Environment

Fundy Ocean Research Centre for Energy (FORCE)

Environmental Assessment Addendum

to the report: Environmental Assessment Registration Document – Fundy Tidal Energy Demonstration Project, Volumes 1 and 2 dated June 10, 2009

Prepared by:

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Project Number:
60153932

Date:
July 22, 2010

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July 22, 2010

Julie Harris
Team Leader, Environmental Assessment
Renewable and Electrical Energy Division
Electricity Resources Branch, Energy Sector
Natural Resources Canada
615 Booth St, Room 160,
Ottawa, ON K1A 0E9

Dear Ms. Harris:

Project No: 60153932
Regarding: ADDENDUM to the 2009 Environmental Assessment Document
Fundy Tidal Energy Demonstration Project

On behalf of FORCE, AECOM is pleased to submit the enclosed report entitled Environmental Assessment Addendum to the report: Environmental Assessment Registration Document – Fundy Tidal Energy Demonstration Project, Volumes 1 and 2 dated July 21, 2010.

This Addendum focuses on the description and assessment of changes to the project that have occurred since the project was approved in September 2009. It has been prepared as per your request to support your review of the project environmental assessment to enable release of federal funding. The principle changes since initial approval are the relocation of the shore facility approximately 200 m east of its original site and, in response to a request by Nova Scotia Department of Energy, inclusion of a fourth berth and cable within the approved Crown Lease area. In addition, an overland power transmission line alternative under consideration by FORCE is currently being assessed. The assessment for this preferred alternative will be submitted under separate cover.

Should you have any questions related to the information above or the contents of the enclosed document, please do not hesitate to contact the undersigned at 428-2029.

Sincerely,
AECOM Canada Ltd.

Russell Dmytriw, P.Geo.
Senior Project Manager, Environment
russell.dmytriw@aecom.com

RD:kv
cc: Doug Keefe, FORCE (electronic version);
J. Kozak, FORCE

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1. Introduction

The Fundy Ocean Research Centre for Energy (FORCE; the Proponent) will construct, operate and decommission a Tidal Energy Demonstration Facility in the Minas Passage, near Parrsboro, Nova Scotia (Figure 1-1). The Project consists of multiple subsea turbine generators, subsea cables connecting the turbines to land-based infrastructure, an onshore transformer substation, and power lines connecting to the local power distribution system.

The Project was assessed under a joint federal – provincial Environmental Assessment (EA) review process and was subject to federal and provincial environmental approval in accordance with the following legislation:

1. *Canadian Environmental Assessment Act* (*CEAA*): pursuant to Section 5(1)(d) of *CEAA*, Fisheries and Oceans Canada (DFO) and Transport Canada (TC) were required to issue permits to enable the Project to proceed; and
2. Environmental Assessment Regulations: pursuant to Schedule A of the provincial regulations under the *Environment Act*, registration as a Class 1 Undertaking was required.

The Project received EA approval on September 15, 2009. The Proponent, as part of the EA approval for the Project, was required to meet Terms and Conditions, provided by Nova Scotia Environment (NSE). The Terms and Conditions for EA Approval are included in Appendix A of this EA Addendum Report. Since the Project was approved, construction began with installation of the first turbine on November 12, 2009 by Nova Scotia Power Inc., and commencement of land-based facilities in February 2010.

In January 2010, Natural Resources Canada (NRCan) awarded funding for the Project through the federal Clean Energy Fund (CEF) Program. In accordance to Section 5(1)(b) of the *CEAA*, NRCan is required to conduct a screening level environmental assessment of the Project prior to releasing funds. It is understood that the scope of NRCan's assessment will include all aspects of the Project as proposed, including those aspects approved in September 2009. Furthermore, it is understood that NRCan will prepare an Environmental Screening Report based on the original environmental assessment, plus new information gathered in the Project area since 2009.

As a result of negotiations with landowners, the location of the landfall and land-based facilities has changed from what was originally proposed and approved in the *Environmental Assessment Registration Document – Fundy Tidal Energy Demonstration Project* (AECOM 2009). Subsequently, the Nova Scotia Department of Energy asked FORCE to develop a fourth subsea grid connected berth within the approved Crown Lease area. This EA Addendum Report has been prepared to support NRCan's environmental assessment process, describe the changes to the Project, and assesses any potential environmental effects that may arise as a result of the changes. The Province of Nova Scotia was advised of the location changes in a letter to Mr. Peter Geddes of Nova Scotia Environment, dated February 5, 2010, and was advised of the Department of Energy's request for a fourth berth in a letter to Mr. Peter Geddes dated July 7, 2010. A copy of relevant correspondence is provided in Appendix B. The combined total production rating of the four turbines will remain below 5.0 MW, the limit for a Canadian Environmental Assessment Act Screening Level EA.

In addition to describing and assessing changes to the Project, this EA Addendum Report also summarizes the supplementary baseline studies that have been conducted since the September 2009 approval. The additional studies are appended to this report.

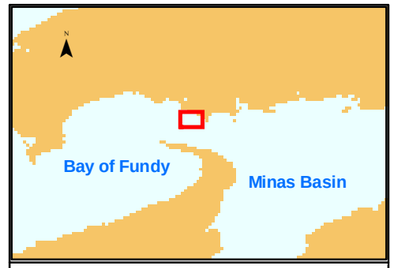
This EA Addendum Report is organized to describe the changes to the Project and to reflect the process by which the assessment of the changes has been conducted. This report does not include a discussion or assessment of the proposed Parrsboro Power Transmission Line Project as the study is still underway and it will be filed separately later this summer.

- Section 1.0 introduces the Project, provides a brief history, and describes the need for the EA Addendum Report.
- Section 2.0 describes the changes to the Project from what was originally proposed and approved including changes to location, components, activities, emissions and discharges and potential malfunctions and accidental events, as appropriate.
- Section 3.0 describes the existing terrestrial, marine and socio-economic characteristics of the new location for the landfall and land-based facilities.
- Section 4.0 provides the results of the environmental effects assessment for the valued environmental components (VECs) affected by the Project changes.
- A summary of the EA Addendum Report and conclusions are presented in Section 5.0.
- A summary of additional / post-EA studies is provided in Section 6.0 and a copy of the studies are appended to this Report.
- Section 7.0 details literature and personal communications cited in the report.

Given that changes to the Project are limited to the addition of a fourth berth and cable and moving the location of landfall 200 m east of the original site, re-assessment of cumulative environmental effects and effects of the environment on the Project is not warranted.

Figure 1-1 Project Location

388000
389000
390000
5026000
5025000
45°22'30"N
45°22'0"N
64°26'0"W
64°25'30"W
64°25'0"W
64°24'30"W
64°24'0"W
N
Wetlands
West Bay Road
Black Rock
Crown Lease Deployment Area
Area: 0.479 km²
Perimeter: 3.910 km
Potential New Berth D
D
B
A
C
Potential
New Berth C
Locations
Area: 1.6 km²
Perimeter: 5.2 km
0 100 200 400 600
Metres
1:10,000



LEGEND

- Potential Route To Berth D
- Potential Berth D
- Potential New Berth C Locations
- Legal Bounds
- Brook
- Crown Lease Corridor
- Proposed Cable Vaults
- Onshore Cable
- Route to Site A
- Route to Site B
- Route to Site C
- Buildings
- Proposed Interpretation Centre

Turbine Generator Berths
- A
- B
- C

- Wetland
- Gravel Bar
- Salt / Fresh Water Marsh
- Salt Marsh
- Pond And Stream
- Crown Lease Deployment Area

GEODETIC INFORMATION

Datum:	WGS84
Spheriod:	WGS84
Semi Major Axis:	6378137.000
Inv. Flattening:	298.257224
PROJECTION PARAMETERS	
Projection:	Universal Transverse Mercator (UTM), Zone 20 North
Latitude of Origin:	0° 0' 0"
False Easting:	500,000 m
False Northing:	0 m
Central Meridian:	63° West
Grid Units:	meters
Scale Factor at Central Meridian:	0.9996

NOTES

1) Line work taken from Survey Plan: E-101 REV3 Dated Feb 8, 2009
2) Engineered routes from International Telecom.
3) Potential route to berth D has NOT been engineered.
4) Revised from Environmental Assessment Registration Document - Fundy Tidal Energy Demonstration Project Volume 1: Environmental Assessment, Figure 1-1.

FIGURE 1-1

FORCE

FUNDY OCEAN RESEARCH CENTRE FOR ENERGY

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RevNo.	Revision		Signed	Date
A	DRAFTFORREVIEW			4Feb10
1	ADDEDENGINEEREDRTS			4Feb10
2	UPDATEDVAULTLOCATIONS			1Feb10
3	ROUTEEDIT			1Feb10
4	ADDEDBROOK			12Feb10
5	UPDATEDROUTEA			30Mar10
6	UPDATEDFORBERTHD			20Jul10
GSAA	CHECKED			
	APPROVED			

Map #: SEG-612-FORCE-004-6

2. Description of Project Updates

2.1 Revised Project Location

The Proponent has revised the location of the landfall portion the Project. Figures 1-1 and 2-1 display the revisions. The 200 m shift in location is not considered to be substantial; for the most part potential impacts at the new location are consistent with the analysis and conclusions presented in the original EA (AECOM 2009). The new location has been assessed from technical, biophysical and socio-economic perspectives. This section of the EA Addendum provides a summary comparison of the new location with the location presented in the *Environmental Assessment Registration Document – Fundy Tidal Energy Demonstration Project* (AECOM 2009).

2.1.1 Land-Based Facilities

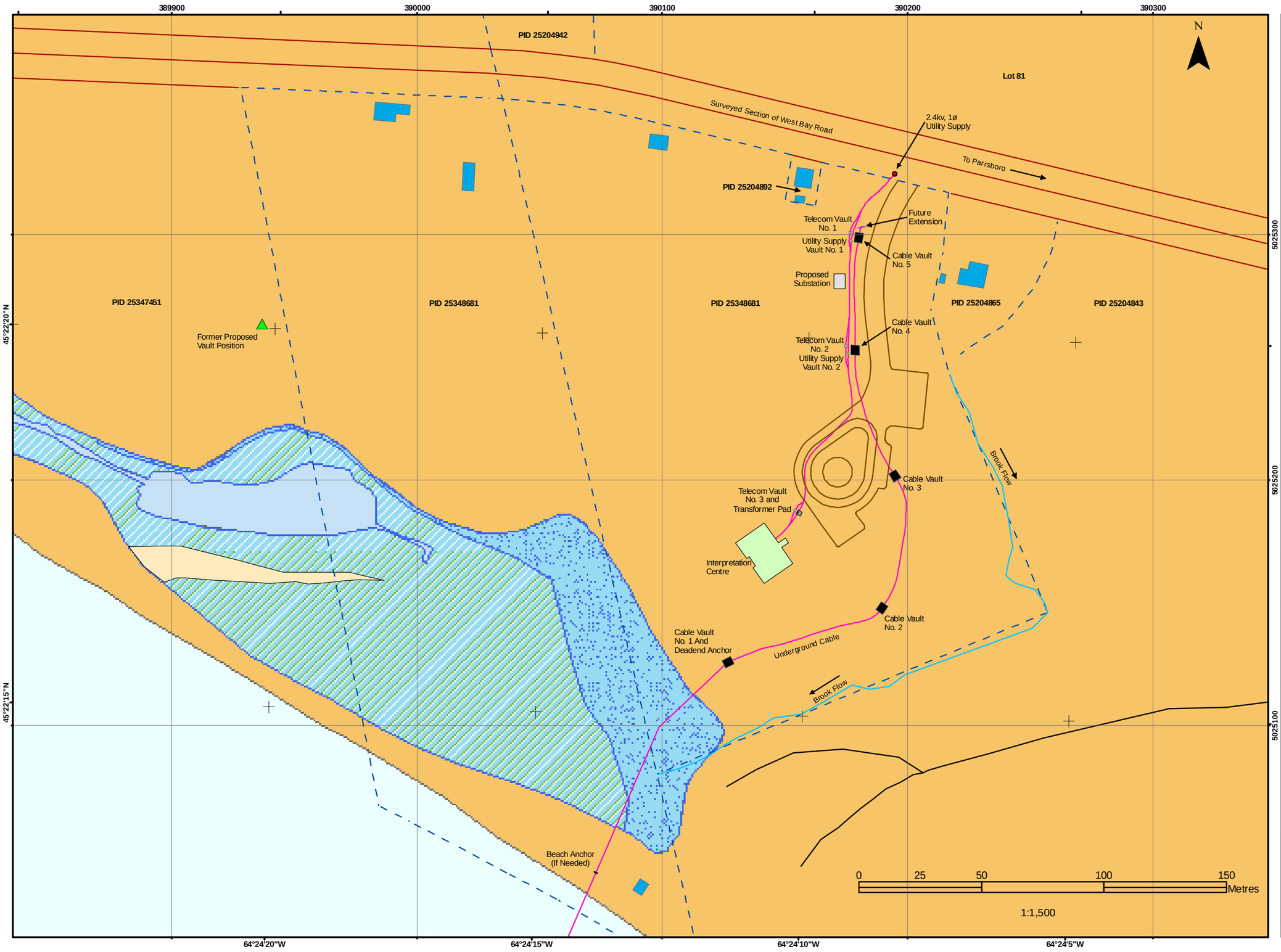
As a result of landowner negotiations, the location of the land-based facilities has changed from what was originally proposed and approved in September 2009. The new location (Figure 2-1), located on a leased parcel of land (PID 25348681), is approximately 200 m east of the original site described in Section 2.2 the EA Registration Document (AECOM 2009). The new site for the land-based facilities is located approximately 10 km west of the Town of Parrsboro, Nova Scotia on West Bay Road. The site is situated on a relatively flat promontory that overlooks the water site in the Bay of Fundy where the Tidal Energy Demonstration Facility tidal in-stream energy conversion (TISEC) generators are located. The landfall site is approximately 22 m above sea level and affords magnificent views to the south and west of the Bay. This property is an unoccupied lot.

