COBSCOOK BAY TIDAL ENERGY PROJECT

FINAL REPORT ON THE ACOUSTIC, MARINE MAMMAL AND BIRD MONITORING STUDIES DURING PHASE I PILE DRIVING ACTIVITIES

PREPARED FOR NOAA

RE: INCIDENTAL HARASSMENT AUTHORIZATION, Dated 3-8-12
For COBSCOOK BAY TIDAL ENERGY PROJECT
FERC PROJECT No. 12711
ORPC MAINE, LLC

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EXECUTIVE SUMMARY

ORPC Maine, LLC submits this Final Report on the Acoustic, Marine Mammal and Bird Monitoring Studies during Phase I Pile Driving Activities for the Cobscook Bay Tidal Energy Project (Project) in compliance with the Incidental Harassment Authorization (IHA) issued by NOAA NMFS, Office of Protected Resources.

Pile driving activities for the installation of ORPC's TidGen™ bottom support frame were completed between March 24 and April 4, 2012. This work was accomplished in accordance with regulatory restrictions relating to the presence of endangered Atlantic salmon smolt after April 9th (Federal Energy Regulatory Commission, Pilot Project License, P-12711-005, Article 402). Marine mammal monitoring and mitigation requirements for pile driving were conducted in accordance with the IHA issued by NOAA NMFS, Office of Protected Resources, on March 8, 2012.

The contractor utilized several pile driving hammer techniques during the installation. The primary means was a vibratory hammer which produced continuous noise levels. The secondary means was a diesel impact hammer which produced a more acute, instantaneous noise source.

Environmental monitoring was conducted by leading scientists and experts during pile driving activities and included the following:

- In-air acoustic monitoring on Goose Island and at the Lubec On-shore Station
- Hydroacoustic monitoring in the near field (from the deployment barge) and at various far field ranges (100 m, 1,000 m, and 2,000 m)
- Marine mammal observations located on vessels anchored around the installation site for all pile driving activity and additionally from land stations for three events
- Marine mammal mitigation measures
- Bird survey from the Lubec shore

Results of monitoring during pile driving activities demonstrated minimal impact to the environment. Source levels measured during impact and vibratory pile driving were below the thresholds of concern for Atlantic salmon smolt. Measured Level A and B isopleths ranges were significantly shorter than the conservative calculated ranges included in the IHA. Although there were sightings of birds and harbor seals in the vicinity of the project area both before and after pile driving, their responses to pile driving noise were minimal. This included harbor seals, or possibly a single individual harbor seal, which returned to the project site (outside the Level A exclusion zone) on multiple days of pile driving.

Mitigation measures used during pile driving were successful in maintaining acoustic source levels within acceptable ranges and minimizing impacts to the environment. These measures included wood sound absorption devices installed in the head of the impact hammer and a "soft start" that initiated pile driving at less than 100% energy for both hammer types. In addition, modifications made by the contractor to the physical connection between the pile and the follower alleviated initial acoustic spikes.

Protected Species Observers (PSOs) were successful in recording marine mammal sightings, determining location and the animal's behavior. However, marine mammals were not observed within or approaching the Level A exclusion zone (initially estimated to be 500 feet). Shut down or delay procedures, therefore, were not initiated during pile driving activities.

ORPC presented the initial pile driving acoustic results, including the effectiveness of mitigation measures, to NOAA NFMS on April 2, 2012, as part of the agency consultation required for requesting modification of the restrictive window for pile driving. Meanwhile, ORPC submitted a license modification request of Article 402 Restriction Period for Pile Driving to FERC on March 29, 2012, and supplemented this request with additional information on April 2, 2012. FERC approved the modification on April 4, 2012.

ORPC will utilize this same pile driving process in the future if the installation requires it, thereby making the restrictive window unnecessary. This conclusion is supported by Phase I testing results. Moreover, this conclusion supports the virtues of adaptive management which allows scientifically gathered data to guide the evolution of best management practices for environmental monitoring and mitigation measures.

The following best management practices should be incorporated into future pile driving activities in Cobscook Bay to minimize the level of effort while addressing the areas of greatest risk:

Pile Driving

- The vibratory hammer in combination with wood sound absorption devices used during Phase I pile driving had source levels below regulatory thresholds.
- Modifications to the physical connection between the pile and the follower alleviated initial acoustic spikes.
- The effectiveness of soft start procedures used during Phase I was difficult to quantify. However, no marine mammals were observed within the Level A exclusion zone or at any time during active pile driving.
- ORPC demonstrated that sound exposure levels (SELs) for vibratory hammer activity are limited by provided best practices are used for hammer and pile assembly.
- Information gathered by experts and submitted by ORPC as a modification request related to the restrictive window for pile driving was used to remove the window for the remainder of Phase I operations. This information remains pertinent to Phase II construction and should be evaluated for this purpose.

Hydroacoustic Monitoring

- Hydroacoustic monitoring results confirmed that pile driving source levels were within acceptable ranges provided that sound absorption devices were used and best practices were implemented for pile and follower assembly. ORPC will implement these best practices if pile driving is used during Phase II installation, which will occur at the same location/environment and geology as Phase 1. Additional hydroacoustic monitoring, therefore, should not be required.

Marine Mammal Observations

- Measured isopleths ranges for both the impact and vibratory hammer indicate that conducting observations from the installation barge rather than moored vessels is practical. It is recommended that PSOs monitor to a distance of 500 m, i.e., the greatest extent of Level B isopleths, during any Phase II pile driving.
- No marine mammal sightings occurred at low tide. It is generally accepted that harbor seals haul out on local ledges during low tide – a behavior that is well documented. For Phase II pile driving events, ORPC recommends two PSOs stationed on the installation barge with 180 degree visibility fore and aft. Further consideration should be given to reduced observations during low tide operations and seasons with minimal marine mammal activity.

Sea and Shorebird Observations

- Bird observations were not required by regulatory agencies; however, ORPC conducted surveys to determine any disturbance to a rookery (not active during pile driving) and potential bald eagle nesting areas. Results of bird surveys indicate minimal to no disturbance to birds in the project vicinity during pile driving. The value of future bird surveys during pile driving should be considered prior to Phase II.

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

ORPC Maine, LLC, a wholly owned subsidiary of Ocean Renewable Power Company, LLC (collectively, ORPC), received a pilot project license for the Cobscook Bay Tidal Energy Project (Project) from the Federal Energy Regulatory Commission (FERC) on February 27, 2012 (FERC Project No. P-12711-005). The Project will evaluate the potential for a new source of clean, renewable energy generation using tidal energy resources in Cobscook Bay, Maine. ORPC obtained an initial preliminary permit for the project area in Cobscook Bay from FERC on July 23, 2007; FERC issued a successive preliminary permit on January 13, 2011. Feasibility studies, including environmental surveys, and pre-filing consultation were conducted, resulting in ORPC's filing of a draft pilot license application (DPLA) with FERC for the Eastport Tidal Energy Project on July 24, 2009. Since submitting the DPLA, ORPC has conducted extensive consultation with regulatory and resource agencies as well as other stakeholders, has collected additional environmental data, and has continued to refine its proprietary technology. As a result of these additional studies and consultations, ORPC now plans to deploy a commercial-scale hydrokinetic power system in stages, with the Project, a small pilot project, as the first phase. The FERC preliminary permit Project boundary for the Cobscook Bay Tidal Energy Project (FERC Project No. 12711-005) encompasses the proposed development area. The FERC pilot project license boundary for the Cobscook Bay Tidal Energy Project encompasses the proposed development area (Figure 1).

Figure 1: Cobscook Bay Tidal Energy Project location map.

1.2 FOUNDATION DESIGN AND INSTALLATION

The foundation design for the TidGen™ devices at the project site consists of a pile bent arrangement consisting of ten steel piles, each with a 30-inch diameter and 0.5½-inch wall thickness. The piles were designed to vary in length due to bottom sediment depth with each driven to the top of the bedrock and protruding 15+ ft above the seafloor.

The bottom support frame for the first TidGen™ device was deployed on the seabed on March 20, 2012 (Figure 2). The deployed bottom support frame acted as a template for the driving of piles to secure the foundation in place.

The contractor's deployment plan included the use of a vibratory and diesel impact hammer to drive the piles to refusal. Hammers specifications were included in the Acoustic Monitoring Plan for Pile Driving Activities submitted to NOAA NMFS, Office of Protected Resources on March 1, 2012.

Figure 2. Bottom support frame deployment, March 20, 2012.

1.3 RESTRICTIVE WORK WINDOW FOR ENDANGERED SPECIES

ORPC anticipated the use of driven piles to fix the TidGen™ bottom support frame to the sea floor during the Final Pilot License Application process. In our consultation with NOAA NMFS, Protected Resource Division, it was identified that the potential sound levels of pile driving may emit sound levels that could damage young salmon if the pile driving occurred during smolting season, April 10 – November 7, but not during other times of the year. Below is an excerpt from correspondence from Dan Tierney, NOAA NMFS, to Herb Scribner, ORPC on October 28, 2011:

> *Pile driving that occurs within Cobscook Bay between November 8th and April 9th will not affect listed salmon because they are not anticipated to be present in the action area. The piles driven for Phase 1 of the proposed project (ten of the fifty) will be driven during March 2012; therefore, their installation is not anticipated to adversely affect listed salmon. Although ORPC will endeavor to install the piles for Phase 2 during the preferred work window (November 8th and April 9th), it will likely not be possible to install all forty of the remaining piles during that timeframe. Therefore, ORPC will conduct acoustic monitoring during the driving of the Phase 1 piles to determine if noise levels are below the thresholds of injury to fish as described above. If it is determined that*

> *the noise levels exceed these thresholds, ORPC will work within the recommended November 8th to April 9th work window and/or use a combination of attenuation devices (cushion or bubble curtain) to reduce levels to a point where they will not harm listed fish. So, if during the monitoring of Phase 1 pile driving it is determined that noise levels are significantly below the thresholds for injury, the work window and the attenuation methods will be unnecessary.*

As a condition of a subsequent IHA (See Section 1.5) from NOAA NMFS, Office of Protected Resources, ORPC included a separate Acoustic Monitoring Plan for Pile Driving Activities that included monitoring during initial pile placement by several methods and mitigation measures that covered the range that NMFS had indicated in their correspondence. It was intended by NMFS to require ORPC to drive the initial piles and collect data regarding the monitored sound levels when no salmon were present.

1.4 Incidental Harassment Authorization

ORPC applied for an IHA for pile placement because the pile's vibratory hammer setting and diesel impact hammer could potentially generate noise levels above NOAA's guidelines for continuous and impact noise under the Marine Mammal Protection Act of 1972.

ORPC's IHA application included the estimation of noise source levels and associated isopleths based on calculations performed by Scientific Solutions Inc. (SSI) of Nashua, NH, on in-air hammer specifications and nameplate information provided by the manufacturers.

On a constant radiated energy level it was determined that in-air data can be transferred to in-water data by the addition of 62 dB to account for differences in reference levels and specific acoustic impedance (ratio of particle velocity to pressure). Thus, the 112 dB in-air vibratory source level at the operator (presumed 1 m away) equated to roughly 174 dB re μPa2 @ 1 m in water. The 131 dBA from the plate on the impact hammer equated to 193 dB re μPa2 @ 1 m in water.

Based on Level A harassment above 180 dB for marine mammals for the impact hammer, the Level A harassment isopleths were estimated to be 30 to 100 m from the source. Therefore mitigation measurements were recommended to insure that no marine mammals be within 100 m of the pile driving.

Based on Level B harassment levels for the continuous vibratory source (120 dB), and assumed 15logR propagation loss in shallow waters (cylindrical spreading attenuates at 10logR and spherical spreading attenuates at 20logR), SSI determined the 175 dB source levels for the vibratory hammer do not attenuate to 120 dB until a distance of 4600 m, or roughly 2.5 miles from the source.

NOAA NMFS grants authorization for incidental takings of marine mammals if it finds that the taking will have a negligible impact on the species or stock(s), will not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined "negligible impact" in 50 CFR 216.103 as "...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

Except with respect to certain activities not pertinent here, the Marine Mammal Protection Act defines "harassment" as:

> *any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].*

ORPC consulted with NMFS prior to submittal of an IHA for the Project and subsequently prepared and submitted detailed Acoustic Monitoring and Marine Mammal Observation Plans for the pile driving activity.

ORPC was granted an IHA by NMFS on March 8, 2012 for the take, by Level B harassment only, 72 total grey and harbor seals (Halichoerus grypus and Phoca vitulina), 72 harbor porpoises (Phocoena phocoena), and two Atlantic white-sided dolphins (Lagenorhynchus aculus) incidental to pile driving associated with the tidal turbine project. The IHA included specific monitoring and reporting requirements to determine actual source levels and harassment isopleths ranges (Appendix A).

2.0 PURPOSE AND OBJECTIVES

ORPC conducted pile-driving activities between March 24, 2012 and April 4, 2012. Of concern was the effect of the pile driving noise on endangered species of fish (primarily Atlantic salmon) and marine mammals. Acoustic monitoring was conducted to quantify noise levels generated from various pile driving techniques and to determine the effectiveness of mitigation methods to eliminate the April 10th through November 7th work-window.

The following were the specific objectives of the acoustic monitoring:

- Measure near field noise levels in dB re1µPa peak pressure and SEL to confirm impact hammer levels are maintained at less than 206 dB re1µPa@1m peak and below 187 dB re 1µPa^{2}s SEL at a range of 10 m.
- Vibratory hammer levels were to be maintained at less than 206 dB re1µPa@1m peak.
- Establish the 180 dB re 1µPa@1m rms pressure isopleth for both vibratory and impact hammers (thresholds for Level A harassment are 190 dB for pinnipeds and 180 dB for cetaceans).
- Establish the 160 dB re 1µPa@1m rms pressure isopleth for impact (Level B transient source) using sound attenuation devices.
- Establish the 120 dB@1µPa@1m rms pressure isopleth for vibratory (Level B continuous source).
- Monitor ambient air noise levels with a sound level meter at Goose Island and at the Lubec shore station to identify in air noise levels at a potential bird rookery and seal haul-out areas within this area of Cobscook Bay concurrent with bird surveys. In addition, the acoustic monitoring was to provide data to assist with determining potential impacts on bald eagles. Article 411 of ORPC's FERC license requires ORPC to follow the U.S. Fish and Wildlife's Bald Eagle Management Guidelines for the protection of bald eagles and their habitat during construction and operation of the project

These limits are summarized in Table 1 and

Table **2**. The Acoustic Monitoring Plan for Pile Driving Activities in included in Appendix B.

Table 1. *Acoustic thresholds for injury at 10 m for fish*[1].

Peak Absolute Pressure Limit (Threshold for Injury)	**Sound Exposure Level (SEL) Limit (Threshold for Injury)**
206 dB re 1 μPa	187 dB re 1 $\mu Pa^2 s$

[1] Correspondence between Herb Scribner and Dan Tierney, NOAA NMFS "*The noise produced by driving 3 foot or 6 foot piles with an impact hammer will likely exceed the injury thresholds for noise (206 dB Peak and 187 dB SEL) set by the Fisheries Hydroacoustic Working Group, an interagency (USFWS and NMFS included) work group on the West coast that considers the effects of pile driving on fish,*" October 4, 2011.

Table 2. *NOAA guidelines for root men square (rms) pressure levels for Level A and Level B harassment of marine mammals due to continuous (vibratory hammer) and transient (impact hammer) sources.*

Type	Level A	Level B
Vibratory	180 dB rms	120 dB rms
Impact	180 dB rms	160 dB rms

The objective of marine mammal observations was to reduce risk of marine mammal exposure to Level A noise harassment through identification, localization, mitigation measures as necessary. The Marine Mammal Observation Plan for Pile Driving Activities is included as Appendix C.

The goal of the bird surveys was to identify impacts of pile driving noise on sea and shorebird behavior in the vicinity of the project site. The final bird survey report for pile driving is included as Appendix D.

3.0 SUMMARY OF PILE DRIVING ACTIVITIES

The geographic scope of the study generally includes the Cobscook Bay Deployment Area (

Figure *1*).

The Phase I TidGen™ foundation is comprised of a bottom support frame secured to the seafloor with steel piles. The pile foundation consists of ten 30-inch diameter piles with 0.5-inch wall thickness. Piles were driven open ended with a cast iron driving shoe. The length of each pile was determined by the depth of seafloor surfical materials overlying bedrock.

The bottom support frame was deployed on March 20, 2012. Pile driving commenced on March 24, 2012. Two technologies were used for the pile installation process; a vibratory and a diesel impact hammer (specifications provided in Attachment B). Due to the depth of water, a 100-foot follower was used between the pile and each hammer type. The follower, using a flanged connection, was attached to the pile on deck in a receiver attached to the barge and lowered to the appropriate pile sleeve on the bottom support frame.

Due to limitations of deploying structures in high velocity tidal currents, pile driving operations only occurred during an approximate 1 hour period centered on slack tide. Water depths were approximately 105 feet and 85 feet at high and low slack water respectively.

Once lowered to the seafloor most piles sunk approximately 10 feet into the marine clay under their own weight. Each pile was then driven to refusal using the vibratory hammer. During a subsequent slack water period three piles were driven further into glacial till or to bedrock using the impact hammer. However, operation of the impact hammer provided minimal additional embedment, so its use was discontinued after March 31, 2012. Following the hammer operations each pile was unbolted from the follower and hammer assembly underwater by divers.

Pile driving was completed on April 4, 2012. Figures 3 and 4 show the impact and vibratory hammer assemblies respectively.

Figure 3. Diesel impact hammer operations, March 25, 2012.

Figure 4. Vibratory hammer operations, April 1, 2012.

4.0 MONITORING METHODOLOGIES

4.1 In-Air Noise Measurement System Equipment and Methods

In-air measurements were performed using a sound level meter mounted on an industrial tripod at a fixed location during a particular pile activity. A GPS recording device was attached to the tripod to determine the distance to the pile activity. The sound level meter was a Quest Technologies SoundPro DL-1-1/3 Octave-20 sound level meter that meets Type 1 requirements of the American National Standards Specifications for sound level meters, SI.4-1971.

Each day the sound level meter was deployed on either Goose Island or at the Lubec On-shore Station location. The meter was calibrated before and after each day of recording using the methods and calibrator provided by the meter manufacturer. A PSO remained at a distance to the unit to ensure that the equipment was not engaged by wildlife and to note if boats passed near or between the barge and the measurement location during the driving activity.

4.2 In-Water Noise Measurement Equipment and Methods

In-water measurements consisted of near-source barge based measurements at approximately 10 m from the pile and boat based measurements ranging from 100 m to 2 km. Barge based measurements were conducted with a pair of hydrophones deployed approximately 10 and 20 ft below the surface. Measurements were made as a series 75 second (s) records with approximately 10 s between records using an IOTech WaveBook/516E data acquisition system. Boat based measurements were made using a similar pair of hydrophones at similar depths and data was captured as a series of 60 s records without breaks using a Measurement Computing LGR-5320 data acquisition system. Specification sheets for the equipment can be found in the appendices of the Acoustic Monitoring Plan (Appendix B).

Figure 5. Acoustic monitoring from barge (right) and vessel at 100 m (left), April 2012.

4.2.1 *Barge Data Acquisition Component Summary*

- Hydrophones: 2 X Reson TC4013
- Preamplifiers: 2 X low-noise 1-100 kHz battery operated preamplifier (EPAC)
- Data Acquisition: IOTech Wavebook/516E to laptop computer over Ethernet

4.2.2 *Boat Data Acquisition Component Summary*

- Hydrophones: 2 x Reson TC4013
- Preamplifiers (stage 1): 2 X low-noise 1-100 kHz battery operated preamplifier (EPAC)
- Preamplifiers (stage 2): SSI custom low-noise preamplifier
- Data Acquisition: Measurement Computing LGR-5320 (2-channels @ 100kHz/channel sampling rate)

Prior to every deployment of the barge and boat measurement systems, the hydrophone sensitivity was calibrated through the entire system using a pistonphone recommended by the hydrophone manufacturer. A calibration was also performed at the end of each deployment. This ensured that there was no degradation in the performance of the hydrophones or acquisition system.

4.2.3 In-Water Mitigation Equipment

Figure 6 shows the mitigation equipment used during impact hammer activity. For the first pile Impacted, a single, ¾ in. piece of plywood was used between the hammer and the follower. Subsequent drives used two layers for 1 ½ in. total.

Figure 6. Plywood sound mitigation measures for the diesel impact hammer after pile driving. The first file used ¾ in. thick plywood (right photo). Subsequent impact drives used two layers for 1 ½ in. total (shown on left and center in photo in various stages of assembly).

4.3 MARINE MAMMAL OBSERVATION METHODOLOGIES

ORPC established a Marine Mammal Observer and Reporting Plan for Pile Placement (Plan) to minimize marine mammal exposure to loud noise-generating activities.

ORPC incidental visual monitoring of marine mammals in Cobscook Bay area between 2007 and 2010 indicated that harbor porpoise (*Phocoena phocoena*), Atlantic white-sided dolphins (*Lagenorhynchus acutus*), grey seals (*Halichoerus grypus)* and harbor seals (*Phoca vitulina*) may be present in the vicinity. Other species that may occur in the vicinity of the project include North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaengliae*), fin whale (*Balaenoptera physalus*), minke whale (*Balaenoptera acutorostrata*), and sei whale (*Balenoptera borealis*). These latter marine mammal species are generally associated with open ocean habitats and occur locally, but in more offshore locations in the Bay of Fundy. Thus, the four species with the greatest likelihood of occurring in the project area are harbor and grey seals, harbor porpoise and to a lesser extent, Atlantic white-sided dolphins. ORPC does not expect to create noise at levels that harasses marine mammals for prolonged periods of time. There may be some limited peripheral harassment if a marine mammal comes into the work area underwater and is not spotted by our observers.

ORPC's Plan included details on PSO skills, training program, equipment needed, survey methods, data collection and management protocols and associated data sheets, and an incident reporting form. Marine mammal observations were conducted 30 minutes prior to, during, and 30 minutes after deployment activities. In the event that a marine mammal was observed entering or within a 152 m (500 ft) marine mammal exclusion zone around the installation site during pile deployment activities, a mitigation action plan and curtailment of deployment activity was provided.

4.3.1 Marine Mammal Observation Training

ORPC led a workshop on February 16-17, 2012 to train PSOs in the identification of the marine mammal species known to occur in and around the waters of Cobscook Bay near the Project site. The instructor for the workshop was Dr. Moira Brown, senior scientist at the New England Aquarium. A total of 21 individuals, including local residents and ORPC staff, were certified as a result of the training.

The specific goals of the training included the following:

1. *Species Identification*

The instructor presented several images of each one of the species known to occur in the area and identified the specific characteristics unique to each one to aid species identification. Each image shown was obtained from a vessel platform closely approximating what the PSOs will see. Additional information was given on typical seal and whale behaviors and on the legal status of each species.

Table 3. *Common and less common species in Cobscook Bay*

Common Species in Cobscook Bay	Less Common Species
Harbor seal	Minke whale
Grey seal	Fin whale
Harbor porpoise	Sei whale
Atlantic white-sided dolphin	Humpback whale
	Right whale

2. *PSO Skills*
The instructor provided the PSOs with specific guidelines on how to set up the PSO team for maximum coverage of the area, how the PSOs should scan the surface of the water, which sighting cues to focus on, and how to distinguish whale species from other marine life (e.g. basking sharks, tuna, ocean sunfish).

3. *Data Recording*
Additional training included how to record data on paper data sheets. PSOs were familiarized with the program and data entry and protocols. Paper data sheets were summarized and digitized into a database for further analysis and reporting.

4. *Distance Estimation*
Distance estimation is difficult, and varies between individuals; the PSOs were introduced to range finder devices and given an opportunity to practice with the device outdoors. PSOs were trained to use a compass to get a bearing to the marine mammal. The range finder distance and compass bearing permit calculation of a sighting to provide for higher resolution data for mapping the sightings collected for the summary report.

4. *Testing*
The PSOs were shown a series of images of marine mammal species expected in the area and be asked to write down their own species identification for each test image. There was a mix of images they had seen before and novel images.

4.3.2 Vessel Observations

ORPC vessel observations were structured as described in the Plan and the IHA. Four PSOs were stationed on two observer boats, one boat anchored at 152 m (500 ft) upstream and one at 500 ft downstream from the installation site (Figure 7). On each boat, two PSOs were positioned so that one PSO surveyed inward toward the installation site (i.e., two PSOs dedicated to scanning continuously only the 152 m, 500 foot exclusion zone) while the second PSO on each boat scanned outward to a distance of 1 nm to conduct behavioral monitoring . Reference marker buoys (Table 4) were anchored at 152 m (500 ft) and 305 m (1,000 ft) were located around the installation site to help the PSOs identify when marine mammals were entering or within the exclusion zone. For behavioral observations from the 152 m (500 ft) marine mammal exclusion zone out to 1 nm, natural land marks can be used (Figure 7). There is water at a distance of 1 nm outward from the installation site on three sides of the installation site, to the southeast, west, and northwest (Table 4).

