Appendix 8:

Terrestrial and Intertidal Environments

(Envirosphere 2009d)

Terrestrial and Intertidal Biophysical Survey – Shore Facilities Fundy Tidal Energy Research & Development Project

Submitted to:

Minas Basin Pulp and Power Co. Ltd.
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Submitted by

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MINAS BASIN

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EXECUTIVE SUMMARY

A baseline biophysical survey of upland and intertidal environments at the site of the proposed shore facility for the Fundy Tidal Energy Research and Development Project near the community of Black Rock on the Minas Passage was carried out in October 2008. The survey provided baseline information for the environmental assessment and for wetland and fish habitat approvals required for the project. Upland areas are dominated by old field and common terrestrial plant communities; areas below the high tide mark are dominated by a salt marsh with an 0.2 ha estuarine pond and fresh marsh around the landward extremities and at the base of the upland slope. The salt marsh is bordered to seaward by a beach ridge and gravel beach, where secondary gravel waves occur bordering and creating several intermittent tidal pools. No regulatory issues, including occurrence of species at risk, were identified for the upland or intertidal portion of the site. The corridor for the electrical cable linking the site with the offshore installations will cross a wetland (salt marsh) and minor watercourse in the intertidal zone, requiring a coastal approval from Nova Scotia DNR; and the watercourse crossing and trenching across these areas and the beach ridge and beach zone will require fish habitat (HADD) approvals from the federal Department of Fisheries and Oceans.

1. INTRODUCTION AND BACKGROUND

As part of a strategy to include an increasing proportion of renewable energy in the energy mix for its citizens, the Province of Nova Scotia together with Minas Basin Pulp and Power Limited of Hantsport, N.S. is developing a tidal energy demonstration facility in the Minas Passage, near Parrsboro, Nova Scotia. The demonstration facility will include an offshore component including berths in deep water in the Minas Passage for installation of experimental tidal power devices; shore facilities to service and monitor tidal devices; and electrical and data cables linking offshore equipment with onshore installations. Site selection, cable routing, construction and environmental approvals for the shore facility and cable installation requires biophysical information on the shore and intertidal zone to identify issues and concerns related to the planning and execution of the project. This report includes biophysical information including terrestrial and intertidal plant and animals communities, wetlands, and geomorphology, collected in two site visits to the proposed shore installation site in October 2008.

2. METHODOLOGY

Terrestrial and preliminary intertidal site surveys were conducted on October 2, 2008 by biologists P. Stewart and H. Levy of Envirosphere Consultants and botanist J. Jotcham (Marbicon Inc.). A detailed survey of beach areas and lower intertidal zone was carried out on October 21, 2008 by Envirosphere Consultants (P. Stewart and B. Stewart) and J. Kozak of AECOM Ltd. During the initial survey, study personnel conducted a walkover of the entire site and relevant adjacent areas to determine key physical features, distribution of terrestrial plant communities, distribution of ponds and wetlands including salt marshes and fish habitat, and beach characteristics. Minnow traps were set in the main saltmarsh/ barachois pond for approximately two hours to assess fish populations; fish captured were identified, measured and counted. Water quality measurements were taken in the pond and associated drainage channels using a YSI Model 85 hand-held salinity-temperature-oxygen meter. A detailed intertidal survey was conducted on October 21, 2008, consisting of laying a rope marked in 10 m intervals, across the intertidal zone from the top of the beach ridge to the approximate low tide mark at two locations marking the approximate area suggested for the cable route; observations and photographs of the substrate and alongshore in both directions, as well as vertically up the shore were taken at 10 m intervals. The biological community was noted qualitatively at each of the sites and representative samples were taken to support observations made in the field. During both surveys, locations of key features were logged on hand-held GPS units and photographed.

3. TERRESTRIAL AND INTERTIDAL ENVIROMENTS

3.1 GENERAL

The site is located west of Cape Sharp on the north shore of Minas Passage, at approximately UTM Zone 20, easting 389,887 m, northing 5,025,263 m (Figure 1), near the community of Black Rock. The shore at the site is dominated by several gradually-sloping, flat-topped bedrock platforms separated by ravines, situated above the extreme high water level, and on one of which the shore facilities will be located (Figure 2). The platforms have associated steep seaward slopes which end at the high tide mark in the saltmarsh. Outwash deposits also occur on the salt marsh margin at the end of the ravines, derived from eroded sediments carried by runoff. The intertidal zone (i.e. below extreme high water and above extreme low water) is dominated by a predominantly gravel barrier beach and beach ridge complex extending from headlands on the east to the mouth of Mill River on the west; and a salt marsh/ barachois pond complex between the barrier beach and the uplands. The beach is gradually sloping and flat on its eastern end, but has several major gravel bars towards its western (Mill River) end, behind which several temporary ponds and a semi-permanent intertidal pond have developed (Figures 2 & 25).

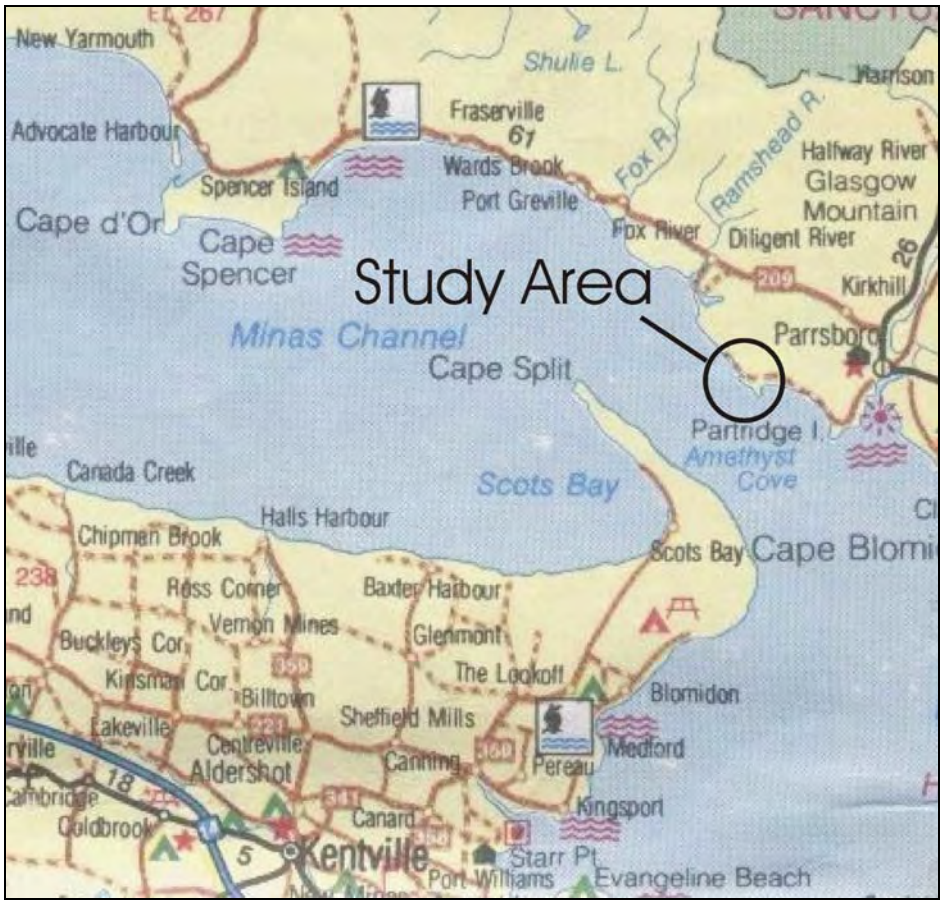

Figure 1. Location of shore installation for Fundy Tidal Energy Research and Development Project.

