CORRECTIVE MEASURES IMPLEMENTATION PLAN

Southern Cove
Orrington Remediation Site
Orrington, Maine

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Acronyms

ADCP	Acoustic Doppler Current Profiler
bgs	below ground surface
CEO	Code Enforcement Officer
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
CQA	Construction Quality Control
CU	Certification Unit
CWA	Clean Water Act
cy	cubic yard
Delineation Technical Memorandum	*Proposed Delineation of Sediment Removal Areas for Basis of Remedial Design*
EPA	U.S. Environmental Protection Agency
ft/s	foot per second
Maine BEP	State of Maine Board of Environmental Protection
Mallinckrodt	Mallinckrodt US LLC
Maine DEP	Maine Department of Environmental Protection
MEPDES	Maine Pollutant Discharge Elimination System
mg/kg	milligrams per kilogram
MPS	Media Protection Standard
NTU	nephelometric turbidity unit
Order	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
PERC	Penobscot Energy Recovery Company
RCRA	Resource Conservation and Recovery Act
RPM	Remediation Project Manager
SI	Site Investigation
SI Report	*Site Investigation Report*
SMA	Sediment Management Area
TCLP	Toxicity Characteristic Leaching Procedure
TESC	temporary erosion and sediment control
TSS	total suspended solids
TSSA-2	Temporary Soil Stockpile Area #2

Section 1. Introduction

1.1 Purpose

This Southern Cove Corrective Measures Implementation Plan (CMI Plan) was prepared by Anchor QEA, LLC, and CDM Smith, Inc., on behalf of Mallinckrodt US LLC (Mallinckrodt). The purpose of this CMI Plan is to present the corrective measures necessary to remediate sediment within the Southern Cove of the Penobscot River adjacent to the Orrington Remediation Site located at 99 Industrial Way, Orrington, Maine, shown in **Figure 1-1**. The 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 hereafter as the "Order"). The Order requires corrective measures to achieve Media Protection Standards (MPSs) for mercury in sediment.

1.2 Site Description

The Southern Cove is located in the Penobscot River bordering the Orrington Remediation Site, as shown in **Figure 1-1**. A full description of the site, which included a former manufacturing plant and five landfills, is included in the *Site Investigation Report* (SI Report; CDM 1998) and the *Corrective Measures Study* (CDM 2003). The Southern Cove lies to the south of the historical manufacturing plant area, on the eastern side of the main channel of the Penobscot River. The Penobscot River is subject to tidal fluctuations up to 16 feet, and a portion of the cove is tidal mudflats exposed under low tide conditions.

Two outfalls and two drainages that currently discharge to the Southern Cove are shown in **Figure 1-2.** One of the two outfalls is the permitted effluent pipe from the on-site groundwater treatment plant (GWTP), which runs beneath the beach at the northern side of the cove and discharges into the river. The other outfall is the cooling water discharge pipe from the Penobscot Energy Recovery Company (PERC) facility; the pipe is buried beneath the beach and runs offshore near the central portion of the Southern Cove. The two drainages that flow into the cove are the Northern Drainage Ditch and the Southerly Stream.

1.3 Report Organization

The report is organized as follows:

- Section 1: Introduction
- Section 2: Summary of the Southern Cove Pre-design Activities
- Section 3: Design Objectives
- Section 4: Southern Cove Corrective Measures Implementation Activities
- Section 5: Permitting
- Section 6: Schedule
- Section 7: References

The following technical appendices (A through I) are also included and referenced in these sections:

- Appendix A: Pre-design Activities Report
  - Attachment A.1: Bathymetric Report
  - Attachment A.2: Acoustic Doppler Current Profiler Report
  - Attachment A.3: Boring Logs
  - Attachment A.4: Geotechnical Data
  - Attachment A.5: Treatability Report
  - Attachment A.6: Mercury Data Report
  - Attachment A.7: Data Usability Assessment
- Appendix B: Turbidity Control Evaluation Report
- Appendix C: Delineation of Sediment Removal Areas for Basis of Remedial Design Technical Memorandum
- Appendix D: Water Quality and Fish Monitoring Plan
- Appendix E: Drawings
- Appendix F: Technical Specifications
- Appendix G: Construction Quality Assurance Plan
- Appendix H: Remediation Contractor Health and Safety Plan (placeholder, to be provided by contractor)
- Appendix I: Schedule (placeholder, to be provided by contractor)

Section 2. Summary of Southern Cove Pre-design Activities

2.1 Background

The Orrington Remediation Site, including the Southern Cove, was investigated during the Site Investigation (SI; CDM 1998) and CMS (CDM 2003). A total of 250 sediment samples were collected from the Southern Cove and analyzed for mercury, with some samples also analyzed for additional physical parameters. The majority of these samples were collected and reported as part of the SI Report and CMS, which were reviewed by Maine DEP and the Maine BEP and formed the basis of their final decisions on the remedial actions required for the Southern Cove in the Order.

Additional data were collected from the Southern Cove during the pre-design field activities conducted in 2015 and 2016. A full report of the pre-design methods and results is included in **Appendix A**. Results are also briefly summarized in the following subsections.

2.2 Pre-design Activities Overview

Pre-design field work was completed in accordance with the Maine DEP-approved *Southern Cove Pre-design Work Plan* (Anchor QEA and CDM 2015). Subsequent work plan modifications were requested during the field activities and approved by Maine DEP, including e-mails from Maine DEP dated May 21, 2015 regarding drilling equipment and oceanographic survey time intervals, and June 12, 2015 regarding sampling sediment for chloropicrin. In addition, a work plan addendum was approved by e-mail from Maine DEP on September 4, 2015.

Field work was completed during late spring and fall 2015. Work was completed in accordance with the *Quality Assurance Project Plan* (CDM Smith 2014a), the *Project Health and Safety Plan* (CDM Smith 2014b), and the *Health and Safety Plan* (Anchor QEA 2014) prepared specifically for remedial data collection activities in the Southern Cove.

Field data collection and laboratory analyses conducted as part of the pre-design field activities included:

- Bathymetric survey
- Hydrodynamic study (including Acoustic Doppler Current Profiler [ADCP] survey and tide gaging)
- Geotechnical investigations
- Disposal characterization
- Treatability testing
- Sediment chemical characterization
- Intertidal vegetation survey

A report of pre-design work is included in **Appendix A** and summaries are provided in subsequent sections.

2.3 Bathymetric Survey

A bathymetric survey of the Southern Cove up to the maximum high tide line was conducted in 2015 and is depicted in the Pre-design Activities Report (**Appendix A; Figure 2-1**).

2.4 Hydrodynamic Study

A hydrodynamic study was conducted to evaluate the range of expected tidal fluctuation and current velocities, and to provide data for hydrodynamic analyses to support the design of turbidity control measures. A temporary tidal gage was installed in the Southern Cove to measure water levels over tidal cycles between June 15 and 20, 2015. Tidal fluctuations were approximately 15 feet.

Water flow velocities across the Penobscot River channel adjacent to the Southern Cove were measured during an ADCP survey in June 2015. Flow velocities measured at the surface and the average of velocities measured at 0.25-foot depth intervals through the water column were evaluated. Velocity data were collected hourly over the study period. **Table 2-1** lists the maximum surface and depth-averaged velocities for the upstream, middle, and downstream locations during the flood and ebb tides measured in the vicinity of the Southern Cove sediment removal areas.

Table 2-1: Flow Velocity Summary – Maximums Measured Near the Southern Cove Over a 12-hour Tidal Cycle on August 3, 2016

ADCP Transect	Flood Tide		Ebb Tide	
	Surface Velocity (ft/s)	Depth-averaged Velocity (ft/s)	Surface Velocity (ft/s)	Depth-averaged Velocity (ft/s)
Upstream Transect	3.5	2.6 3.2 2.7		
Middle Transect	2.9	2.3 3.5 2.8		
Downstream Transect	2.8	2.1	3.2	3.1

Note:
ft/s = feet per second

Based on review of collected field data and published tidal and current data, a hydrodynamic evaluation, including modeling of flood and ebb conditions and flow rates, was completed and results are included in **Appendix B**. The results were used to evaluate loadings from flows in the river on potential silt curtain designs/orientations. Based on this analysis, a mobile turbidity curtain system is being recommended rather than larger, stationery silt curtains, which may not be stable in high flow conditions.

2.5 Geotechnical Investigation

Geotechnical data were collected to support engineering design with the following objectives. Sample locations are shown in **Figure 1-2**.

