Results of a Preliminary Survey of the Seabed at a Site Proposed for Deployment of a Tidal In-Stream Power Turbine in the Minas Passage of the Bay of Fundy

Prepared for

Nova Scotia Power Inc.

by

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1.0 Background

As part of the requirements for an environmental impact assessment of a Tidal In-Stream hydro turbine being planned for deployment in the Bay of Fundy by Nova Scotia Power Inc, a preliminary study was carried out to determine the most appropriate technology for conducting a video survey of the seabed, and to document the substrate and benthic communities present at the proposed turbine site and along the path proposed for the onshore cable connection.. The survey was carried out on two dates in 2007, the first on 27 September and the second on 3 October. An additional attempt on 1 October had to be aborted due to inclement weather conditions.

2.0 Approach

Using underwater video cameras, the survey focused on two regions within the Minas Passage. One region included a 500 m^2 grid centered on the proposed location of the turbine, and the other region included the proposed area over which the cable linking the turbine to its onshore connection would be placed (Figure 1).

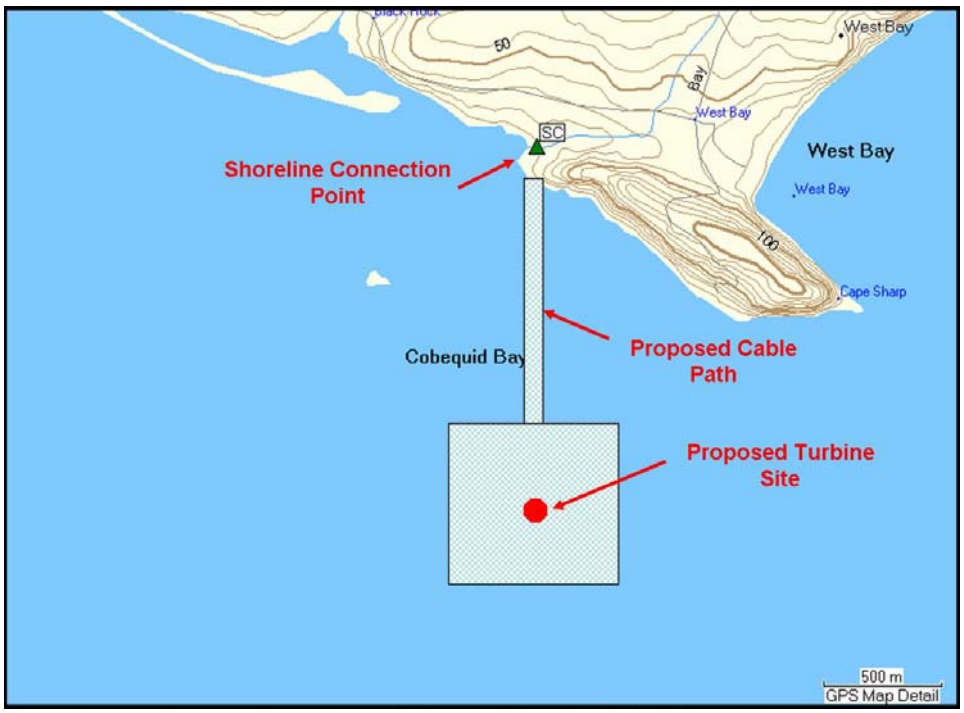

Figure 1. General area of seabed surveys.

3.0 Methodology

The highest quality video surveys of benthic communities are typically obtained using underwater video cameras deployed along predetermined transects by SCUBA divers. Two factors limit the use of this methodology in the Minas Passage: the high current velocities present, on the order of 5-8 knots, make swimming in a predetermined direction difficult and, most importantly, the depth of water, which ranges between 30-40 meters at the proposed turbine site, limits diving times to less that 2-3 minutes before there is a requirement for decompression. For these reasons, the use of a remotely operated underwater video camera (ROV) was considered to be the most appropriate technology for carrying out the benthic survey.

Previous experiences in the Bay of Fundy indicated that the most commonly available ROVs are difficult to control and, because of their light weight and large size, can not be adequately directed in areas having high current velocities. For that reason a small drop and tow underwater video camera* that could be weighted was used (Figure 2). This system included a high resolution video camera equipped with an auxiliary lighting pod, a ship board LCD monitor, and a video recorder linked to a GPS receiver that recorded both position and time directly onto the video record. All of this was connected through a 75 meter long umbilical cord that also served as the tow line.

Figure 2. Video camera used for benthic survey.