As presently proposed, the cable route will extend from a connection 'well' installed in the upland above extreme high tide level, descending the slope in a southerly direction to reach the high tide mark adjacent to the salt marsh. It will subsequently cross the narrowest part (west end) of the salt marsh complex, passing under an existing drainage channel for the salt marsh and barachois pond, and under the major beach ridge, being trenched across the beach as far as is practical on the lower intertidal zone.

3.2 UPLAND AND RAVINES

The proposed shore facility site and parking area is on a rectangular, gradually sloping plateau elevated about 7 m above the salt marsh level, underlain by bedrock and overlain by glacial till, which runs along the coast at the site (Figures 2 & 3). Areas on the plateau proposed for the shore facility and parking area are a combination of old fields and hay fields, connected by grassed walking trails. Old fields are vegetated with typical plant species including grass species, goldenrod, white spruce, white asters, alder, and rose bushes (Figures 4 – 8) (Appendix 1). Seaward, the plateau descends a steep escarpment slope, which is heavily vegetated and substrate consists mainly of glacial till and associated soil. The lower parts of the escarpment are vegetated with dense growth of alders (Figure 8), and the upper margin (where it meets the top of the plateau) with a dense fringe of rose bushes. Two ravines cut through the plateau adjacent to the site, one separating the shore facility from the proposed parking area, and the second and larger ravine located east of the parking area (Figure 2). Both originate near the highway and widen gradually to the shore; the larger one (east of the project site) had a low flow at the time of the survey, but the smaller one had negligible flow, presumably from groundwater seepage. Ravine bottoms consist of bedrock and rock fragments, and are vegetated by various shrub and tree species. Under conditions of high runoff, flow is likely to be greater, though intermittent, as evidenced by gravel debris transported into the marsh at the foot of the ravines.

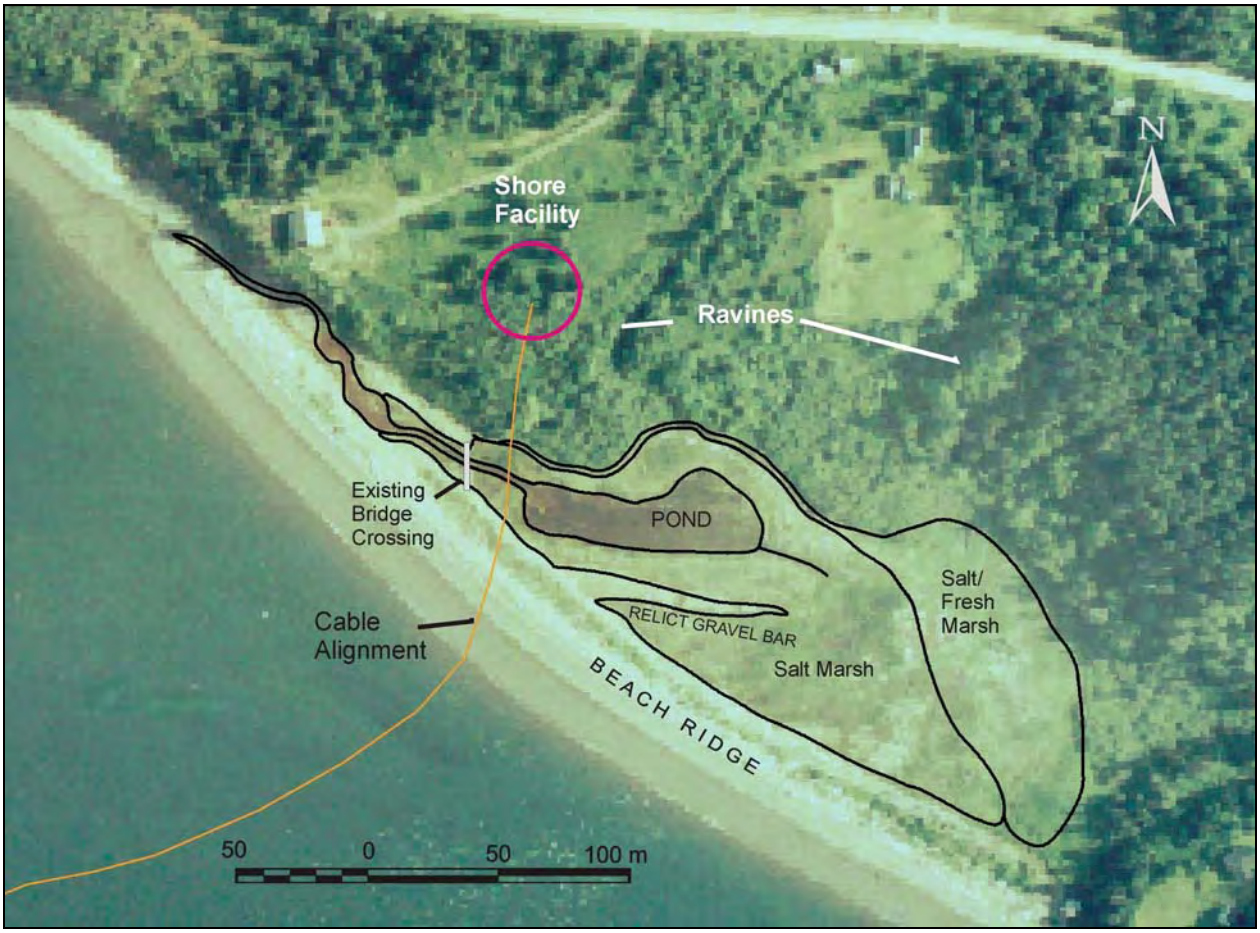

Figure 2. Landscape and wetlands at proposed site of shore facility and cable route.

Figure 3. View from Pelletier residence, about 50 m west of shore installation, October 2, 2008.

Figure 4. Old field showing plant communities typical of installation site, October 2, 2008.

Figure 5. Plant communities and view of Black Rock at approximate location of shore installation, October 2, 2008.

Figure 6. Plant communities at approximate location of shore installation, October 2, 2008.

Figure 7. Bottom of ravine at shore installation site, October 2, 2008.

Figure 8. Plant communities on upper edge and slope of shore plateau at installation site, October 2, 2008. Shows barachois pond in salt marsh, beach ridge, and Black Rock in distance.

3.3 SALTMARSH AND POND COMPLEX

The intertidal zone at the site is dominated by an intertidal barachois pond/saltmarsh complex behind a barrier beach and beach ridge which runs east-west from headlands on the east to the mouth of Mill River on the west (Figures 2 & 9 – 21). The marsh is dominated by 'high' salt marsh grass (*Spartina patens)* but includes occasional other species characteristic of salt marshes (Appendix 1). Lowest elevations in the marsh and the pond are flooded daily by the tide, with more extensive flooding occurring on spring tides and during storm surge events. The east end of the marsh and areas bordering the upland are fresher, due to surface and ground water runoff from the upland and a major ravine entering at the head of the marsh, with typical 'fresh marsh' plant constituents dominating, including sedges, cattails, and bulrushes. Freshwater wetland vegetation (e.g. irises, *Iris* sp., bulrushes, downy alder) also occurs along the upland edge of the salt marsh on the north side within the study area (i.e. below the proposed shore installation), particularly where a ravine meets the salt marsh (Figure 2) and at the foot of the escarpment on the edge of the upland. In these areas, intermittent flow from runoff from the upland and possibly groundwater outflow enters the marsh and concentrates along the edge. The ravine has caused a build-up of pebble/gravel to cobble material, sometimes extending out into the marsh, where the material has washed out of the ravine and is generally unvegetated.

