



STATE OF MAINE  
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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May 20, 2015

Patricia Hitt Duft, VP-Legal  
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675 McDonnell Blvd.  
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RE: Southern Cove Work Plan approval,  
Dated March 25, 2015  
Mallinckrodt Site, Orrington, Maine

Dear Pat:

The Department has reviewed the revised Southern Cove Work Plan dated March 25, 2015. This plan provides for a pre-design investigation of the Southern Cove in support of future sediment remediation and restoration of the Southern Cove Area. This plan is approved with the following conditions:

1. Groundwater from monitoring wells B320 (B-320-B1, B320-01, B320-02, B320-03), B-321-B1/B2, MW-505-B1/B2, and MW-511-B1 will be sampled this spring for chloropicrin. If chloropicrin is identified, Mallinckrodt will need to submit a plan to the Department to add chloropicrin analysis to selected sediment samples in the removal areas. (This approach was included in the response to comments from Mallinckrodt dated March 25, 2015 but was not included in the work plan.)
2. Section 3.3, a copy of the area - specific CHASP (health and safety plan) needs to be submitted to the Department.
3. For TOC by Method 9060, the results of both lab duplicates must be reported.
4. All TCLP VOC samples must be grab samples and not composites.
5. All mercury analysis must be performed using laboratory procedure 7471A per the response to comments. Tables 3-2, 3-3, and 3-4 each still have a footnote that analytical methods may vary based on lab selection.
6. Section 3.6, the data (laboratory reports and EGAD EDDs) need to be provided to the Department in a more timely manner rather than as an appendix to the Southern Cove Corrective Measures Implementation Plan. The Department requests to receive the data the week after Mallinckrodt or its consultants have received it from the laboratory. We understand that Mallinckrodt wants to validate the data prior to providing it to us, but in order for us to respond to you in a timely manner we also need to receive and validate the data. Delays in receiving the data will cause delays

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to the Department's approval of the work and could potentially leave holes open longer than needed. The Department is trying to prevent this from happening.

If you have any question or concerns with this letter, please feel free to contact me at (207) 287-2651.

Sincerely;



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# WORK PLAN

## **Southern Cove** Orrington Remediation Site Orrington, Maine

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March 25, 2015



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## Acronyms

ADCP	Acoustic Doppler Current Profiler
Anchor QEA	Anchor QEA, LLC
CDM Smith	CDM Smith, Inc.
CHASP	<i>Contractor Health and Safety Plan</i>
CMS	Corrective Measures Study
HASP	<i>Project Health and Safety Plan</i>
IDW	investigation-derived waste
Maine BEP	Maine Board of Environmental Protection
MEDEP	Maine Department of Environmental Protection
mg/kg	milligrams per kilogram
MPS	media protection standard
PD	pre-design
PPE	personal protective equipment
PRMSP	Penobscot River Mercury Study Panel
QA/QC	quality assurance/quality control
QAPP	<i>Quality Assurance Project Plan</i>
RCRA	Resource Conservation and Recovery Act
RD	remedial design
SI	Site Investigation
SI Report	<i>Site Investigation Report</i>
Site	Orrington Remediation Site
SOP	standard operating procedure
Southern Cove	Penobscot River Southern Cove Area
TCLP	toxicity characteristic leaching procedure
USEPA	U.S. Environmental Protection Agency
Work Plan	Southern Cove Area Pre-Design Investigation Work Plan

# Section 1.

## Introduction

### 1.1 Purpose

This Southern Cove Area Pre-Design Investigation Work Plan (Work Plan) was prepared by Anchor QEA, LLC (Anchor QEA), and CDM Smith, Inc. (CDM Smith), on behalf of Mallinckrodt US LLC (Mallinckrodt). The purpose of this Work Plan is to describe pre-design (PD) investigations in support of sediment remediation and restoration of the Southern Cove Area (Southern Cove) on the Penobscot River at the Orrington Remediation Site (Site) located at 99 Industrial Way, Orrington, Maine.

The remedial requirements for the Southern Cove are described in 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 (MEDEP) dated November 24, 2008 (Order). The MEDEP and Maine BEP decisions were based on review of extensive data from the Southern Cove sampling and analysis efforts completed during the Site Investigation (SI) and Corrective Measures Study (CMS) phases, which are further described in the following subsection.

Subsequent sections in this Work Plan describe remedy objectives and the PD objectives, approach, and methods; health and safety; waste management; data management; reporting; and schedule. Additional details describing field sampling methods, analytical methods, health and safety procedures, and quality assurance/quality control (QA/QC) procedures are provided in the *Quality Assurance Project Plan* (QAPP; CDM Smith, 2014a), the *Project Health and Safety Plan* (HASP; CDM Smith, 2014b), and the *Contractor Health and Safety Plan* (CHASP; Anchor QEA, 2014) prepared specifically for the PD and remedial activities in the Southern Cove.

### 1.2 Current Understanding of Southern Cove Area

The Southern Cove is located in the Penobscot River bordering the Site, as shown on **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* (CMS; CDM, 2003). The Southern Cove lies to the south of the historic manufacturing plant area, on the eastern side of the main channel of the Penobscot River. The Penobscot River is subject to average tidal fluctuations of approximately 13 feet and a portion of the cove is tidal mudflats exposed under low tide conditions. During the operational life of the facility, the cove received runoff from an outfall, the Southerly Stream, and the North Ditch depicted on Figure 1-1.

Delineation of mercury in sediment is based on previous investigations and analysis, and the MEDEP and Maine BEP have finalized remedial objectives. Over the course of the investigation of the Southern Cove between 1995 and 2013, a total of 250 sediment samples were collected from the locations shown on **Figure 1-2**, and analyzed for mercury; some samples were also analyzed for additional physical parameters. The majority of these samples were collected and reported as part of the SI and CMS, which were reviewed by MEDEP and the Maine BEP, and formed the basis of their final decisions on the remedial actions required for the Southern Cove.

Fourteen of the 250 samples were collected as part of an additional study conducted by the Penobscot River Mercury Study Panel (PRMSP) between 2008 and 2013 within the Penobscot River Estuary (and including the Southern Cove). The *Penobscot River Mercury Study Panel Final Report* (Penobscot River Mercury Study Panel, 2013) was submitted in April 2013 to the United States District Court (District of Maine). The more recent PRMSP data generally confirms previous findings; however, these data are

not being relied upon for final contaminant delineation and remedial design of the Southern Cove removal because the data were not collected by Mallinckrodt and sampling objectives and procedures differed from that of other sampling efforts.

Additional details on these investigations are provided below.

### **1.2.1 Site Investigation**

In total, 209 sediment samples (including duplicates) were collected from 83 boring locations during the SI field programs in 1995 and 1997. In 1995, only two depths were targeted for sample collection: 0.0 to 0.1 foot and 0.8 to 1.0 foot. In 1997, attempts were made to collect deeper sediment samples. However, of the 26 locations sampled in 1997, only eight could be cored deeper than 1-foot depth due to refusal on coarse-grained deposits, and only two samples were collected below 2-foot depth. Mercury was not detected in the two samples collected from deeper than 2 feet.