Table 4. *The location of the 1 nm boundaries A, B and C and the natural landmarks.*

1 nm Boundary	Position	Landmark
Boundary A – southeast of installation site	44 53.985 N x 67 01.640 W	Between Shackford Head and Green can #5
Boundary B – west of installation site	44 54.630 N x 67 04.159 W	Between Grove Point on Seward Neck and Birch Point on mainland
Boundary C – northwest of installation site	44 55.265 N x 67 03.783 W	Between Birch Point on mainland and Nipps Island

All sightings of marine mammals were reported to the recorder who logged an entry on the data sheet for each sighting, including the species, number, and behavior. The location of the marine mammals was estimated using a compass to determine the magnetic bearing to the animal and distance estimation or a range finder to determine the distance from the observation vessel to the animal. The information was entered on the paper data; the actual geo-referenced location was calculated after the observation period has been completed and entered into the computerized record.

The exclusion zone was monitored continuously during all pile driving, including 30 minutes prior to and following operations, to ensure that any marine mammals that enter the area were seen, recorded and if within the exclusion zone, lead to the cessation of pile driving activities until the marine mammal observed was beyond 305 m (1000 ft) or 30 minutes passed with no further sighting. The PSOs continued scanning the marine mammal exclusion zone and outwards to 1 nm until 30 minutes after the pile driving activity had ceased for that event. At the conclusion of the observation period, the team returned to Eastport. The anchoring system remained in place for the duration of the pile installation; however the reference buoys were initially removed daily to prevent entanglement between mooring lines and other vessels.

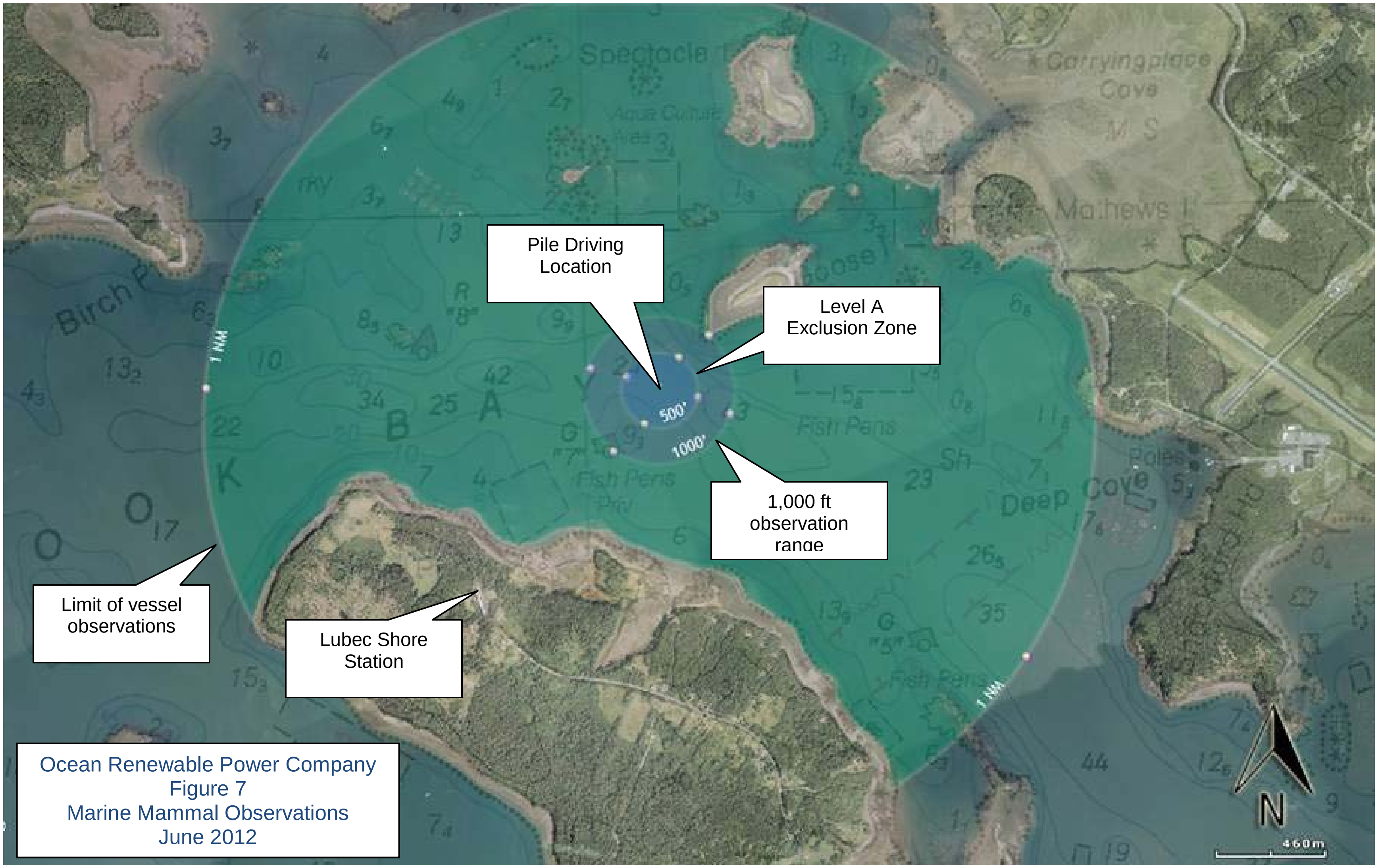

Figure 7. Marine mammal observation ranges.

4.3.3 Land Observations

ORPC's IHA required observations to take place at a 2.5 mile range from the installation site on at least three events during vibratory pile driving to conduct behavioral monitoring and validate take estimates. For these events observers were located at Birch Point in Perry (Figure 8) to look west and southwest and at the Shackford Head Overlook at the Shackford Head State Park (Figure 9) to view to the southwest towards the 2.5 mile ranges.

Land PSOs were provided with the same equipment and recorder sheets as those located on vessels and briefed on communications, access, and safety.

In addition, ORPC prepared plans to add PSOs on land on occasions when low visibility prohibited vessel observations to the 1 nm distance. The plans called for PSOs to be located at the Schooner Overlook to view to the northwest and at Birch Point to look southeast towards the installation site. However, weather conditions encountered during the pile driving installation did not necessitate land PSOs.

Figure 8. Birch Point observations

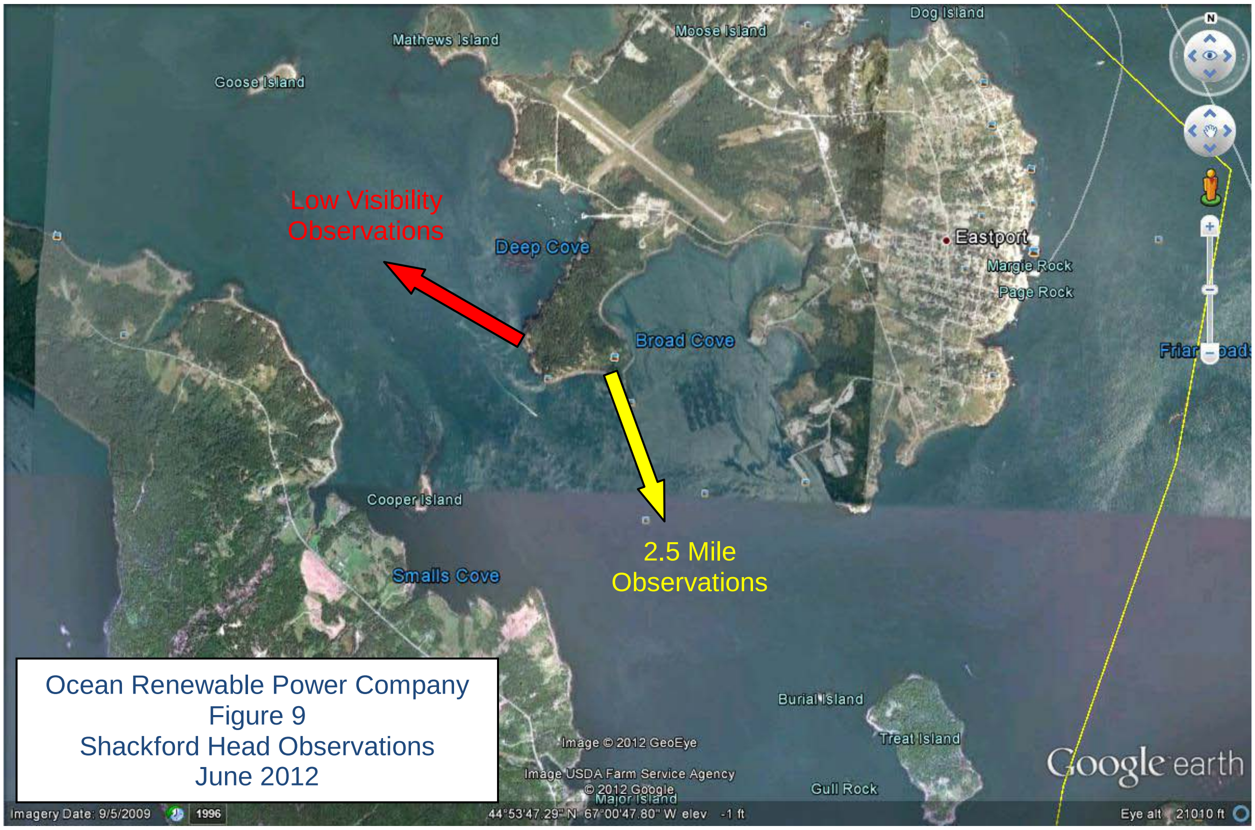

Figure 9. Shackford Head observations

4.3.4 MMO Operational Modifications

During pile driving activities ORPC encountered conditions that necessitated several modifications to marine mammal observations to reduce safety risks and logistical challenges.

<u>PSO Vessel Locations</u>

Due to safety concerns associated with proximity to pile driving, ORPC modified the locations of PSO vessels indicated in our IHA and Marine Mammal Observation Plan for Pile Driving Activities. NOAA NMFS, Office of Protected Resources, was notified of the modification on March 28, 2012. PSO vessels were moored at a distance of 1,000 ft from the installation site (vs. 500 ft proposed). Two dedicated observers on each vessel continued to monitor inwards to the installation site, focusing on the 500 ft exclusion zone. In addition, two dedicated observers on each vessel continued to monitor outwards to a distance of 1 nautical mile.

The barge that the pile driving crane sat on was 150 ft long and was moored at all four corners to large bottom anchors. The mooring lines were approximately 1,000 ft long, making the 500 ft mooring for our observation boats interfere with not only the pile barge but the several other support vessels (diver support, safety, materials barge, and crew boats). The quality of the binoculars and location gear (as described in ORPC's Marine Mammal Observation Plan) assured consistent and full-view coverage of the activity zones.

<u>Removal of 500 ft Range Buoys</u>

Due to inaccuracies in location caused by tidal currents and safety concerns associated with the proximity to pile driving operations, ORPC removed the 500 ft range buoys described in our IHA and Marine Mammal Observation Plan for Pile Driving Activities. NOAA NMFS, Office of Protected Resources, was notified of the modification on March 28, 2012. Strong tidal currents caused the 500 ft range buoys to only surface within approximately 20 to 30 minutes of slack water and their location was greatly compromised by the tidal flow. The buoys also pose a safety hazard to vessels approaching the pile driving barge due to their submergence.

ORPC briefed PSOs on using existing landmarks to identify the 500 ft exclusion zone. In addition, training that occurred by Dr. Moira Brown on February 16-17, 2012, included distance estimation. Each PSO vessel was moored at 1,000 ft from the pile driving barge and equipped with digital range finders (Figure 10). Points of reference for estimating the 500 ft exclusion zone included the following:

- Half the distance between the PSO and the pile driving point
- Half the distance between the southwest tip of Goose Island and the pile driving point
- Half the distance between the green "7" marker buoy and the pile driving point

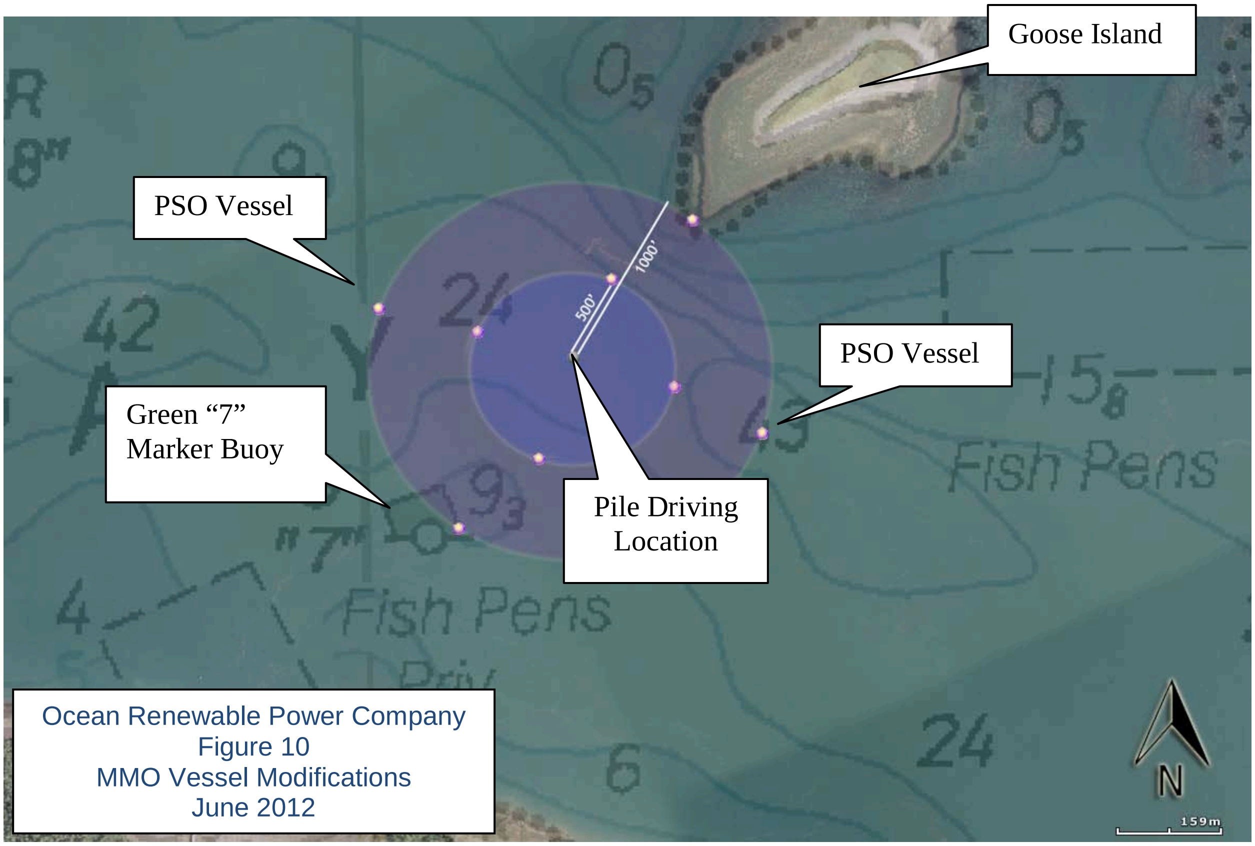

Figure 10. Modifications to PSO vessel locations

4.4 Bird Observation Methods

The Center for Ecological Research (CER) conducted observations on March 31, 2012, to determine if the seabirds that use the proposed deployment area were affected by the installation of the support structure for the TidGen™ device.

The phase of this study documented the number of seabirds that used the general deployment area on March 31, 2012, during both vibratory and diesel impact hammer operations and compared the results to previous survey data from the area.

Wintering Waterfowl and Seabirds

CER conducted two surveys from the landing site at North Lubec on March 31, 2012. Each survey was conducted for a period of two hours. Each survey was divided into 15-minute periods and a maximum of three species and its behavior (see below) were recorded during each period. For reporting purposes, CER condensed the 15-minute observation periods into 30-minute units by selecting the largest count in each of the two 15-minute periods, e.g., if 7 eiders were counted in the first 15 minute period and 11 eiders were counted in the second period, CER used the higher number, in this case, 11 individuals. CER used a continuous scan method to identify and count all species present (Martin and Bateson 1986). Observers used 8x or 10x binoculars and a 20-60x telescope for the land-based surveys.

Behaviors

CER registered all behaviors of birds on the water's surface. Birds were identified as Loafing (floating on the surface), Diving (active feeding below the surface), or Surface Feeding (active feeding on the surface) (Holm and Burger 2002). In addition, CER noted when construction activities were initiated and recorded bird movements and behaviors during those construction activities.

Figure 11. Bird Surveys from pier on Seward Neck

5.0 Monitoring Results

5.1 In-Air Monitoring Results

In-air measurements at the Lubec On-shore Station location and on Goose Island indicated that the pile driving activity was detectable for both vibratory and impact hammer sources based on the ambient noise level during the pile driving. As the pile driving noise levels and ambient noise levels were variable, the results varied from pile activity being completely masked by ambient noise to levels 5 – 10 dB above ambient. Figures 12 through 15 depict acoustic measurements recorded on Goose Island and at the Lubec On-shore Station for both impact and vibratory hammer operations.

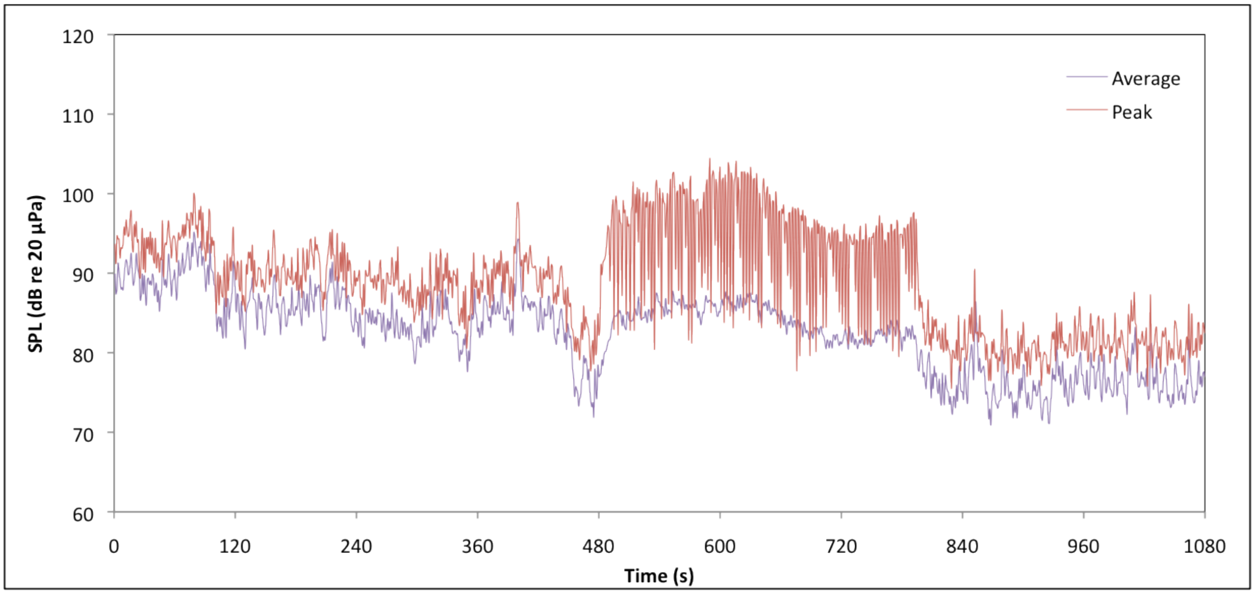

Figure 12. In-air measurements on Goose Island during impact hammer activity, March 25th starting at approximately 2:07 pm.

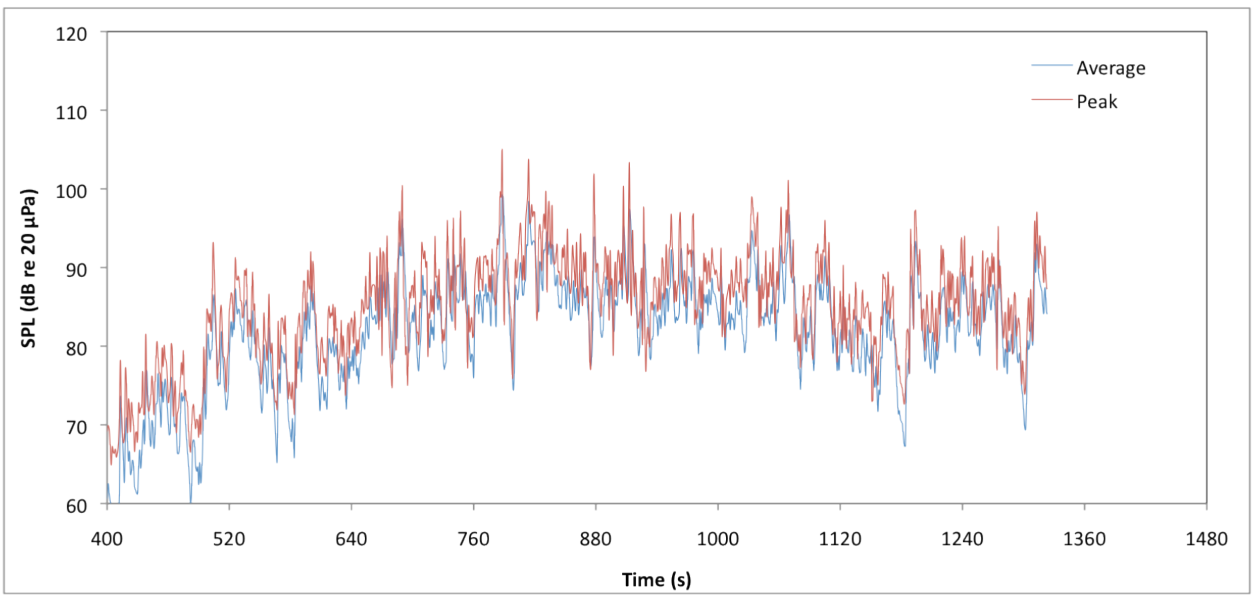

Figure 13. In- air measurements at the Lubec shore station location during impact hammer activity, March 31st starting at approximately 6:00 pm.

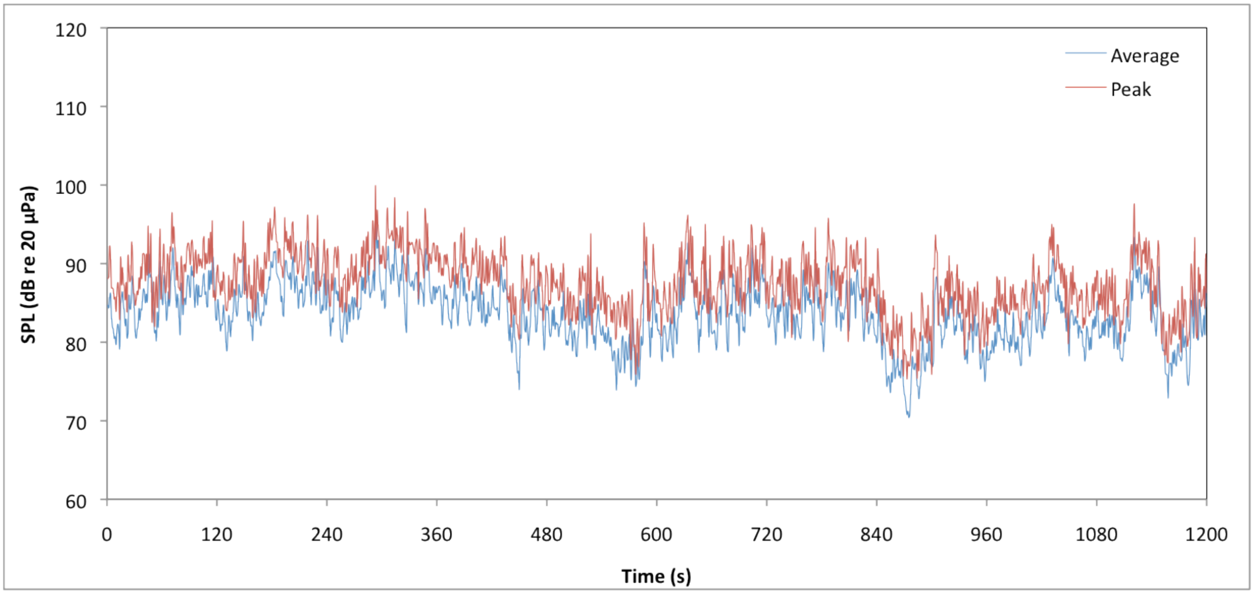

Figure 14. In-air measurements on Goose Island during vibratory hammer activity, March 29th starting at approximately 10:25am.