Within the salt marsh area, several small inactive gravel bars occur inside the main beach ridge, and run parallel to it, likely formed when the area was flooded by earlier storms and extreme high water events. These small bars have been overgrown in places by sparse growth of high marsh grass (*Spartina patens)* but otherwise are free of vegetation (Figure 22). The secondary bars running through the salt marsh have similar composition to the top of the main bar, principally a densely packed, medium to coarse pebble sized shingle (Figure 22).

The salt marsh pond is oval in shape, 90 m x 20 m (0.19 ha in area) (Figure 2) set in the adjacent high marsh. The pond is shallow (~30 cm) with mud bottom and patchy growth of aquatic plants including rockweed (*Fucus sp*.). The pond has sharply-cut banks consisting of tussocks of salt marsh cord grass (*Spartina patens)* which also dominates the shore zone around the margin. Freshwater runoff from the adjoining uplands and salt marsh drainage from tidal flooding with seawater, enters the pond through a narrow channel (0.3 – 1 m wide) (Figure 21) on the east end, creating estuarine conditions (salinities of 23.5 to 26 ppt in the pond and downstream channel (Table 1). The upstream channel is cluttered with debris such as flotsam and pieces of wood, logs etc. The outflow channel from the pond is straight, about 1.5 m wide and 30 cm deep, passing through a narrow band of salt marsh (Figures 18 & 24) before flowing through a sharply cut channel between the main gravel bar and the upland (Figures 16 & 23). Along the downstream portions of the channel there are outcrops of bedrock on the landward side which help to constrain the channel, and patches of marsh peat beneath the edges of the gravel bar, through which the channel has eroded (Figure 17). A second shallow pond 5 m in diameter, less than 30 cm deep and having low salinity occurs in the salt marsh southeast of the main pond (Figure 20).

The main saltmarsh pond held schools of mumichugs (fish, *Fundulus heteroclitus)*. This species was the only one recovered in six, two-hour sets of standard minnow traps at the site. Up to ~140 individuals, 4-5 cm in total length (the dominant size class) were captured per set (average ~51 for 6 sets). Three other size classes, 3-4 cm, 6-8 and 8-10 cm were also present. Two individuals in the 4-5 cm size class were captured in the inflow stream.

Table 1. Water quality observations in salt marsh pond and drainages adjacent to proposed shore facility, October 2, 2008.

Parameters	Drainage Channel, East of Pond	Mouth of Drainage Channel	Backshore Pond (edge of pond at mid-point)	Channel below Pond (at Bridge)
Temperature (˚C)	12.4	13.0	13.8	13.8
Dissolved Oxygen Saturation (%)	70.7	50.1	38.8	96.6
Dissolved Oxygen (mg/L)	7.26	7.88	3.36	8.94
Conductivity (µs)	377	660	29,180	30,390
Specific Conductivity (25°) (µs)	564	865	37,090	38,840
Salinity (ppt)	0.2	0.4	23.5	26.0
pH	6.9	--	7.7	--
TSS (mg/L)	7.5	--	22.5	--

Figure 9. View of slope vegetation southeast of shore plateau, October 2, 2008.

Figure 10. Alder grove, asters and salt marsh grasses on interface of slope with upper salt marsh, October 2, 2008.

Figure 11. View from salt marsh looking towards site of shore installation, showing alder border on lower slope, October 2, 2008.

Figure 12. View from salt marsh looking over the barachois pond towards site of shore installation, showing alder border on lower slope, October 2, 2008.

Figure 13. View from saltmarsh pond towards shore installation site, October 2, 2008.

Figure 14. View from edge of beach ridge, overlooking salt marsh and barachois pond towards site of shore installation, showing alder border on lower slope, October 2, 2008. House visible in the photo is the Lea Pelletier residence.

Figure 15. View from beach ridge to the east, showing barachois pond and alder development at the foot of the slope below the installation site, to the left. Proposed cable trench will be approximately at location of bridge, shown in middle of picture.

Figure 16. View to the west along drainage channel towards Mill River. Beach ridge is shown on the left.

Figure 17. Exposure of saltmarsh peat in drainage channel below salt marsh at project site, October 2, 2008.

Figure 18. View of salt marsh entrance channel, with beach ridge and secondary ridge in background. October 2, 2008.

Figure 19. High salt marsh immediately east of barachois pond, east of project site, October 2, 2008.

Figure 20. Small pond in high salt marsh southeast of project site, October 2, 2008.

Figure 21. East end of barachois pond in salt marsh, October 2, 2008, looking northeast.

Figure 22. High salt marsh between barachois pond and main gravel bar, showing a secondary (older) gravel bar partially colonized by high marsh grasses (*Spartina patens*). View is towards Mill River.

Figure 23. Drainage channel below salt marsh pond showing band of salt marsh vegetation between gravel bars, October 2, 2008, looking west.

Figure 24. Channel draining salt marsh pond, taken from bridge, at approximate location of cable installation, October 2, 2008.

3.4 BEACH AND BEACH RIDGE COMPLEX

A gravel beach and beach ridge runs east-west along the shore at the site, seaward of the pond/saltmarsh complex (Figures 25 - 28). The ridge is predominantly made up of small to medium gravel sized, densely packed shingle, with a small component of coarse sand; has a patchy cover of terrestrial vegetation characteristic of upper shore zones; and has accumulated flotsam including drift wood and logs and man-made debris (e.g. rope, lobster traps etc.) (Figures 26 – 28). The ridge has a fairly steeply sloping seaward face (1:10) transitioning to a more gentle slope of 1:20 to 1:30 across the gravel beach. The character of the beach changes from the east end of the study site where it slopes uniformly seaward (Figures 29 & 30), to the west end where it is dominated by a series of large gravel bars. The proposed cable route will cross the eastern end of the gravel bar complex (Figure 25). The beach zone at the mouth of Mill River (at the western end of the site) widens into a braided, delta-like, fluvial fan (Figures 25 & 46).

Upper levels of the beach consist predominantly of fine small to medium pebble-sized dense shingle, with patches of coarse sand, but substrate on the beach grades into a large pebble to cobble bottom at low water (Table 2). The beach zone is devoid of marine plant life except for isolated groundwater seepages, occasional mobile rocks with attached rockweed, and intermittent tide pools which have formed landward of major gravel bars, Due to the protection and restricted flow of water off the beach. Seepage areas on the lower intertidal have developed localized growth of sea lettuce (*Ulva* sp.) (Figures 31 & 32).

