Public Service of New Hampshire
Seacoast Reliability Project

Madbury, Durham, Newington & Portsmouth, NH

Natural Resource Impact Assessment

Prepared For:
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d/b/a Eversource Energy
780 North Commercial Street
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1.0 Project Description

Public Service Company of New Hampshire d/b/a Eversource Energy ("PSNH") is proposing to construct a new 115 kilovolt ("kV") transmission line between their existing Madbury and Portsmouth substations to enhance the electric reliability in the seacoast region. The Seacoast Reliability Project ("SRP") is proposed to be located in the Towns of Madbury, Durham and Newington as well as the City of Portsmouth, in Strafford and Rockingham Counties, New Hampshire. The SRP transmission line will be approximately 12.9 miles long, including a 0.9 mile crossing under Little Bay (Figure 1-1). It will be primarily located in an existing electric corridor, 12.0 miles of which will be a new transmission route, 0.9 miles will be in an existing transmission corridor. The corridor ranges from 50-300 feet wide, but is predominantly 100 feet wide. For most of the length of the corridor, a mowed area approximately 60 feet in width has been maintained by PSNH in support of the existing electric distribution line. The edges of the corridor are unmaintained and frequently support forest which will need to be cleared for the SRP. The cable crossing proposed in Little Bay will affect a corridor approximately 100 feet wide within a charted Cable Area approximately 1,000 feet wide.

2.0 Proposed Work

PSNH has designed the SRP to avoid environmental impacts where possible. Extensive environmental surveys were conducted by an experienced team of consultants and in consultation with the regulatory agencies. Detailed descriptions of the various natural resources in Little Bay are included in the Natural Resource Existing Conditions Report (see Appendix), Rare, Threatened and Endangered Species and Exemplary Natural Communities Report (see Appendix) the Essential Fish Habitat Report (see Appendix), and the Modeling Sediment Dispersion from Cable Burial report (see Appendix) . The results of these studies were incorporated into the siting, design and construction aspects of the Project, resulting in a final design that avoids and minimizes environmental impacts to the greatest extent possible, while still achieving the goals of the Project. The resulting unavoidable impacts to natural resources are presented below.

The majority of the SRP will be constructed aboveground on overhead structures between about 65 and 120 feet in height. It will cross under Little Bay by being buried about 3.5-8 feet in the substrate using a combination of jet plow and hand-jet technology. For this crossing, the transmission line will be necessarily split into three cables to maintain the required transmissivity for the Reliability Project (Figure 2-1). East of Little Bay, the line will remain underground until it crosses Little Bay Road in Newington, after which it will emerge to cross overland until it terminates at Portsmouth substation. In most locations, the existing distribution line will be co-located on the new structures and the existing distribution structures will be removed. In several locations, the existing distribution line will be relocated outside of the project corridor and the new structures will carry the new transmission cables only. A short portion of an existing transmission line will be relocated to accommodate the new SRP alignment at The Crossings at Fox Run Mall in Newington.

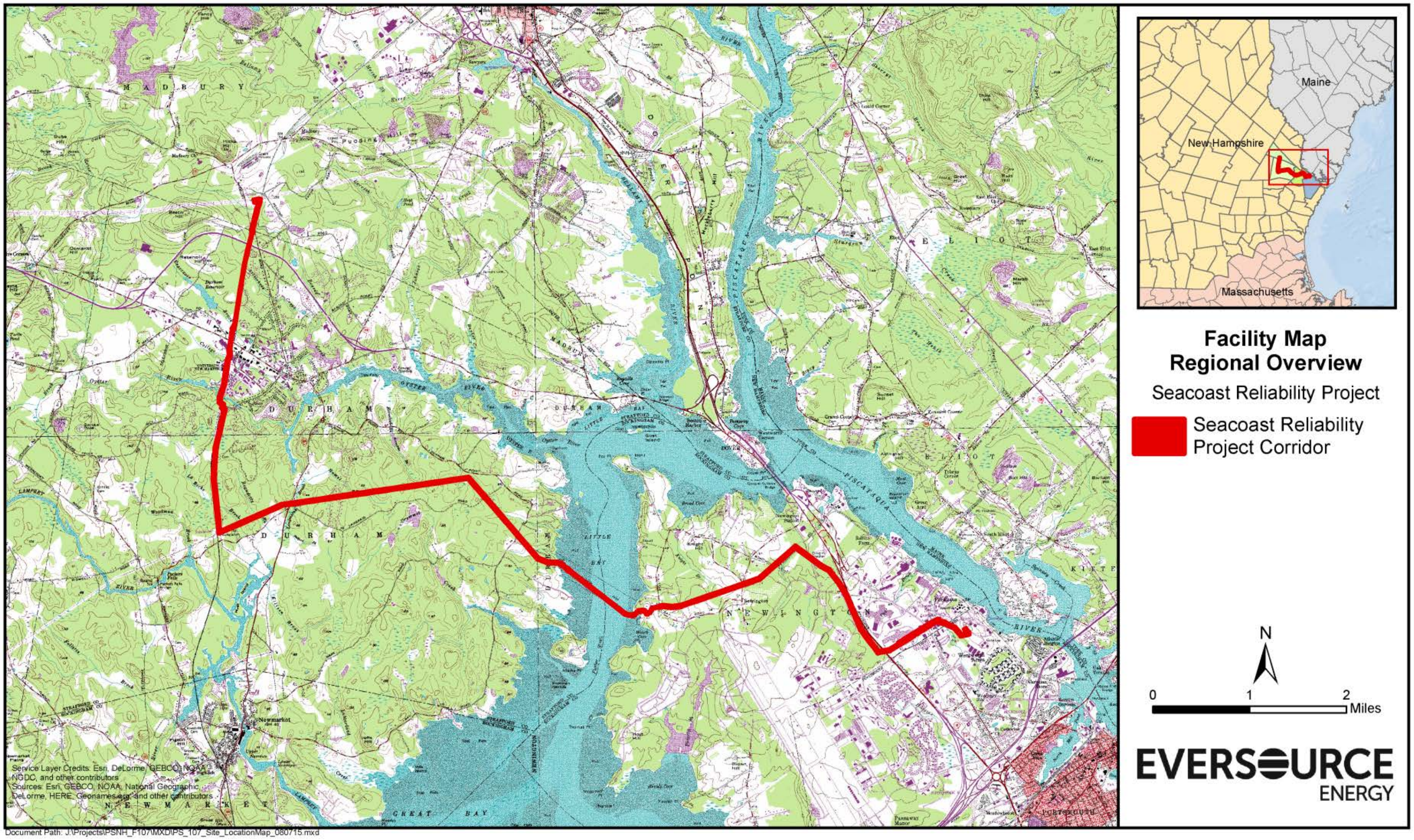

Figure 1-1. Seacoast Reliability Project location map.

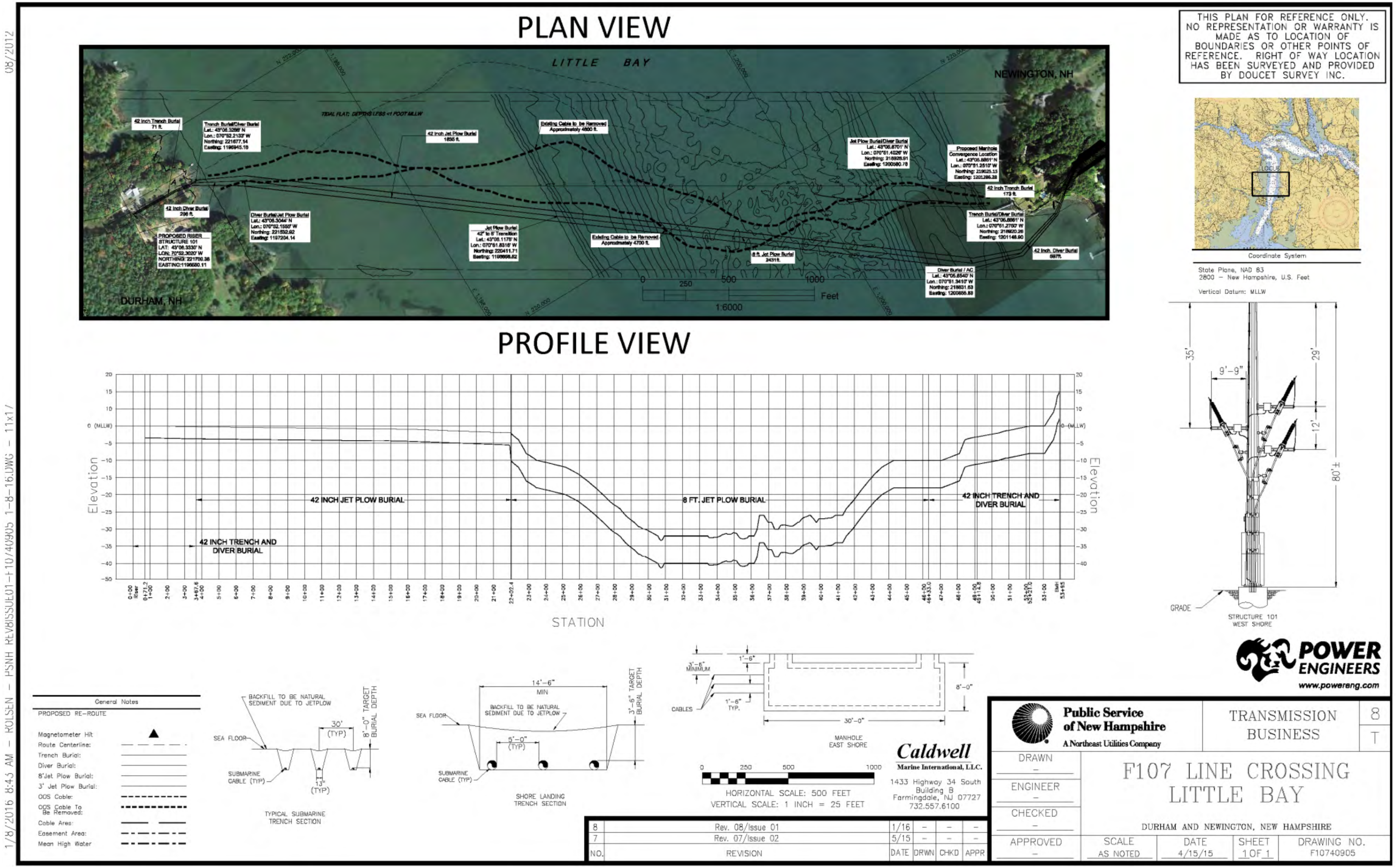

Figure 2-1. Little Bay cable crossing detail for the Seacoast Reliability Project

Substation improvements in Madbury and Portsmouth will be confined to the existing substation footprints. No other substation modifications are proposed.

The Project will result in minor permanent impacts and wetland conversion, plus temporary impacts during construction to both terrestrial and freshwater resources, as well as Little Bay. The following sections discuss the physical and biological components of those impacts in two sections: terrestrial and water resources (including estuarine wetlands), and estuarine resources, primarily effects to tidal waters in Little Bay. See the Natural Resource Existing Conditions Report in Appendices for a detailed description of each component.

3.0 Water Resource Effects

The impacts to freshwater and estuarine water resources, including wetlands and streams, are predominantly temporary (Table 3.0-1). Direct fill impacts have been avoided where possible, resulting in 792 square feet (0.02 acres) of permanent fill in freshwater wetlands; and 5,336 square feet (0.12 acres) of permanent fill in estuarine areas associated with Little Bay. Total proposed permanent impacts are 6,128 square feet ("SF"), or 0.14 acres. Permanent impacts to terrestrial areas are associated with new transmission line structures, their associated foundations,and relocated distribution structures. Permanent impacts to Little Bay are associated with concrete "mattresses" which are required by National Electrical Safety Code ("NESC") Code (NESC Section 352D) to be laid over the submarine cables where the minimum burial depths (42 inches to the top of the cable) cannot be reached due to bedrock or other material. The articulated concrete mattresses provide protection to the cables from accidental and environmental contact/disturbances. The extent of the need for concrete mattresses will not be identified until the project is installed, but has been conservatively estimated for the permit application review. Permanent wetlands to streams and rivers have been avoided.

Temporary impacts to freshwater wetlands primarily result from timber matting to access structure sites, to clear trees and to establish work pads around proposed structures (304,053 square feet, 6.98 acres). Temporary estuarine wetland impacts result from open cut-and-cover in the salt marsh (1,222 square feet; 0.03 acres), and sediment disturbance during cable burial via jet plow and hand-jetting across the tidal flat and subtidal waters (271,984 square feet; 6.24 acres). Temporary impacts to streams are minimal and limited to 211 SF (104 linear feet) of temporary culverts where streams pass through proposed work pad areas and in one location where the underground line will be installed under College Brook in Durham via an open trench.

Indirect, or secondary, impacts are related to vegetation conversion (permanent tree removal) of forested or forest canopy covered wetlands and upland clearing within stream buffers. Clearing is proposed within 317,800 SF (7.30 acres) of forested or forest canopy covered wetlands and within 87,225 SF (2.00 acres) of upland areas within 100 feet of perennial streams, 50 feet of intermittent streams and 25 feet of ephemeral streams.

Table 3.0-1. Summary of Total Proposed Direct Permanent and Temporary Wetland Impacts by Town.

Town	Permanent (SF)	Temporary (SF)	Total (SF)
Madbury	199	29,261	29,460
Durham	3,764	325,627	329,391
Newington	2,165	221,520	223,685
Portsmouth	0	851	851
Total (Sq. Ft.):	6,128	577,259	583,387
Total (Acres):	0.14	13.25	13.39

As required by State and Federal regulations, the SRP design has avoided and minimized impacts to water resources wherever it was feasible and reasonable to do so. The following sections describe the avoidance and minimization measures, and the type and extent of the remaining unavoidable impacts.

3.1 Impact Avoidance

Permanent and temporary impacts to water resources were avoided where possible throughout the design and engineering phases of project development. Multiple rounds of preliminary design reviews were conducted between project engineering and environmental specialists. New structures were located outside of wetlands, unless technical constraints pertaining to project corridor limitations, structure height and maximum spans dictated that a structure be placed in a wetland resource. With the final design, 27 new structures, of the 180 proposed new or relocated transmission and distribution structures will be located within or partially within wetland areas and will result in permanent impacts.

Access routes and temporary work pads for construction were similarly reviewed and wetland crossings were avoided where possible. The required tree clearing along the edges of the existing corridor limited the amount of wetland avoidance; however other methods such as clearing during winter/frozen-ground conditions and hand cutting, may be employed to minimize temporary impacts associated with these activities (see below).

3.2 Impact Minimization

Engineering constraints limited the ability to avoid placing 27 new structures within or partially within wetland areas, thus wetlands have been avoided by approximately 85 percent of the 180 proposed new structures. Additionally, it should be noted that approximately 51 existing distribution structures will be removed from wetland areas by utilizing double circuit designs where necessary. The existing distribution line will be co-located on the same new structures below the new transmission lines. This will result in the net decrease of 24 structures within wetland areas.

Several steps are planned to minimize the extent of temporary impacts on protected areas, including wetlands. For the terrestrial portions of the Project, temporary impacts will be associated with construction access, access for corridor tree removal, access for the removal of existing structures, and construction work pads around new structures. Timber mats (approximately 16 feet long by 4 feet wide) will be utilized where necessary depending on the ground conditions during construction activities. Work will be performed where possible during frozen conditions and using low-ground pressure vehicles as practicable. To the extent feasible, access paths already present in the corridor will be utilized to avoid creating new routes and minimize wetland crossings. Additionally, timber mats will be placed on shrubs to reduce mat timbers sinking into wetland soils. Previous similar projects have found that the shrubs survive the short-term matting. Streams will be spanned with timber mats from bank to bank, with no permanent impacts anticipated.

Potential impacts to water quality related to the construction of the SRP were also considered during project planning and design. Erosion control measures including adherence to New Hampshire Department of Environmental Services ("NHDES") *Best Management Practices Manual for Utility Maintenance in and Adjacent to Wetlands and Waterbodies in New Hampshire* and applicable in ternal Best Management Practices ("BMP") associated with erosion control and clearing during transmission line construction will be strictly enforced. The NHDES manual includes 14 different BMPs that are detailed in Appendix A of thatdocument. BMP #1 through #13 are applicable to the access roads and work pad areas associated with the SRP, and will be utilized where needed.

In addition, the project alignment and all proposed work areas were reviewed to identify potentially high-risk sites for erosion and other soil disturbances associated with construction activities where enhanced BMPs may be needed in addition to those referenced in the applicable BMPs. These areas included steep upland slopes (generally >10 percent) that are located in close proximity to wetland and riparian resources where access roads or work pads are proposed. Minimal grading and gravel may be required in these locations to safely accommodate the required construction equipment. In addition to the standard BMPs, water bars will be installed on access roads that are located on steep (>10% slope) slopes and greater than 100 feet in length, with level spreaders located at the downslope end to disperse flow.

The identified high-risk sites are listed below, and identified on the Project's Environmental Mapping:

1. Proposed Structure #6 (Madbury): Steep slopes associated with Madbury Road up-gradient of Wetland MW1
2. Proposed Structures #13/14 (Durham): Steep slope north of Wetland DW91 and Stream DS92
3. Proposed Structures #28-#30 (Durham): Steep slopes to the north and south of the Oyster River (DS53) including small tributary streams (DS51, DS61, DS61A and DS61B) and multiple wetland areas (DW49, DW55, DW59, DW63)
4. Proposed Structure #47 (Durham): access road on steep slopes up-gradient of Wetland DW56
5. Proposed Structure #58 (Durham): access road and work pad on steep slopes up-gradient of Wetland DW31
6. Proposed Structures #66-#67 (Durham): access roads on steep slopes located immediately to the east and west of Wetland DW9

7. Proposed Structures #80-#81 (Durham): access road traverses steep side-slope up-gradient of Wetland DW42
8. Proposed Structures #82-#83 (Durham): steep access road immediately east of Structure #82 and up-gradient of Wetland DW38

Normandeau environmental monitors and PSNH construction monitors will be on site during construction to insure that the construction contractors follow the approved access plans and construction BMPs.

3.3 Impact Analysis

Unavoidable direct and secondary impacts to water resources and associated upland buffer areas were reviewed throughout the Project area. Direct impacts include permanent and temporary disturbances, as discussed above. Secondary impacts were also reviewed, including wetland conversion and upland clearing within perennial and intermittent stream buffers. Wetland conversion will occur where forested wetland areas within the SRP corridor are cleared to allow for the safe construction and operation of the proposed transmission line. Temporary direct impacts from timber matting to allow for mechanized clearing and construction of the transmission line may be necessary in these areas. These areas will not be stumped or grubbed and soil disturbance will be minimal. The forested wetlands will naturally convert to emergent or scrub-shrub resources following the clearing activities. Upland stream buffer tree removal within 100 feet of perennial streams, 50 feet of intermittent streams, and 25 feet of ephemeral streams was also quantified.

3.3.1 Direct Wetland Impacts

The SRP will impact greater than 20,000 square feet of tidal and non-tidal wetland and intersects with potential habitat for wetland-dependent threatened and endangered species. It is therefore classified as a Major project in accordance with Env-Wt 303.02(c) and Env-Wt 303.02(h).

Direct permanent wetland impacts associated with the SRP total 6,128 SF (0.14 acres). The breakdown of impacts by town and Cowardin cover class associated with the SRP is summarized in Table 3.3-1. A detailed table of individual wetland resources, cover classification, functions and values, and impacts is included in Appendix A of this report.

3.3.2 Direct Stream Impacts

Direct permanent impacts to streams have been avoided, with all structures located in upland or wetland areas. Direct temporary impacts to streams total 211 square feet (104 linear feet) (see Table 3.3-2). The majority of streams will be crossed using temporary mat bridges, with matting placed parallel to, but outside of each bank, and other matting placed perpendicular to these and over the stream. Three streams are located within work pad areas, and may need temporary culverts during construction activities. Temporary culverts will be sized based on appropriate guidelines to accommodate flows. These areas will be inspected and maintained throughout construction by an environmental monitor and the temporary culverts will be removed when no longer needed.

Table 3.3-1. Proposed Direct Permanent and Temporary Wetland Impacts by Cover Class and Town.

	# Wetlands	Permanent Impact (SF)	Temporary Impact (SF)	Total (SF)
Madbury				
PEM/PSS	1	199	28,940	29,139
PSS	1	0	321	321
Sub-Total:	***2***	***199***	***29,261***	***29,460***
Durham				
E1UB (Subtidal)	1	0	49,832	49,832
E2US (Mud Flat)	1	3,550	114,166	117,716
E2EM (Salt Marsh)	1	0	624	624
E2RS (Rocky Shore)	1	0	279	279
PEM (Emergent/Marsh)	5	71	31,185	31,256
PEM/PSS	23	60	72,663	72,723
PEM/PSS/PFO	1	0	807	807
PEM/PSS/PUB	1	20	18,285	18,305
PEM (Wet Meadow)	8	20	5,779	5,799
PFO	3	23	4,517	4,540
PSS	11	20	18,120	18,140
PSS/PFO	4	0	9,370	9,370
Sub-Total:	***60***	***3,764***	***325,627***	***329,391***
Newington				
E1UB (Subtidal)	1	0	77,565	77,565
E2US (Mud Flat)	1	1,484	29,925	31,409
E2EM (Salt Marsh)	1	0	598	598
E2RS (Rocky Shore)	1	302	217	519
PEM (Emergent/Marsh)	2	134	16,500	16,634
PEM/PSS	8	173	54,020	54,193
PEM/PSS/PFO	3	0	3,722	3,722
PEM/PUB	2	0	976	976
PEM (Wet Meadow)	5	41	13,829	13,870
PSS	3	20	8,854	8,874
PSS/PFO	2	0	4,131	4,131
PSS/PUB	1	11	10,063	10,074
PUB	1	0	1,120	1,120
Sub-Total:	***31***	***2,165***	***221,520***	***223,685***
Portsmouth				
PEM/PSS/PFO	1	0	648	648
PEM (Wet Meadow)	1	0	203	203
Sub-Total:	***2***	***0***	***851***	***851***
Total:	**SF**	**6,128**	**577,259**	**583,387**
	Acres	**0.14**	**13.25**	**13.39**

Additionally, one perennial stream in Durham, College Brook (DS74), is proposed to be crossed with an open trench associated with underground line construction. A short section of this stream will be temporarily relocated using coffer dams to divert water around the impact area during construction. The underground electrical conduit will be installed and the impacted portion of the channel will be reconstructed with native material and stream flow will be restored to its original channel. The area will be stabilized as needed to support the disturbed banks.