- Collect standard penetration test data to evaluate the depth to competent strata and to determine the type and design of footings if required for a silt curtain
  - Sample data were collected outside the sediment removal areas, near or at the break between the Southern Cove and the edge of the Penobscot River Channel at SD-SC-01, -02, and -03
- Collect standard penetration test and grain size data to support design of an equipment access road across the intertidal area of the Southern Cove, if needed
  - Sample data were collected within the intertidal area at locations SD-SC-04, -05, and -06
- Characterize physical properties of sediment to be removed and stratigraphy to support engineering for the sediment removal design

– Data were collected from all locations sampled during the pre-design investigation

Subsurface sampling conditions were difficult, with frequent refusals encountered. Both vibracore (4-inch diameter) and split-spoon (2- or 3-inch diameter) sampling techniques were employed, and both sampling techniques met with refusal between 1 and 2 feet at many of the sampling locations. Details on the techniques used at specific sampling locations are available in the boring logs included in the *Pre-design Activities Report* in **Appendix A**.

Overall, based on field observations and geotechnical analyses, material within the sediment removal areas is generally characterized as well graded, ranging from cobbles to clay, with medium to coarse sand as the dominant grain sizes. Sediment is finest in the southern sections of the cove where a discontinuous soft silt layer occurs within the top 1 to 2 feet below the mudline. This surface silt layer is generally absent toward the north (SD-SC-07) and toward the Penobscot River Channel (SD-SC-01 and -02).

Generally, deposits coarsen with depth. The extent of cobbles and coarse gravel in the material throughout the cove is unclear because both vibracore and split-spoon subsurface sampling equipment encountered refusal at several locations, which was most likely on cobbles, although samples could not be collected. Thus, the geotechnical sample results may not reflect some of the coarser material (coarse gravel and cobbles) in some areas.

Although refusal was met at several locations, bedrock was not confirmed in any of the explorations in the Southern Cove, nor is it expected to be present in the removal areas. Bedrock maps developed for the upland portion of the site during the SI (CDM 2003) indicate a phyllite bedrock with elevation varying steeply. The bedrock surface appears to outcrop where the Southerly Stream discharges to the Southern Cove, but maps indicate it may be 90 feet below ground surface along the beach at the northern end of the Southern Cove.

2.6 Disposal Characterization

Sediment from within the horizontal and vertical extents of the sediment removal areas was sampled for disposal characterization. Methods and results are detailed in the *Pre-design Activities Report* in **Appendix A**, and an overview of the studies is provided below.

Mercury in the Southern Cove is assumed to be primarily from historical wastewater discharges from the plant. Based on chemical data, the sediment is not a characteristic waste as defined by the U.S. Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) methods. Disposal characterization consisted of analyses for a suite of chemical and physical characteristics typically required by waste disposal facilities. Four composite samples (SD-SC-07 through -10) were collected from within the extent of each sediment removal area to characterize material for handling and disposal requirements. Sampling locations are shown in **Figure 1-2**. Samples were analyzed using EPA TCLP methods for volatile organic compounds, semivolatile organic compounds, metals, pesticides, and select herbicides (i.e., 2,4,5-TP and 2,4-D). Samples were also analyzed for a suite of additional chemical and physical characteristics that could be required by disposal facilities. The results were either non-detect or below the disposal facility

requirements; thus, the material is not characteristically hazardous in accordance with RCRA requirements and can be characterized as solid, non-hazardous, waste.

2.7 Treatability Testing

Sediment samples collected for disposal characterization were also subject to treatability testing to determine feasible post-removal dewatering methods for the project. Details of the study are included in Attachment A.5 to the *Pre-design Activities Report* in **Appendix A**.

The treatability testing evaluated the rate that sediments would dewater, the need for adding amendments to achieve low moisture requirements (i.e., the ability to pass the "paint filter" test), and the chemical composition of the dewatering elutriate in comparison to the on-site GWTP requirements. In general, the material drained well, and the addition of several types of amendments was successful in achieving the low moisture requirements for transport and disposal. Dewatering elutriate generally met requirements to be accepted by the on-site GWTP, although some filtering may be necessary to reduce the level of total suspended solids (TSS) prior to delivery to the on-site GWTP.

2.8 Sediment Chemical Characterization

In addition to sediment samples collected for treatability testing and disposal characterization, samples were collected during PD activities to complete delineation of mercury in sediments, and to support delineation of removal areas that will meet MPS requirements outlined in the Order. A full description of samples collected, objectives and results in presented in the *Pre-design Activities Report* (**Appendix A**) and *Proposed Delineation of Sediment Removal Areas for Basis of Remedial Design* (Delineation Technical Memorandum; **Appendix C**). Results are also discussed in Section 4.

2.9 Intertidal Vegetation Survey

The extent of wetland communities within the project area were delineated during a field survey in May 2015. At the time of the survey, the plants within the wetland had not reached full growth for the season but had grown enough for the extent and species present to be identified.

Three separate wetland communities were identified covering 2.1 acres, as shown in **Figure 2-2**. The three communities were composed of the following:

- A high marsh community of beaked spikerush growing near the shoreline on a thick base of peat (0.15 acre)
- Multiple, sparse beds of common three-square growing in soft, unconsolidated mud (1.9 acres)
- A small bed of densely growing hardstem bulrush embedded within the sparse common three-square, which appeared to be growing partly on a small chunk of peat mat as well as soft mud (0.03 acre)

Only one of the species identified is listed as a Maine rare, threatened, or endangered plant. Beaked spikerush is identified as threatened in Maine, as of September 2015, and was identified in the high marsh community at the Orrington Remediation Site (ME Natural Areas Program 2015).

Section 3. Design Objectives

3.1 Corrective Measures Implementation Plan Objectives

The primary objectives of the remedy for the Southern Cove are to remove sediments that are above the MPS as required in the Order, and to restore mudline elevations and vegetation to pre-remediation conditions.

3.2 Media Protection Standards

The MPSs identified in the Order require that sediment be removed where mercury levels exceed 2.2 milligrams per kilogram, averaged over a 0.25-acre area. Irrespective of concentrations, sediment within the two hot spot areas identified for three separate depth intervals must also be removed. The hot spots are defined in the Order by both the map and a list of sample locations included as a "narrative MPS" that must be encompassed in the sediment removal areas.

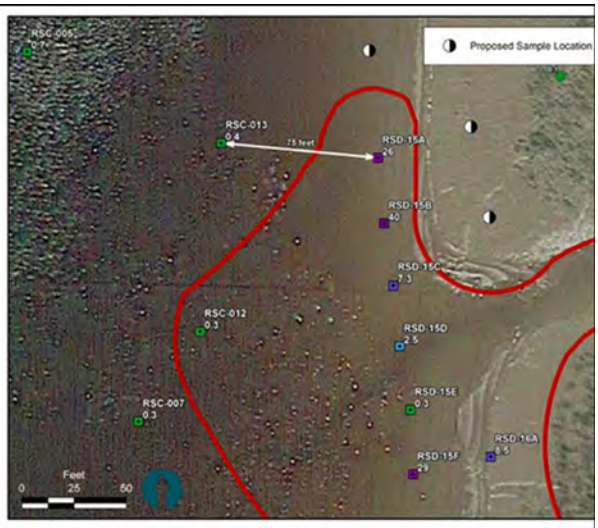
3.3 Compliance with the Order Media Protection Standards

The Order-defined sediment removal areas and the proposed sediment removal areas are depicted in **Figure 2-1** and **Drawing C-4**. The proposed sediment removal areas include the areas and depths required by the Order. The basis of the proposed sediment removal areas and compliance with the MPS is further described in the following subsections.

Mallinckrodt submitted a draft Delineation Technical Memorandum (**Appendix C**) on October 29, 2015. Following that submittal, Mallinckrodt presented an overview of the technical memorandum to Maine DEP on February 18, 2016, and received comments from Maine DEP by e-mail on February 26, 2016. Mallinckrodt presented responses to Maine DEP comments during a webinar on March 15, 2016. Based on feedback received from Maine DEP in its written comments, and comments received during the March 15 webinar, Mallinckrodt submitted responses to Maine DEP comments and a final Delineation Technical Memorandum to Maine DEP on March 25, 2016, which is included as **Appendix C**. The reader is directed to figures in the Delineation Technical Memorandum (**Appendix C**) that show mercury concentrations at various depths within the Southern Cove and are referenced in the following paragraphs.