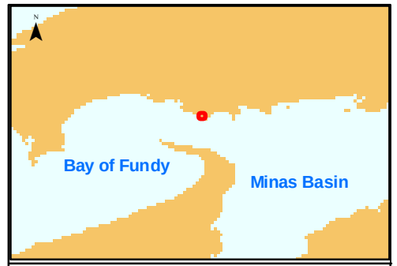
The majority of the promontory is densely vegetated (Figure 3-1) and a treed buffer will be maintained surrounding the facilities. Unchanged from what was approved in September 2009, the site plan features an onshore building, substation, a short entry road, and parking lot. Approximately 2 ha of the terrestrial site will require site preparation for construction of the land-based facilities. The size of the parking lot (for approximately 16 vehicles and one (1) tour bus) and entry road, approximately 0.11 ha (1,115 m^2), also remain unchanged. The driveway will be configured as a turnaround loop so that busses can exit without the need for reversing. The onshore building for the Project will serve as the main public access point for education and information regarding the ongoing testing and trials of Tidal In Stream Energy Conversion (TISEC) turbines in the Bay of Fundy.

The building footprint will be relatively small, with an area of 0.028 ha (277 m^2). It will combine a space of 0.016 ha (160 m^2) for interpretive exhibitions and research, a space of 0.0032 ha (32 m^2) for community and meeting space, and the remainder for entry, small office, washrooms and circulation. The building is located approximately 130 m from the nearest residence, while the entry road is located within 30 m of the nearest residence. Limited and intermittent construction activities will occur during the construction of the land-based facilities for the Project, such that any landowner concerns regarding Project-associated noise or aesthetics will be considered and discussed with landowners on a case by case basis, if required.

The building will function primarily to demonstrate the latest technology in tidal power generation and the science of the Bay of Fundy. Visitors will include not only the public, but educators and visitors with a professional interest in tidal power generation. The research space will assist researchers who have a direct interest in the Project. Although the building will have a limited life span associated with the “demonstration” nature of the Project, it will incorporate a number of sustainable features. The major feature will be the modular, demountable design of the walls and roof. This will allow for the building to be easily dismantled and reused elsewhere, with very limited generation of waste material. The building will also make full use of the south and west orientation for solar heating and daylight harvesting. Both the roof and roadway drainage will be led to a stormwater retention pond in the middle of the turnaround loop. Stormwater will seep down to the water table which is located approximately 5 m below the ground surface.

Figure 2-1 Site Plan





LEGEND

Former Proposed Vault Location

- Utility Pole
- Brook
- Roadway
- Driveway
- Legal Bounds
- Proposed Onshore Cable
- Provincial Roads
- Proposed Utility Vaults
- Proposed Telecom Vaults
- Proposed Cable Vaults
- Proposed Transformer Pad
- Buildings
- Gravel Bar
- Salt / Fresh Water Marsh
- Salt Marsh
- Pond And Stream
- Proposed Substation
- Proposed Interpretation Centre

GEODETIC INFORMATION

Datum:	WGS84
Spheriod:	WGS84
Semi Major Axis:	6378137.000
Inv. Flattening:	298.257224
PROJECTION PARAMETERS	
Projection:	Universal Transverse Mercator (UTM), Zone 20 North
Latitude of Origin:	0° 0' 0"
False Easting:	500,000 m
False Northing:	0 m
Central Meridian:	63° West
Grid Units:	meters
Scale Factor at Central Meridian:	0.9996

NOTES

1) Line work taken from Survey Plan: E-101 REV 3 Dated Feb. 8, 2009
2) Engineered routes from International Telecom.
3) Revised from Environmental Assessment Registration Document - Fundy Tidal Energy Demonstration Project Volume 1: Environmental Assessment, Figure 2-5.

REVISED FIGURE 2-5

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Rev No.	Revision	Signed	Date
A	DRAFT FOR REVIEW		31-Dec-09
0	ISSUED FOR USE		8-Jan-10
1	CHANGED TITLE		4-Feb-10
2	ENGINEERED RTS & VAULT LOCATIONS		12-Feb-10
3	ADDED BROOK		12-Feb-10
4	ADDED PROPOSED SUBSTATION		26-May-10
GIS:AA	CHECKED		

Map #: SEG-612-FORCE-003-4

The land-based components of the Project will also include an intertie substation designed to house a line-up of 13.8 kV switchgear, the monitoring / SCADA equipment, and basic building services electrical equipment. The substation will be located approximately 75 m south of West Bay road, although the final design may move this small building elsewhere on the property. At this time the dimensions of the substation pad are estimated to be approximately 100 m by 60 m. The substation will provide space for the device developers' power conversion equipment, the substation transformer and 35 kV switchgear and isolating switch. The intertie substation will have an overall 5/6.67 MVA power delivery capacity, designed and constructed to meet all relevant Canadian, Nova Scotia, and municipal codes and standards of design and construction.

The new site for the land facilities also marks the revised landfall location of the subsea power cables (shifted slightly east - see Section 2.1.2 Marine Facilities below). The cables will follow a revised new cable corridor extending through the intertidal zone to the substation and will feed generated power to the electrical grid (Figure 2-1). The connection to the local power utility distribution system will be via a 35 kilovolt (kV) 133% EPR installation buried power line providing a connection to the local 25 kV distribution line along West Bay Road. It is noted that FORCE is currently considering construction of a new 69 kV transmission line to carry electricity generated by the subsea turbines overland to Parrsboro. In support of this alternative, FORCE has commissioned the preparation of an Environmental Assessment, including environmental baseline studies, as this is currently FORCE's preferred alternative. A Project Description Document for this alternative has been submitted to NRCan for regulatory review. For clarity, this EA Addendum report maintains the project as originally proposed and describes the project as connecting to the distribution line along West Bay Road at the new landfall location since this alternative also remains under consideration by FORCE. Regardless of the method for grid connection, the cables are designed for either AC or DC operation.

As with the cable route planning undertaken for the route proposed in 2009, routing for the current subsea and terrestrial cable corridors considered environmental constraints, technical constraints and features, and constructability issues. Based on the most recent design information, the cable corridor will occupy a terrestrial area of approximately 0.6 ha (50 m corridor width and 120 m length) prior to passing through the intertidal zone. The cable corridor was chosen to cross the salt marsh / wetland area over the shortest possible distance however total avoidance is not possible due to the steep sided volcanic structure immediately east of the wetland (Figure 2-1). This structure consists of very hard exposed bedrock that prevents the installation of cables in the immediate vicinity (International Telecom 2010). The cable footprint through the wetland area is estimated to be approximately 0.0165 ha (165 m^2; 33 m long by 5 m wide); comprised of four (4) independent trenches through the salt marsh, each approximately 0.5 m wide by 1 m deep and spaced approximately 1 m apart; however the total affected area may be greater than 0.016 ha due to the potential for sloughing of wetland materials into the excavated trench. Although not all wetland habitat could be avoided, the affected area is minimized, the appropriate protection measures will be used to limit impacts on the wetlands and a wetland compensation plan with the appropriate level of compensation for the total area affected will be developed, as required, in consultation with Nova Scotia Environment (NSE) and Nova Scotia Department of Natural Resources (NSDNR) and other regulatory agencies as appropriate (*i.e.,* Environment Canada).

2.1.2 Marine Facilities

The location of the fourth berth and cable requested by the Nova Scotia Department of Energy is shown on Figure 1-1. It is important to note that these berth locations are not fixed, as these are 200 m diameter circles intended to guide turbine developers in selecting a preferred site within the approved Crown Lease Deployment Area shown on Figure 1-1. As an example, Figure 1-1 illustrates two potential alternate berth locations for Berth C that are currently being considered by FORCE and the developer.

The change in location of the land-based facilities from that originally approved in 2009 also necessitated a relocation of the associated subsea cable corridor routes extending from the turbine berths to landfall. The revised routes (Figure 1-1) are shifted approximately 200 m east of the original routes presented in Section 2.2 the EA Registration Document (AECOM 2009). Based on the most recent design and routing information, the four (4) subsea cables will together occupy an area of approximately 0.20 ha or 0.05 ha more than the previous estimate.

2.2 Cable Installation Activities

Additional details regarding the cable installation have been developed, although the general approach to cable installation remains unchanged from that which was approved in September 2009. The preferred approach to cable installation begins the installation at shore and extends the cables out to the berths. Installation of "outbound" cables to the distribution or transmission line will begin at the onshore Cable Vault No. 5, as displayed in Figure 2-1. Cables will be placed in a trench extending through a number of onshore vaults (Cable Vault No. 5 through Cable Vault No. 1) to an area just above the low tide water level, as opposed to from a single vault as presented in 2009.

To bring the submarine cables ashore, "deadman" anchors will be installed in the intertidal zone to hold the barge in place as the tide comes in (tugs cannot be alongside). In total, six (6) heavy concrete blocks (deadman anchors) will be (temporarily) buried under the beach in advance of cable installation activities, two (2) blocks may be close to the high tide mark, two (2) abeam of the barge's mid-ship area and two (2) astern of the barge (likely close to the low water mark). The final anchor locations will be determined by the tug type and their draft requirements at high tide. Anchors will be removed once construction is the nearshore area is complete.

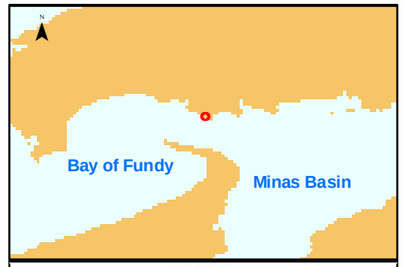
Cable installation in the intertidal zone will require crossing of the beach and a portion of the wetland. The beach access required for this activity is shown in Figure 2.2 .The barge will beach at the same location for the installation of all four subsea cables, using the same anchors each time. The barge beaching point has been selected on a relatively flat area. All six (6) anchors will be removed following the installation of the cables.

Once the barge begins to unreel the cable and move away from the shoreline, the cables laid in the intertidal zone will need to be moved to the side to prevent the barge from resting on it when the barge returns to shore to install the next cable. From the intertidal zone, the cables will be winched to Cable Vault 1. Once all four subsea cables are installed, they will be placed into individual trenches, extending from the manhole (Cable Vault No. 1) through the wetland. Four subsea cables will be laid in individual trenches from the nearshore area to Cable Vault No. 1 (Figure 2-1), while one single cable will be laid in a single trench for the remainder of the route from Cable Vault No. 1 to Cable Vault No. 5.

Below the low water mark, a steep scarp is present along the coast of the study area. This scarp must be crossed by the cables to access the turbine deployment area. The subsea cables will be laid at a right angle down the steep slope to minimize the potential for slumping. In contrast, the route approved in the 2009 EA Registration Document followed the top of the scarp in approximately 5 to 6 m water depth, leaving this section of the cable potentially vulnerable to damage by large pieces of ice rafting up on the shore line. The new cable route descending directly down the slope is considered to be safer, as deeper water is attained more quickly. Although the scarp area directly in front of the new landing site shows signs of submarine slumping, it is the opinion of the cable installer International Telecom, that the new route will offer a safer, shorter way down the slope. In addition, as the remaining slope is not very high, any future slumping should be minimal and would not threaten the integrity of the double armored cable (International Telecom 2010).