3.3.3 Secondary Wetland and Stream Impacts

Secondary impacts include wetland conversion from a forested canopy to scrub-shrub and emergent due to tree removal within wetlands and upland stream buffer tree removal within 100 feet of perennial streams, 50 feet of intermittent streams and 25 feet of ephemeral streams.

The majority of the existing legal corridor is 100 feet wide; however the width of currently cleared and regularly maintained area is on average 60 feet, although it varies from nearly the entire 100 feet width to as narrow as 30 feet. To safely accommodate the proposed transmission line while meeting the applicable clearances for 115kV and the co-located distribution lines, the entire corridor will need to be cleared of capable tree species to its full width. Capable species are those woody (tree) species that have the potential of growing to a height (typically 30 feet) that could pose a risk to the structures and conductor if they were to fall. Lower growing shrubs and herbaceous vegetation will not be cleared as they will not grow up to a height that could endanger the line. Minimum clearances from all vegetation must be maintained, and routine maintenance clearing according to PSNH's vegetation clearing procedures and practices is an important component of the SRP operation[1].

Wetland areas within the surveyed treeline boundary were quantified within each town (Table 3.3-3). Cleared wetlands will not be stumped or grubbed and PSNH will consult with individual landowners on the disposal of cut trees. The remaining logs and brush will be removed from wetlands and either sold or chipped for erosion control.

Stream buffers function to protect the riparian areas of streams from sedimentation by trapping runoff, erosion by binding the soils near and along stream banks, and providing shade to keep water cool and for cover, plus other habitat benefits for wildlife and aquatic organisms. Tree removal within wetland areas near streams is included in the forested wetland conversion calculation. Proposed tree clearing of upland areas within 100 feet of perennial streams, 50 feet of intermittent streams and 25 feet of ephemeral streams was quantified based on agency recommendations (Table 3.3-4). Cleared areas within these buffers will not be stumped or grubbed and ground disturbances will be limited to those associated with the logging equipment. Additionally, low-growing native shrubs and other species common within riparian buffers will not be removed. Over time, other shrub and low-growing woody species will colonize the cleared areas helping to enhance and restore stream functions.

[1] Northeast Utilities, 2013. *Vegetation Clearing Procedures and Practices for Transmission Line Sections*. OTRM 230. Rev. 2 8/19/2013.

Table 3.3-2. Proposed Temporary Stream Impacts by Town and Flow Regime with Proposed Crossing Type.

Stream ID	Stream Type	Name	Temp. Impact (SF)	Temp. Impact (LF)	Crossing Type
Durham					
DS8	Ephemeral		0	0	Mat Bridge
DS32	Intermittent		0	0	Mat Bridge
DS34	Ephemeral		0	0	Mat Bridge
DS35	Perennial	Beaudette Brook	0	0	Mat Bridge
DS39	Perennial		0	0	Mat Bridge
DS46	Perennial	LaRoche Brook	0	0	Mat Bridge
DS51	Perennial		20	10	Temp. Culvert
DS60	Perennial	LaRoche Brook	0	0	Mat Bridge
D061	Perennial		0	0	Mat Bridge
DS74	Perennial	College Brook	146	49	Diversion, Trench & Mat Bridge
DS92	Intermittent		0	0	Mat Bridge
		Subtotal:	*166*	*59*	
Newington					
NS8	Intermittent		0	0	Mat Bridge
NS14	Ephemeral		0	0	Mat Bridge
NS36	Ephemeral		45	45	Temp. Culvert
NS50	Intermittent		0	0	Mat Bridge
NS107	Perennial		0	0	Mat Bridge
		Subtotal:	*45*	*45*	
		Total:	**211**	**104**	

Table 3.3-3. Forested Wetland Conversion by Town.

	Wetland Conversion (SF)	Wetland Conversion (acres)
Madbury	2,072	0.05
Durham	217,334	4.99
Newington	87,089	2.00
Portsmouth	11,305	0.26
Total (SF):	**317,800**	**7.30**

Table 3.3-4. Upland Stream Buffer Tree Removal by Town.

	Perennial Stream Buffer (SF)	Intermittent Stream Buffer (SF)	Ephemeral Stream Buffer (SF)	Total (SF)
Madbury	7,383	0	0	7,383
Durham	53,348	11,453	4,221	69,022
Newington	5,010	4,691	1,119	10,820
Portsmouth	0	0	0	0
Total (SF):	**65,741**	**16,144**	**5,340**	**87,225**
Total (Acres):	**1.51**	**0.37**	**0.12**	**2.00**

3.3.4 Vernal Pool Impacts

No vernal pools were identified within the SRP corridor and no impacts are anticipated.

3.3.5 Effects on Wetland Functions and Values

Permanent impacts to wetlands and streams were avoided and minimized wherever possible. The remaining unavoidable permanent impacts to terrestrial (palustrine) wetlands are relatively minor in extent (792 SF) and distributed across 27 structures in 24 wetlands. Table 3.3-5 summarizes the total proposed permanent impact to each princiapal wetland function or value in each town. These data do not include functions or values that a wetland is classified as suitable for, as the wetland was not observed performing this function or value within or immediately adjacent to the ROW area. Additionally, because wetlands can have multiple principal functions or values, proposed permanent impacts to a given function or value will exceed the total permanent impact to each given wetland. Wetlands The functions most commonly associated with the permanently impacted wetlands include groundwater discharge, floodflow alteration, production export, sediment/toxicant retention and wildlife habitat. The small footprint of the new transmission line structures is not expected to affect the existing wetland functions or values. The impacted wetland areas are primarily located within an existing electric corridor and are already subject to periodic maintenance including clearing and other repair work. Temporary impacts are anticipated to have minimal adverse effects on the functions and values associated with the impacted wetland systems. Applicable construction BMPs, on-site monitoring, and restoration of temporarily impacted areas according to standards and based on agency recommendations will be employed (Section 4.0). More details on the expected impacts to the estuarine resources associated with Little Bay are included below (Section 5).

Table 3.3-5. Permanent Impacts to Principal Functions and Values for Wetlands in each Town.

Town	Groundwater Discharge	Floodflow Alteration	Fish/Shellfish	Sediment/Toxicant Retention	Nutrient Removal	Production Export	Shoreline/Sediment Stabil.	Wildlife Habitat	Recreation	Education/Scientific	Uniqueness/Heritage	Visual Quality/Heritage	RTE Habitat
Madbury	199	199	199	0	0	199	199	199	0	199	0	199	0
Durham	94	3,550	3,550	3,570	0	3,553	0	3,600	3,550	3,550	3,550	3,570	0
Newington	298	1,979	1,786	1,940	154	1,959	0	1,817	1,786	1,786	1,786	1,786	0
Portsmouth	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (SF):	**591**	**5,728**	**5,535**	**5,510**	**154**	**5,711**	**199**	**5,616**	**5,336**	**5,535**	**5,336**	**5,555**	**0**

*RTE: Rare, Threatened and Endangered

3.3.6 Temporary Impacts Restoration Plan

Wetland and upland areas temporarily disturbed for access road and structure replacement activities will be restored. The likely wetland restoration areas will be associated with the location of timber mats shown for the structures and access roads in wetlands on the construction plans. Once timber mats and other temporary wetland protections have been removed, any displaced or compacted topsoil will be smoothed or graded to match previous or adjacent soil elevations. Acquired upland and wetland topsoil or reused topsoil will be evaluated for project use in any areas requiring fill, and will be spread and moderately compacted to match adjacent grades. Areas with disturbed soils will be stabilized with upland or wetland seed mix of native and naturalized species along with annual ryegrass (for erosion control while the other seed germinates). Alternative seed mixes or stabilization methods may be negotiated with individual landowners for upland areas by the contractor, as long as these alternatives are equally protective of jurisdictional wetlands and waterbodies and do not introduce noxious or invasive species.

Areas of the fringing salt marsh that will be temporarily impacted by the underwater cable installation will be restored immediately following completion of the cable laying. Prior to construction, all salt marsh peat will be salvaged within the impact area and stockpiled for replacement during restoration. The stockpiled peat blocks will be protected and maintained for the duration of the installation period. Upon completion of construction, the underlying gravel substrates will be restored to match surrounding elevations. The peat blocks will be replaced and anchored with rebar stakes driven into the gravel and/or adjacent peat. Any open interstices between the peat blocks will be filled with a mixed sand to cover exposed roots and maintain grades. The seaward face of the restored peat will be protected from ice and wave action with a coir log.

All construction and restoration will be done under the supervision of the Engineer and an environmental monitor to ensure minimization of impacts to native vegetation and wildlife, and that all disturbed areas are stabilized.

The environmental monitor will assure compliance with permit conditions during and after the construction activities, including one year of post-construction corridor monitoring after one full growing season, and preparation of the appropriate compliance reports for submittal to NHDES. The monitoring will include a site inspection, vegetation cover estimates in restored wetlands and uplands by species in random plots, photographs, and wildlife observations. Areas with less than 80% cover at the end of the growing season will require additional seed or other appropriate enhancements. Any areas with erosion will be repaired immediately. Non-biodegradable erosion control materials will be removed as soon as they are no longer necessary. Other potential maintenance issues, such as erosion gullies or vandalism, will be documented and reported immediately to PSNH for repair.

Restored areas will be monitored for invasive species. Potential invasive species on this site include purple loosestrife, glossy and smooth buckthorn, bittersweet, multiflora rose and autumn olive among others. Invasive plants will be pulled and removed from restoration areas and disposed of in a manner and location to preclude their survival or spread. PSNH has a maintenance mowing protocol that encourages native shrubs while removing capable trees and non-native species. A monitoring report will be submitted to NHDES by November 1 of the year following construction impacts.

4.0 Compensatory Wetland Mitigation

Compensatory mitigation is proposed for unavoidable impacts to permanent wetland fill, and conversion of forested wetlands as a result of tree clearing. The first steps in mitigating wetland impacts are to avoid and minimize impacts. This has been a key component of the design for SRP project. The Project design team has worked with engineers and scientists to make design changes in order to avoid and minimize wetland impacts wherever possible (Sections 3.1 and 3.2)

Permanent direct wetland impacts are below the NHDES threshold for mitigation (10,000 SF of permanent wetland impact). . Secondary impacts due to tree removal are in accordance with applicable U.S. Army Corps of Engineers (“USACE”) regulations and guidance, howver, mitigation is proposed for direct and secondary Project impacts to wetlands and impacts to stream buffers.

SRP wetland resource impacts are currently calculated as 5,336 square feet of permanent estuarine impact, 792 square feet of permanent terrestrial wetland impact, 317,800 square feet of forested wetland conversion and 87,225 square feet of upland stream buffer clearing. Direct temporary impacts to streams total 211 square feet (104 linear feet). No vernal pool impacts occur. Mitigation ratios were applied to these anticipated impacts in accordance with the *New England Army Corps of Engineers Mitigation Guidance* document and in coordination with the USACE, and NHDES. A qualitative assessment of 13 wetland functions and values using the USACEHighway Methodology found that, while multiple functions were provided to some degree by most wetlands, the principal functions were the distinguishing features among the wetland types. The most common principal functions include: Groundwater Recharge/Discharge, Wildlife Habitat, Production Export, Sediment/Toxicant/Pathogen Retention, Floodflow Alteration and Nutrient Retention.

Because of the linear nature of the Project and its wetland resource impacts, high value within-project mitigation would be difficult. The Project includes four towns, multiple watersheds and a variety of freshwater and estuarine resources. During agency pre-application meetings, NHDES and USACE agreed that in-lieu fee payment into the State's Aquatic Resource Mitigation fund was potentially appropriate compensatory mitigation for a linear project such as the SRP. Mitigation ratios were applied to these anticipated impacts in accordance with the *New England Army Corps of Engineers Mitigation Guidance* document and in coordination with the USACE, and NHDES. Calculations for payment into the In-Lieu Fee program based on the types and extent of impacts by town are shown in Table 4.0-1. The dollar value shown in Table 4.0-1 may change during the review process with NHDES and USACE should design modifications result in changes in wetland impacts.

The Town of Durham provided a potential wetland restoration and upland buffer protection project, summarized below. The restoration concepthas merit for compensation for different aspects of wetland resource impacts by the SRP if the regulatory agencies concur.

Durham

The Town of Durham has proposed an environmental mitigation project to reduce the amount of erosion from the Wagon Hill Farm shoreline bordering the Great Bay Estuary and the Oyster River. Wagon Hill Farm is Town-owned conservation land consisting of 139 acres with 1100 feet of tidal frontage on the Little Bay, Oyster River and Smith Creek, and 8.5 acres of tidal and freshwater wetlands. The project proposes to stabilize the existing eroded portions of the shoreline, which is partially the result of uncontrolled foot traffic along the shoreline. The erosion has been exacerbated by natural conditions including wind, wave, ice action, and shading from mature trees on the bank. This erosion is continuing to degrade shoreline and salt marsh habitats and has negative impacts on wildlife, shellfish, and fish habitats. The erosion stabilization would include both stabilizing and restoring the shoreline, as well as further measures to halt foot traffic in the sensitive areas by re-designing nearby walking paths to discourage off-path travel, fences and viewing platforms on the adjacent upland. A second habitat protection effort is a footbridge proposed to be constructed over Davis Creek and adjacent wetlands to control off-path travel by people and pets.

The stabilization projects will help to protect the water quality and aquatic habitats of the local streams, adjoining bordering wetlands, and the Great Bay estuary including the adjacent Salt Marsh and Sparsely Vegetated Intertidal systems, both of which are Exemplary Natural Communities documented by NHNHB. Preliminary estimates suggest that approximately 700-900 square feet of salt marsh, plus approximately 1,100 linear feet of adjacent shoreline could be restored. Impacts to freshwater wetlands along Davis Creek are estimated as 500 square feet. The Town of Durham has recently partnered with UNH ecologists and DES coastal staff to develop strategies for restoring salt marsh and developing long-term stabilization along the shoreline.. This partnership will bring current and potentially innovative techniques to addressing erosion, controlling freshwater runoff, and protecting from human-caused destabilization.

The Wagon Hill Farm shoreline stabilization project provides the opportunity to mitigate for unavoidable permanent impacts caused by SRP structures in freshwater wetlands (approximately 700 square feet in Durham), potentially 2,500 square feet of impact from concrete mattresses on tidal flats, and clearing of freshwater wetlands and streams as a result of tree removal within the SRP project corridor. It also provides the opportunity to restore sections of deteriorated or fully eroded salt marsh, and would further reduce sediment loading into critical estuarine habitats. The project has been estimated to cost $370,000, including $340,000 for shoreline restoration, $10,000 for a bridge over Davis Creek, and $20,000 to stabilize and restore Davis Creek Point. The Town of Durham is anticipating that PSNH's contribution of approximately $170,000 would complete the project, in addition to $115,000 from the Lois Brown Trust and approximately $84,000 to be raised by the town. The Durham Selectmen and Budget Committee have approved this project as part of the 2016 annual budget, pending regulatory permit approval for the PSNH contribution. Additional detail on the project is provided in Appendix B of this report within a memorandum regarding *Environmental Mitigation Project along the Wagon Hill Farm Shoreline* prepared by the Town of Durham Department of Public Works.

PSNH will continue to work with applicable parties to develop a mitigation package that will be acceptable to NHDES and USACE.

Table 4.0-1. New Hampshire Aquatic Resource Mitigation (ARM) Fund Payment Calculation for Permanent and Secondary Wetland Impacts

Town	A: Secondary Impact: Forested Wetland Conversion (SF)	A1: Conversion Mitigation Area (15% of total area A)(SF)	B: Secondary Impact: Stream Buffer Clearing (SF)	B1: Conversion Mitigation Area (15% of total area B)(SF)	C: Permanent Impacts (SF)	Total Impacts for Mitigation by Town (SF) (Sum A1+B1+C)	ARM Payment (from NH DES ARM Fund Calculator by Town)[2] (USD)
Madbury	2,072	311	7,383	1107	199	1,617	$6,488.92
Durham (Freshwater)	217,334	32,600	69,022	10,353	214	43,167	$183,385.10
Durham (Tidal)	-	-	-	-	3,550	3,550	$30,162.72
Newington (Freshwater)	87,089	13,063	10,820	1,623	379	15,065	$66,079.42
Newington (Tidal)	-	-	-	-	1,786	1,786	$15,667.82
Portsmouth	11,305	1,696	0	0	0	1,696	$8,187.14
Total:	317,800	47,670	87,225	13,084	6,128	66,882	$309,971.11

[2] http://des.nh.gov/organization/divisions/water/wetlands/wmp/

5.0 Impacts in Little Bay

The three transmission cables will be installed across Little Bay within an area mapped as "Cable Area" on NOAA Chart 13825. The primary installation will involve sinking each cable to the desired burial depth using a jet plow (Figure 2-1). This process essentially softens sediments, lays the cable which sinks through the softened sediments, and buries the cable in one step. The jet plow functions by injecting pressurized water into the sediment to fluidize it, allowing the cable to settle below the bay floor to the required depth (3.5-foot burial on the tidal flats; 8-foot burial in the channel). The support barge and jet plow will not be able to reach the shoreline on either side, however. In these nearshore areas, the cable will be laid on the substrate surface and divers will use hand jets to lower the cable to the desired 3.5-foot burial depth (a total distance of approximately 880 feet [268 meters] per cable). Silt curtains will be placed surrounding the intertidal areas to be hand jetted or trenched to contain suspended sediments.

Within the jet plowing zone, each cable will disturb a rectangular area about 1-foot wide (the width of the plow blade) and about 4,266 feet (1,300 meters) long for a total direct surface disturbance of 4,266 SF (0.1 acre) per crossing or a total of 12,798 SF (0.3 acres) for all three cables. The jet plow installation will begin on the western tidal flat approximately 300 feet (95 meters) seaward of the shoreline and continue until approximately 580 feet (178 meters) west of the eastern landfall. For the majority of the length, the cables will be laid 30-feet apart on center, although as they near the shorelines they funnel together to rejoin. The wide separation is necessary to protect the cables because the physical constraints of the crossing will require a multipoint anchoring system on the installation barge.

Both the jet plowing and diver hand jetting will require the support of a barge. On the shallow tidal flats, the barge will be grounded for a period of time for each installation phase.

Additional underwater construction activity will include removal of sections of existing cables and other minor debris that could present obstacles to the jet plow. Four PSNH transmission cables from an earlier crossing currently lie on or within 24 inches of the sediment surface within the Cable Area. The cables are between 60 and 110 years old, and are largely intact on the seafloor. PSNH attempted to remove the cables in the mid-1990's (NHDES Wetlands Board Permit 95-02299; USACEPermit 1996-00160), but the effort was halted after the cables fractured during the removal attempt. An inspection by divers in 2014 indicated that the cables were sufficiently intact to be successfully "grappled" to the surface. Most of one cable and approximately half of a second cable lie within the proposed jet plow route. The planned approach is to sever the old cables and cap the ends at the minimum length necessary to clear the jet plow route. The severed cable sections will be lifted to a barge for on-land disposal (See proposed Marine Work Plan in Appendix).

The jet plow process is expected to extend over a period of three to four weeks, including all equipment mobilization. Each cable will require about five to seven days in total, including equipment mobilization and cable preparation. The jet plow installation will generally take one day per cable. Divers using hand held jets will complete the cable burial from the end of the jet plow to each landfall. This process will take up to 90 days. Cable laying is planned for the fall (after Labor Day) and will be completed before air temperatures routinely fall below 32˚F, a point at which the cables would not be flexible enough to handle off the spool.

Potential temporary impacts along the Little Bay crossing include:

- Direct disturbance of the sediment surface from cable installation along each cable trench (quantifiable) and from anchoring of the installation vessel (not quantifiable)
- Deposition of sediments suspended during the jet plowing and dispersed beyond the footprint of each trench (quantifiable)
- Increase in suspended sediments above ambient conditions during jet plowing
- Entrainment of planktonic organisms in the jet plow water intake

Potential long-term impacts as a result of the operating cables include:

- Exposure of organisms to electromagnetic fields emitted from the three cables
- Exposure of organisms to heat emanating from the cables

5.1 Water Quality Effects

RPS ASA used the SSFATE model to predict the excess suspended sediment concentration and dispersion of suspended sediments from jet plowing and hand jetting (see Appendices). Since ambient suspended sediment concentrations are variable and unpredictable based on available information, the model predicts excess concentration, defined as the concentration above ambient suspended sediment concentration that results from the jetting activities. SSFATE also calculates the resulting deposition thickness of suspended sediments that have resettled back on the bottom. Ambient current speeds, tidal stage, trench depth and rate of advance of the jet plow are important factors in predicting settlement, resuspension and dispersion. The jet plow model was run assuming spring tide conditions. Spring tides usually result in a larger areal coverage (larger transport from the currents) but with lower concentrations and deposition thickness (since sediment would be spread over a larger area) than neap tides. The three-to-four week duration of the installation process will encompass at least one spring and one neap tidal period. The hand jetting model assumed that no silt curtains would be used to isolate the work area in order to evaluate the worst case for this activity.

