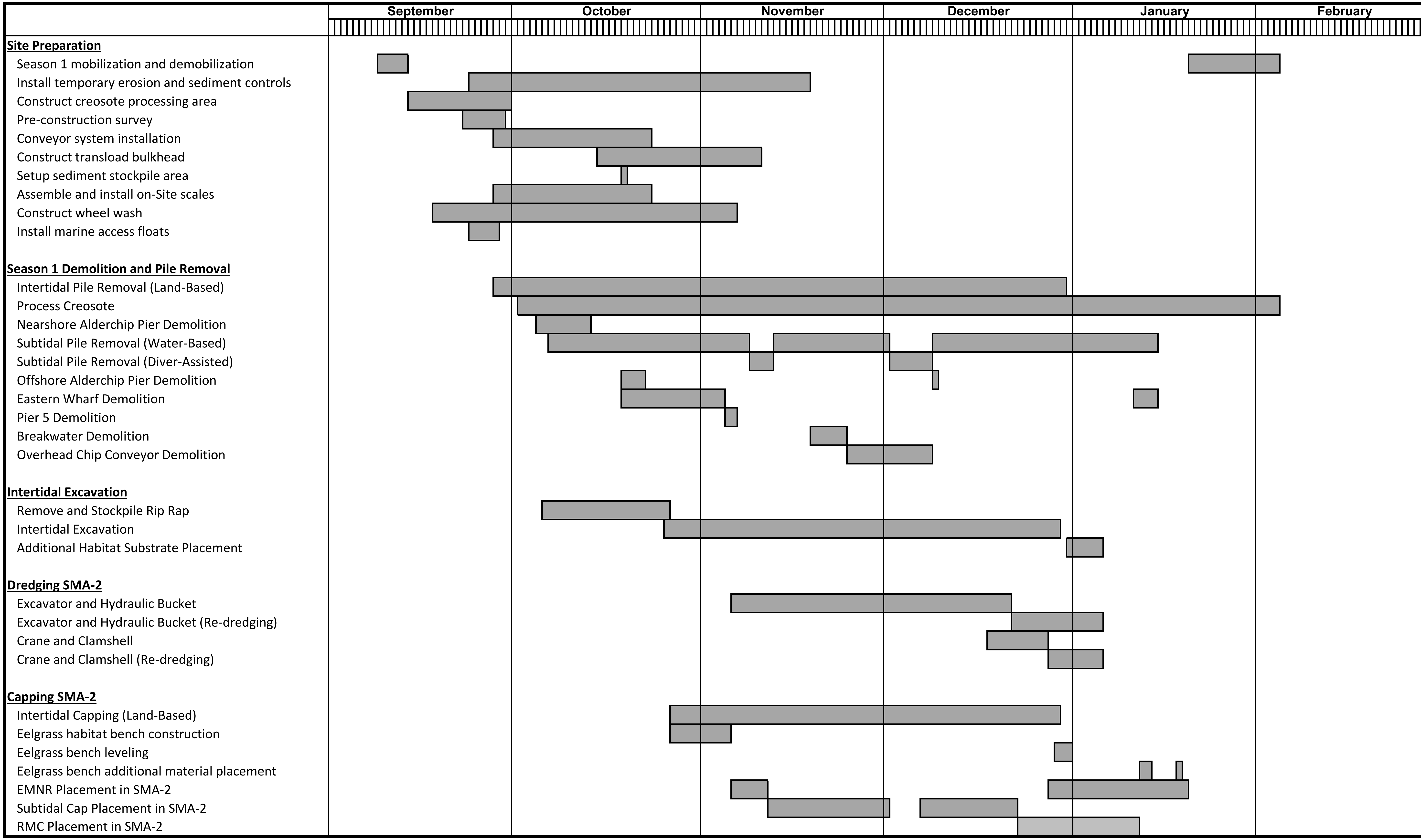


Table 3
Summary of Demolition Timeline and Equipment

Demolition Activity	Date Started	Date Completed	Primary Equipment	Notes
Intertidal Pile Removal	9/29/15	12/30/15	• PC490 Komatsu Excavator • ICE Vibratory Hammer – Model 14D • Hitachi EX300LC Excavator • Light plants for low tide nighttime work	Work was performed in the dry and work areas were enclosed within containment and sorbent booms. Fallen debris were removed from within the containment as work progressed.
Creosote Demolition Debris Processing	10/2/15	2/3/16	• A30C Volvo off-road dump trucks • PC270 Komatsu Excavator (w/ Waratah Log Attachment) • Hitachi 245LC w/Breaker	Piles were cut into 4-foot lengths, as required for disposal. Work was conducted inside of the upland creosote processing area, constructed with a perimeter wall of ecology blocks, a 20-mil plastic containment liner, and a layer of hog fuel over the liner.
Nearshore Alder Chip Pier Demolition	10/5/15	10/13/16	• 100-ton Manitowoc 3900 Series 1 Crawler Crane on the KRS 110-54 Crane Barge • ICE Vibratory Hammer – Model 22 • 1,200-horsepower Redwood City Tug Boat • KRS 181-2 and KRS-110-4 Material Barges • PC490 Komatsu Excavator • ICE Vibratory Hammer – Model 14D • Light plants for low tide nighttime work	Work areas were enclosed within containment and sorbent booms. Fallen debris were removed from within the containment as work progressed. Sawdust from cutting with chainsaws was contained as cuts were made, using either plastic tarps or containers. A small section of Pier supporting the offshore end of the Overhead Chip Conveyor was demolished with the Overhead Chip Conveyor.
Offshore Alder Chip Pier Demolition	10/19/15	10/22/15		
Subtidal Pile Removal – Nearshore Alder Chip Pier	10/7/15	10/14/15	• 100-ton Manitowoc 3900 Series 1 Crawler Crane on the KRS 110-54 Crane Barge • ICE Vibratory Hammer – Model 22 • 1,200-horsepower Redwood City Tug Boat • KRS 181-2 and KRS-110-4 Material Barges	Removal of pier support pilings conducted as part of pier demolition activities. OMCI contracted with Harbor Offshore, Inc. (HOI), for dive services. Divers were used to locate submerged pile stubs and guide the crane operator while placing the vibratory hammer on the underwater pile to extract it.
Subtidal Pile Removal - Offshore Areas in SMA-2 (visible piles)	10/14/15	10/16/15		
Subtidal Pile Removal – Offshore Alder Chip Pier	10/19/15	10/26/15		
Subtidal Pile Removal – Eastern Wharf	10/26/15	1/14/16		
Subtidal Pile Removal - Offshore Areas in SMA-2 (submerged piles)	11/9/15	11/12/15		

Demolition Activity	Date Started	Date Completed	Primary Equipment	Notes
Subtidal Pile Removal – Sensitive Habitat and Breakwater (submerged piles)	12/2/15	12/8/15		
Eastern Wharf Demolition (Southern Portion)	10/26/15	11/5/15	• 100-ton Manitowoc 3900 Series 1 Crawler Crane on the KRS 110-54 Crane Barge • ICE Vibratory Hammer – Model 22 • 1,200-horsepower Redwood City Tug Boat • KRS 181-2 and KRS-110-4 Material Barges • PC490 Komatsu Excavator • ICE Vibratory Hammer – Model 14D • Light plants for low tide nighttime work	Work areas were enclosed within containment and sorbent booms. Fallen debris were removed from within the containment as work progressed. Sawdust from pile cutting with chainsaws was contained as cuts were made, using either plastic tarps or containers.
Eastern Wharf Demolition (Northern Portion)	11/13/15	1/14/16		
Pier 5 Demolition	11/5/15	11/6/15		
Breakwater Demolition	11/19/15	11/24/15		
Overhead Chip Conveyor Demolition	11/25/15	12/8/15	• 100-ton Manitowoc 3900 Series 1 Crawler Crane on the KRS 110-54 Crane Barge • ICE Vibratory Hammer – Model 22 • 1,200-horsepower Redwood City Tug Boat • ICE Vibratory Hammer – Model 14D • A30C Volvo off-road dump trucks • John Deere 700 Dozer	Containment and sorbent booms were deployed around the work area.