In an e-mail to Mallinckrodt dated April 4, 2016, Maine DEP concurred with the areas to be removed with the following provisions:

1. The results from the additional samples shown below will be reviewed to determine if they increase the scope of the removal area.

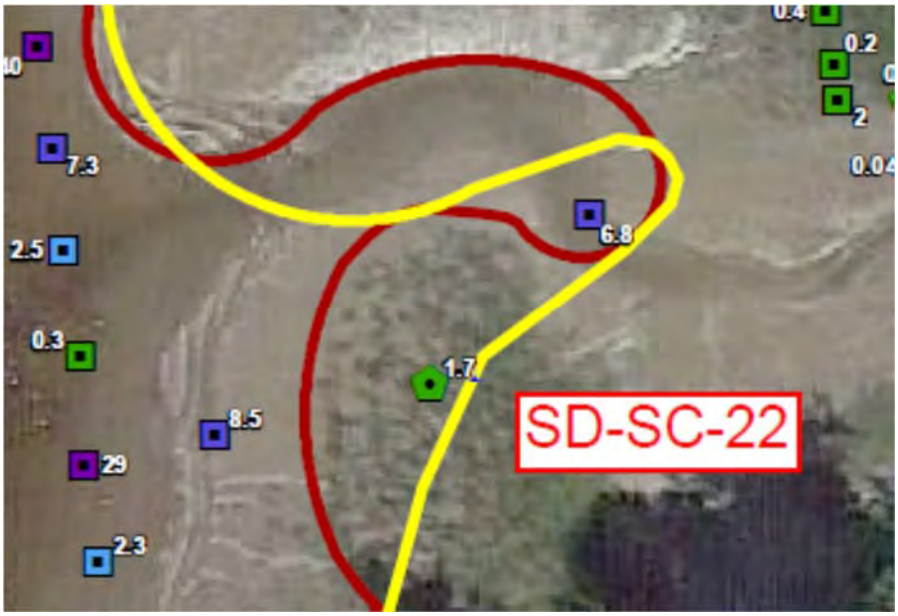


Northern Sediment Removal Area (SMA-2)	Southern Sediment Removal Area (SMA-3)
Proposed Additional Removal Area Delineation Samples	

2. The removal depth of the northern portion of Northern Sediment Removal Area (SMA-2) will need to be determined in the field during removal operations (see Section 7.3.1 of the Delineation Technical Memorandum [**Appendix C**]).

Mallinckrodt conducted this additional sampling in May 2016, and subsequently identified the need for additional sample collection to complete delineation. To keep the project construction on schedule, this draft CMI Plan is submitted based on preliminary sediment removal areas, with the understanding that the final sediment removal areas will be adjusted based on new sample data to be generated in June 2016.

Based on recent sampling and review of historical data, three proposed sediment removal areas/prisms have been identified to meet the requirements in the Order. The horizontal and vertical extents of the proposed removal prisms are shown on **Appendix C Figure 9**, along with the removal areas and depth intervals required by the MPS in the Order. One section of the removal area identified in the Order was excluded from the proposed sediment removal areas based on data collected since the Order was issued, as described in Section 5.3.2. The Order included a vegetated wetland hummock east of SMA-3 (Southern Sediment Removal Area) where no sample data were available from the SI and CMS. Samples collected as part of the pre-design investigation from SD-SC-22 (0 to 0.2 and 0.8 to 1 foot) showed mercury levels below 2.2 milligrams per kilogram (mg/kg) at this location (see image below); therefore, it was excluded from the proposed sediment removal areas.

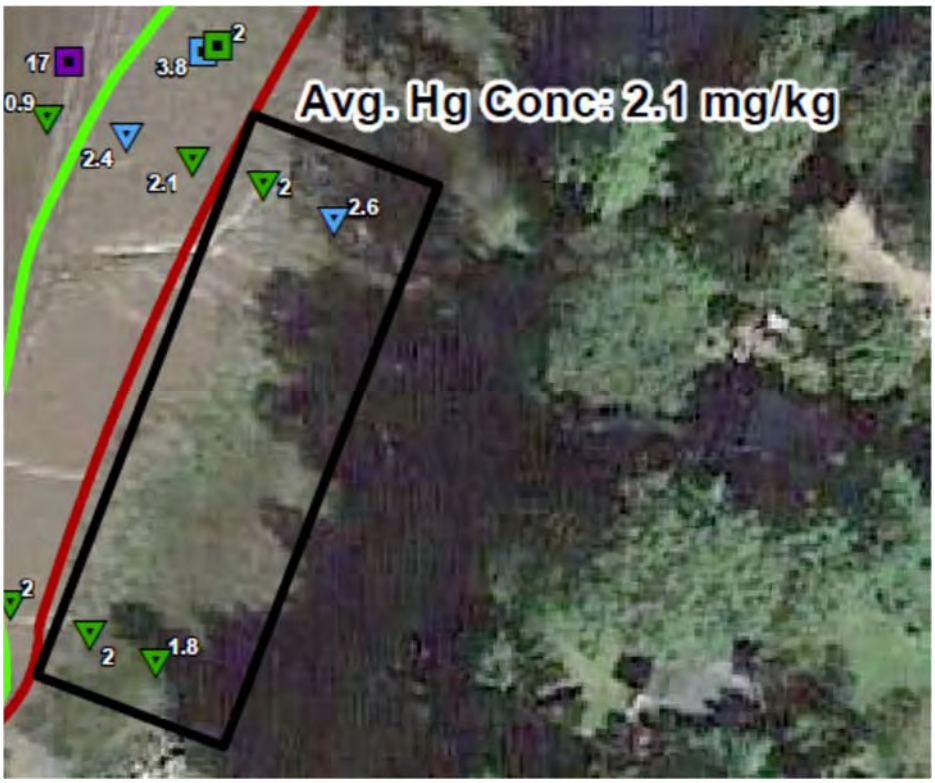


SMA-3 (Southern Sediment Removal Area) (0.8 to 1 foot) – Mercury MPS Compliance at SD-SC-22

The rationale for delineation of the horizontal and vertical extents of the three proposed sediment removal areas is explained in the following sections.

3.4 Southern Sediment Removal Area (SMA-3)

The horizontal extent of the proposed Southern Sediment Removal Area (SMA-3) includes all sample locations in the area exceeding 2.2 mg/kg in any sampled depth intervals, as depicted on **Appendix C Figure 7**. One exception outside the removal area is a concentration of 2.6 mg/kg mercury detected at SD-10-C1 from 0 to 0.2 foot (see image below). However, with consideration of samples from the same depth interval within a 0.25-acre area that includes SD-10-C1, the average mercury concentration of the 0.25-acre area is 2.1 mg/kg, which is less than the MPS (see **Appendix C Figure 2**). Therefore, this sample location is not included in the proposed Southern Sediment Removal Area (SMA-3).

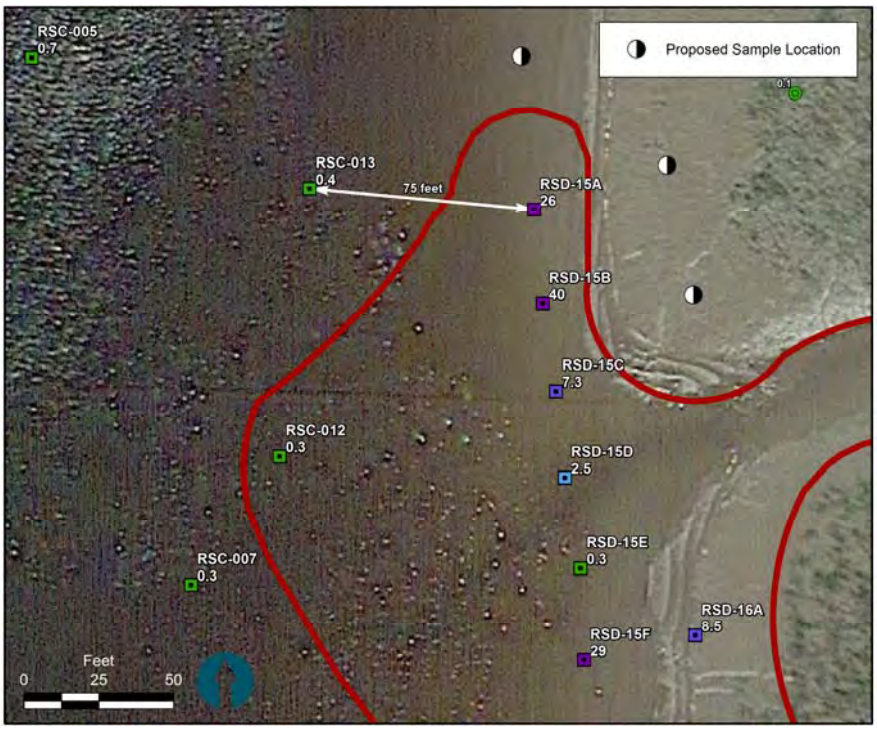


Southern Sediment Removal Area (SMA-3) (0 to 0.2 foot) – Mercury MPS Compliance within 0.25 acre at SD-10-C1