5.1.1 Water Quality Effects from Jet Plowing

Jet plowing will always be initiated on the western tidal flat and, because of the shallow depths encountered on the flat, it will have to start at high tide. Burial depth determines the amount of sediment that could potentially be fluidized and released into the water column. The Project has determined that each cable must be buried to 3.5 feet below the sediment surface on the western and eastern tidal flats and 8 feet below the sediment surface under the channel. According to the marine contractor, Caldwell Marine Inc., the jet plow is likely to advance at a rate of 100 m/hr (330 ft/hr). At this rate, each installation will take approximately 13 hours. The likelihood of starting the jet plowing substantially later than high slack tide on a given day or of moving more slowly than the modeled advance rate is very low. The jet plow will be launched (i.e., placed on the substrate) the day before the scheduled crossing so that it will be ready to activate immediately as soon as water depths are sufficient for operation of the barge. Should the plow encounter an obstruction, the blade will be raised incrementally until it clears the obstruction. The ability to adjust the vertical position of the blade ensures that forward progress will continue.

Figures 5.1-1 through 5.1-4 show the plan view of the predicted excess suspended sediments ("SS") concentration at one-hour intervals starting one hour after jet plowing has been initiated for one cable. The colored contours can be identified from the legend showing concentrations from 10 mg/L on up. Figures 5.1-1 and 5.1-2 depict an ebbing or low tide and the plume is directed northward. By eight hours after the start (Figure 5.1-3), the tide has begun the flood stage and the plume has headed south towards Furber Strait. When the jet plow has reached the eastern end, the tide is still flooding (Figure 5.1-4). The contours show the highest concentrations centered directly over and adjacent to the immediate location of the jet plow on the cable route. Once the jet plow shuts down, no additional sediment will be dispersed into the water column and the plume will quickly dissipate. This is depicted in the two bottom panels in Figure 5.1-4 (13.5 and 14 hours after start).

A vertical section view of the cable path is inserted at the bottom of the figure. The insert shows that the highest concentrations occur just above the jet plow near the bottom with reduced concentrations extending up into the water column above the plow. In the shallow portions of the route, the plume reaches the surface but in the deeper portions the plume is generally restricted to the lower half of the water column.

At any given point in time during the crossing, the size of the entire plume (defined as greater than or equal to 10 mg/L excess suspended sediments) would encompass an area of about 14 acres (4 hours after start) to 55 acres (9 hours after start), averaging 37 acres. The area encompassed by the portion of the plume where excess suspended sediment concentrations are predicted to be equal to or greater than 100 mg/L is estimated to range from 0.8 (8 hours after start) to 15.9 (2 hours after start) acres instantaneously averaging 5 acres. 100 mg/L is the highest "natural" concentration measured by GBNERR off Adams Point in the fall during monthly surface water collections between 2002 and 2011. Concentrations of 1000 mg/L or higher would encompass a maximum of 3.5 acres and would typically be much smaller in extent (averaging <1 acre).

Figure 5.1-5 shows the plan view of the maximum time-integrated (i.e., maximum extent of plume at any given time over the entire installation period for one cable) excess SS concentration for the entire 13-hour jet plowing operation plus continuation for six additional hours in order to track the residual plume. This plot shows only the maximum excess SS concentration integrated over time and would not actually be seen in the Bay. However, it is useful for understanding the maximum potential extent of the plume for identifying natural resources exposure. The biological significance of that exposure depends on both excess suspended sediment concentration and the duration; these are summarized in Figure 5.1-6 and Table 5.1-1 for each plume concentration identified in Figure 5.1-5. At 10 mg/L excess SS concentration, the area that is enclosed by the contour is 90.2 hectares (222.9 acres) but lasts for only 1 hour. This short duration continues through all the concentration thresholds through 1000 mg/L. The areas quickly drop in time for a given concentrations so by 2 hours the 10 mg/L area has dropped to 32.2 hectares (79.6 acres). The plume will have completely disappeared within six hours. The area coverages drop dramatically for the higher concentrations near the jet plow indicating that the duration and extent of the plume are relatively limited.

5.1.2 Water Quality Effects from Hand Jetting

Cable installation in nearshore areas with insufficient water depth to support the jet plow and installation barge will involve a two-step process. Each cable will be laid directly on the substrate surface and then divers will use hand-operated jets to fluidize the sediments under the cables, allowing them to sink to the required burial depth (3.5 feet). Caldwell estimates that each this process will temporarily open a 4-foot wide trench for burial of each cable. This work will take place during a four-hour window around high slack tide. With an advancement rate of approximately 30 feet per day (7.5 ft/hr), it is estimated that installation for all three cables will take approximately 30 days on the west side and 60 days on the east side. Silt curtains will be placed around the entire work area on the west and a portion of the work area on the east (370 feet) to contain the suspended sediments. A 230-foot long section of the area to be hand jetted on the east side is located offshore of the intertidal and is likely to be exposed to currents in excess of 0.5 knot, the limiting speed for silt curtains.

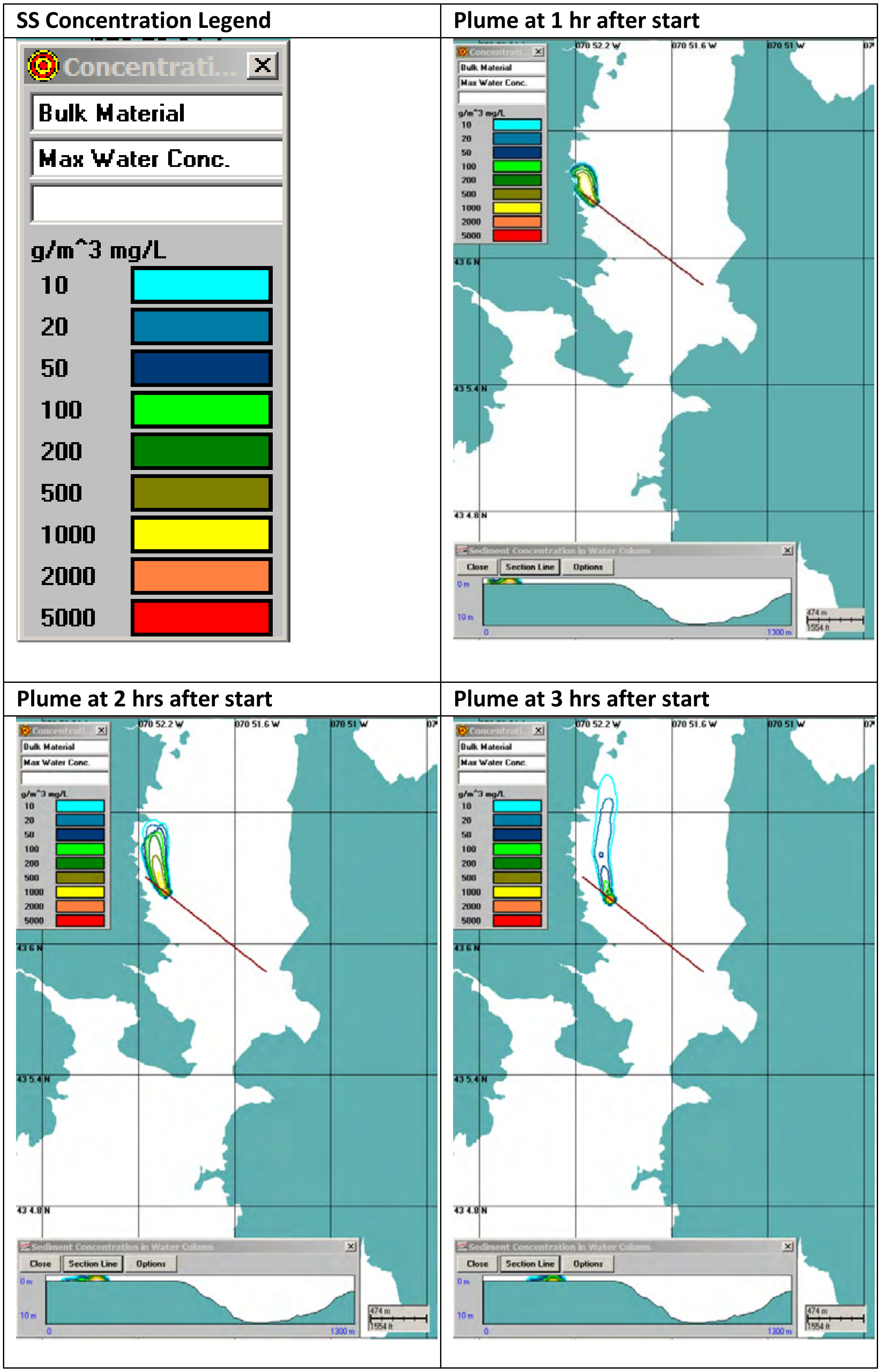

Figure 5.1-1. Plan view of instantaneous excess SS concentrations at 1 through 3 hours after start of jet plowing initiated at high slack. Vertical section view at lower left.

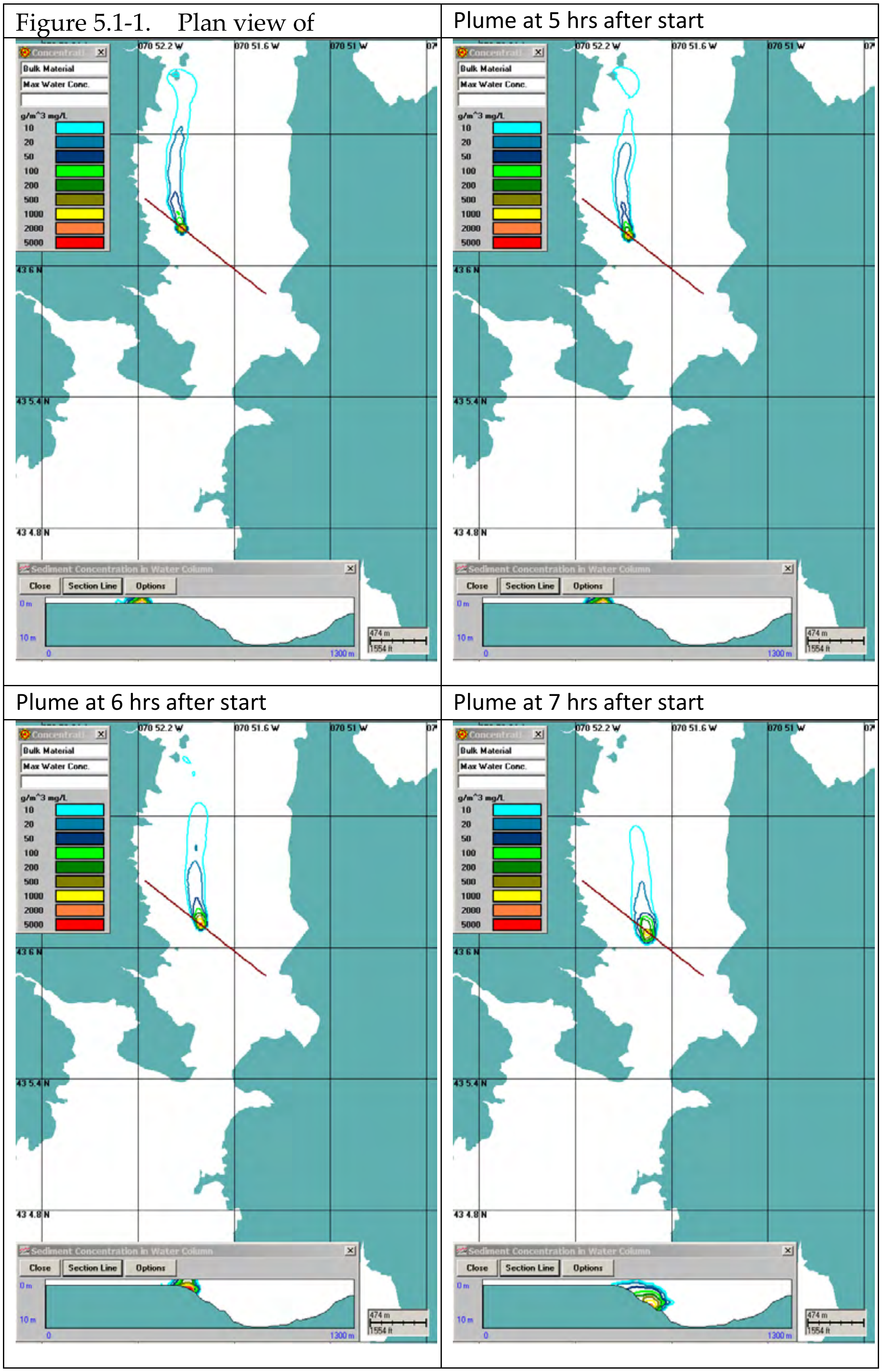

Figure 5.1-2. Plan view of instantaneous excess SS concentrations At 4 through 7 hours after start of jet plowing initiated at high slack. Vertical section view at lower left.

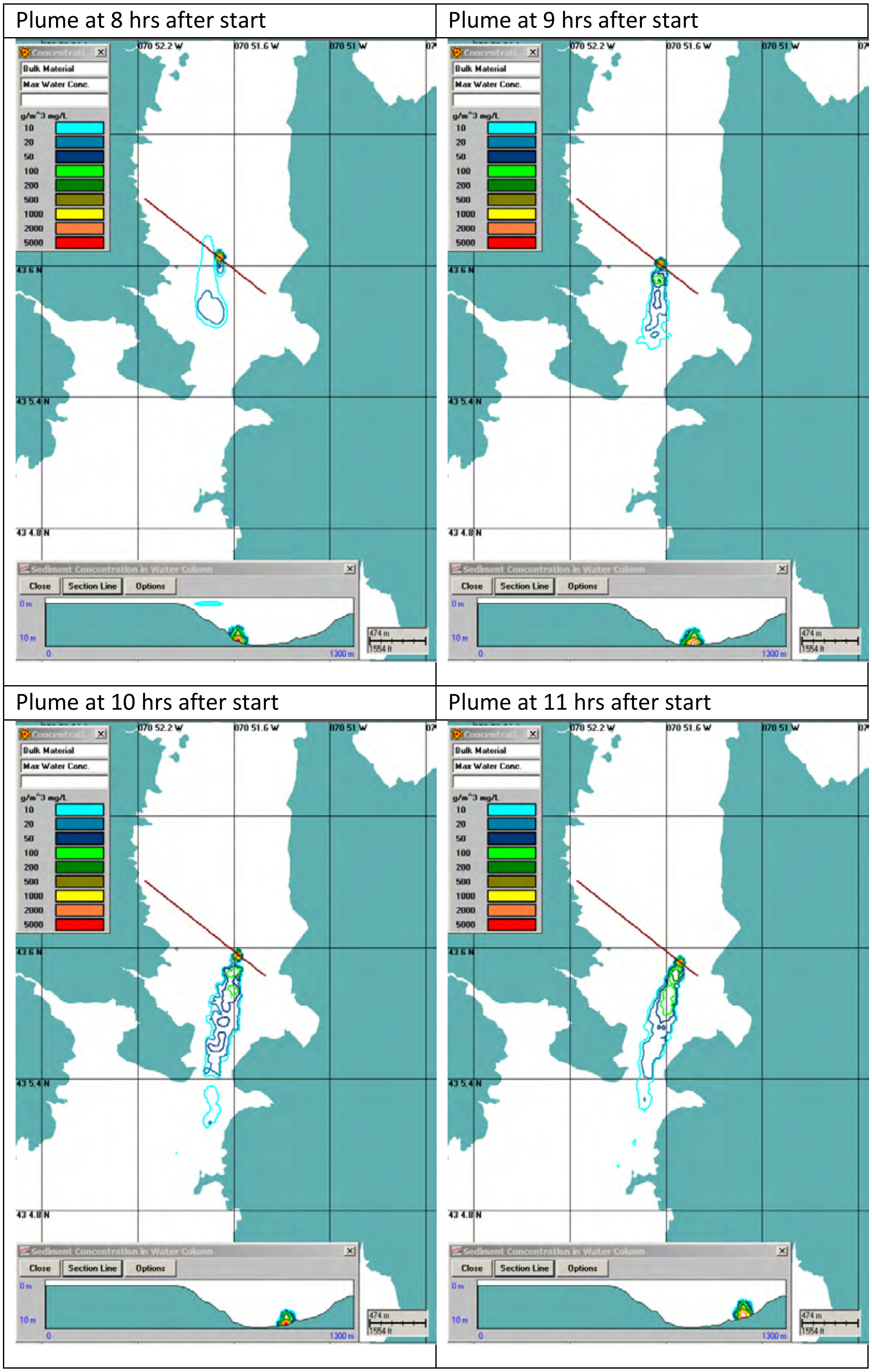

Figure 5.1-3. Plan view of instantaneous excess SS concentrations At 8 through 11 hours after start of jet plowing initiated at high slack. Vertical section view at lower left.

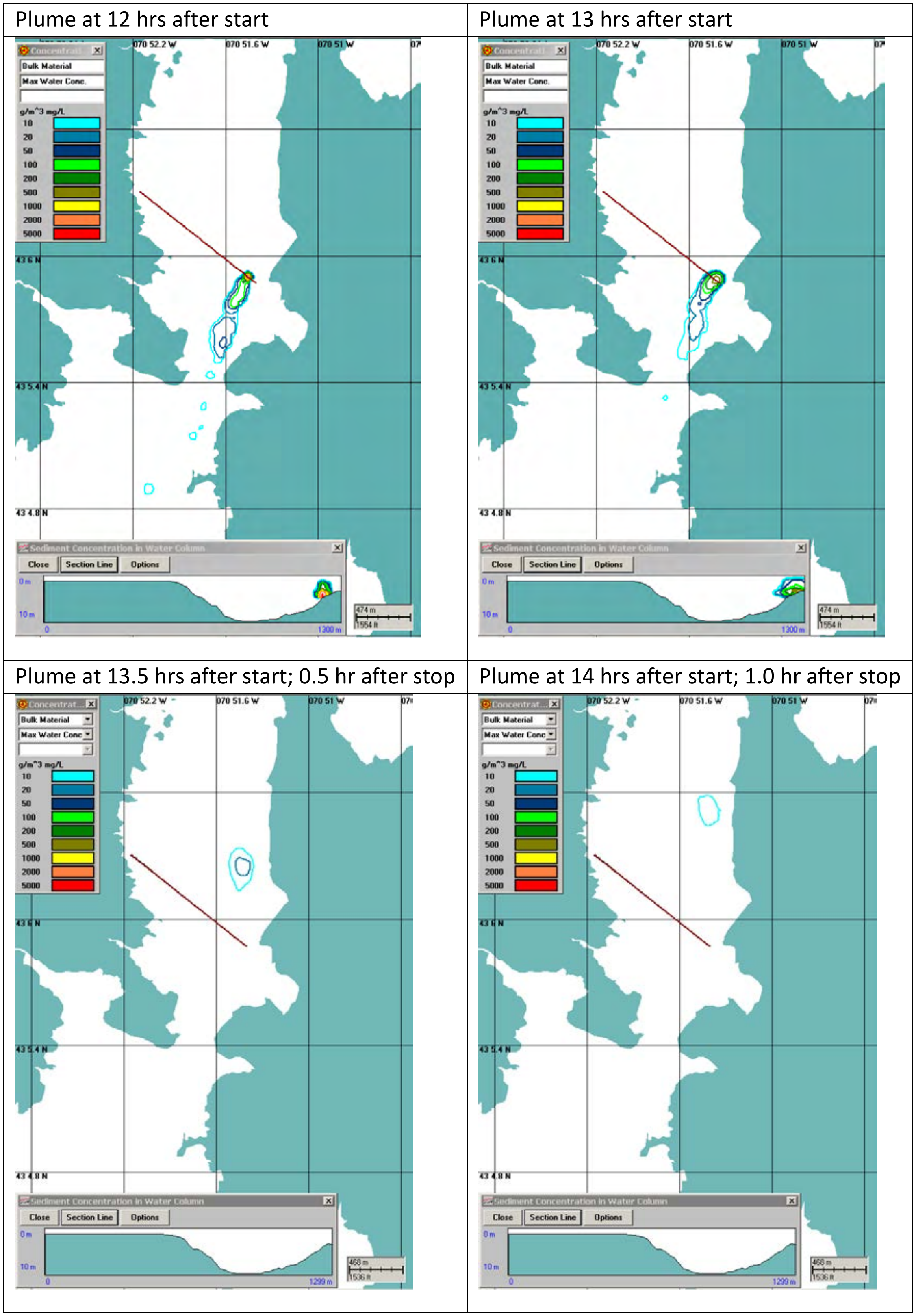

Figure 5.1-4. Plan view of instantaneous excess SS concentrations at 12 through 14 hours after start of jet plowing initiated at high slack and ending at hour 13. Vertical section view at lower left.