*Ocean Systems Inc. Deep Blue Underwater Video System

4.0 Results

Although it was possible to obtain good quality video records in the shallower nearshore waters, obtaining good quality videos at the proposed turbine site proved challenging. Accompanying this report are three DVDs, one documenting the 27 September survey and two documenting the 3 October survey. Table 1 contains details of the contents of each DVD.

The survey carried out on 27 September 2007 produced two video records of acceptable quality (Titles 1 and 3). Title 1 was of a transect carried out in shallow water (generally less than 15 m) off the point of Cape Sharpe (see Figure 3) and was done primarily to determine our capacity to control the movement of the camera. The transect covered a distance of approximately 350 m and revealed a diverse benthic community composed largely of epiflora and epifauna living attached to large cobble and small boulder sized rocks lying on what appears to be a hard sandy substrate. The epiflora consists of various seaweeds including rockweeds, kelps and red algae. The latter appears to be mainly Irish moss. The epifauna consists mainly of barnacles and bryozoans.

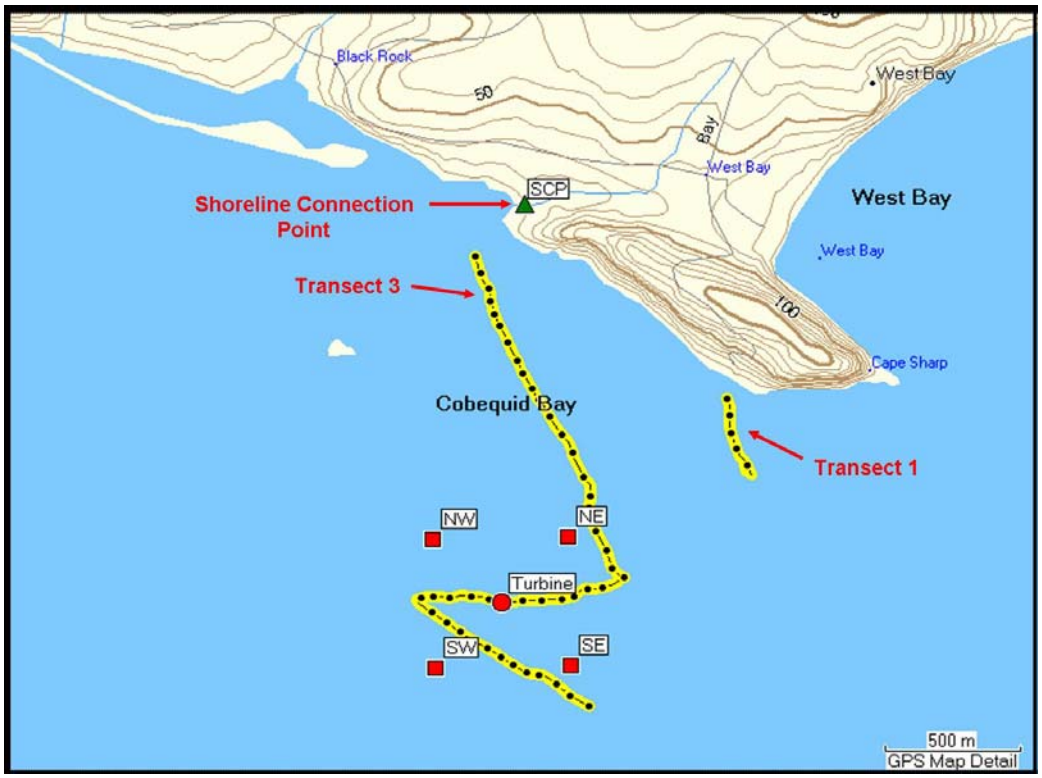

Figure 3. Location of video transects for surveys carried out on 27 September 2007.

The second successful video record (Title 3) covered a transect from the nearshore to the proposed turbine site along the approximate area of the path proposed for the shoreline cable connection (see Figure 3). This record showed much inshore subtidal area to be composed of hard sand with scattered clusters of red algae (also probably Irish moss).

Further along the transect, at about midway, the substrate consists largely of small boulder sized rocks heavily colonized by barnacles and bryozoans. No algae are present in this area. Further along, and in close proximity to the proposed turbine site, the substrate consists mainly of small cobble that appears to lack any epiflora or epifauna. The latter part of this transect included a pass through the proposed turbine site but the camera could not be towed close enough to the seabed to make a recording of the substrate and the biological community present.