### **1.2.2 Corrective Measures Study**

During the CMS field investigation conducted in 2001, 15 borings were advanced along three transects in the Southern Cove. A minimum of two samples were collected from each boring, and a total of 36 samples were analyzed for mercury. Two intervals in the top foot were targeted (0 to 0.2 and 0.8 to 1.0 foot), and deeper samples were only collected if soft sediments were encountered at greater than 1.5 feet.

### **1.2.3 Penobscot River Mercury Study Panel Investigation**

The PRMSP was tasked with evaluating mercury throughout the entire Penobscot River estuary. As part of that study, 14 sediment samples were collected from within the Southern Cove and analyzed for mercury. Samples were collected from the sediment surface (0 to 0.2 foot) and shallow sediment (0.2 to 0.8 foot). In addition, samples were collected from depth intervals down to below 2 feet at two locations, and down to 1.5 feet at one location.

## Section 2.

# Proposed Remedy Objectives and Media Protection Standards

As previously noted, the remedial requirements, including remedy objectives and the media protection standard (MPS), for the Southern Cove are described in the Order. This section provides a summary of these objectives.

The objective of the remedy for the Southern Cove is to remove sediments with mercury above the MPS as necessary to address risk to the public health and safety and the environment. The MPS identified in the Order requires that sediment be removed where mercury levels exceed 2.2 milligrams per kilogram (mg/kg), 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 removal areas.

The map on Figure 1-2 depicts the locations sampled during previous investigations. The areas shown on Figure 1-2 were developed based on the maps delineating the hot spots (by depth interval) in the CMS (and adopted as part of the Order) as well as consideration of the list of sample locations included in the MPS narrative standard. In addition, Mallinckrodt has expanded the hot spots to include adjacent sample locations where mercury was detected at levels above 2.2 mg/kg. The proposed sediment removal areas shown on **Figure 1-3** were further expanded to smooth out the extents and provide practical removal limits.

The outer boundary of all hot spot depth intervals were combined to develop a conservative delineation of the proposed sediment removal areas, as shown on Figure 1-3. Mallinckrodt intends to remove all soft sediment above the coarse-grained layer that underlies the soft sediment within the sediment removal areas indicated on Figure 1-3 (see Section 3 for additional details).

Data were further evaluated to determine if mercury concentrations exceed the MPS of 2.2 mg/kg over a 0.25-acre area outside of the proposed sediment removal areas shown on Figure 1-3. Based on this review, three sample points shown on Figure 1-3, and described below, were identified where additional sample data are proposed as part of the PD investigation to confirm and delineate elevated mercury concentrations in sediment (see Task 6):

- Mercury was previously detected at 2.9 mg/kg in the sample at location RSD-07D from 0 to 0.2 foot; four surface sediment samples are proposed to be collected from 0 to 0.2 foot and analyzed for mercury to evaluate this area.
- Mercury was previously detected at 54 mg/kg in the sample at location RSD-05C from 0.8 to 1 foot; four additional samples will be collected from 0.8 to 1 foot, and analyzed for mercury to evaluate this data point.
- Data generated from the Penobscot River Mercury Study Panel (2013) indicate a possible elevated mercury concentration of 18.43 mg/kg at PBR-16-A-09V at 0.2 to 0.8 foot; one additional sample will be collected from this sample interval to verify the data. If the data is verified, additional sampling may be proposed to DEP if appropriate.

Other areas where the average mercury concentration over a 0.25-acre area exceeds 2.2 mg/kg (Figure 1-3) appear to be located within areas of protected natural resources (sedge); these areas will be further evaluated, if necessary, based on results of the natural resources survey completed during the PD investigation.

## Section 3.

# Southern Cove Area Pre-Design Investigation

The following section details the objectives of the PD investigation for the Southern Cove and the tasks involved to attain these objectives.

## 3.1 Pre-Design Investigation Objectives

As noted in previous sections, delineation of mercury in sediment presented in this Work Plan is based on more than 250 mercury sediment samples within the Southern Cove. The Southern Cove encompasses an area of approximately 20 acres, and the number of samples previously collected generally defines the areas to be removed, with some additional refinement sampling proposed herein. Based on these data, the Order included remedial objectives and identified hot spots requiring removal, which were subsequently expanded as part of the data review performed during development of this Work Plan. The scope of work detailed in this Work Plan has been developed to provide data to refine the delineation of sediment removal areas, determine management and disposal options for removed sediment, and collect geotechnical data to support remedial design.

The purpose of this PD investigation will be to collect engineering data to support remedial design. Data to be collected will include:

- Total mercury and Resource Conservation and Recovery Act (RCRA) characteristic data to determine disposal options (bulk composite samples will be collected to best represent the material that will be transported to the disposal facility)
- Treatability testing data to determine dewatering and processing required to meet moisture content and strength requirements for overland transport and the disposal facility (bulk composite samples will be collected)
- Natural resource survey in the Southern Cove to determine presence of sedge and other protected species
- Geotechnical and hydrodynamic data to support design of the turbidity control system and turbidity monitoring program during sediment removal
- Geotechnical data to support design of an access road anticipated for equipment access
- Total mercury sediment data to delineate or verify earlier data points at: RSD-05C, RSD-07C, and PBR-16-A-09V
  - These data will be used in conjunction with previous data to delineate final sediment removal areas
- Physical delineation and total mercury data to confirm that the coarse-grained layer that underlies soft sediment meets MPSs for mercury and can be used to delineate the depth of removal in the design (discrete grab samples will be collected)

These data are intended to support the remedial design, which will include sediment removal and restoration design, preparation for permitting, and material management.

## 3.2 Pre-Design Investigation Scope

This Work Plan was developed to meet the objectives described in Section 3.1, and includes the following tasks, which are fully described in the following section:

- Task 1 – Evaluate Existing Site Investigation Sample Data
- Task 2 – Existing Conditions Survey
- Task 3 – Hydrodynamic Survey
- Task 4 – Geotechnical Borings
- Task 5 – Natural Resource Characterization
- Task 6 – Sediment Characterization and Limited Historical Data Confirmation

### 3.2.1 Task 1 – Evaluate Existing Site Investigation Sample Data

Existing data relevant to the Southern Cove from the reports listed in **Table 3-1** will be summarized and evaluated in terms of the remedial objectives for the Southern Cove. Data will be compiled into geographic information system files. Section 2 presents a summary of the data evaluation conducted to date; additional data analysis, including an evaluation of results from the sediment sampling proposed in this Work Plan, will be performed as part of this task and presented in the Southern Cove Corrective Measures Implementation Plan.