For vertical delineation in Southern Sediment Removal Area (SMA-3), data depicted on **Appendix C Figures 2 and 3** show mercury concentrations exceeding the MPS in the top 1 foot of sediment. All data from sediment samples collected below 1-foot depth show mercury concentrations below 2.2 mg/kg (**Appendix C Figures 4, 5, and 6**) with the exception of sample SD-10-B4, which had 5.7 mg/kg mercury at 1.5- to 2-foot depth (**Appendix C Figure 5**). However, adjacent samples had less than 1 mg/kg mercury at the same depth interval for an average concentration of 1.6 mg/kg over a 0.25-acre area within the 1.5- to 2-foot depth interval. Based on these results, the proposed depth for Southern Sediment Removal Area (SMA-3) dredge prism is 1 foot.

Based on comments received from Maine DEP on the draft Delineation Technical Memorandum (**Appendix C**), Mallinckrodt collected the following samples in May 2016, and will collect additional samples in June 2016 to complete delineation:

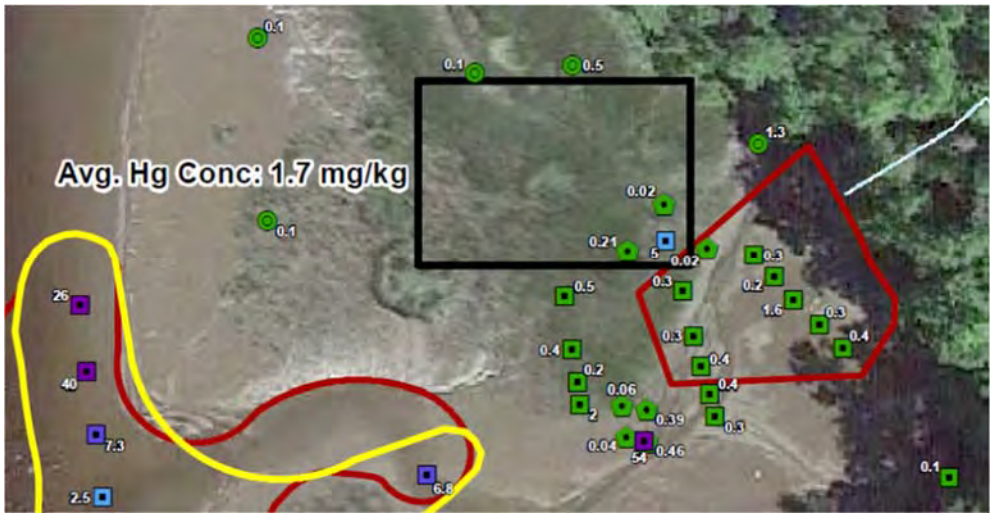
- North and East of RSD-15A and RSD-15B: Three additional samples will be collected to complete delineation—one north of Southern Sediment Removal Area (SMA-3) and two to the east, as shown in the image below. Samples will be collected from 0- to 0.2-foot and 0.8- to 1-foot depth intervals.



Delineation at RSD-15A and RSD-15B – Southern Sediment Removal Area (SMA-3)

3.5 Southerly Stream Sediment Removal Area (SMA-1)

The horizontal extent of the proposed Southerly Stream Sediment Removal Area (SMA-1) was established based on mercury concentrations greater than 2.2 mg/kg and applying the narrative MPS of an average mercury concentration of less than 2.2 mg/kg over a 0.25-acre area to sample locations outside the proposed removal area, as shown on **Appendix C Figures 2 and 3**. The average concentration was calculated based on samples from similar depth intervals. The proposed depth of this removal area is 0.8 foot (**Appendix C Figure 9**) based on concentrations meeting the MPS in samples from the 0.8- to 1-foot depth interval.



Southerly Stream Sediment Removal Area (SMA-1) (0.8 to 1 foot) – Mercury MPS Compliance

3.6 Northern Sediment Removal Area (SMA-2)

The horizontal extent of Northern Sediment Removal Area (SMA-2) is well defined by sample data and encompasses all data points that exceed 2.2 mg/kg in this vicinity. This removal area has been divided into three subsections based on differences in the depth of mercury contamination, as discussed in the following sections and shown on **Appendix C Figure 9**.

3.6.1 Northern Sediment Removal Area (SMA-2) – Northern Portion

The highest and deepest mercury concentrations are found in the northern portion of Northern Sediment Removal Area (SMA-2), which is close to a Maine Pollutant Discharge Elimination System (MEPDES) discharge. The elevated concentrations of mercury are localized and decrease rapidly in the horizontal direction out from RSC-024, the location with the highest concentration, especially to the west with increasing water depth toward the main river channel. The proposed removal depth is 3 feet in the area of highest mercury concentrations, corresponding to the deepest measured interval, with mercury greater than 2.2 mg/kg (sample SD-SC-07 from 30 to 36 inches). However, because the pre-design investigation sampling equipment could not penetrate to deeper depths, it is unclear if the contamination extends deeper than 3 feet in this area. Additional sampling will be completed in June 2016 to establish the dredge depth in this area.

Based on comments received from Maine DEP on the draft Delineation Technical Memorandum (**Appendix C**), Mallinckrodt collected the following samples in May 2016, and all results were less than 2.2 mg/kg mercury (the data will be presented along with the additional June 2016 sample data to finalize the sediment removal areas):

- North and East of RSC-11G: Sediment samples from two additional locations east of SMA-2 (Northern Sediment Removal Area) as shown in the image below. From each location, samples will be collected from two depth intervals between surface and 2 feet.

RSD-11G – Northern Sediment Removal Area (SMA-2)

3.6.2 Northern Sediment Removal Area (SMA-2) – Southern Portion

Mercury concentrations in the southern portion of SMA-2 (Northern Sediment Removal Area) are lower than to the north, but still exceed the MPS in the top 2 feet. The deeper sample (SD-SC-08) indicates a much lower mercury concentration of 0.06 mg/kg at 3 feet depth. Therefore, the proposed removal depth in this area is 3 feet based on sample results.

3.6.3 Northern Sediment Removal Area (SMA-2) – Western Edge

Mercury concentrations show a rapid decrease in concentration and contaminant depth along the western edge of Northern Sediment Removal Area (SMA-2) and toward the main river channel where water depths increase. Thus, the removal depth of the western edge of Northern Sediment Removal Area (SMA-2) is proposed at 1 foot to meet the MPS.

3.7 Definition of Preliminary Sediment Removal Areas

Based on pre-design sampling and review of historical data described herein, three sediment removal areas have been identified and are described in the Delineation Technical Memorandum (**Appendix C**). These areas are shown on Figure 2-1 and Drawing C-4, along with the removal areas and depth intervals required by the MPS defined in the Order. As described above, additional samples were collected in May 2016 at Maine DEP's request. Based on those sample results and the inability of equipment to penetrate

to required depths, Mallinckrodt will collect additional samples to complete delineation in June 2016. Final sediment removal areas will be presented in the next version of the CMI Plan.

Section 4. Southern Cove Corrective Measures Implementation Activities

4.1 Overview of the Remedial Action

The Southern Cove remedial action will involve removal of sediment to comply with the MPS, as described in previous sections, and restoration of the removal areas to pre-construction elevation. Details of the corrective action implementation are provided in the design drawings in **Appendix E**, the Technical Specifications in **Appendix F**, and the following sections, which are organized as follows:

- Section 4.2 – Existing Conditions and Site Preparation
- Section 4.3 – Sediment Removal and Processing Activities
- Section 4.4 – Environmental Controls
- Section 4.5 – Restoration Activities

The Construction Quality Assurance Plan is presented in **Appendix G**.

4.2 Existing Conditions and Site Preparation

Prior to beginning sediment removal activities, support areas for staff and equipment, access to sediment removal areas, and sediment management and stockpiling will be established. Temporary erosion and sediment control measures will also be established. Each of these requirements are described in the following subsections.