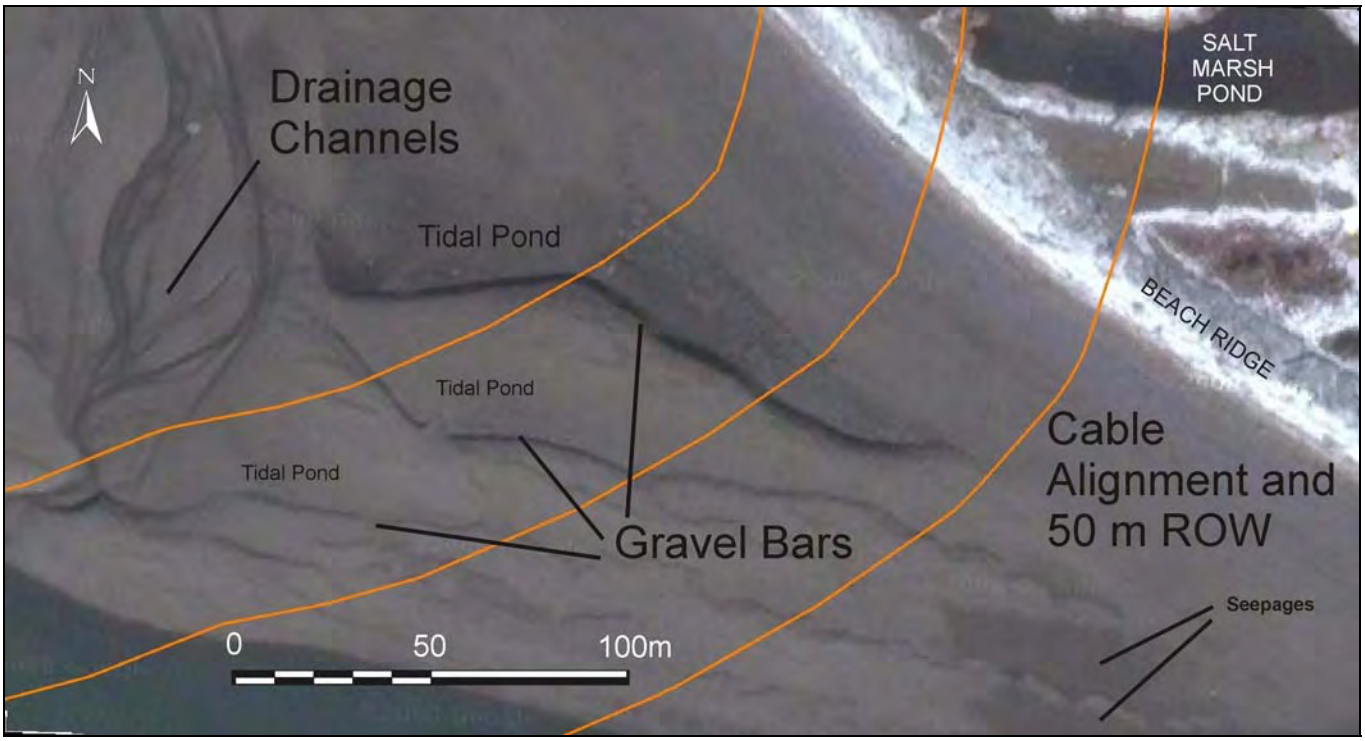

Figure 25. Characteristics of beach zone at shore facilities, and cable corridor.

The complex of large gravel bars is a dominant feature of the mid-to low-intertidal zone on the west end of the beach (Figures 25 & 34 – 46). The bars appear to be moderately stable, in that they appeared in roughly the same position in October 2008 as in a winter satellite image (Figure 25). They have a gradual seaward slope, and a relatively steep upshore slope (Figure 39). In addition, the bars trap the receding tide upshore, creating semi-permanent ponds which have developed low diversity, intermittent tide-pool biological communities (Figures 40 & 41). Behind the more shoreward bar, differs in substrate from the adjacent gravel bar, containing a level muddy gravel to cobble and boulder bottom supports patchy growth of rockweed *Fucus*; the margins have similar substrate and supports barnacles, as well as patchy *Fucus* and *Ascophyllum* and small and large sea lettuce (*Ulva lactuca*), the latter which had died off due

Figure 26. Beach and beach ridge gravel bar southeast of project site and east of proposed cable routing, October 2, 2008.

Figure 27. Beach ridge in approximate location of cable route, October 2, 2008.

Figure 28. View of beach ridge from shore, October 2, 2008. Black Rock is shown in background.

Figure 29. Beach southeast of shore installation and east of proposed cable route, October 2, 2008.

Figure 30. Lower beach, southeast of shore installation and east of proposed cable route, October 2, 2008. Taken approximately mid-tide.

Figure 31. Groundwater seepage zone on lower intertidal zone southeast of shore installation, located east of proposed cable route, October 21, 2008. Shows development of sea lettuce (*Ulva lactuca*).

Figure 32. Lower mid-tidal zone at approximate location of cable route, southeast of shore installation. Incursion of water in the background is the approximate location of the outlet of Mill River. October 2, 2008.

Figure 33. View of intertidal zone west of proposed cable route, October 21, 2008. Intertidal pond behind gravel ridge, as well as alluvial fan at the mouth of Mill River is shown, and Black Rock is in upper left.

Table 2. Beach characteristics along transects perpendicular to shore at site of proposed cable route, October 21, 2008.

Transect	Distance (metres)	Physical Description	Biological Description	Comment
Transect 1	0	Medium to coarse pebble, man-made debris; wood.	Patchy upper shore zone terrestrial species (e.g. beach pea, wild rose)	Beach ridge
	10	Medium to coarse sand overlain by fine to medium pebble.	No seaweeds present	Slope 1:10
	20	Uniform fine gravel (granule to medium pebble)	"	Several hard packed sand/gravel waves.
	30	Coarse sand to fine to coarse pebble	"	Slope 1:25
	40	Mixed, fine gravel (fine to coarse pebble) to occasional firm cobble.	"	Slope 1:30
	50	Mixed coarse sand to medium cobble (10%)	"	"
	60	Coarse granule dominated wave over to medium to large cobble.	"	"
	70	Coarse sand to coarse cobble.	Occasional sea lettuce (*Ulva* sp) both living and dead plants, on cobbles.	"
	80	Predominantly gravel with cobble	Occasional drift rockweed (*Fucus)* and sea lettuce (*Ulva sp)* in pools.	Small gravel wave; patchy groundwater seepage.
	90	Gravel to cobble, with fine gravel waves.	Occasional sea lettuce (*Ulva sp)* and juvenile rockweed (*Fucus)* in seepage areas.	Groundwater seepage; fine gravel waves
	100	Gravel to cobble with fine coarse gravel to gravel waves.	Drift seaweeds	Groundwater seepage. Approx. mid-tide level. Intertidal ponds upslope of gravel waves.
	110	Heterogeneous coarse sand to coarse pebble with occasional fine cobble waves.	No biota.	Slope 1:30
Transect 2	0	Medium pebble sized shingle.	Patchy terrestrial vegetation	
	10	Very coarse sand to fine pebble beach (fine pebble waves over coarse sand base)	No biota.	
	20	Coarse granule to fine pebble beach	No biota.	
	30	Fine granule to medium pebble beach.	No biota.	
	40	Coarse sand to medium pebble beach with occasional large cobble.	No biota.	

Table 2. Beach characteristics along transects perpendicular to shore at site of proposed cable route, October 21, 2008.

Transect	Distance (metres)	Physical Description	Biological Description	Comment
Transect 2 (con't)	50	Coarse pebble to fine to medium cobble beach with occasional boulder.	Drift rockweed (*Fucus* sp), occasional dead sea lettuce (*Ulva* sp), occasional small periwinkles (*Littorina* sp)	
	60	Predominantly medium to coarse pebble in mud matrix, with occasional cobble, and small boulder common.	Rockweed abundant (50% cover), barnacles on rock surfaces.	
	70	Coarse sand to medium pebble, with occasional coarse pebble.	Rockweed (*Fucus*) abundant, dead sea lettuce (*Ulva*). Large patches of *Ascophyllum nodosum* in upper part of low area.	Slope adjacent to intertidal pond developed above major gravel wave.
	80	Predominantly fine to medium pebble with muddy matrix.	Rockweed (*Fucus)* abundant *(*50% cover), barnacles and occasional periwinkles (*Littorina* sp*).*	Edge of intertidal pond.
	90	Fine to medium pebble in muddy matrix.	Barnacles, juvenile periwinkles (*Littorina littorea)* on rocks.	Base of intertidal pond above major gravel wave.
	100	Coarse pebble to occasional fine cobble in muddy matrix.	Barnacles, attached rockweed (*Fucus*), periwinkles.	On secondary slope of gravel wave.
	110	Granule to predominantly coarse gravel and occasional cobble.	Occasional barnacles on rocks.	Shoreward edge of pebble to cobble wave and ridge.
	120	Predominantly fine to medium pebble with occasional cobble	No biota.	Near crest of large gravel wave.
	130	Predominantly fine gravel (fine pebble to medium pebble) with occasional coarse gravel and cobble.	Occasional drift rockweed (*Fucus*) and sea lettuce (*Ulva*).	Seaward slope of gravel wave.
	140	Predominantly mixed fine to coarse pebble with fine to coarse cobble.	Sea lettuce (*Ulva* sp) and rockweed (*Fucus* sp).	Slope of secondary gravel ridge.
	150	Fine pebble to coarse cobble with occasional small boulder, behind gravel bar.	Occasional barnacles on cobble/boulders; dead sea lettuce (*Ulva* sp.) 50% cover, occasional juvenile rockweed (*Fucus* sp), Occasional small periwinkles.	Intertidal pond area above secondary gravel bar.
	160	Well-sorted fine to coarse pebble c/w occasional fine to medium cobble.	No biota on ridge. Adjacent pond has cobble in muddy matrix with dead sea lettuce (*Ulva)* plus abundant rockweed (*Fucus*) on cobbles.	Upshore slope of wave is 45º

Table 2. Beach characteristics along transects perpendicular to shore at site of proposed cable route, October 21, 2008.

