STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PAUL R. LEPAGE
GOVERNOR

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COMMISSIONER

August 3, 2018

Kathryn Zeigler
Remediation Program Manager
Mallinckrodt US LLC
7777 Bonhomme Ave, Suite 1800
St. Louis, MO 63105

RE: Southern Cove Closure Report

Dear Ms Zeigler:

The Department has reviewed the Southern Cove Closure Report dated January 11, 2018. This report details the Corrective Measures performed during the period of July 5 – November 27, 2017 at the Southern Cove site in Orrington, Maine.

In addition to our review of the Closure Report, the Department's Project Manager, Kyle Jellison was on site during the majority of the work, the Department's oversight inspector was on site full time, and our Project Engineer attended all weekly progress meetings, reviewed compaction tests, and inspected erosion and sedimentation controls on a regular basis.

Based on our review of the Closure Report and staff oversight, The Department concludes that the Corrective Measures completed in the Southern Cove were done in accordance with the approved Corrective Measure Implementation Plan (CMIP) and applicable protocols.

Please accept this letter as Department approval of the Southern Cove Closure Report, and do not hesitate to contact me if you should have questions or comments.

Sincerely,

Chris Swain
RCRA Corrective Action Program Manager
Bureau of Remediation and Waste Management
Maine Department of Environmental Protection
Chris.Swain@Maine.Gov

Mallinckrodt US LLC

January 11, 2018

Mr. Kyle Jellison
Bureau of Remediation and Waste Management
Maine Department of Environmental Protection
17 State House Station
Augusta ME 04333

Subject: **Southern Cove Closure Report**
Orrington Remediation Site
Orrington, Maine

Dear Mr. Jellison:

Please find enclosed the **Southern Cove Closure Report** for the Orrington Remediation Site. This Closure Report includes a summary of the remedial construction activities completed in accordance with the Southern Cove Corrective Measures Implementation (CMI) Plan dated May 2017. The report also summarizes the construction quality assurance (CQA) program, operations and submittals completed as part of the remedial work and related quality control documentation.

If you have questions or comments regarding this report please feel free to contact me at 314-281-5947.

Sincerely,

Kathy Zeigler

Kathy Zeigler
Remediation Program Manager

cc: Chris Greene, Geosyntec
Dean Carter, CDM Smith
John Weston, CDM Smith
Pat Duft, Mallinckrodt US LLC
Paul LaRosa, Anchor QEA, LLC
Rebecca Gardner, Anchor QEA, LLC
Susanne Miller, DEP-Bangor

CLOSURE REPORT

Southern Cove
Construction Closure Report
Orrington Remediation Site
Orrington, Maine

Prepared by:

Anchor QEA, LLC
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Amesbury, MA 01913

CDM Smith, Inc.
25 Industrial Ave.
Chelmsford, MA 01824

Mallinckrodt US LLC

January 2018

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Acronyms

Alpha	Alpha Analytical, Inc.
Anchor QEA	Anchor QEA, LLC
ARIS	Adaptive Resolution Imaging Sonar
CDM Smith	CDM Smith, Inc.
CES	CES, Inc.
CMI	corrective measures implementation
CMI Plan	Corrective Measures Implementation Plan
CQA	Construction Quality Assurance
CU	Certification Unit
cy	cubic yard
ESA	Endangered Species Act
GWTP	groundwater treatment plant
HASP	Health and Safety Plan
HDPE	high-density polyethylene
Maine BEP	Maine Board of Environmental Protection
Maine DEP	Maine Department of Environmental Protection
Mallinckrodt	Mallinckrodt US LLC
mg/kg	milligrams per kilogram
MPS	Media Protection Standards
NTU	nephelometric turbidity unit
PAMP	Perimeter Air Monitoring Plan
QA	quality assurance
QC	quality control
Report	*Southern Cove Construction Closure Report*
RFI	Request for Information
RTK	Real-Time Kinematic
Sevenson	Sevenson Environmental Services, Inc.
Site	Orrington Remediation Site
SMA	Sediment Management Areas
TSSA	temporary soil stockpile area
USACE	U.S. Army Corps of Engineers

Section 1. Introduction and Project Organization

1.1 Introduction

Mallinckrodt US LLC (Mallinckrodt) performed the corrective measures necessary to remediate sediment within the Southern Cove of the Penobscot River adjacent to the Orrington Remediation Site (Site) located at 99 Industrial Way, Orrington, Maine, shown in **Figure 1-1**. The Southern Cove *Corrective Measures Implementation Plan* (CMI Plan) presents the objectives of the corrective measures, results of the pre-design activities, Design Drawings, and Technical Specifications to implement the remedial action. Plans and engineering designs for the Southern Cove remediation were developed in accordance with the State of Maine Board of Environmental Protection (Maine BEP) Order dated August 19, 2010, and effective April 3, 2014, which incorporates, with modifications, the Compliance Order issued by the Maine Department of Environmental Protection (Maine DEP) dated November 24, 2008 (collectively referred to hereafter as the "Order"). The Order requires corrective measures to achieve Media Protection Standards (MPS) for mercury in sediment.

1.2 Purpose of the Report

The purpose of this *Southern Cove Construction Closure Report* (Report) is to summarize the construction activities, quality control (QC) documentation, and quality assurance (QA) monitoring and documentation activities (collectively referred to as "Closure Activities") necessary to demonstrate that the Southern Cove remediation was completed in accordance with the Order and the MPS for mercury in sediment was achieved. The Closure Activities were performed by various members of the Project Team, identified in Section 1.4, during the corrective measures implementation (CMI) construction at the Site, between July 5, 2017, and November 27, 2017.

The Construction Quality Assurance (CQA) Plan (Anchor QEA 2017) establishes the QA monitoring and documentation procedures used during the Southern Cove CMI activities by the Remediation Project Manager and the CQA Engineer to verify that CMI activities were accomplished in accordance with the requirements of the CMI Plan and Contract Documents, including the Design Drawings, Technical Specifications, and other applicable construction documents.

1.3 Report Organization

The Southern Cove CQA Report is organized as follows:

- Section 1 – Introduction and Project Organization
- Section 2 – Summary of Construction Activities
- Section 3 – Summary of QC and CQA Activities
- Section 4 – Deviations
- Section 5 – Conclusion
- Section 6 – References

Documentation presenting the results of the CQA monitoring and testing activities performed by Anchor QEA, LLC (Anchor QEA), record drawings, and other relevant documents are provided in the following appendices to this report:

- Appendix A – CQA Inspector's Daily Reports
- Appendix B – Photographic Log

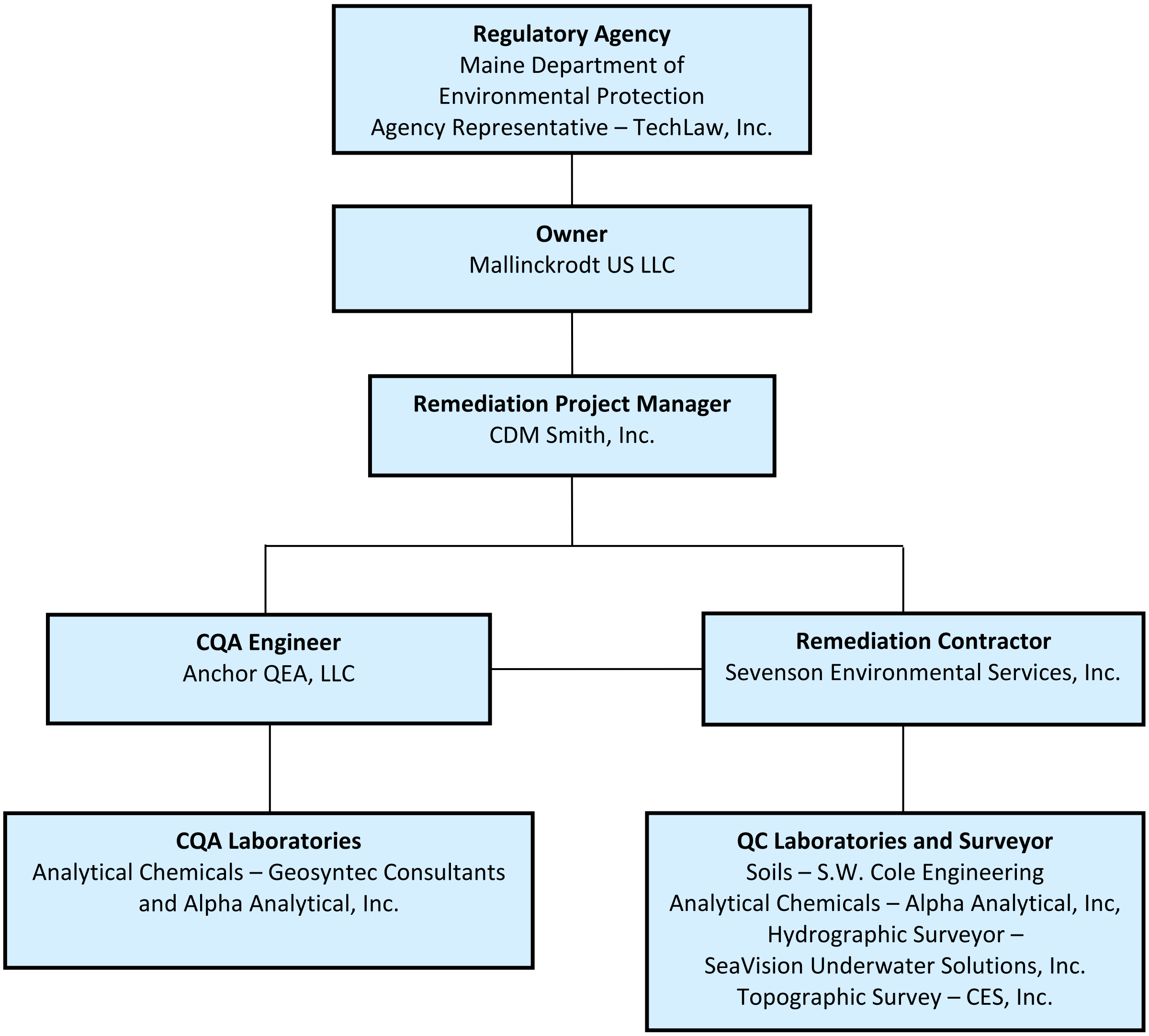
- Appendix C – Requests for Information (RFIs) and Responses
- Appendix D – Material Pre-Qualification Submittals
- Appendix E – Water Quality Monitoring Summary
- Appendix F – Post-Removal and Post-Backfill Survey Measurements
- Appendix G – Confirmation Sample Laboratory Results
- Appendix H – Confirmation Sample MPS Calculations

1.4 Project Team

The organization structure and lines of communication for the Project Team were set forth in the CQA Plan provided as an appendix to the CMI Plan. Members of the Project Team, including CDM Smith, Inc. (CDM Smith), Sevenson Environmental Services, Inc. (Sevenson), and Anchor QEA, held weekly construction progress meetings on site to review progress updates, address questions, and convey schedule updates. As part of the CQA Engineer responsibilities, Anchor QEA issued daily field reports summarizing daily construction progress, QC/QA activities, and highlighting any matters requiring action. These reports were issued to CDM Smith and are included in **Appendix A**. Additional communications made throughout the Closure Activities were documented in Contractor RFIs and subsequent responses, QC submittals and subsequent responses, CDM Smith daily reports, Sevenson daily field reports, monthly teleconferences with Maine DEP, and daily toolbox meetings.