**Table 3-1: Summary of Previous Southern Cove Investigations**

Name of Report/Author/Date	Date of Field Work
<i>Site Investigation Report</i> CDM December 22, 1998	Summarizes previous investigations in 1995 and 1997
<i>Evaluation of Ecological Health of the Lower Penobscot River</i> Menzie-Cura and Associates, Inc. January 19, 2001	2000
<i>Corrective Measures Study</i> CDM September 2003	November 2001 to November 2002
<i>Penobscot River Mercury Study Final Report</i> April 2013	Various – pre-2013

### 3.2.2 Task 2 – Existing Conditions Survey

Existing bathymetry, sub-bottom information, vertical survey control, and existing infrastructure surveys are important considerations for remedial design, environmental monitoring, and site restoration planning. The area to be surveyed and mapped is shown on **Figure 3-1**, and extends from the Southern Cove shoreline into the river channel, beyond the potential turbidity control location. All survey data will be tied to the survey control datums currently being used for survey of upland portions of the Site.

Based on a preliminary review of survey information, the removal area will likely include both intertidal and permanently inundated areas, possibly extending into the main river channel. Given the

varying water depths and investigative equipment requirements, a variety of approaches may be required to fully map the study area, as discussed below.

Bathymetry data from acoustical surveys can effectively provide detailed information where water depth allows use of the instrumentation. However, there are significant limitations within shallow nearshore areas due to the water depth requirements associated with the survey instruments. Therefore, supplemental manual/topographic survey information may also be necessary to augment acoustical bathymetry data in the intertidal zone. In addition to bathymetric/topographic data collection, physical surveys will likely be required to help identify debris and obstructions in the sediment removal areas. Mapping bathymetry and bottom debris may include a variety of technical approaches to accommodate varying water depths. The following are possible approaches and will be determined based on field conditions:

- Single-beam or multi-beam acoustical surveying
- Manual surveying
- Shoreline topographic surveying
- Side-scan sonar surveying
- Sub-bottom profiling
- Manual poling

### 3.2.3 Task 3 – Hydrodynamic Survey

Turbidity barriers are a proven method for limiting migration of suspended sediments that result from sediment removal activities. Installation of turbidity barriers around the removal areas is anticipated to meet regulatory water quality criteria during sediment removal operations. Several types of turbidity barriers are available; for the purposes of this Work Plan, it has been assumed that silt curtains will be most appropriate for the Southern Cove based on the water depths, tidal ranges, and other Site conditions.

Silt curtains are vertical, flexible structures that extend downward from the water surface to a specified water depth. They are typically constructed of filter fabrics or polyethylene sheets combined with flotation and anchoring devices. Key factors in selecting the appropriate silt curtain and anchoring system include water depths, tidal fluctuations, and current velocities where the silt curtains will be deployed. The PD activities described below will collect data to assist in designing the silt curtain containment system. These data along with other applicable information (manufacturer's data and specifications, experience, and engineering judgment) will be used during the remedial design process to develop an effective turbidity control system.

A tide gage will be installed near the project area during the PD activities to measure the elevation of the Penobscot River at regular intervals throughout the tidal cycle. These data, in conjunction with the bathymetry survey being performed for Task 2, will be used to determine water depths and tidal fluctuations. The specific tide gage equipment, location, and standard operation procedures (SOPs) will be determined with the oceanographic data collection subcontractor.

To measure currents velocities in the vicinity of the Site, velocity transects will be collected for one sampling period during one complete tidal cycle. This will include a sampling period of approximately 24 continuous hours. Due to planning and operational needs, it is not anticipated that any particular flow event (e.g., 10-year recurrence interval) will be captured during sampling. However, the sampling effort will be conducted near the monthly highest tide and targeted toward larger tidal excursions and riverine flows, as feasible.

The cross-channel velocity transects will be collected at three cross-sections within the Site, aligned perpendicular to the centerline of the Penobscot River. Figure 3-1 shows the approximate location of

each transect; the exact locations will be determined following the bathymetric survey. All three transects must be completed within 1 hour to ensure that the data are synoptic relative to the tidal phase. The three transects will be completed multiple times during one complete tidal cycle to capture the variation in current velocities. The velocities will be measured using a boat-mounted, downward-looking Acoustic Doppler Current Profiler (ADCP). The specific ADCP equipment, locations, and SOPs will be determined with the oceanographic data collection subcontractor.

Based on the data generated during the PD investigation, a recommendation for controlling turbidity and sediment transport from the Southern Cove remediation area will be developed during the remedial design phase and will likely include a silt curtain. The following Site-specific factors will be considered in the design and selection of the turbidity control approach:

- Water quality requirements and measurement location
- Water depths and tidal variations
- River velocities and flow
- River traffic and navigation uses
- Riverbed geometry
- Riverbed and shoreline characteristics (such as geotechnical properties) for anchoring
- Sediment removal methods
- Access considerations

#### 3.2.4 Task 4 – Geotechnical Borings

The turbidity barriers will be designed to resist lateral forces influenced by the river velocity, tidal fluctuations, and waves for the duration of remedial construction activities. Based on the anticipated location of the turbidity control system and the Site conditions, it is anticipated that structural piles (e.g., H-beams) will be needed for support. Therefore, geotechnical explorations will be conducted as part of the PD investigation to facilitate design of the pile support system.

In addition to the geotechnical borings needed for the turbidity control system design, geotechnical data will also be needed to evaluate the efficacy of constructing a temporary access road on the tidal flats of the Southern Cove to support sediment removal and material transport in nearshore areas. These samples will be collected using hand augers and will help determine sediment stability for a road that would support conventional mechanical dry removal equipment (excavators) and trucks for transporting the excavated sediments.

A total of six geotechnical data collection locations are proposed, as shown on **Figure 3-2** and described below.

Three explorations along the proposed footprint of the turbidity barrier will be collected by a drilling subcontractor using a boat-mounted rig as follows:

- Borings will extend to approximately 10 feet below competent soil using a hollow-stem auger (ASTM D6151) and performing standard penetration tests (ASTM D1586) at 2.5-foot intervals.
- Representative samples will be collected from a split-spoon sampler and submitted for laboratory testing described below.
- Where soil conditions allow, one or two undisturbed thin-walled samples (e.g., Shelby tubes) will be collected from each boring for laboratory strength testing (Unconsolidated-Undrained Triaxial Compression Test by ASTM D2850).

Three locations in the tidal flats will be sampled using hand augers, as follows:

- Hand auger samples will be collected at approximate 6-inch to 1-foot intervals, depending on the materials encountered.
- Geotechnical analytical parameters listed in the following paragraphs will be measured for representative samples collected from the hand augers.