Transect	Distance (metres)	Physical Description	Biological Description	Comment
Transect 2 (con't)	170	Mixed coarse sand to coarse cobble with predominantly medium to coarse pebble.	Dead sea lettuce (*Ulva* sp); rocks with barnacles; occasional periwinkles (*Littorina littorea).*	Seaward slope of gravel ridge.
	180	Coarse pebble to coarse cobble and occasional boulder.	Dead sea lettuce (*Ulva* sp); rocks with barnacles; occasional periwinkles (*Littorina littorea);* occasional drift *Fucus*.	This area is protected from some wave energy by adjacent gravel waves allowing seaweed development.
	190	Coarse sand to occasional small to medium cobble.	Occasional drift rockweed; occasional periwinkles (*Littorina littorea* & *L. saxatilis*)	Black River fluvial fan; relatively level in elevation with numerous gravel waves.
	205	Coarse sand to fine pebble over occasional cobble to boulder.	No seaweeds or animals observed.	Appears to be a basal eroded till substrate covered by waves of finer material.
	215	Coarse sand to predominantly medium to coarse pebble and occasional cobble.	Occasional periwinkles and barnacles.	Level terrace behind gravel bar.
	225	Predominantly fine to coarse pebble with occasional fine to medium and large cobble	Barnacles on large cobble.	Near low tide mark.
	235	Coarse pebble to coarse cobble.	No seaweeds or animals observed.	Normal low water.

Figure 34. View of gravel waves and surface features of beach area, October 21, 2008. Proposed cable route follows roughly the left edge of the photograph.

to the lateness in the growing season. Various invertebrate animal species were also found among the seaweeds and rocks (Table 3). A similar, less permanent pond seaward of the main bar supports dense growth of sea lettuce (*Ulva lactuca*) (which had also died off at the time of the survey) as well as some smaller specimens up to about 5 cm in length which were alive and bright green (Figure 45). The west end of the beach seaward of the bar complex levels into a low intertidal platform consisting of level cobble with occasional loose small to medium cobble on the surface (Figure 32). Cobbles and solid surfaces are occasionally occupied by barnacles and attached seaweeds (e.g. rockweeds).

Table 3. Marine plant and animals in intermittent tidal pools at project site.

Animals	Plants
Amphipods *Hyale nilssoni* *Marinogammarus obtusatus* Isopods *Jaera marina* Barnacles *Semibalanus balanoides* Gastropods *Littorina littorea* *L. obtusatus* *L. saxatilis* Decapods Green Crab (*Carcinus maenas)* Mud crab (*Rhithropanopeus harrisii)*	Rockweeds (*Fucus* sp., *Ascophyllum nodosum*) Sea lettuce (*Ulva lactuca*)

Figure 35. East end of major trough on beach southeast of shore installation. Proposed location for cable route is in foreground and intertidal pond is in background. October 2, 2008.

Figure 36. Upper intertidal beach below shore installation, October 21, 2008. Proposed cable route is in near background.

Figure 37. Upper beach zone below shore installation, October 21, 2008. Proposed cable routing is in immediate background and beach ridge appears in upper right.

Figure 38. East end of intertidal pond area below shore installation, looking upshore, October 21, 2008. Shore installation is on land at upper left of photo. Proposed cable route crosses beach in background and the low area to the left of the edge of the photograph.

Figure 39. Mid-intertidal of beach area below shore installation, showing pond behind second major seaward gravel bar, October 21, 2008.

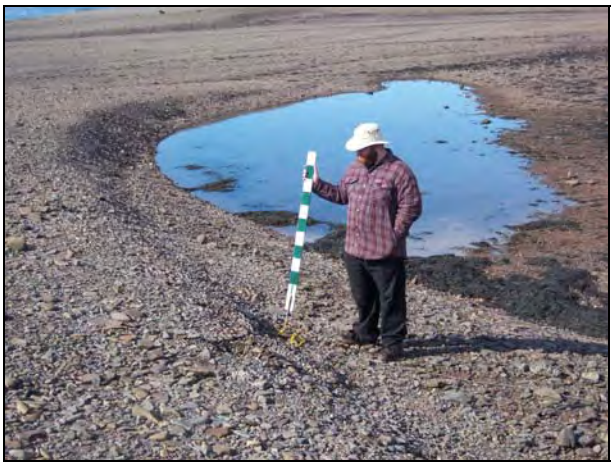

Figure 40. Intertidal pond, looking west, Oct. 21, 2008, low tide. Channel of Mill River is in background.

Figure 41. Close up of muddy to cobble substrate on the shore of the intertidal pond, adjacent to the proposed cable route. Rocks with barnacles and periwinkles (*Littorina littorea*). October 2, 2008.

Figure 42. Muddy to cobble substrate on the shore of the intertidal pond, just west of the proposed cable route. Shows clumps of rockweed (*Fucus* spp), barnacles, and periwinkles (Littorina littorea).

Figure 43. View of beach area adjacent to intertidal pond, showing development of rockweed. Proposed cable corridor will cross the upper end of the vegetated area, shown in the background.

Figure 44. Rockweed (*Fucus* sp) on intertidal zone shoreward of intertidal pond, October 2, 2008. This site is west of proposed cable route.

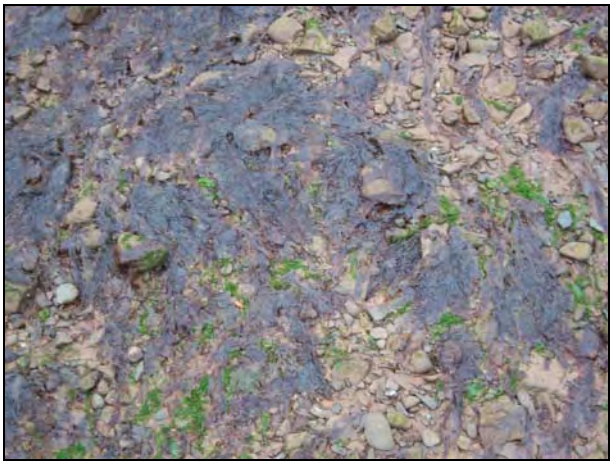

Figure 45. Sea lettuce (*Ulva lactuca)* in intertidal zone at higher elevations than areas where rockweed, periwinkles and barnacles occur. Due to the cold weather and lower light levels associated with the lateness of the season, most of the *Ulva* had died off (purplish patches above) while smaller plants (green) survived. October 2, 2008.

Figure 46. Channels for Mill River and tidal outflow on the outer intertidal zone at mouth of Mill River.