On the same day four attempts were made to record a video of the sea bottom near the centre of the proposed site of the turbine, but these were unsuccessful as a result of the difficulty in reaching the seabed with the amount of cable available.

As a result of the difficulties experienced in deploying the video camera in deep water, the 3 October survey was carried out at low tide (the 27 September survey was carried out at high tide). The shallower depth at the proposed turbine site resulted in greater success in obtaining a video record of the seabed. Three transects were surveyed (Figure 4) and video recordings were made at each (Titles 1, 2 and 3 on the DVD). The details of each transect are listed in Table 1. Although the video records are much better than those obtained during the 27 September survey, it is still difficult to interpret the type of substrate and biological community present, largely due to difficulty in controlling the speed at which the video camera moved over the seabed due to the high current velocities. Much of the bottom in this region appears to be composed of small cobble devoid of any attached organisms, but there are also some regions present that contain larger cobble and small boulder-sized rocks colonized by bryozoans, sea anemones, encrusting sponges and barnacles. Sea stars are also present, but there does not appear to be any plant life at these depths.

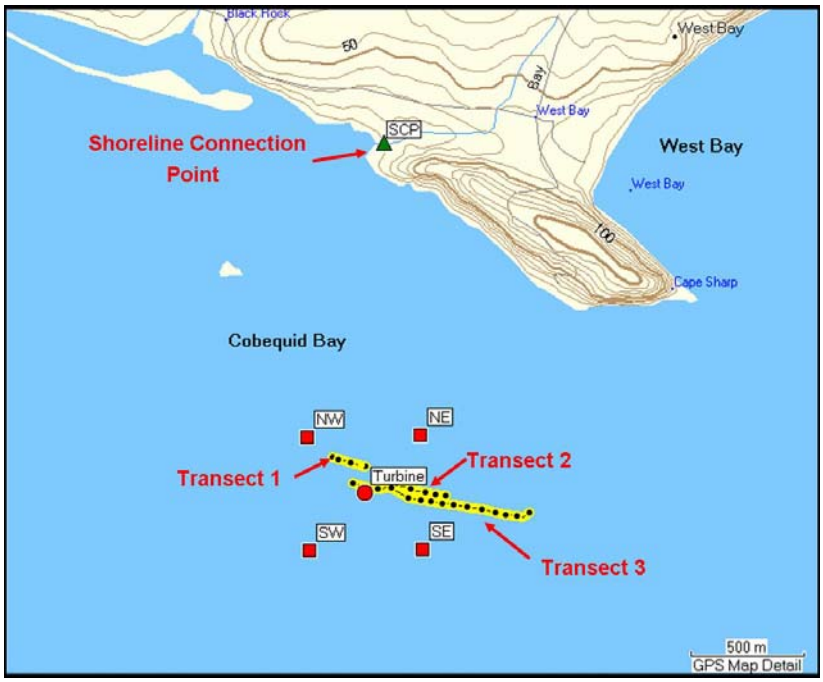

Figure 4. Location of video transects for surveys carried out on 3 October 2007.

On 3 October a video recording was also made using a hand held camera deployed by a SCUBA diver. An attempt was made to video record the seabed along a transect beginning in the upper subtidal, just offshore of the area of the proposed path of the cable connection, and extending toward the proposed turbine site. The strong currents, however, made swimming along this transect difficult and it was only possible to video record a small portion of this transect about 175 m in length (see Figure 5) over water depths ranging between about 5-10 m. The video is approximately 20 minutes in length and is of excellent quality. It shows the seabed of the upper subtidal area to be composed largely of a shallow layer of loosely compacted gravel and cobble sized rock underlain by bedrock which serves as a stable substrate for attachment of a well developed benthic macrophyte community composed mostly of kelps, sea lettuce and Irish moss. There are also some areas of a sandier substrate that is sparely covered with what appears to be Irish moss. There is very little attached epifauna present except for some sponges. Other animals observed included sea urchins, sea stars, flounder and lobster.