The CQA organizational structure is provided in **Exhibit 1.** The duties, responsibilities, and authorities of the entities and personnel positions identified in this figure as they relate to the CQA program are described in the following sections.

Exhibit 1: CQA Organizational Structure – Corrective Measures Implementation



1.4.1 Regulatory Agency

Maine DEP provided oversight of the remediation construction activities and provided feedback and approvals of the Contract Documents submitted to them for review.

1.4.2 On-site Agency Representative

The Regulatory Agency On-site Representative, TechLaw, Inc., provided on-site oversight for the Regulatory Agency (Maine DEP) and coordinated with the CQA Engineer for confirmation sampling.

1.4.3 Owner

The Owner of the Site is Mallinckrodt. Mallinckrodt was responsible for the completion of the corrective measures and contracted with CDM Smith to serve as the Remediation Project Manager for the Site to implement the project in accordance with the Contract Documents.

1.4.4 Remediation Project Manager

The Remediation Project Manager, CDM Smith, coordinated all remedial activities at the Site, including retaining and managing the Remediation Contractor and the CQA Engineer, to implement the project in accordance with the Contract Documents and approved CMI Plan.

1.4.5 Remediation Contractor

Sevenson performed the construction portion of the Closure Activities to satisfy the requirements of the project Contract Documents. Additionally, Sevenson performed construction QC activities to document that materials and activities being completed were in accordance with the Design Drawings and Technical Specifications. The Remediation Contractor employed the services of subcontractors, coordinated material sources, and interfaced with the Remediation Project Manager and the CQA Engineer throughout the Closure Activities. Sevenson subcontracted the following companies to support the QC activities:

- CES, Inc. (CES) of Brewer, Maine, was Sevenson's Maine land surveyor and provided survey control and progress surveys of the remedial construction.
- SeaVision Underwater Solutions Inc., of Fall River, Massachusetts, was Sevenson's hydrographer and performed hydrographic surveys for the pre-construction, final backfill acceptance, and final as-built surveys.
- Alpha Analytical, Inc.(Alpha) of Westborough, Massachusetts, provided analytical testing on QC samples throughout construction.
- S.W. Cole Engineering of Bangor, Maine, provided geotechnical testing of QC samples collected for imported aggregates and backfill throughout construction.

1.4.6 CQA Engineer

Anchor QEA prepared design documents presented in the CMI Plan and performed CQA activities in accordance with the CQA Plan. Anchor QEA was directly accessible to the Owner and the Remediation Project Manager for technical direction and issues relating to QC/QA activities during construction. The CQA Engineer was responsible for carrying out the field sampling, QC/QA oversight, and QC/QA documentation portions of the Closure Activities to ensure that the requirements of the Project Documents were met during construction. The CQA Engineer performed the following QA activities:

- Reviewed conformance of materials and construction to verify compliance with the intent of the requirements of the CMI Plan and Contract Documents
- Reviewed other site-specific documentation, including the Remediation Contractor's bid

- Conducted periodic Site inspections
- Participated in project meetings
- Performed daily CQA activities (e.g., reviewed field reports, interacted with the Remediation Contractor on a frequent basis)
- Prepared and kept field CQA documentation
- Oversaw the preparation of as-built drawings by the Remediation Contractor
- Reviewed the Remediation Contractor's surveyor work products
- Verified the calibration and conditions of on-site CQA and positioning equipment
- Coordinated collection and delivery of laboratory test samples to the CQA laboratories
- Reviewed and reported results of laboratory testing
- Reviewed the Remediation Contractor's submittals
- Reported any unresolved deviations from the CMI Plan and Contract Documents
- Observed and verified that environmental controls were in place and performing properly

Anchor QEA coordinated with the Geosyntec Consultants Field Laboratory, which operated an on-site analytical laboratory during construction for confirmation sample analytical testing. In addition, Alpha analyzed a subset of the confirmation samples for comparison to the analytical results produced by the Geosyntec Consultants Field Laboratory. Anchor QEA coordinated with Alpha for the analysis of confirmation samples as well.

1.4.7 Remediation Transportation and Disposal Contractor

US Ecology, Inc., was responsible for coordinating transportation and disposal of sediment at the off-site disposal facility (Republic Services Landfill in Niagara Falls, New York). US Ecology, Inc., was responsible for providing railcars for transportation, coordinating with Pan-Am Railways on picking up railcars, tracking railcars, weighing railcars, and preparing associated paperwork.

1.4.8 Groundwater Treatment Plant Operator

Woodward and Curran operated the on-site groundwater treatment plant. Contact water from the construction activities was transported to the on-site groundwater treatment plant for treatment prior to discharge in accordance with Maine Pollution Discharge Elimination System Permit ME0000639.

1.5 Project Documentation

The requirements for the Closure Activities are described in the following Project Documents:

- The State of Maine BEP Order dated August 19, 2010, and effective April 3, 2014, which incorporates, with modifications, the Compliance Order issued by Maine DEP dated November 24, 2008
- CMI Plan including the Water Quality and Fish Monitoring Plan, CQA Plan, Confirmation Sampling Protocol, Design Drawings, Technical Specifications, and CQA Plan, prepared by Anchor QEA and dated May 2017
- *Health and Safety Plan (HASP), Orrington Remediation Site*, prepared by CDM Smith dated October 9, 2014
- *Perimeter Air Monitoring Plan (PAMP), Orrington Remediation Site*, prepared by CDM Smith dated July 22, 2015

- *Contractor Construction Work Plans*, prepared by Sevenson, including:
  - *SC Construction Work Plan*, received on June 13, 2017
  - Sevenson's Construction Site-Specific HASP, received on May 15, 2017
  - Construction Quality Control Plan, received on May 15, 2017
  - *Environmental Protection Plan*, received on June 14, 2017 which includes the following individual plans:
    - Spill Prevention, Control, and Countermeasures Plan
    - Stormwater Pollution Prevention Plan
    - Air Pollution and Odor Control Plan
    - Marine Water Quality Criteria Compliance Plan
- *Construction Submittals*, prepared by Sevenson
- *Construction Submittal Responses*, prepared by CDM Smith and Anchor QEA
- *Contractor RFIs*, prepared by Sevenson (see **Appendix C**)
- *Reponses to Contractor RFIs*, prepared by CDM Smith and Anchor QEA (see **Appendix C**)

The CMI Plan and Contractor Construction Work Plans, as well as the HASP, PAMP, and Guidelines for Confirmation Sampling were previously submitted to the Maine DEP and are not included in this report.

Section 2. Summary of Construction Activities

2.1 Permitting

Regulatory requirements were summarized in the CMI Plan. The following is a list of permits and authorizations obtained for the Southern Cove:

- **U.S. Army Corps of Engineers (USACE) Permit:** A Maine General Permit Authorization Letter was issued by the USACE New England District for the Southern Cove project (USACE Permit No. NAE-1999-02231; USACE GP ID No. 17-097, as modified on May 3, 2017). This permit includes Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. The following required consultations were also completed by USACE before granting the permit:
  - Section 7 consultations with National Oceanic and Atmospheric Administration
  - National Marine Fisheries Service, and U.S. Fish and Wildlife Service for Endangered Species Act (ESA) and Essential Fish Habitat
  - Section 106 of the National Historic Preservation Act and with local tribes
- **Shoreland Protection Act Permit:** A permit application was approved on April 8, 2016, by the Orrington Code Enforcement Officer for work within 250 feet from the Penobscot River for the entire site. With respect to the Southern Cove CMI Plan, this permit covers construction and maintenance of staging areas and access roads necessary to perform sediment removal.
- **Maine Natural Resources Protection Act:** A Permit-by-Rule Notification Form was sent to Maine DEP on May 20, 2015, and because no response was received, presumptive approval was granted for the entire site, including the Southern Cove. The approval was confirmed with Jim Beyer of Maine DEP during several subsequent meetings. By email dated April 20, 2017, Mr. Beyer also confirmed that acceptance of the Permit-by-Rule Notification by Maine DEP constitutes the Clean Water Act Section 401 Water Quality Certificate.
- **Maine Department of Agriculture, Conservation and Forestry Submerged Lands Lease:** A Submerged Lands Lease was issued by Maine DEP on June 30, 2017, authorizing the removal of 5,000 cubic yards (cy) of sediment located below the mean low water mark.
- **Other State Agency Reviews:**
  - **Maine Department of Marine Resources:** Denis-Marc Nault confirmed by email, dated March 1, 2017, that they had no concerns after reviewing the Draft CMI Plan.
  - **Maine Department of Inland Fisheries and Wildlife:** Thomas Schaeffer verbally confirmed that any input from them would be provided directly to Maine DEP through the Natural Resources Protection Act permitting review, and they had no further input. This was confirmed by email from Erin Healy of Anchor QEA to Mr. Schaeffer, dated February 21, 2017.