3.5 FISH HABITAT

All salt marsh and associated ponds and fresh marsh, as well as the intertidal zone on the beach, are considered to be Fish Habitat under the federal *Fisheries Act*, administered by the Federal Department of Fisheries and Oceans (DFO). A small channel entering the saltmarsh pond drains the saltmarsh and is also considered to be fish habitat. Fish habitat features are summarized in Figure 2 and Table 2.

3.6 WETLANDS

All the areas of salt marsh and ponds described, as well as fresh marsh areas, are considered to be coastal wetlands under the provincial Wetlands Alteration Approval Policy, and will likely be subject to a

provincial Coastal Alteration Approval through NS Department of Natural Resources. Wetland areas are shown in Figure 2 and summarized in Table 2.

3.7 BEACHES

The beach at the site is not designated under the Nova Scotia Beaches Protection Act.

4. CONCLUSIONS AND RECOMMENDATIONS

The proposed project site has terrestrial, and intertidal plant and animal communities which are commonly found in similar situations along Nova Scotia coasts. The intertidal is occupied by various wetland, watercourse and beach environments, which, although not unique, will require approvals from federal and provincial governments to allow installation of the electrical cable for the project. The survey of the site adequately characterizes terrestrial, wetland and fish habitat areas to allow the proponent to acquire necessary federal and provincial wetland, coastal and fish habitat environmental approvals for the project.

APPENDIX 1 – BOTANICAL SURVEY REPORT, OCTOBER 2008.

Botanical survey
Cape Sharp
Cumberland County, Nova Scotia
2008

By Jim Jotcham, Marbicon Inc
October 31 2008

In the fall of 2008, Marbicon Inc. was contracted to perform a botanical survey of a site on the north shore of the Bay of Fundy, about 7 km southwest of Parrsboro. The site was located at approximately 45^{o} 22' 19'' N and 64^{o} 24' 21'' W. Figure 1 is an aerial view of the study area. Figure 2 is a map provided by the Atlantic Canada Conservation Data Centre (ACCDC).

The site was inventoried by botanist Jim Jotcham on October 2, 2008. Appendix 1 shows the list of plant species found (sorted by habitat), plus their sub-national (S rank) and provincial (NSDNR) status.

The property contained several distinct plant communities. Bordering the Bay of Fundy is an exposed barrier stony/gravel beach (Figure 3) dominated by low shrubs such as Chokecherry and Wild rose. The raised beach protects a small saltwater pond surrounded by a salt marsh (Figure 4). Typical salt marsh plants such as cord-grass were close to the pond, and above the drift line freshwater species such as cat-tails became abundant.

The shore immediately above the marsh on the west side of the site is a high shrub community dominated by chokecherries (Figure 5). On the east side of the property the marsh meets forest (Figure 6). The shrub and forest communities rise over an escarpment.

Additional communities above a small escarpment (not the one shown in the aerial photograph) include old fields (Figure 7) and residential areas with mowed lawns. The sampled old field was diverse, and included some small wet areas. A gully led from the upper portion of

the site and flowed down through the escarpment to the lower saltmarsh. This was not separately sampled as a unit, but is included with the shrub community.

No rare plant species or special habitats were identified on the site. Because the site was quite small, no specific sampling pattern was utilized. All parts of the site were examined from West Bay Road down to the shore. No quantitative sampling was performed.

It must be noted that the site was visited in early October, and no conclusions may be drawn as to the presence or absence of species more easily seen or identified in other seasons.

Appendix 1 shows the list of plant species identified on site, sorted by habitat. Scientific names are from Zinck (1998).

Appendix 2 is a summary of the botany report from the Heritage Division, Nova Scotia Department of Tourism, Culture and Heritage. The appended list of species at risk provided by them includes flora of both aquatic and terrestrial habitats.

Appendix 3 is a summary of the botany portion of the report supplied by the Atlantic Canada Conservation Data Centre (ACCDC). The list shown is for all rare flora identified within 10 km, with no sorting by habitat.

There is some overlap in the lists in Appendices 2 and 3, although there are differences. Note that *Asplenium viride* (on the Heritage Division list) is a synonym for *Asplenium trichomanes* (on the ACCDC list). Because the site includes several habitats, many the listed species were potentially on site. However, none were found during this survey. Some of the listed species prefer habitats that were not found during the survey. For example, some of the species are usually found on exposed cliffs, a habitat missing from the study site, although this habitat is nearby.

Plants can be opportunistic and do not always follow expected patterns. However, based on habitat descriptions found in Zinck (1998), several species that might fit the site include the following:

Alopecurus aequalis is found on ...gravel margins.
Aster (Symphyotrichum) ciliolatus is found in open fields, lawns, and the edges of woods.

Botrychium dissectum is found on sandy, gravelly, turfy, or open soils.
Campanula aparinoides is found in meadows and ditches.
Cardamine parviflora is found in dry woods.
Carex albicans var. emmonsii is found in thickets and clearings.
Huperzia selago is found in rock crevices on stream cliffs and moist ravines.
Juncus dudleyi is found in fields, roadsides, and open ditches.
Lobelia spicata is found in dry fields.
Platanthera grandiflora is found in wet meadows.
Polystichum braunii is found on slopes in ravines and seepy hillsides.
Rubus pensilvanicus is found in thickets, the edges of woods, and clearings.

Although the habitats described above fit at least parts of the site, none of the listed species of concern were identified on the site.

In conclusion, no rare or unusual plants or habitats were identified. Any proposal for work at this site should include a reference to mitigating factors for the wetland (the pond and surrounding salt marsh).

Jim Jotcham

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October 31 2008

(north)

Figure 1. Aerial view of the study area on the north shore of the Bay of Fundy, south of the West Bay Road. The pond is marked on the photograph.