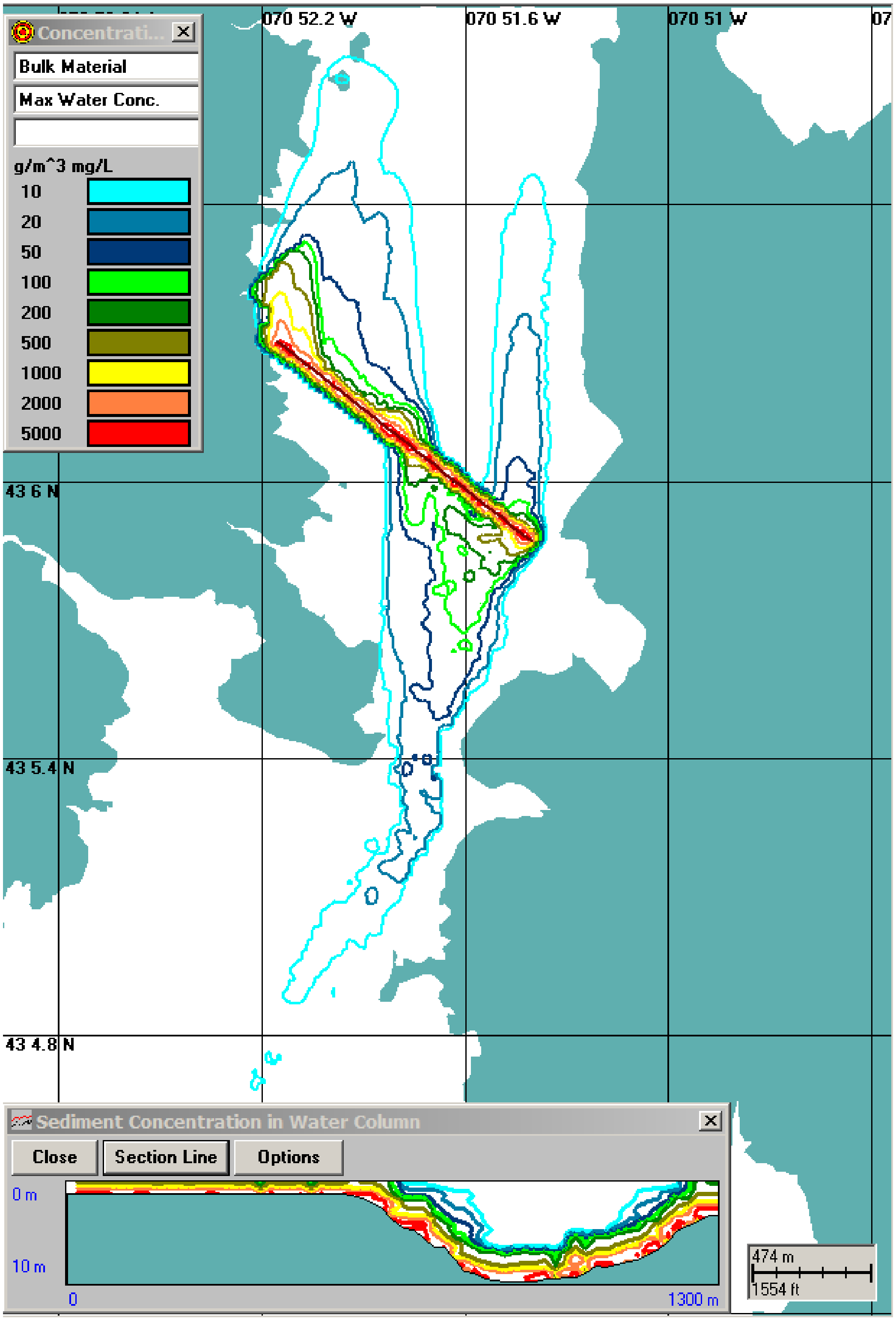

Figure 5.1-5. Plan view of maximum time integrated excess SS concentration over the entire jet plowing operation during one passage of a jet plow on a spring tide. Vertical section view at lower left.

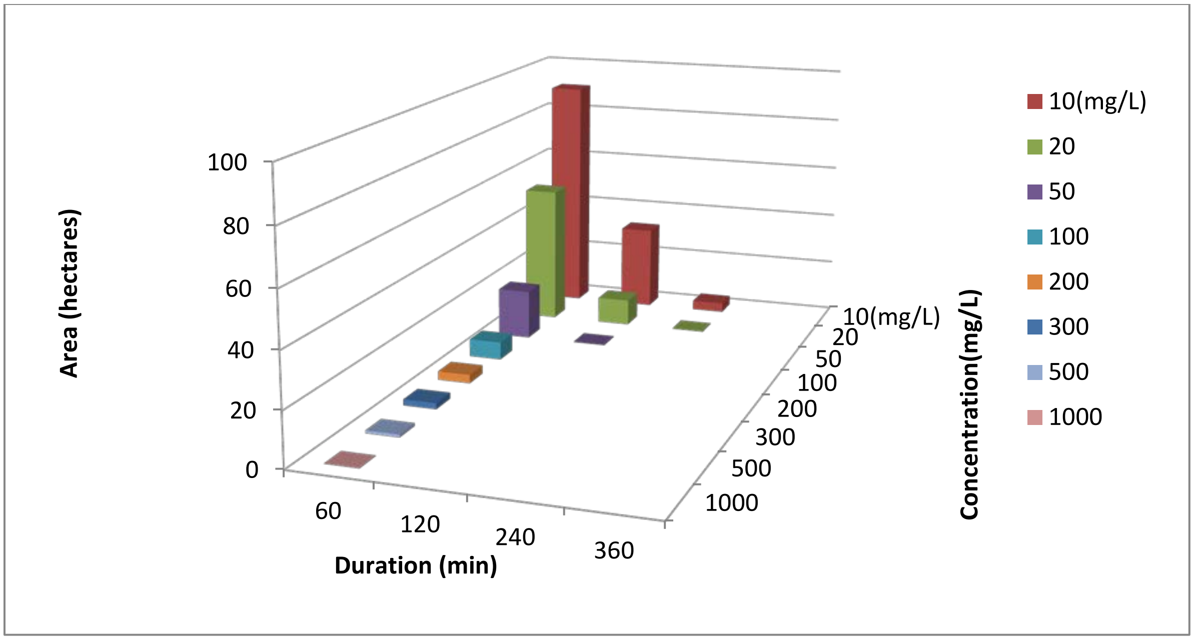

Figure 5.1-6. Duration (minutes) and area (hectares) of maximum time integrated excess SS concentration during one complete passage of a jet plow on a spring tide.

Table 5.1-1. Duration (Minutes) and Area (Hectares and Acres) of Maximum Time Integrated Excess SS Concentration During One Passage of a Jet Plow on a Spring Tide.

SS Concentration	Hectares				Acres			
	60	120	200	360	60	120	200	360
(mg/L)	(min)	(min)	(min)	(min)	(min)	(min)	(min)	(min)
10	90.20	32.20	4.76		222.89	79.57	11.76	
20	52.60	10.00			129.98	24.71		
50	18.70	0.16			46.21	0.40		
100	6.72				16.61			
200	3.20				7.91			
300	2.24				5.54			
500	1.04				2.57			
1000	0.08				0.20			

Water quality modeling of the hand jetting operation was conducted assuming that no silt curtains would be used and that work would only take place during the period from two hours before until two hours after high slack tide. Figure 5.1-7 shows those results, but is actually directly applicable only to the outer portion of the east side. At any given time, the plume (defined as the suspended sediment concentration of 10 mg/L above ambient) from the hand jetting in the section not protected by silt curtains is, likely to extend approximately 850 feet (260 meters) north of the work area and occupy an area of less than 5 acres. Highest

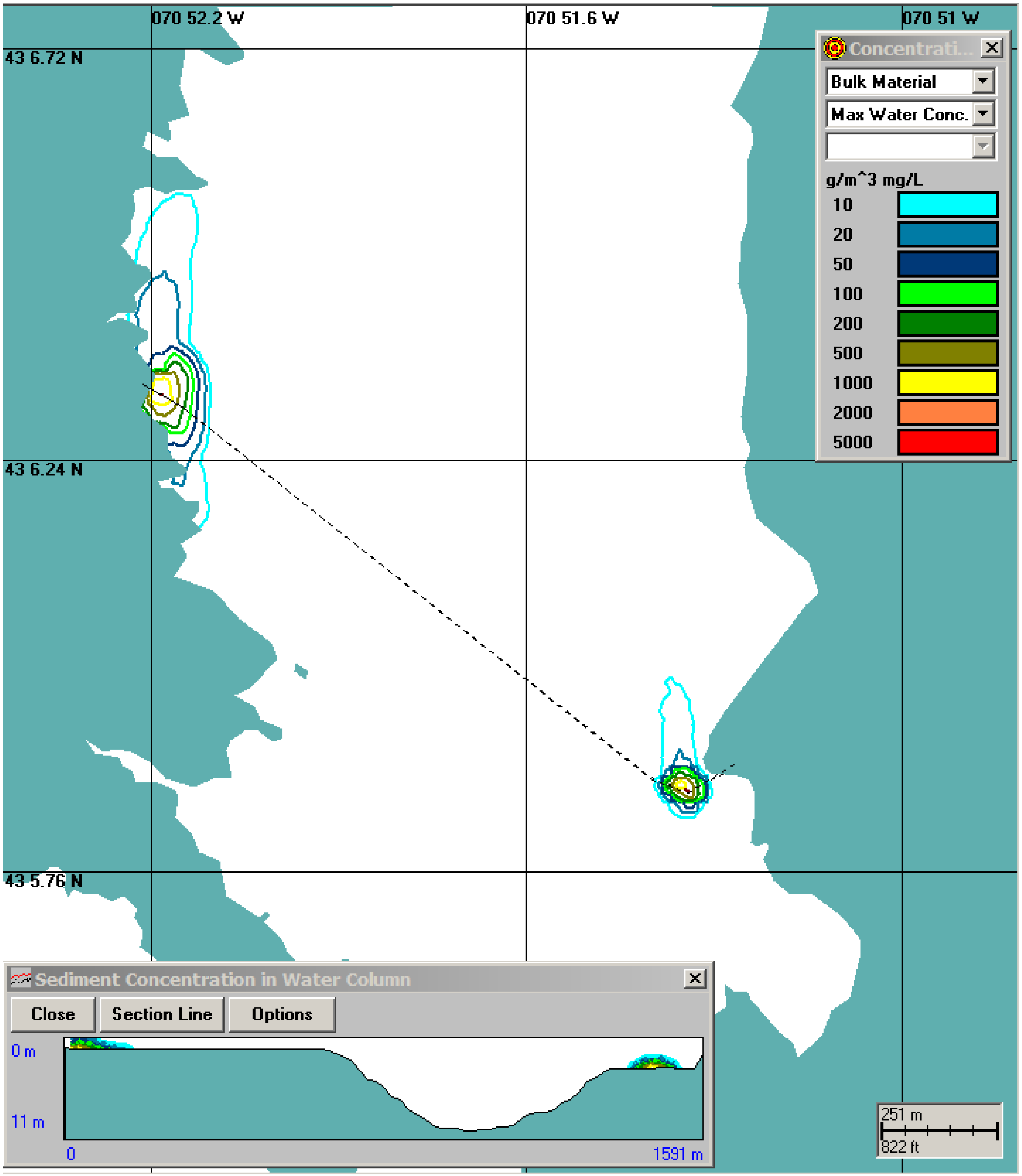

Figure 5.1-7. Plan view of instantaneous maximum excess suspended sediment concentrations for one day approximately midway across the west and east diver burial sections assuming silt curtains were not used. Vertical section view at lower left.

concentrations would be centered over the immediate vicinity of the activity. The plume would remain in the lower half of the water column. RPS ASA (2015) predicted that a residual plume of 10 mg/L excess suspended sediments would remain for about two days after hand jetting is completed because the initial buildup occurs near slack water and the sediments are mostly silts and clays. Water depths along a portion of the outermost section where silt curtain use is unfeasible are sufficient to allow divers to also work around low slack tide as well. When this occurs, the plume would flow primarily to the south. The horizontal and vertical distribution of suspended sediments would have a similar pattern to that described for the northerly flowing plume.

Use of silt curtains around the remaining areas where hand jetting will take place will greatly reduce the potential for a sediment plume outside the work area. The USACE has published suspended sediment retention rates of 80-100% (Francingues and Palermo 2005; Lackey, et al. 2012) for correctly deployed silt curtains. Thus, plumes escaping the silt curtains can be of low concentration with the 10 mg/L contour extending approximately 1100 feet (244 meters) beyond the work area on the west and 200 feet (152 meters) beyond the work area on the east.

5.2 Impacts to Bathymetry and Sediments

In addition to the temporary changes in bathymetry caused by cable installation (through jet plowing, hand jetting, or excavating), substrate conditions in the Project Area will be affected by redeposition of suspended sediments (jet plowing and hand jetting) and potentially by placement of artificial material on top of the cables to ensure the required level of protective cover. These impacts are discussed in this section.

5.2.1 Impacts to Bathymetry and Sediments from Jet Plowing

During the mobilization process for each cable, the installation barge will be maneuvered onto the tidal flat during high tide to allow deployment of the jet plow to the west. It is likely that the barge will become grounded on the substrate as the tide recedes and will compress the unconsolidated sediments beneath. Grounding will affect an area equivalent to three times the dimensions of the barge, a total of approximately 29,160 SF (0.67 acre).

SSFATE modeling conducted by RPS ASA also examined the redeposition of sediments suspended by the jet plow. Figure 5.2-1 shows the plan view of the cumulative bottom deposition thickness distribution from 0.1 milimeter to 50 milimeters (0.004-2.0 inches; see color legend) due to jet plowing the three cables. The distribution pattern is generally similar to the water column plume (ebb-flood-ebb) but much reduced in extent. The higher deposition areas are at and adjacent to the cable routes. There are a few non-contiguous areas of 0.1 – 0.5 milimeter (0.004-0.02 inch) further south of the cable route that are due to the slight changes in current direction transporting water column plumes from slightly different locations on the route so they happen to form a thin deposit at the same place.

The sizes of the deposition thickness patterns seen in Figure 5.2-1 are summarized in Table 5.2-1. The model predicts that an area totaling 144.5 acres would experience redeposition of sediments suspended by the jet plow as a result of installation of three cables. Of this total, 87.9 acres would receive deposition in the range of 0.1 -> 0.5 milimeter (0.004->0.02 inch) thick. These areas drop dramatically for the higher deposition thicknesses (e.g., 2.4 hectares [5.9 acres]

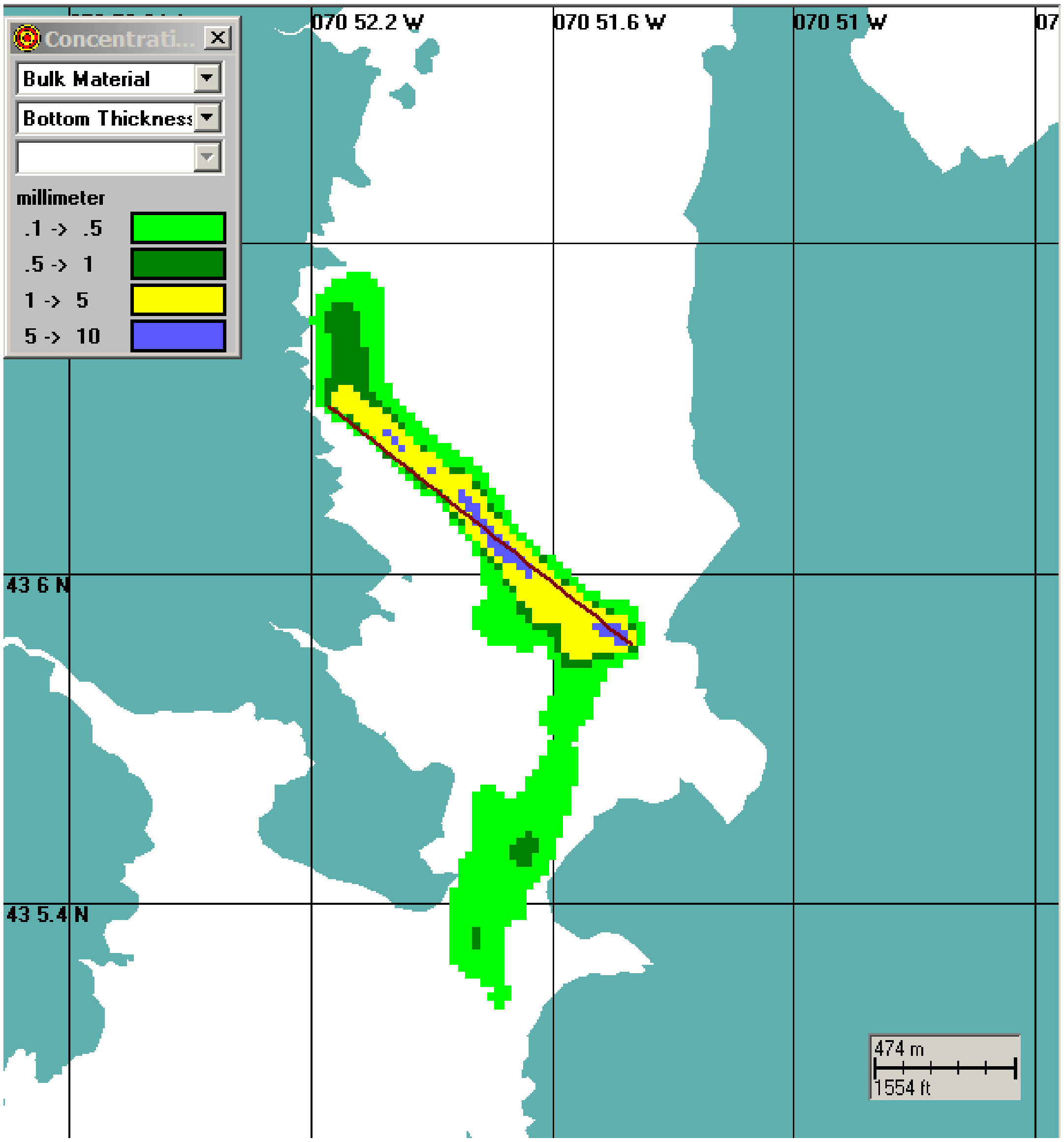

Figure 5.2-1. Plan view of cumulative bottom thickness (milimeters) distribution due to jet plowing for the three cable trenches.

Table 5.2-1. Bottom Thickness (Milimeters) Area Distribution (Hectare and Acre) Due to Jet Plow Installation of Three Cables.

Thickness (mm)	Area (ha)	Thickness (in)	Area (ac)
0.1 -> 0.5	35.6	0.004 -> 0.02	87.9
0.5 -> 1	8.1	0.02 -> 0.04	20.0
1 -> 5	12.4	0.04 -> 0.2	30.7
5 -> 10	2.4	0.2 -> 0.4	5.9

for the 5 -> 10 milimeter [0.2->0.4 inch] thickness range) near the jet plow indicating that the extent of the plume is relatively limited. This deposition may be temporary. RPS ASA (2015) concluded that newly deposited silt/clay and sand grains could be resuspended on subsequent flood and ebb tide within the channel because tidal velocities are sufficient to do so. Tidal currents are lower on the tidal flats, however, so the likelihood of resuspension due to currents is reduced; however Jones (2000) noted that rain events and ice scour are also important factors in resuspension of fine grained sediments on tidal flats in the Great Bay system. All of these factors are likely to contribute to post-installation reworking of the sediments on the tidal flat.

Existing data show that contaminant levels in sediments that will be disturbed by cable installation are low (EPA 2007). Therefore, there is little risk that use of the jet plow will result in dispersal of contaminants to other parts of the estuary.

5.2.2 Impacts to Bathymetry and Sediments from Hand Jetting

Divers performing the hand jetting will operate from a support vessel, either the installation barge or a smaller vessel. Where silt curtains are used, the vessel will be maneuvered inside the silt curtains and then remain stationary. At low tide, it will become grounded and the sediments compressed beneath. On both the west and the east sides, the maximum area affected this way would be the dimensions of the installation barge, 9,720 SF (0.22 acre).

All hand jetting on the western end of the Little Bay crossing will be conducted within silt curtains so an estimated 90% of the sediments suspended during this activity will be redeposited within the work area. The fine grained sediments in this area will likely be more or less uniformly redeposited within the work area forming a layer that averages 94 milimeters (3.7 inch) thick, although deposition will be thickest directly over (and filling) the trench and taper towards the silt curtains. Some evidence of the trenches created by the divers will remain until the uncompacted sediments are reworked and redistributed by currents. The same thing will occur in the eastern intertidal area where use of silt curtains is feasible. The temporary deposition layer in the eastern intertidal is expected to average about 110 milimeters (4.3 inch) thick, with the thickest deposition directly over (and filling) the trench and thinnest near the silt curtains.

Because it will not be feasible to use silt curtains in the offshore portion of the area requiring hand jetting on the eastern end of the route, suspended sediments will be dispersed and redeposited beyond the work area. Areas in the immediate vicinity of, but beyond, the trenches could experience deposition of up to 50 milimeters (2 inches). Beyond that, the depositional layer is likely to be less than 10 milimeters (0.4 inch) thick. Tidal action will rework and redistribute the uncompacted sediments and will tend to fill in the trenches. It is unlikely that the support vessel in this area will become grounded.

5.2.3 Impacts to Bathymetry and Sediments from Placement of Protective Mats

Portions of both shorelines have rock or ledge and the thickness of unconsolidated sediments above large rocks or bedrock has not been determined. Hand probing detected some areas where burial to only 12 inches (30 centimeters) may be achievable. As a result, it is not known whether the marine cable installer will be able to bury the cables to the required 3.5 feet (106 centimeters) burial depth in all locations. If this burial depth cannot be achieved, protective matting must be placed over the cables. The matting will consist of articulated concrete mattresses measuring 8 feet by 20 feet (2.4 m x 6.1 m) and 9 inches (0.2 meter) thick. Caldwell estimated that up to 24 mattresses (3,550 SF; 0.08 acre) might be required at the western shoreline and a total of 12 mattresses (1,920 SF; 0.04 acre) might be required at the eastern shoreline.