Figure 2-2 Beach Access

389900
390000
390100
390200
5025100
5025000
45°22'15"N
45°22'10"N
64°24'20"W
64°24'15"W
64°24'10"W
N
Interpretation Centre
Cable Vault No. 2
Cable Vault No. 1 And Deadend Anchor
Underground Cable
Brook Flow
Mid swamp turn N45 22.247' W64 24.21'
Beach Anchor (If Needed)
Barge Beaching Point N45 22.1864' W64 24.2456'
A
B
C
D
E
F
G
H
Approximate Lower Low Water Mark
Potential Route to Berth D
Route to Berth B
Route to Berth C
Route to Berth A
0 10 20 40 60 Metres
1:1,000



LEGEND

- Barge Anchor Locations
- Approximate Lower Low Water
- Engingeered Routes
- Potential Route to Berth D
- Brook
- Legal Bounds
- Proposed Interpretation Centre
- Proposed Cable Vaults
- Proposed Onshore Cable
- Provincial Roads
- Buildings
- Gravel Bar
- Salt / Fresh Water Marsh
- Salt Marsh
- Pond And Stream
- Disturbed Areas Around Cables and Anchors

GEODETIC INFORMATION

Datum:	WGS84
Spheriod:	WGS84
Semi Major Axis:	6378137.000
Inv. Flattening:	298.257224

PROJECTION PARAMETERS

Projection:	Universal Transverse Mercator (UTM), Zone 20 North
Latitude of Origin:	0° 0' 0"
False Easting:	500,000 m
False Northing:	0 m
Central Meridian:	63° West
Grid Units:	meters
Scale Factor at Central Meridian:	0.9996

NOTES

1) Line work taken from Survey Plan: E-101 REV 3 Dated Feb. 8, 2009
2) Engineered routes from International Telecom.
3) Anchor Locations from International Telecom.
4) Lower low water mark is an approximation only.
5) Potential Route to Berth D has NOT been engineered.

BEACH ACCESS

Submitted for:

FORCE

FUNDY OCEAN RESEARCH CENTRE FOR ENERGY

Submitted by:

AECOM

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http://www.seaforthengineering.com/

Rev No.	Revision		Signed	Date
A	DRAFT FOR REVIEW			6-May-10
B	ADDED AREA FOR PATH TO BEACH			11-May-10
C	UPDATE FOR BERTH D			20-Jul-10
GIS:AA	CHECKED			
	APPROVED			

Map #: SEG-612-FORCE-014-C

From the barge beaching point, the four (4) subsea cables will descend the scarp and will gradually separate from one another on their routes to their respective turbine berths (Figure 1-1).

Updates to the Project presented here (*i.e,* revised Project location, fourth berth, additional Project construction details) do not represent substantive changes in Project emissions and discharges or potential malfunctions and accidental events from what was originally proposed and approved (Sections 2.6 and 2.7) in the EA Registration Document (AECOM 2009).

2.3 Project Schedule

The following is an update to the Project schedule provided in the original EA Report (AECOM 2009).

Table 2-1 Revised Project Schedule

Activity	Original Schedule	Revised Schedule
Deployment of the NSPI (OpenHydro) Turbine	Sept./Nov. 2009	Q4 - 2009
Begin construction of the onshore electrical facility	Aug./Sept. 2009	Q1 2010 to Q2 2011
Construction of power line and connection of electrical facility to the NSPI power line	Mar. 2010	Q1 & Q2 - 2011
Installation of subsea cables	Aug.- Oct. 2010	Q2 - 2011
Turbines deployed and connected to cables	Aug.-Sept. 2010/2011	Q3 – 2011 and Q3 & Q4 - 2012

3. Description of Existing Environment for Revised Project Location

3.1 Terrestrial and Intertidal Environment

3.1.1 Intertidal Environment

Initial botanical surveys of the new location of the terrestrial facilities were conducted on October 2, 2008, and June 11 and August 26, 2009 by botanist Jim Jotcham of Marbicon Inc. Subsequently, wetland delineation was performed on September 20, 2009 by Jim Jotcham of Marbicon Inc. assisted by Heather Levy of Envirosphere Inc. The full wetland delineation report (Marbicon Inc. 2010) is included in Appendix C of this report, containing site photographs, routine wetland determination forms, vegetation inventory, wetland inventory and data point and boundary point locations.

The terrestrial Project area includes a variety of habitats (see following Section 3.1.2 Terrestrial Wildlife and Wildlife Habitat), including upland softwood forest just south of West Bay Road, leading to an escarpment that drops to a salt marsh located behind a barrier beach. Part of the upland area includes cleared fields. There are at least three (3) gullies that discharge intermittently into the salt marsh, each braiding out into a high shrub zone (mostly chokecherries (*Prunus virginiana*) and alders (*Alnus spp.*)). The first two (2) gullies on the west side of the Project site are sharply defined with steep walls, much of which are bare of vegetation. The gully to the east is broader, more like a ravine, and the surrounding slopes are less steep, allowing forest cover down to the stream banks. The stream in the ravine on the east side is a woodland stream, albeit joining the salt marsh is a similar fashion to the two (2) gullies, through a high shrub zone dominated by speckled alders and occasional chokecherries. The shrub zone for this stream was not contiguous to that of the two (2) western gullies, but the botanical structure observed was similar. A small pond (appearing to be man-made) exists on the west side of the ravine, at the end of a woods road.

All surface water on the Project site flows south to the salt marsh. The salt marsh lies between the upland areas and an exposed barrier stony / gravel beach and contains a small pond that discharges through a narrow stream to the Bay of Fundy. As described in Section 3.3.1.3 Fish Habitat of the EA Registration Document (AECOM 2009) the narrow stream is a salt marsh drainage channel, extending from the salt marsh pond to the ocean, and is considered to be intertidal fish habitat.

The wetland delineation was conducted in accordance with the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). Jurisdictional wetland boundaries were delineated through aerial photograph interpretation and single point wetland analysis. Wetland data were recorded on Sample Wetland Delineation Data Sheets. Munsell Soil Color Charts (X-Rite Inc. 2000) were used to aid in identifying hydric soils in the field. The *Flora of Nova Scotia* (Zinck 1998) aided with plant nomenclature and identification.

Delineators walked throughout the Project site to determine the location of jurisdictional boundaries. Four (4) single data point locations were sampled to evaluate whether or not the vegetation, hydrology, and soils data supported a determination of wetland or non-wetland status. The location of these data points was recorded with a Garmin XL12 GPS receiver capable of sub 5 m accuracy. Points were averaged to achieve the most accurate reading possible. The estimated boundary was flagged with pink “wetland delineation” tape, each visible from the other, and marked with the GPS. The area of wetland was estimated using MapInfo using all marked points.

Approximately 2.25 ha of jurisdictional wetland waters of Nova Scotia were mapped for the Project site (Figure 3-1; yellow dots depict sample point locations). This only includes that portion of the salt marsh and steams / gullies within the property boundaries.

Figure 3-1 Wetland Boundaries on Project Site (Marbicon 2010)

Legend

Blue lines are the wetland boundaries covering approximately 2.25 hectares. The yellow dots are the soil sample test pit locations.

Fundy Tidal Energy Demonstration Facility EA Addendum

Figure 3-1 Wetland Boundaries

Prepared for:

FORCE

Prepared by:

Jim Jotcham, Marbicon Inc.

From: Wetland Delineation for Fundy Tidal Power Demonstration Site – Shore Facility, Cape Sharp, Cumberland County, Nova Scotia

Dated: February 23, 2010

The revised location of land-based facilities has three (3) interconnected wetland habitats. These consist of the salt marsh, the flood plains of the intermittent streams that discharge to the marsh, and a seepage area (fen) behind a cabin located by West Bay Road, draining westerly into the central gully. A small aquatic habitat (pond) is also located just west of the eastern stream beside the woodland, at the end of a woods road.

Within the salt marsh, the species composition gradually changes from halophytic vegetation by the pond, to fresh water species at the upper reaches of the marsh. Hydrophytic vegetation dominates the site. Wetland /salt marsh hydrology indicators observed on the Project site included water saturation and surface water. The salt marsh is a depression receiving runoff from adjacent slopes.

Within the stream flood plains, hydrophytic vegetation is the dominant type. Stream flood plain (wetland) hydrology indicators observed on the Project site included water saturation and surface water.

Within the seepage area (a fen), hydrophytic vegetation dominates the site. Seepage area (wetland) hydrology indicators observed on the Project site included drainage patterns, geomorphic position, and microtopographic relief. The area was otherwise dry during the site survey on September 20, 2009.

Descriptions of the beach and fish habitat presented in Section 3.3.1.2 Beach and Beach Ridge Complex and Section 3.3.1.3 Fish Habitat of the EA Registration Document (AECOM 2009) remain valid for the new terrestrial Project location and so are not reproduced in this Addendum.

3.1.2 Terrestrial Wildlife and Wildlife Habitat

Botanical surveys of the new location of the terrestrial facilities were conducted by a botanist on October 2, 2008, and on June 11, August 26 and September 22, 2009. All parts of the site were examined from West Bay Road down to the shore. No quantitative sampling was performed. Due to the small size of the site, no specific sampling pattern was utilized. The full botanical report (Marbicon Inc. 2009) is included in Appendix D of this report, and contains site photographs and a complete list of plant species observed during surveys. A total of approximately 160 plant species were recorded. No native species had other than a Green NSDNR rank.

The terrestrial area of the Project contains several distinct plant communities. Bordering the Bay of Fundy is an exposed barrier stony / gravel beach dominated by low shrubs, such as chokecherry (*Prunus virginiana*) and Virginia rose (*Rosa virginiana*). The raised beach protects a small saltwater pond which is surrounded by a salt marsh. Typical salt marsh plants such as cordgrasses (*Spartina spp*.) are observed close to the pond, and above the drift line freshwater species such as cat-tails (*Typha latifolia*) become abundant. The dominant graminoid between the pond and the cat-tails is Chaffy sedge (*Carex palacea*).

The shore area immediately above the saltwater pond and salt marsh, on the west side of the Project site, is a high shrub community dominated by chokecherries and speckled alder (*Alnus incana*). On the east side of the Project site the salt marsh meets forest. Both the high shrub and forest communities rise up over the escarpment that dominates the Project site.

A number of additional distinct plant communities are present above the escarpment, including old fields, residential areas with mowed lawns, and a small number of forested areas. A gully leads from the central upper portion of the Project site and flows down through the escarpment to the lower salt marsh. Running water was observed discharging through the gully to the salt marsh. Sides of the gully are rocky with occasional cover such as buttercups (*Ranunculus repens*), various ferns, and red raspberry (*Rubus idaeus*). Solitary roseroot plants (*Sedum rosea*) were also occasionally noted along the banks. A second gully was observed to the west, but was not sampled separately. It also has a stream with running water and a similar floristic composition.

The west forest area is quite open, with occasional white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*) intermingled with speckled alders. The east upland softwood forest is a dense conifer forest dominated by white spruce and balsam fir between the road and the escarpment. Below the escarpment the forest opens into an open deciduous / mixed forest with white and yellow birches (*Betula allegheniensis* and *B. papyrifera*) and shrubs such as speckled alder and chokecherry.

No wildlife was observed during the 2008 and 2009 botanical surveys, although white-tail deer tracks (*Odocoileus virginianus*), a provincially green-listed species, were observed in the eastern forest stand. The descriptions of wildlife which are known to be supported by old field and alder growth plant communities presented in Section 3.3.2 Terrestrial Wildlife and Wildlife Habitat of the EA Registration Document (AECOM 2009). These descriptions remain valid for the new terrestrial Project location and are not reproduced in this Addendum.

3.1.3 Terrestrial Birds

Preliminary incidental observations of coastal birds were undertaken in 2008 as a part of field observations of the Project site and are presented in Section 3.3.2 Terrestrial Wildlife and Wildlife Habitat of the EA Registration Document (AECOM 2009). No surveys were undertaken at that time for migratory birds above the low tide level or for birds in the intertidal areas and terrestrial portions of the Project site.

In response to a commitment made in the 2009 EA Registration Document, additional field surveys by qualified biologists were undertaken for terrestrial breeding birds on June 11 - 12 and 19, 2009; and incidental observations of terrestrial birds and coastal bird surveys (shorebirds, waterfowl, seabirds and raptors) were carried out on July 20, August 12 - 13 and September 4, 2009, to provide additional baseline information for the Project. As noted in the June – September 2009 survey summary report by Envirosphere Consultants Limited, the location of the land-based facilities was moved in late 2009 and surveys carried out in 2009 covered an area broad enough to include the new facility location. The full survey summary report (Envirosphere Consultants Limited 2009a) is included in Appendix E of this report, including survey methods used, species lists and breeding status, and figures depicting terrestrial habitat types surveyed.