Table 4

Summary of Initial and Contingency Dredging Timeline

Location	Dredge Pass	Equipment	Date Started	Date Completed
CU-1	Initial Dredging	PC400 Excavator	11/6/15	11/11/15
CU-2	Initial Dredging	PC400 Excavator	11/11/15	11/13/15
CU-5	Initial Dredging	PC400 Excavator	11/13/15	11/30/15
CU-3	Initial Dredging	PC400 Excavator	12/1/15	12/3/15
CU-5	Initial Dredging	PC400 Excavator	12/4/15	12/8/15
CU-4 and CU-7	Initial Dredging	PC400 Excavator	12/9/15	12/14/15
CU-10	Initial Dredging	PC400 Excavator	12/15/15	12/22/15
CU-8 and CU-9	Initial Dredging	3900 Crane	12/18/15	12/21/15
CU-6	Initial Dredging	3900 Crane	12/21/15	12/28/15
CU-1 and CU-2	Re-dredging	PC400 Excavator	12/22/15	12/23/15
CU-5 and CU-7	Re-dredging	PC400 Excavator	12/24/15	1/5/16
CU-6	Re-dredging	3900 Crane	12/28/15	12/28/15
CU-4	Re-dredging	3900 Crane	12/29/15	12/30/15
CU-9	Re-dredging	3900 Crane	12/31/15	12/31/15
CU-8	Re-dredging	3900 Crane	1/4/16	1/5/16

Table 5
Season 1 Pile Removal Tracking

Date	Cut off Piles	Subtidal Treated	Subtidal Untreated	Intertidal Treated	Intertidal Untreated	Daily Total	Area
09/28/15	0	0	0	1	0	1	Nearshore Alder Chip Pier
09/29/15	0	0	0	1	0	1	Nearshore Alder Chip Pier
09/30/15	0	0	0	0	0	0	Nearshore Alder Chip Pier
10/01/15	0	0	0	21	20	41	Nearshore Alder Chip Pier
10/02/15	0	0	0	29	20	49	Nearshore Alder Chip Pier
10/05/15	0	0	0	0	0	0	Nearshore Alder Chip Pier
10/06/15	0	0	0	50	20	70	Nearshore Alder Chip Pier
10/07/15	0	0	0	17	0	17	Nearshore Alder Chip Pier
10/08/15	0	98	0	29	0	127	Nearshore Alder Chip Pier
10/09/15	0	29	0	12	0	41	Nearshore Alder Chip Pier
10/12/15	0	86	0	2	0	88	Nearshore Alder Chip Pier
10/13/15	0	51	0	58	14	123	Nearshore Alder Chip Pier
10/14/15	0	47	0	21	41	109	SMA-2 Intertidal
10/15/15	0	49	0	12	0	61	SMA-2 Offshore Areas
10/16/15	0	37	0	0	0	37	SMA-2 Offshore Areas
10/19/15	0	11	0	28	0	39	SMA-2 Intertidal
10/20/15	0	40	0	0	0	40	Offshore Alder Chip Pier
10/21/15	0	20	0	0	0	20	Offshore Alder Chip Pier
10/22/15	0	32	0	113	0	145	Offshore Alder Chip Pier
10/23/15	0	15	0	28	0	43	Offshore Alder Chip Pier
10/26/15	0	49	0	0	0	49	Offshore Alder Chip Pier and Eastern Wharf
10/27/15	0	56	0	0	0	56	Eastern Wharf
10/28/15	0	63	0	5	0	68	Eastern Wharf
10/29/15	0	40	0	0	0	40	Eastern Wharf
10/30/15	0	15	0	7	0	22	Eastern Wharf
11/02/15	0	66	0	0	0	66	Eastern Wharf
11/03/15	0	75	0	0	0	75	Eastern Wharf
11/04/15	0	52	0	0	0	52	Eastern Wharf
11/05/15	0	58	0	42	0	100	Eastern Wharf and SMA-2 Intertidal
11/06/15	0	64	0	0	0	64	Pier 5
11/09/15	0	10	0	0	0	10	SMA-2 Submerged Piles - diver assisted
11/10/15	0	35	0	0	0	35	SMA-2 Submerged Piles - diver assisted
11/11/15	0	29	0	4	0	33	SMA-2 Submerged Piles - diver assisted
11/12/15	0	26	0	7	0	33	SMA-2 Submerged Piles - diver assisted
11/13/15	0	84	0	0	0	84	Eastern Wharf
11/16/15	0	20	0	0	0	20	Eastern Wharf
11/17/15	0	46	0	0	0	46	Eastern Wharf
11/18/15	0	2	0	0	0	2	SMA-2 Dredge Prism
11/19/15	0	48	0	6	0	54	Breakwater and SMA-2 Intertidal
11/20/15	0	68	0	0	0	68	Breakwater
11/23/15	0	68	0	0	0	68	Breakwater
11/24/15	0	23	0	0	5	28	Breakwater and SMA-2 Intertidal
12/01/15	0	12	0	0	0	12	Nearshore Alderchip Pier
12/02/15	0	68	0	0	0	68	Sensitive Habitat (34), Alderchip Pier (31), SMA-2 dredge prism (3)
12/03/15	0	42	0	0	0	42	Sensitive habitat (40), SMA-2 dredge prism (2)
12/04/15	0	41	0	0	0	41	Sensitve Habitat (34), Breakwater Submerged piles - diver assisted (7)

Table 5
Season 1 Pile Removal Tracking

Date	Cut off Piles	Subtidal Treated	Subtidal Untreated	Intertidal Treated	Intertidal Untreated	Daily Total	Area
12/07/15	0	18	0	0	0	18	Breakwater Submerged piles - diver assisted
12/08/15	0	16	0	21	0	37	Breakwater submerged piles - diver assisted (16), SMA-2 Intertidal (21)
12/09/15	0	33	0	0	0	33	Offshore Alder Chip Pier (30), SMA-2 dredge prism (3)
12/10/15	0	38	0	6	0	44	Offshore Alder Chip Pier (38), SMA-2 Intertidal (6)
12/11/15	0	68	0	6	0	74	Offshore Alder Chip Pier (68), SMA-2 Intertidal (6)
12/14/15	0	35	0	6	0	41	Offshore Alder Chip Pier (34), SMA-2 dredge prism (1), SMA-2 Intertidal (6)
12/15/15	0	0	0	36	0	36	SMA-2 Intertidal
12/16/15	0	0	0	92	0	92	SMA-2 Intertidal
12/17/15	0	0	0	56	0	56	SMA-2 Intertidal
12/18/15	0	14	0	0	0	14	SMA-2 Dredge Prism
12/21/15	0	1	19	0	0	20	Offshore from Pier 5
12/22/15	0	0	0	59	0	59	SMA-2 Intertidal
12/23/15	0	54	0	23	0	77	SMA-2 Dredge Prism, SMA-2 Intertidal
12/28/16	0	16	5	13	0	34	SMA-2 Dredge Prism, SMA-2 Intertidal
12/30/16	0	30	0	59	0	89	SMA-2 Dredge Prism, SMA-2 Intertidal
12/31/16	0	2	0	0	0	2	SMA-2 Dredge Prism
01/04/16	0	11	0	0	0	11	Dredge areas in SMA-2
01/05/16	0	7	0	0	0	7	Dredge areas in SMA-2
01/11/16	0	9	0	0	0	9	Eastern Wharf
01/12/16	0	90	0	0	0	90	Eastern Wharf
01/13/16	0	103	0	0	0	103	Eastern Wharf
01/14/16	0	80	0	0	0	80	Eastern Wharf
Totals	**0**	**2,300**	**24**	**870**	**120**	**3,314**	

Notes:
SMA - Sediment Management Area

Table 6
Season 1 Columbia Ridge Landfill Certificate of Disposal Tracking

Disposal Date	Waste Type	Container Number	Disposal (pounds)	Disposal (tons)	Disposal Certificate
10/13/2015	Creosote	480563	41,660	20.83	Yes
10/13/2015	Creosote	480566	44,120	22.06	Yes
10/14/2015	Creosote	483328	39,120	19.56	Yes
10/15/2015	Debris	480599	53,060	26.53	Yes
10/15/2015	Creosote	483087	33,160	16.58	Yes
10/23/2015	Debris	483031	61,320	30.66	Yes
10/23/2015	Creosote	483138	61,180	30.59	Yes
10/23/2015	Creosote	483048	60,600	30.3	Yes
10/28/2015	Creosote	480409	52,220	26.11	Yes
10/28/2015	Debris	480517	50,740	25.37	Yes
10/28/2015	Creosote	480589	42,840	21.42	Yes
10/28/2015	Creosote	480663	53,960	26.98	Yes
10/28/2015	Creosote	481349	57,300	28.65	Yes
10/28/2015	Debris	483017	47,380	23.69	Yes
10/28/2015	Creosote	483119	49,900	24.95	Yes
10/28/2015	Creosote	483137	52,380	26.19	Yes
10/28/2015	Creosote	483152	54,860	27.43	Yes
10/28/2015	Debris	483179	52,840	26.42	Yes
10/28/2015	Creosote	483236	47,380	23.69	Yes
10/29/2015	Creosote	480530	37,860	18.93	Yes
10/29/2015	Creosote	480567	50,440	25.22	Yes
10/29/2015	Creosote	480443	57,500	28.75	Yes
10/30/2015	Creosote	480566	53,460	26.73	Yes
10/30/2015	Creosote	483018	55,380	27.69	Yes
10/30/2015	Creosote	483072	50,700	25.35	Yes
10/30/2015	Creosote	483266	49,860	24.93	Yes
10/30/2015	Creosote	483295	53,700	26.85	Yes
10/30/2015	Creosote	483328	49,760	24.88	Yes
11/6/2015	Creosote	480446	59,680	29.84	Yes
11/6/2015	Creosote	480578	54,160	27.08	Yes
11/6/2015	Debris	480597	52,000	26.00	Yes
11/6/2015	Creosote	480606	55,220	27.61	Yes
11/6/2015	Debris	483010	48,700	24.35	Yes
11/6/2015	Debris	483026	53,860	26.93	Yes
11/6/2015	Debris	483031	47,280	23.64	Yes
11/6/2015	Debris	483040	54,160	27.08	Yes
11/6/2015	Debris	483045	53,920	26.96	Yes
11/6/2015	Creosote	483048	52,320	26.16	Yes
11/6/2015	Creosote	483049	46,820	23.41	Yes
11/6/2015	Debris	483083	56,560	28.28	Yes
11/6/2015	Creosote	483087	48,440	24.22	Yes
11/6/2015	Creosote	483109	51,480	25.74	Yes
11/6/2015	Creosote	483136	55,820	27.91	Yes
11/6/2015	Creosote	483150	48,100	24.05	Yes
11/6/2015	Creosote	483166	55,020	27.51	Yes
11/6/2015	Creosote	490002	48,800	24.4	Yes
11/11/2015	Creosote	480641	53,360	26.68	Yes
11/11/2015	Creosote	481348	60,360	30.18	Yes
11/11/2015	Creosote	483098	59,440	29.72	Yes
11/11/2015	Creosote	483295	58,340	29.17	Yes
11/11/2015	Creosote	483328	57,180	28.59	Yes
11/12/2015	Creosote	480611	51,920	25.96	Yes
11/12/2015	Creosote	483063	58,460	29.23	Yes