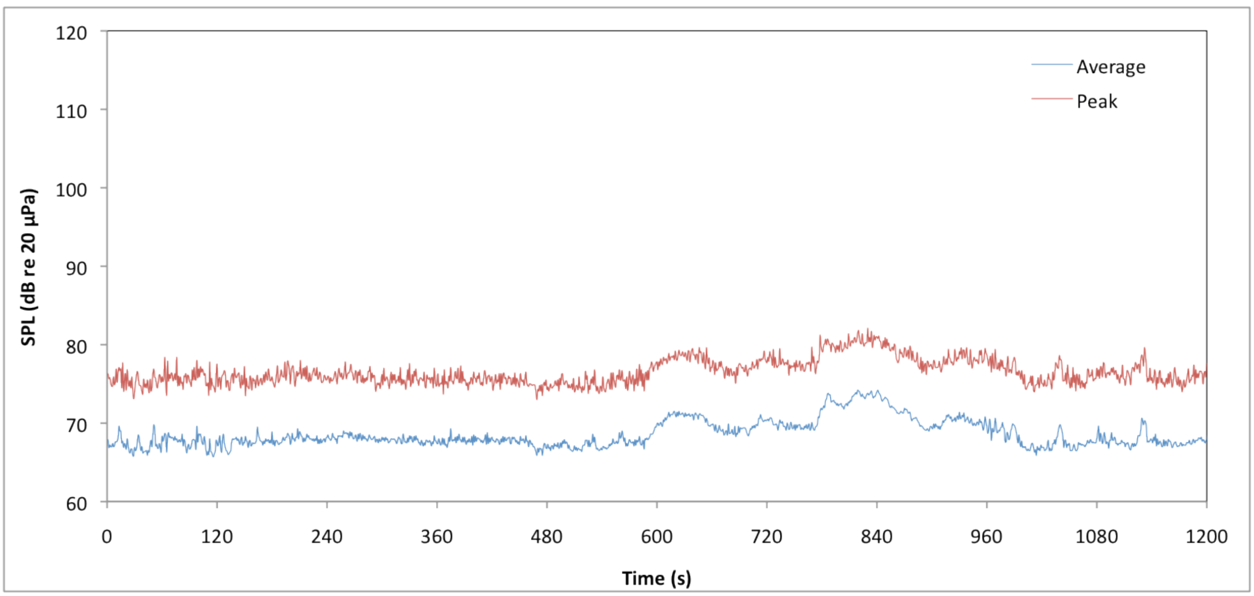

Figure 15. In- air measurements at the Lubec shore station location during vibratory hammer activity, April 1st starting at approximately 6:25am.

5.2 In-Water Acoustic Monitoring Results

5.2.1 Near-Source Summary

In-water acoustic monitoring results indicate that ORPC did not exceed either the SEL or peak noise threshold during the observed impact hammer activity or during the majority of the vibratory hammer activity. Table 4 summarizes the near-source measurements, associated pile activity and relevant noise threshold levels (peak absolute pressure level and sound exposure level). For the two initial vibratory hammer piles that exceeded the SEL limit, the cause is attributable to an improper connection between the vibratory hammer and the pile, which was addressed in later vibratory pile driving events. Upon correction of the connection issue the SEL for vibratory pile driving was within allowable limits. Figures 16 and 17 show recorded peak absolute pressure for impact and vibratory hammer events in the order of pile driving.

Table 4. *Summary of pile driving activity including hammer type, duration, drive depth and near-source receive levels (peak absolute pressure and sound exposure level) at 10 m.*

Pile	**Type**	**Drive Distance (vertical ft)**	**Duration (min)**	**Peak Pressure (206 dB re 1 μPa Threshold for Injury)**	**SEL re 1 μPa²s (187 dB Threshold for Injury)**
8	Vibratory	32	7:30	195	188 (25% over limit)
8	Impact	15	5:17	202	168
5	Vibratory	38	8:09‡	184	188 (25% over limit)
3	Vibratory	36	8:30†	177	180
3	Impact	0	3:00	200	170
5	Impact	0	1:00	198	169
1	Vibratory	29	7:31†	170	171
7	Vibratory	48.5	13:30†	171	178

.

‡ Includes soft start period of 2 minutes at 50% energy

† Includes soft start period of 4 minutes at 0% (off) and 50% energy

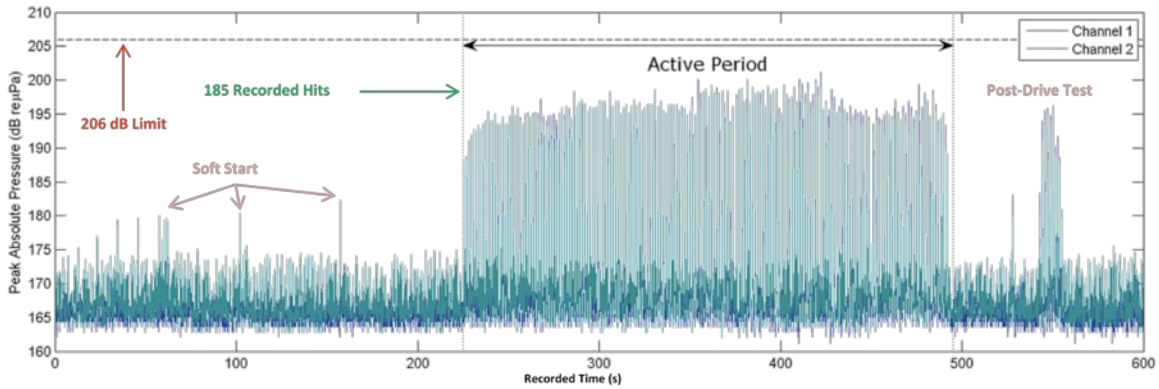

Figure 16. Peak absolute pressure as a function of recorded time for impact hammer activity of pile 8 on March 25th, including soft-start. The peak amplitudes of the impacts never reach or exceed to the 206 dB peak absolute pressure limit.

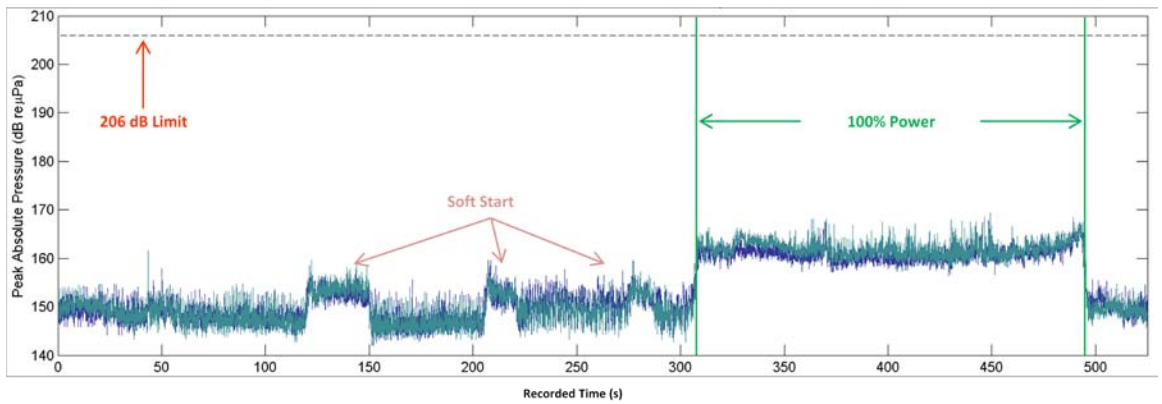

Figure 17. Peak absolute pressure as a function of recorded time for vibratory hammer activity after improving connections between the hammer and follower and the follower and pile. Under normal conditions the vibratory hammer showed fairly consistent output at 100% power. Pile 1, April 1st.

5.2.2 Isopleth Summary

Table 5 summarizes the isopleth ranges for Level A and B harassment using the vibratory hammer (continuous source) and impact hammer (transient source) based on direct measurements and the measured transmission loss. These values show that measured Level A and B ranges were significantly closer to the pile driving operation than the conservative ranges included in the Acoustic and Marine Mammal Observation Plans. The measured Level A (where applicable) and Level B ranges are included in Figures 18 and 19 for vibratory and impacts hammer operations respectively.

Table 5. *Summary of isopleth ranges based on near-source and far-field measurements for Level A and B harassment of vibratory and impact hammer types.*

Type	**Level A range (m)** **(Vibratory 180 dB re 1 µPa rms)** **(Impact 180 dB re 1 µPa rms)**	**Level B range (m)** **(Vibratory 120 dB re 1 µPa rms)** **(Impact 160 dB re 1 µPa rms)**
Vibratory	N/A	500
Impact	10	275

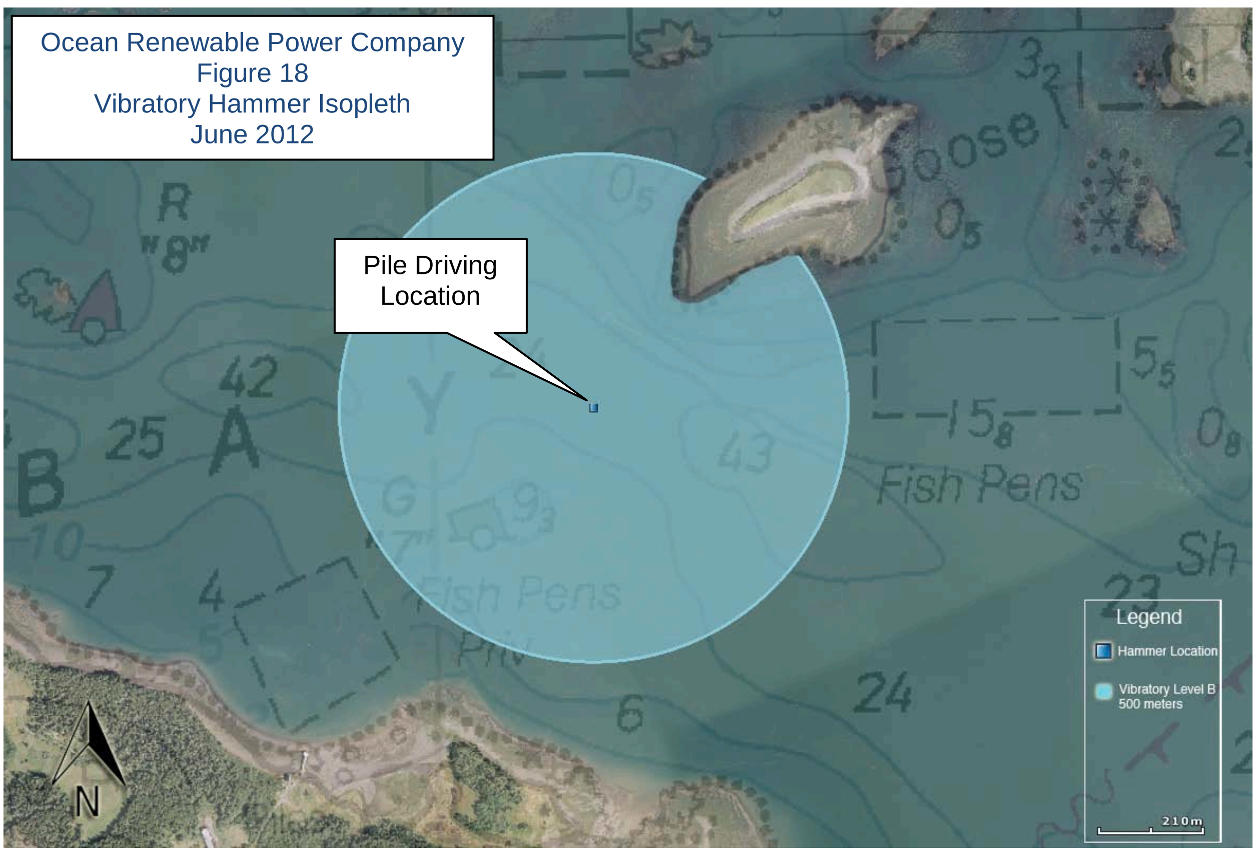

Figure 18. Measured Level B harassment isopleth for vibratory hammer.

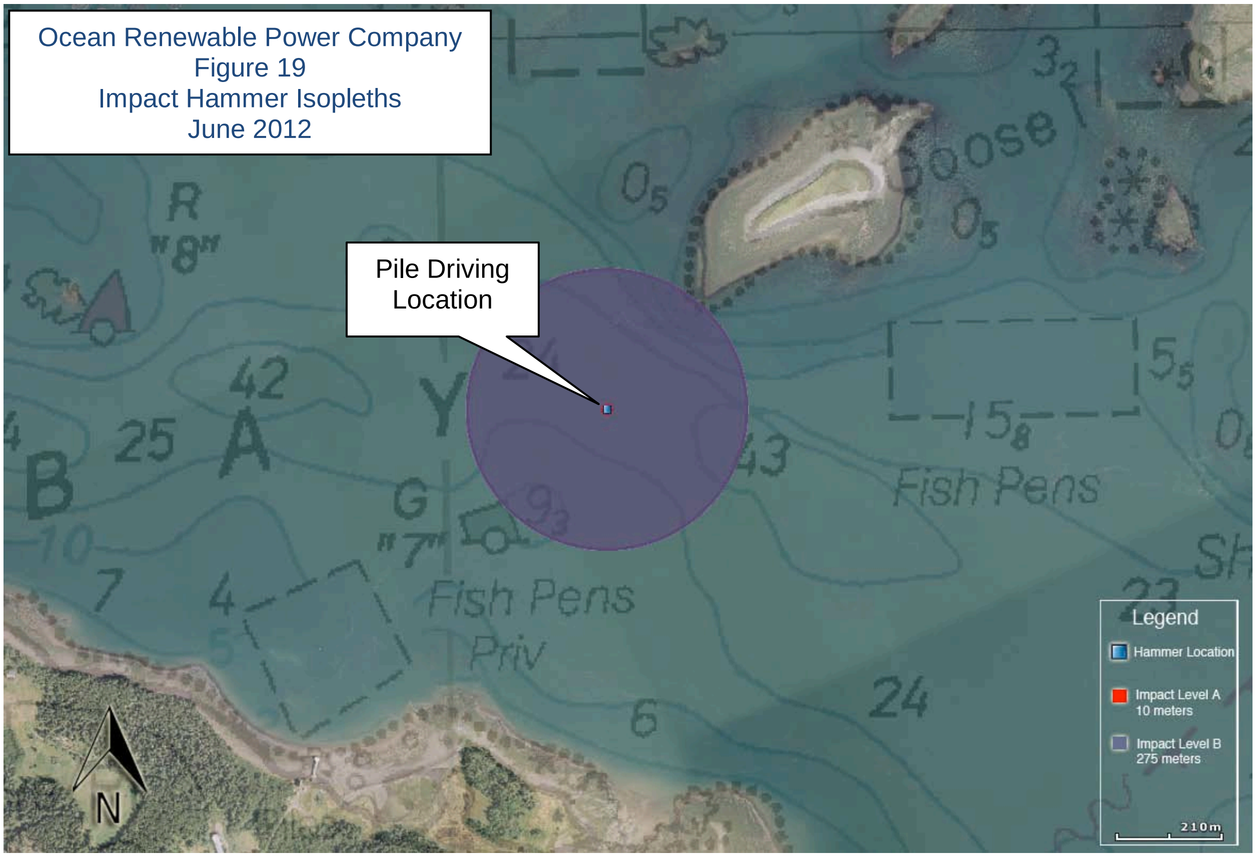

Figure 19. Measured Level A and B harassment isopleths for diesel impact hammer.

5.3 Marine Mammal Observation Results

Marine mammal observations were conducted for all pile driving activities in accordance with the IHA and ORPC's Marine Mammal Observation Plan for Pile Driving Activities (including operational amendments). Observations were conducted during 13 separate pile driving events. Marine mammal sightings occurred during 4 of the 13 events. Recorder sheets for each event are included in Appendix F.

5.3.1 Species

All marine mammal sightings recorded during the Project's Phase I pile driving were Atlantic harbor seals (*Phoca vitulina*). ORPC staff and the PSOs believe with a high level of confidence that all sightings were of an individual harbor seal. There was one the exception of a vibratory hammer event on the morning of April 2, 2012, when due to multiple sightings within a short timeframe on opposite sides of the installation barge there were possibly two harbor seals present during that event.

Information suggesting the harbor seal sightings was an individual animal include:

- *Physical characteristics.* All sightings were of a medium sized harbor seal with no distinguishing features. Figure 20 is a photo of a harbor seal at the Project site prior to pile driving activities.
- *Surfacing times and location.* No sightings recorded multiple seals at the same time. Sightings most frequently occurred between approximate 5 minute dive times. Most sightings were concentrated within a relatively small area.
- *Behavior.* The harbor seal sightings were typically very similar and generally within 500 ft of the southeast observation vessel. Two dominant behaviors were observed; "bottling" (their entire bodies remain submerged with just their heads exposed at the surface) and travelling.

Figure 20. Harbor seal observed swimming prior to pile driving activities.

5.3.2 Behavioral Trends

Table 6 summarizes key environmental monitoring information, including marine mammal sightings, during Phase I pile driving. Figures 21 through 24 indicate sighting locations for the four events during which harbor seals were observed and the associated measured Level A (impact hammer only) and Level B isopleths. Each sighting contains the sequential number of the sighting. Sightings colored yellow occurred during the 30 minute pre or post observation period (no sightings occurred during active pile driving). Sightings colored orange occurred prior to the 30 minute pre-observation period.

Notable information and key trends associated with the observations include:

- Harbor seal (most likely 1 individual) was sighted during 4 pile driving events (3 vibratory hammer and 1 impact hammer).
- No Level A sightings. Shut down or delay procedures were not required.
- No sightings occurred during active pile driving.
- 82% of sightings (28 of 34) occurred within the Level B isopleth (versus outside Level B).
- 100% of the sightings (34) occurred at high tide.
- 88% (30 of 34) of the sightings occurred on the southeast side of the installation.
- 100% of the sightings (20) prior to the 30 minute pre-installation window (when current velocities were relatively high) occurred on the southeast side of the installation (up current from installation). Tidal velocities during this period are estimated to be 1.5 knots or greater. As the tidal velocity slacked the sightings became more distributed.
- 88% of the sightings (30 of 34) occurred prior to pile driving activity. (71% 30 min prior vs. 30 min following [10 of 14]).

5.3.3 Estimation of Takes

As discussed in Section 5.3.1, marine mammal observations sightings and behavior have led to the determination that, with a high degree of confidence, the majority, if not all, of sightings were of a single harbor seal. Therefore, ORPC has estimated a single Level B “take” for each pile driving event where a harbor seal was observed with the exception of the morning pile driving event on April 2, 2012. Due to the location and frequency of sightings during this event ORPC has conservatively estimated two Level B 'takes." Total Level "B" takes of marine mammals during the pile driving period, all harbor seals and most likely a single animal, were five.

Table 6. *Pile Driving Log – Environmental Monitoring*

Pile/Sleeve#	Date	Pile Driving Method	Vertical Drive Length (ft)	Hammer Start	Hammer Stop	Near Field Acoustic Distance (m)	Far Field Acoustic Distance (m)	In-Air Acoustics	Level B "Takes"	Tidal Level	Water Depth (ft)
6/8	3/24/2012	Vibratory	32	13:49	13:37	20	100	Goose Is.	1 Harbor Seal	High Slack	106
6/8	3/25/2012	Impact	15	14:16	14:21	20	100	Goose Is.	1 Harbor Seal	High Slack	103
5	3/29/2012	Vibratory	38	10:32	10:39	15	80	Goose Is.	0	Low Slack	85
3	3/31/2012	Vibratory	36.5	12:04	12:13	10	1000-1100	Shore Station	0	Low Slack	87
3	3/31/2012	Impact	0	18:14	18:17	15	1000	Shore Station	0	High Slack	~99
5	3/31/2012	Impact	0	18:34	18:35	15	1000	Shore Station	0	High Slack	~99
1	4/1/2012	Vibratory	29	6:38	6:45	10	500	Shore Station	0	High Slack	97
7	4/1/2012	Vibratory	48.5	13:02	13:17	10	1000	-	0	Low Slack	84
9	4/2/2012	Vibratory	54.5	7:39	7:50	20	2000	-	2 Harbor Seals	High Slack	100
6	4/2/2012	Vibratory	50	14:03	14:13	-	-	-	0	Low Slack	83.5
4	4/3/2012	Vibratory	44	8:47	8:56	-	-	-	0	High Slack	100.5
2	4/4/2012	Vibratory	38	9:53	10:00	-	-	-	1 Harbor Seal	High Slack	101.4
10	4/4/2012	Vibratory	52.5	16:11	16:17	-	-	-	0	Low Slack	81.5

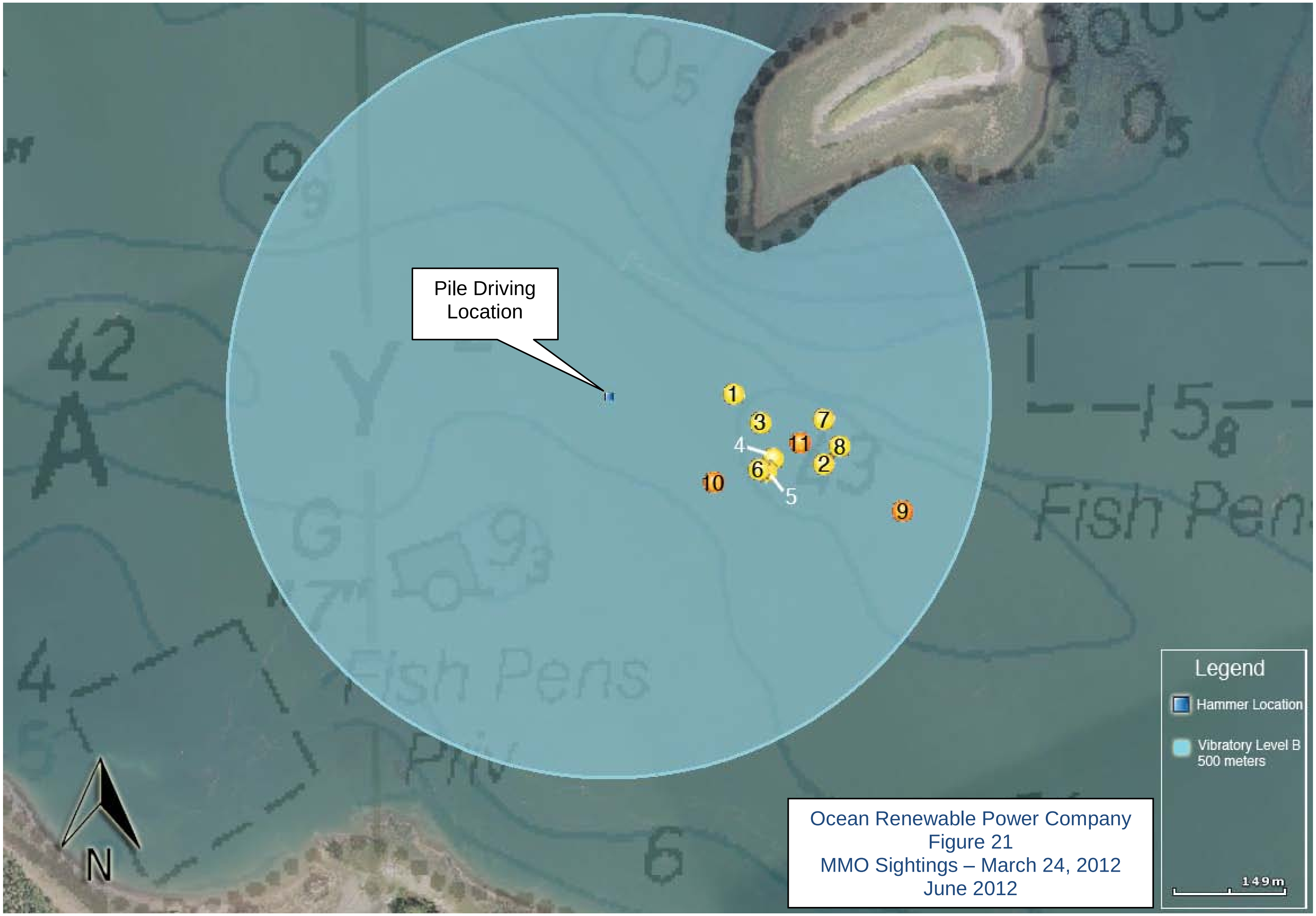

Figure 21. Harbor seal sightings during March 24, 2012 vibratory hammer event. High slack water. Hammer activity 13:49 to 13:57. Sightings that occurred within period 30 minutes prior to or 30 minutes after hammer activity colored orange. Sightings outside this period in yellow.