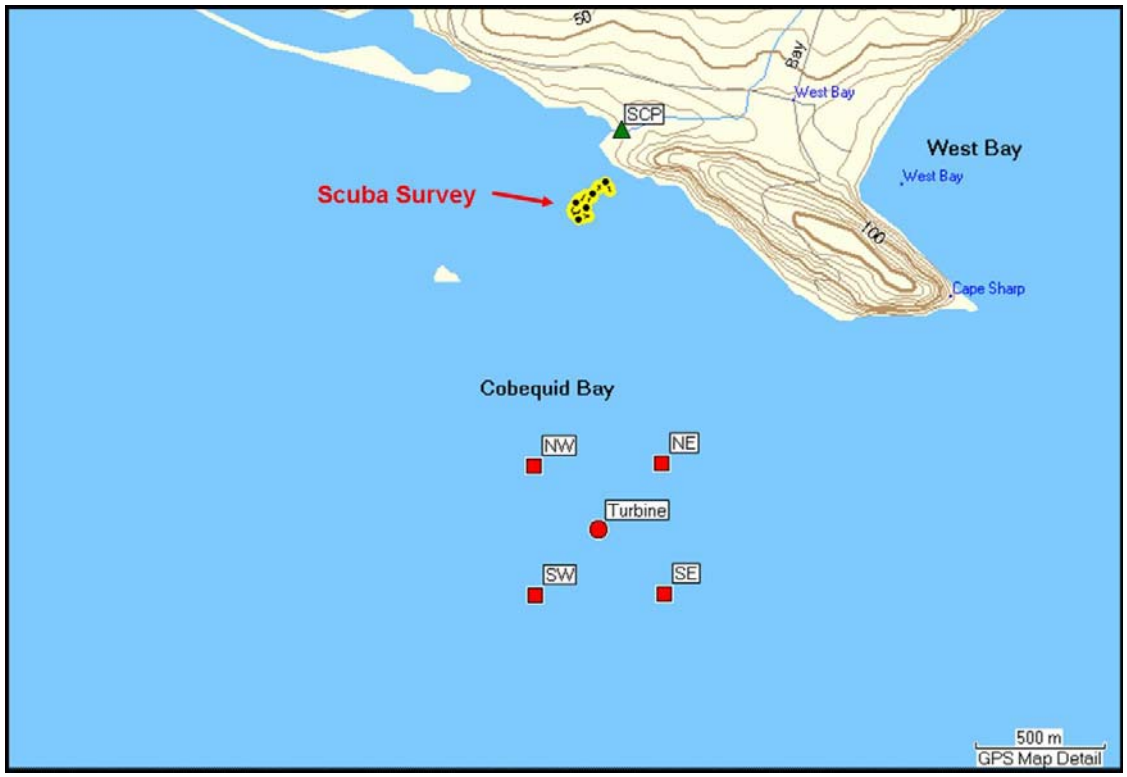

Figure 5. Location of SCUBA Survey carried out on 3 October 2007.

5.0 Future Surveys

Future attempts will be made to obtain improved video footage of the seabed in the area of the proposed turbine site. We are exploring the possibility of obtaining the use of a ROV specifically designed for operating under conditions of high current velocities. These systems are more compact and have more maneuvering power than standard ROVs and may allow us to better control the speed at which the camera travels over the seabed.

We also plan to carry out surveys using benthic grabs to obtain plant and animal specimens suitable for taxonomic identification. These studies will likely not be carried out until the Spring of 2008 in order to take advantage of longer daylengths and more favorable weather conditions.

Table 1. Menu for contents of video recordings.

DVD	Title*	Transect**	Begin	End	Comments
27 Sept 2007	1	1	45 21.858N/64 23.621W	45 21.6825N/64 23.521W	Good quality video showing inshore benthic community off Cape Sharp
"	2	-	-	-	Failed attempt at proposed turbine site.
"	3	3	45 22.124N/64 24.312W	45.21208N/64 23.996W	Fair to poor quality video showing sea bottom along transect of proposed path for shoreline cable connection.
"	4	-	-	-	Failed attempt at proposed turbine site.
"	5	-	-	-	Failed attempt at proposed turbine site.
"	6	-	-	-	Failed attempt at proposed turbine site.
3 Oct. 2007	1	1	45 21.512N/64 24.348W	45 21.495N/64 24.251W	Fair quality video showing benthic community at turbine site (camera moving too quickly in most instances).
"	2	2	45 21.457N/64 24.189W	45 21.420N/64 23.949W	As Title 1, but of poorer quality due to the inability to slow the travel speed of the video camera.
"	3	3	45 21.448N/64 24.288W	45 21.376N/64 23.705W	As Title 1, but of poorer quality due to the inability to slow the travel speed of the video camera
"	4	-	-	-	Above sea level coastal survey of Cape Sharp shoreline
3 Oct.2007 SCUBA Dive	-	1	45 22.157N/64 24.234W	45 22.131N/64 24.292W	Excellent quality video showing shallow subtidal benthic community.

* Reference for video track on DVD.
** See Figures x and x for location of each transect.