4.2.1 Site Trailers/Offices

Trailers for Mallinckrodt, the Remediation Project Manager (RPM), the Construction Quality Control (CQA) Engineer, and Maine DEP; an on-site laboratory; and restroom facilities were established during previous site work phases. The Remediation Contractor will be responsible for providing its own trailers to be installed in the Remediation Contractor Office Trailer Complex shown in **Drawing G-7**.

4.2.2 Site Staging

A small staging area (labeled as Nearshore Support Area in **Drawing G-4**) will be established as part of the Northern Drainage Ditch CMI Plan (submitted to the Maine DEP on February 5, 2016). The Remediation Contractor will use this area to offload dredged/excavated sediments for transport to the Sediment Management Area (SMA), and to load clean materials for backfilling. The Remediation Contractor will be responsible for maintaining the condition of the staging area pad in accordance with **Drawing C-9** and the Technical Specifications (**Appendix F, Section 01 50 00**).

4.2.3 Sediment Processing and Stockpiling Areas

Sediment will be stockpiled and dewatered at the Remediation Support Area, which has been previously established and is operated for the entire Orrington Remediation Site (both soil and sediment) by the RPM (see location in **Drawing G-4**). Dredged and excavated sediment will be transported from the Nearshore Support Area to the Remediation Support Area in sealed containers or trucks. Prior to transferring the sediment onshore, the Remediation Contractor will remove any accumulated overlying water (see Section 4.3.2). Sediment will be dewatered by mixing additives (e.g., cement or other dry site soils) directly into the sediment on a processing pad as shown in **Drawing G-3**. Any necessary enhancements to the processing pad will be determined after the Remediation Contractor has been

selected; however, at a minimum, the pad will meet the requirements shown in **Drawing C-3**. Stockpiles of dewatered sediment will be managed in accordance with **Drawing C-3** and the Technical Specifications (**Appendix F, Section 01 57 19)**.

Clean stockpile areas for import backfill have been previously established and will be managed to minimize dust.

4.2.4 Access Roads

The access road between the Nearshore Support Area and the existing Remediation Support Area (see **Drawing G-4**) will be established as part of the Northern Drainage Ditch CMI Plan. Material transferred along this access road will be contained within sealed containers or trucks; therefore, housekeeping of the road is expected to be minimal. This road will remain in place after construction is complete.

To access Southerly Stream Sediment Removal Area (SMA-1), the Remediation Contractor will need to establish access along the shoreline. The exact method of access will be determined after the Remediation Contractor has been retained; however, it is expected that the Remediation Contractor will use existing tide flats supplemented by marsh or crane mats, where necessary, that are resilient to the high tide and minimize disturbance of the area. If contaminated materials are transferred along this access road, they will be contained within sealed and covered containers; therefore, housekeeping of the road is expected to be minimal. The Remediation Contractor may elect to build additional access roads using similar methods through the Southern Cove to access the sediment removal areas. All of these roads will be removed, and the area restored, after construction is complete.

4.2.5 Temporary Erosion and Sediment Control

It is not expected that activities immediately adjacent to the Southern Cove will significantly disturb upland soils and require temporary erosion and sediment controls (TESCs) per Maine DEP Stormwater Construction General Permit conditions. However, as shown in **Drawing C-1**, silt fences will be installed between the Nearshore Staging Area and the river as a precaution to contain any accidental spills during sediment transfer. Existing TESCs around the Remediation Support Area will be maintained and supplemented, as necessary, in accordance with the Technical Specifications (**Appendix F, Section 01 57 19**).

4.3 Sediment Removal and Processing Activities

This section describes the removal of sediment from the three sediment management areas (SMAs) shown in **Drawing C-4**, the controls that will be used to minimize water quality impacts, and the anticipated processes necessary to prepare the removed sediment for off-site transport and disposal. The nature and extent of sediment contamination and the rationale for the removal depths for each SMA are discussed in Sections 2.8 and 3.3.

4.3.1 Excavation

The existing bathymetry surrounding Southerly Stream Sediment Removal Area (SMA-1) is very shallow and water levels at high tide limit traditional floating dredging equipment access. Therefore, it is expected that the Remediation Contractor will remove the sediment within Southerly Stream Sediment Removal Area (SMA-1) using traditional land-based excavation equipment during low tide. The approximate volume of sediment targeted for removal from this area is 230 cubic yards (cy), and excavations will likely occur over several tidal cycles.

The area of work that can be completed within a tidal cycle will be designated as a Certification Unit (CU). To minimize the potential for recontamination between tidal cycles, each CU will be immediately backfilled after verification that the design removal targets, in terms of depth and extent, have been achieved and verified by the CQA Engineer. CU verification will be based on traditional survey methods

to verify that the required removal depth has been achieved throughout the excavation. The Technical Specifications (**Appendix F, Sections 02 21 00 and 35 20 23**) include minimum requirements for survey accuracy and performance.

4.3.2 Dredging

Sediment removal within Northern Sediment Removal Area (SMA-2) and Southern Sediment Removal Area (SMA-3) will occur predominately using traditional mechanical dredging equipment. The required removal areas and depths are shown in **Drawing C-4** and the sequence of work will generally occur from upstream to downstream. The approximate volume of sediment targeted for removal from these areas is 4,390 and 2,000 cy, respectively. The Technical Specifications (**Appendix F, Sections 02 21 00 and 35 20 23**) include detailed requirements for positioning control to ensure that the Remediation Contractor removes the sediment with the most practicably achievable precision. The Technical Specifications also include best management practices that must be followed to minimize the potential to generate excessive turbidity during dredging and recontamination of previously dredged areas.

Dredging will occur within a mobile turbidity curtain system as shown in **Drawing C-2**. Each position of the system will define a dredging CU. Prior to moving the system to the next CU, the Remediation Contractor will survey the dredged area in accordance with the Technical Specifications (**Appendix F, Section 35 20 23**) and the CQA Engineer will verify that the required removal depth has been achieved. Once approved, the Remediation Contractor will place an initial backfill layer and then move on to the next CU. The intent of the initial backfill layer is to stabilize any thin veneer of disturbed sediment remaining on the post-dredge surface to minimize the potential for subsequent water quality impacts.

The Remediation Contractor will place the dredged sediment either into a storage barge (scow) or transport containers located on a flat-deck barge. Overlying water that accumulates in the scow or containers will be filtered in accordance with the Technical Specifications (**Appendix F, Section 01 57 19**) before discharge to the river. The overlying water must be removed prior to initiating transfer of the sediment onto land to minimize the potential for sloshing or spills during transfer and transport. Sediment will first be transferred on land at the Nearshore Support Area and then transported via the access road to TSSA-2 for processing.

The eastern portion of Northern Sediment Removal Area (SMA-2) contains two industrial outfalls that require special consideration during dredging and excavation. The areas immediately adjacent to the industrial outfalls will be dredged using careful procedures, and potentially special dredging equipment, to prevent damage to the outfall. These areas will be dredged in small-area intervals and immediately backfilled with clean backfill to prevent undermining of the outfalls.

The northern portion of Northern Sediment Removal Area (SMA-2) contains an area of hard subgrade in the vicinity of standard penetration test (SPT) boring location SD-SC-07. During the SPT, extremely hard material was encountered at 3.3 feet below ground surface (bgs) and an N-value of 177 was reported. The Remediation Contractor will attempt to dredge the CU surrounding SD-SC-07 to a depth of 3.5 feet bgs (i.e., to a depth deeper than the refusal interval encountered during the SPT) as shown in **Drawing C-4**. If refusal occurs prior to reaching 3.5 feet bgs, dredging in this CU will be considered complete. Depth verification and initial backfill layer placement will proceed consistent with other CUs.

4.3.3 Dredged Material Processing

Prior to final off-site transport to the disposal facility, the dredged material will require dewatering and verification using the paint filter test. Based on the results of the Treatability Study (Attachment A.5 of the *Pre-design Activities Report* in **Appendix A**), blending the sediments with other excavated on-site soils (in accordance with the Soil Use Plan approved by Maine DEP) is expected to be sufficient to reduce the moisture content of the dredged sediments to levels acceptable for transport and disposal. In the

event that on-site material is not available at the time of dewatering, another economical, well-performing agent from the Treatability Study will be used.