The breeding status of 50 bird species observed in or near the Project area over the course of the summer was surveyed and recorded. In summary, four (4) bird species were confirmed as breeding, 13 as probable breeding and 19 as possible breeding. Coastal surveys of the intertidal shore, brackish ponds and nearshore waters near the area of the proposed land-based facilities indicated small numbers of shorebirds foraging during the key migration period, suggesting the Project area is not important for these species. The peregrine falcon (*Falco peregrinus anatum*), a provincially red-listed species, was not observed during the surveys, although individuals are likely to forage in the area. A single common loon (*Gavia immer*), a provincially yellow-listed species, was noted in water along the shore during the August and September coastal surveys, but is not likely to be impacted by construction of the land-based facilities or cable installation due to the relatively low density of this species, compared with other coastal environments where greater numbers congregate. The low density suggests the Project area is not of particular importance to the species. The common loon was also observed in the Project area during the 2008 field observations of the previous Project site (AECOM 2009).

The survey determined that the area proposed for land-based facilities supports a normal range of species and activity of terrestrial birds, shorebirds and coastal birds. No species of particular conservation significance were identified to be breeding or commonly occurring on the Project site. As committed to in the EA Registration Document (Section 6.8 Terrestrial Species at Risk), certain Project activities should be undertaken at times which will avoid critical periods of nesting for terrestrial birds including the peregrine falcon (May - August period) and shorebirds (late-July to mid-August) periods. Maintenance clearing in the Project area will be prioritized to occur

outside of the breeding season for most species of birds (April 1st to August 15th). If maintenance clearing is required prior to August 15th, the Project area will be surveyed for breeding activities no more than one week prior to the beginning of Project activities (AECOM 2009).

3.1.4 Terrestrial Species at Risk

No rare or plants species of conservation concern or special habitats were identified on the site during surveys conducted on October 2, 2008, and on June 11, August 26 and September 22, 2009. A total of 160 plant species were recorded. No native plant species had other than a Green NSDNR rank.

No wildlife was observed during the 2008 and 2009 botanical surveys, although white-tail deer tracks (Green NSDNR Rank) were observed in the eastern forest stand. The peregrine falcon (Red NSDNR Rank) was not observed during the August and September 2009 coastal surveys, although a few are likely to forage in the area, however, a single common loon (Yellow NSDNR Rank) was noted in waters along the shore. The common loon was also observed in the Project area during the 2008 field observations (AECOM 2009) and 2009 field observations (Envirosphere Consultants Limited 2009f).

The description presented in Section 3.3.3 Terrestrial Species at Risk of the EA Registration Document (AECOM 2009), remains valid for the new terrestrial Project location.

3.2 Marine Environment

3.2.1 Seabed Characteristics and Biological Communities

Baseline video and photographic surveys were conducted in late 2009 for the revised cable landfall location and new subsea cable corridor connecting the original three turbine berths to the intertidal area. The surveys were taken to obtain detailed site-specific information on seabed characteristics and biological communities in parts of the Project area which were not covered in the 2008-2009 baseline video and photographic surveys (Envirosphere Consultants Limited 2008a & 2008b; Envirosphere 2009e). In contrast, the description of the seabed characteristics and biological communities for the turbine berths presented in Sections 3.1.4 (Geology), 3.1.5 (Bathymetry) and 3.2.5 (Marine Benthos) of the original EA Registration Document remain valid and unchanged (AECOM 2009).

The surveys took place in 2009 using the *Tide Force*, a 50 foot lobster boat operated by Mr. Mark Taylor of Halls Harbour, Nova Scotia. For positioning, a DGPS and computer navigation software operated by Seaforth Geosurveys, Dartmouth, Nova Scotia was used to acquire and log position information. The four (4) full survey reports are included in Appendix F of this report, containing maps of station locations and image captures:

- Seabed Video and Photographic Survey – Nearshore Cable Route Stations (Envirosphere Consultants Ltd. 2010a)
- Seabed Video and Photographic Survey – Berth “A” and Cable Route (Envirosphere Consultants Ltd. 2010b)
- Seabed Video and Photographic Survey – Berth “B” and Cable Route (Envirosphere Consultants Ltd. 2010c)
- Seabed Video and Photographic Survey – Berth “C” and Cable Route (Envirosphere Consultants Ltd. 2009b)

Although the newly requested fourth berth location was not specifically surveyed in the studies referenced above, the seabed geology and benthic diversity within the Crown Lease have been well characterized in the seven studies conducted between 2008 and 2010, sufficient to assess the incremental effects of a fourth berth and cable. AECOM also notes that if a fourth turbine is eventually deployed, the berth developer will be required to obtain a HADD authorization under the *Fisheries Act* as well as a permit pursuant to the *Navigable Waters Protection Act* and to

implement the environmental effects monitoring programs that will be imposed as a condition of such and authorization.

Nearshore Cable Route Stations

The survey of the nearshore Project area took place on August 4, 2009. The approach of the transmission cable to the landfall site crosses the platform and outer edge of the nearshore shelf. The shelf is underlain by mainly stratified glaciomarine sediments with a surface layer of coarser sediments (AMGC 2009). Biological communities observed during the survey appeared similar to those observed in surveys undertaken in 2008 (Envirosphere Consultants Limited 2009e; Stewart 2009) on the shelf in the vicinity of the previous cable route to the west (Section 3.2.5 Marine Benthos; AECOM 2009), except that a widespread, moderate to low density kelp bed was identified at the new site in the immediate subtidal zone in 2009. Depths sampled were from mean low water (MLW) to about 8 m below MLW, determined from a digital elevation model (Seaforth Engineering, Dartmouth NS, personal communication in Envirosphere Consultants Limited 2010a).

Moving from inshore to offshore at the Project site, the substrate changes from level, predominantly gravel bottom with cobbles, to an increasing proportion of clean, well-sorted cobbles and boulders. The outer edge of the shelf has a mixed character, predominantly cobbles and small boulders, but also including gravel and sand fractions. Bottom types reflect the distribution observed on the shelf in 2008 (Envirosphere Consultants Limited 2008a & 2008b) and presented in Sections 3.1.4 (Geology), 3.1.5 (Bathymetry) of the EA Registration Document, which included sites west of the revised Project area (AECOM 2009).

Immediately below the MLW, a reduced biological community including rockweed (*Fucus sp*.) and sea lettuce (*Ulva lactuca*) occurs on well-sorted gravels. This community is interspersed with a low density kelp bed (*Laminaria longicruris)* consisting of scattered fronds of *Laminaria* attached to embedded cobbles, as well as clumps of rockweed and the kelp *L. digitata*. Further seaward, at depths of 3 to 5 m below MLW, seaweeds such as rockweed, *Palmaria palmata* (dulse) and coralline algae (*Lithothamnium)* encrusting on rocks, are present. At the deepest site, the erect bryozoan *Flustra foliacea*, *Palmaria,* and encrusting coralline algae (*Lithothamnium sp*.) were the dominant community components; slipper shells (*Crepidula sp*.) were also common in video from this zone. Although few animals were seen in the video, the animal community on the shelf presumably includes common species for the area, such as hermit crabs (*Pagurus sp*.), rock and green crabs, etc., as well as various smaller species which cannot be seen in the video images.

The communities types observed are not particularly significant with respect to potential impacts from the Project. The sea bottom type conforms to the earlier understanding of the area and should not change the technical approach to cable laying for the Project.

Berth "A" and Cable Route

The survey of berth "A" and the associated subsea cable route took place on July 2-3 and August 4-5, 2009. The cable route to shore from berth "A" extends eastward for 700 m over a scoured volcanic bedrock platform in 27-30 m of water before descending the escarpment formed by the northern edge of the platform, to an area of relatively level cobble and boulder bottom at the base of the scarp. The route continues northeast along the base of the scarp over cobble and boulder bottom towards the west edge of Black Rock, passing just east of a field of mobile gravel and cobble waves. Passing Black Rock enroute to shore, the cable route descends into a shallow longshore trough, and then rises abruptly onto a gravel shelf which borders the shore in the vicinity of the newly proposed cable landfall.

Imagery from the shallower water on the shelf is contained in the companion report for berth "C" also included in Appendix F of this report. The shelf has been described in baseline studies from 2008 (AMGC 2009; Envirosphere Consultants Ltd. 2009e; Stewart 2009) and presented in the original EA Registration Document (AECOM 2009).

Biological organisms characteristic of the basalt bedrock were observed along the cable route where it crosses the basalt platform. Typical species include northern red anemone (*Urticina felina*), the red blood star (*Henricia sanguinolenta*) and the yellow breadcrumb sponge (*Halichondria panicea*) encrusting on rocks, and occasional occurrences of seastars (*Asterias sp*.) and hermit crabs. Few organisms were observed on the cobble / boulder bottom, particularly where the gravel and cobble, as well as gravel waves predominate, but the biological community was similar to that observed in earlier surveys in the adjacent areas to the west, including the occasional breadcrumb sponge on the tops of boulders, and the occasional occurrence of mobile species such as hermit crabs, and a fish. Breadcrumb sponge occurred more frequently in the trough between Black Rock and the nearshore shelf, where boulders and bedrock exposures are more common, and particularly where barnacles and edge fauna (the erect bryozoan, *Flustra foliacea*) occur. Cobbles and boulders on the slope of the shelf supported a "biolayer" of organisms at the surface, as well as attached organisms, such as *Flustra.* The outer edge of the shelf where the survey ended was occupied by coralline algae and short dulse (*Palmaria palmata*).

In general, the cable route crossed parts of the basalt bedrock platform and bottom types and communities that were similar to those observed in those areas in the earlier survey and presented in the EA Registration Document (AECOM 2009). Sea bottom types encountered between the basalt bedrock platform and shore demonstrated the same characteristics and associated biological communities as determined in nearby areas to the west in earlier surveys, with the exception of an occurrence of bedrock (mudstone) outcrops, and an associated increased occurrence of more encrusting sponges on boulders between Black Rock and the nearshore shelf.

Berth "B" and Cable Route

The survey on berth "B" and the associated subsea cable route took place on July 2-3 and August 4-5, 2009. The cable route to shore extends for about 1.0 km eastward along a long, linear, fault-like feature floored by sandstone and mudstone bedrock, with overlying cobble and boulder, which cuts through the areas of sedimentary bedrock outcrops. Leaving the zone of sedimentary bedrock outcrops, the cable route crosses a zone dominated by boulder, cobble and gravel, and then runs eastward at the base of a scarp formed by the nearshore shelf in the area. Eventually, the cable route rises abruptly up the scarp onto a gravel shelf which borders the shore in the vicinity of the newly proposed cable landfall.

The fault-like feature that will host the cable is relatively devoid of organisms with the exception of the breadcrumb sponge, which is fairly common on larger boulders, and attached organisms such as barnacles and hermit crabs. Where the bedrock zone transitions into cobble and boulder (approximately 1 km east of berth "B"), sponge density drops off, but this species still occurs occasionally on larger boulders. Little in terms of visible biological communities occurs along the cable route where it crosses the cobble and boulder bottom, which separates the sedimentary bedrock from the nearshore shelf. In the bouldery area at the base of the slope of the nearshore shelf, a 'biolayer' of tube-building organisms develops on boulders, and a community including seastars and barnacles occurs. Rising up to the break of the shelf, gravel to cobble bottom supports seaweeds (typically red seaweeds such as *Palmaria palmate* and encrusting corallines) as well as attached organisms such as barnacles and the commonly occuring erect bryozoan *Flustra foliacea*. Closer to shore, a patchy kelp bed dominated by *Laminaria longicruris* develops, in a community which continues to include seaweeds such as *Palmaria* and possibly *Chondrus crispus* and *Fucus,* as well as corallines. The kelp bed was not observed in the earlier surveys; individual fronds observed in the present study were large enough to be older than one year and appear to be anchored and stable enough to resist ice abrasion and the strong currents. Other organisms in the subtidal communities were similar to those observed in 2008 (Section 3.2.5 Marine Benthos; AECOM 2009).

In general, the cable route crosses an extended area of sedimentary bedrock. Sea bottom types and communities are similar to those observed in similar types of sea bottom to the northwest in the earlier survey and presented in the EA Registration Document (AECOM 2009). Bottom types encountered between the zone of sedimentary bedrock and shore (where the cable route crosses areas of cobble and boulder bottom) demonstrate the same characteristics and associated biological communities as determined in nearby areas to the west in earlier surveys (Sections 3.1.4 Geology 3.1.5 Bathymetry; AECOM 2009). Communities on cobble and boulder bottom at the base of the nearshore shelf, as well as communities on the shelf break, were also similar to those observed in 2008; however the occurrence of kelp beds (*Laminaria longicruris*) in the shallowest water (below MLW) was not seen in the earlier surveys.