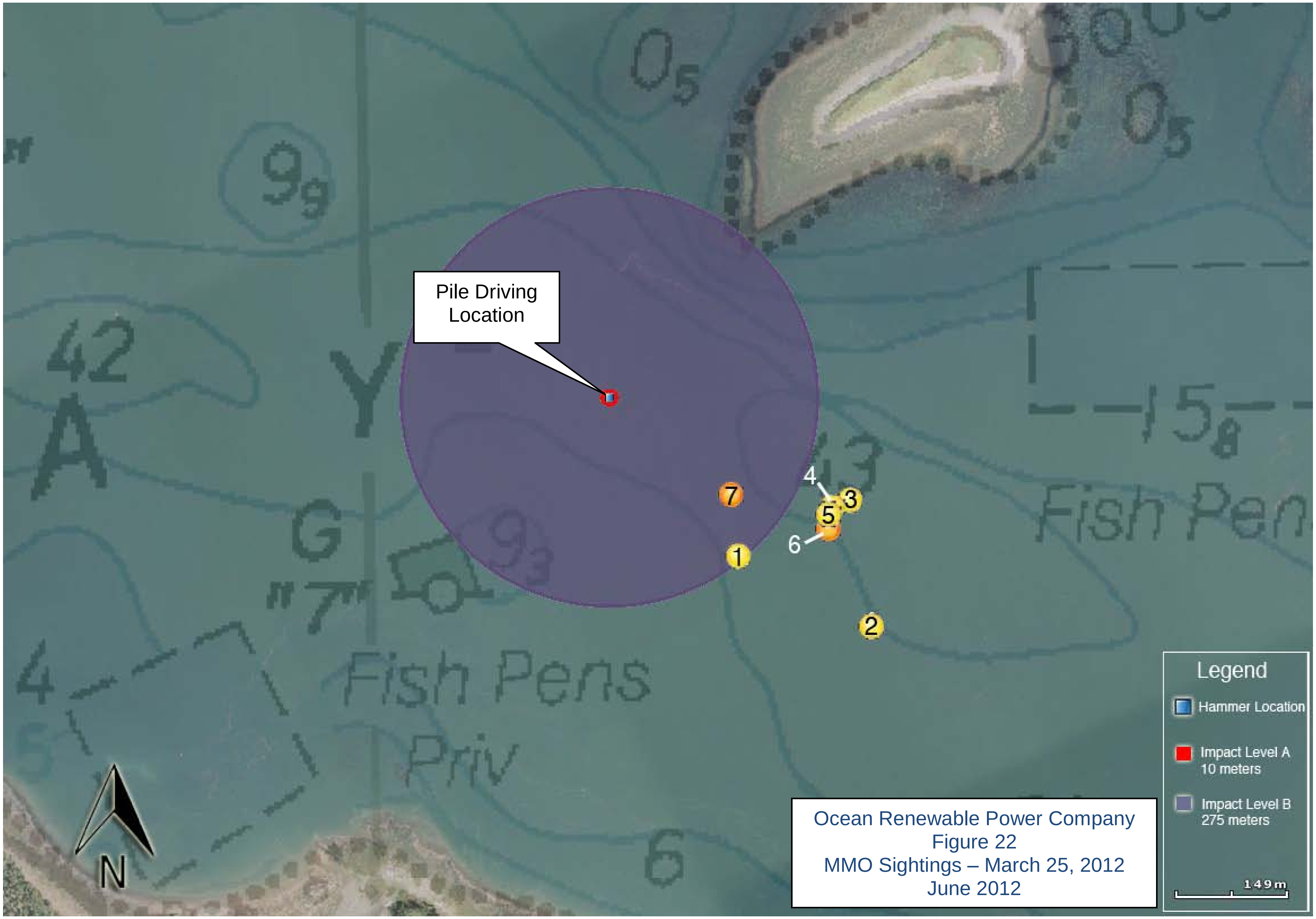

Figure 22. Harbor seal sightings during March 25, 2012 diesel impact hammer event. High slack water. Hammer activity 14:16 to 14:21. Sightings that occurred within period 30 minutes prior to or 30 minutes after hammer activity colored orange. Sightings outside this period in yellow.

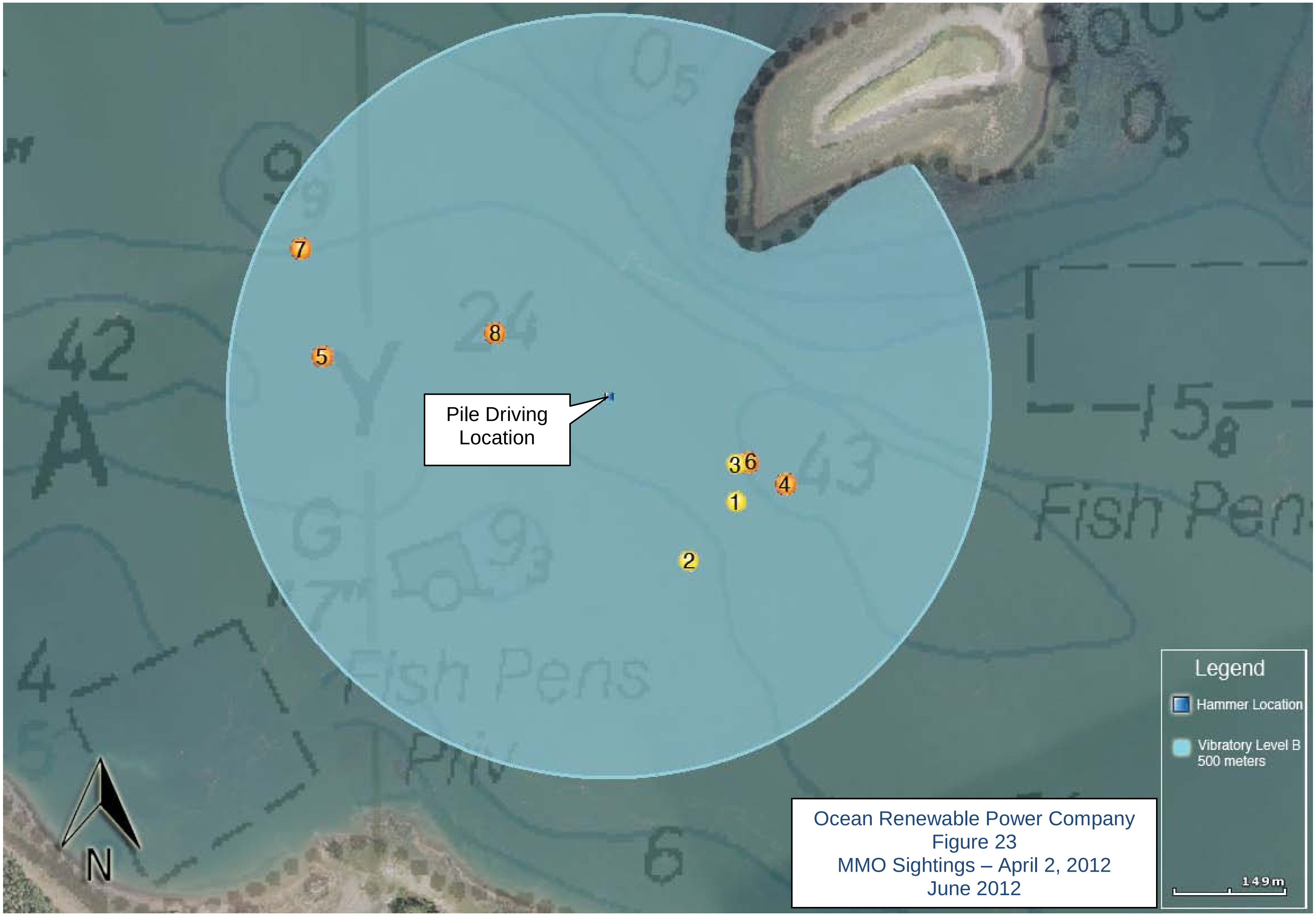

Figure 23. Harbor seal sightings during April 2, 2012 vibratory hammer event. High slack water. Hammer activity 07:39 to 07:50. Sightings that occurred within period 30 minutes prior to or 30 minutes after hammer activity colored orange. Sightings outside this period in yellow.

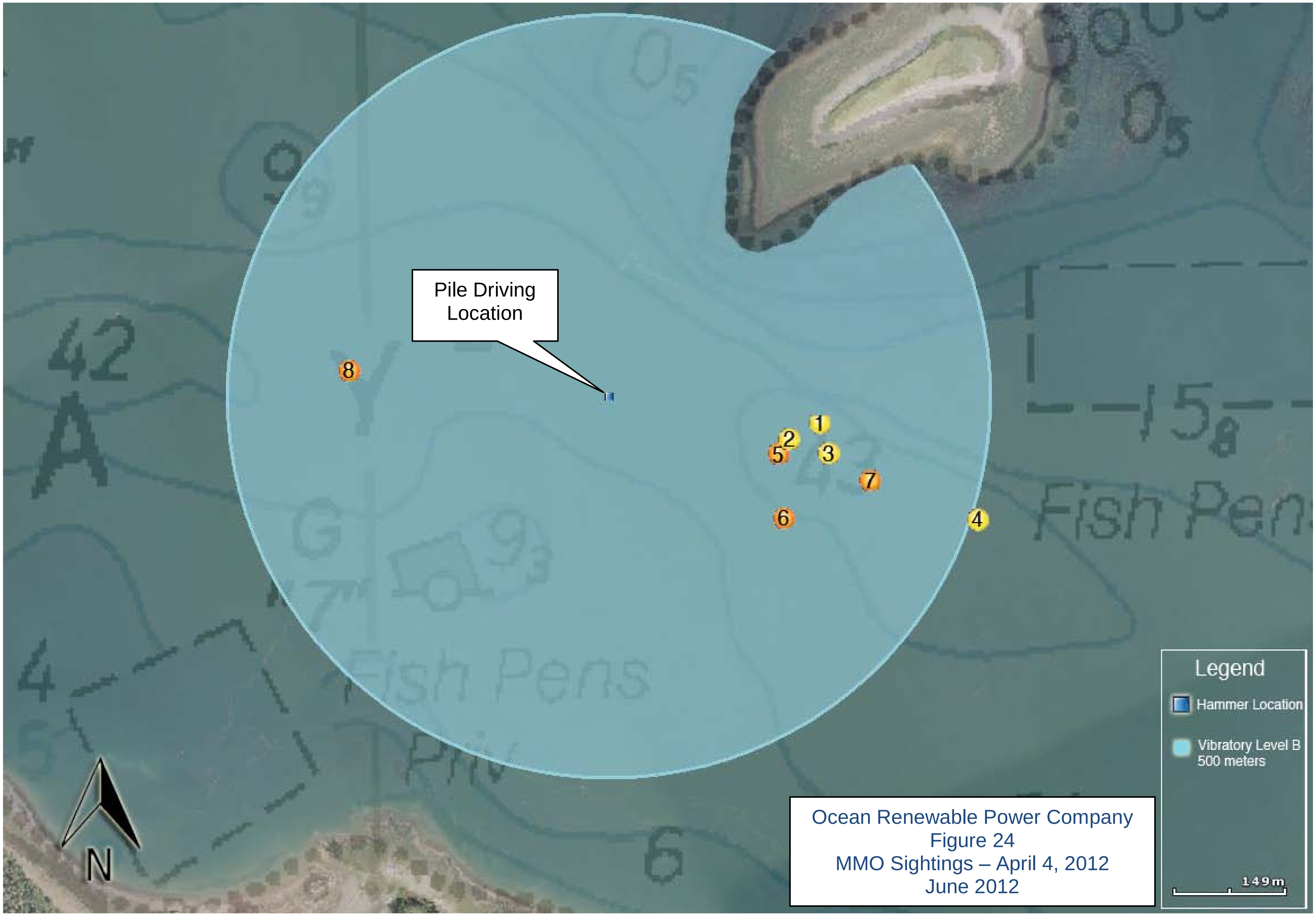

Figure 24. Harbor seal sightings during April 4, 2012 vibratory hammer event. High slack water. Hammer activity 09:53 to 10:00. Sightings that occurred within period 30 minutes prior to or 30 minutes after hammer activity colored orange. Sightings outside this period in yellow.

5.4 Bird Observation Results

There was little response of seabirds to the vibratory hammer noises. Any effects were generally minimal or of short duration. Given the general boat activity in the area, CER could only detect brief displacements that were less than 15 minutes long and it was not possible to determine if the seabird response was precipitated by the installation activities. Three Canada geese near the landing site appeared to be disturbed by the vibratory hammer and departed the area when this equipment started operation. Common eiders were displaced by a fishing vessel that passed through the deployment area while the vibratory hammer was in use but these birds quickly settled in the same area where they had been foraging. This suggests that eiders were not impacted by the noise or action on the barge.

CER observed no obvious seabird response to the louder diesel impact hammer. Common eider numbers declined from 8 to 5 individuals during operation but this was within the normal fluctuation of this species in this area at the time (Figure 3). Common loon numbers declined briefly but it was not clear whether this was in response to the diesel impact hammer noise or it was part of the normal loon movements in this area. Loon numbers returned to previous levels (3 individuals) within 15 minutes.

All seabirds were actively feeding prior to and during installation activities. The fact that this behavior did not change when the vibratory or diesel impact hammers were in use seems to indicate that the seabirds present were not affected by the noise.

Endangered and Threatened Species

CER surveys did not find any federal or state endangered or threatened species on March 31, 2012. Bald eagles are regular in the study area but this species was removed as a threatened species in 2009 (Charles Todd, pers. comm.; MDIF&W). In addition to observations, in-air acoustic results (discussed in Section 5.1) confirm minimal impacts at the shore station site in Lubec from the temporary pile driving noise. Information from the Maine Department of Inland Fish and Wildlife provided on February 17, 2011 indicates no active Eagle nests on Seward Neck in Lubec. The nearest active nest is located approximately 1 mile northeast of the site on Mathews Island within the City of Eastport.

Potential Impact for ORPC Activities in Winter

Given that CER staff observed a general lack of seabird response to these installation activities, it seems unlikely that installation activities will have any adverse affect on non-breeding seabirds at any season. It also seems unlikely that general maintenance activities will disturb seabirds at this site. It does appear that major installation and maintenance activities could affect Canada geese but previous observations confirm that this species is rare in the study area at any season, and Canada geese have not been observed in the deployment area. CER staff did not observe any Canada geese during winter surveys from November 2010 through May 2011, nor from September 2011 through February 2012. The three individuals on March 31, 2012, were the only geese seen on CER surveys.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Pile driving activities were completed between March 24 and April 4, 2012 in accordance with regulatory concerns related to Atlantic salmon occurrence. Environmental monitoring during pile driving activities included:

- In-air acoustic monitoring on Goose Island and at the Lubec On-shore Station
- Hydroacoustic monitoring in the near field (from the deployment barge) and at various far field ranges (100 m, 1,000 m, and 2,000 m)
- Marine mammal observations located on vessels anchored around the installation site for all pile driving activity and additionally from land stations for three events
- Bird survey from the Lubec shore

6.1 INTEGRATED MONITORING RESULTS

Results of the monitoring during pile driving activities demonstrate minimal impact to the environment. Source levels measured during impact and vibratory pile driving were below the thresholds of concern for Atlantic salmon. Measured Level A and B isopleths ranges were significantly smaller than the conservative ranges included in the IHA. In addition, responses to pile driving noise by birds and harbor seals were minimal, with sightings of each occurring in the vicinity of the project area both before and after pile driving. Harbor seals, or more likely a single harbor seal, returned to the project site on multiple days of pile driving.

6.2 EVALUATION OF PILE DRIVING BEST MANAGEMENT PRACTICES

Mitigation measures used during pile driving were successful in maintaining acoustic source levels within acceptable ranges and minimizing impacts to the environment. These measures included wood sound absorption devices installed in the head of the impact hammer and a “soft start” that initiated pile driving at less than 100% energy.

In addition, modifications made by the contractor to the physical connection between the pile and the follower alleviated initial acoustic spikes. PSOs were successful in recording sighting frequency, location and animal behavior. However, no marine mammal was observed within or approaching the Level A exclusion zone (initially estimated to be 500 feet); therefore, shut down or delay procedures were not initiated.

ORPC presented initial pile driving acoustic results, including the effectiveness of mitigation measures, to NOAA NFMS on April 2, 2012 as agency consultation required to modify the restrictive window for pile driving required by the FERC License. ORPC’s presentation, prepared by SSI, is included as Appendix G. A license modification request to FERC was submitted by ORPC on March 29, 2012, and supplemented with additional information on April 2, 2012. The modification was approved on April 4, 2012.

6.3 RECOMMENDATIONS

ORPC will utilize this same pile driving techniques in the future. Phase I testing results provided information pertinent to future activities with the project and the need for an IHA in particular. This process was also suggested by the NOAA NMFS, Office of Protected Resources.

The following methodologies and modifications should be considered for Phase II installation:

<u>Pile Driving</u>

- Sound absorption devices used during Phase I pile driving were successful in maintaining source levels below regulatory thresholds.
- Modifications to the physical connection between the pile and the follower alleviated initial acoustic spikes.

- The effectiveness of soft start procedures used during Phase I is difficult to quantify. However, no marine mammals were observed within the Level A exclusion zone or at any time during active pile driving.
- ORPC demonstrated that SELs for vibratory hammer activity could be limited provided best practices are used for hammer and pile assembly.
- Information collected by ORPC, and subsequently submitted as a modification request related to the restrictive window for pile driving, was used to remove the window for the remainder of Phase I operations. This information remains pertinent to Phase II construction and should be evaluated for this purpose.

Hydroacoustic Monitoring

Hydroacoustic monitoring results confirmed that pile driving source levels were within acceptable ranges provided sound absorption devices were used and best practices were implemented for pile and follower assembly. ORPC intends to use these best practices if pile driving is used during Phase II installation. Additional hydroacoustic monitoring, therefore, should not be required.

Marine Mammal Observations

Marine mammal sighting and location information collected during Phase I pile driving indicate that certain tidal cycle periods present a greater probability for the presence of harbor seals in the water. In addition, measured isopleths ranges indicate that observations to a distance of 1 nautical mile are not necessary for either the impact or vibratory hammer. Based on these results ORPC suggests the following modifications to marine mammal observations should be considered if pile driving is conducted for Phase II construction:

- Measured isopleths ranges for both the impact and vibratory hammer should facilitate conducting observations from the installation barge rather than moored vessels. It is recommended that observers monitor to a distance of 500 m (the greatest extent of Level B isopleths) during any Phase II pile driving.
- No marine mammal sightings occurred at low tide. It is generally accepted that harbor seals haul out on local ledges during low tide – a behavior that is well documented (Patterson and Acevedo-Gutierrez, *Tidal influence on the haul-out behavior of harbor seals,* 2008). For Phase II pile driving events, ORPC recommends two PSOs stationed on the installation barge with 180 degree visibility fore and aft. Further consideration should be given to reduced observations during low tide operations and seasons with minimal marine mammal activity.

Sea and Shorebird Observations

Bird observations were not required by regulatory agencies; however, ORPC conducted surveys to determine any disturbance to a rookery (not active during pile driving) and potential bald eagle nesting areas. Results of bird surveys indicate minimal to no disturbance to birds in the project vicinity during pile driving. Any disturbance that did occur was temporary; therefore, the value of further bird surveys during pile driving should be considered prior to Phase II.

Appendix A

Final Incidental Harassment Authorization, March 8, 2012

DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE

INCIDENTAL HARASSMENT AUTHORIZATION

Ocean Renewable Power Company Maine, LLC (ORPC) (120 Exchange Street, Suite 508, Portland, Maine 04101) is hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1371(a)(5)(D)) and 50 CFR 216.107, to harass marine mammals incidental to pile driving in Cobscook Bay, subject to the following:

1. This Authorization is valid from March 12, 2012 through March 11, 2013.

2. This Authorization is valid for pile driving activities in Cobscook Bay, Maine, for installation of an underwater tidal turbine unit, as described in the Incidental Harassment Authorization (IHA) application.

3. ORPC is hereby authorized to take, by Level B harassment only, 72 total grey and harbor seals (*Halichoerus grypus* and *Phoca vitulina*), 72 harbor porpoises (*Phocoena phocoena*), and two Atlantic white-sided dolphins (*Lagenorhynchus acutus*) incidental to pile driving associated with the tidal turbine project.

4. The taking by Level A harassment, serious injury, or mortality of any of the species listed in 3 above or the taking of any kind of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this Authorization.

5. The taking of any marine mammal in a manner prohibited under this Authorization must be reported immediately to NMFS' Northeast Region, 55 Great Republic Drive, Gloucester, Massachusetts 01930-2276; phone 978-281-9328, and NMFS' Office of Protected Resources (NMFS), 1315 East-West Hwy, Silver Spring, MD 20910; phone 301-427-8401; fax 301-713-0376.

6. The holder or designees must notify NMFS' Northeast Region and Headquarters at least 24 hours prior to the seasonal commencement of the specified activity (see contact information in 5 above).

7. Mitigation Requirements

   The holder of this Authorization is required to abide by the following mitigation conditions listed in 7(a)-(d). Failure to comply with these conditions may result in the modification, suspension or revocation of this Authorization.

(a) *Sound Attenuation Device*: When using an impact pile hammer to install piles, wooden sound absorption cushions and/or a bubble curtain will be used to reduce hydroacoustic sound levels and avoid the potential for marine mammal injury.

(b) *Establishment of an Exclusion Zone*: During all in-water impact pile driving, ORPC will establish a preliminary marine mammal exclusion and buffer zone of 152 m (500 ft) around each pile to avoid exposing marine mammals to sounds at or above 180 dB. The exclusion zone will be monitored continuously during all impact pile driving to ensure that no marine mammals enter the 152-m (500-ft) radius. Once underwater sound measurements are taken, the exclusion and buffer zone may be adjusted accordingly so that marine mammals are not exposed to Level A harassment sound pressure levels. An exclusion zone for vibratory pile driving is unnecessary to prevent Level A harassment as source levels will not exceed the Level A harassment threshold.

(c) *Pile Driving Shut Down and Delay Procedures*: If a protected species observer sees a marine mammal within or approaching the exclusion zone prior to the start of impact pile driving, the observer will notify the on-site project lead (or other authorized individual), who will then be required to delay pile driving until the marine mammal has moved 305 m (1,000 ft) from the sound source or if the animal has not been resighted within 30 minutes. If a marine mammal is sighted within or on a path toward the 152-m (500-ft) exclusion and buffer zone during pile driving, pile driving will cease until that animal has moved 305 m (1,000 ft) and is on a path away from the exclusion zone or 30 minutes has lapsed since the last sighting.

(d) *Soft-start Procedures*: A ''soft-start'' technique will be used at the beginning of each pile installation to allow any marine mammal that may be in the immediate area to leave before the pile hammer reaches full energy. For vibratory pile driving, contractors will initiate noise from the vibratory hammer for 15 seconds at 40-60 percent reduced energy, followed by a 1-minute waiting period. The procedure will be repeated two additional times before full energy may be achieved. For impact hammering, contractors will provide an initial set of three strikes from the impact hammer at 40 percent energy, followed by a 1-minute waiting period, then two subsequent three-strike sets. The soft-start procedure will be conducted prior to driving each pile if hammering ceases for more than 30 minutes.

8. Monitoring Requirements

The holder of this Authorization is required to abide by the following monitoring conditions listed in 8(a)-(b). Failure to comply with these conditions may result in the modification, suspension, or revocation of this Authorization.

(a) Visual Monitoring

(i) The holder of this Authorization must designate at least two biologically-trained, on-site individual(s), approved in advance by NMFS, to monitor the exclusion and buffer zone (preliminarily set at 152 m [500 ft]) for marine mammals 30 minutes before, during, and 30 minutes after all impact pile driving activities. The protected species observer(s) shall conduct observations on the number, type(s), location(s), and behavior(s) of marine mammals in the designated exclusion zone (see Reporting section below).

(ii) Protected species observers must call for delay or shut down if any marine mammal is observed within or approaching the designated exclusion zone (preliminarily set at 152 m [500 ft]).

(iii) The holder of this Authorization must designate at least two biologically trained, on-site individuals, approved in advance by NMFS, to conduct behavioral monitoring out to 1 nmi during all impact pile driving. In addition, observers will be stationed at the Level B harassment isopleth (4,600 m [2.5 mi]) during at least three events of vibratory pile driving to conduct behavioral monitoring and validate take estimates.

(iv) Protected species observers will be provided with the equipment necessary to effectively monitor for marine mammals (for example, high-quality binoculars, spotting scopes, compass, range-finder, and digital SLR camera with telephoto lens) in order to determine if animals have entered into the exclusion zone or Level B harassment isopleth and to record species, behaviors, and responses to pile driving.

(v) NMFS must be informed immediately of any changes or deletions to any portions of the monitoring plan, as described in the application.

(b) Hydroacoustic Monitoring

(i) Underwater sound measurements will be taken at the initial installation of each pile driving method to ensure that the harassment isopleths are not extending past the estimated distances. Exclusion zones and harassment isopleths may be adjusted accordingly for marine mammals so that they are not exposed to Level A harassment sound pressure levels (180 dB). ORPC will contact NMFS within 48 hours in order to make the necessary adjustments.

(ii) Persons conducting sound measurements shall coordinate with the pile driver operator and marine mammal observer(s) to determine which activities are occurring at the time measurements are taken and if any marine mammals are in the area.