4.4 Environmental Controls

Monitoring of the environment will occur throughout the construction period. The Remediation Contractor will prepare an environmental pollution protection plan that will include general controls regarding spill prevention, dust and odors, noise, light, TESCs, fuel storage, equipment decontamination, waste management, and other environmental considerations. The RPM will be responsible for air and water quality monitoring and fish observations in accordance with permit requirements. This monitoring is described in the *Perimeter Air Monitoring Plan* (CDM Smith 2015) and the *Water Quality and Fish Monitoring Plan* (**Appendix D**).

As discussed in the previous section, dredging will occur within a mobile turbidity curtain system as shown in **Drawing C-2**. **Appendix B** describes the site conditions and engineering evaluations that were used to select a mobile system in lieu of the use of a stationary turbidity barrier enclosing the entire Southern Cove work areas. The Remediation Contractor will be responsible for the final design, operation, and maintenance of the system.

During transfer of sediment onshore, the Remediation Contractor will establish temporary controls as shown in **Drawing C-9** to contain any potential spills that may occur during transfer and transport to TSSA-2.

4.4.1 Water Quality and Fish Monitoring

Water quality and fish monitoring requirements will be finalized based on the permits issued by the U.S. Army Corps of Engineers. Mallinckrodt's proposed approach is described in the *Water Quality and Fish Monitoring Plan* (**Appendix D**).

Water quality will be monitored during all in-water work either by hand from a small utility boat, or using two anchored buoys. Monitoring points will be located in the Penobscot River north and south of the Southern Cove. The upstream and downstream location will be determined based on tidal conditions and flow direction. The water quality monitoring criteria that will trigger corrective actions are 35 nephelometric turbidity units (NTUs) higher at the downstream buoy compared to the upstream measurement.

Prior to commencing sediment removal with a mobile turbidity curtain system, the contained dredge area will be checked for the presence of Atlantic salmon or Atlantic or shortnosed sturgeon, which are listed species under the Endangered Species Act. If these species are identified, the fish will be cleared from the area prior to commencing dredging.

4.4.2 Water Treatment

Water generated during sediment dewatering will be sent through the on-site GWTP and discharged under the current MEPDES permit (#ME0000639). Storage tanks on site may be used for temporary storage as needed. Water will be tested to verify that it meets influent requirements for the on-site GWTP.

The Southern Cove CMI has been designed to minimize the volume of water directed through the on-site GWTP. Overlying water from sediment will be decanted on the barge and discharged to the river at the point of dredging prior to transport to TSSA-2. It is anticipated that pre-filtering of the decanted water prior to discharge into the river may be required to meet water quality standards required in the project's Clean Water Act (CWA) Section 401 Water Quality Certification.

The sediment dewatering method will include a stabilization process that generates limited excess water. Any dewatering effluent generated during dewatering activities will be transferred to the on-site

GWTP for processing prior to discharge in accordance with MEPDES permit limits. As a contingency, existing storage tanks may be used to temporarily store dewatering effluent so that GWTP capacity is not exceeded. Dewatering effluent will be tested to determine if it meets influent criteria of the on-site GWTP. Based on results of the Treatability Study, it is possible that the water will exceed TSS criteria and require pre-treatment prior to being delivered to the GWTP.

4.5 Restoration Activities

4.5.1 Backfilling

Each area excavated or dredged will be backfilled to pre-construction grades. The backfill material will consist of imported clean gravely sand, similar in size distribution to materials currently found within the Southern Cove.

As stated in Section 4.3.1, backfilling of Southerly Stream Sediment Removal Area (SMA-1) CUs will occur during the same tidal cycle in which dredging occurs. In Northern Sediment Removal Area (SMA-2) and Southern Sediment Removal Area (SMA-3), each verified CU will be backfilled with an initial backfill lift prior to repositioning the mobile turbidity curtain system to an adjacent CU, as discussed in Section 4.3.2. After all CUs are dredged, the remaining backfill material will be placed to return the areas to pre-construction grades. The placement of the final layer of backfill will generally occur from upstream to downstream locations. Post-construction surveys will be used to confirm that the areas have been returned to pre-construction grades within acceptable tolerances.

The preliminary limits of areas requiring revegetation are shown in **Drawing C-10**. In addition to gravely sand backfill, these areas will receive a 6-inch layer of habitat-amended backfill to support subsequent planting and seeding.

4.5.2 Planting and Seeding

The planting and seeding plan shown in **Drawing C-10** will be finalized based on observations made during dredging activities. The RPM will verify the extents and types of wetland vegetation impacted by construction operations.

Depending on the completion date of backfilling activities, planting and seeding activities may be delayed until the following spring once ice is thawed and temperatures support plant establishment and seed germination.

Section 5. Permitting

The following permits are needed for the Southern Cove CMI activities:

- **Shoreland Protection Act Permit**. A permit application was submitted on April 5, 2016, to the Orrington Code Enforcement Officer for work within 250 feet from the Penobscot River for the entire Orrington Remediation Site. With respect to the Southern Cove CMI, this permit covers construction and maintenance of staging areas and access roads necessary to perform sediment removal.
- **Maine Individual Permit**. The Maine Individual Permit includes the CWA Section 401 Water Quality Certification, CWA Section 404, and Section 10 of the Rivers and Harbors Act of 1899. The following required consultation is also completed by the U.S. Army Corps of Engineers before granting the permit:
  - Section 106 of the National Historic Preservation Act and with local Tribes
  - Section 7 consultations with National Oceanic and Atmospheric Administration, National Marine Fisheries Service, and U.S. Fish and Wildlife Service for Endangered Species Act and Essential Fish Habitat
- **Maine Natural Resources Protection Act**. Permit-by-rule was granted by the Maine DEP for the entire Orrington Remediation Site, including the Southern Cove.

Following initial review of the CMI Plan by Maine DEP, Mallinckrodt will submit the Maine Individual Permit application, which should occur in fall 2016. This submission will include the draft CMI Plan (revised to address Maine DEP's initial comments) and the draft Remediation Contractor Work Plans.

Section 6. Schedule

The anticipated schedule for the Southern Cove is presented in **Table 6-1**. This schedule is contingent on Maine DEP approval.

Table 6-1: Proposed Southern Cove Schedule

Activity	Anticipated Start Date	Anticipated End Date
Submit Southern Cove CMI Plan to Maine DEP	--	June 8, 2016
Maine DEP Preliminary Review of CMI Plan	June 8, 2016	August 12, 2016
Meet with Maine DEP	--	June 15, 2016
Revise CMI Plan with Remediation Contractor Work Plans and Submittals	July 11, 2016	November 16, 2016
Meet with Maine DEP	--	January/February 2017
Finalize CMI Plan	January 23, 2017	March 14, 2017
Final Maine DEP Approval	--	April 25, 2017
Remediation Contractor Mobilization	--	Mid-June 2017

Section 7. References

Anchor QEA, LLC, 2014. *Health and Safety Plan*. Southern Cove, Orrington Remediation Site. Prepared for CDM Smith, Inc. December 2014.

Anchor QEA, LLC, and CDM Smith, Inc., 2015. *Southern Cove Pre-design Work Plan.* Orrington Remediation Site, Orrington, Maine. Prepared for Mallinckrodt US LLC. June 2015.

CDM (Camp Dresser & McKee Inc.), 1998. *Site Investigation Report Volume I*. HoltraChem Manufacturing Site, Orrington, Maine. December 22, 1998; Revised August 15, 2001.

CDM, 2003. *Corrective Measures Study*. Mallinckrodt Inc., HoltraChem Manufacturing Site, Orrington, Maine. May 27, 2003; Revised September 19, 2003.

CDM Smith, 2014a. *Quality Assurance Project Plan.* Orrington Remediation Site, Orrington, Maine. Revision No. 01. December 15, 2014.

CDM Smith, 2014b. *Project Health and Safety Plan*. Orrington Remediation Site, Orrington, Maine. October 9, 2014.