Berth "C" and Cable Route

The survey on berth "C" and the associated subsea cable route took place on February 2, March 20, June 19 and July 2, 2009. The cable route to shore extends over a relatively level cobble and boulder bottom, which gradually slopes shoreward, and supports occasional mobile gravel and cobble waves. Nearshore the route rises abruptly onto a gravel shelf, which borders the shore in the vicinity of the newly proposed cable landfall.

The proposed cable route runs roughly from west to east from berth "C", across the zone of predominantly level cobble and boulder occurring west of Black Rock, to the newly proposed cable landfall. From berth "C", the route first passes across an area of occasional bedrock outcrops / ridges jutting out of the cobble / boulder surface, and then passes through an extended zone of cobble and boulder, including occasional gravel waves, which occurs west of Black Rock. Approaching shore, it rises up the slope of a near shore shelf dominated by boulder and cobble on the slope and gravel and cobble on the gradually sloping plateau of the shelf. Bottom types resemble the zone of cobble and boulder, as well as gravel / cobble waves and shelf features, which were encountered in the earlier surveys (AMGC 2009) and presented in Sections 3.1.4 (Geology), 3.1.5 (Bathymetry) of the EA Registration Document (AECOM 2009).

Few biological organisms were observed along the cable route where it crosses the cobble / boulder bottom, but the biological community was similar to that observed in earlier surveys (Section 3.2.5 Marine Benthos; AECOM 2009). This community consists of occasional breadcrumb sponges on the tops of rocks (also observed in the earlier surveys where sediment movement at the seafloor hindered development lower on the rocks), barnacles, the occasional occurrence of mobile species such as hermit crabs and a lobster. Sandstone outcrops which occur as the cable route leaves berth "C" showed some biological development including occurrence of patchy cover of sponges and a "biolayer" (visible growth of fine tube-building organisms). On the near shore shelf, a zone of *Fucus* (rockweed) and *Palmaria* (dulse) occurs on gravel to cobble bottom at the outer edge of the shelf, but the closest approach to shore includes a sparsely populated kelp bed dominated by *Laminaria longicuris* (including possibly *L. digitata*) as well as clumps of *Fucus, Palmaria* and encrusting coralline algae. The slope off the near shore shelf did not support seaweeds.

In general, bottom communities were likewise similar to those observed earlier and presented in the EA Registration Document (AECOM 2009) and reflected a similar relationship to the major seabed types (Envirosphere Consultants Limited 2009e; Stewart 2009).

Berth "D" and Cable Route

As noted above, no specific surveys have been conducted for this berth/cable route given the timing of the request from Nova Scotia Energy. However, some seabed video and photographic coverage was obtained in the vicinity of this berth site during preliminary surveys in 2008 and much information has been generated in this area, including

the specific biophysical conditions that exist in nearby berth “B”, and the entire length and width of the cable corridor. The description is as described above for berth “B”.

In water depths of approximately 40 m, berth “D”, like berth “B” is located within a zone of sedimentary bedrock outcrops. The cable route to shore from berth “D” is north and within approximately 75 – 100 m of the cable for berth “B”. The route extends eastward for a few hundred metres then northeast through a zone dominated by boulder, cobble and gravel. Unlike the other cable routes, this route takes a more gradual approach up the scarp and onto the gravel shelf which borders the shore in the vicinity of the newly proposed cable landfall location.

Biological organisms characteristic of the sedimentary bedrock and boulder, cobble, and gravel are as described under berth “B” above including breadcrumb sponge, barnacles and hermit crabs in the sedimentary bedrock zone, occasional sponges in the boulder area, seastars and barnacles at the base of the scarp, and seaweeds, barnacles, patchy kelp beds and corallines on the gravel shelf (Section 3.2.5 Marine Benthos; AECOM 2009).

3.2.2 Marine Water Quality

Oceanographic measurements in the Project area were undertaken in August and September 2008 and February and March 2009 as a part of a survey which included seabed video and still photography, water column temperature measurements, salinity and turbidity profiling, water column sampling for suspended sediment, background noise measurements and retrieval of current meter moorings. Depth profiles of salinity, temperature, turbidity, and depth were obtained by a Seabird SBE 19plus V2 SEACAT CTD (salinity-temperature-depth and turbidity) profiler equipped with a low and high range optical backscatter sensor (OBS). The CTD profiler was selected by a member of the project team (Oceans Ltd.) as the appropriate instrument to measure oceanographic parameters and suspended sediment for the monitoring program. This instrument is widely used in studies of turbidity and suspended sediments in coastal and estuarine environments in North America. The full oceanographic survey report (Envirosphere Consultants Limited 2009c) is presented in Appendix G of this report and includes methods used, temperature, salinity and turbidity profiles, photographs and figures depicting oceanographic stations for CTD deployments.

CTD measurements and water samples for suspended sediment analysis were obtained at several stations (surface, mid-water and near bottom) in the northern Minas Passage west of Black Rock. On all occasions except August 2008, CTD measurements were made on flood and ebb tides in order to measure the amount of re-suspension caused by tidal currents. The water column was vertically well-mixed on all occasions, showing negligible difference between surface and bottom in salinity, temperature and turbidity. Salinity ranged from about 30.5 to 31.7 PSU over the study period. Turbidity and suspended sediment levels were low to moderate and were highest in February – March. No significant near-bottom maxima (2 - 5 m off bottom) were observed. Measured suspended sediment levels ranged from 1.0 to 16.5 mg/L in September; 13.5 to 23.5 mg/L in February; and 21.0 to 28 mg/L in March 2009.

3.2.3 Marine Mammals and Seabirds

Preliminary seabird and marine mammal surveys were undertaken in July and October of 2008 as a component of vessel cruises aimed at recording information of occurrence and species composition at the Project site (Envirosphere Consultants Limited 2009f). Observations were presented in Sections 3.2.7 Marine Mammals and Sea Turtles and 3.2.8 Marine Birds of the EA Registration Document (AECOM 2009). In response to a commitment to provide additional baseline information made in the EA Registration Document, a comprehensive survey program was established in 2009 and single day-long seabird and marine mammal surveys were undertaken in June, July, August and September of 2009 by an experienced observer. The full survey report (Envirosphere Consultants Limited 2009d) is presented in Appendix H of this report, and includes survey methods used, figures depicting the

survey route and sightings and recommendations for an ongoing survey program which will include additional surveys for the second and third quarters of 2010 and 2011.

Twelve (12) bird species including seabirds (herring gull (*Larus argentatus)*, great black-backed gull (*Larus marinus)*, ring-billed gull (*Larus delawarensis*), black guillemot (*Ceppheus grille)*, northern gannet (*Morus bassanus)*, and greater shearwater (*Puffinus gravis)*), waterfowl (common eider (*Somateria molissima)*, double-crested cormorant (*Phalacrocorax Auritus)*, common loon (*Gavia immer)*, Pacific loon (*Gavia pacifica)*, white-winged scoter (*Melanitta fusca)*), and shorebirds (red phalarope (*Phalaropus fulicaria)*) were observed. Abundances were generally lower than in the Outer Bay of Fundy and other coastal areas in Atlantic Canada. Herring gull was the most abundant and common seabird. Common eider, a coastal seaduck species, was next in abundance, occurring occasionally in large flocks. Great black-backed gull ranked third in abundance overall and in frequency of occurrence. The remaining species were present generally in low numbers and occurred infrequently. Overall abundance of birds peaked in July - August but individual species often showed occurrences in particular months. Seasonal patterns in abundance, reflecting the peak in summer (July - August) abundance and activity of birds, predominated, and differences between the study sub-areas (Minas Basin, Minas Passage and Minas Channel) were less important.

The 2009 study found 12 species of birds, five (5) of which were observed during the previous 2008 and 2009 bird surveys. The additional seven (7) bird species observed in more recent surveys are within groups of species (*i.e.,* seabirds, waterfowl, and shorebirds) which as groups were generally considered in relevant sections of the EA Registration Document (AECOM 2009).

Black guillemot and red phalarope are listed as S3 and S3M, respectively by the Atlantic Canada Conservation Data Centre (ACCDC). This indicates that these species are uncommon throughout their range in the province, or found only in a restricted range, even if abundant in at some locations ("M" represents the migratory population). Neither of these species are listed as rare or of special concern provincially by NSDNR. These two (2) bird species are within groups of species (*i.e.,* seabirds, waterfowl, and shorebirds) which as groups were generally considered in relevant sections of the EA Registration Document (AECOM 2009).

The study found low densities of seabirds and waterfowl in Minas Basin, Minas Passage and Minas Channel, which confirms the understanding that the area is not particularly important for them. Deep diving species, including common loon, northern gannet, and black guillemot (the main group potentially impacted by contact with turbines) were not common and the likelihood of interactions with seabed installations would be relatively low. Densities are expected to be higher in the spring and fall migratory periods (which were not sampled in the present survey) but probably will also be low in comparison to other areas of the Bay of Fundy and other Nova Scotia coastal waters, and therefore not likely to lead to significant interactions with and impacts from the turbine installations.

Marine mammals, all which occurred occasionally, were observed throughout the study area. These mammals include the Atlantic harbour porpoise (*Phocoena phocoena)* a provincially listed species of special concern (most commonly observed), Atlantic white-sided dolphin (*Lagenorhynchus acutus)*, harbour seal (*Phoca vitulina concolor)*, and, unidentified whales. Marine mammals occurred only in June - August, with a peak in the July - August period. All of the species observed in the 2009 seabird and marine mammal survey are also species considered to be commonly occurring in the Bay of Fundy and were considered in relevant sections of the EA Registration Document (AECOM 2009).

3.2.4 Marine Species at Risk

During the single day-long seabird and marine mammal surveys undertaken in June, July, August and September of 2009, Atlantic harbour porpoise, a provincially listed species of special concern, was the species most commonly

observed. In the EA Registration Document (AECOM 2009) the Atlantic harbour porpoise was also considered to be a rare species potentially occurring in the Bay of Fundy.

The description presented in Section 3.2.9 Marine Species at Risk of the EA Registration Document (AECOM 2009), remains valid for the new terrestrial Project location.

3.3 Socio-economic Environment

3.3.1 Archaeological, Heritage and Cultural Resources

An archaeological field reconnaissance was conducted in November 2009 by Davis MacIntyre & Associated Limited on the new location for land-based facilities. The assessment was a follow-up to an earlier archaeological assessment conducted in October 2008 at the original terrestrial site proposed and approved in the EA Registration Document (AECOM 2008). The purpose of the assessment was to determine the potential for archaeological resources within the zone proposed for development and to provide recommendations for further mitigation, if deemed necessary. The full assessment document (Davis MacIntyre & Associated Limited 2009) is included in Appendix I of this report, including a number of figures and photographs.

The background study conducted in 2008 revealed that land comprising the community of Black Rock, later known as Union Valley, was originally granted to Loyalists in the late 1700s and may have been occupied by First Nations people prior to this. Consequently, the area was determined to be of elevated potential for both historic period and precontact archaeological resources.

A field reconnaissance of the study area was conducted on November 30, 2009 immediately after geotechnical testing had been initiated for building foundations. Six (6) geotechnical test pits were excavated by backhoe along the east side of the study area. No archaeological resources were seen in the disturbed soils. The visible soils in the test pits were medium brown sandy silt with gravel.

The north end of the study area sits on elevated ground at 50 - 100 m above sea level. A dry ravine runs along the east edge of the study area from behind the Wheaton property (PID 25204868) toward a road that skirts along the base of the hill. Here, a possibly artificial pond was noted on the south side of the old roadway near the base of the hill. The land on the west side of the ravine has been cultivated in the past, indicating historic farming. Secondary spruce growth in this area is approximately 50 to 60 years old. A one-and-a-half storey Maritime Vernacular house with a dormer, which was popular from the 1840s to about 1900, is located toward the west end of the study area. The house has been abandoned and is in a state of disrepair. A ravine runs along the east side of the house. A wooden outbuilding is located on the west edge of the ravine and is associated with the collapsing house.

Further east of this house is a more modern bungalow (likely mid-20th century) which is also abandoned and in disrepair. This property is owned by Aramathea E. Nakayama / Murdock (PID 25204892). A wooden outbuilding, likely an outhouse, is located behind the dwelling. Directly across West Bay Road, outside the study area is an old abandoned school house. The school house is likely the same vintage as the Maritime Vernacular house located across the road. No additional outbuilding or features associated with these residences were noted during the archaeological reconnaissance.