Placement of articulated concrete mattresses will permanently change the substrate from unconsolidated to artificial hard ("rock") substrate. It is likely that macroalgae such as *Fucus vesiculosus* or *Ascophyllum nodosum* and invertebrates such as oysters and barnacles that are common on the nearby rocky shore will ultimately colonize the mattresses.

5.3 Impacts to Eelgrass

The shallow flats along the eastern side of Little Bay have supported eelgrass in some years, most recently in 2011 and 2012 when it occurred in the southern portion of the Cable Area. Surveys conducted in 2013 and observations in 2014 indicate there is no established eelgrass bed in this area at the present time. Repopulation of the area would likely be governed by dispersal of seeds from other eelgrass beds rather than through vegetative growth, as was hypothesized by Short (2013) for the new bed observed in 2011. Therefore, the likelihood of the Project directly affecting eelgrass is very low. Results of water quality modeling discussed in Sections 5.1 and 5.2 indicate that the likelihood of indirect impacts to eelgrass is also very low as neither the plume nor the areas of deposition are predicted to intersect with established eelgrass beds. The cable installation will be performed in the fall, at the time when eelgrass is senescing for the year, further limiting any potential impacts.

Because of the importance of eelgrass to the Great Bay estuary system however, PSNH is committed to conducting an eelgrass survey in the summer of 2017 prior to installation of cables through Little Bay. If the Project area (particularly Welsh Cove) has been re-colonized by eelgrass, potential impacts are still likely to be minor. The portion of the cable route that crosses Welsh Cove will be disturbed during diver installation of the three cables. Any eelgrass within the three four-foot wide trenches or in the area where the diver support barge is grounded would be uprooted and killed. Eelgrass adjacent to the trenches within the area bounded by silt curtains (0.5 acre) would be subject to sedimentation, but may survive because once the silt curtains are removed as it is likely that some of the recently deposited sediments will be redistributed as a result of current and scour processes reworking the sediments. It is expected that the habitat conditions would be as suitable for eelgrass in the following year as they were prior to installation.

5.4 Impacts to Macroalgae

Distribution of macroalgae within Little Bay is not well known but is likely concentrated on rocky areas. An estimated 496 SF of rocky shore within the work area will be temporarily disturbed, and macroalgae on the rocks will be eliminated. Once construction is complete, it is likely that the same species of macroalgae currently present on the rocks will recolonize during the next reproductive season. The temporary sediment plumes and minor redeposition are not expected to adversely affect other macroalgae beds.

Up to 302 square feet (0.01 acres) of rocky shore may be permanently impacted if concrete mattresses are required to protect the cable; however if placement of concrete mattresses over unconsolidated intertidal substrate is required in order to provide sufficient protective cover for the cables, this material is likely to be colonized by macroalgae such as the commonly occurring

Fucus vesiculosus or *Ascophyllum nodosum*, thereby increasing suitable habitat for intertidal macroalgae by an area of up to approximately 5,760 SF (0.13 acre).

5.5 Impacts to Shellfish

Molluscan shellfish are sessile organisms that reside in or on the substrate. Normandeau surveys found that the soft substrate conditions along the proposed cable route provide suitable habitat for several species of infaunal shellfish, including softshell clams, razor clams, and the noncommercial *Macoma*. Highest abundances of these species are most likely to occur on the shallow subtidal flats although they may also be present in the channel. Individuals that are in the areas where the barge becomes grounded will be crushed. Those in the direct path of the jet plow will be displaced and potentially injured or killed. Shellfish adjacent to the trenched areas may be buried. Maurer et al. (1986) reported that deep and rapidly burrowing species were able to tolerate burial by as much as 10-50 centimeter (3.9 – 5.9 inches), with larger individuals being more resistant than smaller individuals. Thus, it is likely that adult softshell clams and razor clams covered by sediments deposited after passage of the jet plow would survive, although juveniles (e.g., less than at least half the deposition depth) would not. Individuals located between two cables may be subjected to deposition a second time. If concrete mattressing is required on either side of the route, any shellfish residing in the sediment will be covered and the substrate will no longer be suitable for infaunal shellfish. However, the mattresses could provide new substrate for oysters, particularly if the new substrate is colonized by macroalgae; Capone et al. (2008) reported the intertidal occurrence of oysters in association with macroalgae in the Great Bay estuary.

There are no major natural or restored oyster beds identified in the immediate vicinity of the Cable Area although it is likely that oysters are present in relatively small numbers wherever there is suitable habitat (hard substrate). The closest major bed is located offshore of the southeastern point of Adams Point and a planned restoration area adjacent to this bed is expected to be in place by the time cable installation occurs. Water quality modeling indicates that by the time the turbidity plume reaches this area excess suspended sediment concentrations will likely be ≤10 mg/L and that the plume will be likely to intersect only a small portion of the bed for two hours or less (Figure 5.5-1), an exposure level that Wilbur and Clarke (2001) indicated would be too low to elicit any response from the oysters. Deposition closest to the oyster bed will be ≤0.5 milimeter (≤0.02 inch). Thus, there will be no sedimentation impacts to natural oyster beds from the jet plow operation. The sediment plume and subsequent redeposition of sediments suspended by hand jetting outside of silt curtains are not expected to reach the vicinity of the Adams Point oyster bed.

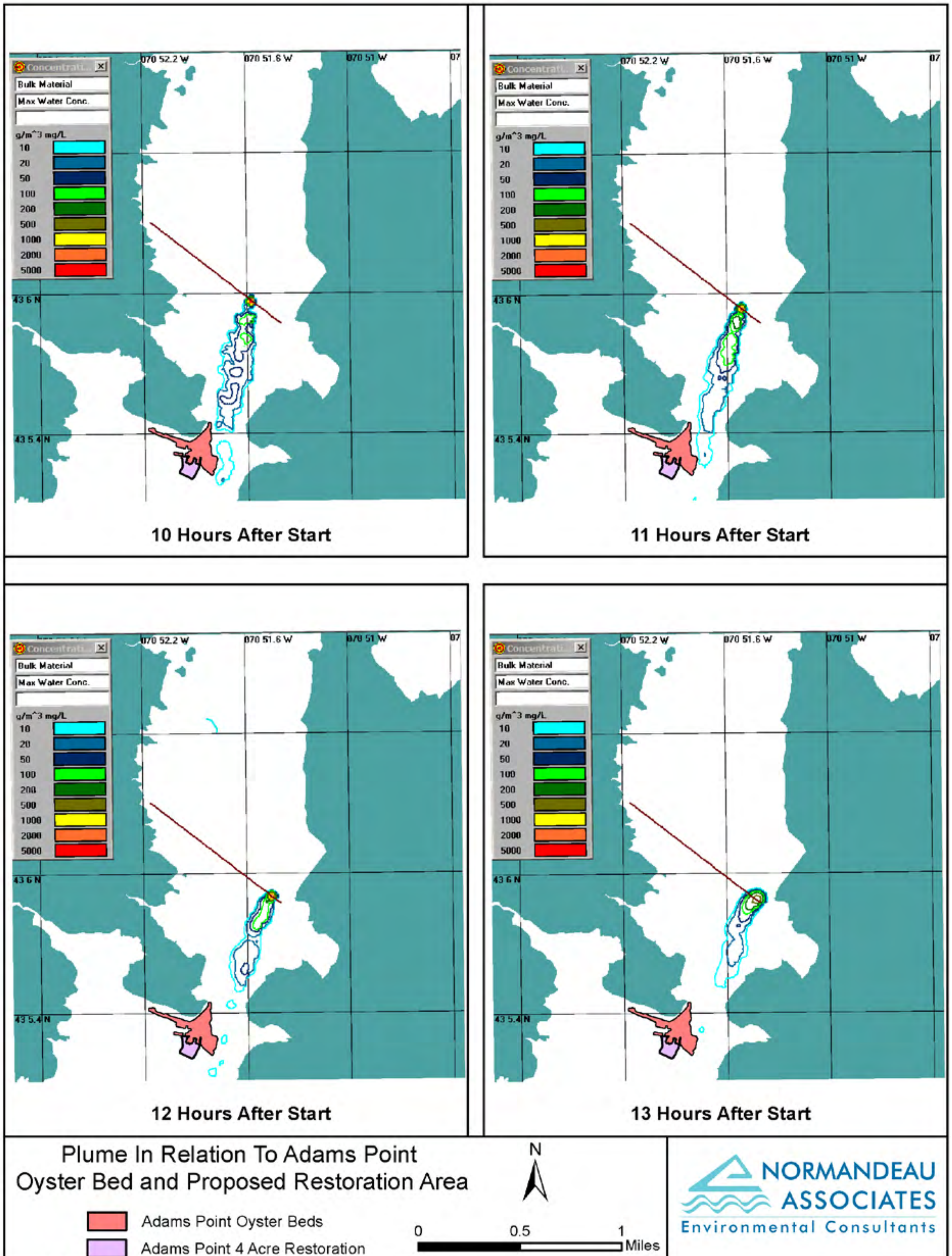

Figure 5.5-1. Potential exposure of Adams Point oyster bed and restoration area to sediment plume generated by jet plow installation of cable.

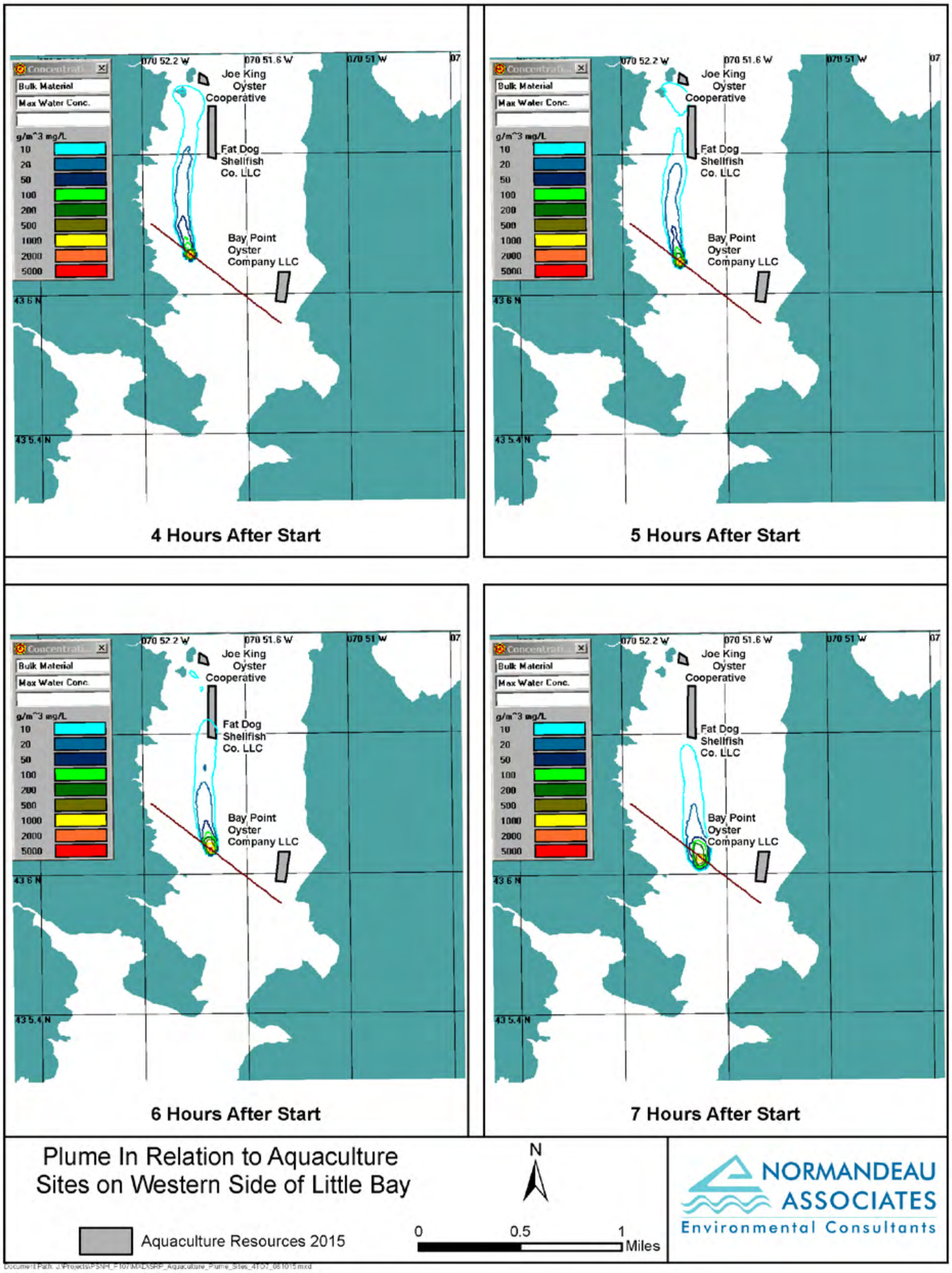

Figure 5.5-2. Potential exposure of shellfish aquaculture areas on west side of Little Bay to sediment plume generated by jet plow installation of cable.

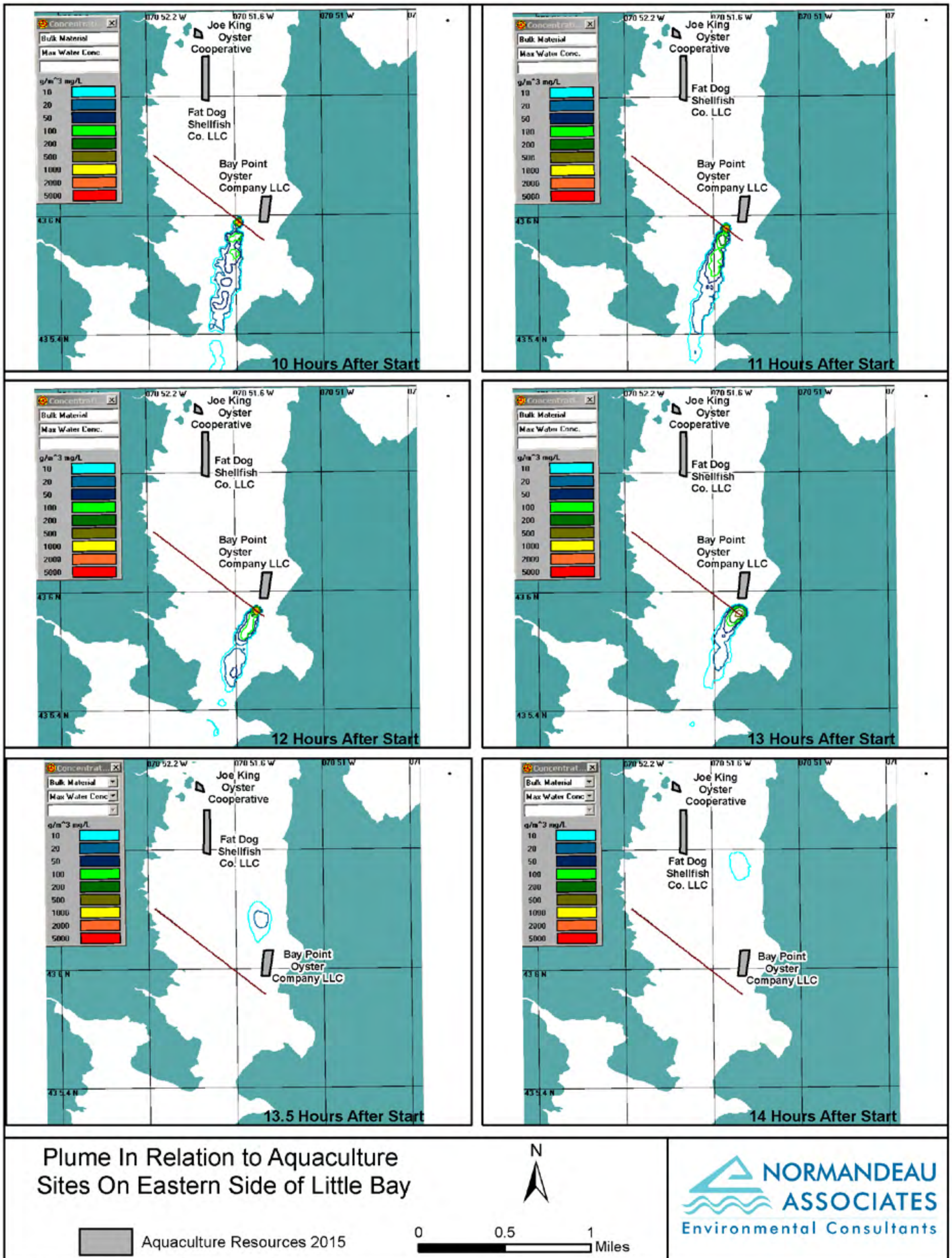

Figure 5.5-3. Potential exposure of shellfish aquaculture areas on east side of Little Bay to sediment plume generated by jet plow installation of cable.

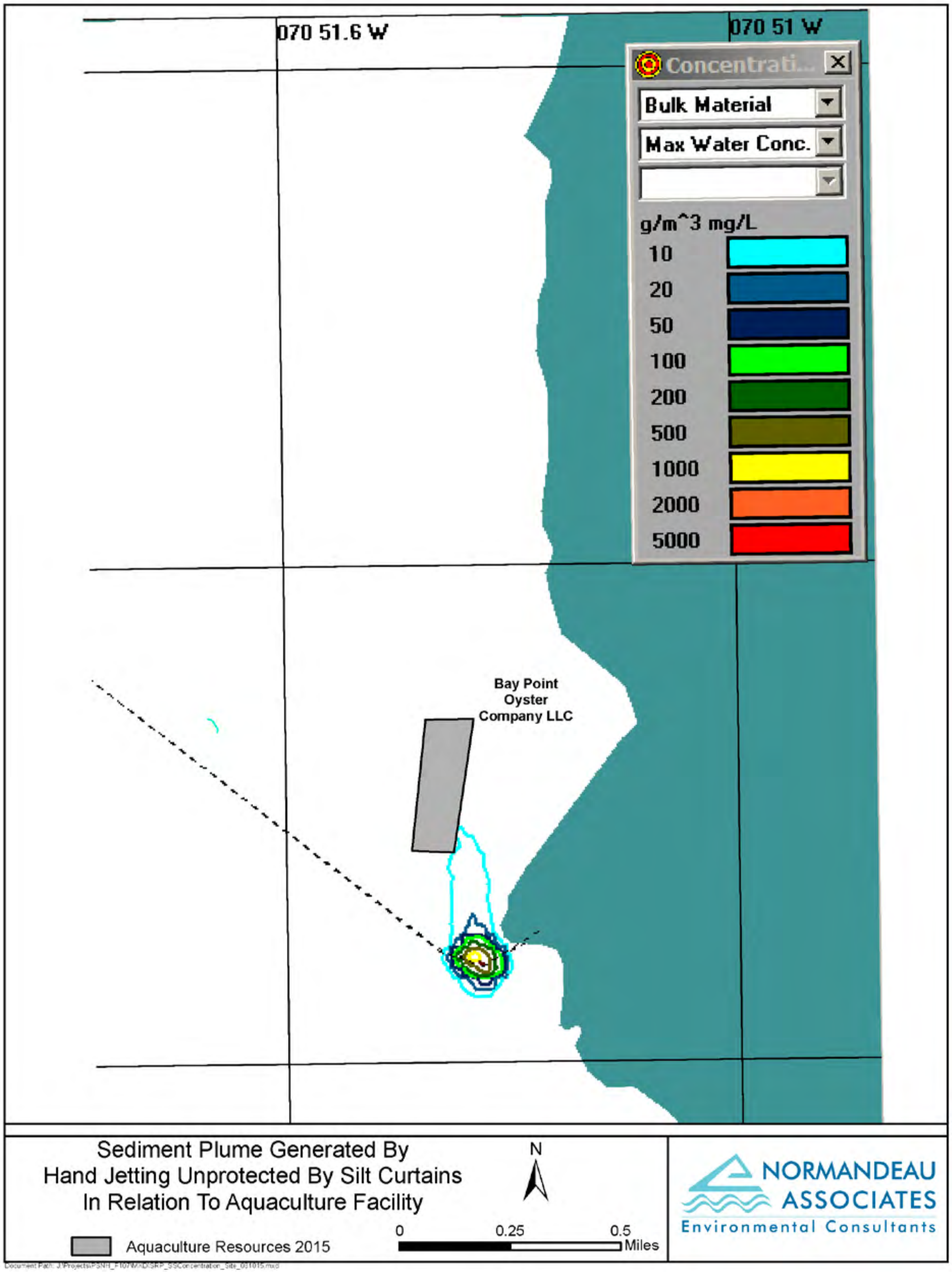

Figure 5.5-4. Potential exposure of shellfish aquaculture areas on east side of Little Bay to sediment plume generated by burial of cable by hand jetting in area where use of silt curtains is infeasible.

Larval forms of both American oysters and softshell clams may be in the water column during the cable installation. The jet plow will cycle approximately 1,000 m^3/hr (264,172 gallons/hour) during this process from a depth of about 4-5 feet below the water surface, for an approximate total of $4.2x10^4$ m^3 ($1.11x10^7$ gallons). As there will be no filtration on the intake, planktonic organisms will be entrained in the system and will be unlikely to survive. Trowbridge (2007) determined that the volume of water contained in upper Little Bay, where the crossing is located, is $1.58x10^7$ m^3 ($4.16x10^9$ gallons) at low tide and $2.51x10^7$ m^3 ($6.62x10^9$ gallons) at high tide. Water withdrawn from the bay for the jet plow will therefore consume 0.17 to 0.27 percent of the volume of upper Little Bay and the associated plankton. There are no data on shellfish larval densities available to calculate absolute losses, but these percentages represent a very minor proportion of the Little Bay capacity so should be considered insignificant.