9. Reporting Requirements

The holder of this Authorization is required to submit a report on all activities and visual and acoustic monitoring results to the Office of Protected Resources, NMFS, and the Northeast Regional Administrator, NMFS, 90 days prior to the expiration of the IHA if a renewal is sought, or within 90 days of completion of pile driving.

a) The visual monitoring report must contain the following information:

(i) number of marine mammals observed and number taken, by species, and, if possible, sex and age class;

(ii) marine mammal behavior patterns observed;

(iii) marine mammal distances to pile driving activities;

(iv) time pile driving begins and ends and if pile driving was occurring during a sighting;

(v) time and locations of all marine mammal sightings;

(vi) environmental conditions, including but not limited to visibility, tide level and state (i.e., slack, ebb, flood), and sea state; and

(vii) other human activity in the area (e.g., vessel operation).

b) The acoustic monitoring report must contain the following:

(i) type of equipment used to collect acoustic data including frequency range;

(ii) estimated water depth of pile being driven and depth at which measurements were taken;

(iii) distances to the source where acoustic data were collected;

(iv) maximum, minimum, and average dB_{RMS} levels received at each measured distance;

(v) the type of pile driving method (i.e., impact or vibratory) associated with each collected measurement;

(vi) estimated rate of attenuation or transmission loss (TL) based on collected measurements; and

(vii) estimated source levels based on TL rate.

c) In the unanticipated event that pile driving activities clearly cause the take of a marine mammal in a manner prohibited by this Authorization, such as an injury (Level A harassment), serious injury, or mortality, ORPC shall immediately cease pile driving activities and report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401 and/or by email to Michael.Payne@noaa.gov and Michelle.Magliocca@noaa.gov and the Northeast Regional Stranding Coordinator (Mendy.Garron@noaa.gov). The report must include the following information:

(i) time, date, and location (latitude/longitude) of the incident;

(ii) the name and type of vessel involved;

(iii) the vessel's speed during and leading up to the incident;

(iv) description of the incident;

(v) status of all sound source use in the 24 hours preceding the incident;

(vi) water depth;

(vii) environmental conditions (e.g. wind speed and direction, Beaufort sea state, cloud cover, and visibility);

(viii) description of marine mammal observations in the 24 hours preceding the incident;

(ix) species identification or description of the animal(s) involved;

(x) the fate of the animal(s); and

(xi) and photographs or video footage of the animal (if equipment is available).

Activities shall not resume until NFMS is able to review the circumstances of the prohibited take. NMFS shall work with ORPC to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. ORPC may not resume their activities until notified by NMFS via letter, email, or telephone.

d) In the event that ORPC discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as described in the next paragraph), ORPC will immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401, and/or by email to Michael.Payne@noaa.gov and Michelle.Magliocca@noaa.gov and the Northeast Regional Stranding Coordinator (Mendy.Garron@noaa.gov). The report must include the same information identified in Condition 9(c) above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with ORPC to determine whether modifications in the activities are appropriate.

e) In the event that ORPC discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in Condition 3 of this Authorization (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), ORPC shall report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401, and/or by email to Michael.Payne@noaa.gov and

Michelle.Magliocca@noaa.gov and the Northeast Regional Stranding Coordinator (Mendy.Garron@noaa.gov), within 24 hours of the discovery. ORPC shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Activities may continue while NMFS reviews the circumstances of the incident.

14. A copy of this Authorization must be in the possession of the lead contractor on site and PSOs operating under the authority of this Incidental Harassment Authorization.

15. This Authorization may be modified, suspended, or withdrawn if the Holder fails to abide by the conditions prescribed herein or if the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

James H. Lecky,
Director, Office of Protected Resources,
National Marine Fisheries Service.

3/8/12
Date

Appendix B

Acoustic Monitoring Plan for Pile Driving Activities

ORPC
OCEAN RENEWABLE
POWER COMPANY

ACOUSTIC MONITORING PLAN FOR PILE DRIVING ACTIVITIES

INCIDENTAL HARASSMENT AUTHORIZATION
COBSCOOK BAY TIDAL ENERGY PROJECT
FERC PROJECT No. 12711
ORPC MAINE, LLC

March 1, 2012

Ocean Renewable Power Company, LLC
120 Exchange Street, Suite 508
Portland, ME 04101
Phone (207) 772-7707
www.orpc.co

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1.0 INTRODUCTION

1.1 GENERAL DESCRIPTION OF THE COBSCOOK BAY TIDAL ENERGY PROJECT

ORPC Maine, LLC, a subsidiary of Ocean Renewable Power Company (collectively, ORPC), has applied to the Federal Energy Regulatory Commission (FERC) for a pilot project license for the Cobscook Bay Tidal Energy Project (Project) on September 1, 2011. The Project will evaluate the potential for a new source of clean, renewable energy generation using tidal energy resources in Cobscook Bay, Maine. ORPC obtained an initial preliminary permit for the project area in Cobscook Bay from FERC on July 23, 2007; FERC issued a successive preliminary permit on January 13, 2011. Feasibility studies, including environmental surveys, and pre-filing consultation were conducted, resulting in ORPC's filing of a draft pilot license application (DPLA) with FERC for the Eastport Tidal Energy Project on July 24, 2009. The DPLA included project areas within Cobscook Bay and Western Passage. Since submitting the DPLA, ORPC has conducted extensive consultation with regulatory and resource agencies as well as other stakeholders, has collected additional environmental data, and has continued to refine its proprietary technology. As a result of these additional studies and consultations, ORPC now plans to deploy a commercial-scale hydrokinetic power system in gradual stages, with the Project, a small pilot project, as the first stage. The FERC preliminary permit Project boundary for the Cobscook Bay Tidal Energy Project (FERC Project No. 12711) encompasses the proposed development area.

The Project will be carried out in two separate phases over an expected eight-year pilot license term. In Phase I, ORPC will deploy, monitor and test a single-device TidGen™ Power System for one year. In Phase II, ORPC will add four additional TidGen™ devices to the power system, for a total of five. During both phases, ORPC will deploy environmental monitoring equipment on the TidGen™ Power System and within the Project boundary (Figure 1). The plan includes monitoring of more intensive activities during the installation phase, such as during pile driving, and monitoring during the operational phase to verify impacts and ensure there is no change during long-term operation.

The core component of the TidGen™ Power System is ORPC's proprietary turbine generator unit (TGU). The TGU utilizes four advanced design cross flow (ADCF) turbines to drive a permanent magnet generator mounted between the turbines on a common driveshaft. The ADCF turbines rotate in the same direction regardless of tidal flow direction; rotational speed of the turbines is directly related to water flow speed. The TGU is 98 feet in length, 17 feet high and 17 feet wide. It is attached to a bottom support frame, which holds the TGU in place approximately 15 feet above the sea floor. The bottom support frame is 98 feet long by 50 feet wide by 15 feet high. The bottom support frame is constructed of steel, and the TGU is constructed of steel and composite material. Together, the coupled TGU and bottom support frame comprise the TidGen™ device (Figure 2 shows the conceptual design for the TidGen™ device). The depth at the proposed Deployment Area is 85 feet at Mean Lower Low Water (MLLW); the TidGen™ devices will thus be placed 49 feet below the surface at MLLW. Each TGU will have a maximum design capacity of 180 kilowatts (kW). During the Project each TGU will operate at a rated capacity of 60 kW. The five-device TidGen™ Power System will have a maximum design capacity of 900 kW and a rated capacity of 300 kW. The power generated will be connected to the grid using a single subsea transmission cable with a line voltage of 13 kilovolts (kV) DC. The total cable length is approximately 4,200 feet (3,700 feet from the TidGen™ Power System to the shore in Lubec, Maine and approximately 500 feet from shore to the on-shore station). ORPC has chosen an underwater cable route that avoids abrupt changes in bottom topography. Based on consideration of environmental concerns, ORPC proposes to bury the cable at all feasible locations along the cable route. The power generated by the TidGen™ Power System will be conditioned at the on-shore station and delivered to the Bangor Hydro Electric Company power grid.

Figure 1. Cobscook Bay Tidal Energy Project location map.

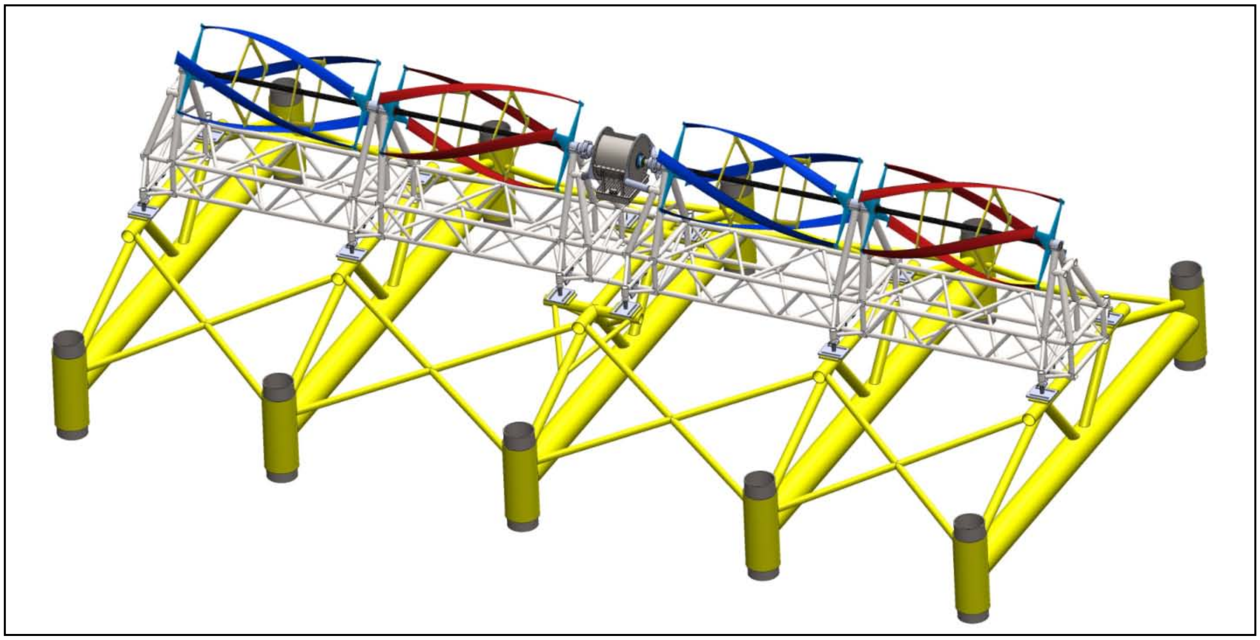

Figure 2. TidGen™ device.

In preparation for the Project, ORPC designed, built, deployed and tested a beta pre-commercial TidGen™ Power System (Beta TidGen™ System) in Cobscook Bay in 2010 (see Figure 3). The Beta TidGen™ System was comprised of a beta pre-commercial TGU (Beta TGU); ORPC's *Energy Tide 2* research, testing and deployment vessel; a mooring system for the *Energy Tide* 2; and data acquisition and environmental monitoring equipment. Rather than being mounted on a bottom support frame, the Beta TGU was deployed top-down from the *Energy Tide 2* and suspended 21 feet below the water surface.

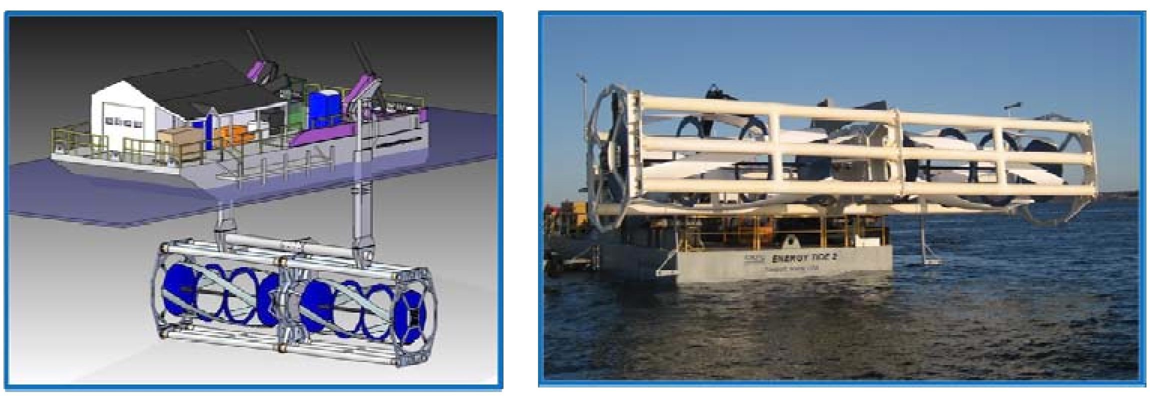

Figure 3. Beta TidGen™ system.

1.2 INCIDENTAL HARASSMENT AUTHORIZATION PROCESS

Authorization for incidental takings will be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined "negligible impact" in 50 CFR 216.103 as "...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

Section 101(a)(5)(D) of the MMPA established an expedited process by which U.S. citizens can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Section 101(a)(5)(D) further established a 45-day time limit for NMFS' review of an application, followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny the authorization.

Except with respect to certain activities not pertinent here, the MMPA defines "harassment" as:
any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

Summary of Request

On November 2, 2011, NMFS received ORPC's application requesting an Incidental Harassment Authorization (IHA) for the take, by Level B harassment, of small numbers of harbor seal (*Phoca vitulina*), gray seal (*Halichoerus grypus*), harbor porpoise (*Phocoena phocoena*), and Atlantic white-sided dolphin (*Lagenorhynchus acutus*) incidental to pile driving activities in Cobscook Bay, Maine (Appendix A). Upon receipt of additional information and a revised application, NMFS determined the application complete and adequate on January 7, 2012.

2.0 GOALS AND OBJECTIVES

ORPC will be conducting pile driving activities beginning March 1, 2011. Of concern is the effect of the piling driving noise on endangered species of fish (primarily Atlantic salmon) and marine mammals. Acoustic monitoring will be conducted to quantify noise levels generated from various pile driving techniques and determine the necessity for future mitigation measure. The applicability of modifications or elimination of the March 1 through April 9 work window will also be assessed. The following objectives are included in the acoustic monitoring plan:

- Determine near field noise levels in dB//1μPa peak and rms pressure. No impact for endangered fish is expected if levels can be maintained at less than 206 dB//1μPa@1m peak at a range of 10 m. If this can be held then the April 9 deadline for a cessation of pile driving activities can be removed.
- Validate the actual location of the 180 dB //1μPa@1m rms pressure isopleth for both vibratory and impact (level A), with and without sound attenuation devices (thresholds for Level A harassment are 190 dB for pinnipeds and 180 dB for cetaceans).
- Validate the actual location of the 160 dB//1μPa@1m rms pressure isopleth for impact (level B transient source), with and without sound attenuation devices.
- Validate the actual location of the 120 dB//1μPa@1m rms pressure isopleth for vibratory (level B continuous source), with and without sound attenuation devices.
- Integrate the acoustic data with the marine mammal observation data to identify actual number of "takes."
- Monitor ambient air noise levels with a sound level meter at Goose Island and at the Lubec shore station to identify in air noise levels at a potential bird rookery and seal haul-out areas within this area of Cobscook Bay.

3.0 STUDY AREA

The geographic scope of the study will generally include the Cobscook Bay Deployment Area (see Figure 1).

4.0 METHODOLOGY

ORPC and Scientific Solutions Inc. (SSI) have developed a combination of in-water and in-air methods that will be used to measure the noise in the environment where the TidGen™ Power System will be installed. The following sections describe measurement equipment, data collection and processing required to complete the acoustic analysis.

4.1 In-Water Noise Measurement System Equipment

- Measurement system for near-field deployed on the pile driving barge:
  - Hydrophones: 2 X Reson TC4013 (Appendix B)
  - Preamplifiers: 2 X low-noise 1-100 kHz battery operated preamplifier (EPAC)
  - Data Acquisition: IOtech Wavebook/516E to laptop computer over Ethernet (Appendix C)
  - Deployment:
    - ~4" X ~4' spar to be fabricated by SSI

- Drifting Noise Measurement System (DNMS) deployed remotely from monitoring vessel:
  - Hydrophones: 2 X ITC 1042 (see Appendix D)
  - Preamplifiers: SSI custom low-noise preamplifier
  - Data Acquisition: Measurement Computing LGR-5320 (2-channels @ 100kHz/channel sampling rate) (Appendix E)
  - Deployment: 8" spar buoy tethered to small vessel

- Two hydrophones at each location separated by 3 m centered at mid-water column.
- Inside location (approximately or larger than 4' x 6' shack) on barge with 120 V power source.
- Remote and near-field measurement systems manually synchronized to ~1 second accuracy time stamp (GPS time).
- Handheld ruggedized GPS units deployed on each hydrophone buoy for accurate geo-referencing.
- GRAS 42AA piston-phone calibrator with RA0043 coupler for RESON hydrophones.
- Measurements taken from the pile driving barge and those from the DNMS will be coordinated to account for timing, type of pile driving activity and other factors.

4.2 In-Air Noise Measurement System Equipment

- Quest Technologies SoundPro DL-1-1/3 Octave-20 sound level meter which meets Type 1 requirements of the American National Standards Specifications for sound level meters, SI.4-1971 (Appendix F).

- Acoustic calibrator for SLM
- Industrial tripod
- Dinghy will be required to access Goose Island

4.3 Data Collection

Underwater ambient noise measurements will be made at slack tide while pile driving operations take place. A team of 3 SSI employees will join ORPC in Cobscook Bay prior to the commencement of pile-driving operations to conduct an intensive monitoring and measurement effort in the initial days of pile-driving. Table 1 lists potential measurement periods identified during the first 10 days of March as an example. Actual measurement periods will be modified based on schedule, weather conditions, and other factors.

Table 1. *Initial Measurement Periods*

Date:	Slack Times:	Tide:	30 Min. Window:
3/1/2012	10:49	Low	10:34 - 11:04
3/2/2012	11:46	Low	11:31 - 12:01
3/3/2012	6:18	High	6:03 - 6:33
	12:45	Low	12:30 - 13:00
3/4/2012	7:15	High	7:00 - 7:30
	13:41	Low	13:26 - 13:56
3/5/2012	8:08	High	7:53 - 8:23
	14:33	Low	14:18 - 14:48
3/6/2012	8:58	High	8:43 - 9:13
	15:22	Low	15:07-15:37
3/7/2012	9:45	High	9:30 - 10:00
	16:09	Low	15:54 - 16:24
3/8/2012	10:31	High	10:16 - 10:46
	16:54	Low	16:39 - 17:09
3/9/2012	11:17	High	11:02 - 11:32
3/10/2012	12:04	High	11:49 - 12:19

The near-field measurement system will consist of two Reson TC4013 hydrophones wired to two separate EPAC preamplifiers and recorded on a Wavebook 16 bit digital recording system at 500 kHz per channel (acoustic frequency range of 10 Hz - 100 kHz). The hydrophones will be deployed hanging below a small PVC spar buoy or spherical cable float with DSS-2 cable running from the preamplifiers to data acquisition system on the barge. The EPACs will be secured in a watertight enclosure aboard the hydrophone float. The hydrophone cable will be adjusted to position the two hydrophones at approximately mid water column and separated by approximately 3 m. The data recording equipment will be located at the surface in a small covered location aboard the pile-driving barge. To measure the far field levels around the estimated harassment isopleths the DNMS will be deployed from a small vessel.

Prior to the start of testing the Reson hydrophones and the entire near-field data-acquisition chain will be calibrated with the pistonphone. The DNMS will be calibrated by collocating the two measurement systems and referencing the DNMS measurements to the calibrated Reson measurements.

Measurements of both vibratory hammer and impact hammer operations will be made at ranges of 10, 100, and 1000 m, and further as necessary to determine the 160 dB and 180 dB isopleths. The measurements will be made at each location for a minimum of the duration of the pile driving activity, or 1 minute, whichever is longer, for each configuration of the pile driving activity. For all far-field measurements a corresponding near-field measurement will be made to provide a corollary source level. The data will be analyzed using MATLAB to determine the the root-mean-square (rms) sound pressure levels (SPL). For impact hammer operations, SPL will be calculated by determining rms level over the time window that contains 90% of the energy. A report will be written summarizing all results.

If the measurements exceeds either the 180 dB//µPa rms pressure level at a range of 100 m, or the 160 dB re µPa rms pressure level at a range of 1000 m than the measurements will be repeated at increasing ranges until the actual range of the isopleths for these levels are determined. Further, pile driving operating conditions will be changed in an attempt to lower the levels, and the measurements will be repeated. This includes lowering the impact force, the potential use of an air curtain, and/or a wooden suppression block between the diesel hammer and pile [or pile follower].

Table 2. Pile Driving Techniques and Sequencing

Priority	Method
1	Impact hammer (no suppression)
2	Impact hammer (with sound absorption blocks)
3	Vibratory hammer (no suppression)

Due to the many possible configurations of the pile-driving equipment, it is crucial that all parameters be logged alongside each measurement. This includes the above mentioned optional equipment configurations as well as ambient environmental conditions and the time of day. As an additional correction for the variability of the pile driving source function, the near-field recording taking during each measurement can be utilized to normalize the observed levels to a nominal source level.

For each record, an in-air sound level measurement will be collected as well as the in-water measurements. These will be collected from a tripod mounted sound level meter (SLM) located on Goose Island nearby the pile-driving site and at the proposed location of the Lubec shore station (only one site will be collected for a given record). The SLM is to be calibrated each day prior to the start of data collection and following the cessation of collection. Along with the measured level a log will be kept of the ambient and weather conditions at the in-air recording site. For the impact pile driving measurements will be given as dB//20 µPa^2 Peak and for vibratory pile driving as narrow band and third octave band spectral levels.

4.4 DATA PROCESSING

To determine the near-field sound level the rms and peak pressure of recordings taken from the near-field system will be calculated for the duration of the pile driving operation. The hydrophones will be deployed as close to 10 m from the pile being driven as practical. The levels will be normalized to a 10 m range if required by correcting for cylindrical spreading transmission loss from the 10 m radius to the actual location of the buoy. This calculation will be completed for each record and for each pile-driving configuration employed (i.e. impact hammer, vibratory hammer, suppression block in place, etc).

To determine the far-field noise the measurements from the DNMS will be used in conjunction with the near-field measurements from each recorded pile drive. The near-field measurements will be used to determine the source level of each pile. The rms pressure will be calculated from each record and the resultant rms pressure will normalized to the average/nominal source level of the employed pile-driving configuration. The range of each isopleth of interest will be located for each equipment configuration measured by calculating the transmission loss from the observed far-field pressure levels and the near-field source level.

The far-field recordings will also be analyzed in 1/3 octave bands. This groups the observed energy into more meaningful bands and will be used to determine the frequency content of the propagating pile-driving noise.

The in-air sound level meter will provide direct output of the in-air sound-level which will be recorded for each operation and correlated with the source levels to provide any additional insight or illuminate any observed anomalies. Additionally, the in-air results will be tabulated in 1/3 octave bands provided by the SLM's on-board filter for the sake of future research into the in-air effects of these activities.

5.0 REPORTING

If hydroacoustic monitoring indicates that the threshold isopleths are greater or less than originally calculated, ORPC will contact NMFS within 48 hours and make the necessary adjustments.

Thirty days after completion of the pile driving activity, the SSI will submit a report to NMFS. The report will include the details of the acoustic measuring methods employed including:

- Methods and Systems Review
- Data Review
- Summary of Findings

6.0 SCHEDULE

Pile driving activities are schedule to occur between March 1 and April 9, 2012 in accordance with regulatory concerns related to Atlantic salmon occurrence. If acoustic measurements indicate levels below those harmful to marine life ORPC will request further consultation with appropriate regulatory agencies to modify or remove the date restrictions.

Pile driving activities will occur during slack water period which provide approximate 1 hour duration per event. Depending on daily tidal cycles, pile driving may occur during one or two occasions per day.

Herbert C. Scribner
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hscribner@oceanrenewablepower.com

ORPC
OCEAN RENEWABLE POWER COMPANY

December 20, 2011

Michelle Magliocca
National Marine Fisheries Service
Office of Protected Resources
1315 East West Highway
Silver Spring, MD 20910

RE: Marine Mammal Incidental Harassment Authorization for Pile Placement for ORPC's Cobscook Bay Tidal Energy Pilot Project

Dear Ms. Magliocca:

ORPC Maine has revised our application for a Marine Mammal Incidental Harassment Authorization for pile placement for ORPC's Cobscook Bay Tidal Energy Pilot Project in Eastport, Maine from March 1, 2011 through October 1, 2012, to NOAA's Office of Protected Resources.

Using the guidance provided by your office, ORPC has addressed each of the fourteen areas of interest as mandated by Section 7 of the Endangered Species Act and the National Environmental Policy Act (NEPA).

If you have any questions or comments, please reply to Herbert C. Scribner at ORPC.

Thank you.

Sincerely,

Herbert C. Scribner
Director of Environmental Affairs

MARINE MAMMAL INCIDENTAL HARASSMENT AUTHORIZATION FOR PILE PLACEMENT FOR ORPC'S COBSCOOK BAY TIDAL ENERGY PILOT PROJECT

QUESTIONNAIRE TO NOAA'S OFFICE OF PROTECTED RESOURCES

December 19, 2011

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MARINE MAMMAL INCIDENTAL HARASSMENT AUTHORIZATION FOR PILE PLACEMENT FOR ORPC'S COBSCOOK BAY TIDAL ENERGY PILOT PROJECT

Questionnaire to NOAA's Office of Protected Resources

1. Description of Activity

Purpose of IHA Application

ORPC Maine, LLC, a wholly owned subsidiary of Ocean Renewable Power Company, LLC (collectively ORPC), filed a FERC final pilot license application on September 1, 2011 for our Cobscook Bay Tidal Energy Pilot Project (Project), a hydrokinetic project to be deployed in Cobscook Bay, Eastport/Lubec, Maine (FERC Project No. 12711). In conjunction with this deployment, ORPC is requesting a Marine Mammal Incidental Harassment Authorization (IHA) for the placement of foundational piles below the mud line at the deployment site.