Table 6
Season 1 Columbia Ridge Landfill Certificate of Disposal Tracking

Disposal Date	Waste Type	Container Number	Disposal (pounds)	Disposal (tons)	Disposal Certificate
11/12/2015	Creosote	483137	50,980	25.49	Yes
11/12/2015	Creosote	483261	50,080	25.04	Yes
11/12/2015	Creosote	483266	53,800	26.9	Yes
11/13/2015	Creosote	480546	57,140	28.57	Yes
11/13/2015	Creosote	480579	57,600	28.8	Yes
11/13/2015	Creosote	483029	55,580	27.79	Yes
11/13/2015	Creosote	483067	55,160	27.58	Yes
11/13/2015	Creosote	483138	54,780	27.39	Yes
11/13/2015	Creosote	483336	55,500	27.75	Yes
11/18/2015	Creosote	480574	57,640	28.82	Yes
11/18/2015	Creosote	480663	57,920	28.96	Yes
11/18/2015	Creosote	481349	57,800	28.9	Yes
11/18/2015	Creosote	483304	53,180	26.59	Yes
11/19/2015	Creosote	480545	56,640	28.32	Yes
11/19/2015	Creosote	480667	59,280	29.64	Yes
11/19/2015	Creosote	483118	58,440	29.22	Yes
11/19/2015	Creosote	483214	54,720	27.36	Yes
11/19/2015	Creosote	483287	56,880	28.44	Yes
11/19/2015	Creosote	483120	42,920	21.46	Yes
11/20/2015	Creosote	480651	58,180	29.09	Yes
11/25/2015	Creosote	483043	55,020	27.51	Yes
11/25/2015	Creosote	483084	55,500	27.75	Yes
11/25/2015	Creosote	483194	54,540	27.27	Yes
11/25/2015	Creosote	483236	55,220	27.61	Yes
12/3/2015	Creosote	483060	55,100	27.55	Yes
12/3/2015	Creosote	483103	49,320	24.66	Yes
12/9/2015	Creosote	483016	55,300	27.65	Yes
12/9/2015	Creosote	483282	50,640	25.32	Yes
12/11/2015	Creosote	480418	55,880	27.94	Yes
12/14/2015	Creosote	490002	57,660	28.83	Yes
12/17/2015	Creosote	480556	61,040	30.52	Yes
12/18/2015	Creosote	483160	59,220	29.61	Yes
12/23/2015	Creosote	483304	57,380	28.69	Yes
12/24/2015	Creosote	480595	50,880	25.44	Yes
12/24/2015	Creosote	480679	51,720	25.86	Yes
12/24/2015	Creosote	490020	48,540	24.27	Yes
1/15/2016	Creosote	481349	53,160	26.58	Yes
1/15/2016	Creosote	483232	54,800	27.40	Yes
1/15/2016	Creosote	480546	59,040	29.52	Yes
1/15/2016	Creosote	480589	59,880	29.94	Yes
1/15/2016	Creosote	483316	58,380	29.19	Yes
1/15/2016	Creosote	490002	57,060	28.53	Yes
2/2/2016	Creosote	480618	55,700	27.85	Yes
2/2/2016	Creosote	483209	54,300	27.15	Yes
2/2/2016	Creosote	481342	55,060	27.53	Yes
2/2/2016	Creosote	483083	54,120	27.06	Yes
2/2/2016	Creosote	483003	55,240	27.62	Yes
2/2/2016	Creosote	480522	58,760	29.38	Yes
2/2/2016	Creosote	480427	57,440	28.72	Yes
2/2/2016	Creosote	483182	56,620	28.31	Yes
2/2/2016	Creosote	483363	54,720	27.36	Yes
2/2/2016	Creosote	490018	58,320	29.16	Yes
2/2/2016	Creosote	483285	57,500	28.75	Yes

Table 6
Season 1 Columbia Ridge Landfill Certificate of Disposal Tracking

Disposal Date	Waste Type	Container Number	Disposal (pounds)	Disposal (tons)	Disposal Certificate
2/2/2016	Creosote	483355	58,280	29.14	Yes
2/2/2016	Creosote	483134	55,860	27.93	Yes
2/2/2016	Creosote	483371	56,480	28.24	Yes
2/2/2016	Creosote	480402	56,040	28.02	Yes
2/9/2016	Creosote	480630	53,560	26.78	Yes
2/9/2016	Creosote	480564	54,600	27.30	Yes
2/9/2016	Creosote	483282	54,000	27.00	Yes
2/9/2016	Creosote	480592	57,500	28.45	Yes
2/9/2016	Creosote	483182	56,720	28.36	Yes
2/9/2016	Creosote	483120	54,680	27.34	Yes
2/9/2016	Creosote	480663	55,160	27.58	Yes
2/9/2016	Creosote	483003	54,840	27.42	Yes
2/9/2016	Creosote	483017	55,260	27.63	Yes
2/9/2016	Creosote	481303	56,000	28.00	Yes
2/9/2016	Creosote	481342	58,280	29.14	Yes
2/9/2016	Creosote	483201	54,560	27.28	Yes
2/9/2016	Creosote	483175	55,620	27.81	Yes
2/9/2016	Creosote	483298	53,640	26.82	Yes
2/9/2016	Creosote	483122	57,220	28.61	Yes
2/9/2016	Creosote	483243	55,340	30.37	Yes
2/9/2016	Creosote	483031	54,260	27.13	Yes
2/9/2016	Creosote	480402	55,800	27.9	Yes
2/9/2016	Creosote	480648	56,620	28.31	Yes
2/9/2016	Creosote	480417	59,600	29.8	Yes
2/9/2016	Creosote	480217	55,720	27.86	Yes
2/9/2016	Creosote	483184	57,560	28.78	Yes
2/9/2016	Creosote	483140	63,380	31.69	Yes
2/9/2016	Creosote	483001	60,400	30.2	Yes
2/9/2016	Creosote	483176	58,340	29.17	Yes
2/9/2016	Creosote	483221	53,740	26.87	Yes
2/9/2016	Creosote	480655	59,860	29.93	Yes
2/9/2016	Creosote	483120	57,520	28.76	Yes
2/9/2016	Creosote	483041	54,460	27.23	Yes
2/9/2016	Creosote	480517	57,760	28.88	Yes
2/9/2016	Creosote	480581	57,060	28.53	Yes
2/9/2016	Creosote	483025	54,080	27.04	Yes
2/9/2016	Creosote	480663	56,500	28.25	Yes
2/9/2016	Creosote	480630	56,280	28.14	Yes
2/9/2016	Creosote	480627	58,260	29.13	Yes
2/9/2016	Creosote	483120	56,060	28.03	Yes
2/9/2016	Creosote	483017	56,160	28.08	Yes
2/23/2016	Steel	481342	34,940	17.47	Yes
2/23/2016	Steel	483016	28,020	14.01	Yes
2/23/2016	Steel	480663	28,420	14.21	Yes
2/23/2016	Steel	483213	27,320	13.66	Yes
12/18/2016	Creosote	480441	57,800	28.90	Yes