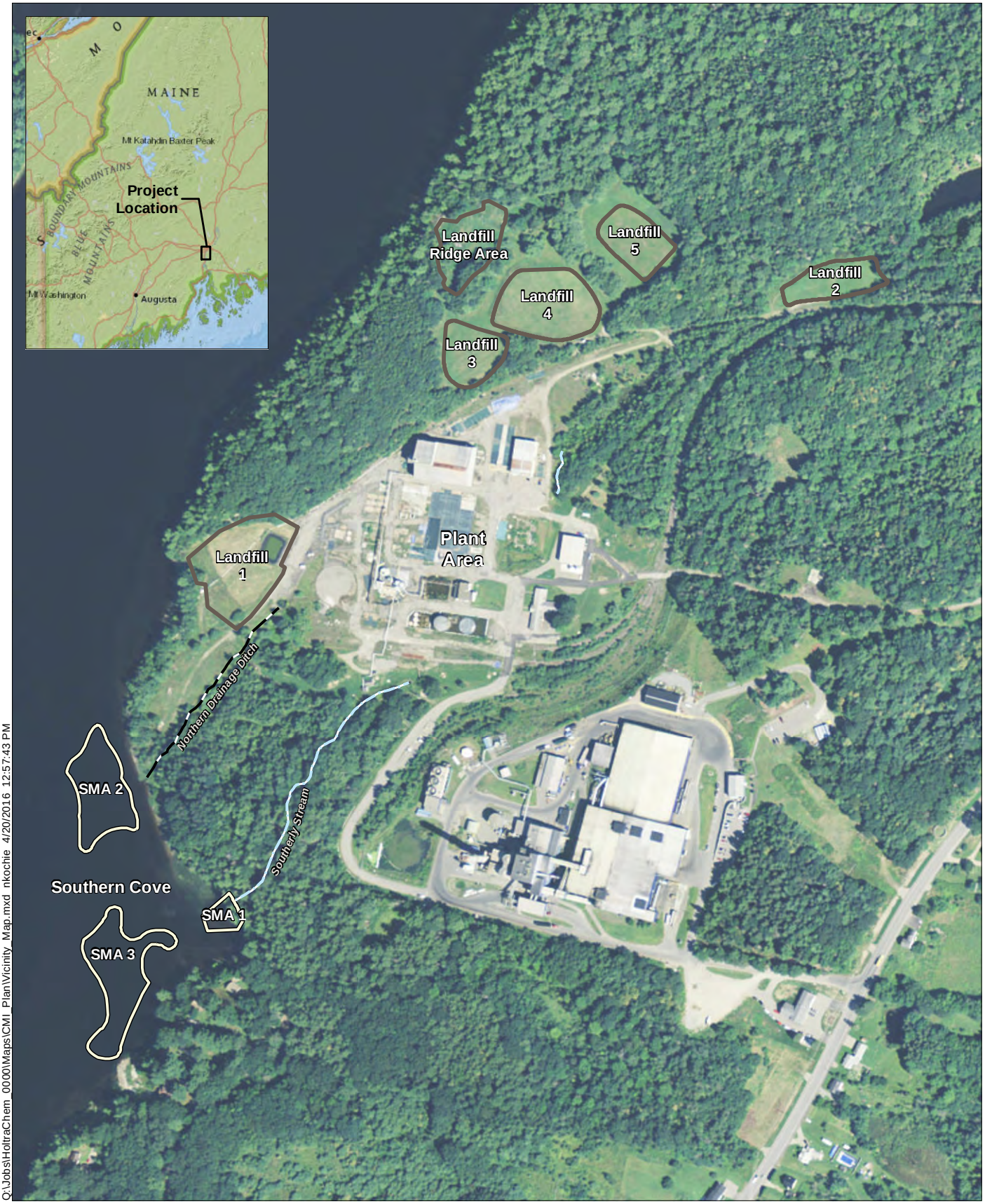
CDM Smith, 2015. *Perimeter Air Monitoring Plan (PAMP), Orrington Remediation Site, Orrington, Maine*. June 25, 2015.

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. § 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. § 1365, Uncontrolled Hazardous Substance Sites Law; November 24.

Maine Natural Areas Program, 2015. Department of Agriculture, Conservation and Forestry. Elements of Diversity Rare, Threatened and Endangered Plants. September 2015.

FIGURES



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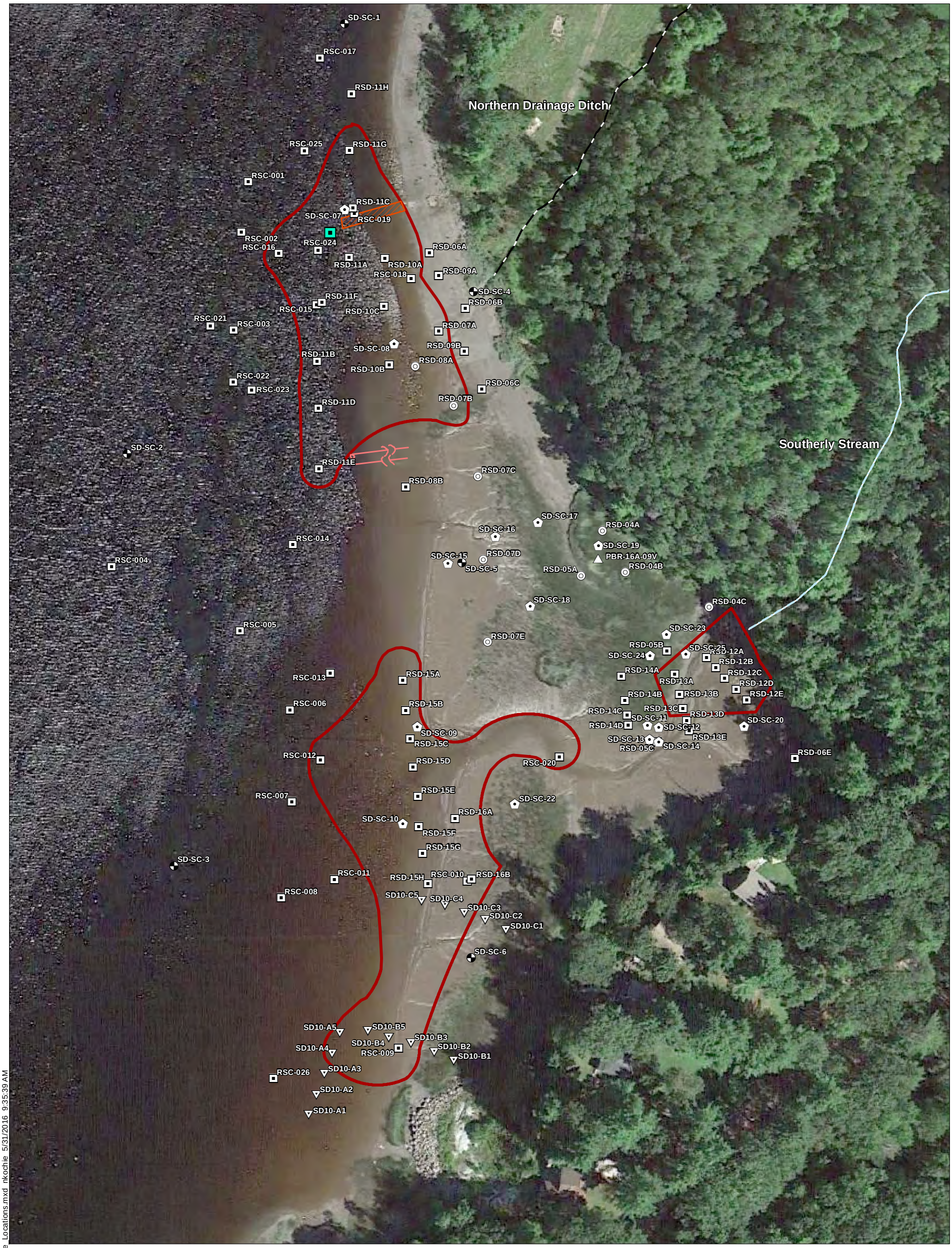
Feet
0 200 400

Figure 1-1
Site Map
Corrective Measures Implementation Plan
Southern Cove, Orrington Remediation Site



Sample Locations

- 1995 Sample Location
- 1997 Sample Location
- 2001 Sample Location
- 2015 Sample Location
- 2007-11 Penobscot River Study Panel Sample Location
- 2015 Geotechnical Sample Location
- Proposed Sediment Removal Area
- Tide Gauge
- MEPDES Outfall
- PERC Outfall
- Northern Drainage Ditch
- Stream