2.2 Scope of Activities

The CMI Plan outlines details for the removal of sediment with mercury concentrations above the MPS (2.2 milligrams per kilogram [mg/kg] for mercury), backfill, and restoration of the Southern Cove. Remedial construction in the Southern Cove area included the following primary components in the general order in which they were executed:

- Mobilization of excavation, dredging, and backfilling equipment

- Site preparation, including construction of a floating pier, a clean imported material staging area, and the nearshore intertidal access road, and installation of erosion controls
- Pre-construction surveys
- Removal (excavation/dredging) of sediment
- Water quality (i.e., turbidity) and fish monitoring during construction to demonstrate the effectiveness of environmental controls
- Post-removal (post-dredge/excavation) surveying to verify required removal elevations were achieved
- Collection of confirmation samples following completion of sediment removal within a Certification Unit (CU)
- Placement of initial lift backfill material in removal areas following the completion of a CU (backfill was placed to final elevations in Sediment Management Area [SMA]-1) immediately following verification of removal
- Placement of final backfill over SMA-2 and SMA-3 after all removal and initial lift backfill was completed
- Post-backfill surveying to verify removal areas had been returned to pre-construction grades
- Sediment processing and preparation for transport and disposal
- Transport by rail and final placement of dewatered materials in an approved off-site upland disposal facility
- As required, water treatment and discharge into the Penobscot River in accordance with Maine Pollution Discharge Elimination System Permit ME0000639, revised on May 10, 2016
- Removal of the floating pier, concrete bin blocks used for the clean imported material staging area, nearshore intertidal access road, and erosion controls
- Demobilization of excavation, dredging, and backfill equipment

A photographic log summarizing the major construction components is provided in **Appendix B**.

2.2.1 Site Preparation and Pre-Construction Activities

Mobilization and site preparation were initiated on July 5, 2017. Site preparation and pre-construction activities were conducted at two locations: a nearshore support area located adjacent to the Penobscot River near SMA-2 and the Cianbro facility located approximately 3 miles upriver in Brewer, Maine.

The Cianbro facility has access to a dock area, crane, and crane operator and support personnel. This location was used to mobilize larger marine equipment into the river and for assembly of barges (**Appendix B**, Photograph 1). Items mobilized into the river at this location primarily included tug boats and sectional barges. Sectional barges were attached together to assemble the floating working equipment for the project, including the following:

- Material transport barges (also referred to as scows), each with a capacity of 100 cy
- A floating pier with sectional barges that were linked together using double-hinge connections
- The main barge used for sediment removal and backfilling; after assembly, the main barge was loaded with the following equipment:
  - An equipment storage box
  - Two roll-off boxes filled with gravel used as ballast

  - Two 40-foot-long spuds (two additional spuds were added as construction progressed)
  - Spud winches
  - Temporary lighting
  - Water filtration system
  - Komatsu PC450LC long-stick excavator that was used for sediment removal and backfilling
- Moon pool equipped with spuds, spud winches, and a generator that could be used to raise and lower a turbidity curtain

Initially, four transport barges were assembled, with two dedicated to transporting removed sediment and two dedicated to transporting backfill. After removal had been initiated, two additional transport barges were mobilized to the nearshore support area and assembled to provide additional capacity for transport of the removed sediment.

The floating pier was assembled at the Cianbro site, floated down-river, and installed adjacent to the nearshore support area. The floating pier would rise and fall with the tide on seven spuds and was accessible to transport barges and tug boats at both high and low tide. The floating pier was used to offload sediment transport barges and load clean backfill transport barges.

At the nearshore support area, site preparation activities included construction of a clean imported material stockpile area, construction of a floating pier for barge loading and offloading, installation of a short gravel roadway for use as a shoreline access point for the floating pier, and installation of a nearshore intertidal access road with adjacent silt fencing.

The stockpile area was constructed using concrete bin blocks that were stacked to create an enclosure on three sides for containment of imported crushed rock used for the nearshore intertidal access road and clean backfill material used for post-removal backfill in the Penobscot River.

A nearshore intertidal access road was installed using 1.5-inch stone placed atop geotextile fabric (**Appendix B**, Photograph 2). High-density polyethylene (HDPE) mats were also used along portions of the nearshore intertidal access road to improve heavy equipment accessibility. The intertidal access road was approximately 700 feet long and was installed adjacent to the shoreline between the mean sea level and mean higher high-water elevations. This access road was used during the excavation and backfilling of SMA-1 and a portion of SMA-2. A super-silt fence was also installed adjacent to the nearshore intertidal access road, between the road and the river (**Appendix B**, Photographs 3 and 4). The super-silt fence was constructed in accordance with the Design Drawings using steel fence posts, steel chain-link fencing, and geotextile fabric that was secured to the fence posts and chain-link using steel fasteners. The toe of the geotextile fabric was buried into a 6-inch deep trench to anchor the silt fence. The trench was re-filled with 1.5-inch stone to maintain the anchoring of the silt fence.

2.2.2 Sediment Removal

Sediment removal commenced on July 20, 2017, and was completed on November 3, 2017. Two methods were used to perform the removal. For nearshore excavation areas, which included SMA-1 and a limited portion of SMA-2 nearest to the shoreline, a CAT349E long-reach excavator with a conventional bucket was used to excavate the material without overlying water (i.e., in the dry; **Appendix B**, Photograph 5). For most of SMA-2 and all of SMA-3, sediment removal was completed using a barge-mounted Komatsu PC450LC long-reach excavator equipped with a 1.5-cy Cable Arm environmental clamshell bucket (**Appendix B**, Photograph 6).

Both excavators used for sediment removal were equipped with Dredgepack positioning and tracking software by Hypack, as well as with Real-Time Kinematic (RTK) GPS controls and other positioning equipment (e.g., GPS receivers, inclinometer, and tilt sensors) that were used to track horizontal and vertical positions of the bucket in relation to the removal prism in real time. GPS accuracies were maximized by the installation of an on-site RTK base station, providing positioning accuracies of 3 inches horizontally and 2 inches vertically. For the barge-mounted Komatsu PC450LC excavator, in addition to the standard inclinometers on the boom and stick, two inclinometers were placed perpendicular to each other at the machine's center of rotation to correct for any listing of the barge platform.

For the nearshore excavation areas completed using the CAT349E excavator, the intertidal access road was used to reach the removal area. Temporary HDPE mats were also used as necessary to provide access for the excavator. The excavator was always positioned either on the intertidal access road or the HDPE mats, and was never positioned directly atop the sediment to be removed. Excavated materials were loaded directly onto an off-road truck equipped with a splash cover (**Appendix B**, Photograph 7) and transported to one of three on-site temporary sediment stockpile areas (**Appendix B,** Photograph 8) for processing and eventual disposal.

For sediment removal using the barge-mounted Komatsu PC450LC excavator, removal was completed both in the wet and in the dry, depending on the tide cycle. All sediment removal from the barge-mounted Komatsu PC450LC excavator was performed within a moon pool system to control turbidity and prevent fish from entering the work area. For sediment removal with the barge-mounted Komatsu PC450LC excavator, these steps were followed:

- Tug boats positioned the barge and moon pool system over the target removal area.
- The turbidity curtain affixed to the moon pool was lowered to the sediment surface to create an enclosed area within the moon pool (**Appendix B**, Photographs 9 and 10). When using the non-rigid moon pool system (see RFI 003 in Section 2.3 for discussion of the non-rigid moon pool system), the silt curtains forming the moon pool were not reefed completely to the water surface and subsequently lowered during each move; instead, the moon pool was slowly repositioned with the silt curtains deployed to minimize the release of any remaining turbidity outside of the enclosed moon pool.
- The enclosed area within the moon pool was scanned using an Adaptive Resolution Imaging Sonar (ARIS) camera to search for ESA-listed fish species that could be present, including shortnose sturgeon, Atlantic sturgeon, and Atlantic salmon (**Appendix B**, Photographs 11 and 12).
    - No ARIS camera scan was conducted when excavating in the dry because the sediment surface and absence of fish could be directly observed.
    - The ARIS camera scan would be conducted whenever dredging was initiated in the wet; if no ESA-listed fish species were observed during the ARIS camera scan, dredging could begin. Throughout the duration of dredging operations, no ESA-listed fish species were observed within the moon pool system.
- Sediment removal was performed using the 1.5-cy Cable Arm environmental bucket, either in the wet or in the dry depending on the tide cycle (**Appendix B**, Photographs 6 and 13).
- Material removed was placed into a 100-cy capacity sediment transport scow (**Appendix B**, Photograph 14).
- Free water was decanted from the sediment transport scow using a submersible pump (**Appendix B**, Photograph 15). The free water was passed through an on-barge filtration system consisting of a 5-micron geotextile tube and bag filters (**Appendix B**, Photograph 16), and the filtered water was returned to the river within the moon pool.
- Filled sediment transport scows were brought to the floating pier using tug boats. If free water was observed in the sediment transport scow at this location, the free water was pumped into

a storage tank that was also used to contain water collected from decontaminating the bucket for later disposal.

- A CAT 336F long-reach excavator positioned on the floating pier offloaded the removed sediment from the transport scow onto off-road trucks equipped with splash covers (**Appendix B**, Photograph 17).
- The off-road trucks transported the removed sediment from the floating pier along the upland haul road to one of three temporary soil stockpile areas (TSSAs) for processing and eventual disposal (**Appendix B**, Photograph 8). Each day, CDM Smith directed Sevenson as to which of the three TSSAs to use.

Once removal within a moon pool was complete, the remaining surface was surveyed by a licensed surveyor, and confirmation samples were collected according to the confirmation sampling protocol included in the CMI Plan. Surveying and sample collection is described further in Section 3.6.

2.2.3 Material Dewatering and Stabilization

As described in Section 2.2.2, following removal, the sediment was transported via scows to the floating pier using tug boats, loaded into off-road trucks, and transported to the TSSAs for processing. All sediment was processed at the TSSAs, and processing was accomplished by one of the following three methods:

- When space and time were available, sediment was spread out to air dry (**Appendix B**, Photograph 18).
- Sediment was mixed with dryer soils removed from other phases of the project that had similar contaminant properties.
- Sediment was mixed with saw dust at a rate of 1% to 3% by weight (**Appendix B**, Photograph 18).