Testing will be performed in conformance with most current versions of referenced ASTM standards. The laboratory will measure the following geotechnical analytical parameters (subject to the sediment types encountered):

- Unconsolidated-Undrained Triaxial Compression Test (ASTM D2850) where Shelby tube samples can be collected
- Liquid Limit, Plastic Limit, and Plasticity Index (ASTM D4318)
- Moisture Content (ASTM D2216)
- Particle Size Analysis, including hydrometer on a subset of samples (ASTM D422)
- Moisture, Ash, and Organic Matter (ASTM D2974)
- Specific Gravity (ASTM D5550 or D854)

The following parameters will be measured in the field for samples not collected using a hand auger:

- Standard Penetration Test (ASTM 1586)
- Pocket Penetrometer Tester
- Torvane Shear Tester

### 3.2.5 Task 5 – Natural Resource Characterization

Anchor QEA will perform a visual survey of the Southern Cove to identify wetland vegetation species present within the intertidal mudflats, with particular attention to occurrences of sedge. Sedge areas will be delineated using a global positioning system. The Site visit will be timed to coincide with a mid-day low tide to allow access on foot from land in daylight hours. The delineation of sedge will be used to support future permitting for the sediment removal.

### 3.2.6 Task 6 – Sediment Characterization and Limited Historical Data Confirmation

The primary objective of this task is to develop requirements/procedures for the handling, processing, and solidification (if necessary) of the removed sediments to meet the transport requirements and acceptance criteria established by the chosen disposal facility. In addition, limited additional sediment mercury data will be collected to support vertical and horizontal delineation, as described in Section 2.

Remediation will involve removal of sediment from within the vertical and horizontal extent of the contamination as delineated based on the MPS in the Order using mechanical excavation equipment. Excavation of sediment will be done “in the dry” where possible in intertidal areas. The material will be transported to the upland portion of the Site for gravity dewatering, and will be mixed with appropriate additives, as needed to meet overland transport and disposal facility requirements (e.g., paint filter test). Under this task:

- Four composite samples (SD-SC-07 through SD-SC-10) will be collected from within the extents of the designated removal areas indicated on Figure 3-2 to characterize the material for handling and disposal requirements.

- The depth to the coarse-grained layer identified by previous investigations will be established during sediment sampling and geotechnical evaluations (Task 4).
- Attempts will be made at four locations within the sediment removal area to collect grab samples of the underlying coarse-grained material for mercury characterization to confirm that the coarse-grained layer can serve as a physical demarcation layer of the vertical extent of sediment to be removed. Samples will be collected from one of the composite sub-sample locations at each of the four composite sample locations, with specific locations determined based on sample recovery.
- Four sediment samples from 0.8 to 1-foot depth will be collected surrounding a location approximately 100 feet from the discharge of the Southerly Stream (RSD-05C; 0.8- to 1-foot sample interval; Figure 1-3).
- Four surface sediment grab samples (0- to 0.2-foot sample interval) will be collected at and around existing sample location RSD-07C (Figure 1-3).
- One sediment sample will be collected to confirm the mercury concentration data at PBR-16-A-09V (0.2 to 0.8-foot interval), which is a sample previously collected by the PRMSP (Figure 1-3).

Samples collected for treatability testing and to characterize the material for disposal purposes will be collected as bulk samples composited over the anticipated removal interval from an area around the points indicated on Figure 3-2. Bulk composite samples are needed to be representative of the material the disposal facility will receive, and to provide sufficient sample volume for treatability testing. The subsampling points for each bulk composite sample are shown on Figure 3-2.

The depth of the underlying coarse-grained layer, or refusal, will be determined at each subsampling point indicated on Figure 3-2. If possible, samples of the underlying coarse layer will be collected as grab samples and analyzed for mercury concentrations to confirm that the material is below the MPS. Previous sediment sampling programs using vibracoring techniques were not successful in penetrating the coarse-grained layer that occurs at less than 1-foot depth in some locations. Therefore, for this PD investigation, a variety of sample collection methods may be attempted to successfully sample the coarse-grained layer, and also to collect the large volumes of sediment required for physical treatability testing.

The analytical program for characterization of sediment to be removed, including data quality objectives, QA/QC, and data validation, is listed in **Tables 3-2, 3-3, and 3-4**. All samples will be submitted to an analytical laboratory certified by the State of Maine.

Treatability tests will evaluate a range of characteristics of material affecting passive dewatering techniques such as gravity drainage, bulking with various types of additives (including lime, soil, and Portland cement), and solidification with reagents (such as polymers). Treatability tests may include the following:

- Hanging bag tests and/or other appropriate tests to evaluate drainage
- Characterization of dewatering effluent and evaluation for disposal through the on-Site water treatment system
- Addition of drying agents (such as Portland cement, lime, or useable Site soils excavated from the landfills) to stabilize the sediment by absorbing water, which decreases the sediment water content
  - Other possible sediment-water binding agents will be evaluated as part of the treatability study, pending a review of locally available materials

Typically, these tests involve adding different amendments at various mix ratios, and determining the amount needed and the time required for the material to meet moisture and strength requirements

necessary to pass the paint filter test and meet any additional requirements of the selected disposal facility.

Three sediment mercury sampling points from previous investigations were identified for further sampling and evaluation relative to the MPS. As previously noted, samples will be collected at or nearby previous sample locations RSD-05C, RSD-07D, and PBR-16\_A\_09V as shown on Figure 1-3. Samples will be collected as discrete grab samples from depth intervals identified above. The final delineation of the targeted removal areas will consider the results of this sampling.

**Table 3-2: Sediment Characterization Sampling – Data Quality Objectives**

Matrix	Objective	Analytical Parameters	Analytical Methods <sup>1</sup>	Analytical Level <sup>2</sup>	Data Evaluation Tier <sup>3</sup>	Intended Data Use	
Sediment	Confirmation that underlying coarse layer is below MPS	Mercury	USEPA 7471A	Level II	Tier I/Tier I Plus	RD	
	Characterization for transport and disposal and determine amendment requirements	Mercury	USEPA 7471A	USEPA 7471A	Level II	Tier I/Tier I Plus	RD
		RCRA Characteristics	TCLP Metals – USEPA 1311/6010B/7470A	TCLP Metals – USEPA 1311/6010B/7470A	Level II	Tier I	RD
			TCLP VOCs – USEPA 1311/8260	TCLP VOCs – USEPA 1311/8260			
			TCLP SVOCs – USEPA 1311/8270	TCLP SVOCs – USEPA 1311/8270			
			TCLP Herbicides – USEPA 1311/8151	TCLP Herbicides – USEPA 1311/8151			
			Corrosivity (pH) – USEPA 9045D	Corrosivity (pH) – USEPA 9045D			
			Reactivity – USEPA SW 846 Chapter 7	Reactivity – USEPA SW 846 Chapter 7			
		Paint Filter Test	USEPA 9095B	Level II	Tier I	RD	
		Moisture Content	ASTM D2216	Level II	Tier I	RD	
		Grain Size	ASTM D422		Tier I	RD	
	Total Organic Carbon	USEPA 9060	Level II	Tier I/Tier I Plus	RD		
	Sulfate/Chloride	USEPA 9056A	Level II	Tier I/Tier I Plus	RD		

## Notes:

1) Analytical methods may vary based on laboratory selection.