There are several aquaculture operations (Joe King Oyster Cooperative, Fat Dog Shellfish Co., and Bay Point Oyster Co.) within the predicted range of the plume generated by the jet plow. As shown in Figure 5.5-2, the plume is predicted to flow north on the western side of the bay and reach the vicinity of Joe King Oyster Cooperative and Fat Dog Shellfish Co. for a period of several hours. It is expected that the highest excess suspended sediment concentrations that will near, and potentially intersect with, these operations will be limited to 10-20 mg/L. Wilbur and Clarke (2001) reported that the eastern oyster exhibited no discernible response to a three-week exposure to TSS concentrations as high as 710 mg/L but a two-day exposure to concentrations $\geq$1000 mg/L resulted in reduced pumping activity. Based on this research, it is likely that the farmed oysters will exhibit no response to the turbidity plume. If they do continue pumping, subsequent exposure to less turbid seawater will allow them to cleanse any excess sediments from their tissues. It is also possible that sediments will be deposited on the shells and cages. The low levels of sediment contaminants means that there is negligible risk of contaminating the meat of the farmed shellfish. Because of the low suspended sediment concentrations reaching these two shellfish farms, sedimentation is expected to be negligible, less than 0.1 milimeter (0.004 inch).

While the Bay Point Oyster Company LLC is located immediately north of the proposed cable route off Gundalow Landing, exposure to a suspended sediment plume caused by jet plowing is expected to be very limited. As Figure 5.5-3 shows, as the jet plow approaches this operation the tide will be flooding causing the plume to flow towards the south. Once the jet plow stops, about 13 hours after starting and at about high slack tide, no additional sediment will be dispersed into the water column. Thus when the tide starts ebbing, the plume will dissipate quickly. It is expected that concentrations in the residual plume will be on the order of $\leq$ 20 mg/L when it passes over this facility and the duration of exposure will be well under an hour. Bay Point Oyster Co. is located north of the area where cable burial must be done by divers using hand-held jets and the currents are too swift to allow use of silt curtains. When this work is conducted during the period from about two hours before until two hours after high slack, a sediment plume will flow towards the aquaculture site (Figure 5.5-4). However, any sediment plume associated with the hand jetting that reaches this facility will be of very low suspended sediment concentration (10 mg/L). A portion of the hand jetting is likely to take place during the four-hour period around low slack tide. As noted in Section 5.1.2, the resulting suspended sediment plume will flow primarily to the south away from the Bay Point Oyster farm. Sedimentation on this bottom-oriented oyster farm is expected to be negligible. For both jet plowing and hand jetting, plume concentrations in the vicinity of the oyster farm would be within the range of natural conditions.

There is some level of infestation of oysters in Great Bay by the polychaete *Polydora* a genus that was found in the site-specific surveys for the Project. The concern was raised that disturbing the sediments to bury the cables could increase the risk of infestation to farmed oysters. *Polydora* densities ranged from 0 to 7 per 0.04 m^2 on the eastern channel slope and from 39 to 98 per 0.04 m^2 on the western tidal flat. Given that these organisms are much larger than sediment particles, although less dense, it is likely that individuals suspended in the water column would be redeposited well within the area demarcated by the 0.1 milimeter thickness contour shown on Figure 5.2-1. Impacts to farmed oysters through increased exposure to *Polydora* would therefore be negligible.

The buried cables have the potential to emit electromagnetic fields into the sediments surrounding the cables (Eversource 2015). Cable design, including sheathing, will prevent emission of electric fields from the buried cable but cannot prevent emission of magnetic fields. Infaunal shellfish could potentially be exposed to the magnetic fields. Immediately above the cable, Eversource (2015) predicted a maximum magnetic field strength of 100 milliGauss (mG) that would decay laterally to 20 mG within 60 feet either side of the center cable. The magnetic field will also decay vertically above the cable. Several researchers (Malagoli et al. 2003, 2004 and Ottaviani et al. 2002) have examined the physiological effects of exposure of the Mediterranean mussel *Mytilus galloprovincialis* to magnetic fields from a 50 Hz source. In each case, the minimum magnetic field strength required to evoke a change (e.g., change in shape of immunocyts or increase in concentration of heat shock proteins) was 30 to 40 times higher than the predicted magnetic field strength at the cables in Little Bay. It is unlikely, therefore, that the magnetic fields emitted by the SRP cables will have a discernable effect on area shellfish or on the oysters stock at the Bay Point Oyster Co.

The buried cables could also emit heat. Power Engineers (2015) predicted that each cable will elevate the temperature of the sediment two feet (0.6 meter) above the cable (or 1.5 feet [0.5 meter] below the substrate surface in the tidal flats) to 30˚C. Adult softshell clams may burrow that deep into the substrate so could be exposed to elevated temperatures, although smaller clams will reside closer to the substrate surface and, therefore, not be exposed to as great an increase in temperature. Kennedy and Mihursky (1971) found that softshell clams (*Mya arenaria*) acclimated at 20-25˚C (likely temperature of the substrate in the summer in Little Bay) experienced a 50 percent mortality rate when exposed to temperatures of 31-32˚C. *Macoma balthica*, another common estuarine bivalve, exhibited similar temperature tolerance (Kennedy and Mihursky 1971). The area where increased sediment temperatures will occur is limited to a narrow band above each cable, so any deleterious effects to shellfish will be limited. Increased temperature associated with the cables in the deep burial (8 feet) section will not reach the biotic zone of the substrate.

5.6 Impacts to Benthic Infauna

Benthic infauna along each cable route will be displaced into the water column and adjacent substrate by the jet plow and the diver jetting. Displaced individuals may or may not survive. Predators such as lobsters and demersal-feeding fish are often attracted to areas of disturbance, so the likelihood of being consumed will be increased for displaced infauna. Individuals buried by redeposition may or may not survive depending on their mobility. The most abundant species on the western tidal flat is the polychaete *Scoletoma tenuis*, an active burrower that reworks the sediments. Individuals from this species may survive burial. The second most abundant species in this area (*Streblospio benedicti*) is a small-bodied sessile surface deposit feeder. While it is unlikely to survive burial, it is considered to be an opportunist with high reproductive rates that can quickly colonize disturbed sediments. This species will be able to recolonize the cable route from adjacent habitats. The most abundant species in the channel, *Tharyx acutus*, *Aricidea (Acmira) catherinae*, and *Scolelepis (Parascolelepis) texana*, are all sessile surface deposit feeders so may not survive burial. Again, however, these species are present outside the Cable Area so they are likely to be available to recolonize the disturbed areas. Small areas in the upper intertidal may require placement of articulated concrete mattresses to provide sufficient protection for the cables. This will result in the conversion of unconsolidated substrate to hard substrate. It is likely that this material will be ultimately colonized with the same organisms that occupy the nearby rocky intertidal.

Recovery of the benthic infauna will be dependent on recruitment from nearby populations. As noted, the numerically-dominant species are present beyond the area to be disturbed and will provide a source of individuals for recruitment. Some mobile species may start moving into the disturbed sediments soon after installation is complete simply by crawling or burrowing. It is likely that most repopulation will not occur until the next major reproductive period when infauna produce planktonic larvae however. This will probably take place the following spring and summer.

As described in Section 5.5 (Impacts to Shellfish), the buried cables have the potential to emit low level magnetic fields into the sediments to which benthic infauna could potentially be exposed. Little is known about how benthic invertebrates respond to EMF (Normandeau et al. 2011), and while exposure would be higher on the tidal flats where cable burial is shallower than in the channel, the fact that the predicted field from the SRP cables is too low to evoke physiological changes in mussels suggests it is unlikely that other benthic organisms would be affected either. It is unlikely that the magnetic fields emitted by the SRP cables will have a discernable effect on area benthic infauna.

As described in Section 5.5, the buried cables could also emit heat. The potential effects on benthic infauna are unknown. Because most infauna occur in the uppermost 6 inches (0.2 meter) and will be separated from the cables by at least 3 feet (1 meter), effects are likely to be very limited.

5.7 Impacts to Epibenthos

American lobsters and horseshoe crabs are both large benthic organisms likely to occur along the submarine cable route although population estimates for these species are not available for Little Bay. American lobsters often burrow in the substrate during the daytime, feeding actively at night. The soft sediments along the cable route would be suitable for burrowing. Lobsters that have burrowed along the cable route would be displaced and potentially injured or killed by the force of the jet plow. Lobsters adjacent to the jet plowroute would be subject to burial although it is likely that they would be able to uncover themselves even in the area of thickest deposition as the newly deposited sediments would be loose and unconsolidated and lobsters are capable of rapid excavation. Lobsters close to the jet plow paths would likely be attracted to the disturbed sediments to scavenge for exposed prey items so may receive some feeding benefits.

Horseshoe crabs likely feed on the tidal flats along the Little Bay shorelines. This species bulldozes through the sediments in search of benthic infaunal prey items. Those located along the jet plow path would be displaced and potentially injured or killed by the force of the plow. Those adjacent to the plowed area would be subject to burial. Horseshoe crabs are adapted to turbulent conditions because they must cross the nearshore wave zone to reach the intertidal zone for spawning. When flipped over, adults are able to right themselves using their elongated telson. Thus, those adult individuals that are simply displaced by the jet plow or buried under a relatively thin layer sediment are unlikely to experience more than a fleeting impact from cable installation. The proposed time frame for cable installation avoids the critical spring spawning period for horseshoe crabs so there will be no effect on the vulnerable early lifestages.

Population estimates for lobsters and horseshoe crabs in the Great Bay estuary are not available. There is no reason to believe that the Cable Area represents unique habitat for either species within the estuary. Thus, the proportion of suitable habitat within the Great Bay system affected by the cable installation is small and it is reasonable to assume that the number of American lobsters or horseshoe crabs potentially affected is also small.

Jury et al. (1994) reported that American lobster larvae have been documented in Great Bay in fall months when cable installation will occur making them susceptible to entrainment by the jet plow water intake. As described for shellfish, the volume of water that will be withdrawn to support the jet plow represents about 0.17 to 0.27 percent of the volume of upper Little Bay so entrainment impacts to American lobster would be insignificant.

It is unlikely that horseshoe crab larvae will be present in the water column during cable installation. Horseshoe crabs spawn in the spring and Rudloe (1979, 1980) and Botton et al. (2010) reported that the duration of the planktonic stage is approximately one week. Thus there will be no entrainment impacts to this species.

Spiny lobsters (*Panulirus*) have been found to be able to detect magnetic fields from DC sources, but not from AC sources (Normandeau et al. 2011). It is not expected, therefore, that EMF emitted from the SRP cables will affect American lobsters in the Project Area.

5.8 Impacts to Fish

Impacts to fishes will be temporary and include alteration of benthic habitat, increased levels of suspended sediments, and mortality of early life stages entrained in the jet plow's water system. Available habitat for demersal species will be temporarily disturbed and altered, slightly reducing the area available for use. Disturbance of sediment during jet plowing will, however, expose some benthic infauna which may attract demersal feeders. While this could expose them to increased suspended sediments, reduced effort to capture prey could be beneficial energetically.

Highest concentrations of suspended sediments will be close to the seafloor adjacent to the cable route being plowed. This could be a deterrent for some fishes and cause them simply to avoid the densest part of the plume. Wilbur and Clarke (2001) reported that salmonids exposed to suspended sediment concentrations of 1000 mg/L or higher for up to one full day generally respond with behavioral changes (e.g., altered swimming behavior with either attraction or repulsion to the plume) or experience sublethal effects (e.g., reduced feeding). Given that the duration of the highest densities in the plume is limited to about an hour per cable, it is not expected that fish would be impacted by exposure.

According to Jury et al. (1994), eggs or larvae of a number of fishes, included Atlantic cod, Atlantic mackerel, white hake, windowpane flounder, and yellowtail flounder may be present in the water column during the fall when cable installation will occur. These early lifestages would be vulnerable to entrainment by the withdrawal of water for the jet plow. As indicated in the discussion on shellfish, the amount of water expected to be withdrawn represents approximately 0.17 to 0.27 percent of the total volume in upper Little Bay so the impact to early fish lifestages is expected to be insignificant.

The buried cables have the potential to emit magnetic fields into the sediments and overlying water column and demersal and pelagic fishes could potentially be exposed to these fields, particularly in the shallow portions of the crossing where cables will be buried with only 3.5 feet of cover. Normandeau et al. (2011) found, however, that the magnetic fields emitted from low voltage AC cables are unlikely to be detectable by most fishes.

5.8.1 Impacts to Essential Fish Habitat

The proposed crossing provides EFH for juvenile, adult, or spawning life stages of ten species at some point during the year. Of these, Atlantic halibut, red hake, white hake, windowpane flounder, winter flounder, and yellowtail flounder are demersal (bottom-dwelling) species. Pollock is a semi-demersal species; Atlantic mackerel and bluefish are pelagic (mid-column dwelling) species. One or more lifestages of six of these species is expected to be in Little Bay in September-October during the cable installation work window. EFH for demersal species will be temporarily reduced in areal extent during the installation of the cables due to suspended solids and bottom disturbance for several hours for any given location. It is expected that along the jet plow routes, plowing and cable burialwill occur nearly simultaneously. EFH for pelagic species will be temporarily degraded by increased suspended sediments for a short period in a narrow band perpendicular to the cable route during installation of each cable. No permanent impacts to EFH are anticipated.

5.8.2 Impacts to Diadromous Fish

Diadromous species are those that use both freshwater and saltwater for some portion of their life cycle. Diadromous fish require unobstructed passage through any streams within the proposed project corridor that meet the habitat requirements for migration, spawning, or development. Additionally, any migrations to and from tributaries of Great Bay (e.g. Lamprey River) would require passage through the Little Bay cable corridor. The Little Bay cable crossing area may also provide nursery or staging habitat for diadromous species. Any impacts to diadromous species habitat within the corridor or Little Bay related to construction activities could be minimized by restricting underwater construction activities or adhering to customary time-of-year restrictions to address the time period when the least number of species are likely to occur (Table 5.9-1).

Adult American eel (“yellow”) and juvenile alewife, blueback herring, American shad, and rainbow smelt may all encounter the cable installation process during their seaward migration in the fall. Eels burrow into the substrate during the day so those in the pathway of the cable installation will be disturbed by the advancing jet plow. Each species has the potential to encounter the turbidity plume generated by the jet plow. Although none of these species was specifically examined by either Newcombe and Jensen (1996) or Wilbur and Clarke (2001), it is likely that results of those studies can be applied in general. Specifically, lethal or sublethal effects are likely to require exposures to SS concentrations for a minimum of several hours. Because these fishes would not be constrained to remain in the jet plow plume if conditions were "distasteful," the most likely response to exposure to the plume would be to actively swim away from it or to meander in the general area. Within a short distance or a short period of time, the fish would find more favorable water quality conditions and be able to continue their outmigration.

Table 5.9-1. Summary of Potential Seasonal Occurrence of Diadromous Species Within the Proposed Project Corridor and Little Bay Cable Corridor.

Species	Designation*	Life Stage	Spring	Summer	Fall	Winter
American Eel	SC-A1	Juveniles (Elvers)	X			
		Adults (Yellow)	X	X	X	X
		Adults (Silver)	X			X
Alewife (Oyster River)	SC-A1	Eggs/Larvae/Juveniles	X	X	X	
		Adults	X			
Alewife (Little Bay)	SC-A1	Juveniles		X	X	
		Adults	X			
Blueback Herring (Oyster River)	SC-A1	Eggs/Larvae/Juveniles	X	X	X	
		Adults	X			
American Shad	SC-A1	Juveniles			X	
		Adults	X	X		
Rainbow Smelt (Oyster River)	SC-A1	Eggs/Larvae	X			
		Adults	X			
Rainbow Smelt (Little Bay)	SC-A1	Juveniles		X	X	X
		Adults	X			
Sea Lamprey (Oyster River)	SC-A1	Eggs/Larvae		X	X	
		Adults	X			
Sea Lamprey (Little Bay)	SC-A1	Juveniles	X			X
		Adults	X			

* New Hampshire Fish and Game Department - Nongame and Endangered Species Program (NHFG 2009).

6. 0 Impacts on Rare Species

One state-listed plant species, the state-Endangered crested sedge (*Carex cristatella*), was observed within the Project Area. Four exemplary natural communities or natural community systems were confirmed within the Project Area in Little Bay: *High salt marsh, Salt marsh system, Sparsely vegetated intertidal system* and *Subtidal system*.

The ringed boghaunter, a state Endangered dragonfly, occurs in a sedge meadow near the Project Area. Some marginally suitable larval habitat for this species was identified during a field survey, but no exuvia were observed.

Two federally listed fish species, shortnosed sturgeon (Endangered) and Atlantic sturgeon (Threatened), may use the Project Area in Little Bay as feeding habitat. Neither species is known to breed in New Hampshire, but adults could occasionally feed in Great Bay, including the Project Area. Short-nosed sturgeon is considered extirpated in New Hampshire. Three state-listed Special Concern fish species, American eel, swamp darter and banded sunfish, are known to occur upstream and downstream of several streams crossing the SRP corridor, including the Oyster River. These species are assumed to periodically use the Project Area.

Three state-listed reptiles, northern black racer (Threatened), Blandings turtle (Endangered), and spotted turtle (Threatened), and two state listed bird species, bald eagles (Threatened), and osprey (Special Concern) are likely to occur in the Project Area based on their relatively large home ranges and use of varied habitats. Two listed mammals, northern long-eared bat (federally Threatened; state Threatened) and New England cottontail (state Endangered species) have habitat potential within the Project Area.

In general, impacts to protected species will be avoided and minimized through species-specific management practices and standard BMPs during construction. Species specific management practices will include include pre-construction surveys to ensure the absence of nesting bald eagles and osprey (if either species is breeding within or near the Project Area, time-of-year restrictions may apply); cable installation in the fall to minimize impacts to marine species; repeated surveys during land-based construction to clear the active work area of turtles and snakes; handcutting in the vicinity of the ringed boghaunter habitat; and minimization of clearing preferred shrubby areas in high priority New England cottontail habitat.

The northern long-eared bat (NLEB; *Myotis septrionalis*) is state and federally threatened. Therefore, a formal consultation with the USFWS is required as part of the permitting process (NLEB Biological Assessment, see Appendices). The USFWS rules and guidance on this species are still evolving. The interim 4(d) rule published as part of the NLEB's April 2, 2015 listing allows tree clearing for expansions of transmission corridors up to 100 feet from the edge of an existing cleared Project Area, which applies to the SRP, but the final rule may contain different or additional requirements. PSNH is committed to meeting the USFWS rules when finalized.

Unavoidable temporary impacts to the fringing salt marsh will be restored following burial of the cable. Restoration techniques will include salvaging the intact peat prior to trenching for replacement after the cables are buried.

The intertidal flats and subtidal bottom will be allowed to restore and recolonize naturally after completion of the cable installation. The jetplow process will disturb sediments while laying the cable, but the water pressure of the jets and the speed of the plow will be controlled to maximize the return of sediments to the trench and minimize sediments going into suspension in the water column. The currents within the channel and wave and ice action on the tidal flats are expected to restore existing bottom contours in the vicinity of the trenches, followed by recolonization of benthic infauna and shellfish after completion of construction.

Monitoring of all impacted rare, threatened and endangered ("RTE") habitats will occur both during and after construction to assess the success of the habitat restoration.