To determine if the material was acceptable to load for transport to the landfill, CDM Smith either performed a Paint Filter Test or visually inspected the material to confirm that the material was stackable with a minimum of slumping. Once the materials were inspected and deemed ready for transport, the materials were loaded into rail cars that were covered (**Appendix B**, Photograph 19) and sent to Republic Services Landfill in Niagara Falls, New York. Disposal operations were managed by U.S. Ecology.

2.2.4 Initial Backfill

In SMA-2 and SMA-3, an initial backfill layer was placed on the same day as the sediment removal after verification surveys were performed and confirmation samples were collected. The initial backfill was placed within the moon pool prior to relocating to the next sediment removal area. Therefore, the duration for initial backfill was equivalent to the duration for sediment removal, commencing on July 20, 2017, and completed on November 3, 2017.

The target thickness for the initial backfill layer was 6 inches, within a tolerance of ± 3 inches. This thickness, with the allowable tolerance, is roughly equivalent to the practical precision of the placement equipment. As such, where the sediment removal thickness was less than 6 inches (i.e., because of equipment refusal on hard substrate), these areas were backfilled slightly above the final backfill target necessary to restore the area to preconstruction grades. In some areas where the sediment removal thickness was less than 12 inches, the initial backfill layer was determined by survey to meet final backfill elevation requirements. These areas are discussed further in Section 2.2.5.

Prior to the delivery of the imported backfill material to the site, this material was tested for geotechnical and chemical parameters as described in Section 3.2.

2.2.4.1 Nearshore Areas

For the nearshore excavation areas, following the verification survey and collection of confirmation samples, the initial backfill layer was placed using the following steps:

- The bucket of the CAT 349E excavator was pressure washed to prepare the bucket for backfilling. The pressure washing was conducted over a storage container to collect the decontamination water; this water was transported to the on-site water treatment plant for eventual treatment and disposal.
- After the excavator bucket was pressure washed and ready to place backfill, the backfill material was transported along the nearshore intertidal access road by a clean off-road truck. Dedicated trucks were used to haul either contaminated material or clean backfill materials.
- The excavator then scooped the backfill material out of the truck and placed it within the area where excavation was just completed (**Appendix B**, Photograph 20).
- Following placement of the initial backfill layer, the post-backfill surface was surveyed as described in Section 3.7.

Excavation and initial backfill placement in the nearshore areas was sequenced around the low tide portion of the tidal cycle, such that both operations could be completed in the dry before the incoming tide inundated the work area.

2.2.4.2 Offshore Areas

For placement of the initial backfill layer using the barge-mounted Komatsu PC450LC excavator, backfill placement was completed both in the wet and in the dry, depending on the tide cycle. All initial backfill placement was placed to cover the entire area where the removal was performed within a moon pool setup, prior to moving the moon pool system to the adjacent removal area. For backfill placement from the barge-mounted Komatsu PC450LC excavator, the following steps were followed:

- Backfill transport scows were loaded at the floating pier, using off-road trucks to deliver the backfill from the on-site stockpile to the floating pier where a CAT 336F long-reach excavator would transfer the backfill material from the off-road truck to the backfill transport scow (**Appendix B**, Photograph 21). If the excavator bucket had previously been used to offload sediment transport scows, the bucket was pressure washed prior to loading backfill scows. Dedicated transport scows were used to transport backfill material such that contaminated sediment transport scows were not used to transport backfill unless they were fully decontaminated.
- Tug boats delivered the backfill transport scows from the floating pier to the barge-mounted Komatsu PC450LC excavator (**Appendix B**, Photograph 22).
- Following the completion of removal within a moon pool setup, surveying, and sample collection, the clamshell bucket of the Komatsu PC450LC was pressure washed to prepare the bucket for backfill placement (**Appendix B**, Photograph 23). The pressure washing was conducted over a sediment transport scow so the decontamination water could be collected and processed using the on-barge water filtration system.
- The barge-mounted Komatsu PC450LC long-reach excavator placed the initial backfill layer across the entirety of the area within the moon pool setup (**Appendix B**, Photographs 24

and 25). The initial backfill layer was typically placed in two lifts, with one lift placed while moving the clamshell bucket in a direction parallel to the direction of the barge, and the second lift placed while moving the clamshell bucket perpendicular to the direction of the barge.

Once initial backfill placement within a moon pool was complete, the post-backfill surface was surveyed by a licensed surveyor. Post-backfill surveying is described further in Section 3.7. After the surveyor confirmed that adequate thickness of initial backfill had been placed, the barge and moon pool were relocated to the next area for sediment removal.

2.2.5 Final Backfill

Final backfill placement commenced on November 3, 2017, and was completed on November 27, 2017. Final backfill was placed to the required grade necessary to approximate the pre-removal elevations over SMA-2 and SMA-3. Final backfill in SMA-1 was completed within the same tidal cycle in which sediment removal occurred.

Procedures for the placement of the final backfill layer were consistent with the procedures described for the initial backfill layer in Section 2.2.4. The final backfill layer was placed in all removal areas where the initial backfill layer placement was not of sufficient thickness to return the average post-backfill elevation to the original elevation.

Once final backfill placement within an area was complete, the post-backfill surface was initially surveyed prior to relocating the excavator barge to the next location; the survey data were collected either by a licensed survey collecting pole shot data or by using the RTK-GPS-equipped excavator bucket (see Section 2.3 for a summary of survey measurements using the excavator bucket as part of RFI 008). Upon completion of all final backfill placement, multibeam survey data was collected across the entirety of SMA-, SMA-2, and SMA-3. Post-backfill surveying is described further in Section 3.7.

2.2.6 Revegetation and Restoration

Revegetation of areas affected by the sediment removal and backfilling will occur in 2018 and will be described and documented in an addendum to this Closure Report.

Site restoration activities that occurred in 2017 included removal of materials and equipment from the nearshore and upland staging areas that were used to conduct removal and backfill operations. Materials and equipment that were removed included the following:

- The nearshore intertidal access road, including the 1.5-inch stone and geotextile
- The super-silt fence located adjacent to the nearshore intertidal access road
- The remaining on-site backfill stockpile and the concrete bin blocks used to contain the stockpile
- The floating pier used for barge access during construction
- All sectional barges and vessels used to conduct removal and backfill activities

2.3 Requests for Information

During construction activities, Sevenson submitted eight RFIs for clarifications regarding the Project Documents. Responses to RFIs were prepared by CDM Smith and Anchor QEA. The RFIs and the issued responses are generally described as follows and presented in **Appendix C**.

- **RFI 001:** Sevenson requested to construct the southernmost 200 linear feet of the intertidal access road with HDPE mats rather than geotextile and 1.5-inch stone. This request was approved.

- **RFI 002:** Pre-construction multibeam bathymetric survey data collected on June 22, 2017, indicated differences in some portions of SMA-1, SMA-2, and SMA-3 as compared to the multibeam bathymetric survey data collected on June 29 and 30, 2015, provided with the contract documents. Sevenson requested guidance on how to proceed with sediment removal and backfill in areas where the two surveys showed differences. Anchor QEA investigated the surveys and performed limited follow-up sampling within SMA-1 to verify the elevation of contaminated material. Maine DEP was consulted and the following path forward was established:
  - Throughout SMA-1, the pre-construction survey indicated that the design sediment removal elevations were above the existing elevations or within 3 inches below the existing elevations. The response for SMA-1 was to establish a minimum target excavation cut of 3 inches with an allowable over-excavation tolerance of 3 inches. For areas requiring only a 3-inch target excavation cut, the minimum backfill thickness was 3 inches with a tolerance of -0/+3 inches.
  - For SMA-2 and SMA-3, for areas where the design sediment removal elevations from the CMI Plan were above or within 6 inches below the 2017 pre-construction survey (existing) elevations, the minimum target sediment removal thickness was revised to 6 inches. Sevenson was directed to removal sediment in all other areas within SMA-2 and SMA-3 to the grades specified in the original design presented in the CMI Plan (with some exceptions presented in Section 4). Sevenson was directed to backfill all excavations in SMA-2 and SMA-3 in accordance with the original Technical Specifications, with one exception: for areas requiring only a 6-inch target removal thickness, the initial backfill thickness could be accepted as final backfill, considering an allowable tolerance of ±3 inches.
- **RFI 003:** Sevenson requested the use of a non-rigid moon pool system with a permeable turbidity curtain. This request was approved, with the conditions that the turbidity curtain have an apparent opening size no greater than an ASTM International Standard No. 70 sieve and that water quality criteria presented in the CMI Plan must still be met.
- **RFI 004:** Due to the water current in the work area, the impermeable curtain on the moon pool tore on two occasions. Sevenson proposed a permeable curtain for the moon pool system to reduce stress on the curtain and reduce the likelihood of damage. This request was approved, with the condition that water quality criteria presented in the CMI Plan must still be met.
- **RFI 005:** Sevenson requested permission to ground barges on previously placed backfill, to provide opportunities to increase efficiency. This request was approved.
- **RFI 006:** Sevenson requested permission to reduce survey density for the initial backfill layer from a 5-foot by 5-foot grid to a 10-foot by 10-foot grid in areas to be backfilled to less than final grade. This request was partially approved, with a reduction of survey density for the initial backfill layer to a 5 foot-by 10-foot grid. Survey methods for the excavation, dredging, and final backfill layer remained unchanged from the original Technical Specification.
- **RFI 007:** Sevenson requested permission to perform final as-built surveys of the backfill layer using topographic surveys using an RTK rover on a 10-foot by 10-foot grid similar to the method used for sediment removal and initial backfill layer placement elevation confirmation. This request was not approved, and additional information was requested from Sevenson. This request was then superseded by RFI 008.
- **RFI 008:** Sevenson requested permission to perform final as-built surveys of the backfill layer using the GPS-enabled clamshell bucket on the backfill excavator in lieu of single beam survey data; this request would allow surveys to be conducted on the same day during the same tide

cycle as the final backfill placement. This request was approved for the purposes of verifying the minimum required thickness of final backfill was placed; however, multibeam survey methods were used to prepare the final as-built survey.

Section 3. Summary of QC and CQA Activities

QC and CQA testing and activities were performed to verify that the corrective measures were implemented in accordance with the Contract Documents. QC testing was conducted by Sevenson or their subcontractors and reviewed on an ongoing basis by the CQA Engineer. QC testing included collection of samples for imported materials including 1.5-inch stone and backfill material (Section 3.2) and of post-removal and post-backfill survey data (Sections 3.6 and 3.7).