2) CDM Smith (2014a)

3) USEPA (2013)

RCRA = Resource Conservation and Recovery Act

RD = remedial design

TCLP = toxicity characteristic leaching procedure

USEPA = U.S. Environmental Protection Agency

VOC = volatile organic compound

**Table 3-3: Sediment Characterization Sampling – Quality Assurance/Quality Control Summary**

Matrix	Analytical Parameters	Analytical Methods <sup>1</sup>	Analytical Level <sup>2</sup>	Number of Field Duplicate Pairs	Number of Samples	Estimated Number of Equipment Blanks
Sediment	Mercury	USEPA 7471A	Level II	2	16	2
	RCRA Characteristics TCLP VOC, SVOC, Metals, Herbicides	TCLP – USEPA Methods 1311/8260/8270/6010/7470/8151	Level II	1	4	0
	Corrosivity	USEPA 9045D	Level II	0	4	0
	Ignitability	USEPA 1010	Level II	0	4	0
	Reactivity	USEPA SW 846 Chapter 7	Level II	0	4	0
	Paint Filter Test	USEPA 9095B	Level II	0	4	0
	Moisture Content	ASTM D2216	Level II	0	4	0
	Grain Size	ASTM D422		0	4	0
	Total Organic Carbon	USEPA 9060	Level II	1	4	0
	Sulfate/Chloride	USEPA 9056A	Level II	1	4	0

## Notes:

1) Analytical methods may vary based on laboratory selection.

2) CDM Smith (2014a)

RCRA = Resource Conservation and Recovery Act

SVOC = semivolatile organic compound

TCLP = toxicity characteristic leaching procedure

USEPA = U.S. Environmental Protection Agency

VOC = volatile organic compound

**Table 3-4: Data Validation Summary**

Medium /Matrix	Analytical Parameter	Analytical Method <sup>1</sup>	Tier Level <sup>2</sup>	Validation Criteria <sup>3</sup>	Validation Tier/Criteria Modified	Data Validator
Sediment	Mercury	USEPA 7471A	Tier I/ Tier I Plus	QAPP <sup>2</sup> Criteria and USEPA-NE Data Review Guidelines <sup>3</sup> as described in the QAPP	No	Anchor QEA staff or external data validator to be determined
	Total Organic Carbon	USEPA 9060	Tier I/ Tier I Plus	Same as above	No	Same as above
	Sulfate/Chloride	USEPA 9056A	Tier I/ Tier I Plus	Same as above	No	Same as above
	RCRA Characteristics TCLP VOC, SVOC, Metals, Herbicides	TCLP – USEPA Methods 1311/8260/8270/ 6010/7470/8151	Tier I	Same as above	No	Same as above
	Ignitability	USEPA 1010	Tier I	Same as above	No	Same as above
	Corrosivity	USEPA 9045	Tier I	Same as above	No	Same as above
	Reactivity	USEPA SW 846 Chapter 7	Tier I	Same as above	No	Same as above
	Paint Filter Test	USEPA 9095B	Tier I	Same as above	No	Same as above
	Moisture Content	ASTM D2216	Tier I	Same as above	No	Same as above
	Grain Size	ASTM D422	Tier I	Same as above	No	Same as above
	Specific Gravity	ASTM D5550 or D854	Tier I	Same as above	No	Same as above

## Notes:

1) Analytical methods may vary based on laboratory selection.

2) CDM Smith (2014a)

3) USEPA (2013)

RCRA = Resource Conservation and Recovery Act

SVOC = semivolatile organic compound

TCLP = toxicity characteristic leaching procedure

USEPA = U.S. Environmental Protection Agency

VOC = volatile organic compound

### 3.3 Health and Safety

Work detailed in this Work Plan will be performed in accordance with the project HASP (CDM Smith, 2014b). An area-specific CHASP has been prepared by Anchor QEA to cover investigation and remedial activities in the Southern Cove. The CHASP complies with the project HASP and provides details on personal protective equipment (PPE) and environmental monitoring required during investigation activities.

### 3.4 Investigation-Derived Waste Management

Investigation-derived waste (IDW) generated during the PD activities for the Southern Cove will be handled in accordance with the procedures described below for each IDW category. IDW generated from the Southern Cove investigation will be managed along with IDW generated from other remedial activities at the Site.

The following categories of IDW may be generated during the investigation:

- Sediment
  - Rejected recovery from borings
  - Excess sample volume from sample collection
- Water-based liquids
  - Fluids generated from decontamination of sampling equipment
  - By-catch of sediment sampling equipment
- PPE

Management procedures for each of these categories of IDW is discussed in the following sections.

#### 3.4.1 Sediment

Excess cuttings from sediment explorations will be managed together with upland soil IDW. Southern Cove investigation IDW will be placed in drums and transferred to the Site IDW material management area, and appropriately segregated, classified, and disposed.

#### 3.4.2 Water-Based Liquids

Water runoff from equipment decontamination or decanted from sediment explorations will be containerized and treated in the on-Site groundwater treatment system.

#### 3.4.3 Personal Protective Equipment

PPE will undergo gross decontamination (i.e., removal of visual soil/sediment and general wash) at the sampling point. It will be thoroughly cleaned so that no visible soil/sediment, mercury contamination, or contamination from other constituents remains. Then it will be placed in trash bags for disposal as regular trash.

## 3.5 Data Management

Samples will be collected and data will be managed and validated in accordance with the QAPP (CDM Smith, 2014a).

In accordance with Section 10 of the QAPP, the following documentation will be included in the field notes:

- Personnel performing the sampling
- Date and time of sample collection
- Sample location identification
- Depth interval of sample collection
- Parameters to be analyzed
- Description of sampling procedures (i.e., grab or composite)
- Visual classification of sediment
- Identification and description of field QA/QC samples

## 3.6 Reporting

Information collected from the PD tasks will be incorporated in the Southern Cove Corrective Measures Implementation Plan. The data will be included as an appendix to the plan with a brief summary that will include the following information:

- Summary of the scope of activities completed
- Field and analytical methodology
- Figure showing investigation locations
- Tabulated analytical results compared to MPSs
- Copies of Maine Environmental and Geographic Analysis Database electronic data deliverables with the laboratory reports, including minimum MEDEP-required QA/QC
- Copies of exploration logs
- Copy of the laboratory analytical data packages

## 3.7 Schedule

The anticipated schedule for the Southern Cove PD investigation is included as **Table 3-5**.