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Appendix A. Wetland Resource Summary Table

PSNH Seacoast Reliability Project (SRP)
Wetland Summary Table

Wetland ID	Permanent Impact (SF)	Temporary Impacts (SF)	Cowardin Class	Delineated Area (SF)	Town	Functions and Values^												
						GW	FF	FSH	STR	NUT	PE	SSS	WH	REC	EDU	UH	VQ	RTE
DNW2 (Subtidal)	0	127,397	E1UB	259,459	Durham/Newington	S	P	P	P	S	P	S	P	P	P	P	P	S
DNW2 (Salt Marsh)	0	1,222	E2EM	9,047	Durham/Newington	S	P	P	P	S	P	S	P	P	P	P	P	S
DNW2 (Rocky Shore)	302	496	E2RS	15,636	Durham/Newington	S	P	P	P	S	P	S	P	P	P	P	P	S
DNW2 (Intertidal Flats)	5,034	144,091	E2US	278,668	Durham/Newington	S	P	P	P	S	P	S	P	P	P	P	P	S
DW1	0	0	PEM1/PSS1	18,663	Durham	S	S	S	S	S	S	S	S	-	S	-	S	-
DW2	30	9,303	PEM1E	51,456	Durham	P	-	-	-	-	S	-	P	-	-	-	S	-
DW4	0	1,325	PEM1J	6,829	Durham	S	-	-	-	-	-	-	-	-	-	-	-	-
DW5	0	230	PSS1	18,121	Durham	S	-	-	-	-	-	-	-	-	-	-	-	-
DW6	0	3,857	PEM1E/PSS1E	35,338	Durham	S	S	-	S	-	P	S	P	-	-	-	S	-
DW7	0	667	PSS1	4,726	Durham	S	S	-	S	S	-	-	-	-	-	-	-	-
DW9	0	1,005	PSS1/PEM1	5,839	Durham	S	S	-	S	S	-	-	-	-	-	-	-	-
DW10	0	376	PSS1E/PEM1J	17,144	Durham	S	-	-	-	-	P	-	S	-	-	-	-	-
DW11	0	0	PEM1/PSS1	7,353	Durham	S	-	-	S	S	-	-	-	-	-	-	-	-
DW12	0	822	PSS1E/PEM1E	11,821	Durham	S	-	-	S	-	-	-	P	-	-	-	S	-
DW13	0	1,942	PSS1/PEM1	48,977	Durham	S	-	-	S	S	-	-	-	-	-	-	-	-
DW14	20	3,246	PEM1J/PSS1E	21,504	Durham	P	S	-	S	-	S	-	P	S	-	-	P	-
DW16	0	64	PEM1E	763	Durham	S	S	-	-	-	-	-	S	-	-	-	-	-
DW17	0	42	PSS1/PEM1	11,886	Durham	S	P	-	P	P	S	P	P	-	-	-	-	-
DW18	0	2,619	PSS1E/PEM1E	54,161	Durham	P	S	-	-	-	S	-	P	-	S	-	S	-
DW20	0	169	PEM1J	3,144	Durham	S	-	-	-	-	-	-	-	-	-	-	-	-
DW21	0	3,241	PSS/PEM	24,887	Durham	S	-	-	S	S	S	-	S	-	-	-	-	-
DW22	0	3,011	PSS1E/PFO14E	40,728	Durham	P	S	-	-	-	S	-	P	-	-	-	-	S
DW24	0	7,267	PSS1E/PEM1E	35,043	Durham	S	-	-	-	-	P	-	P	-	P	S	S	-
DW25	0	1,399	PEM/PSS	10,231	Durham	S	S	-	S	S	-	-	S	-	-	-	-	-
DW26	0	245	PEM1J	245	Durham	S	-	-	-	-	-	-	-	-	-	-	-	-
DW27	0	53	PSS1E/PEM1F	2,294	Durham	S	S	-	S	S	-	-	S	-	-	-	-	-
DW28	0	643	PEM1J	839	Durham	S	-	-	-	-	-	-	-	-	-	-	-	-
DW29	20	3,551	PEM/PSS	9,272	Durham	S	S	-	S	S	-	-	S	-	-	-	-	-
DW30	0	857	PSS1E/PEM1J	14,577	Durham	S	S	-	S	-	P	S	P	-	S	-	-	-
DW31	20	8,940	PEM	46,279	Durham	S	S	-	S	S	-	-	S	-	-	-	-	-
DW33	0	5,436	PEM/PSS	39,676	Durham	S	S	-	S	S	-	-	S	-	-	-	-	-
DW36	0	1,104	PSS1/PFO1	10,787	Durham	P	P	-	-	-	-	-	-	-	-	-	-	-
DW37	0	1,420	PEM/PSS	3,294	Durham	S	S	-	S	S	-	S	S	-	-	-	-	-
DW38	0	4,089	PSS1/PFO1	32,062	Durham	P	S	-	-	-	S	-	-	-	-	-	-	-
DW40	0	630	PSS1/PEM1	6,354	Durham	P	-	-	-	-	P	-	S	-	-	-	P	-
DW41	20	18,285	PEM/PSS/PUB	96,107	Durham	S	S	-	S	S	-	S	S	-	-	-	-	S
DW42	0	0	PSS1/PFO1	4,930	Durham	P	-	-	-	-	-	-	-	-	-	-	-	-
DW43	0	0	PSS/PFO	4,476	Durham	S	S	-	S	S	-	-	S	-	-	-	-	-
DW44	0	1,437	PEM1	7,145	Durham	P	-	-	-	-	-	-	-	-	-	-	-	-
DW45	0	2,889	PSS	7,812	Durham	S	-	-	-	-	-	-	S	-	-	-	-	-
DW47	0	4,563	PEM/PSS	23,061	Durham	S	S	-	S	S	-	S	S	-	-	-	-	-
DW48	0	1,176	PSS/PEM	14,505	Durham	P	P	-	-	-	S	P	S	-	-	-	-	-
DW49	0	3,172	PEM/PSS	3,533	Durham	S	S	-	S	S	-	-	S	-	-	-	-	-

Wetland ID	Permanent Impact (SF)	Temporary Impacts (SF)	Cowardin Class	Delineated Area (SF)	Town	Functions and Values^												
						GW	FF	FSH	STR	NUT	PE	SSS	WH	REC	EDU	UH	VQ	RTE
DW50	0	1	PEM1	2,753	Durham	P	-	-	-	-	-	-	-	-	-	-	-	-
DW52	0	807	PSS1/PFO1/PEM1	18,865	Durham	P	-	-	-	-	S	-	-	-	-	-	-	-
DW54	0	2,739	PSS1	12,577	Durham	P	-	-	-	-	-	-	-	-	-	-	-	-
DW55	0	0	PSS	687	Durham	S	-	-	S	-	-	-	S	-	-	-	-	-
DW56	20	13,910	PEM1/PSS1	41,860	Durham	P	-	-	-	-	S	-	S	-	-	-	-	-
DW58	0	8,060	PSS1/PEM4	70,192	Durham	P	P	-	-	-	P	P	P	-	-	-	-	-
DW59	0	0	PEM/PUB	3,150	Durham	S	S	S	S	S	-	S	-	-	-	-	-	-
DW63	0	0	PSS/PEM	6,200	Durham	S	S	-	S	S	-	S	S	-	-	-	-	-
DW65	7	3,917	PEM	8,221	Durham	P	-	-	S	S	-	-	-	-	-	-	-	-
DW67	14	8,972	PEM	15,266	Durham	P	S	-	S	S	-	-	S	-	-	-	-	-
DW69	0	53	PEM	7,574	Durham	P	S	-	P	S	-	-	S	-	-	-	-	-
DW71	0	0	PEM	163	Durham	P	-	-	-	-	-	-	-	-	-	-	-	-
DW72	0	0	PSS1	2,527	Durham	-	-	-	S	S	-	-	-	-	-	-	-	-
DW73	0	0	PSS1/PEM1	1,098	Durham	S	S	S	S	S	-	S	-	-	S	-	-	-
DW74	0	1,166	PFO1/SS1	2,795	Durham	S	P	-	S	S	-	S	-	-	-	-	-	-
DW76	20	4,321	PSS1	12,237	Durham	S	-	-	-	-	-	-	-	-	-	-	S	-
DW77	0	1,711	PSS1	9,755	Durham	P	-	-	P	-	-	-	-	-	-	-	-	-
DW78	0	0	PSS1	139	Durham	P	-	-	P	P	-	-	-	-	-	-	-	-
DW79	0	842	PSS1	2,189	Durham	S	-	-	S	S	-	-	-	-	-	-	-	-
DW80	0	935	PSS1	5,966	Durham	S	-	-	-	-	-	-	-	-	-	-	-	-
DW91	0	1,240	PSS1	4,177	Durham	S	S	-	-	-	-	S	S	-	-	-	-	-
DW93	3	1,949	PSS1	4,637	Durham	P	-	-	-	-	P	-	-	-	-	-	-	-
DW94	20	4,961	PSS1	12,802	Durham	S	-	-	S	-	S	-	-	-	-	-	-	-
DW100	20	1,895	PEM1E	6,571	Durham	S	S	-	P	-	-	-	-	-	-	-	-	-
DW101	0	4,019	PEM1/SS1E	3,219	Durham	S	-	-	S	-	-	-	S	-	-	-	-	-
DW102	0	0	PSS1E	5,043	Durham	-	-	-	S	-	-	-	-	-	-	-	-	-
DW103	0	0	PSS1/EM1B	12,099	Durham	P	-	-	S	S	S	-	S	-	-	-	-	-
DW104	0	0	PSS1/EM1E	874	Durham	P	-	-	S	S	-	-	-	-	-	-	-	-
DW105	0	153	PFO1E	1,227	Durham	S	-	-	S	S	S	-	S	-	S	-	-	-
MW1	0	321	PSS1	8,078	Madbury	P	-	-	-	-	P	-	-	-	-	-	-	-
MW2	199	28,940	PEM1/PSS1	74,736	Madbury	P	P	P	-	-	P	P	P	-	P	-	P	-
NW1*	20	6,583	PEM1/SS1	75,679	Newington	S	P	-	P	P	P	-	-	-	-	-	S	-
NW3	20	6,141	PEM1/SS1	80,336	Newington	S	P	-	S	S	-	S	-	-	-	-	-	-
NW4	0	3,987	PSS1E/PUB3/PFO14E	48,442	Newington	S	S	-	P	S	S	-	P	-	-	-	S	-
NW6	20	2,817	PSS1C	13,332	Newington	S	P	-	S	-	P	S	P	-	-	-	-	-
NW9	133	12,399	PEM1	44,940	Newington	P	-	-	S	-	-	-	-	-	-	-	S	-
NW10	0	3,499	PSS1E/PEM1E/PFO1B	31,671	Newington	P	-	-	-	-	-	-	P	S	-	-	-	-
NW11	133	13,147	PSS1/PEM1	38,909	Newington	P	P	-	P	P	P	-	S	-	-	-	S	-
NW12*	0	3,332	PSS1E/PEM1E	30,058	Newington	S	S	-	S	-	P	S	P	-	-	-	-	-
NW13	0	211	PEM1/PUB	16,815	Newington	S	S	-	S	S	S	S	P	-	-	-	S	-
NW16	0	8,145	PEM1F/PSS1E	47,505	Newington	P	S	-	S	-	S	-	P	-	S	-	S	-
NW17*	0	4,507	PSS1	12,715	Newington	P	-	-	S	S	S	-	-	-	-	-	-	-
NW18	0	2,016	PEM1J/PSS1J	7,003	Newington	S	-	-	P	-	-	-	S	-	-	-	-	-

Wetland ID	Permanent Impact (SF)	Temporary Impacts (SF)	Cowardin Class	Delineated Area (SF)	Town	Functions and Values^												
						GW	FF	FSH	STR	NUT	PE	SSS	WH	REC	EDU	UH	VQ	RTE
NW19	1	387	PEM1	578	Newington	S	-	-	-	-	S	-	-	-	-	-	-	-
NW20	0	0	PEM1J	1,929	Newington	P	-	-	S	-	-	-	S	-	-	-	-	-
NW21	0	295	PEM1	6,666	Newington	S	-	-	-	-	-	-	-	-	-	-	-	-
NW22	0	1,264	PFO1E/PSS1E	10,953	Newington	P	-	-	-	-	-	-	S	-	-	-	-	-
NW24	0	0	PEM1F/PSS1E/PFO1E	18,186	Newington	S	-	-	S	-	P	-	P	-	-	-	-	-
NW26	0	1,530	PSS1E	15,500	Newington	P	-	-	S	-	-	-	S	-	-	-	-	-
NW28	20	6,421	PEM1J	39,285	Newington	P	-	-	S	-	-	-	-	-	-	-	-	-
NW30	0	1,981	PEM1J	13,978	Newington	S	-	-	-	-	-	-	-	-	-	-	-	-
NW32	20	4,745	PEM1J	11,001	Newington	S	-	-	-	-	-	-	-	-	-	-	-	-
NW34*	11	10,063	PSS1E/PUBb	23,065	Newington	P	S	S	S	-	S	S	P	-	-	-	-	-
NW35	0	223	PEM1/SS1/FO1B	8,824	Newington	P	S	-	P	P	-	-	P	-	-	-	-	-
NW37	0	544	PEM1/SS1E	33,462	Newington	P	P	S	P	P	P	P	P	-	-	-	-	-
NW39	0	0	PEM1/SS1E	2,472	Newington	P	P	-	P	P	P	P	P	-	-	-	-	-
NW41	0	0	PEM1E	4,114	Newington	P	P	-	P	P	P	S	S	-	-	-	-	-
NW42	0	765	PEM1/UB1E	7,736	Newington	P	P	-	P	P	S	S	P	-	-	-	-	-
NW43	1	4,101	PEM1B	9,495	Newington	P	S	-	P	P	-	S	S	-	-	-	-	-
NW44	0	0	PEM1E	4,194	Newington	P	S	-	P	P	S	S	P	-	-	-	-	-
NW45*	0	14,112	PEM1/SS1B	27,199	Newington	P	P	-	P	P	-	-	P	-	-	-	-	-
NW100	0	0	PEM1E	6,727	Newington	S	S	-	P	-	-	-	S	-	-	-	-	-
NW102	0	0	PEM/PFO/PSS	33,836	Newington	S	-	-	S	S	-	-	-	-	-	-	-	-
NW104	0	0	PEM	716	Newington	S	S	-	S	S	-	-	-	-	-	-	-	-
NW105	0	0	PEM	3,070	Newington	S	-	-	S	S	-	-	-	-	-	-	-	-
NW106	0	0	PEM/PSS	6,017	Newington	S	S	-	S	S	-	-	-	-	-	-	-	-
PW1	0	0	PEM/PSS	2,440	Portsmouth	S	-	-	S	S	-	-	-	-	-	-	-	-
PW2	0	648	PEM1/SS1/FO1B	51,333	Portsmouth	P	S	-	S	S	-	-	P	-	-	-	-	-
PW3	0	0	PEM1B	2,132	Portsmouth	P	S	-	S	S	-	-	P	-	-	-	-	-
PW4	0	0	PEM1E	535	Portsmouth	P	S	-	P	P	-	-	S	-	-	-	-	-
PW5	0	203	PEM1/SS1E	2,760	Portsmouth	S	-	-	S	S	-	-	-	-	-	-	-	-

^ GW= Groundwater Recharge/Discharge; FF= Floodflow Alteration; FSH= Fish/Shellfish Habitat; STR= Sediment/Toxicant Retention; NUT= Nutrient Removal; PE= Production Export; SSS= Sediment/Shoreline Stabilization; WH= Wildlife Habitat; REC= Recreation; EDU= Education/Scientific Value; UH= Uniqueness/Heritage; VQ= Visual Quality/Aesthetics; RTE= Endangered Species
* Prime Wetland

Appendix B. Memorandum: Environmental Mitigation Project along the Wagon Hill Farm Shoreline, Town of Durham, NH.

Department of Public Works
Town of Durham
100 Stone Quarry Drive
Durham, N.H. 03824
603-868-5578
Fax 603-868-8063

MEMORANDUM

TO: Sarah Allen, Normandeau Associates Inc.

FROM: Michael Lynch, Public Works Director

DATE: September 3, 2015

RE: Environmental Mitigation Project along the Wagon Hill Farm Shoreline

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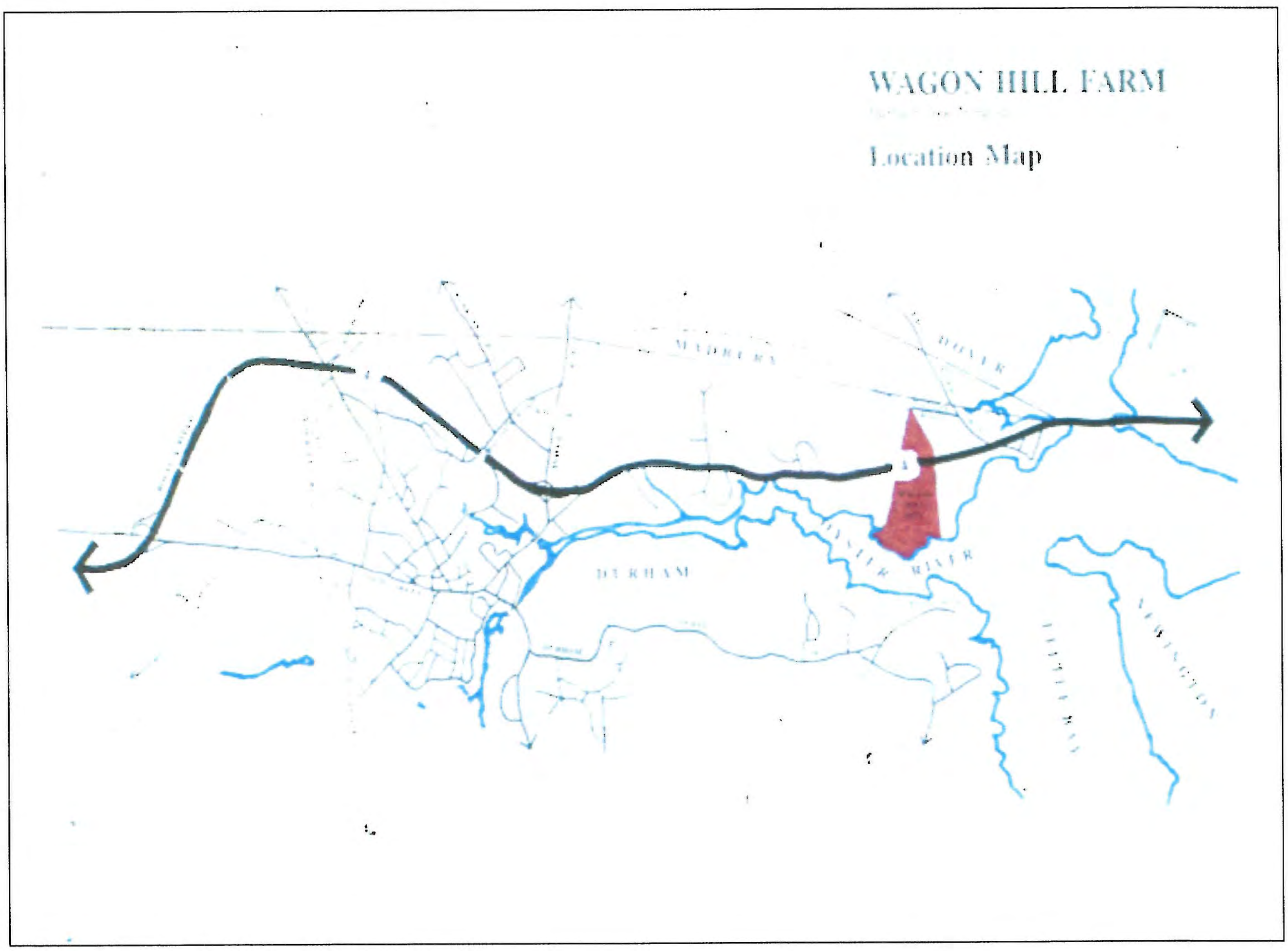
The Town of Durham in cooperation with Eversource (previously Public Service of New Hampshire) is partnering to propose an Environmental Mitigation Project which will eliminate a significant amount of erosion from the Wagon Hill Farm shoreline along the Great Bay Estuary and the Oyster River.

BACKGROUND

The Wagon Hill Farm consists of 139 acres. It consists of a 99 acre parcel on the south side of Route 4 and a 40 acre parcel on the north side of Route 4. It has approximately 1100 feet of frontage on Little Bay.

The farm was purchase by the Town of Durham in 1989. The land was purchased by the Town ***"to preserve its scenic vistas, provide for future municipal purposes, preserve open space, provide a healthful and attractive outdoor environment for work and recreation, and to conserve land, water, forest and wildlife resources."***

In 1995 the Strafford Regional Planning Commission and the Town of Durham received a grant from the New Hampshire Office of State Planning, New Hampshire Coastal Program to hire a consultant to prepare a master and a management plan for the process. The Strafford Regional Planning Commission issued a Request for Proposals for the work. It received four proposals from consulting firms. After reviewing three of the firms who submitted proposals it selected one of the firms, The Cavendish Partnership Inc., to perform the work. The following documents, the planning process and planning and management recommendations for the Wagon Hill Farm.



Existing Site Conditions

The 139 acre site is located three miles from downtown Durham on Route 4. The site is bisected east to west by Route 4 with 99 acres to the south and 40 acres to the north. The farm has not been used agriculturally for several years and indigenous plants have begun to reclaim the pastures north of Route 4 to some degree around the perimeter of the southern parcel. Gently rolling fields are the dominant feature of the parcel south of Route 4. (See location map)

The openness of the meadows affords distant views to Little Bay to the south and Oyster River to the southwest. The high knolls create an opportunity for significant views across the 99 acre parcel. The views from the shores of the Oyster River are exceptionally good. The views of Route 4 may be considered undesirable due to the heavy volume of automobile and truck traffic. The "wagon" is the focal point on the property for motorists traveling on Route 4.

There are a number of important historic sites and structures on the property. The most prominent historic feature of this site is the Bickford-Chesley farmhouse and its surrounding foundations. The Davis graveyard and the area where the garrison house once stood are also important features. On the northern parcel are the remains of a school house close to Route 4. The history of the site could be interpreted to provide a strong focus for future improvements.

The existing trails system traverses the southern portion of the site with trails in both meadows and wooded areas. Overall the trails are in excellent condition however, some degradation has occurred due to excessive use in sensitive areas by pedestrians and equestrians. Improved surfaces and the introduction of some structures in sensitive areas could prevent future degradation in wet and shoreline areas. If the number of visitors continues to increase, the trails will have to be surfaced with a material that will help define and maintain the walking surfaces while at the same time providing a surface suitable for physically and visually impaired visitors.

Elevation and Surface Hydrology

The site has two distinct high points. The northern high point is at the most northerly portion of the 40 acre parcel along Watson Road. Water drains from this area and collects in the wetland adjacent to Route 4. The other high point is on the 99 acre parcel and is where the wagon is located. Water drains from this ridge north to the wetlands along Route 4 and south to Davis Creek. Water that collects in the wetland along Route 4 eventually exits under the Wagon Hill driveway westerly to Smith Creek and into the Oyster River.