CQA field oversight activities included routinely inspecting erosion and sedimentation controls, observing construction activities, monitoring material deliveries, reviewing surveys to verify sediment removal and backfill placement activities, attending daily and weekly construction meetings, water quality and fish monitoring, post-removal confirmation sampling, and preparing various reports.

This section describes QC and CQA activities that were completed prior to and during removal and backfill activities. Daily CQA activities and construction activities were documented by the CQA Engineer in the Inspector's Daily Reports, which are provided in **Appendix A**.

3.1 Contractor Submittals Review

Sevenson provided Contractor work plans, material QC information and/or samples of proposed materials, and as-built survey information in the form of submittals to CDM Smith and Anchor QEA as required by the CMI Plan Design Drawings and Technical Specifications. CDM Smith and Anchor QEA reviewed the submittals and generated corresponding submittal responses. Submittal responses marked as "Reviewed – no comments" or "Comments as noted" were issued to Sevenson. For submittal responses marked as "Revise and Resubmit," Sevenson revised the submittal according to the comments, and CDM Smith and Anchor QEA reviewed the updated submittal to verify the product met the requirements of the CMI Plan Design Drawings and Technical Specifications. Submittals included Contractor work plans, sources of imported fill materials including 1.5-inch stone and backfill sand, chemical and geotechnical sample results for imported fill materials, geosynthetics, erosion and sedimentation control materials, and as-built surveys.

A complete list of pre-construction submittals and corresponding responses are provided in **Table 3-1**. Review of material sources including geotextile fabric, super-silt fence, 1.5-inch stone, and backfill sand is discussed in more detail in Section 3.2.

Table 3-1: Pre-Construction Submittals

Submittal	Submittal Date(s)	Submittal Response
Pre-Construction Work Plan	Original – 10/13/2016 Revision 4 – 6/13/2017	Final Record Only
Environmental Protection Plan	Original – 10/13/2016 Revision 4 – 6/14/2017	Final Record Only
Quality Control Plan	Original – 4/25/2017 Revision 2 – 5/11/2017	Final Record Only
Contractor Health and Safety Plan	5/15/2017	Reviewed

3.2 Qualifying of Material Sources

Prior to applicable aspects of the construction, Sevenson provided initial material QC information, including certification(s), analytical data, QC test results, and samples of proposed materials. The CQA Engineer examined the provided QC information to verify that the materials met the project requirements. Material QC information was provided for geotextile fabric, super-silt fence, 1.5-inch stone, and backfill material.

Backfill material and 1.5-inch stone were obtained from Thornton Construction's Greenfield Road Pit in Greenbush, Maine. Samples of both materials were collected by Sevenson and submitted to a qualified laboratory for chemical and geotechnical analysis in accordance with the CQA Plan included in the CMI Plan. Chemical analyses were performed by Alpha and geotechnical analyses were performed by S.W. Cole Engineering.

Prior to importing the material on site, the CQA Engineer reviewed the laboratory test results and evaluated whether they met the requirements of the CMI Plan Design Drawings and Technical Specifications. If, during the pre-construction qualification, a sample failed to meet the requirements of the Contract Documents, the Remediation Project Manager notified Sevenson. Use of the material was not allowed unless the material was prequalified by further tests or otherwise accepted by the Remediation Project Manager and the CQA Engineer. As construction progressed, additional samples of the backfill sand were collected at a frequency of 1 per 1,000 cy and submitted for grain size analysis.

The backfill material was generally within the specification requirements, with the exception that the sieve analyses typically indicated too low a percentage of gravels (too much material passed through the No. 4 and No. 10 sieves). Because the sieve analyses were typically close to the specification requirements and met the intent of the specification, these results were accepted by the CQA Engineer. However, on November 6, 2017, it was noted by the on-site CQA inspector that the material being delivered contained a lower amount of gravel than had been previously accepted. The Contractor was immediately notified, and the quarry was instructed to deliver backfill materials that better matched the requirements. In addition, the Contractor received two loads of gravel on site, which were then blended with backfill containing a lower percentage of gravel to bring the backfill to an appropriate amount of gravel prior to placing that material. Laboratory test result reports are provided in **Appendix D.**

3.3 Site Preparation

CQA monitoring activities for site preparation included verification and documentation of the following:

- Erosion and sediment controls were in place prior to the start of clearing and nearshore intertidal access road installation, and they were maintained throughout construction, as described in Section 3.4.
- Access road(s) and staging areas were maintained in accordance with the Contract Documents.
- Minimal disturbance to surrounding areas (e.g., outside the limit of work) occurred during work activities, and any such areas were properly addressed or restored.
- The location and configuration of stockpile areas were in compliance with the Contract Documents and different materials were stockpiled separately.

3.4 Erosion and Sedimentation Control

The CQA Engineer observed Sevenson's work activities and verified that prior to initiating work in any given area, erosion and sediment controls as set forth in the Contract Documents had been installed.

Erosion and sedimentation controls in use included a super-silt fence installed adjacent to the intertidal access road, use of concrete bin blocks around the backfill stockpile to contain and limit sedimentation from the stockpile, splash guards on the floating pier and off-road trucks to contain sediment during loading and offloading of trucks, use of polyethylene sheeting where necessary to contain sediment where the splash guards were not sufficient on their own, and use of containers to collect and store decontamination water.

The CQA Engineer routinely verified that Sevenson kept the Site free from excessive sediment and in a neat condition. This included the project area, haul roads, borrow areas, stockpile areas, Site entrance roads, and nearby waterways. The super-silt fence located adjacent to the intertidal access road required maintenance on several occasions to keep the fence in good working order. The CQA Engineer routinely observed that Sevenson's erosion control systems were in adequate condition and were not releasing excess amounts of sediment.

3.5 Environmental Monitoring

3.5.1 Water Quality Monitoring

As described in Appendix D of the CMI Plan, two water quality monitoring stations were installed to monitor for potential water quality impacts related to in-water work in the Southern Cove. The monitoring stations were installed prior to the initiation of sediment removal at fixed positions within the Penobscot River approximately 600 feet north and south of the Southern Cove (**Appendix B**, Photograph 26). Water quality monitoring station locations are depicted in **Figure 3-1**.

Pre-construction sampling events were conducted on July 6 and 7, 2017, as reference surveys to establish background reference values for turbidity. The initial reference value was established at the 90th-percentile concentration of the dataset. Data collected from the up-current construction monitoring station (which switched depending on the tide) during construction was added to the dataset as it was collected and the 90th-percentile of the dataset was updated continuously as the construction progressed. The reference value generally ranged between 10 to 15 nephelometric turbidity units (NTUs) for the duration of in-water work.

The monitoring buoys collected a turbidity measurement at 10-minute intervals for the duration of in-water work. Data from the monitoring buoys was transmitted wirelessly and uploaded to a database for real-time monitoring and comparison to water quality criteria. The water quality criterion was established at not-to-exceed 35 NTUs above the reference value at the compliance point, averaged over a 1-hour period. Reference values were set at the higher of the daily up-current measurement or the updated 90th-percentile reference value. If an instantaneous turbidity measurement exceeded the water quality criterion, Anchor QEA project team members would receive an automated email alerting them to the elevated result.

Throughout the duration of water quality monitoring, turbidity measurements were heavily influenced by the tide cycle. Elevated turbidity levels were typically measured around low tide and approximately 90 minutes prior to high tide. These elevated measurements were observed both prior to and throughout the duration of removal and backfill placement operations. Exceedances of the water quality criteria were noted at regular intervals during in-water work, but these exceedances were observed at times that generally coincided with natural fluctuations caused by the tide cycle. Elevated turbidity levels measured during the in-water work generally coincided with the natural tide cycle as observed prior to the in-water work, and the on-site CQA Engineer did not observe visible turbidity plumes leading from the work area to the monitoring buoys. Thus, the CQA Engineer concluded that these elevated measurements were unrelated to the Contractor's operations. No exceedances were noted during the in-water work that were attributable to the Contractor's operations.

The monitoring buoys were removed from the river on November 28, 2017, following the completion of backfill activities (**Appendix B**, Photographs 27 and 28). Water quality monitoring data collected during in-water work are summarized in the Water Quality Monitoring Summary included as **Appendix E**.

3.5.2 Fish Monitoring

As discussed in Section 2.2.2, each time Sevenson relocated the moon pool to a new location to conduct dredging in the wet, fish monitoring was conducted within the moon pool prior to initiating removal.

The objective of the fish monitoring program was to minimize the potential for adverse impacts to fish during in-water construction activities in the Southern Cove, consistent with the requirements outlined in the Biological Opinion issued by National Marine Fisheries Service (NMFS) and other permits. The ESA-listed fish species that could be present in the Southern Cove during the construction period were the shortnose sturgeon, Atlantic sturgeon, and Atlantic salmon.

The area enclosed by the moon pool and turbidity curtain was scanned using an ARIS camera. No ARIS camera scan was conducted when excavating in the dry because the sediment surface and absence of fish could be directly observed. Throughout the duration of dredging operations, no ESA-listed fish species were observed within the moon pool system.

3.5.3 Air Monitoring

CDM Smith performed site-wide perimeter air monitoring throughout the duration of the project; details are provided in the *Perimeter Air Monitoring Plan* (CDM Smith 2015). They monitored for total gaseous mercury, particulates (PM10), and volatile organic compounds at four permanent air monitoring stations and two temporary air monitoring stations that were moved to locations of interest depending on the site activities.

3.6 Sediment Removal

The CQA Engineer monitored and documented removal of sediment within SMA-1, SMA-2, and SMA-3. These CQA activities generally included the following:

- Documented the construction equipment used for excavation and dredging
- Verified that survey and position control equipment were calibrated
- Verified environmental controls were in place and working
- Inspected work on site
- Reviewed survey data documenting removal progress (Section 3.6.1)
- Implemented the Confirmation Sampling Protocol (Section 3.6.2)

The verification plans and performance criteria for removal addressed the following objectives:

- Verification that removal achieved the horizontal and vertical extent required by the design
- The required removal to target elevations over 90% of the work area was achieved as outlined in the CMI Plan

Verification of the completion of sediment removal was performed on a CU basis. A CU is a removal subarea within an SMA that was established to provide a framework for confirmation of sediment removal, backfill, and facilitation of MPS compliance sampling. As shown in the CMI Plan, a grid of CUs was established at approximately the size of the interior of Sevenson's initially constructed moon pool (44 feet by 31 feet, or 1,364 square feet). The CU layout, consisting of 131 CUs, is depicted in **Figure 3-2**. This grid of CUs allowed for the tracking of the work in an organized manner, though the moon pool was typically set up over a portion of multiple CUs rather than just a single CU, as the time spent trying to get it perfectly aligned over a single CU was not deemed to be reasonable or necessary.