ORPC is applying for an IHA for pile placement because the vibratory hammer (and possibly a diesel impact hammer) that will be used for pile driving will potentially generate noise levels above NOAA's guidelines (for continuous and impact noise) under the Marine Mammal Protection Act of 1972.

This IHA request does not cover activities proposed for Phase II of the Project. If Phase I monitoring indicates that deployment is generating noise exceeding allowable limits, ORPC will file a second IHA request for Phase II.

Project Overview

The Project will be carried out in two separate phases over an expected eight-year pilot license term. In Phase I, ORPC will build, deploy, monitor and test a single-device TidGen™ Power System for one year. In Phase II, ORPC will add four additional TidGen™ devices to the power system, for a total of five. ORPC will also deploy environmental monitoring equipment within the project boundary. Electricity generated by the pilot project will be delivered by an underwater power cable to the on-shore station in Lubec, Maine, where it will be power-conditioned and connected to the Bangor Hydro Electric Company power grid.

The primary project works include: 1) the TidGen™ Power System (made up of the TGU [turbine generator unit], bottom support frame, and underwater power and data [P&D] cables); 2) the on-shore station; and 3) environmental monitoring equipment. The TGU is approximately 98 ft long, 17 ft high and 17 ft wide. It is attached to a bottom support frame, which holds the TGU in place approximately 15 ft above the sea floor. The TGU weighs approximately 69,000 pounds (lbs). The coupled TGU and bottom support frame comprise the TidGen™ device (Figure 1).

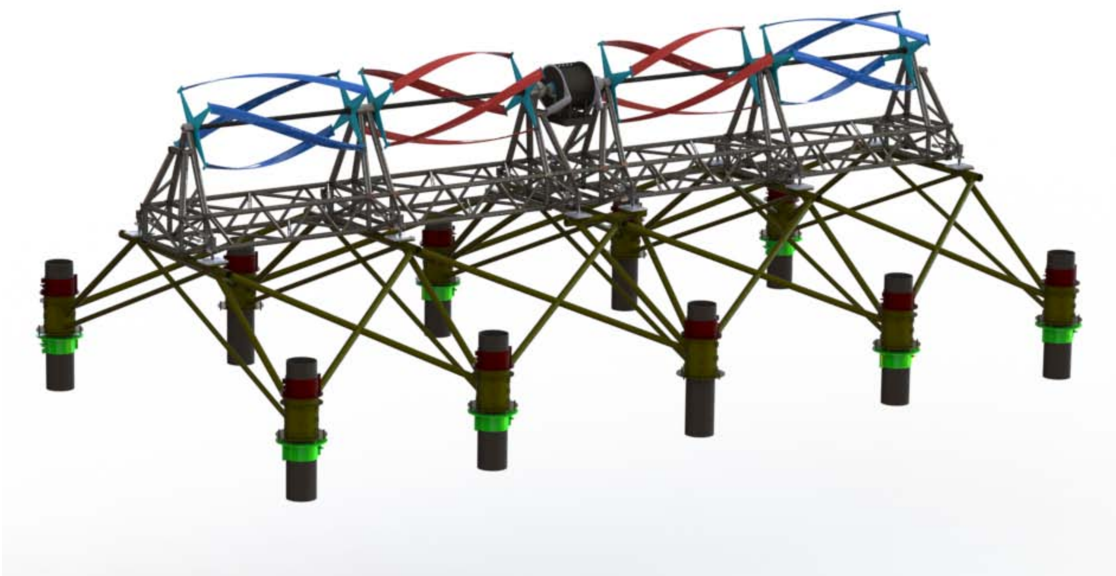

Figure 1. TidGen™ device.

Foundation Requirements

At the interface with the seabed, the bottom support frame requires a site-specific design based on the Project's deployment area conditions (Figure 2). ORPC has conducted bathymetric and geophysical surveys of the deployment area to identify bottom conditions for the design of the bottom support frame and foundation and has completed a geotechnical survey of the deployment. Geotechnical data shows that the TidGen™ devices will be located in areas with up to 40 ft of marine clay and some thin layers of glacial till overlaying bedrock.

At the Project site, the foundation design for the single-device TidGen™ Power System is a pile bent arrangement consisting of ten piles. Each pile will have a three-foot diameter and a one-inch wall thickness, and will rest on bedrock. The piles will vary in length due to bottom sediment depth, but each pile will be driven to the top of the bedrock and will protrude 10+ ft above the seafloor.

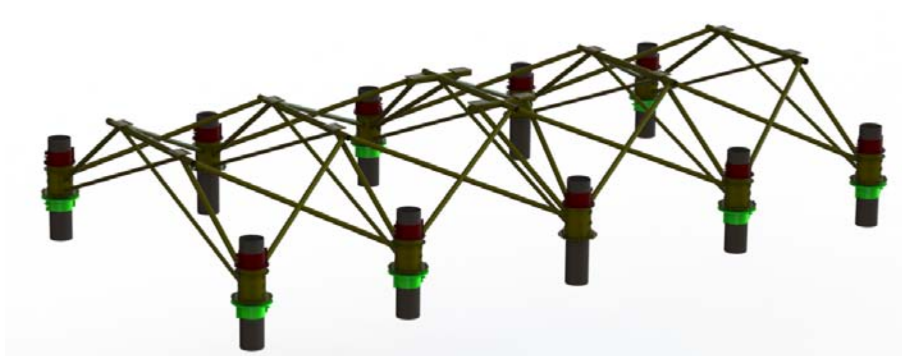

Figure 2. Bottom support frame.

Pile Driving Plan
A total of 11 piles (ten for the foundation and one for mounting environmental monitoring equipment) will be driven for Phase I of the Project. Placing and driving these 11 piles will require the following equipment:

- Deck barge, *Cap't E*, 150 ft long x 54 ft wide x 10 ft high
- 250-ton Linkbelt crane LS 718H with 150 ft of boom or equivalent
- Push boat "Workhorse"
- A second push boat/workboat to assist in setting anchors, moving the barge into position and quick demobilization in the event of a extreme weather event
- Material barge to deliver the bottom support frame to the deployment location. This barge will be configured from sectional barge sections and will be 60 ft long x 40 ft wide x 5 ft high
- Small crane on the small barge to assist in the installation of anchors and deadmen
- Crane mats on top of the *Cap't E* to distribute the crane load
- +/- 100 ton of barge counterweight consisting of +/- 50 concrete Jersey barricades or other similar concrete or granite weights
- Diesel powered vibratory hammer
- Diesel powered impact hammer model Berminghammer B-3505 with a maximum capacity of 46 ft-kips
- 4 deck winches to position and secure the deck barge on location
- 2 additional deck winches to facilitate positioning the bottom support frame
- Hydraulic power pack to power the winches
- Tool crib on the barge with typical tools for marine construction, including welders, torches, hand tools, spare parts, etc.
- Ground tackle, including anchors and lines
- Granite deadmen to assist in positioning the bottom support frame

The steel pipe piles each have a 30 in diameter and a ½-inch wall thickness with an open shoe of hardened steel attached to the bottom for seating itself into bedrock without deformation. The piles will be delivered with the hardened shoes attached and will be uncoated. The piles will be configured in two rows of five piles each, as illustrated in Figure 2.

The individual piles will be approximately 20 ft apart in each row, and the rows will be approximately 50 ft from each other. The piles will be approximately 60 ft long; 10 ft to 15 ft will be above the mud line when driven to refusal. Prior to driving the pile, a follower will be attached to the pile, which will enable the pile to be driven from the surface. Based on extensive soil studies of the area, the piles will sink in the soft bottom under its own weight plus the weight of the follower and vibratory hammer for most of the 40 ft of marine clay. The piles will then be driven the remaining depth using vibratory and impact pile driving procedures from barge-based pile driving equipment.

During the pile driving, a pile for mounting environmental monitoring equipment will be installed with the same pile-driving equipment used for the foundation. This monitoring pile will have a 30 in diameter and a ½-inch wall thickness, and will protrude approximately 20 ft above the sea floor. As with the other 10 other piles, the monitoring pile will be driven to refusal into bedrock.

The vibratory hammer, an H&M model H-1700, will drive the pile by applying a rapidly alternating force to the pile by rotating eccentric weights about the shaft, resulting in a downward vibratory force on the pile. The vibratory hammer will be attached to the pile head with a clamp. The vertical vibration in the pile functions by disturbing or liquefying the soil next to the pile, causing the soil particles to lose their frictional grip on the pile. The pile moves downward under its own weight, plus the weight of the hammer. It takes approximately one to three minutes to drive one pile.

If additional energy is required to reach bedrock, the vibratory hammer will be removed and a diesel impact hammer (Berminghammer model B-3505 diesel, 34,500 lb hammer with maximum rated impact energy of 21,533 ft-lb) will be rigged to the crane and used to seat the pile to bedrock or “proof” the pile. Pile driving with a diesel impact hammer takes approximately one to five minutes. Although driving piles with an impact hammer generally results in the greatest noise production, this noise is not constant. It is expected that the need for an impact hammer will be minimal and for very short durations (less than five minutes per pile).

To ensure alignment of the pile array, a driving template, which is a semi-permanent base structure, will be set into place prior to the pile driving operation to help guide the piles to the required location. This template will later be raised to become the support structure for the single-device TidGen™ Power System. It is expected that divers will be required to help guide the piles to the structure to get them started into the template.

Due to the presence of strong currents during tide changes, pile driving will occur during slack tides only. Due to the short window of slack tide, it is expected that only one pile will be driven per tide cycle. The total time spent at the mooring is anticipated to be between 7 and 12 days.

Cold weather will not have an effect on pile driving activities. Only foul weather such as high winds/seas, icy conditions, and conditions limiting visibility would prohibit pile-driving operations. Prior to commencing work, there the long-term weather forecast will be consulted to pinpoint a likely stretch of favorable weather.

A detailed pile placement plan submitted by the contractor is included in Attachment 1.

Foundation Installation

The foundation will be installed before any other power system component, with the exception of the P&D cable. For foundation installation, ten piles will be placed into the seabed using a driving template as well as pile driving equipment located on a moored barge. Temporary moorings will be used to hold the position in position for these operations. Subsea construction will begin with the setting of the template, followed by the placing and driving of the individual piles. After the piles are driven, they will be surveyed for elevation from the surface to allow for positioning and installation of subsequent fixtures and components, and will be cut to final dimension if necessary.

Once the foundation is installed, the template will be removed, and receiving fixtures for the bottom support frame will be installed. Next, the bottom support frame will be installed by aligning it with the foundation piles and lowering it into place on top of them. When it is positioned on the lower receiving fixtures, the bottom support frame must be able to withstand the force of the maximum tidal current experienced at the site. To accomplish this, a set number of supporting piles will need to be immediately engaged with the bottom support frame in order to provide the necessary uplift resistance. Once the bottom support frame has been initially stabilized, it will be thoroughly affixed to the foundation during subsequent operations.

2. Date, Duration and Location of Activity

Date of Activity
Piling driving will begin as soon as ORPC receives a FERC pilot license. We therefore anticipate that the start date will be no sooner than March 1, 2012.

ORPC plans to extend pile driving activities into the NMFS suggested restriction window if we can demonstrate that noise levels from this activity are below NOAA/NMFS guidelines. To bring down the level of noise caused by the diesel impact hammer, mitigative measures, such as the use of wooden sound absorption cushions and bubble curtains, will be applied (see above for details).

Duration of Activity
It is estimated that pile driving will take approximately one to three minutes and that seating each pile will take approximately five minutes. It is expected that only one pile will be driven per tide cycle due to the short window of slack tide. It is anticipated that placement of all eleven piles will occur over a period of seven to twelve days.

ORPC understands that an IHA can only have a one-year duration, and since there are several other permits also pending for Phase I of the Project, ORPC requests an IHA for the period of March 1, 2012 to November 30, 2012. ORPC believes that this time period will provide ample opportunity for permitting delays, weather events, and other unforeseen delays. Pile driving will only occur during daylight hours and in weather that provides adequate visibility for marine mammal monitoring activities.

Geographical Region of Activity
The foundation installation will take place in Cobscook Bay off of Lubec/Eastport, Maine (Figure 3). The piles and other deployment materials will be brought by barge from an on-shore staging area at the Eastport Boat School and/or other access points in the vicinity.

Specific Activities that ORPC Anticipates Could Result in Marine Mammal Takes
Pile driving activities have the potential to harass marine mammals by temporarily elevating sound levels around the proposed project location.

Figure 3. Cobscook Bay Tidal Energy Project site location and project area map.

3. Species and Number of Marine Mammals in Area of Activity

ORPC has been conducting incidental visual observations of marine mammals in the Cobscook Bay since 2007, during turbine testing, travel to and from ORPC's research vessel *Energy Tide 2*, and acoustic, fisheries, subtidal, and avian surveys (Table 1). During this time, ORPC personnel and contractors, who have received specialized training in marine mammal observation and documentation, have recorded approximately 252 observational periods over 222 days. During these periods, ORPC observed two dolphins, 47 harbor porpoises, and 57 seals. The most intensive effort was conducted in 2010, when approximately 71 marine mammals were observed over the course of 132 observation days between March 8 and December 31. Of these, there were two dolphins, 27 harbor porpoises, and 42 harbor seals. This information is documented in ORPC's Marine Mammal Monitoring Plan for the Cobscook Bay Tidal Power Project (FPLA Appendix C) and submitted to NOAA separately (Attachment 2).

All 2010 marine mammal observations were made near the Cobscook Bay deployment area. No observations of any whale species have been made in Cobscook Bay by ORPC personnel or those contracted to work for ORPC since the observation program began in 2007. Table 1 presents the number of each species observed and the months in which the observations were made.

Table 1. *Marine Mammal Observations in Cobscook Bay and Western Passage between December 2007 and December 2010.*

Month	Number of 4-hour Observation Periods Over 3 yrs	Number of Observed Harbor and Grey Seals (3yrs)	Number of Observed Harbor Porpoise (3yrs)	Number of Observed Atlantic White-Dolphins (3 yrs)
January	4	0	0	0
February	9	0	1	0
March	17	1	0	0
April	40	4	3	0
May	17	1	3	0
June	21	8	1	0
July	21	4	10	0
August	30	16	24	2
September	25	9	5	0
October	24	8	0	0
November	18	4	0	0
December	26	2	0	0
Total Number Observed		**57**	**47**	**2**

4. Description of Status, Distribution, and Season Distribution of Affected Species or Stocks of Marine Mammals Likely to be Affected by Such Activities

Gray seal (*Halichoerus grypus*), harbor porpoise (*Phocoena phocoena*), harbor seal (*Phoca vitulina*), and Atlantic white-sided dolphin (*Lagenorhynchus acutus*) are commonly observed in Cobscook Bay (NMFS, 2009). Other species that could theoretically occur in the Project vicinity include North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaengliae*), fin whale (*Balaenoptera physalus*), minke whale (*Balaenoptera acutorostrata*), and sei whale (*Balenoptera borealis*). However, because these marine mammal species are generally associated with opean ocean habitats in more offshore locations, they are unlikely to occur in Cobscook Bay (NMFS letter to FERC dated November 24, 2010).

Table 2. *Marine mammals likely to be affected.*

SPECIES	STATUS OF STOCK	DISTRIBUTION	POPULATION SIZE	TYPICAL HABITATS
Gray seal (*Halichoerus grypus*)	MMPA	Western North Atlantic stock located in eastern Canada and the northeastern United States	Over 250,000 in western North Atlantic	Coastal waters, islands, sandbars, ice shelves and icebergs. When hunting, they use the entire water column--from the surface to the sea floor.
Harbor porpoise (*Phocoena phocoena*)	MMPA	In the North Atlantic, range from West Greenland to Cape Hatteras, NC	89,054 in Gulf of Maine/Bay of Fundy area	Northern temperate and subarctic coastal and offshore waters: bays, estuaries, harbors, and fjords less than 650 ft deep.
Harbor seal (*Phoca vitulina*)	MMPA	On the East Coast, found from the Canadian Arctic to southern New England, New York and occasionally the Carolinas	91,000 in New England	Temperate coastal habitats and use rocks, reefs, beach, and drifting glacial ice as haul out and pupping sites
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	MMPA	Found in the western North Atlantic from 35°-80° N, from North Carolina to Greenland. Exhibits seasonal movements, moving closer inshore and north in the summers and offshore and south in the winters	63,000 in the western North Atlantic	Found only in temperate waters of the North Atlantic Ocean. Inhabit the oceanic waters of the continental shelf and slope.

Source: http://www.nmfs.noaa.gov/pr/species/mammals/
MMPA = Protected under the Marine Mammal Protection Act

5. Type of Incidental Taking Authorization Requested

ORPC requests an IHA for incidental takes by harassment of the four species of marine mammals identified in Table 2 that may occur during pile placement activities (the harbor seal, the grey seal, the harbor porpoise and the Atlantic white sided dolphin). There is a potential for noise generated by the pile placement activities to exceed the harassment levels for both continuous and impact levels. ORPC's Pile Placement Plan identifies the types of pile driving equipment that our contractor proposes for installation activities; Attachment 3 provides the equipment nameplate noise levels from the manufacturer.

ORPC contracted with Dr. Peter Stein of Scientific Solutions, Inc. to analyze this data and provide ORPC with guidance on the need for an IHA. Dr. Stein's recommendation for an IHA and the area of influence is attached (see Attachment 4).

6. Marine Mammals That May Be Taken

Species for which authorization is sought include the four species cited in Question 4 that have the highest likelihood of occurring in the project area: gray seal, harbor porpoise, harbor seal, and Atlantic white-sided dolphin. As Table 3 below indicates, in the worst case, we may harass four seals and two porpoise during the pile driving phase of this project. Cobscook Bay is characterized by the substantial mixing and redistribution of water resulting from strong tidal currents. Marine mammal critical habitats, as designated by the resource agencies, have not been identified for Cobscook Bay.

ORPC's Marine Mammal Monitoring Plan (Attachment 2) includes a mitigation action plan based upon trained observers and deployment activity curtailment. This plan was developed to minimize loud noise-generating activities if marine mammals are observed in Cobscook Bay, and to cease such noises if the animals come within 500 ft of the project area. ORPC does not expect to create noise at levels that harasses marine mammals for prolonged periods of time. There may be some limited peripheral harassment if a marine mammal comes into the work area underwater and is not spotted by our observers.

Based upon the history of marine mammal sightings summarized in Table 1 above, there is only a very small chance of such an interaction. Based on our marine mammal observations in the area, it is possible that seals or porpoises could enter the deployment area during the pile placement, but would probably focus on the salmon aquaculture operation several thousand feet from the deployment area.

Table 3. *Calculated Incidental Harassment Incidents by Species and by Month of the IHA.*

Month	**Total Number of 4 Hour Observation Periods (3yrs)**	**Calculated # of hours of Observations Per Month/ year**	**Estimated Hrs of Pile Driving per month**	**Total Observed Harbor and Grey Seals (3yrs)**	**Calcu Takes Seals**	**Total Observed Harbor Porpoise (3yrs)**	**Calcu Takes Porpoise**	**Total Observed Atlantic White-Dolphins (3 yrs)**	**Calcu Takes White Dolphins**
			(11 piles total)						
March	17	31.4	10	1	0	0	0	0	0
April	40	53.2	4	4	0	3	0	0	0
May	17	22.4	4	1	0	3	0	0	0
June	21	28.0	4	8	1	1	0	0	0
July	21	28.0	2	4	0	10	1	0	0
August	30	40	1	16	1	24	2	2	0
September	25	33.2	1	9	1	5	0	0	0
October	24	32.0	1	8	1	0	0	0	0
November	18	24.0	1	4	0	0	0	0	0
			Total 28 hrs						
Observation Periods =4 hours average				**TOTAL TAKES**	**4**		**2**		**0**

Note: These are very conservative numbers, based on the low number of hours of pile driving during high-observation months. The mitigation measures committed to by ORPC should lower these incidents even further.

7. Anticipated Impact upon the Species and Subsistence Uses

Any takes would be temporary and it is anticipated that no effect on the reproduction, survival, or recovery of the identified species would occur.

ORPC contracted with Dr. Peter Stein of Scientific Solutions Inc. to help define the zones of influence that will be potentially be created by the pile driving noise. According to Dr. Stein, a 112 dB in-air vibratory source level at the operator (presuming 1 m away) equates to roughly 174 dB re µPa2 @ 1 m in water. The 131 dBA from the plate on the impact hammer would equate to 193 dB re µPa2 @ 1 m in water. Tables in Appendix 4 show source levels (rms) averaging about 190 dB re µPa2 @ 1 m for impact measurements (190 dB for a 1-meter diameter pipe) and 175 dB re µPa2 @ 1 m for the vibratory hammer. Presuming Level A harassment is above 180 dB for the impact hammer, Dr. Stein has calculated ORPC's zone of influence for Level A harassment to be roughly 30-100 m. Presuming Level B harassment levels for the continuous vibratory source is 120 dB, and assuming 15logR propagation loss in shallow waters (cylindrical spreading would be 10logR and spherical spreading would be 20logR), Dr. Stein has calculated that the

175 dB vibratory levels do not attenuate to 120 dB until one is 4600 meters, or roughly 2.5 miles, from the source. Since this covers virtually the entire bay, ORPC will require an IHA for Level B harassment for the bay area.

8. Anticipated Impact on the Availability of Marine Mammals for Subsistence Uses

There are no traditional subsistence hunting areas in the project area.

9. Anticipated Impact on the Habitat of Marine Mammal Populations, and the Likelihood of Restoration of the Affected Habitat

ORPC proposes driving 11 piles. The benthic impact of the foundation for Phase I of the Project will be approximately 113 square ft. There should therefore be no adverse impacts to the marine mammal habitat after the pile placement is complete.

ORPC has filed a Biological Assessment with our FPLA that covers in detail the overall benthic impacts of the Project, which we anticipate to be minimal. In addition, ORPC has developed a benthic monitoring plan to assess benthic disturbance based upon a pre-deployment investigation and follow-up assessments through the duration of the Project.

10. Anticipated Impacts of the Loss or Modification of Habitat

ORPC does not anticipate any loss to or modification of the habitat for the marine mammal populations involved.

11. Availability and Feasibility of Alternative Methods

To mitigate the effects of noise from pile placement, energy applied to the hammers will be slowly ramped up. ORPC will also evaluate the use of wooden sound absorption cushions and/or bubble curtains to ensure noise levels are below the impact noise criteria suggested by NMFS. ORPC plans to initiate pile driving with a trial procedure that monitors ambient and sub-surface noise levels for the three different pile driving methods (vibratory, diesel impact, and drop-weight or “close-pin” hammers) and the two mitigation methods (sound suppression block and bubble curtains). The purpose of this trial procedure is to identify which combination of driving method and sound mitigation best assures that ORPC will not generate impact noise at the acute levels identified by NMFS (203dB). It is not anticipated that this trial will bring the pile driving noise above the continuous or impulse levels set by NOAA/Office of Protected Resources but if we find that it does, we will promptly notify the Office of Projected Resources. ORPC also plans to visually monitor the Level A harassment zone (out to 180 dB) for half an hour before, during, and for half an hour after impact pile driving (see Question 13 for more information). Acoustic monitoring will also be carried out during the pile driving trial to verify estimated sound levels and sound propagation.

Hydrokinetic power systems are an evolving technology that still holds numerous technical challenges. Foundation requirements and bottom fixity are foremost among these challenges.

Although ORPC has been closely following the development of international hydrokinetic projects to learn from their advances and disappointments, there are currently only a small number of deployed hydrokinetic devices around the world with which to compare.

This will be ORPC's first deployment of a full-scale hydrokinetic device. We have no previous experience or field data regarding the optimal foundational structure for such devices below the mud line. ORPC has therefore contracted several experts in marine structures for foundation designs and deployment strategies. These experts have evaluated gravity bases, suction caissons, rock anchors, cable and anchor systems and other oil-industry-developed methods, and have chosen this pile approach as the most cost-effective, low-failure risk, locally familiar, local infrastructure supportable, and safest path forward for our pilot project. We also believe that this design will have the least practicable adverse impact on marine mammals and their habitats.

12. Arctic Subsistence Evaluation

There are no Arctic subsistence marine mammals to consider at the Project site.

13. Monitoring Plans and Observation Data

ORPC has provided NOAA/Office of Protected Resources with our Marine Mammal Monitoring Plan (Attachment 2), which we will implement prior to and during the pile placement. During pile driving activities, ORPC will employ two dedicated marine mammal observers whose credentials will be approved by NOAA/Office of Protected Resources. Observations will commence a half-hour prior to pile driving, will continue through the work period, and will extend for a half-hour after pile driving has ceased. The watch will cover 180 degrees fore and 180 degrees aft of the area of activity. The fore and aft watches may take place on two different vessels to assure a full view for each. All watchers will use binoculars and record number, type, activity, and location of all sightings. Each watcher will carry a hand held radio for immediate communication to the ORPC project lead. The project lead will responsible for communicating to all aspects of the Project that a marine mammal has been spotted within the vicinity of the Project. The watchers will continue to observe the marine mammal and report to the project lead if the marine mammal is moving towards the Project area. The project lead will alert work crews of the marine mammal's activities and determine whether pile driving has to be suspended if the animal continues to approach the Deployment Area. All pile driving will cease if and when a marine mammal comes within 500 ft of the work area, and may not recommence until the marine mammal is outbound and more than 1000 ft from the work area.