**Table 3-5: Proposed Schedule for Southern Cove Area Pre-Design Investigation**

Task	Anticipated Start Date	Anticipated End Date
Submit Southern Cove Pre-Design Investigation Work Plan to MEDEP	2-September-14	5-January-15
MEDEP Review of Pre-Design Investigation Work Plan	6-January-15	4-February-15
Meeting with MEDEP to Review	22-January-15	
Finalize Pre-Design Investigation Work Plan	5-February-15	28-April-15
Conduct Field Work for Pre-Design Investigation	29-April-15*	12-May-15
Prepare Southern Cove Corrective Measures Implementation Plan (Remedial Design)	13-May 15	10-September-15
MEDEP Review of Southern Cove Corrective Measures Implementation Plan (Remedial Design)	11-September-15	12-October-15

Note:

\*Dependent on seasonal restrictions on conducting natural resource survey prior to starting field activities.

## Section 4.

### References

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

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

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

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.

MEDEP (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.

Menzie-Cura and Associates, Inc., 2001. *Evaluation of Ecological Health of the Lower Penobscot River*. Prepared for Camp, Dresser & McKee, Inc. January 2001.

Penobscot River Mercury Study Panel, 2013. *Penobscot River Mercury Study Final Report*. Mercury Contamination of the Penobscot River Estuary: Current Situation, Remediation Targets and Possible Remediation Procedures. Submitted to Judge John Woodcock United States District Court (District of Maine). April 2013.

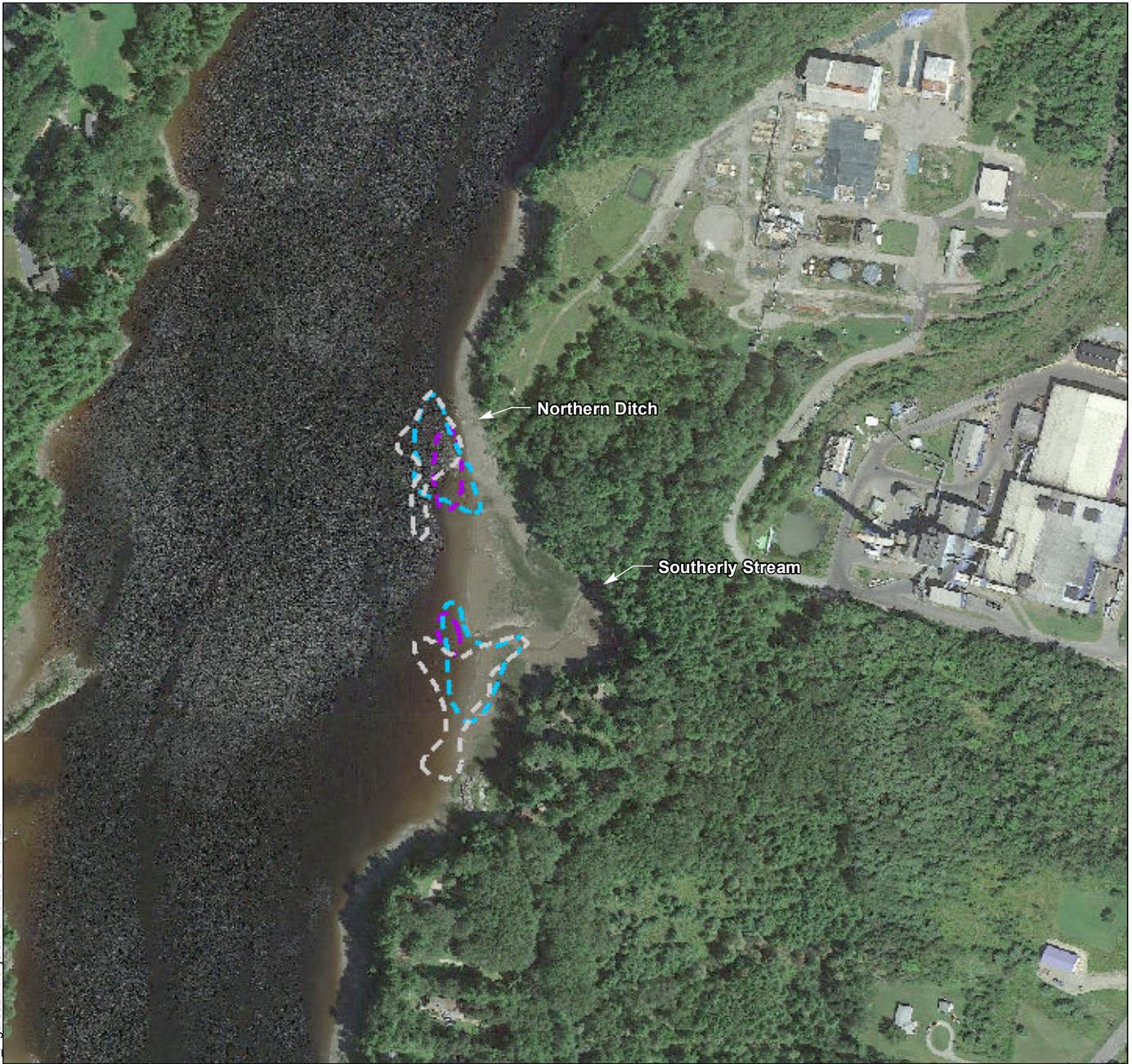
USEPA (U.S. Environmental Protection Agency), 2013. New England Environmental Data Review Supplement for Regional Data Review Elements and Superfund Specific Guidance/Procedures. April 2013.

# FIGURES

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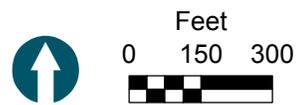
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-  Generalized Hot Spots (0 - 0.2 ft)
-  Generalized Hot Spots (0.8 - 1 ft)
-  Generalized Hot Spots (> 1 ft)

**Note:**  
Generalized hot spots are from the Board of Environmental Protection (BEP) Order (Order) effective April 3, 2014, which incorporates, with modifications, the Compliance Order issued by the MEDEP dated November 24, 2008.