Toward the beach, the hill drops off at a steep (35 to 40 degree) angle. The land between the base of the hill and the beach is overgrown with marsh grass. The beach itself is a high energy environment where driftwood and refuse is deposited by tides and storm surges. The beach is sandy beneath the high tide mark but above this elevation the 25 degree slope is rocky and constantly changing as a result of tidal action.

No First Nations resources were encountered along the beach although quartz, a material useful in stone tool production, can be seen along the beach. In 2008 during the first archaeological reconnaissance of the property to the west, landowner Lea Pelletier reported finding some sandstone net weights along the shore. These weights were deemed to be of historical rather than pre-contact origin.

The 2008 historic background study combined with the 2009 archaeological reconnaissance indicate this area was occupied by Euro-Canadian immigrants (mainly Loyalists) in the late eighteenth and nineteenth centuries and standing buildings from late in that era still exist. Previous finds elsewhere in the region suggest that the area may have been occupied by the Mi'kmaq prior to this although there is no direct evidence of Mi'kmaq occupation at the study area. Four (4) ships are known to have been stranded off shore near Black Rock in the twentieth century. However, no significant archaeological resources were encountered during the archaeological reconnaissance of the current study area.

The 2009 follow-up reconnaissance indicated that the new location of the landfall and land-based facilities was of low potential for historic period resources. Nevertheless, given the potential for First Nations resources along the shore and the commitments made in the EA Registration Document, Section 6.10 Archaeological and Heritage Resources, it is recommended that archaeologists monitor the excavation of the trench from the cable landing site to the building site. Should any archaeological resources be encountered during ground disturbance activities, it is recommended that all activity cease and the Manager of Special Places, Mr. Robert Ogilvie (902-424-6475) be contacted immediately to determine a suitable method of mitigation (AECOM 2009).

4. Environmental Impact Assessment Methods and Scoping

The description of Environmental Impact Assessment Methodology presented in Section 4.1 of the EA Registration Document (AECOM 2009) remains valid for this EA Addendum Report.

The scoping exercise undertaken for the Project EA Addendum identified valued environmental components (VECs) for which the change in location of the landfall and land-based facilities from that originally approved in 2009 would correlate to changes in the assessment of Project VECs. This exercise was conducted by the study team to identify VECs upon which to focus the assessment for a meaningful and effective evaluation.

Although the developer and design of the fourth berth has not yet been selected by the Province of Nova Scotia, it is anticipated that, for the purpose of this assessment, the design would be similar to those proposed and approved previously, as such, reassessment of the effects of the technology is not warranted. Once the turbine technology has been selected, it will be evaluated by the study team to confirm that the results of the assessment remain valid. All relevant agencies will be notified of the selected design. The successful developer will be required to obtain a HADD Authorization and an NWPA Permit prior to deploying the turbine.

The environmental issues considered in this Addendum are shown in the following Table 4-1, along with the rationale for inclusion / exclusion as a VEC.

Table 4-1 VEC Selection

Environmental Issue	Project Interaction	Scoping Considerations for Project Changes	VEC
Atmospheric Environment			
Air Quality	Air emissions from vehicles during all Project phases and equipment exhaust and dust generated during construction / decommissioning.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). Vehicles and equipment will be regularly inspected and maintained. Idling of equipment will be minimized to the extent practical. Water will be used for dust suppression in disturbed areas. Air emissions will not exceed the Nova Scotia Air Quality Regulations (*Environment Act*) and the federal Ambient Air Quality Objectives (*CEAA*). No further assessment required.	N/A

Acoustic Environment (Terrestrial)	Noise generated by vehicles and equipment during all Project phases.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). As previously mentioned in Section 2.1.1 Land-Based Facilities, the Project building will be located approximately 130 m from the nearest residence, while the entry road located within 30 m. Limited and intermittent construction activities will occur for the construction of the land-based facilities for the Project, such that any landowner concerns regarding Project associated noise will be considered and discussed with landowners on a case by case basis, if warranted. The majority of the promontory is densely vegetated thereby limiting Project noise reaching potential receptors. A treed buffer will be maintained surrounding the facilities, further limiting noise. Noise emissions will not exceed the NSE provincial guidelines at the property boundaries of the site. No further assessment required.	N/A
Climate	If demonstration is successful, there are implications for long-term benefits in terms of climate change (*i.e., r*educed greenhouse gas).	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required.	N/A
Terrestrial Environment			
Soil Quality	Potential for accidental fuel spill during construction.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required.	N/A
Surface Water Quality	Potential for siltation of surface water during construction and decommissioning. Potential for contamination as a result of accidental spills during construction, operation, and decommissioning.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required.	N/A
Groundwater Quality	Potential for contamination as a result of accidental fuel spill during on-land construction or decommissioning. Potential construction, operation and decommissioning related effects on local groundwater users.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required.	N/A

Wildlife and Wildlife Habitat	Potential for physical damage / loss of vegetation and wildlife habitat due to construction. Potential for disruption / displacement of birds, mammals, amphibians through noise, light, traffic etc.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). To the extent possible, the area to be cleared and grubbed will be minimized. Vegetation cover including tall shrub species will be allowed to grow over the cable corridor. A variety of species of native plants will be used in revegetation efforts, where needed. Clearing (including maintenance clearing) will be conducted during the fall and winter. Should clearing be required prior to August 15th, the Project area will be surveyed for breeding activities no more than one (1) week before commencing Project activities. Project lighting will be shielded and minimized to the extent possible. Mechanical clearing will be the preferred vegetation control method and herbicides will not be used. No further assessment required.	Section 6.7 Terrestrial Wildlife and Wildlife Habitat of the EA Registration Document (AECOM 2009) remains valid for Project changes.
Species at Risk	Potential for harm / displacement of Species at Risk: plants, animals and birds.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No Species at Risk were identified during the 2008 and 2009 botanical surveys. During the August and September 2009 coastal surveys no new Species at Risk were observed (a single common loon was observed, however, this species was also observed during the 2008 field observations of the previous Project site and considered in relevant sections of the EA). Construction that would affect wetland hydrological systems should be undertaken in winter. Excavation will include standard construction best management practices to control erosion and stabilize exposed slopes. Operation of the interpretive center on shore will include measures to manage the number of visitors permitted on to the beach, if required. Guidelines will be established in consultation with wildlife biologists from NSDNR and / or CWS. Vessels used for turbine installation will avoid, to the extent possible, the use of West Bay and the waters immediately beneath the cliffs at Cape Sharp in the April to late-July period to minimize potential effects on peregrine falcons. No further assessment required.	Section 6.8 Terrestrial Species at Risk of the EA Registration Document (AECOM 2009) remains valid for Project changes
Intertidal Environment	Potential for disruption (*e.g.*, sedimentation) of salt marsh habitat and adjacent associated pond and watercourse during cable installation. Potential for harm to fish and fish habitat associated with watercourse crossing during cable installation and potentially decommissioning. Potential for accidental events / spills during installation, maintenance, or decommissioning.	The intertidal environment includes sensitive aquatic habitat (*i.e.,* wetland / salt marsh). Not all wetland habitat could be avoided by Project activities at the revised Project location (*i.e.,* estimated cable footprint through the wetland area is estimated to be approximately 0.0165 ha, including the fourth cable).	**Intertidal Environment**
Marine Environment			

Currents, Tides and Sediment Transport	Removing energy from the water column may result in changes to current velocity, scouring patterns and sediment distribution. These changes may affect food distribution and aquatic biota as well as turbidity levels throughout the water column.	The incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on currents, tides, and sediment transport. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required; however, monitoring for the purpose of modelling for larger scale developments is proposed.	N/A
Marine Water Quality	Potential for accidental events / spills during installation, maintenance, or decommissioning. Potential for corrosion of protective coatings. Potential for temporary increased turbidity and suspended sediment during deployment, maintenance, and decommissioning. Potential for increased turbidity from seafloor scouring due to the presence of turbines. Potential heating of the water column by NSPI device.	The incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on marine water quality. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). A spill contingency plan for marine activities is included in the Project EMP. Marine water quality is discussed with relevant biophysical components. No further assessment required.	Section 6.2 Marine Fish and Water Quality and Section 6.3 Marine Mammals of the EA Registration Document (AECOM 2009) remain valid for Project changes.
Acoustic Environment (Marine)	Increases to ambient noise from boats and equipment during construction, operations and maintenance, and decommissioning. Increases to ambient noise from the operating turbines.	The incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on the marine acoustic environment. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). An objective of the demonstration facility is to gather information that will serve to further evaluate this potential effect, particularly for a larger scale development. The potential environmental effects of this issue are explored and a data collection and monitoring program is under development. No further assessment required.	Section 6.2 Marine Fish and Water Quality and Section 6.3 Marine Mammals of the EA Registration Document (AECOM 2009) remain valid for Project changes.

Benthic Habitat and Communities	Destruction or disruption of benthic fauna due to installation and decommissioning of turbines and cables. Potential changes of current patterns to sediment deposition / distribution. Biofouling of TISEC devices.	Based on previous studies, benthic habitat and communities in the area of the fourth berth and cable route is anticipated to similar to those of route and berth B. The berth developer will be required to obtain a HADD authorization prior to installation of the turbine. Additional site specific information may be required in support of the application. The incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on benthic habitat and communities. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). Bottom types and communities observed during the 2009 baseline video and photographic surveys of the revised subsea cable routes and the nearshore Project area were similar to those observed in those areas in the earlier survey and presented in the EA Registration Document (AECOM 2009). The types of communities observed are not considered particularly significant in terms of impacts of the Project, and the bottom type conforms to the earlier understanding of the area and should not change the approach to cable laying for the Project. Biodegradable lubricants will be used. No further assessment required.	Section 6.1 Marine Benthos of the EA Registration Document (AECOM) remains valid for Project changes.
Fish and Fish Habitat	Potential disruption to spawning and migration patterns, fish strikes due to presence of turbines. Loss of fish habitat due to the device and cable installation. Creation of new habitat around device base. Potential changes to fish behaviour due to noise / vibration/ EMF and sediment (food) distribution. Potential decrease in reproductive success due to changes in current patterns / velocities, changes to sedimentation. Potential effects from accidental events / spills during installation, maintenance, or decommissioning.	The incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on fish and fish habitat. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). HADD Authorization, if required, will be obtained for loss of fish habitat and compensation will be completed as required / negotiated. Artificial lighting will be minimized to only what is required for safe operations. No further assessment required.	Section 6.2 Marine Fish and Water Quality of the EA Registration Document (AECOM 2009) remains valid for Project changes.

Species at Risk	Potential disruption to spawning and migration patterns, fish strikes, loss of fish habitat due to the Project footprint. Potential changes to fish behaviour due to noise / vibration / EMF and sediment (food) distribution. Potential decrease in reproductive success due to changes in current patterns/velocities, changes to sedimentation. Potential effects from accidental events / spills during installation, maintenance, or decommissioning.	The incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on species at risk. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). During the seabird and marine mammal surveys undertaken in June, July, August and September of 2009, Atlantic harbour porpoise, a provincially listed species of special concern, was the species most commonly observed. This species was also considered in the 2009 EA. As much as possible, marine vessels will maintain a constant course and travel at slow constant speeds (under 14 knots) while in transit to minimize potential for collisions with birds and mammals. Whales nearer than 100 m will not be approached, nor by greater than two (2) vessels at one time. No further assessment required.	Section 6.5 Marine Species at Risk of the EA Registration Document (AECOM) remains valid for Project changes.
Seabirds and Waterfowl	Potential for changes in food availability. Potential for changes in behaviour or breeding due to human activity. Potential changes to the distribution / migration due to surface tower and lights. Potential effects from accidental events / spills during installation, maintenance, or decommissioning.	The incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on seabirds and waterfowl. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). The 2009 study found 12 species of birds, five (5) of which were observed during the previous 2008 and 2009 bird surveys. The additional seven (7) bird species observed are within groups of species that were generally considered in the 2009 EA. The 2009 study found low densities of seabirds and waterfowl in Minas Basin, Minas Passage and Minas Channel, which confirms the understanding that the area is not particularly important for them. Deep diving species were not common and the likelihood of interactions with seabed installations would be relatively low. Project vessel crews will monitor the decks for evidence of bird collisions, particularly during night activities. Consultations will be initiated with CWS and appropriate mitigation developed and implemented should there be a regular reoccurrence of collision incidents or if lighting becomes a problem for marine birds. No further assessment required.	Section 6.4 Marine Birds of the EA Registration Document (AECOM) remains valid for Project changes.