3.6.1 Post-Removal Surveying

Post-removal bathymetric surveys were performed by Sevenson's surveying contractor, CES. Manual survey methods were used to collect post-removal survey measurements on a 5-foot by 5-foot grid within the mobile turbidity curtain system moon pool. If the post-removal surface was in the dry, the surveyor would walk across the remaining surface to collect survey measurements (**Appendix B**, Photograph 29); if the post-removal surface was in the wet, the surveyor would collect pole survey measurements from a floating platform placed inside the moon pool (**Appendix B**, Photograph 30). Post-removal survey measurements are included in **Appendix F**. Sediment removal thicknesses across SMA-1, SMA-2, and SMA-3 are included in **Figure 3-3**.

The first step of survey verification was to establish if the required removal depth was met. Compliance with the design was based on achieving the required grade across at least 90% of the CU, excluding locations where rock or clay (i.e., hard subgrade) constrained the depth of removal. Hard subgrade was noted by the surveyor during post-removal survey data collection. In addition to achieving the required grade over 90% of the CU, the following additional requirements applied:

- Individual "high spots" above the required elevations (i.e., up to 10% of the area) were relatively isolated (i.e., non-contiguous) and not the result of intentional bias during implementation.
- No area within a given CU area was permitted to exceed the required grade by more than 3 inches.

As discussed in Section 4, Sevenson was directed to remove additional sediment beyond the originally specified design (specifically down to hardpan) in much of SMA-2 and SMA-3 based on the results of confirmation samples. Therefore, the above criteria became irrelevant in those areas where Sevenson was directed to remove sediment to hardpan.

3.6.2 Confirmation Sampling

Following the completion of sediment removal within each CU, a confirmation sample was collected in accordance with the Confirmation Sampling Protocol in Appendix H of the CMI Plan. If excavation of the CU was completed in the dry, the confirmation sample was collected by hand using stainless steel hand tools (**Appendix B**, Photograph 31) by the CQA Engineer or designee. If removal of the CU was completed in the wet, the confirmation sample was collected using a pneumatically-powered power grab sampler (**Appendix B**, Photograph 32). If the power grab sampler was unable to collect a sample after two attempts, then no removable sediment was assumed to be remaining at that location and further attempts to collect a sample were discontinued.

Following the collection of a post-removal confirmation sample, the sample was submitted to the Maine-certified on-site Geosyntec Consultants Field Laboratory for analysis of mercury. Confirmation sample results are provided in **Appendix G**.

The MPS for the Southern Cove is an average mercury concentration of 2.2 mg/kg averaged over an area less than 0.25 acre in size. As described in Appendix H of the CMI Plan, compliance with the MPS was determined for each CU by calculating the average mercury concentration of all confirmation samples collected within a 0.25-acre area centered around that particular CU. For a CU where a sample could not be recovered, the result for that CU was represented by a null, or zero, value and the MPS area averages were calculated using the average of these and other available sample results to characterize the full 0.25-acre area. **Figure 3-4** depicts a summary of MPS compliance evaluation results.

Confirmation sample results following the initial pass of removal are summarized in **Figure H-1** included with **Appendix H.** Based on the confirmation sample results and initial MPS average calculations, 12 CUs were determined to have an average mercury concentration greater than 2.2 mg/kg, six in SMA-2 (CUs 004, 020, 025, 026, 027, and 046) and six in SMA-3 (CUs 069, 078, 085, 094, 100, and 103). Additional removal within these 12 CUs was completed between October 24 and November 3, 2017. Following the additional removal, new confirmation samples were collected from each of the CUs using the same sampling protocol. Confirmation sample results following the additional removal are summarized in **Figure H-2** included with **Appendix H.** After the additional removal and follow-up confirmation sample analysis, the average MPS calculation for each CU was less than 2.2 mg/kg and removal was complete. The final MPS average calculations are provided in **Appendix H.**

3.7 Backfilling

The CQA Engineer monitored and evaluated Sevenson's backfill materials, placement methods, and survey methods in accordance with Contract Documents.

An initial backfill lift of approximately 6 inches was placed following acceptance of the required removal within a CU (as described in Section 3.6) and prior to moving the mobile turbidity curtain system to the adjacent CU. After all sediment removal and initial lift backfilling was completed, final backfill was placed to the required grade to approximate pre-removal conditions over SMA-1, SMA-2, and SMA-3. The following QA/QC steps were performed relative to backfilling:

- **Verification of Import Material Quality:** As described in Section 3.2, the chemical and physical characteristics of the materials used for backfilling were verified for their intended use, in accordance with the Technical Specifications.
- **Verification of Required Grade:** The satisfactory placement of backfill material over the required areas and to the required grade to match pre-removal conditions was verified, in accordance with the Technical Specifications.

Post-backfill bathymetric surveys for the initial backfill layer were performed by Sevenson's surveying contractor, CES, on the same date as the backfill placement. Manual survey methods were used to collect post-backfill survey measurements on a 5-foot by 5-foot grid within the mobile turbidity curtain system moon pool (and eventually a 5-foot by 10-foot grid as described in RFI 006 in Section 2.3). If the post-backfill surface was in the dry, the surveyor would walk across the post-backfill surface to collect survey measurements (**Appendix B**, Photograph 33). If the post-backfill surface was in the wet, the surveyor would collect pole survey measurements from a floating platform placed inside the moon pool (**Appendix B**, Photograph 34). The target thickness for the initial backfill layer was 6 inches with a tolerance of ± 3 inches. As discussed in Section 2.3, some areas of initial backfill were accepted as final backfill in accordance with RFI 002. Additional backfill material was added if any area within an SMA did not meet the minimum required thickness.

Once final backfill placement within an area was complete, the post-backfill surface was surveyed the same day on a 5-foot by 5-foot grid (**Appendix F**) using one of the following methods, depending on the tides:

- Pole survey measurements through the water column collected by CES from a floating platform
- Pole survey measurements in the dry collected by CES by walking on the exposed backfill surface
- RTK-GPS equipped environmental clamshell bucket that was used to place the backfill

Multi-beam bathymetric surveying was then employed following the completion of all final backfill layer placement to record the final post-backfill layer surface. The post-backfill multibeam survey is depicted in **Figure 3-5**.

Section 4. Deviations

The work was generally performed in compliance with the approved work plans. The following deviations were noted:

- See Section 2.3 of this report for requested and approved deviations from the original design that were addressed under the RFI procedures. An abbreviated summary of these RFIs included the following:
  - **RFI 001:** Construct a portion of the intertidal access road with HDPE mats
  - **RFI 002:** Adjustments to the target sediment removal and backfill thicknesses in portions of SMA-1, SMA-2, and SMA-3 based on differences in the pre-construction multibeam bathymetric survey data collected on June 22, 2017, as compared to the multibeam bathymetric survey data collected on June 29 and 30, 2015, provided with the Contract Documents
  - **RFI 003:** Use of a non-rigid moon pool system with a permeable turbidity curtain with an apparent opening size no greater than an ASTM Standard No. 70 sieve
  - **RFI 004:** Use of a permeable turbidity curtain as described in RFI 003 due to the water current in the work area causing damage to the impermeable turbidity curtain
  - **RFI 005:** Grounding of barges on previously placed backfill
  - **RFI 006:** Reduction of survey density for the initial backfill layer from a 5-foot by 5-foot grid to a 5-foot by 10-foot grid in areas to be backfilled to less than final grade; final backfill layer survey density remained unchanged (5-foot by 5-foot) from the original Technical Specification
  - **RFI 007 and RFI 008:** Performance of final as-built surveys of the backfill layer using the GPS-enabled clamshell bucket on the backfill excavator in lieu of single beam survey data. This survey method was approved for the purposes of verifying the minimum required thickness of final backfill that was placed; however, multibeam survey methods were used to prepare the final as-built survey.
- Based on confirmation sample results received as the sediment removal progressed, which indicated that some CUs did not meet the MPS concentration of 2.2 mg/kg for mercury, instruction was provided to Sevenson to increase the minimum removal thickness in the south portion of SMA-3 from 12 inches to 18 inches. This instruction was then further amended to continue sediment removal in SMA-2 and SMA-3 until a hard bottom surface that could not be effectively removed using the 1.5-cy clamshell bucket had been reached.
- On September 27, 2017, Sevenson began dredging 2 hours before the planned start time and did not notify the CQA Engineer in advance. As a result, dredging was initiated on this date before a scan for endangered fish species was made within the moon pool using the ARIS camera. Sevenson was notified that this was unacceptable and would not be tolerated in the future. They accepted responsibility, and dredging in the wet prior to conducting an ARIS camera scan did not occur again. No endangered fish species were observed within the moon pool throughout the duration of dredging activities, and none were encountered during this event on September 27, 2017.

Section 5. Conclusions

CDM Smith and Anchor QEA observed the construction and implementation of the Southern Cove CMI Plan at the Site during the period of July 5, 2017, to November 27, 2017. During that time, CQA field personnel monitored removal of sediment required for disposal (i.e., sediment with mercury concentrations greater than the MPS) and backfill placement in the Southern Cove area. In total 6,136 cy of material was removed from the Southern Cove. This material was dewatered using multiple methods and transported to the Republic Services Landfill in Niagara Falls, New York, for off-site disposal. Following removal, 7,334 cy of backfill material was placed to restore the surface to pre-removal elevations.

Confirmation samples were collected from the completed removal areas to verify compliance with the MPS for the Southern Cove. Summaries of the MPS compliance assessment for each SMA were submitted to the Maine DEP for concurrence that the MPS had been achieved throughout the Southern Cove. After concurrence was received, placement of the final backfill layer commenced.