We have further committed to NOAA/Office of Protected Resources that we will initiate a sub surface and ambient air acoustic monitoring study to monitor the actual noise levels during pile placement.

The data from our observers and our acoustic monitoring efforts will be provided to NOAA as a summary report after pile placement is complete.

14. Learning and Further Research

Over the past several years, ORPC has demonstrated our commitment to advancing hydrokinetic technology and studying the interaction of our devices with the marine environment. We have funded the innovative environmental and biological research needed to assess this new technology. ORPC has secured DOE funding and Congressional appropriations for marine mammals and fisheries studies in Maine and Alaska, through the University of Maine, Maine Maritime Academy, University of Alaska Fairbanks, Denali Commission, and several state funding organizations. We jointly support several professors and graduate students, as well as leaders in acoustic research and developments in environmental monitoring.

ORPC has successfully developed a drifting noise measurement system for assessing acoustic impacts of hydrokinetic power systems. With continued guidance and input from NOAA, we have been able to develop alternative methods for monitoring subsurface sites where hydrokinetic devices might be deployed. These sites are complicated by very high currents, deep and unforgiving bottom bathymetry, and other industrial and commercial source acoustic impacts.

This science-based approach to development has also been at the forefront of the fisheries studies with which ORPC has been involved. Rather than employing the past practices of large trawls and extensive netting studies needed for surface impoundment dams, we have been utilizing a much less invasive approach. Dr. Gayle Zydlewski at the University of Maine has utilized active acoustic echosounders in the deployment area and at a control site to identify fish population distribution and interaction. This work uses some limited netting for speciation and calibration, but provides the interaction data needed to best assess the environmental interaction and impacts of this technology.

As we move forward with Phase I of the Project, we will deploy a single-device TidGen™ Power System on a pile foundation. This power system will be instrumented with strain and load measuring devices—the data from which ORPC and its consultants will use to refine and modify the current foundation design. ORPC believes this approach will allow us to optimize future foundation designs, while reducing deployment costs and minimizing environmental impacts. ORPC has applied for a FERC pilot project license for this first-of-a-kind hydrokinetic device, and it will be from these efforts that we and others within the emerging hydrokinetic industry will achieve commercialization. ORPC has provided our approaches, our collected data, and our lessons learned to all interested parties worldwide.

The results of the pile testing trials and noise measurements will be provided to the regulatory agencies as a Report from our acoustics consultant, Scientific Solutions Inc. This Report will be utilized as baseline data to support an IHA for Phase 2 of OPRC's TidGen™ project if it is deemed necessary.

References

National Oceanic and Atmospheric Association. 2009. NOAA Fisheries, Office of Protected Resources – Harbor porpoise (*Phocoena phocoena*). [Online] URL: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/harborporpoise.htm. (Accessed June 3, 2009).

National Oceanic and Atmospheric Association. 2011. Comments, Recommendations, Terms and Conditions, and Intervention Notice for Ocean Renewable Power Company, LL's Final Hydrokinetic Hydropower Pilot License Application for the Cobscook Bay Tidal Energy Proejct (FERC No. P-12711), November 4, 2011.

Attachments

1. Pile Placement Plan
2. Marine Mammal Monitoring Plan
3. Pile Hammer Manufacturer Correspondence
4. Stein, Peter. Calculation of Noise Levels due to Pile Driving.

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August 18, 2011

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Cobscook Bay Tidal Energy Project
TidGen™ Foundation Placement Plan

Pile Driving

The Cobscook Bay Tidal Energy Project will require the placement of a series of steel pilings for the purpose of providing a stable foundation for the TidGen™ power system. The surface vessels and equipment required for the placement and driving of the 10 piles for each TidGen™ will consist of 1ea 50'X130' deck barge; 1ea push boat 25'loa manufactured by 'Work Horse' powered by 2 ea 225HP John Deere 6068 inboard motors; 1ea Linkbelt LB 518 150-ton crane; deck winches with power pack and 1ea 185cfm air compressor.

The barge will be held in position with 4 large anchors positioned at the four corners located somewhere between 500' and 800' from the barge. The barge will be attached to the four anchors with 1000' of line each, running through a fairlead and spooled onto a deck-mounted winch. The winches will be used to position and move the barge to its proper location. This is similar to the mooring design that was successfully used for ORPC's geotechnical investigation in Cobscook Bay.

Steel pipe piles will be used for the foundation for the TidGen™ devices, which will be 36" diameter and have a 1"inch wall with an open shoe of hardened steel attached to the bottom for seating itself into bedrock without deformation. The piles will be delivered with the hardened shoes attached and will be uncoated.

The piles will be transferred from the delivery truck to the barge with either the crane on the barge or one on shore at either the Staniels Road launch facility or the boat school property. Both of these sites are less than two miles by water from the Project area. Ten piles will be required to provide a stable foundation for each TidGen™ device. These piles will be configured in two rows of 5 piles in each row. The individual piles will be approximately 20 feet apart in each row and the rows will be approximately 50 feet from each other. The piles will be in the order of 50’ to 60’ long and 10’ to 15’ will be above the mud line when driven to refusal. Prior to driving the pile a follower will be attached to the pile, which will enable the pile to be driven from the surface. This follower will be an H-pile section, approximately 100’ long and its size will be in the order of an HP 12X53. Based on extensive soils study of the area the piles will sink in the soft bottom under its own weight plus the weight of the follower and vibratory hammer, for most of the 40’ of marine clay, then will be driven the remaining depth using vibratory and impact pile driving procedures from barge-based pile driving equipment.

The TidGen™ device foundation(s) will be constructed in an area that is completely submerged (below low tide). Two main methods used to install piles are impact and vibratory pile driving. An impact hammer is a large metal ram that is attached to a crane. A vertical support (leads) holds the pile in place and the ram is dropped or forced downward. The energy is then transferred to the pile that is driven into the seabed. The ram is typically lifted by mechanical, air steam, diesel, or hydraulic power sources. A Berminghammer model B-3505 diesel, 34,500 lb hammer with maximum rated impact energy of 21,533 ft-lb will be used (*See attachment for vendor specifications*). Driving piles using an impact hammer generally results in the greatest noise production, however this noise is not constant and is considered as a multiple pulse source by NMFS. NMFS current acoustic threshold for pulsed sounds (*e.g., impact pile driving*) is 180 and 190dB re 1 microPa for Level A harassment of cetaceans and pinnipeds, respectively, and 160 dB re 1 microPa for Level B harassment. As mentioned prior, this noise is not constant and it is expected that the need for a diesel hammer will be minimal and for very short durations (less than 5 minutes per pile). Information provided by the manufacturer was provided as follows; “We did testing on a similar hammer back in 2005 and the actual sound levels were read to be: 109.5 dBAI @ 50 BPM; 110.5 dBAI @ 45BPM; 112.3 dBAI @ 40 BPM; and 112.6 dBAI @ 36.5 BPM. These actual readings were taken 30 feet away from the hammer when the hammer was at around ground level and the pile was at refusal. I would use those values for the 3505. These readings were taken without any cushioning (using our direct drive system). I do have readings with the use of a cushion also, which is less then the ones stated above.”(*See attachments for vendor correspondence*)

Vibratory hammers install piles by applying a rapidly alternating force to the pile by rotating eccentric weights about shafts, resulting in a downward vibratory force on the pile. The vibratory hammer to be used will be an H&M model H-1700(*See attachments for manufacturer’s specification sheet*), hydraulically powered using an environmentally sensitive product, AMERIgreen AW hydraulic oil to minimize environmental impacts in the event of a ruptured hose or other spill. (*See attachments for Hydraulic oil Specification*).The CPM spill plan provides that containment booms and other clean-up devices will be onboard in a ‘spill-kit’ if such an event should occur.

The vibratory hammer attaches to the pile head with a clamp and the vertical vibration in the pile disturbs or liquefies the soil next to the pile causing the soil particles to lose their frictional grip on the pile. The pile moves downward under its own weight plus the weight of the hammer. This method is very effective for non-displacement piles such as sheet piles, H-beams, and open-end pile or caissons. The noise source of this hammer is from the power pack, which drives the hydraulic pump. It consists of a John Deere 6068HE 225 HP engine. There is no manufacturer information on the noise output of this power pack, but field measurements may be a possibility. Correspondence with the vibratory hammer manufacturer provided in-air noise levels (*see attachments for correspondence*) which have been used by ORPC's acoustic expert SSI, (Scientific Solutions Inc), to calculate the in-water noise levels (*see Attachments for SSI correspondence*) and the calculated zone of acoustic influence.

The type of hammer used depends on subsurface conditions and the effort required to advance the pipe pile to final elevation. The soils study performed by Haley and Aldrich has found the marine deposits in the area where the TidGen™ device foundation piles will be driven to be very soft clay, indicating that little effort will be required to seat the piles to bedrock.

For the vibratory hammer, driving is in progress from less than 1 to approximately 3 minutes. If it is determined by a member of Haley and Aldrich onboard soils scientist that additional energy is required to seat the pile to bedrock, the vibratory hammer will be removed and the impact hammer will be rigged to the crane and used to seat the pile to bedrock or 'proof' the pile. When the impact hammer is being used, driving takes place from 1 to 5 minutes. All piles will be driven with the vibratory hammer and the impact hammer used only when vibratory methods are not sufficient to reach bedrock. Due to strong currents during tide changes, pile driving will occur during slack tides only and it is expected that only one pile will be driven per tide cycle due to the short window of slack tide. Total anticipated time at mooring is between 7 to 12 days. Lights will be as required by U.S. Coast Guard and local Harbor Master; local fishermen will also be notified prior to operations.

To ensure alignment of the pile array, the semi-permanent base structure, which will later be raised and become the support structure for the TidGen™ device, will be used as a driving template. (*See attached drawing of base*). This structure will have alignment features built into it to help guide the piles to the location required. It is expected that divers will be required to help guide the piles to the structure to get them started into the template. This semi-permanent structure will be set into place prior to the pile driving operation and the setting of it will be included in the section following this pile driving as part of the setting of the base structure plan to follow.

Diesel fuel on deck will be in a double walled storage tank with less than 250 gallons capacity. Every effort will be made to prevent spillage; however in the event of a spill; a spill kit with absorbent pads and containment boom will be present to contain and clean up as needed.

Cold weather will not have an effect on pile driving activities. Only foul weather would prohibit pile-driving operations such as high winds/seas or icy conditions. It is expected that this work will occur during the early spring of 2012 (March 1, 2012), so icing should not be a problem. A look ahead at the long-term weather forecast for a stretch of favorable weather will be done prior to starting.

Setting, Raising and Securing Bottom Support Frame

The dimensions of the bottom support frame are 50’X100’. It is a three-dimensional truss made of 36” and 8” to 10” steel pipe. This unit shall be hoisted with a single crane (on the order of 150-ton capacity) mounted on a 50’ X 120’ barge. This crane and barge configuration will be used throughout the pile driving and setting of the TidGen™ device and installing the cable.

The bottom support frame will be manufactured at either the Staniel’s Road launch facility or the boat school property. It will be brought to the water by a special trailer and loaded onto a material barge with either a land-based or barge-mounted crane. The bottom support frame will be motored out to the deployment area. With the assistance of divers, the bottom support frame will be lowered to the sea floor with the barge mounted 150-ton crane, aligned and checked for levelness and laid to rest to be used later as a pile-driving template, prior to being raised to the proper elevation and affixed to the pipe piles where it will be utilized as the bottom support frame for the TGU.

Once all ten piles are driven as described above, they will be marked for the bottom or top of bottom support frame. The bottom support frame will then be raised to the proper elevation, and secured to the piles using friction collars. This will be a slack tide operation and divers will be required to perform this work. It is intended to use the 150-ton crane on a 50’ X 120’ barge to raise the frame. With the assistance of divers, during one slack tide cycle, the frame will be secured to the piles. No additional anchoring will be required for this process and will utilize that which had been installed for the pile-driving phase earlier.

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STUDY PLAN 5:
MARINE MAMMAL MONITORING PLAN

FINAL PILOT LICENSE APPLICATION

COBSCOOK BAY TIDAL ENERGY PROJECT

FERC PROJECT No. 12711

ORPC MAINE, LLC

FINAL PILOT LICENSE APPLICATION
COBSCOOK BAY TIDAL ENERGY PROJECT
ORPC MAINE, LLC
FERC PROJECT No. 12711

STUDY PLAN 5
MARINE MAMMAL MONITORING PLAN

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1.0 INTRODUCTION

1.1 GENERAL DESCRIPTION OF THE COBSCOOK BAY TIDAL ENERGY PROJECT

ORPC Maine, LLC, a subsidiary of Ocean Renewable Power Company (collectively, ORPC), is applying to the Federal Energy Regulatory Commission (FERC) for a pilot project license for the Cobscook Bay Tidal Energy Project (Project). The Project will evaluate the potential for a new source of clean, renewable energy generation using tidal energy resources in Cobscook Bay, Maine. ORPC obtained an initial preliminary permit for the project area in Cobscook Bay from FERC on July 23, 2007; FERC issued a successive preliminary permit on January 13, 2011. Feasibility studies, including environmental surveys, and pre-filing consultation were conducted, resulting in ORPC's filing of a draft pilot license application (DPLA) with FERC for the Eastport Tidal Energy Project on July 24, 2009. The DPLA included project areas within Cobscook Bay and Western Passage. Since submitting the DPLA, ORPC has conducted extensive consultation with regulatory and resource agencies as well as other stakeholders, has collected additional environmental data, and has continued to refine its proprietary technology. As a result of these additional studies and consultations, ORPC now plans to deploy a commercial-scale hydrokinetic power system in gradual stages, with the Project, a small pilot project, as the first stage. The FERC preliminary permit Project boundary for the Cobscook Bay Tidal Energy Project (FERC Project No. 12711) encompasses the proposed development area.

The Project will be carried out in two separate phases over an expected eight-year pilot license term. In Phase I, ORPC will deploy, monitor and test a single-device TidGen™ Power System for one year. In Phase II, ORPC will add four additional TidGen™ devices to the power system, for a total of five. During both phases, ORPC will deploy environmental monitoring equipment on the TidGen™ Power System and within the Project boundary (Figure 1).

The core component of the TidGen™ Power System is ORPC's proprietary turbine generator unit (TGU). The TGU utilizes four advanced design cross flow (ADCF) turbines to drive a permanent magnet generator mounted between the turbines on a common driveshaft. The ADCF turbines rotate in the same direction regardless of tidal flow direction; rotational speed of the turbines is directly related to water flow speed. The TGU is 98 feet in length, 17 feet high and 17 feet wide. It is attached to a bottom support frame, which holds the TGU in place approximately 15 feet above the sea floor. The bottom support frame is 98 feet long by 50 feet wide by 15 feet high. The bottom support frame is constructed of steel and the TGU is constructed of steel and composite material. Together, the coupled TGU and bottom support frame comprise the TidGen™ device (Figure 2 shows the conceptual design for the TidGen™ device). The depth at the proposed Deployment Area is 85 feet at Mean Lower Low Water (MLLW); the TidGen™ devices will thus be placed 49 feet below the surface at MLLW. Each TGU will have a maximum design capacity of 180 kilowatts (kW). During the Project each TGU will operate at a rated capacity of 60 kW. The five-device TidGen™ Power System will have a maximum design capacity of 900 kW and a rated capacity of 300 kW. The power generated will be connected to the grid using a single subsea transmission cable with a line voltage of 13 kilovolts (kV) DC. The total cable length is approximately 4,200 feet (3,700 feet from the TidGen™ Power System to the shore in Lubec, Maine and approximately 500 feet from shore to the on-shore station). ORPC has chosen an underwater cable route that avoids abrupt changes in bottom topography. Based on consideration of environmental concerns, ORPC proposes to bury the cable at all feasible locations along the cable route. The power generated by the TidGen™ Power System will be conditioned at the on-shore station and delivered to the Bangor Hydro Electric Company power grid.

Figure 1. Cobscook Bay Tidal Energy Project location map.

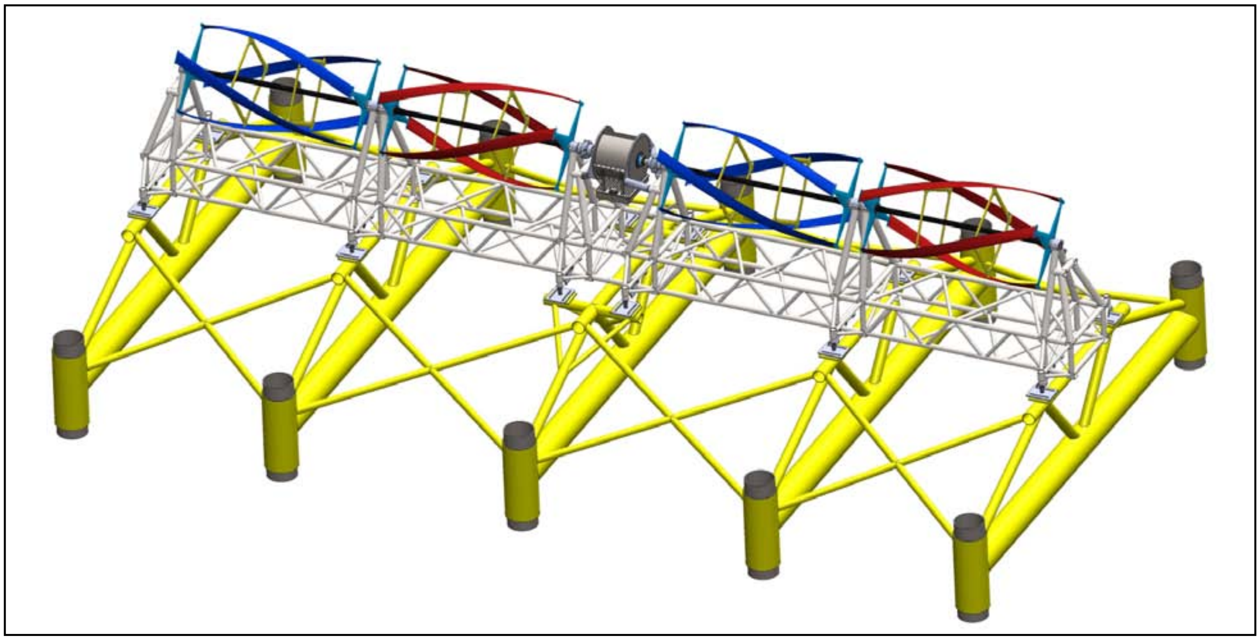


Figure 2. TidGen™ device.

In preparation for the Project, ORPC designed, built, deployed and tested a beta pre-commercial TidGen™ Power System (Beta TidGen™ System) in Cobscook Bay in 2010 (see Figure 3). The Beta TidGen™ System was comprised of a beta pre-commercial TGU (Beta TGU); ORPC's *Energy Tide 2* research, testing and deployment vessel; a mooring system for the *Energy Tide* 2; and data acquisition and environmental monitoring equipment. Rather than being mounted on a bottom support frame, the Beta TGU was deployed top-down from the *Energy Tide 2* and suspended 21 feet below the water surface.

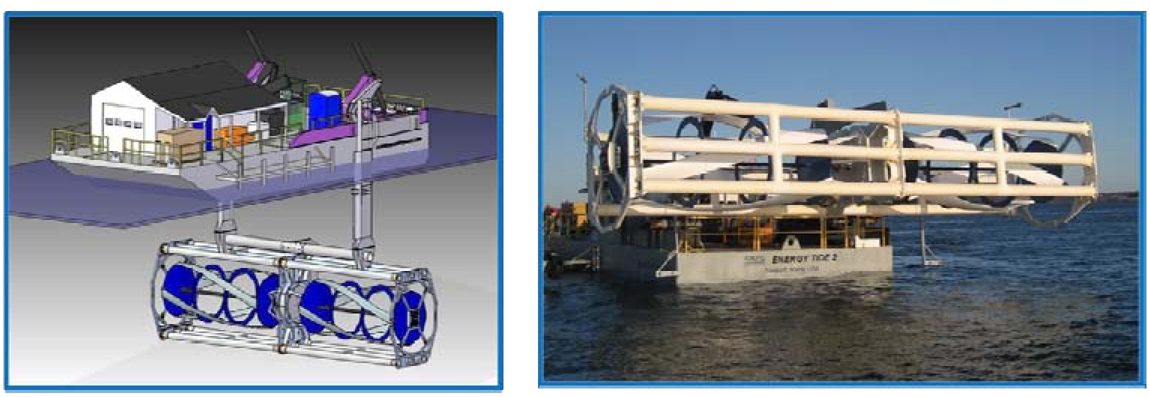


Figure 3. Beta TidGen™ System.

1.2 PILOT LICENSING PROCESS

ORPC's proposed Project is intended to study the short-term installation of ORPC's TidGen™ Power System and its effect on the marine environment. FERC's pilot licensing program has been designed to support the advancement and orderly development of innovative hydrokinetic technologies for projects that are small, short-term, removable and carefully monitored. The purposes of FERC's pilot license program are to test new hydrokinetic technologies, to determine the appropriate sites for hydrokinetic projects, and to collect information on the environmental and other effects of these new generating devices.

ORPC filed its DPLA for review and comment on July 24, 2009. Federal and state resource agencies and other stakeholders submitted comments on the DPLA. FERC also issued an additional information request (AIR) on September 23, 2009 in response to the DPLA. FERC's AIR Item #24 requested that the mandatory monitoring and safeguard plans required for hydrokinetic pilot licenses be reformatted in compliance with the Integrated Licensing Process study plan criteria at 18 CFR 5.11. Accordingly, this study plan has been revised to conform to the Integrated Licensing Plan study plan requirements.

Since filing the DPLA, ORPC has continued discussions on its pilot license proposal with the Cobscook Bay fishing community and the resource agencies to resolve potential conflicts in the marine environment, and to revise the proposed studies to address comments submitted on the DPLA. As a result of this continuing consultation, ORPC has modified the Project and updated this study plan to reflect the updated Project.

The concept of adaptive management is foundational to ORPC's Project study plans. As stated by FERC (2006), "adjustments to measures required during the license term will be based on information gleaned from ongoing monitoring or other post-license studies." ORPC believes that given the uncertainty associated with the relatively new pilot project process, being able to adjust the monitoring studies through adaptive management, based on experienced gained through the Project, allows for more effective studies. ORPC is proposing the adaptive management approach as the most responsible path forward, considering the available ecological and environmental data. This approach is also more appropriate to the pilot license program's goals and objectives than attempting to finalize each study plan prior to deploying the Project's first phase.

ORPC's proposed environmental study plans include this Marine Mammal Monitoring Plan. As described in the study methodology below, ORPC plans to conduct marine mammal observations in the deployment area for the eight-year term of the Project, beginning with the deployment of the single-device TidGen™ Power System. This will allow the monitoring to occur: during Phase I of the Project, with the installation of a single TidGen™ device; during the first two years of Phase II, with the installation of a five-device TidGen™ Power System; and during any major on-water activities. Based on the results of these observations, ORPC and its marine mammal scientific advisor, Dr. Brandon Southall of Southall Environmental Associates, in consultation with the appropriate resource agencies, will review and, if appropriate, modify the Marine Mammal Monitoring Plan at regular reporting intervals.

2.0 GOALS AND OBJECTIVES

The primary goal of the proposed Marine Mammal Monitoring Plan is to characterize changes in marine mammal use in and around the deployment area (Figure 1) due to the deployment of hydrokinetic devices. This will be accomplished by ORPC personnel and contractors: 1) conducting multi-season marine mammal observations to characterize the species presence, relative frequency of occurrence, and habitat use prior to the deployment of a single-device TidGen™ Power System; 2) conducting multi-season marine mammal observations around the single-device TidGen™ Power System after its Phase I deployment; and 3) conducting multi-season marine mammal observations on the five-device TidGen™ Power System after its Phase II deployment. In addition, dedicated and trained marine mammal observers will 4) conduct marine mammal watch prior to and during major deployment, maintenance and retrieval activities. The Marine Mammal Monitoring Plan will use the data gathered to characterize marine mammal presence in Cobscook Bay and the effects (if any) of the TidGen™ Power System on marine mammals, in accordance with the requirements of the FERC pilot license process.

Since marine mammals are known to utilize the Cobscook Bay area, ORPC will provide a dedicated marine mammal watch, by qualified personnel, before and during major on-water deployment, maintenance and/or retrieval activities. This independent service will provide ORPC and its contractors with advance notification of the approach, presence and all-clear for marine mammals. ORPC will take all precautions to minimize harassment of and/or contact with marine mammals during these periods of higher risk. ORPC will consult with National Oceanic and Atmospheric Association (NOAA)/National Marine Fisheries Service (NMFS) regarding the credentials of the persons to be assigned to this task. ORPC will also follow work stop and avoidance procedures to be approved by NOAA/NMFS (Office of Protected Resources) to assure minimal harassment and risk to marine mammals.