Table 7
Final Total Volatile Solids Results for Z-layer Samples

Core location	Post-dredge Depth (feet below mudline)	Wood Waste Visual Estimate (% vol)	Wet Sieve (% wood waste)	TVS (% dw)
Intertidal				
PG-EC-01	0.0 - 0.5	0	--	1.4
PG-EC-02	0.0 - 1.0	20	20	4.9
PG-EC-03	0.0 - 0.5	10	--	5.3
PG-EC-04	0.0 - 0.5	0	1.2	1.3
PG-EC-05	0.0 - 0.5	0	1.8	0.9
PG-EC-06	0.0 - 0.5	5	--	0.9
PG-EC-07	0.0 - 0.5	5	--	0.7
PG-EC-08	0.0 - 0.5	10	19	4.6
PG-EC-09	0.0 - 0.5	2	7	9.2
PG-EC-10	0.0 - 0.5	45	15	2.7
	0.5 - 1.0	45	6	6.5
	1.0 - 1.6	35	47	7.7
Subtidal				
PG-SC-01	0.0 - 0.5	30	--	3.0
PG-SC-02	0.0 - 0.5	15	--	4.6
PG-SC-03	0.0 - 0.5	15	--	5.5
PG-SC-04	0.0 - 0.5	10	--	2.9
PG-SC-05	0.0 - 0.5	10	8	5.0
PG-SC-06	0.0 - 0.5	15	13	5.6
PG-SC-07	0.0 - 0.5	11	11	5.7
PG-SC-08	0.0 - 0.5	5	--	3.3
PG-SC-09	0.0 - 0.5	30	22	5.3
PG-SC-10	0.0 - 0.5	20	12	6.7
PG-SC-11	0.0 - 0.2	0	--	1.3
PG-SC-12	0.0 - 3.5	0	--	1.1
PG-SC-13	0.0 - 0.5	10	--	5.9
PG-SC-14	0.0 - 0.5	10	13	5.8
PG-SC-15	0.0 - 0.5	10	--	7.6
PG-SC-16	0.0 - 0.5	20	19	12.2
PG-SC-17	0.0 - 0.5	0	0	2.9
PG-SC-18	0.0 - 0.5	20	22	13.3
PG-SC-19	0.0 - 0.5	10	0	3.8
PG-SC-20	0.0 - 0.5	10	--	4.9
PG-SC-21	0.0 - 0.5	15	--	5.7
	0.5 - 1.0	30	--	12.4
PG-SC-22	0.0 - 0.5	20	--	12.1
PG-SC-23	0.0 - 0.5	2	7	7.7
PG-SC-24	0.0 - 0.5	5	0	1.5
PG-SC-25	0.0 - 0.5	10	12	9.9
PG-SC-26	0.0 - 1.3	0	0	0.8
PG-SC-27	0.0 - 0.5	10	15	13.2
PG-SC-28	0.0 - 0.5	10	15	11.9
PG-SC-29	0.0 - 0.5	10	9	9.6
PG-SC-30	0.0 - 0.5	0	0	1.1
PG-SC-31	0.0 - 0.5	0	0	0.5
PG-SC-32	0.0 - 0.5	10	11	3.8

Table 7
Final Total Volatile Solids Results for Z-layer Samples

Core location	Post-dredge Depth (feet below mudline)	Wood Waste Visual Estimate (% vol)	Wet Sieve (% wood waste)	TVS (% dw)
PG-SC-33	0.0 - 0.5	10	8	2.0
	0.5 - 1.0	5	0	0.9
PG-SC-34	0.0 - 0.5	0	0	0.9
PG-SC-35	0.0 - 0.5	0	0	0.1

Notes:
dw - dry weight
TVS - total volatile solids

Table 8
SMA-2 Subtidal Cap Quantities – Season 1

Date	Bucket Mark Area (sy)	Barge Vol (cy)	Volumetric Thickness (ft)
11/12/2015	575	1,040	5.4
11/13/2015	645	1,252	5.8
11/16/2015	540	958	5.3
11/17/2015	422	801	5.7
11/18/2015	752	1,248	5.0
11/19/2015	794	1,315	5.0
11/20/2015	804	1,293	4.8
11/23/2015	637	1,087	5.1
11/24/2015	572	988	5.2
11/25/2015	370	744	6.0
11/30/2015	822	1,758	6.4
12/1/2015	79	161	6.1
12/7/2015	156	301	5.8
12/8/2015	323	538	5.0
12/9/2015	490	835	5.1
12/10/2015	170	289	5.1
12/11/2015	422	696	4.9
12/14/2015	539	864	4.8
12/15/2015	328	482	4.4
12/16/2015	327	548	5.0
12/17/2015	534	912	5.1
12/18/2015	481	720	4.5
12/21/2015	459	665	4.3
12/22/2015	72	111	4.6
Total	**11,312**	**19,606**	**5.2**

Notes:
cy - cubic yards
ft - feet
sy - square yards

Table 9
SMA-2 Thin Layer EMNR Quantities – Season 1

Date	Bucket Mark Area (SY)	Barge Vol (CY)	Volumetric Thickness (in)
11/6/2015	889	298	12.1
11/9/2015	766	243	11.4
11/10/2015	837	262	11.3
11/11/2015	783	229	10.5
12/28/2015	1,396	340	8.8
12/29/2015	3,493	704	7.3
12/30/2015	2,131	500	8.4
12/31/2015	518	194	13.5
1/13/2015	1,808	248	4.9
1/14/2015	3,969	568	5.2
1/15/2015	3,273	461	5.1
1/18/2015	734	102	5.0
1/19/2015	1,081	151	5.0
Total	**21,677**	**4,300**	**7.1**

Notes:
cy - cubic yards
ft - feet
sy - square yards

Table 10
SMA-2 Post-dredging RMC Quantities – Season 1

Date	Bucket Mark Area (sy)	Barge Vol (cy)	Volumetric Thickness (in)
12/23/15	1,025	261	9.2
12/24/15	1,276	313	8.8
01/06/16	1,391	327	8.5
01/07/16	1,327	323	8.8
01/07/16	1,769	411	8.4
01/08/16	1,297	296	8.2
01/08/16	2,085	468	8.1
01/11/16	1,599	359	8.1
Total	**11,769**	**2,758**	**8.4**

Notes:
cy - cubic yards
ft - feet
sy - square yards

Table 11
SMA-2 Subtidal Cap Contingency Thickness Verification Measurements

Location	Date	Time	Leadline Depth (feet)	Probed Depth to Native (feet)	Sand Cap Thickness (feet)
Target 1.1	01/12/16	1:28 PM	24.7	30.4	5.7
Target 1.2	01/12/16	1:00 PM	23.7	28.3	4.6
Target 1.3	01/12/16	1:38 PM	26.5	32.0	5.5
Target 1.4	01/12/16	1:48 PM	23.6	28.7	5.1
Target 1.5	01/12/16	1:53 PM	26.5	31.2	4.7
Target 1.6	01/12/16	2:00 PM	25.4	30.5	5.1
Target 2.1	01/13/16	1:38 PM	21.7	26.0	4.3
Target 2.2	01/13/16	1:44 PM	21.5	26.0	4.6
Target 2.3	01/13/16	1:54 PM	20.0	25.0	5.0
Target 2.4	01/13/16	1:59 PM	19.5	24.6	5.1
Target 2.5	01/13/16	2:04 PM	19.6	24.3	4.7
Target 2.6	01/13/16	2:08 PM	19.5	24.7	5.2
Target 2.7	01/13/16	2:10 PM	25.0	30.5	5.5
Target 2.8	01/13/16	2:25 PM	26.7	31.3	4.6
Target 2.9	01/13/16	2:28 PM	27.7	33.0	5.3
Target 2.10	01/13/16	2:33 PM	28.3	33.4	5.1
Target 2.11	01/13/16	2:42 PM	19.1	25.0	5.9
Target 2.12	01/13/16	2:36 PM	28.5	33.3	4.8
Target 2.13	01/13/16	2:49 PM	20.3	24.6	4.3

Table 12
SMA-2 EMNR Material Placement Area Contingency Thickness Verification Samples

Location ID	Date	Measured EMNR Material Layer Thickness (inches)
SMA-2-1	05/04/16	5.0
SMA-2-2	05/04/16	6.5
SMA-2-3	05/04/16	5.0
SMA-2-4	05/04/16	5.0
SMA-2-5	05/04/16	5.5
SMA-2-6	05/04/16	4.5
SMA-2-7	05/04/16	4.0
SMA-2-8	05/04/16	4.5
SMA-2-9	05/04/16	5.0
SMA-2-10	05/04/16	5.0
SMA-2-11	05/04/16	6.0
SMA-2-12	05/04/16	6.5
SMA-2-13	05/04/16	6.3