Marine Mammals	Potential for direct strikes on the turbines. Potential changes to migration, breeding and/or feeding patterns due to vessel traffic, lights, device noise, vibration and/or EMF. Potential changes in distribution as a result of change in food and prey species. Potential effects from accidental events / spills during installation, maintenance, or decommissioning.	The incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on marine mammals. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). During the seabird and marine mammal surveys undertaken in June, July, August and September, 2009 Atlantic harbour porpoise, Atlantic white-sided dolphin, harbour seal and unidentified whales were observed. All of these species are considered to be commonly occurring in the Bay of Fundy were considered in the 2009 EA. No further assessment required.	Section 6.3 Marine Mammals of the EA Registration Document (AECOM 2009) remains valid for Project changes.
Human / Socio-economic Environment			
Recreational and Commercial Fisheries	Potential reduction in catch sizes due to death / disruption of lobsters and other species from noise / vibration, EMF or other factors. Loss of fishing grounds and potential reduction in catch sizes due to the exclusion zone around the turbines. Displacement and crowding of fishing activity due to exclusion zone. Potential damage to boats and fishing gear.	Given that the location of the fourth berth will be within the Crown Lease Area, the incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on recreational and commercial fisheries. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). The installation of the subsea cables and turbine devices, maintenance and decommissioning are tentatively scheduled to occur outside of the key commercial lobster fishing season. If activities must take place during lobster season, the fishers will be informed of the vessel movements, timing and locations. If it is determined necessary that traps will be relocated and / or fishing vessel movement restricted, then a mutually acceptable plan will be developed to identify appropriate compensation for displacement from the area for a given period. Cable coordinates will be provided so fishers can avoid placing their equipment in the area. No further assessment required.	Section 6.9 Recreational and Commercial Fishing of the EA Registration Document (AECOM 2009) remains valid for Project changes.
First Nations and Aboriginal Land and Resource Use	Potential restriction of access to commercial fisheries, social-ceremonial sites. Potential damage to areas of cultural interest (archaeological sites, plant collection sites).	Given that the location of the fourth berth will be within the Crown Lease Area, the incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on recreational and commercial fisheries. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). An MEKS was conducted in 2009 and is summarized in Section 7.3 of the EA Addendum Report. No further assessment required.	Section 6.9 Recreational and Commercial Fishing and Section 6.10 Archaeological and Heritage Resources of the EA Registration Document (AECOM 2009) remain valid for Project changes.

Archaeological and Heritage Resources	Potential damage to marine and/or terrestrial archaeological sites, including First Nations / Aboriginal sites.	The incremental effect of the addition of a fourth berth and cable is not considered substantial in consideration of the potential effects on archaeological and heritage resources. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). The 2009 follow-up reconnaissance indicated that the development area exhibited low potential for historic period resources, however, the potential for First Nations resources along the shore remains. The revised Project location has less overall potential for archaeological resources. An archaeologist will be on site to monitor the excavation of the trench from the cable landing site to the building site. Should any archaeological resources be encountered, it is recommended that excavation cease and the Manager of Special Places be contacted immediately to determine a suitable method of mitigation. No further assessment required.	Section 6.10 Archaeological and Heritage Resources of the EA Registration Document (AECOM 2009) remains valid for Project changes.
Tourism and Recreation	Potential interaction with sea kayaking and recreational boating during all phases (*i.e.,* when actively working with the devices and or cable). Potential positive impacts identified by tourist operators (*i.e*., ecotourism), Strategic Environmental Assessment and other public participants.	The incremental effect of the addition of a fourth berth is not considered substantial in consideration of the potential effects on tourism and recreation. No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required.	Section 6.11 Tourism and Recreation of the EA Registration Document (AECOM 2009) remains valid for Project changes.
Marine Transport and Navigation	Potential disruption to shipping and navigation causing economic impacts to shippers and support industries. Potential disruption to local boaters / recreational fishers / tour operators due to anchorage restrictions and exclusion zone. Potential increase of marine safety concerns.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required.	N/A
Aquaculture	Potential disruption to aquaculture operations identified in Strategic Environmental Assessment.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required.	N/A
Other Seabed Users and Activities	Potential for disruption to dulse harvest at Black Rock. Disruption to potential use such as ocean dumping, exploration, military and research activities.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required.	N/A

Visual Environment	Potential negative perception of electrical facility. Potential for disruptive noise and traffic during construction.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). As previously mentioned in Section 2.1.1 Land-Based Facilities, the Project building will be located approximately 130 m from the nearest residence, while the entry road located within 30 m. Limited and intermittent construction activities will occur for the construction of the land-based facilities for the Project, such that any landowner concerns regarding Project aesthetics will be considered and discussed with landowners on a case by case basis, if warranted. The majority of the promontory is densely vegetated, thereby limiting the view of the Project from potential receptors. A treed buffer will be maintained surrounding the facilities, further limiting potential visual impairments. No further assessment required.	N/A
Local Economy	Potential positive impacts from use of local resources, boats, ports and increased tourism.	No change from considerations presented in Section 4.2 the EA Registration Document (AECOM 2009). No further assessment required.	N/A

In summary, the environmental assessment for this EA Addendum report will focus on one (1) VEC; Intertidal Environment.

5. Environmental Effects Assessment of the Updated Project

5.1 Intertidal Environment

Intertidal environment has been selected as a VEC in consideration of the potential environmental effects of Project activities on this component. Specifically, changes in the location of the cable landfall and land-based facilities may have effects on intertidal habitats present in the Project area, namely the salt marsh complex, including the small pond that discharges through a stream to the Bay of Fundy, the fish habitat, and the flora and fauna that occupy these habitats (Figure 3-1). This VEC has been selected to meet various federal and provincial regulatory requirements and due to the important role the intertidal environment plays in the transition from marine to terrestrial ecosystems.

This VEC was previously assessed in Section 6.6 Intertidal Environment in the EA Registration Document (AECOM 2009), much of which remains valid for the revised Project landfall. The change in location is not considered to be substantial (*i.e.,* 200 m) and conditions at the new location are consistent with the analysis and conclusions presented in the original EA (AECOM 2009).

In general, a larger area of intertidal / wetland habitat (*i.e.,* 165 m^2 cable footprint through the wetland compared to ~100 m^2 for the previous landfall location) will be affected by Project-related activities. On the other hand, the cable corridor will now cross a part of the salt marsh further east of the pond, reducing impacts to the pond, discharge stream and intertidal fish habitat (Figure 2-1).

5.1.1 Boundaries

The spatial boundary for the assessment of the intertidal environment includes all areas of the Project footprint and habitats immediately adjacent to the footprint. This includes all areas of the intertidal environment that the proposed land-based facilities and cable corridor will directly or indirectly disrupt, including portions of the salt marsh complex and (potentially) the fish habitat within the small pond. The description of boundaries presented in Section 6.6.1 of the EA Registration Document (AECOM 2009) remains valid for Project changes.

5.1.2 Residual Environmental Effects Evaluation Criteria

The description presented in Section 6.6.2 Residual Environmental Effects Evaluation Criteria of the EA Registration Document (AECOM 2009) remains valid for Project changes.

5.1.3 Potential Issues, Interactions and Concerns

The potential interactions between Project-related activities and the intertidal environment are generally limited to the construction phase and the decommissioning phase of the Project, assuming that the cables are removed upon completion of the demonstration. Potential interactions include:

- Disturbance of salt marsh (wildlife) habitat during installation and removal of the cables through the intertidal environment;
- Disturbance of fish habitat during cable installation and removal;
- Sedimentation of intertidal habitats from onshore construction; and
- Accidental spills leading to potential contamination (addressed in Section 7.0 of the EA Registration Document (AECOM 2009) which remains valid for Project changes).

The installation of the cable through the salt marsh and nearshore area (i.e., between low and high water mark) is estimated to take approximately seven (7) to ten (10) days to complete. Work will begin with the removal of debris

along the cable corridor and installation of deadman anchors on the beach at low tide. Construction will be scheduled daily in consideration of the tides to avoid heavy equipment operation in the water. As the tide comes in, heavy equipment will be removed from the shore area and brought above the high water mark. Furthermore, construction will be scheduled in consideration of weather forecasts and will be delayed when heavy rains or storm surges are anticipated.

Cable installation will involve the use of medium to large equipment (*e.g.,* winch, barge, excavators). As previously described in Section 2.0 of the EA Registration Document (AECOM 2009), the cables will be pulled ashore and placed in a trench which will be subsequently backfilled using the excavated material. The use of such large equipment and the trenching and backfilling activities will disturb the habitats present in the intertidal zone and potentially downstream. Additional information regarding cable installation is provided in Section 2.2 of this EA Addendum Report.

5.1.4 Analysis, Mitigation and Residual Environmental Effects Prediction

Activities associated with the cable installation and removal could adversely affect species in the intertidal environment as a result of habitat disruption, noise, and related disturbance. As indicated in Section 3.0 of the EA Registration Document (AECOM 2009) and Section 3.1.2 Terrestrial Wildlife and Wildlife Habitat of this EA Addendum Report, local flora and fauna in the intertidal zone were found to have low species diversity and low population densities, thereby limiting the potential for adverse environmental effects. No rare species were identified. The Project footprint does not contain critical habitat for wildlife species. As such, the disruption of habitat associated with the Project will not threaten the existence of local wildlife populations.

Wetland habitats (salt marsh) are most sensitive to physical and noise disturbance during spring and early summer when they have thawed and are easily physically disturbed. During this time, birds and wildlife that use wetland / intertidal environments as breeding habitat are more susceptible to disturbance. Intertidal wildlife habitat may also be more sensitive to construction activity in the spring and early fall when migrating waterbirds feed and rest in productive areas such as salt marshes. Shorebirds are expected to occur both inshore and offshore at the Project site, both through movements and foraging, as well as while resting during high tide periods. The densities for foraging and resting are expected to be low due to the absence of mudflats in the intertidal zone at the site. A small area of the inlet at the mouth of Mill River 100 m to the west of the Project site supports salt marsh and possibly mud flat areas at low tide, which may be frequented by and support small numbers of shorebirds. Every effort will be made to schedule cable installation through the intertidal zone and wetland areas between August and September, 2011; however should the overall schedule for the Project prevent installation during that time period, wildlife surveys, focusing on breeding activities, will be undertaken by a qualified biologist no more than one (1) week before commencing cable installation activities.

Cable installation may occur during shorebird migration, however given the relative short duration of construction activity (*i.e.,* 7 - 10 days) compared to duration of the migration season (*i.e.,* 4 - 5 months), the limited affected area, the unsuitable environment for foraging (*i.e.,* gravel beach), and the relatively small contribution the beach makes to shorebird feeding compared with other beach and intertidal areas in Minas Basin, the potential environmental effect is considered to be not significant. It should be noted that shorebirds presently occupy and feed in areas affected by human development (*e.g.,* mudflat environments adjacent to Minas Basin including coastal communities such as Wolfville and Windsor) and roost in dykeland areas where farming is occurring.

Equipment use in the intertidal environment has the potential to disrupt habitat and cause soil rutting. As such, equipment use will be limited to only those areas where excavation is required for installation / removal of the anchors and installation of the cables. The smallest equipment possible for wetland trenching will be used.

Equipment travel in the intertidal zone will be minimized to the extent possible and any damage or rutting to the beach area will be repaired / stabilized. As each individual cable is winched in to the land-based facility, support structures (stilts) will be used to support the cable and prevent it from dragging across the beach.

As with the cable routing study undertaken for the route proposed in 2009, routing for current terrestrial cable corridor considered environmental constraints, technical constraints and features, and constructability issues. The cable corridor as shown in Figure 2-1 was chosen to cross salt marsh / wetland area over the shortest distance possible, however total avoidance was limited by the steep sided volcanic bedrock structure immediately east of the wetland. The cable footprint through the wetland is estimated to be approximately 0.0165 ha (165 m^2; 33 m long by 5 m wide); comprised of four (4) independent trenches through the salt marsh, approximately 0.5 m wide by 1 m deep and spaced approximately 1 m apart; however the total affected area may be greater than 0.0165 ha. Although not all wetland habitat could be avoided, all efforts to minimize the construction footprint through the salt marsh have and will be taken. Wetland habitat will be restored immediately after installation of the cable. Restoration will include preservation and replacement of the vegetative / organic layer after backfilling and contouring. This will enable revegetation with native species over time. A wetland compensation plan with the appropriate level of compensation for the total area affected will be developed, as required, in consultation with Nova Scotia Environment (NSE) and Nova Scotia Department of Natural Resources (NSDNR) and other regulatory agencies as appropriate (*i.e.,* Environment Canada).