CQA personnel verified that conformance and CQA testing were performed on the construction materials at the frequencies required in the Construction Documents, and that materials meeting the requirements set forth in the Project Documents were used for the remedy. CQA personnel correspondingly verified that conditions or materials identified as not conforming to the Project Documents were removed, replaced, repaired, and/or retested, as described in this report. The results of the CQA activities performed by CDM Smith and Anchor QEA document that the removal and restoration of the Southern Cove was performed in accordance with the Project Documents and changes approved through the RFI process or as described herein.

Dean Carter
CDM Smith
Construction Manager

Paul LaRosa, P.E.
Anchor QEA
CQA Engineer of Record
Maine P.E. No. PE13654

Section 6. References

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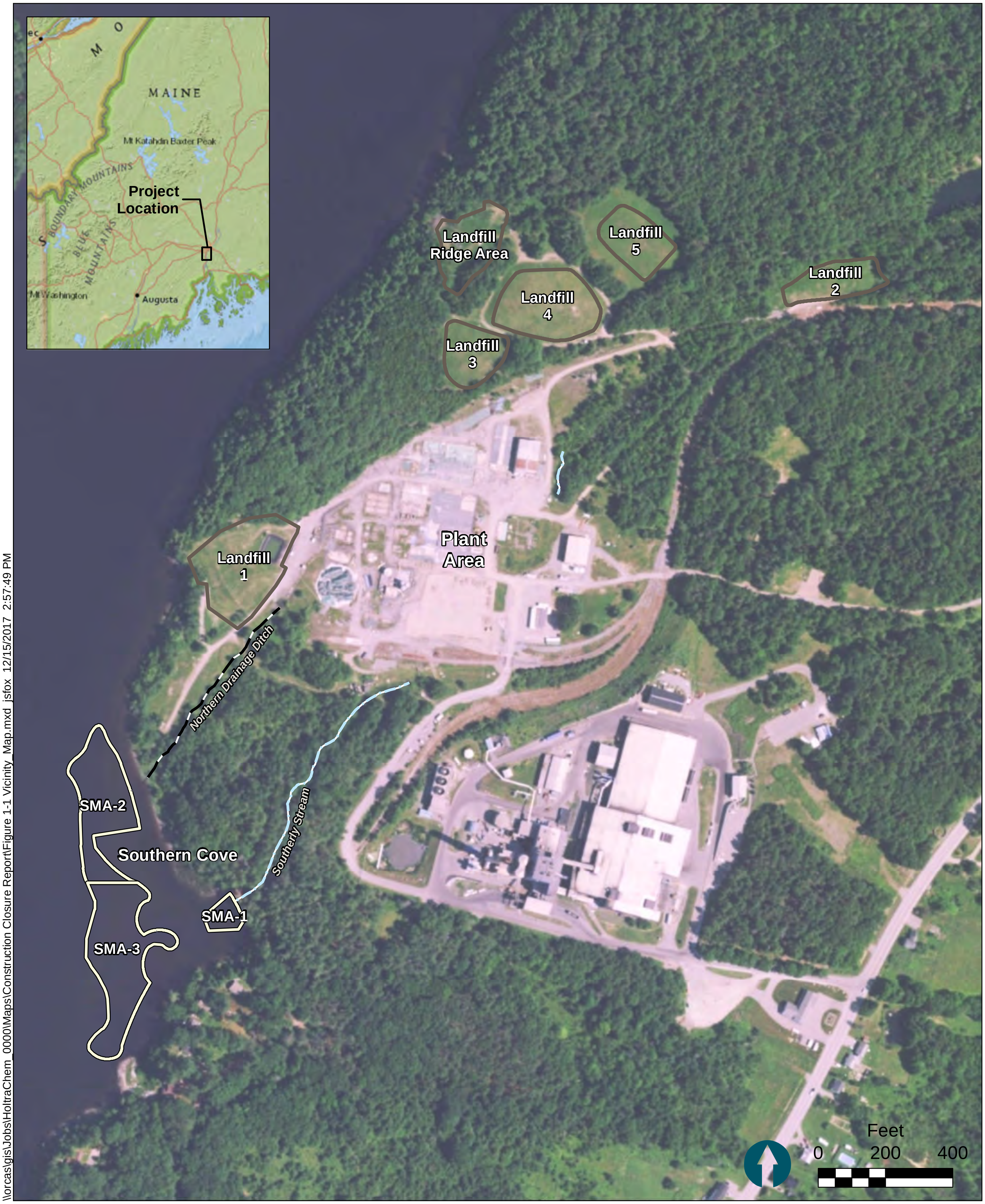
CDM Smith and Anchor QEA, LLC, 2017. *Construction Quality Assurance Plan*. Southern Cove, Orrington Remediation Site, Orrington, Maine. Prepared for Mallinckrodt US LLC. May 2017.

CDM Smith and Anchor QEA, LLC, 2017. *Corrective Measures Implementation Plan*. Southern Cove, Orrington Remediation Site, Orrington, Maine. Prepared for Mallinckrodt US LLC. Revised May 2017.

Maine BEP (Maine Board of Environmental Protection), 2010. Appeal of Designation of Uncontrolled Hazardous Substance Site and Order, Findings of Fact and Order on Appeal in the Matter of United States Surgical Corporation and Mallinckrodt LLC Concerning a Chlor-alkali Manufacturing Facility in Orrington, Penobscot County, Maine Proceeding Under 38 M.R.S.A. Section 1365, Uncontrolled Hazardous Substance Sites Law; August 19, effective date April 3, 2014.

Maine DEP (Maine Department of Environmental Protection), 2008. Compliance Order: Designation of Uncontrolled Hazardous Substance Site and Order in the Matter of United States Surgical Corporation, Mallinckrodt LLC Concerning a Chloralkali Manufacturing Facility in Orrington, Penobscot County, Maine Formerly Owned and Operated by Mallinckrodt Inc., Proceeding Under 38 M.R.S.A. Section 1365, Uncontrolled Hazardous Substance Sites Law; November 24.

FIGURES



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ANCHOR QEA

CDM Smith

Figure 1-1
Site Map
Construction Closure Report
Southern Cove, Orrington Remediation Site

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Upstream Buoy Location
Downstream Buoy Location
Proposed Sediment Removal Area
Historical NPDES Discharge
PERC Outfall
Northern Drainage Ditch
Stream

Upstream buoy locations:

1. 7/6/2017: Approximate location of original upstream buoy installation, as installation was occurring.
2. 7/7/2017 to 8/12/2017: Confirmed location of the original upstream buoy installation, after installation was complete.
3. 8/12/2017 to 11/28/2017: Upstream buoy was moved to this location upon request of the contractor, because the previous location of the buoy was too close to the floating pier to permit unrestricted access to the pier.

Downstream buoy locations:

1. 7/6/2017: Approximate location of original downstream buoy installation, as installation was occurring.
2. 7/7/2017: Confirmed location of the original downstream buoy installation, after installation was complete.
3. 7/7/2017 to 11/28/2017: Downstream buoy was moved to this location because the previous location of the buoy was further into the main river channel than intended, so the buoy was relocated closer to shore.

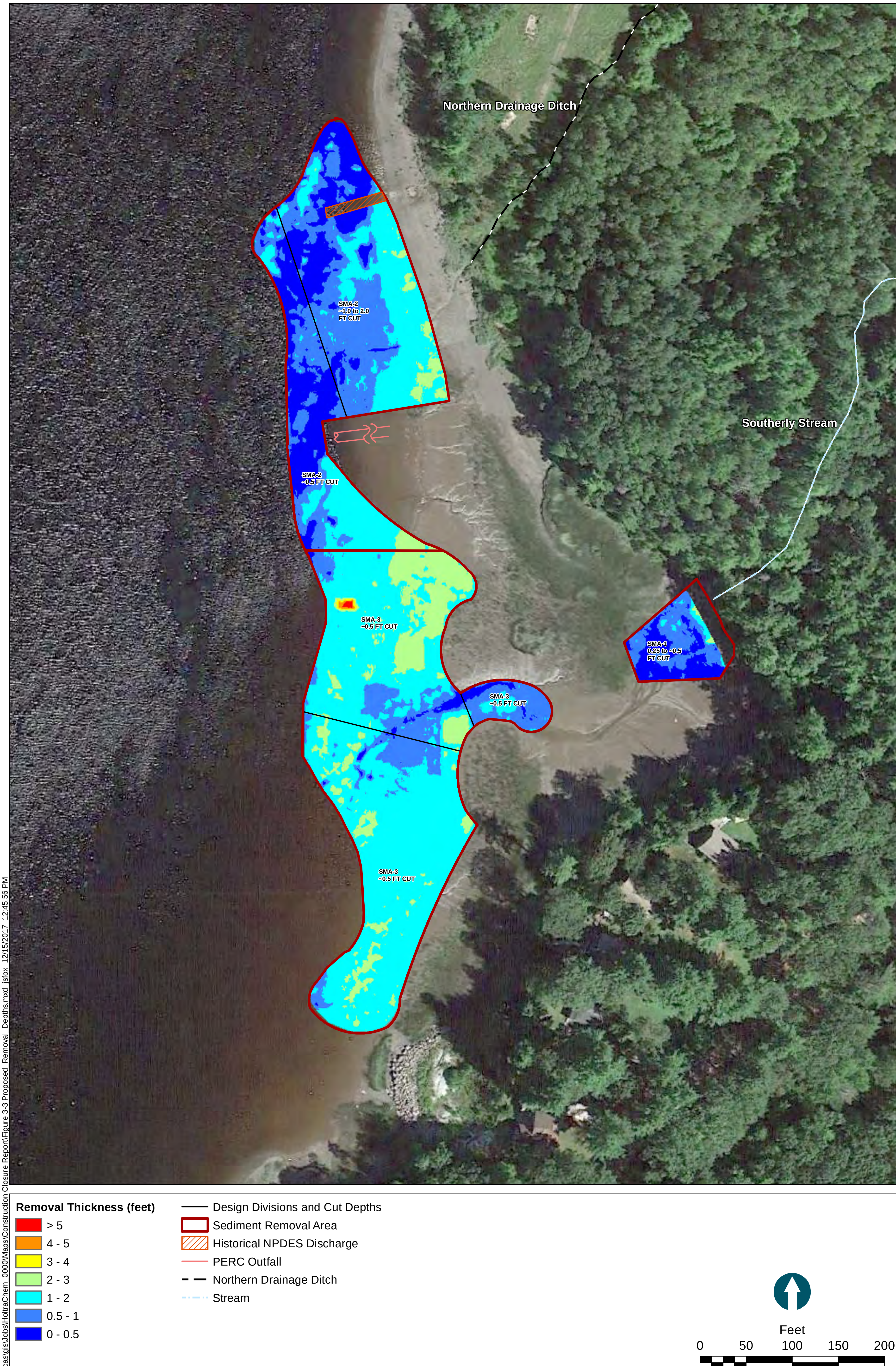
Feet
0 100 200 300 400

ANCHOR QEA
CDM Smith

Figure 3-1
Water Quality Monitoring Buoy Locations
Construction Closure Report
Southern Cove, Orrington Remediation Site