Table 13
Eelgrass Habitat Bench Quantities – Season 1

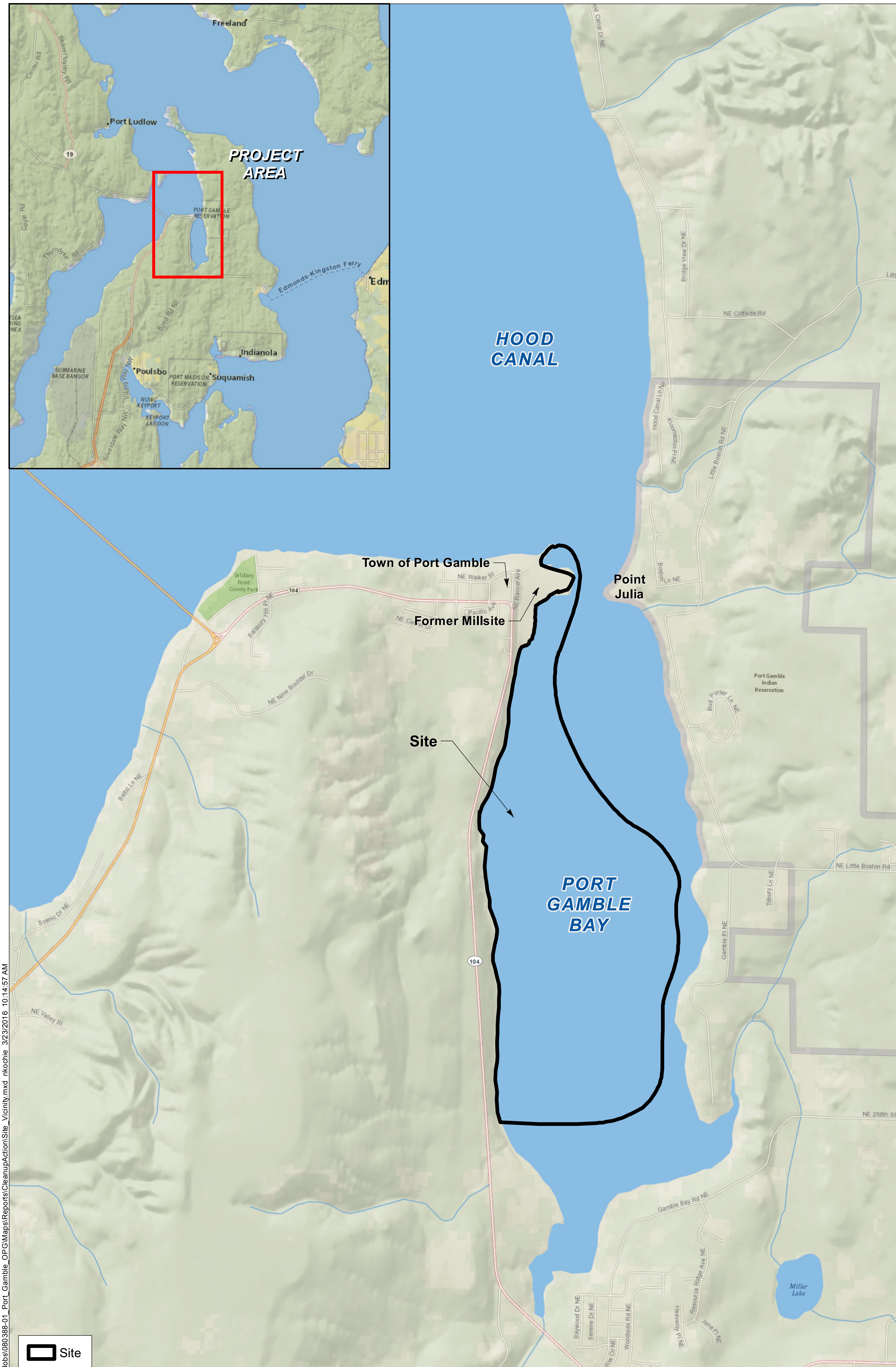
Date	Bucket Mark Area (sy)	Barge Vol (cy)
10/27/15	335	828
10/28/15	212	521
10/29/15	524	1407
10/30/15	247	780
11/02/15	340	1028
11/03/15	258	831
11/04/15	261	808
01/12/16	--	533
01/13/16	--	
01/18/16	--	518

Notes:

cy - cubic yards

sy - square yards

FIGURES



Site

Feet

0 1,000 2,000 3,000 4,000

Figure 1
Site Vicinity Map
Cleanup Action Completion Report – Season 1
Port Gamble Bay Cleanup

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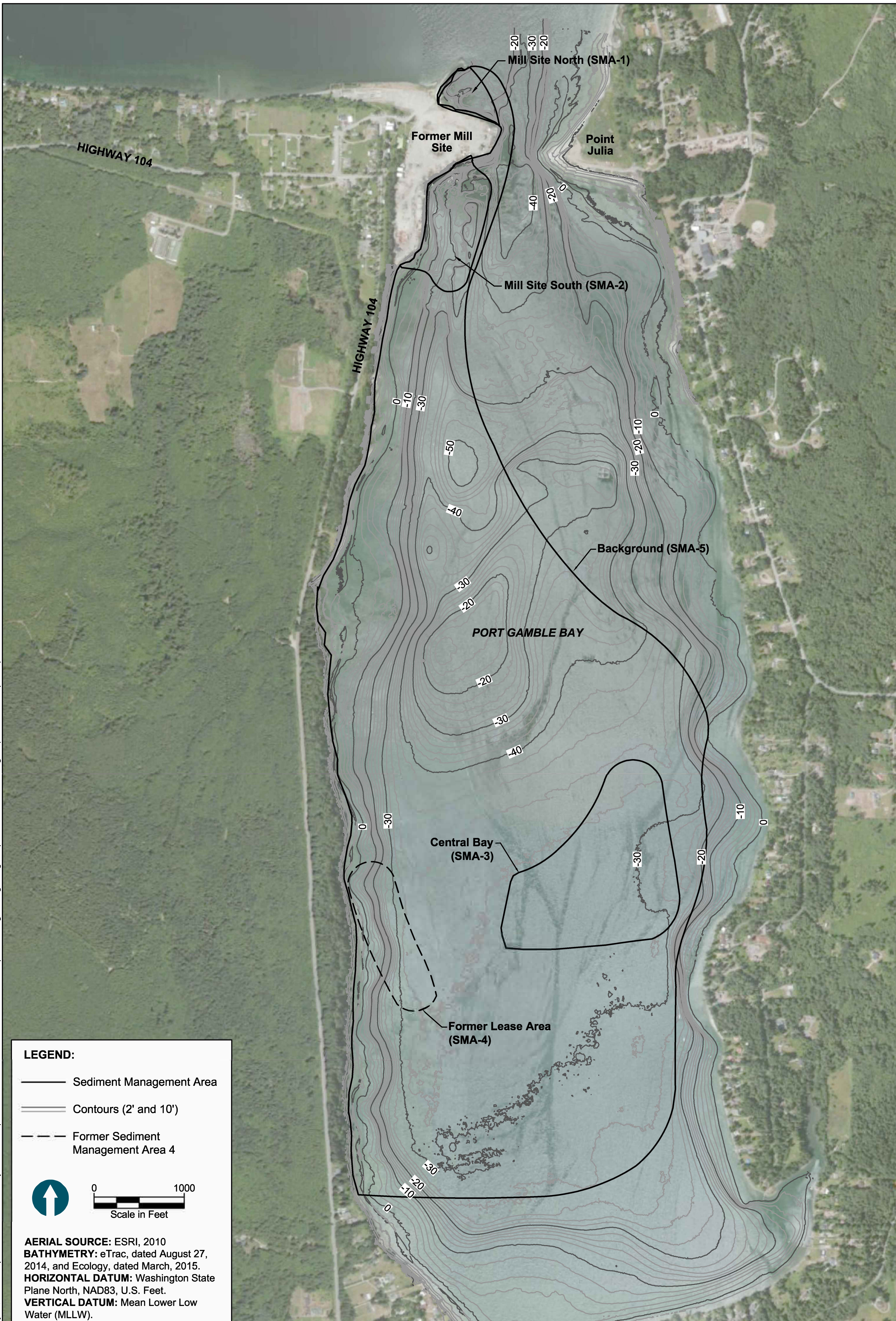

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Figure 2
Sediment Management Areas
Cleanup Action Report - Season 1
Port Gamble Bay Cleanup Project

ANCHOR QEA

Perimeter silt fence installation

Lined eco-block containment for creosote processing

Installation of clean capping material barge loading conveyor

On-site truck scale

Temporary transload bulkhead

Perforating stockpile area

ANCHOR QEA

Figure 3
Site Preparation Photographs
Cleanup Action Report - Season 1
Port Gamble Bay Cleanup

Intertidal pile removal

Creosote pile processing

Pier 5 demolition

Breakwater demolition

Diver assisted submerged subtidal pile removal

Offshore Alder Chip Pier demolition

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ANCHOR QEA

Figure 4
Demolition and Pile Removal Photographs
Cleanup Action Report - Season 1
Port Gamble Bay Cleanup

SOURCE: Bathymetry from eTrac, dated January 20, 2016, and Triad Associates, dated 2012.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:
Post Season 1 Contours (2' and 10' Interval)
Existing Mean Higher High Water Line (Elevation 10.3' MLLW)
Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
Approx. Dredge/Excavation Limits
Eelgrass Beds (Do Not Disturb: No Dredging, Spudding, Or Material Placement)
CU Area Designation and Boundary
Excavation/Dredging Complete (Thin Cover/Cap Complete in Intertidal Area)