Fish and fish habitat in the small stream is unlikely to be disrupted during installation (and removal) of the cables, since the new cable corridor is now proposed to cross a part of the salt marsh rather than the pond or stream. Furthermore, the stream drains the pond in a westerly direction, away from the cable route. Although very few species were observed (Section 3.3.1.3 Fish Habitat (AECOM 2009)), there is potential for additional species to be present. In order to minimize disruption and disturbance of fish and fish habitat trenching and backfilling for cable installation through the salt marsh will be accomplished in two to three days. Prior to trenching, the four (4) cables will be pulled ashore and placed on the beach. At low tide, trenching will begin at the low tide mark and will work toward the shoreline. Trenching will not occur in open / flowing water. Once the trench is excavated, the cables will be placed approximately 1 m apart and the trench will be immediately backfilled. Additional mitigative measures (*e.g.,* sediment and erosion control) are provided in the Project EMP.

Project activities within the wetland / salt marsh will be of short-term duration (*i.e.,* intermittent and completed within less than 10 days) and of limited extent (*i.e.,* limited to the cable trench area and barge anchor area). All disturbed areas will be restored to their original condition, to the extent possible, immediately upon installation of the cables. It is acknowledged that the effects of the activities on the salt marsh / wetland habitat may persist throughout the year, and potentially into the next growing season. Given the high tidal energy, open coastline and winter ice, the area is regularly subject to a great degree of natural disturbance. In consideration of the above, the limited disturbance associated with the Project is not considered to result in a significant adverse environmental effect.

FORCE will make application for all necessary approvals (*i.e.,* NSE Water Approvals for the alteration of the wetland, HADD Authorization and *Beaches Act* Permit) and will, if granted, comply with all conditions of approval throughout all Project phases.

5.1.5 Follow-up and Monitoring

As previously indicated, a provincial Water Approval pursuant to the Activities Designation Regulations is required for alteration of the salt marsh required for cable installation. During this provincial permitting process, NSE and NSDNR will determine the level of compensation, if any, that may be required. FORCE in consultation with NSE and

NSDNR will then develop a wetland compensation plan to ensure no net loss of wetland function. This will include a follow-up monitoring plan to monitor the effectiveness of wetland compensation project(s). Furthermore, the federal Policy on Wetland Conservation will apply and CWS will be included in the consultation and development of the compensation and monitoring plans.

5.1.6 Summary of Residual Environmental Effects Assessment

By following the above mitigative measures, standard construction practices, and available guidelines, Project-related activities are not likely to cause significant adverse residual environmental effects on the intertidal environment within the Project area.

Accidents, malfunctions and unplanned events are assessed in Section 7.0 and cumulative environmental effects are assessed in Section 8.0 of the EA Registration Document (AECOM 2009) and remain valid for Project changes.

6. Assessment Summary and Conclusion

FORCE proposes to construct, operate and decommission a Tidal Energy Demonstration Facility in the Minas Passage, near Parrsboro, Nova Scotia. The Project consists of multiple subsea turbine generators, subsea cables connecting the turbines to land-based infrastructure, an onshore transformer substation, and power lines connecting to the local power distribution system. The demonstration turbines will operate for a period of at least one (1) year, which can be extended up to a maximum of four (4) years.

The Project (as originally proposed) received federal and provincial environmental approval in September 2009. Construction began with the installation of the first turbine in November 2009.

As a result of negotiations with landowners, the location of the landfall and land-based facilities has moved approximately 200 m east from where it was originally proposed and approved in the *Environmental Assessment Registration Document – Fundy Tidal Energy Demonstration Project* (AECOM 2009). Subsequently, the Nova Scotia Department of Energy asked FORCE to develop a fourth subsea grid connected berth within the approved Crown Lease area. This EA Addendum Report has been prepared to support NRCan's environmental assessment process, describe the changes to the Project, and assesses any potential environmental effects that may arise as a result of the changes. In addition to describing and assessing changes to the Project, this EA Addendum Report also summarizes additional baseline studies that have been conducted since the September 2009 approval. The additional studies are appended to this report.

In addition to the above noted Project changes, an alternative to the originally proposed grid connection that is currently being considered and assessed (i.e., not assessed in this report), is construction of a new 10 km 69 kV above ground transmission line. A CEAA Screening Level Environmental Assessment for the transmission line will be filed with NRCan later this summer.

A scoping process was used to identify VECs related to changes in the cable corridor routes and location of the landfall and land-based facilities. The intertidal environment was selected as a critical VEC for the assessment. The VEC was evaluated for potential interactions between the VEC and Project activities during all Project phases. These interactions were evaluated for potential significance after application of technically and economically feasible mitigative measures to reduce or eliminate potential Project-related adverse environmental effects. Given that the changes to the Project are limited to adding a fourth berth and cable and moving the location of landfall 200 m east of the original site, re-assessment of cumulative environmental effects and effects of the environment on the Project was not warranted.

The Project will be constructed, operated and decommissioned in accordance with applicable legislation, permit conditions and accepted industry best practices. The Proponent, the turbine owners and the contractors will be proactive in planning and implementing procedures to prevent pollution, will continually improve environmental performance and will manage environmental issues as a priority.

In addition to environmental design and construction features, the VEC assessment has confirmed the need for further VEC-specific mitigation. This mitigation must be economically and technically feasible to manage potential adverse environmental effects of the Project and promote sustainability. These mitigation measures for the Intertidal Environment are summarized below and are also part of the Project Environmental Management Plan (EMP). A copy of the summary of mitigation and follow-up provided in the original EA Report is provided in Appendix M.

Table 6-1 Summary of Wetland Mitigation, Follow-up and Monitoring

VEC	Proposed Mitigation	Follow-up and Monitoring
Intertidal Environment	• Obtain and comply with all required permits and authorizations. • Avoid construction activity during sensitive periods for birds. • Should the overall schedule for the Project prevent installation between August and September, 2011, wildlife surveys focusing on breeding activities will be undertaken by a qualified biologist in the intertidal Project area no more than one (1) week before commencing cable installation activities. • Limit equipment travel; repair any damage caused by equipment travel. • Utilize smallest equipment possible for wetland trenching. • Place cable on stilts during cable pull (winching) to minimize the disruption of habitat. • Trench, install cables and backfill at low tide, within a single day. • Restore to pre-construction conditions to the extent possible. • Install appropriate erosion and sediment control measures for on-land construction.	• Monitoring success / effectiveness of wetland compensation project, if required.

In conclusion, the Tidal Energy Demonstration Facility Project is not likely to have significant adverse effects on the environment. In particular, the changes in the location of the cable landfall and land-based facilities and associated cable corridor routes are not predicted to have significant adverse residual environmental effects on the intertidal environment. Adverse environmental effects will be reduced to acceptable levels through the use of technically and economically feasible design and mitigation measures.

7. Summary of Post EA Baseline Studies

7.1 Lobster Catch Monitoring Survey

As specified in the EA Registration Document (AECOM 2009), there is potential for the Project to result in environmental effects on the commercial lobster fishery at the individual fisher level. However, given the inconsistent and variable nature of the placement of traps and the uncertainty in lobster movement, further information is needed to assess potential effects. To address this lack of information, a lobster catchability study was begun in an effort to determine the "before and after effects", to the extent possible, of the Project on lobster fishing.

CEF Consultants Ltd. collected baseline lobster catch monitoring data in the fall of 2009. The study is designed to measure fishing success before, during and after construction and operations both within the Project area (*i.e.,* test sites) as well as outside the Crown lease area (*i.e.,* control sites east and west of the test site). Two lobster catch monitoring surveys have been conducted to date: the first from September 25 to October 3, 2009 and the second from November 5 to November 18, 2009. The early survey yielded 1387 lobster from 132 traps while the later survey yielded 1135 lobster from 126 traps. The decrease in catch (*i.e.,* average number of lobster per trap) from the early survey to the late survey is tentatively attributed to the following:

- removal of available lobster by the commercial fishery, which began October 14th; and
- seasonal migration out of the inner Bay of Fundy in the later fall.

According to the study, one set of data was collected following installation and operation of the NSPI turbine on November 12th. Any effect from installation and operation of the turbine was insufficient to cause all lobster to leave the vicinity or cause discernable changes in lobster distributions. Further studies are required, but a good baseline was established.

In addition to lobster catch, the survey also gathered information on a variety of other parameters including catch by size; soak time (*i.e.,* time between setting and hauling of traps); sex and condition of lobster (*i.e.,* damaged shells, fungus growth); trap movement by current; trap damage; by-catch; and water temperature. A copy of the study is included in Appendix J of this EA Addendum Report.

Baseline data have been established for comparison with future survey results. Continued collection of information on lobster catchability from these areas will allow comparison over time between test and control areas for evaluating potential effects of turbine installation and operation.

7.2 Acoustics Monitoring Report

The Draft Acoustics Monitoring Report, *Acoustic Levels in Minas Basin, September 28, 2008 and December 02, 2009* was completed in March 2010 (Oceans Ltd. 2010), but is undergoing analysis and interpretation by NSPI and Open Hydro in relation to the deployed turbine. The final report will be provided as soon as it is available. It should be noted that the acoustics monitoring was undertaken to measure background marine acoustic noise before and after turbine deployment. This initial work was not meant for the interpretation of impacts to marine organisms.

7.3 Mi'kmaq Ecological Knowledge Study (MEKS)

In 2009, a Mi'kmaq Ecological Knowledge Study (MEKS) was undertaken for the Fundy Tidal Energy Demonstration Site by Membertou Geomatics Consultants (Membertou Geomatics Consultants 2010). The objective of the study was to identify the current and past Mi'kmaq traditional uses within the Project area and document what Mi'kmaq ecological knowledge presently exists in regards to the Project area. The study area included a 10 km radius zone around the Project area, encompassing Parrsboro and a number of other communities. An additional objective of the work was to complete a broader MEKS study of a much larger area defined in the MEKS report as the "Bay of Fundy Phase I Area". This MEKS study may be used for future renewable energy projects. The Phase I Area covered parts of Chignecto Bay, the Bay of Fundy, Greville Bay, Minas Channel, a large portion of the Minas Basin and a number of communities.

Membertou Geomatics Consultants conducted interviews with Mi'kmaq hunters, fishers and plant gatherers between June and July of 2009, who shared details of their knowledge of traditional use activities. Interviewees were asked to identify where they would undertake their activities, as well as to identify where and what activities were undertaken by other Mi'kmaq. All data gathered was considered in regards to Mi'kmaq significance and where permitted, the information obtained was incorporated into a GIS database by Membertou Geomatics Consultants.

The study reports that Mi'kmaq have historically undertaken traditional fishing activities in the immediate Project area, and that this practice reportedly continues to occur today. Commercial fishing and harvesting activities by members of the Annapolis Valley First Nation was reported to have occurred and is still occurring today. Lobster, mackeral and herring are currently, and have been in the recent past, fished for commercial purposes while lobster and halibut are reportedly being fished for harvesting at present.

The MEKS report concludes that Mi'kmaq have historically undertaken traditional use activities in the 10 km radius zone around the Project area, and that this practice continues to occur today. These activities involve the harvesting of fish species, plants and animals; all of which occurs in varying locations throughout the study area and at varying times of the year.

Flounder, lobster and mackeral were reported to be the most fished species taken within the 10 km radius zone. Halibut, haddock, herring, perch, periwinkle, trout, cod, clams and mussels were also found to a somewhat lesser degree. Deer, rabbit and partridge were found to be the most hunted species within the 10 km radius zone around the Project area. Blueberries, apples and strawberry were the most harvested plant species that were found within the 10 km radius study area.

Bear, beaver, bobcat, deer, lynx, muskrat, otter, partridge, pheasant, porpoise, rabbit and raccoon were found to be hunted within the 10 km radius zone with no specific species identified as the majority species harvested. Dulse was the only plant identified that is harvested by the Mi'kmaq in the 10 km radius zone around the Project area.

A historical site, a historical fishing area and a reported burial site was also identified through the interview process within the 10 km radius zone.

The study resulted in the following recommendation:

> *"In consideration that the Mi'kmaq undertake fishing activity, for commercial and harvest, directly within the Project Site where the turbines are to be built as well as in various locations throughout the Study Area, it is recommended that the proponent meet with the Assembly of Nova Scotia Mi'kmaq Chiefs to determine possible future steps to be taken in regards to Mi'kmaq use of the area."* (Membertou 2009).

A full copy of the study is included in Appendix K of this EA Addendum Report.

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