Slope Analysis

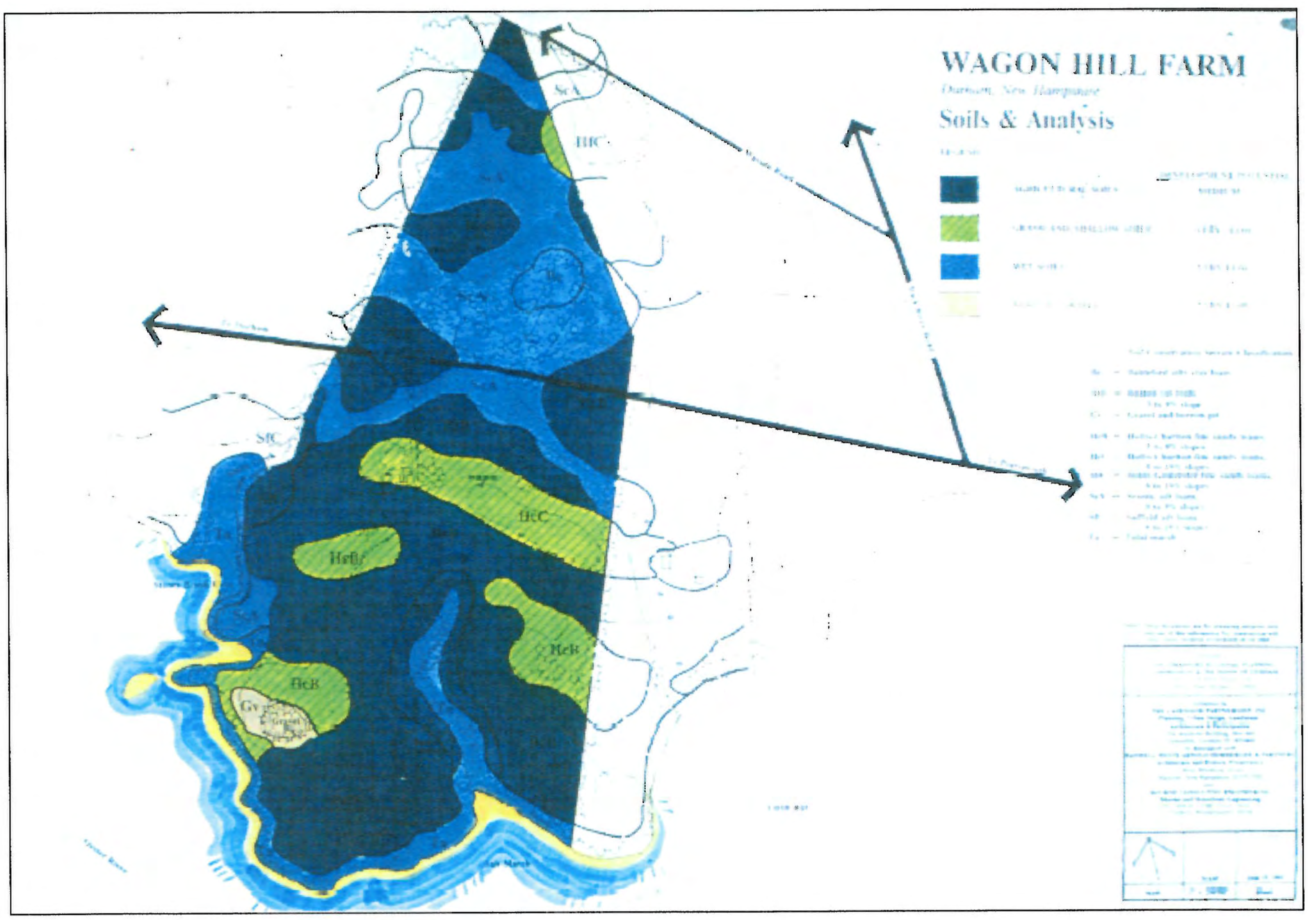
The slope analysis data was derived from United States Geological Survey mapping and site observations. The slopes are generally gradual to moderate on the 40 acre parcel with no areas above 10% gradient. The steepest slopes, in excess of 10% are on the 99 acre parcel around the farmhouse; along the southerly and westerly shorelines; in the gravel pit; adjacent to the knoll with the wagon; and along Davis Creek. The remainder of the 99 acre parcel has gradients within the 2 to 10% range. (See Slope Analysis Map)

Soils Analysis

Soil information was derived from the Soil Survey of Strafford County, New Hampshire prepared by the United States Department of Agriculture- Soil Conservation Service and the Soils Potential Report, prepared by the Strafford County Conservation District. The following soil types have been identified on the Wagon Hill Farm site. (See Soils Analysis Map)

Be	Biddeford Silty Clay on a small portion of the 40 acre parcel
BzB	Buxton Silt Loam- 3 to 8% gradients on the 99 and 40 acre parcels
GV	Gravel Pit located on in the southwest portion of the 99 acre parcel
HcB	Hollis-Charlton- fine sandy loams on top of the knoll on the 99 acre parcel
HcH	Hollis-Charlton- on 8 to 15% gradients on the 99 acre parcel
HfC	Hollis-Gloucester- fine sandy loams, on 8 to 15% gradients on the northeast portion of the 40 acre parcel
ScA	Scantic silt loams on 0 to 3% slopes on the majority of the 40 acre parcel and in the low lands adjacent to Route 4 on the 99 acre parcel
Ta	Tidal Marsh- along the shores of the Oyster River

The Soils Potential Report identified 48 acres on the 99 acre parcel (BzB and SfC) as having medium potential for recreational development. The remaining 92 acres were poorly drained with low to no potential for recreational development.



Vegetation

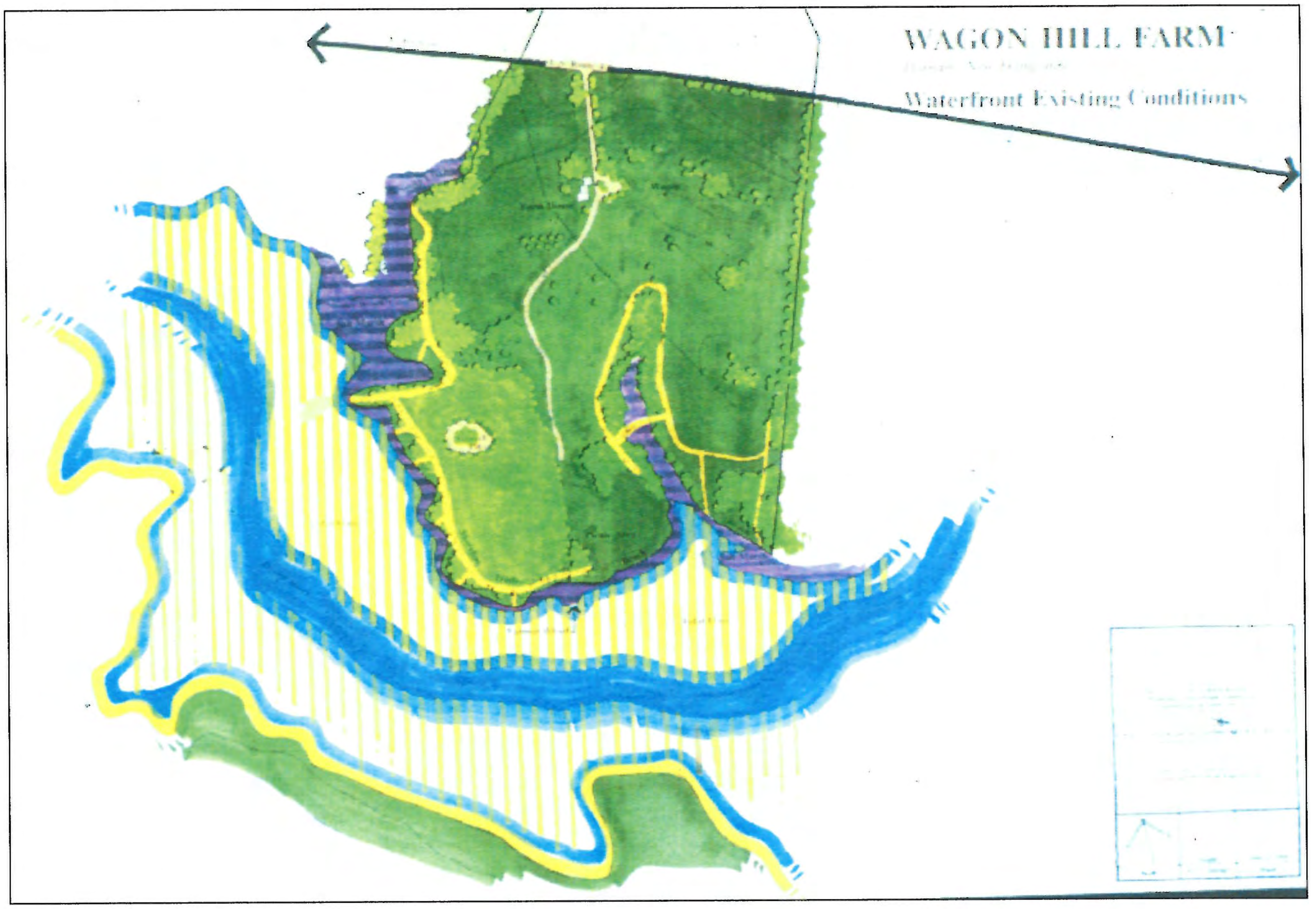
This information was derived from a report entitled, Summary of Existing Potential Bio-diversity of Wagon Hill Farm, Durham, New Hampshire, by Auchly, Jones, Kimmel, Midura, 1990. The report identified forty four different plants. The types of vegetation are indicative of the micro climatic and soil conditions of the site. The white pine stand is significant in that historically the British Navy harvested white pines for ships masts from this region. The diverse plant material also provides food for a variety of wildlife that lives on or in close proximity to the site. The site may be suitable for an arboretum or coastal botanical garden.

Wildlife and Domesticated Animals

This information was also derived from the Summary of Existing and Potential Bio-diversity of Wagon Hill Farm, Durham, New Hampshire report that identified birds, mammals, and coastal flora and fauna. There were fourteen bird species identified on the site and in addition another 28 species were identified as having the potential to utilize the site. Eleven mammals and two sea creatures were also identified. The site is used extensively by visitors walking and running dogs. Dogs (domesticated or otherwise) are natural predators for a variety of animal species and they are naturally perceived as a threat by mammals and birds, even if they don't physically harm them. Dogs may threaten other species by leaving a scent, making noise or by disturbing habitat areas. Dogs running loose can trample plants and unattended leave scat throughout the site. It is recommended that the management plan should provide an opportunity for dog owners to continue to bring their dogs to the farm if specific areas are designated for walking dogs with leashes and for allowing dogs to run free. In addition, existing leash laws should be strictly enforced and owners should be responsible for removing scat from the farm. Preservation and enhancement of the wildlife should be encouraged to create a balance in natural, economic and social use of the site.

Shoreline Conditions

The existing shoreline conditions are a result of soil and ice and tidal forces and human intervention. Segments of the shoreline indicate over use by visitors which has created erosion. These unnatural conditions (pathways) are exacerbated by natural conditions including wind, tidal and ice forces. This erosion, unchecked, has and will continue to result in degradation of the shoreline and salt marshes, negative impacts on wildlife, shell fish and fish habitats. It is recommended that a shoreline stabilization program be implemented as soon as possible. The measures taken should as minimally as possible, emulating the natural conditions of the shoreline. Rip-rapping should only be used where absolutely necessary and whenever possible plant materials or erosion control fabrics should be used. The farm site is susceptible to flooding during the 100-year flood stage and flooding should not impact most recreational uses. (See Waterfront Existing Conditions Map)



Water-based Recreation

The farm is primarily used for land-based recreation. The potential for boating is limited due to tidal conditions, water depths and shoreline that are naturally limited for launching boats. The installation of piers and boar landings may be difficult to permit and implement due to the currents, ice and tidal conditions. Swimming is now taking place on the 99 acre parcel on a limited basis. The site is not ideal for swimming due to tidal conditions and the water currents and it is not recommended that this activity be encouraged to expand for both safety and environmental reasons. Environmentally the salt marshes are particularly sensitive to pedestrian activity which may result from the unplanned expansion of existing swimming areas. Limited access from the water by canoes and kayaks is now taking place and has minimal impact on the farm as long as the access points are defined and controlled. (See Waterfront Existing Conditions Map)

SHORELINE RESTORATION RECOMMENDATIONS

1. The shoreline is in a state of deterioration and it is not anticipated that it will stabilize itself naturally. Shoreline stabilization along the water's edge should take two forms: a hardened edge installation of a rip rap slope. This would be appropriate in limited areas above the salt marsh fringe to prevent continued erosion. Rip rap would include filter

fabric insulation- $410 per linear foot, $451,000. (This project recommends rip rap in limited areas.)

A softer form of shoreline stabilization would require the installation of vegetated fiber roll along the toe of the slope backfilled with soil suitable for the salt marsh plantings. The system would include palette mats that are pre-vegetated to begin the initial re-vegetation of shoreline areas. This method is most desirable where the salt marsh has eroded and replacement is required to prevent further degradation of the salt marsh. Vegetated shoreline stabilization- $205 per linear foot= $225,500. (This project recommends substantial salt marsh plantings.)

2. Protecting the pristine marsh system involves two steps:
First areas of limited degradation should be re-vegetated using a pre-seeded mesh to reestablish plants quickly. The area around the point needs to be rip rapped to protect the area from further erosion.

Secondly, the area known as "The Point" where Davis Creek meets the Oyster River will require some type of structure and/or protection to prevent any further erosion. The area is a part of the pristine marsh system identified by the Durham Coastal Method Inventory & Evaluation Project (DCMT & EP). The structure will be a valuable spot to observe wildlife in the river and marsh. Some of the shoreline degradation is caused by ice and tides, however, most of the impact in this area is from human intervention. Estimate is $20,000

3. There is a desire to short cut the present trail system at Davis Creek bringing people through sensitive wetland habitats. Building a bridge structure will help prevent erosion from occurring at the crossing and will create a wildlife and habitat observation point along the trail. The construction of the bridge should begin by flagging the wetlands in the area and then creating a structure that effectively keeps people above the grasses.

A footbridge at Davis Creek would help protect the wetlands that are now being jeopardized by people crossing the creek. The cost could be minimized by donations- $50 per square foot or approximately $10,000.

4. Trail system improvements include the spreading mulch to help keep people on the trail and to prevent root compaction through wooded areas. The new surface will help prevent people from tripping over tree roots or into holes as well. Areas such as the steep bank down to the beach in the southeast shoreline should either be closed off to prevent further erosion or re-vegetated with plant mats to help protect the bank from further degradation. Simplifying the trails through the area south of the orchard will help keep environmental impact to a minimum. If a phasing program is needed to defer the costs, the areas closet to the river and through any wet areas should be the first to receive the bark mulch. No cost- in house project.

Project Details

Location: Route 4
Tax Map: Map 12, Lot 8-2
Acreage: Entire Property 139 acres
Road Frontage: 1,341' +/- of frontage on Piscataqua Road (US Route 4)
River Frontage: 1,100' +/- of tidal frontage on the Oyster River and Smith Creek
Zoning: Residence Coastal, with a minimum lot size of 150,000 square feet and road frontage requirement of 300 feet.

Wagon Hill Farm consists of high quality working farmland, healthy forest, and significant coastal and estuarine resources along the Oyster River in Durham, NH. The tract has important ecological resources including significant undeveloped coastal shoreline, tidal and estuarine riparian conservation values, and water quality protection attributes.

With 1100 feet of tidal frontage on Little Bay, Oyster River and Smith Creek, and 8.5 acres of tidal and freshwater wetlands, this project will permanently protect important on and off-site aquatic resources. The project will help protect the water quality and aquatic habitats of the Great Bay estuary including the adjacent NHB-documented "sparsely vegetated intertidal system", an exemplary natural community. Wagon Hill Farm has critical pollutant (e.g. nitrogen) attenuation characteristics (NH DES). Historically abundant oyster populations occurred in the Oyster River and Great Bay which The Nature Conservancy and others are working to restore to mitigate water quality impairments of Great Bay. This project will remove the threat of sediment loading from incompatible uses on the property that could smother oyster reefs. The Oyster River and Smith Creek are part of the Piscataqua River Network, classified as having "high relative resilience" according to a recent scientific analysis of predicted resilience to the impacts of climate change (TNC 2013). This project will incorporate significant riparian buffers to protect the estuarine and coastal resources of Smith Creek and the Oyster River.

Maintain Prominent Scenic Vista:

This project provides a very prominent viewshed for commuters along the heavily traveled corridor of Route 4 and boat traffic along the Oyster River. In fact, this parcel is the most visible and recognized parcel due to the prominent fields and the wagon on the hill.

The Durham Master Plan (2000) identifies this viewshed as one part of "the entrance to Durham as you pass Wagon Hill Farm, Emery Farm, Johnson Creek, Old Piscataqua River, and Bunker Creek" . . . protection of these viewsheds should be and will continue to be a high priority for Durham.

Draft Project Budget

Expenses

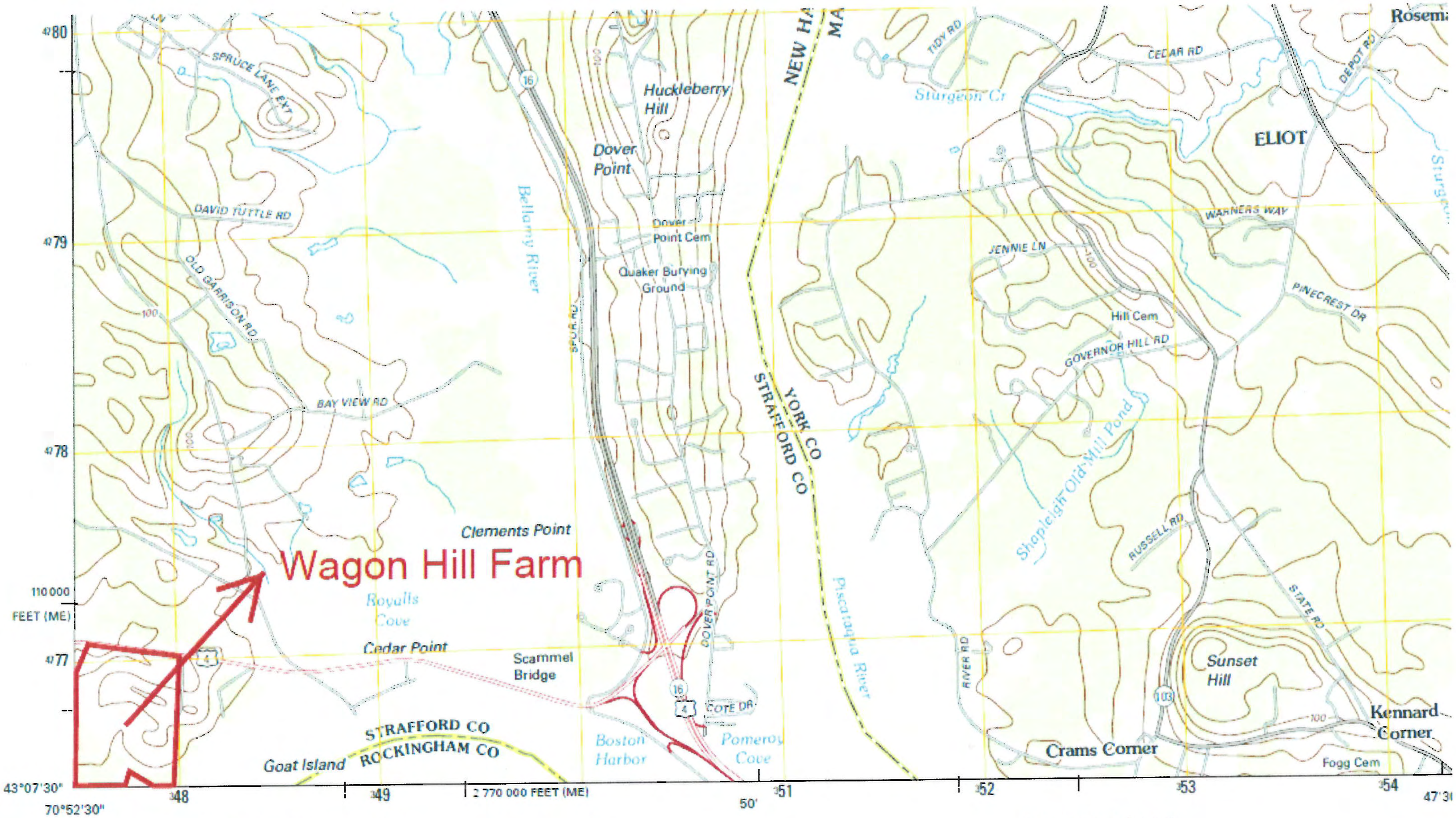
Shoreline Restoration	$338,250	(mix of hardened edge and soft re-vegetated stabilization.)
Bridge (Davis Creek)	$10,000	
Davis Creek Point	$20,000	
TOTAL EXPENSES	**$368,250**	

Revenues

Eversource Mitigation Project	$170,000
Lois Brown Trust	$115,000
Town of Durham	$83,250
TOTAL INCOME	**$368,250**

Attachments:

USGS Map
Current Erosion Photos (9/3/15)



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 19T
10 000-foot ticks: Maine Coordinate System of 1983 (west zone), New Hampshire Coordinate System of 1983

Imagery.......NAIP, July 2009 - July 2011
Roads.......©2006-2011 TomTom
Names.......GNIS, 2011
Hydrography.......National Hydrography Dataset, 2009
Contours.......National Elevation Dataset, 2005
Boundaries.......Census, IBWC, IBC, USGS, 1972 - 2010

MN GN 15° 24' 274 MILS 1° 14' 22 MILS

UTM GRID AND 2012 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
CH
Grid Zone Designation
19T

SCALE 1:24 000

KILOMETERS
METERS
MILES
FEET

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.2

EROSION PHOTOS 9/3/15