0 100
Scale in Feet

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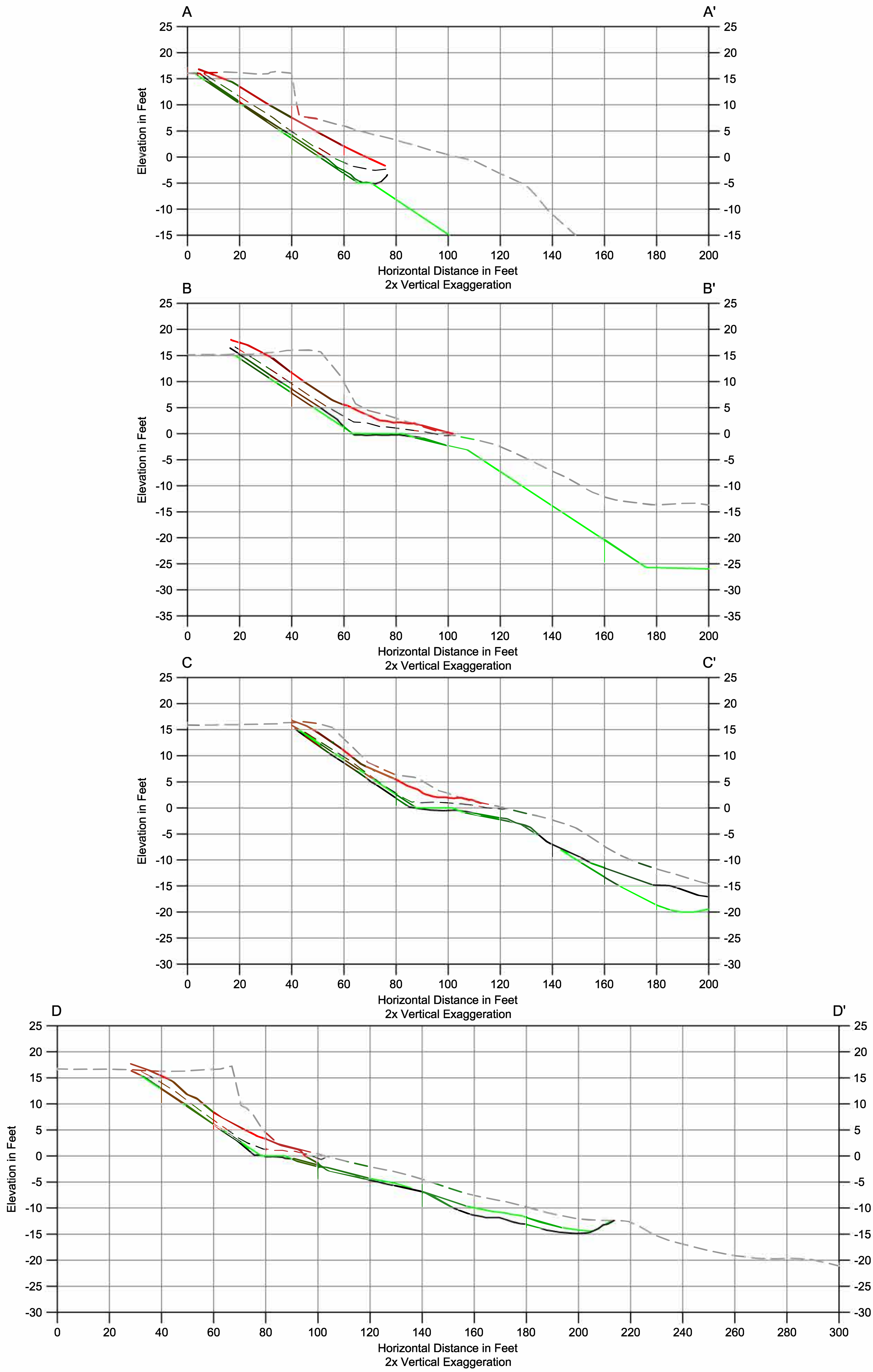
Figure 5a
SMA-2 Dredge Plan
Cleanup Action Report – Season 1
Port Gamble Bay Cleanup Project



SOURCE: Bathymetry from eTrac, dated January 20, 2016, and Triad Associates, dated 2012. Acceptance surveys by Orion Marine Group.
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
- Post-filter Material Acceptance Survey
- Post-cap Acceptance Survey

0 40
Scale in Feet

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May 09, 2016 4:33pm chewett

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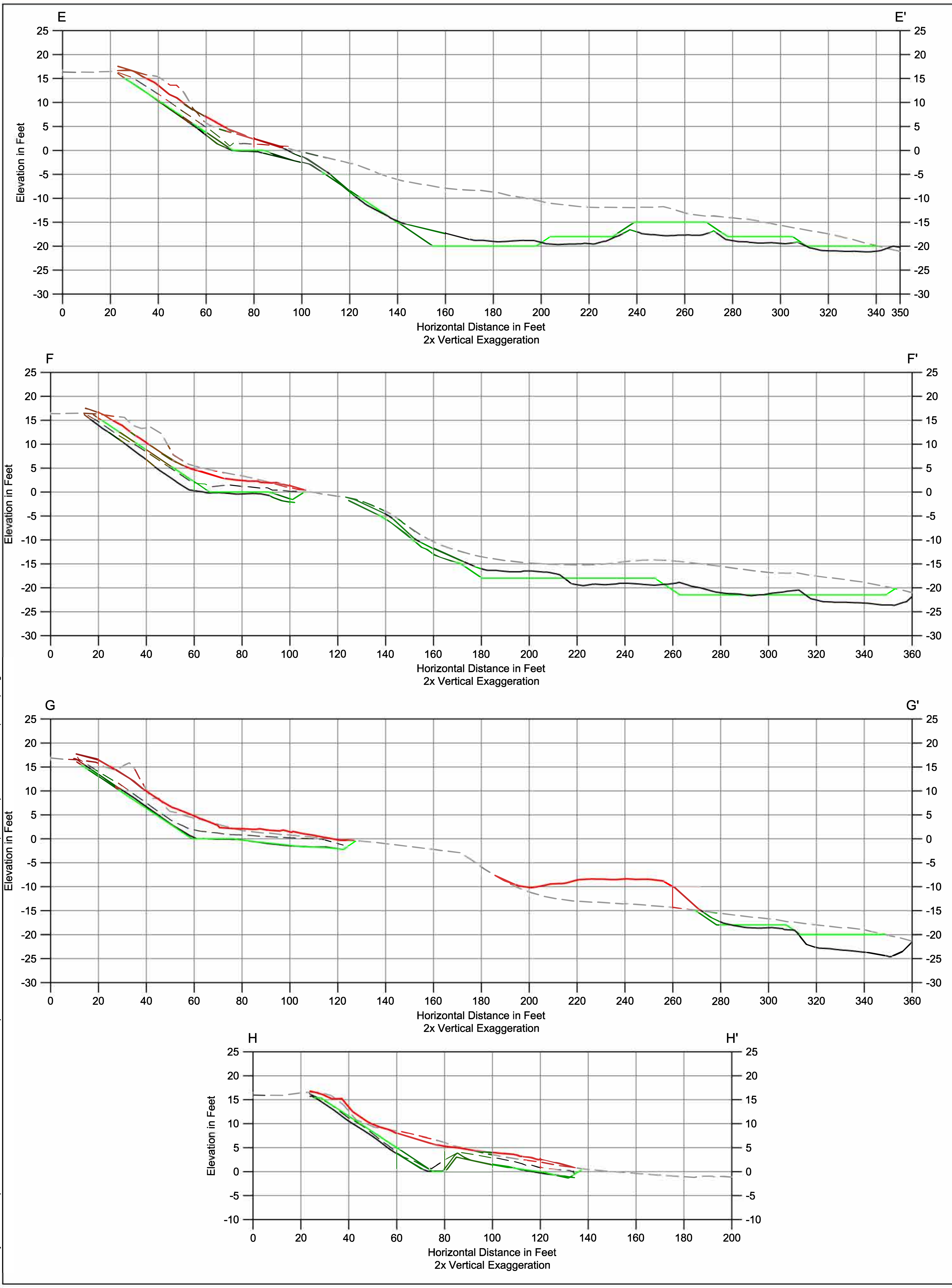
Figure 5b
SMA-2 Intertidal and Subtidal Cross-sections – Season 1
Cleanup Action Report – Season 1
Port Gamble Bay Cleanup Project



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SOURCE: Bathymetry from eTrac, dated January 20, 2016, and Triad Associates, dated 2012. Acceptance surveys by Orion Marine Group.
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
- Post-filter Material Acceptance Survey
- Post-cap Acceptance Survey

0 40
Scale in Feet

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Figure 5c
SMA-2 Intertidal and Subtidal Cross-sections – Season 1
Cleanup Action Report – Season 1
Port Gamble Bay Cleanup Project