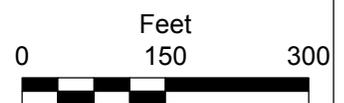
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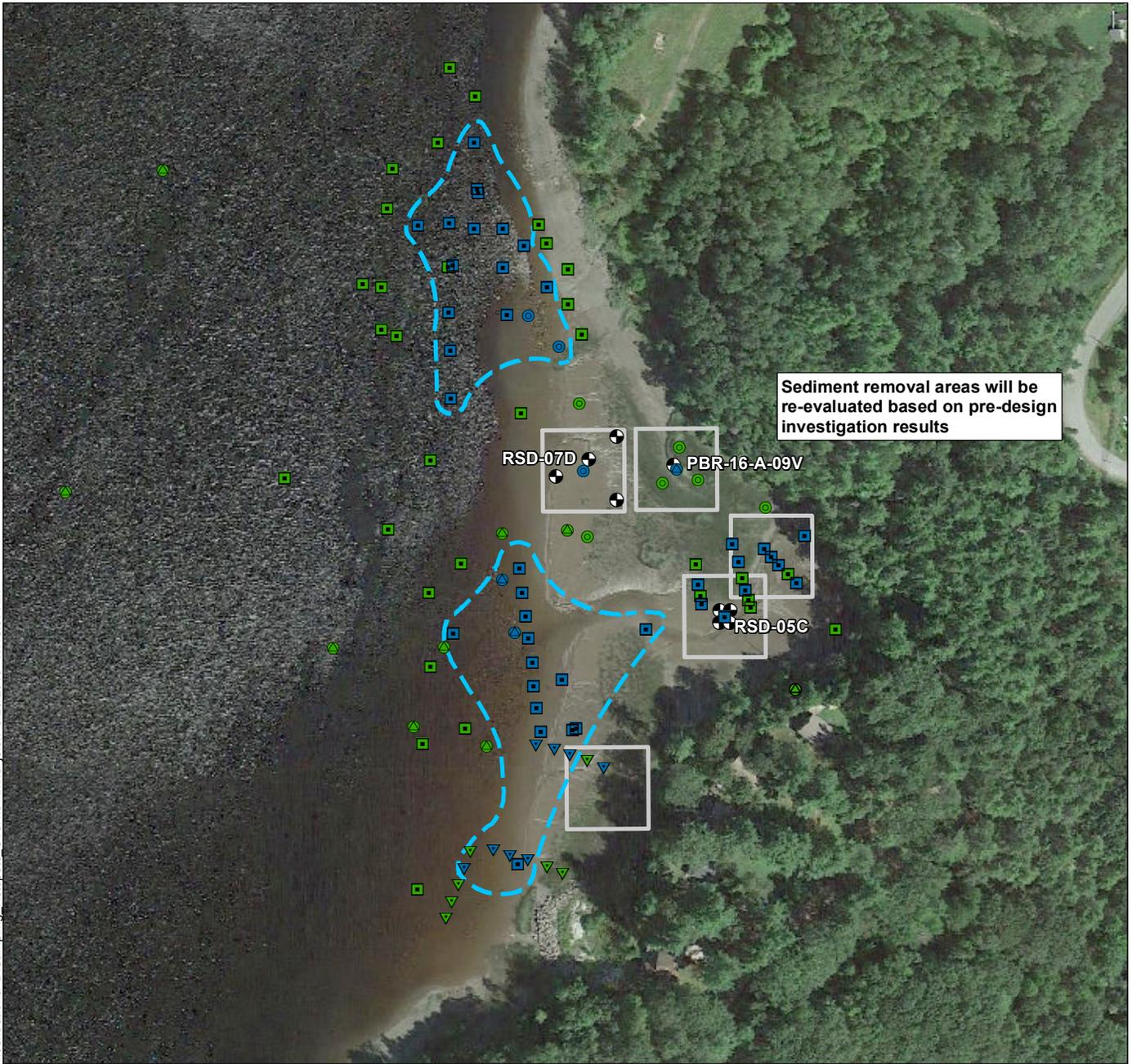
- Sample Location
- ▭ Generalized Hot Spots (0 - 0.2 ft)
- ▭ Generalized Hot Spots (0.8 - 1 ft)
- ▭ Generalized Hot Spots (> 1 ft)

**Notes:**

1. Samples collected in 1995, 1997, 2001, and 2007 to 2011.
2. Generalized hot spots are from the Board of Environmental Protection (BEP) Order (Order) effective April 3, 2014, which incorporates, with modifications, the Compliance Order issued by the MEDEP dated November 24, 2008.



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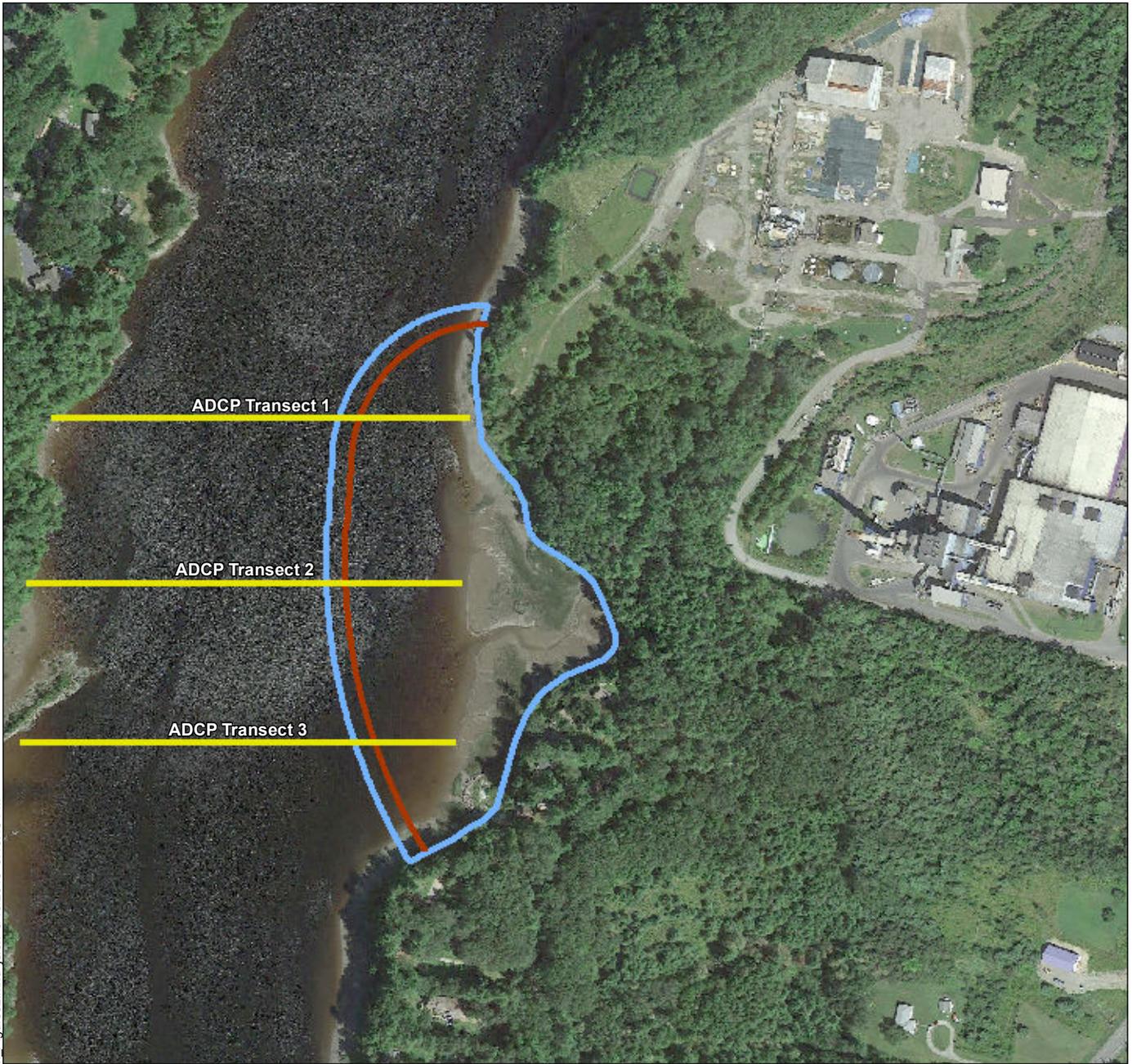
- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>⊙ 1995 Sample Location</li> <li>▣ 1997 Sample Location</li> <li>▽ 2001 Sample Location</li> <li>⊕ Penobscot River Data (2007 to 2011)</li> <li>⋮ Proposed Sediment Removal Area</li> </ul> | <p><b>Mercury Concentrations (mg/kg)</b></p> <ul style="list-style-type: none"> <li>● ≤ 2.2</li> <li>● &gt; 2.2</li> <li>⊕ Proposed Data Confirmation Sampling Locations</li> <li>▭ Quarter acre area where mercury concentrations exceed 2.2 mg/kg over a 0.25-acre area</li> </ul> |
|---|--|