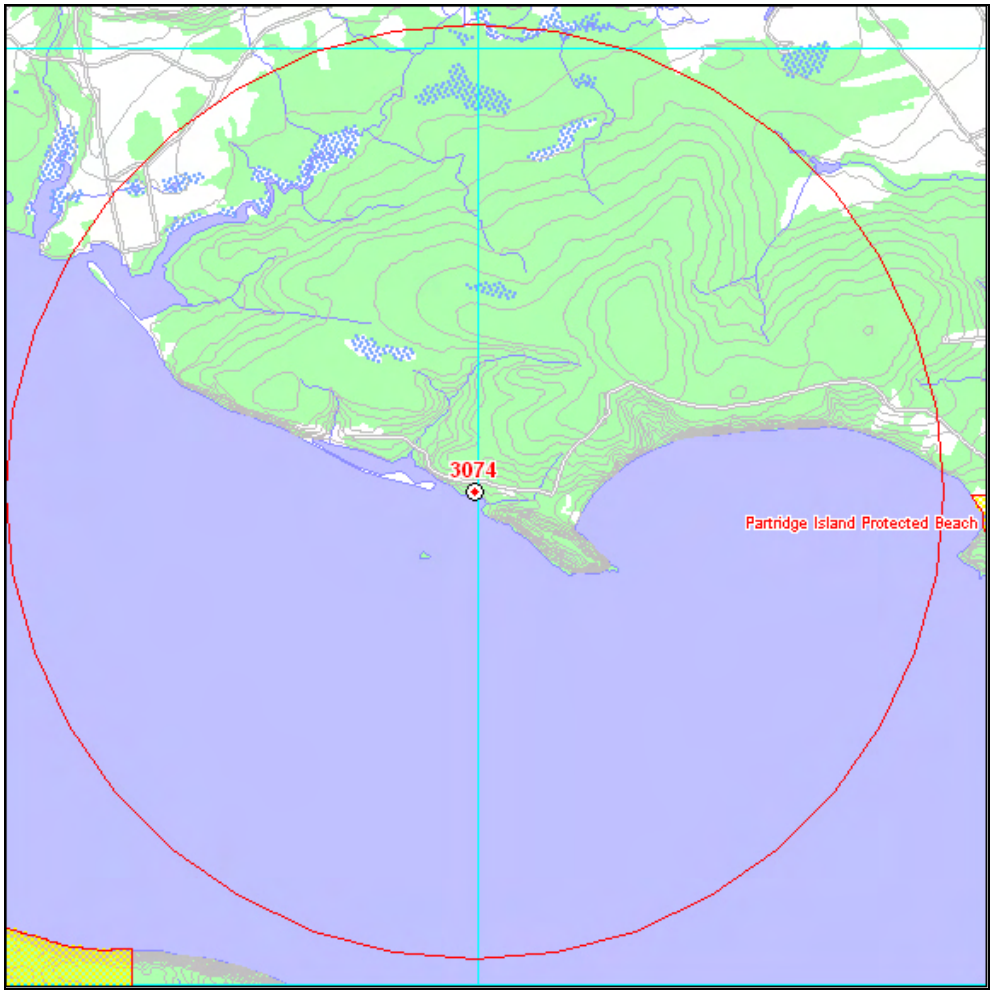

Figure 2. Map of the area provided by ACCDC. The centre point is the study area (defined here as No. 3074).

Figure 3. Barrier beach between the pond/salt marsh complex and the Bay of Fundy.

Figure 4. Pond/saltmarsh complex behind the barrier beach. Note the forest on the right background (behind the saltmarsh), and the shrubs to the left.

Figure 5. View of the shrub thicket from the top of the escarpment, looking south.

Figure 6. Looking into the forest on the northeast part of the saltmarsh.

Figure 7. The old field above the escarpment.

Appendix 1. List of species identified October 2, 2008. Scientific names are from Zinck (1998). Synonyms are in brackets. Species with population status below S5 are highlighted. No native species had other than a Green NSDNR rank.
S-ranks are defined in Appendix 3. NSDNR ranks are restricted to native species: Red = known to be, or that is thought to be at risk. Yellow = sensitive to human activities or natural events. Green = not believed to be sensitive or at risk.

Common Name	Binomial	Sub-national status (ACCDC)	NSDNR Status
Plant species found on the exposed gravel barrier beach:			
Pearly everlasting	*Anaphalis margaritacea*	S5	Green
Small white aster	*Aster (Symphyotrichum) lateriflorus*	S5	Green
Rough aster	*Aster (Symphyotrichum) puniceus*	S5	Green
Parasol white-top	*Aster* (*Doellingeria) umbellatus*	S5	Green
Wild morning-glory	*Calystegia sepium*	S5	Green
Ox-eye daisy	*Chrysanthemum leucanthemum*	SE	--
Bull thistle	*Cirsium vulgare*	SE	--
American dune grass	*Elymus (Leymus) mollis*	S5	Green
Common eyebright	*Euphrasia officinalis (nemorosa)*	S5SE	Green
Strawberry	*Fragaria virginiana*	S5	Green
Hemp-nettle	*Galeopsis tetrahit*	SE	--
Mouse-eared hawkweed	*Hieracium pilosella*	SE	--
Hawkweed	*Hieracium piloselloides*	SE	--
Beach pea	*Lathyrus maritimus (japonicus)*	S5	Green
Fall dandelion	*Leontodon autumnalis*	SE	--
Scotch lovage	*Ligusticum scothicum*	S5	Green
Sea lavender	*Limonium carolinianum*	S5	Green
Butter-and-eggs	*Linaria vulgaris*	SE	--
Evening primrose	*Oenothera biennis*	S5	Green
White spruce	*Picea glauca*	S5	Green
Seashore plantain	*Plantago maritima*	S5	Green
Chokecherry	*Prunus virginiana*	S5	Green
Gooseberry	*Ribes hirtellum*	S5	Green
Multiflora rose	*Rosa rugosa*	SE	--
Common wild rose	*Rosa virginiana*	S5	Green
Raspberry	*Rubus idaeus*	S5	Green

Common groundsel	*Senecio vulgaris*	SE	--
White goldenrod	*Solidago bicolor*	S5	Green
Perennial sow-thistle	*Sonchus arvensis*	SE	--
Cord grass	*Spartina alterniflora*	S5	Green
Salt hay	*Spartina patens*	S5	Green
Cord grass	*Spartina pectinata*	S5	Green

Plant species found in the saltmarsh (all zones listed):

Orach	*Atriplex prostrata*	S5	Green
A Sedge	*Carex sp.*	N/A	--
Chaffy sedge	*Carex paleacea*	S5	Green
Spikegrass	*Distichlis spicata*	S4	Green
Soft rush	*Juncus effusus*	S5	Green
Seashore plantain	*Plantago maritima*	S5	Green
American alkali grass	*Puccinellia americana*	S4S5	Green
Holy grass	*Hierochloe odorata*	S4S5	Green
Blunt-leaved dock	*Rumex obtusifolius*	SE	--
Glasswort	*Salicornia europaea*	S5	Green
Seaside goldenrod	*Solidago sempervirens*	S5	Green
Cord grass	*Spartina alterniflora*	S5	Green
Salt hay	*Spartina patens*	S5	Green
Cord grass	*Spartina pectinata*	S5	Green
Sea-blite	*Suaeda maritima*	S5SE	Green
Arrow-grass	*Triglochin maritima*	S5	Green
Cat-tail, broad-leaved (found above the drift line)	*Typha latifolia*	S5	Green

Plant species found along the forest/saltmarsh edge northeast of the pond:

Balsam fir	*Abies balsamea*	S5	Green
Green alder	*Alnus viridis*	S5	Green
Rough bedstraw	*Galium asprellum*	S5	Green
White spruce	*Picea glauca*	S5	Green
Trembling poplar	*Populus tremuloides*	S5	Green
Creeping buttercup	*Ranunculus repens*	SE	--
Raspberry	*Rubus idaeus*	S5	Green

American mountain-ash	*Sorbus americana*	S5	Green

Plant species found along the shrub/saltmarsh edge west of the forest:

Speckled alder	*Alnus incana*	S5	Green
Green alder	*Alnus viridis*	S5	Green
Shallow sedge	*Carex lurida*	S5	Green
Narrow-leaved goldenrod	*Euthamia graminifolia*	S5	Green
Northern manna-grass	*Glyceria X laxa*	S4?	Green
Blue flag	*Iris versicolor*	S5	Green
Japanese knotweed	*Polygonum cuspidatum*	SE	--
Lady's-thumb	*Polygonum persicaria*	SE	--
Coltsfoot	*Tussilago farfara*	SE	--
Canada goldenrod	*Solidago canadensis*	S5	Green
Rough-leaf goldenrod	*Solidago rugosa*	S5	Green
Cat-tail, broad-leaved	*Typha latifolia*	S5	Green

Plant species found in the shrub zone (including the escarpment) :

Red maple	*Acer rubrum*	S5	Green
Speckled alder	*Alnus incana*	S5	Green
Green alder	*Alnus viridis*	S5	Green
Parasol white-top	*Aster* (*Doellingeria) umbellatus*	S5	Green
Strawberry	*Fragaria virginiana*	S5	Green
Hemp-nettle	*Galeopsis tetrahit*	SE	--
Sensitive fern	*Onoclea sensibilis*	S5	Green
White spruce	*Picea glauca*	S5	Green
Chokecherry	*Prunus virginiana*	S5	Green
Apple	*Pyrus malus*	SE	--
Common blackberry	*Rubus allegheniensis*	S5	Green
Common wild rose	*Rosa virginiana*	S5	Green
Rough-leaf goldenrod	*Solidago rugosa*	S5	Green
Meadow-rue	*Thalictrum pubescens*	S5	Green
Possum-haw viburnum	*Viburnum nudum*	S5	Green