Subtidal dredging with the PC400 Komatsu excavator in SMA-2

Hydraulic Young bucket used on the PC400 excavator

Subtidal dredging in area with larger wood debris

Subtidal dredging with the Manitowoc 3900 crane and clamshell bucket in SMA-2

Dredge spoils with wood waste material

Placement of post-dredging RMC in SMA-2

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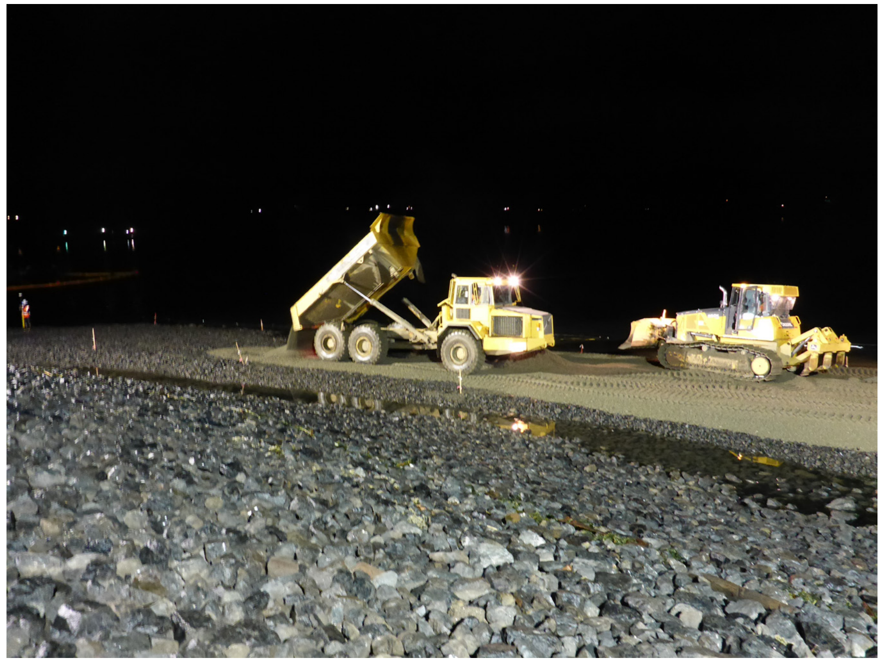
Figure 6
Subtidal Dredging and RMC Placement Photographs
Cleanup Action Report - Season 1
Port Gamble Bay Cleanup

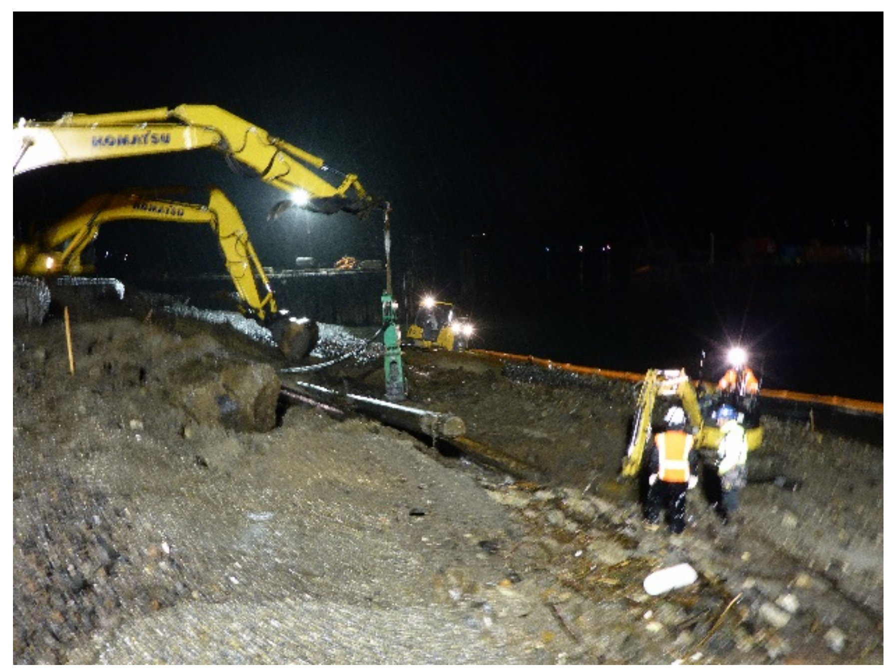


Placing habitat substrate over Type 3 armor

Section of completed SMA-2 intertidal cap

Intertidal excavation and placement of filter material

Placement of Type 2 armor layer in SMA-2 intertidal cap



Removal of piles encountered during intertidal excavation

Completed intertidal cap area in SMA-2

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Figure 7
Intertidal Excavation and Capping Photographs
Cleanup Action Report - Season 1
Port Gamble Bay Cleanup

Subtidal cap, EMNR, and RMC sand material stockpile and barge loading conveyor

Loading sand cap material for capping in SMA-2

Placing SMA-2 subtidal cap using the Bombay box

Placing SMA-2 subtidal cap with the DB Rainier and Bombay box

Placing EMNR material with the Manitowoc 3900 crane and clamshell bucket

Placing shallow subtidal cap filter material layer

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Figure 8
Subtidal Capping and EMNR Material Placement Photographs
Cleanup Action Report - Season 1
Port Gamble Bay Cleanup

Offloading a dredge material barge at the transload facility

Dredge material barge moored at transload bulkhead

Intertidal excavation stockpiles

Subtidal dredging stockpiles

Removing large wood debris from subtidal dredge material stockpiles

Transporting dredge material to stockpiles

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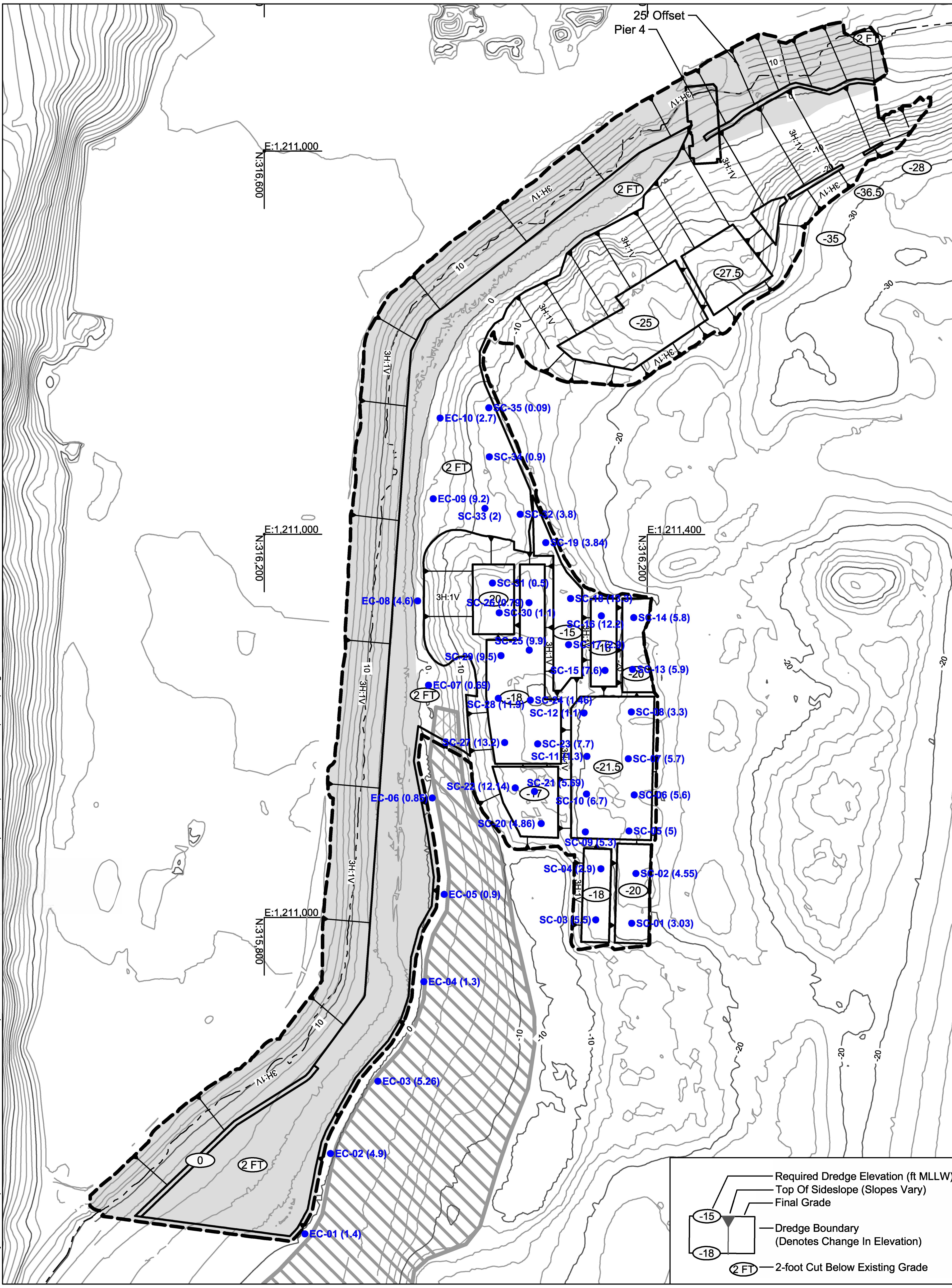
Figure 9
Transload and Stockpile Photographs
Cleanup Action Report - Season 1
Port Gamble Bay Cleanup