Feet

0 50 100 150 200

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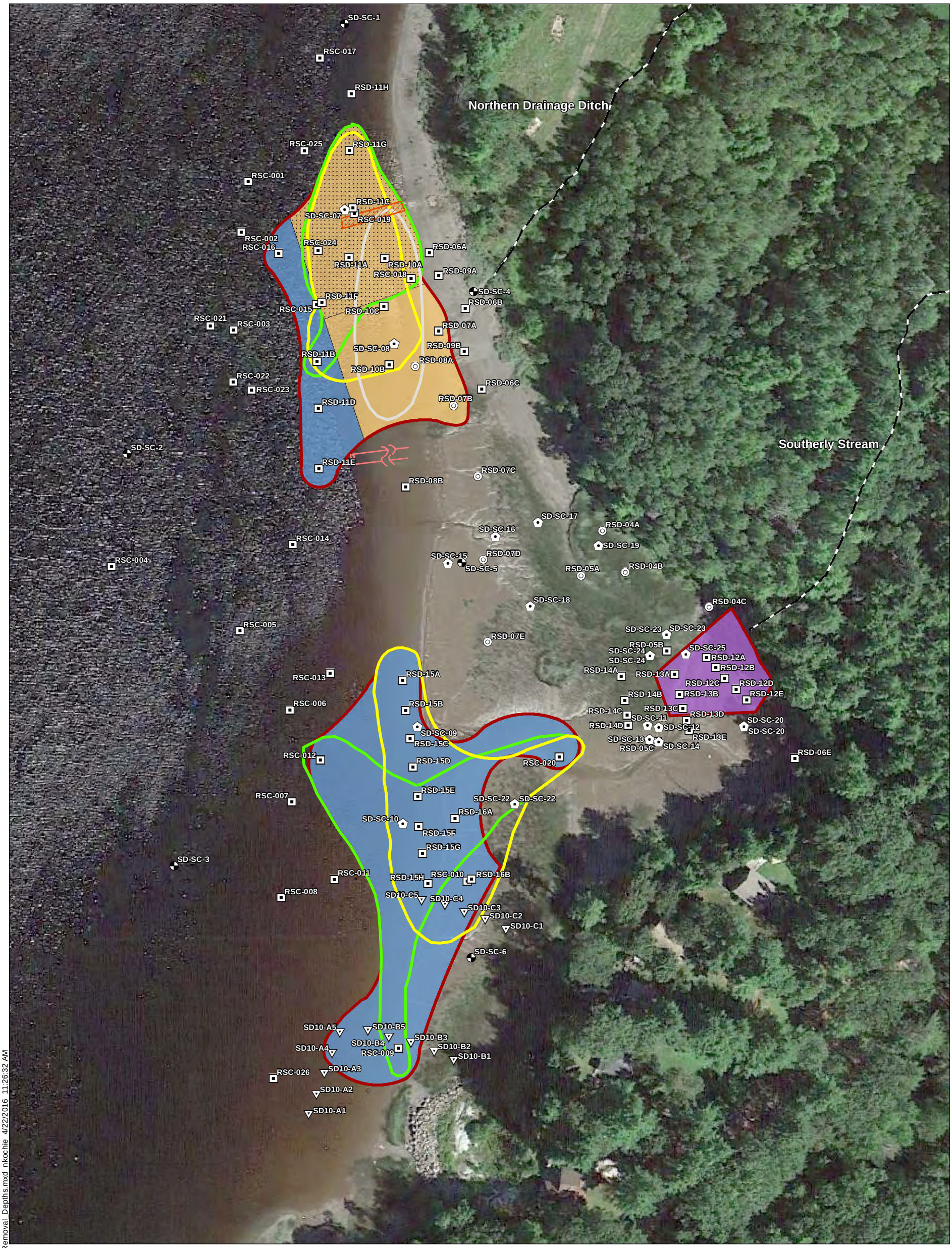
CDM Smith ANCHOR QEA

Figure 1-2
Sediment Sample Locations
Corrective Measures Implementation Plan
Southern Cove, Orrington Remediation Site



Sample Locations

- 1995 Sample Location
- 1997 Sample Location
- 2001 Sample Location
- 2015 Sample Location
- 2015 Geotechnical Sample Location

Dredge Depth Delineation

- 0.8 feet
- 1 foot
- 3 feet
- 3 feet (Final Dredge Depth To Be Adjusted During Construction)

- Proposed Sediment Removal Area

Sediment Removal Area required by Order MPS

- 0 - 0.2 feet
- 0.8 - 1 feet
- > 1 feet

- MEPDES Outfall
- PERC Outfall
- Stream

Feet
0 50 100 150 200

Note:
Proposed sediment removal areas represent the minimum removal limits; the boundaries may be optimized for efficient construction.

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CDM Smith ANCHOR QEA

Figure 2-1
Sediment Removal Areas and Depths
Corrective Measures Implementation Plan
Southern Cove, Orrington Remediation Site

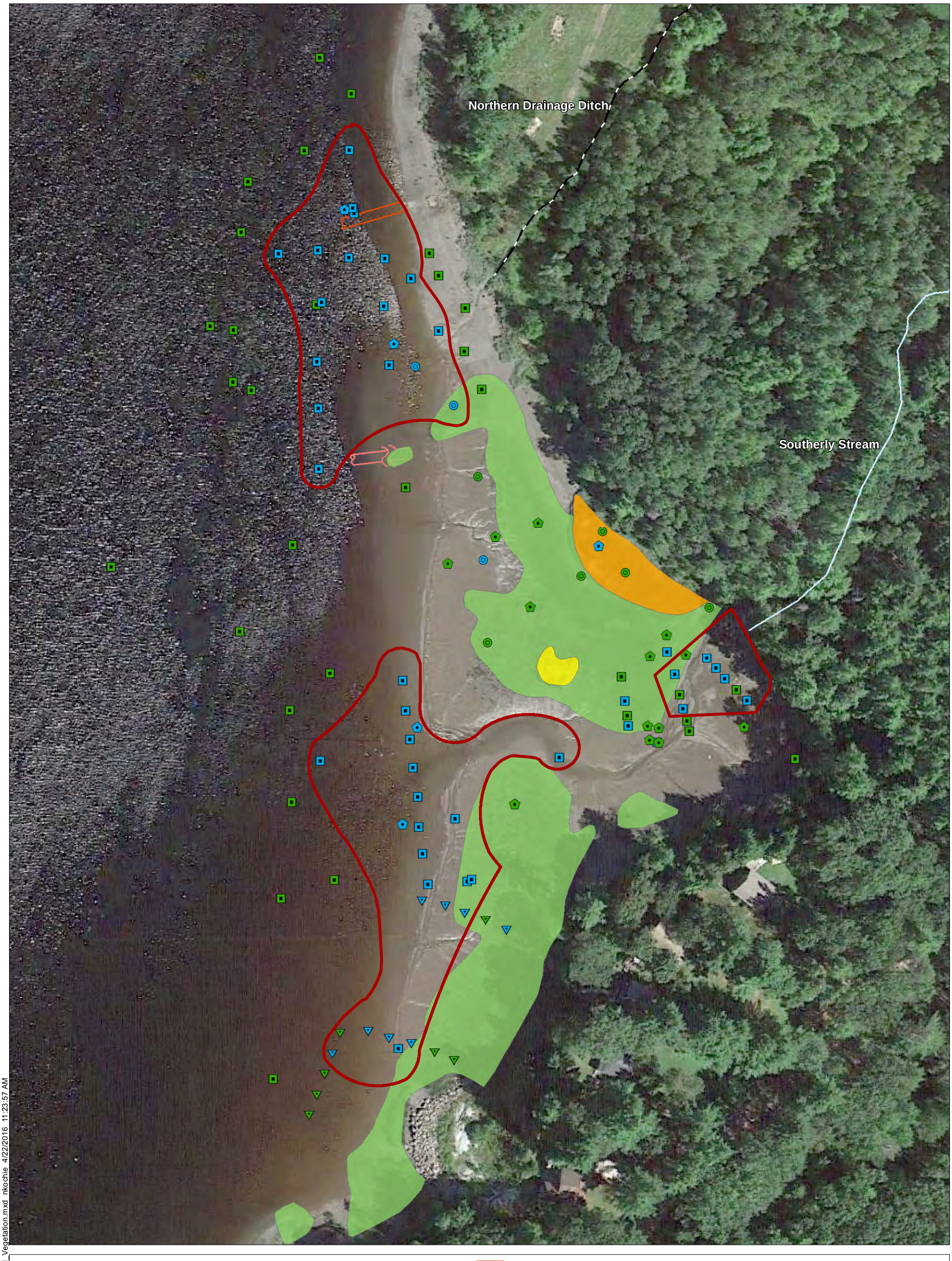

Figure 2-2
Extent of Intertidal Vegetation
Corrective Measures Implementation Plan
Southern Cove, Orrington Remediation Site