Plant species found in the old field above the escarpment:

Yarrow	*Achillea millefolium*	S5	Green
Green alder	*Alnus viridis*	S5	Green
New York aster	*Aster (Symphyotrichum) novi-belgii*	S5	Green
Fringed sedge	*Carex crinita*	S4 S5	Green
Marsh straw sedge	*Carex hormathodes*	S4 S5	Green
Quack-grass	*Elymus repens*	SE	--
Narrow-leaved goldenrod	*Euthamia graminifolia*	S5	Green
Strawberry	*Fragaria virginiana*	S5	Green
Fowl manna-grass	*Glyceria striata*	S5	Green
Soft rush	*Juncus effusus*	S5	Green
Timothy	*Phleum pratense*	SE	--
Kentucky bluegrass	*Poa pratensis*	S5	Green
Creeping buttercup	*Ranunculus repens*	SE	--
Common wild rose	*Rosa virginiana*	S5	Green
Common blackberry	*Rubus allegheniensis*	S5	Green
Raspberry	*Rubus idaeus*	S5	Green
Bulrush	*Scirpus atrocinctus*	S5	Green
Rough-leaf goldenrod	*Solidago rugosa*	S5	Green
Possum-haw viburnum	*Viburnum nudum*	S5	Green

Appendix 2. List of species provided by the Heritage Division, Nova Scotia Department of Tourism, Culture and Heritage.

Staff have reviewed the museum records for the area provided and offer the following list of species-at-risk that could be impacted by development at this site. The presence or absence of the following species should be determined prior to site disturbance and recorded in the site report. any field assessment should be conducted when the species can be positively identified.

Allium tricoccum	Red
Alopecurus aequalis	Yellow
Arabis drummondi	Yellow
Asplenium viride	Yellow
Campanula aparinoides	*Yellow*
Cardamine parviflora	*Yellow*
Draba arabisans	*Yellow*
Draba glabella	*Red*
Dryopteris fragrans	*Yellow*
Festuca subverticillata	*Red*
Impatiens pallida	*Yellow*
Laportea canadensis	Yellow
Poa glauca var. *glauca*	Yellow
Saxifraga paniculata	Yellow
Sphenopholis intermedia	Yellow
Woodsia glabella	Yellow

The colour rank refers to the designation assigned under the NS Department of Natural Resources status review process.

Appendix 3: Botanical data summary from the Atlantic Canada Conservation Data Centre (ACCDC).

Definitions of Provincial (subnational) ranks - SRANKS

S1 Extremely rare throughout its range in the province (typically 5 or fewer occurrences or very few remaining individuals). May be especially vulnerable to extirpation.

S2 Rare throughout its range in the province (6 to 20 occurrences or few remaining individuals). May be vulnerable to extirpation due to rarity or other factors.

S3 Uncommon throughout its range in the province, or found only in a restricted range, even if abundant in at some locations. (21 to 100 occurrences).

S4 Usually widespread, fairly common throughout its range in the province, and apparently secure with many occurrences, but the Element is of long-term concern (e.g. watch list). (100+ occurrences).

S5 Demonstrably widespread, abundant, and secure throughout its range in the province, and essentially ineradicable under present conditions.

S#S# Numeric range rank: A range between two consecutive numeric ranks. Denotes range of uncertainty about the exact rarity of the Element (e.g., S1S2).

SH Historical: Element occurred historically throughout its range in the province (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 - 70 years (depending on the species), and suspected to be still extant.

SU Unrankable: Possibly in peril throughout its range in the province, but status uncertain; need more information.

SX Extinct/Extirpated: Element is believed to be extirpated within the province.

S? Unranked: Element is not yet ranked.

SA Accidental: Accidental or casual in the province (i.e., infrequent and far outside usual range). Includes species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range; a few of these species may even have bred on the one or two occasions they were recorded.

SE Exotic: An exotic established in the province (e.g., Purple Loosestrife or Coltsfoot); may be native in nearby regions.

SE# Exotic numeric: An exotic established in the province that has been assigned a numeric rank.

SP Potential: Potential that Element occurs in the province, but no occurrences reported.

SR Reported: Element reported in the province but without persuasive documentation which would provide a basis for either accepting or rejecting (e.g., misidentified specimen) the report.

SRF Reported falsely: Element erroneously reported in the province and the error has persisted in the literature.

SZ Zero occurrences: Not of practical conservation concern in the province, because there are no definable occurrences, although the species is native and appears regularly. An NZ rank will generally be used for long distance migrants whose occurrences during their migrations are too irregular (in terms of repeated visitation to the same locations) or transitory. In other words, the migrant regularly passes through the province, but enduring, and mappable Element Occurrences cannot be defined.

Appendix 3 (continued): Plant species of note within 10 km of the Cape Sharp site (AACDC data).

Family/Scientific Name		Common Name	Provincial	Sub-National
Apiaceae	*Osmorhiza longistylis*	Smoother Sweet-Cicely	Yellow	S2
Aspleniaceae	*Asplenium trichomanes*	Maidenhair Spleenwort	Yellow	S2
Asteraceae	*Symphyotrichum ciliolatum*	Lindley's Aster	Yellow	S2S3
Brassicaceae	*Arabis drummondii*	Drummond Rockcress	Yellow	S2
	Cardamine maxima	Large Toothwort	Red	S1
	Draba arabisans	Rock Whitlow-Grass	Yellow	S2
	Draba glabella	Rock Whitlow-Grass	Red	S1
Campanulaceae	*Campanula aparinoides*	Marsh Bellflower	Yellow	S3?
	Lobelia spicata	Pale-Spiked Lobelia	Red	S1S2SE
Cyperaceae	*Carex albicans var. emmonsii*	Emmons Sedge	(not listed)	S3S4
	Eleocharis nitida	Slender Spike-Rush	Green	S3
Dryopteridaceae	*Dryopteris fragrans var. remotiuscula*	Fragrant Fern	Yellow	S2
	Polystichum braunii	Braun's Holly-Fern	Green	S3S4
Juncaceae	*Juncus dudleyi*	Dudley's Rush	Yellow	S2?
Liliaceae	*Allium tricoccum*	Small White Leek	Red	S1
	Trillium erectum	Ill-Scent Trillium	Green	
Lycopodiaceae	*Huperzia selago*	Fir Clubmoss	Undetermined	S1S3
Orchidaceae	*Goodyera repens*	Dwarf Rattlesnake-Plantain	Yellow	S2S3
	Malaxis brachypoda	White Adder's-Mouth	Red	S1
	Platanthera grandiflora	Large Purple-Fringe Orchis	Green	S3
Ophioglossaceae	*Botrychium dissectum*	Cutleaf Grape-Fern	Green	S3
Poaceae	*Alopecurus aequalis*	Short-Awn Foxtail	Yellow	S2S3
	Festuca subverticillata	Nodding Fescue	Red	S1S2
	Milium effusum var. cisatlanticum	Tall Millet-Grass	Green	S3

	Poa glauca	White Bluegrass	Yellow	S2S3
	Trisetum spicatum	Narrow False Oats	Green	S3
Polygonaceae	*Rumex salicifolius var. mexicanus*	Willow Dock	Yellow	S2
Rosaceae	*Amelanchier nantucketensis*	Nantucket Shadbush	Red	S1
	Rubus pensilvanicus	Pennsylvania Blackberry	Green	S3?
Saxifragaceae	*Saxifraga paniculata ssp. neogaea*	a White Mountain Saxifrage	Yellow	S2

Literature Cited:

NS Department of Natural Resources: www.speciesatrisk.ca/coastalplainflora

Zinck, M. 1998. Roland's Flora of Nova Scotia. Nova Scotia Museum, Halifax. 2 Vols, 1297 pp.