SOURCE: Bathymetry from eTrac, dated January 20, 2016, and Triad Associates, dated 2012.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Pre-construction Mudline Contours (5' and 25' Interval)
- Existing Mean Higher High Water Line (Elevation 10.3' MLLW)
- Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
- Approx. Dredge/Excavation Limits
- Eelgrass Beds (Do Not Disturb: No Dredging, Spudding, Or Material Placement)
- ● PG-EC-10 (2.7) Confirmatory Sample Location and TVS Result (% Dry Weight)

0 100
Scale in Feet

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

Location	Date	Lead line Depth (feet)	Probed Bottom of Sand (feet)	Sand Thickness (feet)
Target 1	1/12/2016	24.7	30.4	5.7
Target 2	1/12/2016	23.7	28.3	4.6
Target 3	1/12/2016	26.5	32.0	5.5
Target 4	1/12/2016	23.6	28.7	5.1
Target 5	1/12/2016	26.5	31.2	4.7
Target 6	1/12/2016	25.4	30.5	5.1
Target 2.1	1/13/2016	21.7	26.0	4.3
Target 2.2	1/13/2016	21.5	26.0	4.6
Target 2.3	1/13/2016	20.0	25.0	5.0
Target 2.4	1/13/2016	19.5	24.6	5.1
Target 2.5	1/13/2016	19.6	24.3	4.7
Target 2.6	1/13/2016	19.5	24.7	5.2
Target 2.7	1/13/2016	25.0	30.5	5.5
Target 2.8	1/13/2016	26.7	31.3	4.6
Target 2.9	1/13/2016	27.7	33.0	5.3
Target 2.10	1/13/2016	28.3	33.4	5.1
Target 2.11	1/13/2016	19.1	25.0	5.9
Target 2.12	1/13/2016	28.5	33.3	4.8
Target 2.13	1/13/2016	20.3	24.6	4.3

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SOURCE: Bathymetry from eTrac, dated January 20, 2016, and Triad Associates, dated 2012.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Pre-construction Mudline Contours (2' and 10' Interval)
- Existing Mean Higher High Water Line (Elevation 10.3' MLLW)
- Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
- Approx. Dredge/Excavation Limits
- Eelgrass Beds to be Transplanted by Others (No Dredging, Spudding, or Material Placement Prior to Eelgrass Removal by Others)
- Eelgrass Beds (Do Not Disturb: No Dredging, Spudding, Or Material Placement)
- Eelgrass Bench
- Subtidal Confirmatory Probe Sample Location
- Post-Season 1 Subtidal Cap Contour (1' and 5' interval)
- Approved Cap Area

0 80
Scale in Feet

ANCHOR QEA

Figure 11a
SMA-2 Subtidal Cap Verification Probing Locations
Cleanup Action Report – Season 1
Port Gamble Bay Cleanup Project

Location	Date	Thickness (in.)
SMA-2-1	5/4/2016	5.0
SMA-2-2	5/4/2016	6.5
SMA-2-3	5/4/2016	5.0
SMA-2-4	5/4/2016	5.0
SMA-2-5	5/4/2016	5.5
SMA-2-6	5/4/2016	4.5
SMA-2-7	5/4/2016	4.0
SMA-2-8	5/4/2016	4.5
SMA-2-9	5/4/2016	5.0
SMA-2-10	5/4/2016	5.0
SMA-2-11	5/4/2016	6.0
SMA-2-12	5/4/2016	6.5
SMA-2-13	5/4/2016	6.3

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May 31, 2016 10:46am chewett

SOURCE: Bathymetry from eTrac, dated January 20, 2016, and Triad Associates, dated 2012.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Pre-construction Mudline Contours (2' and 10' Interval)
- Pre-work Mean Higher High Water Line (Elevation 10.3' MLLW)
- Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
- Approx. Dredge/Excavation Limits
- Eelgrass Beds to be Transplanted by Others (No Dredging, Spudding, or Material Placement Prior to Eelgrass Removal by Others)
- Eelgrass Beds (Do Not Disturb: No Dredging, Spudding, Or Material Placement)
- Eelgrass Bench
- EMNR Confirmatory Probe Sample Location
- Post-Season 1 Subtidal Cap Contour (1' and 5' Interval)
- Approved EMNR Area

0 80
Scale in Feet

Figure 11b
SMA-2 EMNR Verification Grab Locations
Cleanup Action Report – Season 1
Port Gamble Bay Cleanup Project

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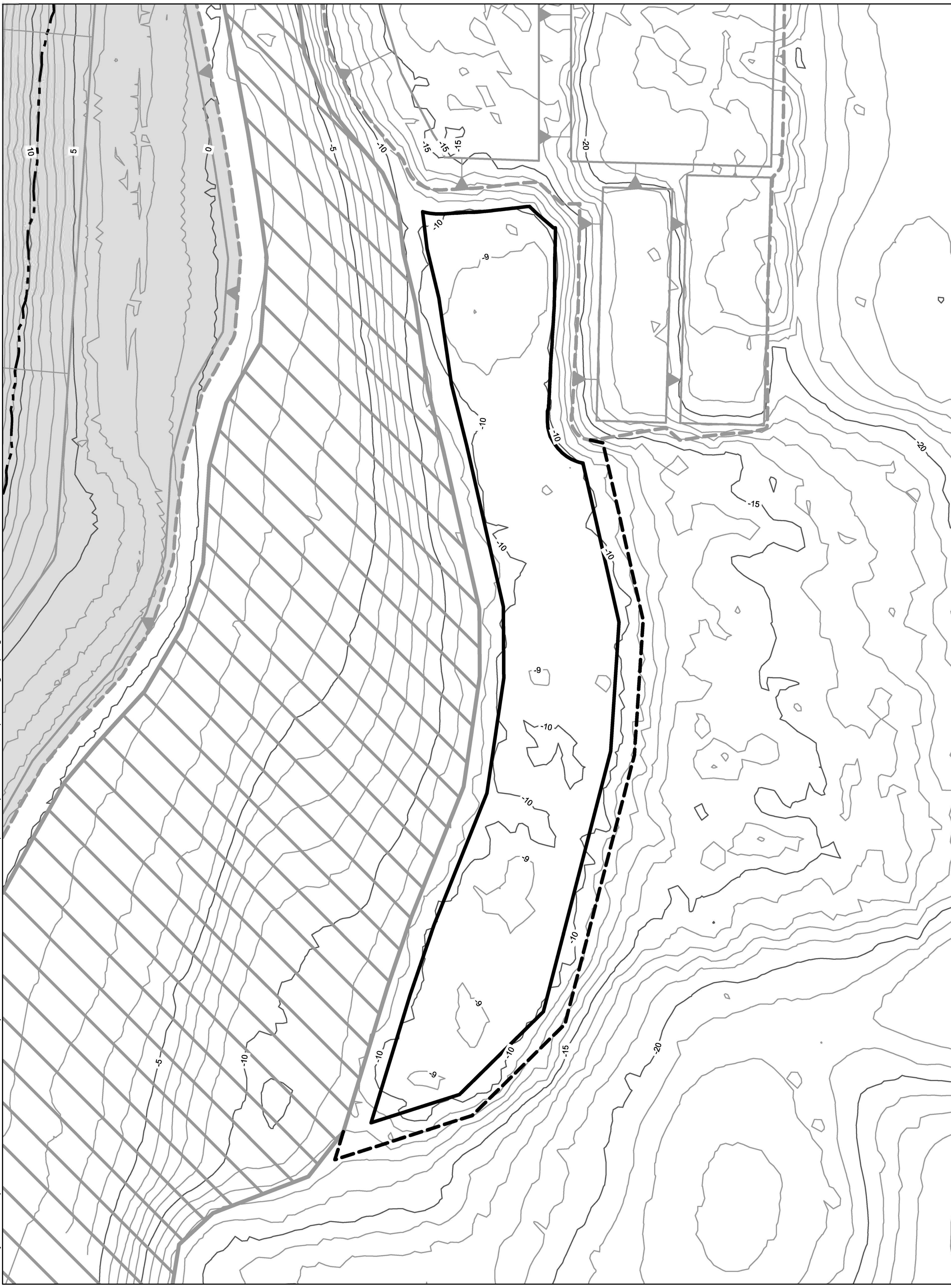

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May 09, 2016 4:34pm chewett

SOURCE: Bathymetry from eTrac, dated January 20, 2016, and Triad Associates, dated 2012.
HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- Post-Season 1 Contours (1' and 5' Interval)
- Existing Mean Higher High Water Line (Elevation 10.3' MLLW)
- Bank Excavation Area Performed in the Dry (> Approx. Elevation 0' MLLW)
- Approx. Dredge/Excavation Limits
- Eelgrass Beds (Do Not Disturb: No Dredging, Spudding, Or Material Placement)
- Eelgrass Bench
- 10' Offset from Eelgrass Bench

0 40
Scale in Feet

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Figure 12
Eelgrass Bench
Cleanup Action Report – Season 1
Port Gamble Bay Cleanup Project