**Note:**  
Target sediment removal areas are based on requirements in the Board of Environmental Protection (BEP) Order (Order) effective April 3, 2014, and expanded to account for practical excavation limits.

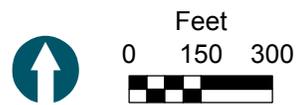


**Figure 1-3**  
Target Removal Areas and Proposed Additional Delineation Sampling  
Southern Cove, Orrington, ME

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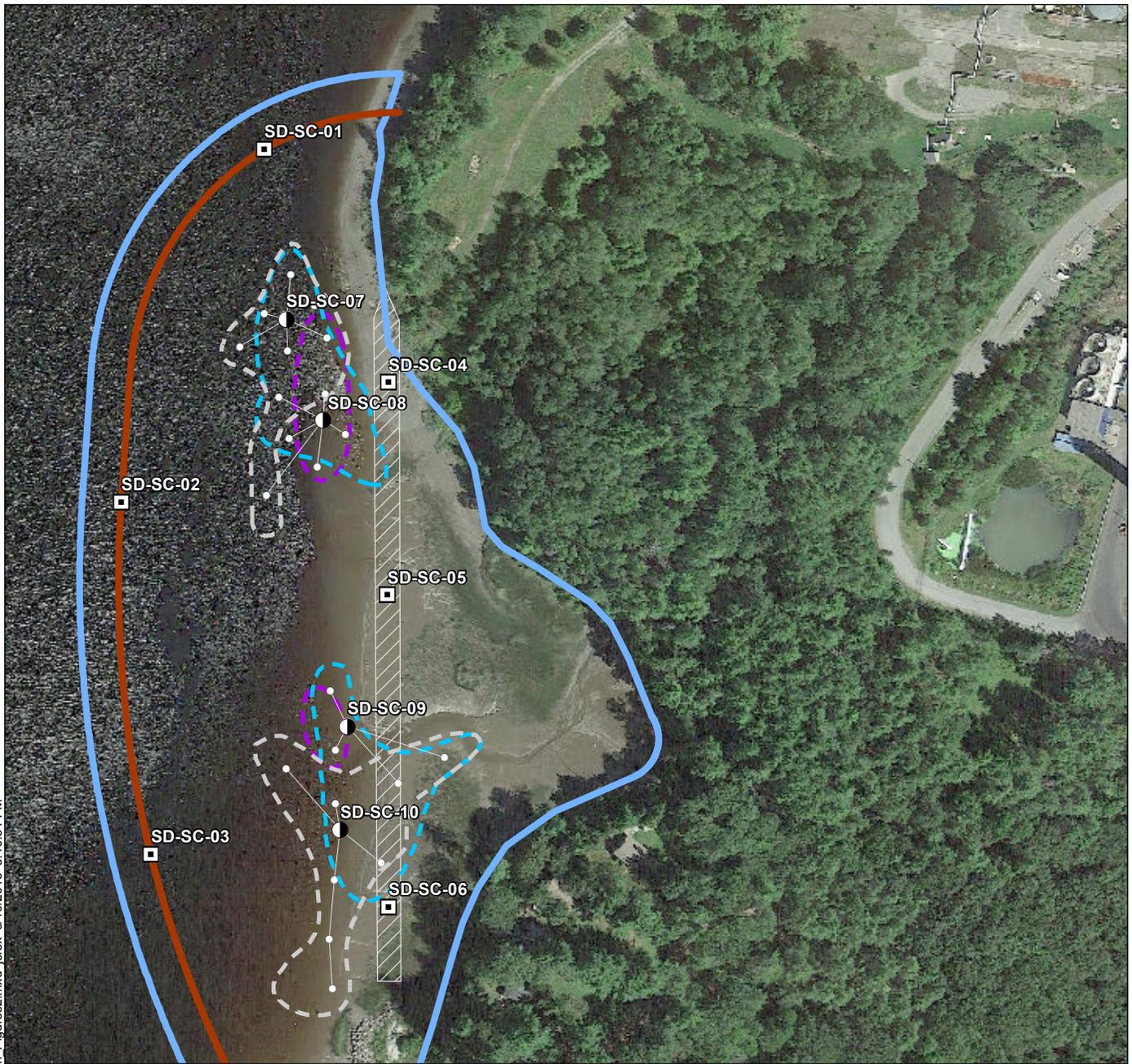


- Approximate Proposed Locations:**
- Acoustic Doppler Current Profiler (ADCP) Transect
  - Anticipated Silt Curtain Location
  - Bathymetric and Debris Survey Area



**Figure 3-1**  
Approximate Locations of Proposed  
Bathymetric and Hydrographic Data Collection  
Southern Cove, Orrington, ME

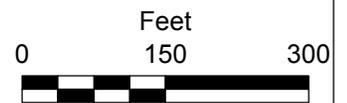
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- Proposed Geotechnical Data Point
- Proposed Composite Characterization Location
- Proposed Subsample Composite Locations
- Anticipated Silt Curtain Location
- Generalized Hot Spots (0 - 0.2 ft)
- Generalized Hot Spots (0.8 - 1 ft)
- Generalized Hot Spots (> 1 ft)
- Bathymetric and Debris Survey Area
- Anticipated Location of Temporary Access Road

**Note:**

Generalized hot spots are from the Board of Environmental Protection (BEP) Order (Order) effective April 3, 2014, which incorporates, with modifications, the Compliance Order issued by the MEDEP dated November 24, 2008.



**Figure 3-2**  
 Proposed Geotechnical and Sediment  
 Characterization Sample Locations  
 Southern Cove, Orrington, ME