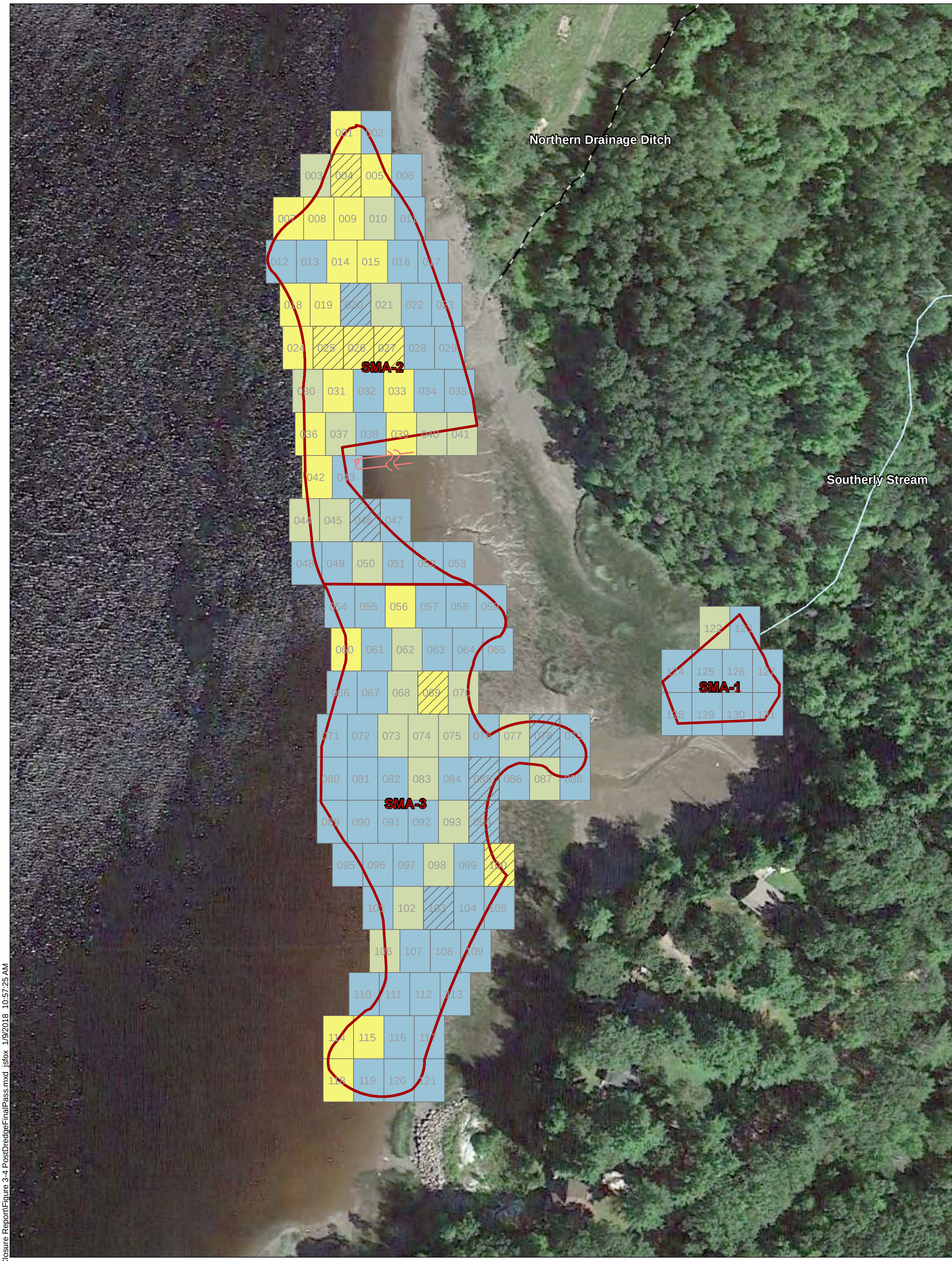
\\orcas\gis\Jobs\HoltraChem_0000\Maps\Construction Closure Report\Figure 3-2 Certification Unit Layout.mxd jsfox 12/15/2017 11:00:14 AM

Figure 3-2
Certification Unit Layout
Construction Closure Report
Southern Cove, Orrington Remediation Site



\\orcas\gis\Jobs\HoltraChem_0000\Maps\Construction Closure Report\Figure 3-3 Proposed_Removal_Depths.mxd jsfox 12/15/2017 12:45:56 PM

Figure 3-3
Sediment Removal Areas and Thicknesses
Construction Closure Report
Southern Cove, Orrington Remediation Site



Certification Units

- CU is less than MPS without averaging
- CU is less than MPS with 0.25-acre averaging
- Hard substrate of non-dredgeable material encountered (sampling not possible)

- PERC Outfall
- Re-dredge Areas
- Sediment Removal Area
- Historical NPDES Discharge
- Northern Drainage Ditch
- Stream

Feet

0 50 100 150 200

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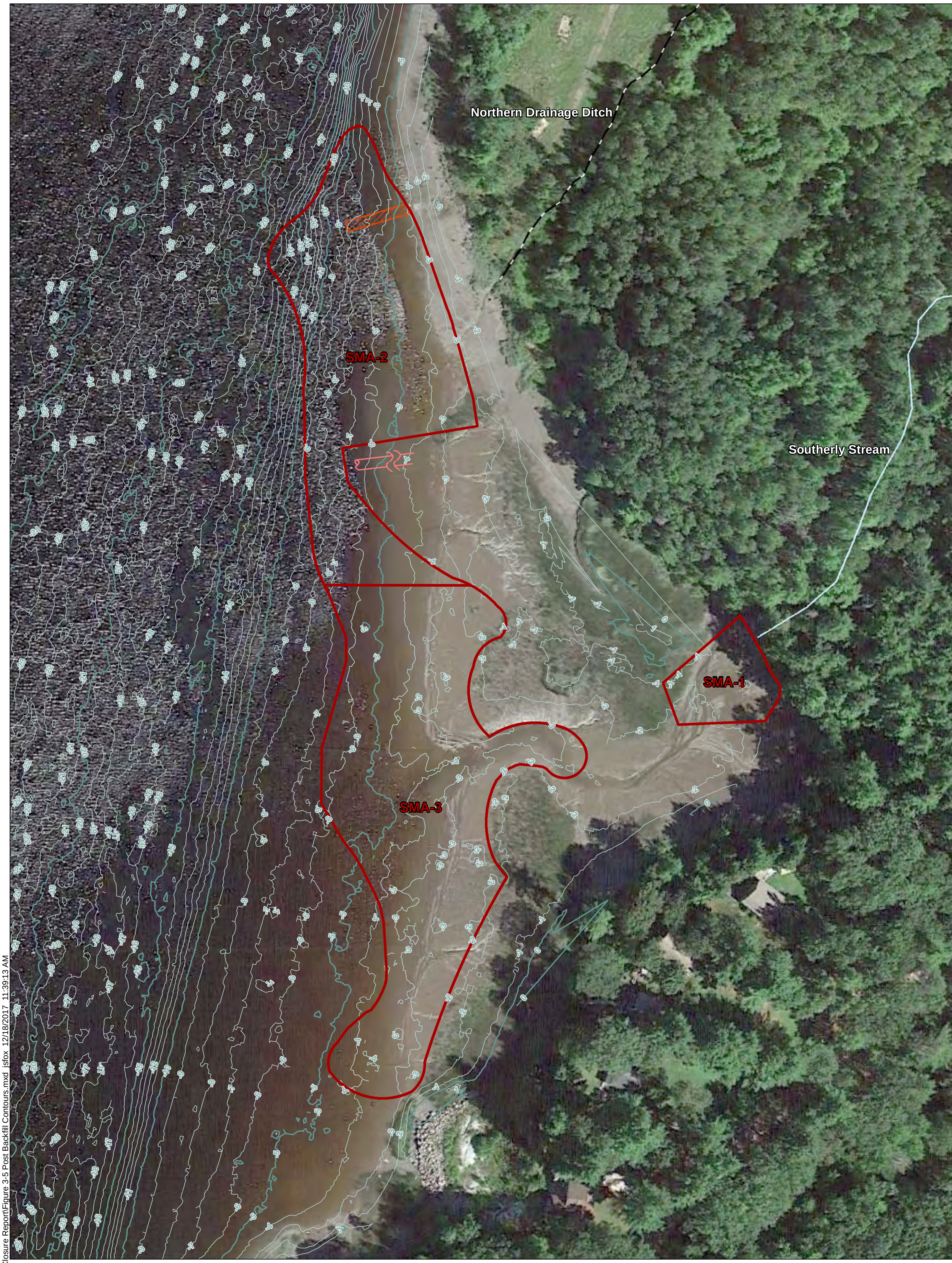
Figure 3-4
Post-Removal MPS Compliance Evaluation Summary
Construction Closure Report
Southern Cove, Orrington Remediation Site



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Post Back-fill Major Contour (5-foot interval)
Post Back-fill Minor Contour (1-foot interval)
Sediment Removal Area
Historical NPDES Discharge
PERC Outfall
Northern Drainage Ditch
Stream

Notes:
1. Bathymetric survey performed by Sea Vision, November 30, 2017.
2. Vertical Datum is NAVD88

Feet
0 50 100 150 200

ANCHOR QEA
CDM Smith

Figure 3-5
Post-Backfill Bathymetric Contours
Construction Closure Report
Southern Cove, Orrington Remediation Site