Additional information on potential direct interactions between marine mammals and the TidGen™ Power System will be monitored as outlined in the Fisheries and Marine Life Interaction Monitoring Plans. The effect of noise produced by the installation and operation of the TidGen™ Power System on marine mammals is addressed in the Acoustic Monitoring Plan. Separate from these study plans, ORPC is working with Scientific Solutions, Inc. (SSI) under a grant from the Department of Energy (DOE) to develop an active acoustic monitoring (AAM) system, a real-time, automated system capable of tracking the movements of fish and mammals in the vicinity of the TidGen™ Power System. ORPC has chosen not to include the AAM system in the pilot license application because it is still in the research and development phase.

3.0 STUDY AREA

The geographic scope of the study will generally include the Cobscook Bay deployment area (Figure 1). Additional information regarding the study area is provided below in Section 6.0.

4.0 BACKGROUND AND RELEVENT INFORMATION

4.1 Resource Discussion

Gray seal (*Halichoerus grypus*), harbor seal (*Phoca vitulina*) and harbor porpoise (*Phocoena phocoena*) are commonly observed in Cobscook Bay. Other species that may occur in the vicinity of the Project include Atlantic white-sided dolphin (*Lagenorhynchus acutus*), North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaengliae*), fin whale (*Balaenoptera physalus*), minke whale (*Balaenoptera acutorostrata*), and sei whale (*Balenoptera borealis*); however, NMFS has stated that none of these species is expected in the proposed deployment area (NMFS 2010).

ORPC has been conducting incidental visual observations of marine mammals in the Cobscook Bay and Western Passage areas since 2007, during turbine testing, travel to and from ORPC's research vessel, and acoustic, fisheries, subtidal, and avian surveys (Table 1). During this time, ORPC personnel and contractors, who have received specialized training in marine mammal observation and documentation, have recorded approximately 252 observational periods over 222 days. During these periods, ORPC observed two dolphins, 47 harbor porpoises, and 57 seals. The most intensive effort was conducted in 2010, when approximately 71 marine mammals were observed over the course of 132 observation days between March 8 and December 31. Of these, there were two dolphins, 27 harbor porpoises, and 42 harbor seals. All 2010 marine mammal observations were made near the Cobscook Bay deployment area. No observations of any whale species have been made in Cobscook Bay by ORPC personnel or those contracted to work for ORPC since the observation program began in 2007. Table 1 presents the number of each species observed and the months in which the observations were made.

Table 1. *Marine Mammal Observations in Cobscook Bay and Western Passage between December 2007 and December 2010.*

Month	**Number of Observation Periods**	**Harbor and Grey Seals**	**Harbor Porpoise**	**Atlantic White-Dolphins**
January	4	0	0	0
February	9	0	1	0
March	17	1	0	0
April	40	4	3	0
May	17	1	3	0
June	21	8	1	0
July	21	4	10	0
August	30	16	24	2
September	25	9	5	0
October	24	8	0	0
November	18	4	0	0
December	26	2	0	0
Total Observed		**57**	**47**	**2**

5.0 PROJECT NEXUS

The direct and in-direct interaction of tidal turbines and aquatic resources, including marine mammals, has not been fully characterized. There is also limited information on marine mammal use of the deployment area. The purpose of conducting small demonstration testing activities through a pilot project is to collect the environmental information needed to more completely evaluate the potential effects of these technologies. Post-deployment monitoring plans are also a mandatory requirement of pilot license applications under FERC's current hydrokinetic pilot license policy. Information collected by this monitoring plan can provide some essential information on how marine mammals use the deployment area.

The Project poses the greatest risk to marine mammals in Cobscook Bay when the TidGen™ Power System's project components are being placed, partially removed for maintenance, or fully removed. Other Project activities, such as cable laying, foundation setting, or subsurface drilling have the potential to present risks to marine mammals in Cobscook Bay.

6.0 METHODOLOGY

6.1 MONITORING BY ORPC PERSONNEL AND CONTRACTORS

ORPC proposes to conduct visual observations of marine mammals in and around the proposed deployment area in Cobscook Bay (Figure 1). These observations will be carried out by ORPC personnel and contractors concurrently with other project-related tasks. ORPC has developed a comprehensive Marine Mammal Observation Training document for use by personnel and contractors conducting work in Cobscook Bay (Attachment A). This document provides education and identification instructions on the different marine mammal species that may occur in Cobscook Bay (including all species noted in Section 4.1 above), to ensure consistency among all staff in recording marine mammal sightings.

Surveys will be conducted from both onshore areas and from the water in and around the deployment area. Marine mammal species visible from the water's surface will be recorded and logged as part of this monitoring effort. Observers will use binoculars, spotting scopes, and telescopes where practical to identify and observe marine mammals while performing other scheduled activities for the Project. If a marine mammal is observed, the observer will document the location where the observation was made, using latitude and longitude or a place name in order to provide perspective of the marine mammal sighting in relation to the TidGen™ Power System location, species identification and count, observed behavior (e.g., apparent foraging; floating with tide), weather conditions, and estimated distance from observation point (see Attachment A for a sample Marine Mammal Species Observation log sheet).

ORPC personnel and contractors are currently conducting numerous pre-deployment testing activities in Cobscook Bay in addition to performing environmental resource surveys. These activities occur throughout the year, during all seasons, and will continue through Phase I and into Phase II of the Project. ORPC personnel will continue to conduct marine mammal observations during these activities. In addition, other contractors such as the Center for Ecological Research (CER), the University of Maine (UMaine) School of Marine Sciences, UMaine Cooperative Extension, and SSI have been and will continue to be responsible for recording marine mammal observations in Cobscook Bay while conducting fisheries studies, bird observations, AAM system testing, and drift noise measurement system studies.

CER is proposing to conduct sea and shore bird surveys in Cobscook Bay as described in the Sea and Shore Bird Monitoring Plan. During these surveys, CER personnel will conduct incidental visual marine mammal observations. The avian surveys will have an expected frequency of eight 8-hour on-site surveys in years 2011 through 2014. These surveys are scheduled to be conducted during expected peak bird occurrence. Peak bird densities are likely to also be coincident with increased marine mammal activity during feeding activities.

UMaine is proposing to conduct hydroacoustic fish surveys in Cobscook Bay as described in the Fisheries Monitoring Plan. During these surveys, UMaine personnel will conduct incidental visual marine mammal observations. The fisheries surveys will have an expected frequency of 16 full 24-hour on-site surveys in 2011, 16 survey days in 2012, 8 survey days in 2013, and 6 survey days in 2014. These surveys are scheduled to be conducted during expected peak fish occurrence. Peak fish densities are likely to also be coincident with increased marine mammal activity, as marine mammals follow prey fish.

SSI is proposing to conduct radiated noise monitoring as well as testing of its AAM system in Cobscook Bay. The activities proposed under the radiated noise monitoring studies are described in the Acoustic Monitoring Plan. During testing of the AMM system, SSI will employ two dedicated marine mammal observers to conduct marine mammal observations concurrently with the radiated noise work. The frequency of the acoustic measurements will be driven by the changing environmental and mechanical conditions. The frequency of AAM system testing will be driven by progress made in the development of that system. The following is the proposed schedule for activities in Cobscook Bay during which SSI will conduct marine mammal observations. SSI will be performing pre-deployment acoustic ambient noise study work and testing of its AAM system in May 2011 for a period of five days. In July 2011, radiated noise monitoring will be performed around the Beta TidGen™ System and additional AAM testing will be conducted for a period of five days. After the deployment of the single-device TidGen™ Power System radiated noise monitoring will be performed in the deployment area and additional AAM testing will be conducted for a period of five days. After the deployment of the single-device TidGen™ Power System, AAM system testing will be conducted quarterly for periods of five days. In October 2012, radiated noise monitoring will be performed around the five-device TidGen™ Power System for a period of three days. After the deployment of the five-device TidGen™ Power System, AAM system testing will be conducted quarterly for periods of five days.

6.2 Monitoring by Dedicated Marine Mammal Observers

ORPC understands that some of the greatest risks to marine mammals can occur during the deployment, maintenance, and retrieval of large, heavy structures using moored vessels. ORPC has included Section 6.2 in this Marine Mammal Monitoring Plan specifically to address monitoring efforts during these high-risk portions of the Project. ORPC will employ two dedicated marine mammal observers during the deployment and retrieval of the TGUs and bottom support frames. NOAA/NMFS will approve the credentials of all dedicated marine mammal observers. Observations will commence a half-hour prior to construction or maintenance activities and will continue through the work period. Observations will cover 180 degrees fore and aft of the area of activity. The fore and aft observations may take place on two different vessels to assure a full view for each. All observers will use binoculars and record number, type, activity, and location of all sightings. Each observer will carry a hand held radio for immediate communication to the ORPC project lead. The project lead will responsible for communicating to the operations leader that a marine mammal has been spotted within the vicinity of the Project. The observers will continue to monior the marine mammal and report to the operations leader if the marine mammal is moving towards the Project area. The operations leader will alert work crews of the marine mammal's activities and determine if construction activities will be suspended if the animal continues to approach the deployment area. All construction activities will cease if a marine mammal comes within 500 feet of the work area, and may not recommence until the marine mammal is outbound and 1000 feet from the work area.

For small-scale, on-water work such as subsurface drilling, and light maintenance utilizing a single work boat (like work from the *Energy Tide 2*), ORPC will utilize one dedicated marine mammal observer at the work site. The physical location of the deployment area allows one dedicated observer to view it from either end of Cobscook Bay. The observer will follow the procedures described in Section 7.0 for communicating the presence and location of marine mammals in the vicinity of the Project so that the ORPC operations leader can prepare for a possible cessation of work activity.

7.0 REPORTING

All marine mammal observations will be recorded on a daily log sheet (Attachment A).

The daily observation log will include:

- Name of Observer
- Observation period (date and time)
- Location from which observations are made
- Estimated bearing and distance from observation location to marine mammal
- Weather conditions
- Number and species of marine mammal
- Notes on behavior (floating, actively foraging, diving activities, direction of travel, etc.)

ORPC will file full summary reports with the regulatory agencies on a biannual basis for the duration of Project operations, beginning six months after the deployment of the single-device TidGen™ Power System. Should altered marine mammal activity be noted at any time during the observations, the appropriate federal and state resource agencies will be notified for immediate consultation.

8.0 SCHEDULE

ORPC proposes to conduct visual marine mammal observations in and around the deployment area. ORPC and its contractors will be in the vicinity of the Project for fishery and bird surveys, and equipment testing frequently during and after deployment. Marine mammal observations are expected to occur incidentally while other activities are being performed, except during periods of deployment, maintenance, and retrieval activities, when dedicated marine mammal observers will be employed.

9.0 BUDGET

The total cost of this monitoring effort will be $184,000 over eight years. ORPC will be performing marine mammal observations in the vicinity of the Project incidentally, as other activities are conducted in support of the Project. A staff dedicated uniquely to marine mammal observation will not be employed, except during deployment, maintenance and retrieval activities. OPRC estimates the cost of dedicated marine mammal observers during deployment, maintenance, and retrieval to be $15,000 per year for eight years. ORPC estimates the cost of compiling the marine mammal observation logs and issuing biannual reports to be approximately $8,000 for each year of the Project.

10.0 DISCUSSION OF ALTERNATIVE APPROACHES

ORPC believes the Project has little potential to affect marine mammal species. ORPC has been testing tidal power devices in Cobscook Bay since 2007 and during this time period has not observed any negative environmental effects of these devices. In addition, the pilot Project is small relative to the available habitat in Cobscook Bay and will be monitored for direct interaction with aquatic life. Marine mammals are known to avoid structures in the ocean environment and it is expected they will similarly avoid direct contact with the proposed power system. In addition to this plan, Fisheries and Marine Life

Interaction Monitoring Plans have been developed to confirm no direct effects based on in-situ data collection. Potential indirect effects associated with underwater radiated noise are being addressed in the Acoustic Monitoring Plan. ORPC believes that the Marine Mammal Monitoring Plan, in conjunction with additional proposed monitoring plans, is sufficient to inform licensing decisions, that it is appropriate to the size and scope of the pilot Project, and that the approaches proposed in the study are in general accordance with those recommended by the resource agencies.

11.0 REFERENCES

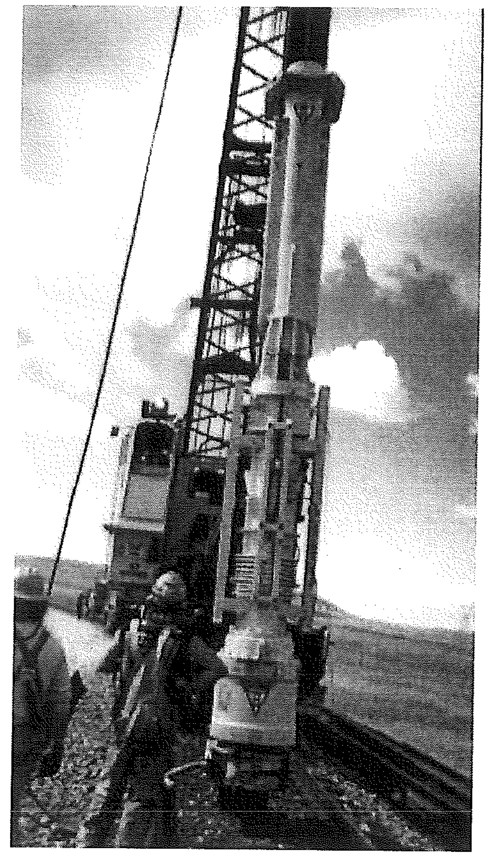
Federal Energy Regulatory Commission (2006). Policy Statement on Hydropower Licensing Settlements. September 21, 2006. Retrieved from http://www.ferc.gov/whats-new/comm-meet/092106/H-1.pdf.

National Marine Fisheries Service (2010). Letter to HDR|DTA providing list of rare, threatened, and endangered species near the Project Area.

ATTACHMENT A
ORPC MARINE MAMMAL OBSERVATION TRAINING DOCUMENT

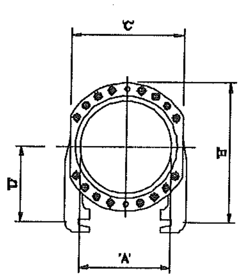
B-3005 General Specifications

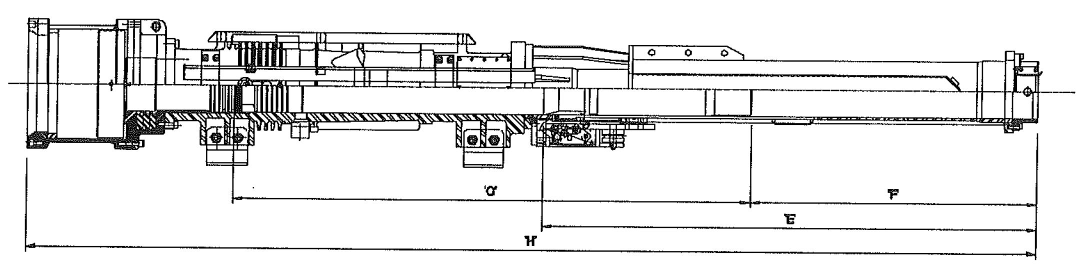
Performance		
Ram Weight X Max. Stroke	34,500 ft•lb	47 kN•m
Impact energy	21,533 ft•lb	29 kN•m
Ram weight/mass	3,000 lb	1,400 kg
Maximum ram stroke	11.5 ft	3.5 m
Impact block weight/mass	802 lbs	364 kg
Blows per minute	36-60	36-60
Operating Weight		
Total operating weight/mass	11,000 lb	4,989 kg
Weight of tool box	150 lb	68 kg
Total shipping weight/mass	11,150 lb	5,056 kg
Capacity		
Fuel tank capacity	16 gal (U.S)	62 liters
Fuel consumption	1.4gal/hr.	5.3 liters/hr.
Oil tank capacity	1.9 gal (U.S)	7.3 liters
Oil consumption	0.16 gal/hr.	0.6 liters/hr.



Impact Hammers B-3005

Dimensional Specifications



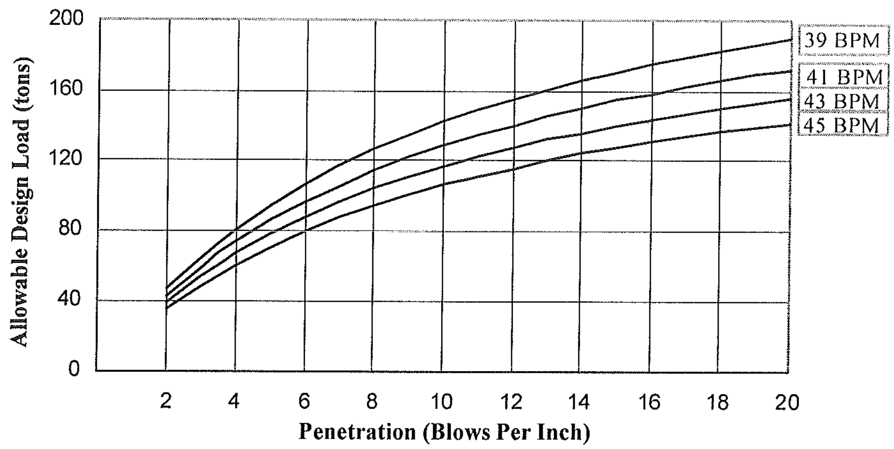


Dimensions	Model-3005							
Units	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Imperial	**21.5 in**	**27.5 in**	**24 in**	**15 in**	**109 in**	**63.7 in**	**114 in**	**222.7 in**
Metric	**546 mm**	**699 mm**	**610 mm**	**380 mm**	**2769 mm**	**1618 mm**	**2896 mm**	**5657 mm**

B-3005	3000 lb Piston				
BPM	Stroke (ft)	Potential Energy (ft.lb)	Velocity (ft/s)	Maximum Impact Force (tons)	Impact Energy (ft.lb)
35	11.8	35,400	22.5	243	24,780
36	11.2	33,600	22.0	238	22,547
37	10.6	31,800	21.5	233	21,533
38	10.0	30,000	21.0	228	20,543
39	9.5	28,500	20.5	222	19,577
40	9.0	27,000	20.0	217	18,633
41	8.6	25,800	19.5	211	17,714
42	8.2	24,600	19.0	206	16817
43	7.8	23,400	18.5	200	15943
44	7.5	22,500	18.0	195	15093
45	7.1	21,300	17.5	190	14266

Stroke height is a function of soil resistance and may not be attainable in certain driving conditions.
Standard Operating Range.

Pile Capacity (from Engineering News Formula)



WEAP Input Data

Ram			Stroke		
Weight	Length	Diameter	Minimum	Maximum	Efficiency
3.00 Kips	113.80 in	11.70 in	4.00 ft	11.80 ft	0.800

Impact Block Information				
Weight	Length	Diameter	C.o.R	RoundOut
0.80 Kips	25.87 in	11.81 in	0.900	0.0100

Diesel Hammer Combustion Chamber Information							
Combustion Chamber Inf.			Combustion			A I Volume	
C-Stroke	Area	Volume	Delay	Duration	ExpCoef	Ignition	Fin.Comb
15.75 in	109.61 in^2	141.00 in^3	0.000	0.000	1.250	155.1 in^3	186.7 in^3

Pressure						
Atmosphere	FS 1	FS 2	FS 3	FS 4	FS 5	Coeff. Conf.
14.7 psi	1400 psi	1300 psi	1200 psi	1100 psi	1000 psi	1.0

Helmet And Hammer Cushion Properties					
Helmet	Hammer Cushion				
Weight	Material	WEAP Input	CoR	Cushion Area	Thickness
1.60 Kips	Steel	30000 Ksi	0.70	280 in^2	6.00 in

B3505

SINGLE ACTING DIESEL PILE HAMMER

SERIAL NO.

__-___-35

Lwa

131 dB

CE

MODEL	**B3505**
RATED ENERGY	**62.4kJ/46,000ftlb**
BARE HAMMER WEIGHT(Mass)	4,809kg/10,602lb
TYPICAL OPERATING WEIGHT(Mass)	5,443kg/12,000lb
RAM WEIGHT(Mass)	1,814kg/4,000lb
RATED STROKE	3.5m/11.5ft
OPERATING FREQUENCY	36-60 BPM
FUEL TANK CAPACITY	59L/15.6gal
OIL TANK CAPACITY	7L/1.9gal

**ADDITIONAL SPECIFICATIONS AT WWW.BERMINGHAMMER.COM*

MANUFACTURE DATE:

Berminghammer

FOUNDATION EQUIPMENT.

HAMILTON ONTARIO CANADA

B3505

SINGLE ACTING DIESEL PILE HAMMER

SERIAL NO.
00 - 01 - 35

L_{wa}
131 dB

CE

MODEL	B3505
BARE HAMMER WEIGHT(Mass)	4,809kg/10,602lb
TYPICAL OPERATING WEIGHT(Mass)	5,443kg/12,000lb
RAM WEIGHT(Mass)	1,814kg/4,000lb
MAX. PHYSICAL STROKE	4.0m/13.0ft
RATED STROKE	3.5m/11.5ft
OPERATING FREQUENCY	36-60 BPM
FUEL TANK CAPACITY	59L/15.6gal
OIL TANK CAPACITY	7L/1.9gal
RATED POTENTIAL ENER[illegible]	62.4kJ/46,000ftlb
MAX. KINETIC ENERGY	46.1kJ/34,000ftlb

MANUFACTURE DATE: 12-2000

Berminghammer

FOUNDATION EQ[illegible]

HAMILTON ONTARIO CANADA

Midwest Vibro

Pile Drivers - Vibratory Hammers - Augers - Air Hammers - Lead Systems - Extractors and Drilling Equipment

- MIDWEST VIBRO /
- DRIVERS / EXTRACTORS /
- Model H-1700 /

 Contact Midwest Vibro

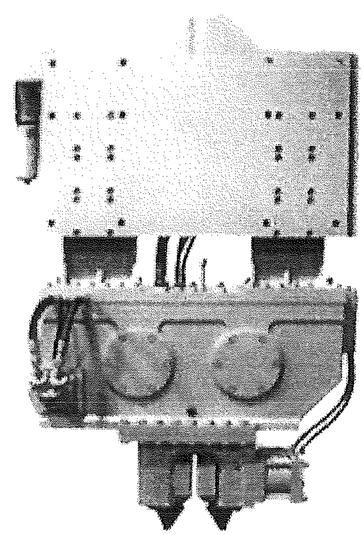
- MIDWEST VIBRO
- DRIVERS / EXTRACTORS»
- DEALERS
- SERVICE SCHEDULE
- GALLERY
- CONTACT

H&M Vibro Inc. Vibratory Driver/Extractor

Model H-1700

Vibrator Specifications

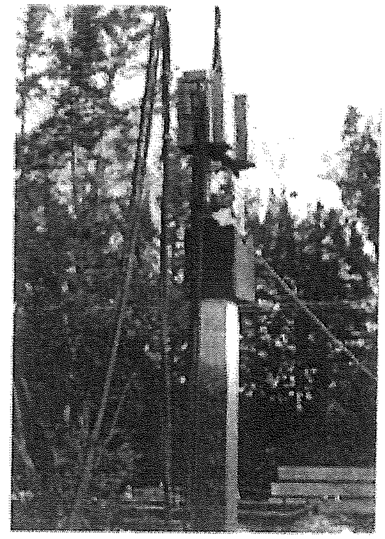
- **Hydraulic** — Type
- **180** — Horsepower
- **1,200** — Frequency
- **7/8 inch** — Amplitude
- **1,740 in. lbs.** — Eccentric Moment
- **30 ton** — Max Line Pull for Extraction
- **75 ton** — Pile Clamping Force
- **107 inches** — Height with Head
- **55 inches** — Length
- **12 inches** — Throat Width
- **7,000 lbs.** — Weight with Standard Clamp
- **3,600 lbs.** — Optional Counterweight



Power Pack Specifications

- **John Deere 6068HE** — Engine
- **225** — Rated HP
- **62 gallons** — Fuel Tank Capacity
- **100 gallons** — Hydraulic Tank Capacity
- **75 gallons** — Eccentric Pump Capacity
- **8 gallons** — Clamp Pump Capacity

- **10 micron** — Hydraulic Filters
- **110 inches** — Length
- **42 inches** — Width
- **55 inches** — Height
- **5,000 lbs.** — Weight



Next Product

Contact Us 800-648-3403
midwestvibro@sbcglobal.net

AMERIgreen AW

BIODEGRADABLE ANTI-WEAR HYDRAULIC FLUIDS

DESCRIPTION:

Amerigreen AW Biodegradable Anti-Wear Hydraulic Fluids are formulated from readi biodegradable renewable resources, high lubricity base oils coupled with proprietary nontoxic anti-wear and anticorrosion additives. These high performance products can reduce operating temperatures, friction, and component wear in mobile and industrial hydraulic systems. Excellent thermal and oxidative stability assure superior service life with minimal viscosity change over a broad range of operating temperatures. Amerigreen AW fluids are suitable for use in ecologically sensitive applications. Available in ISO grades 32, 46 and 68.

FEATURES:

- Readily biodegradable renewable resource.
- Superior anti wear and extreme pressure protection.
- Advanced rust and corrosion protection.
- High viscosity index/temperature stability.
- Low sustainable operating temperature.
- Ultra-low toxicity.

TECHNICAL DATA:

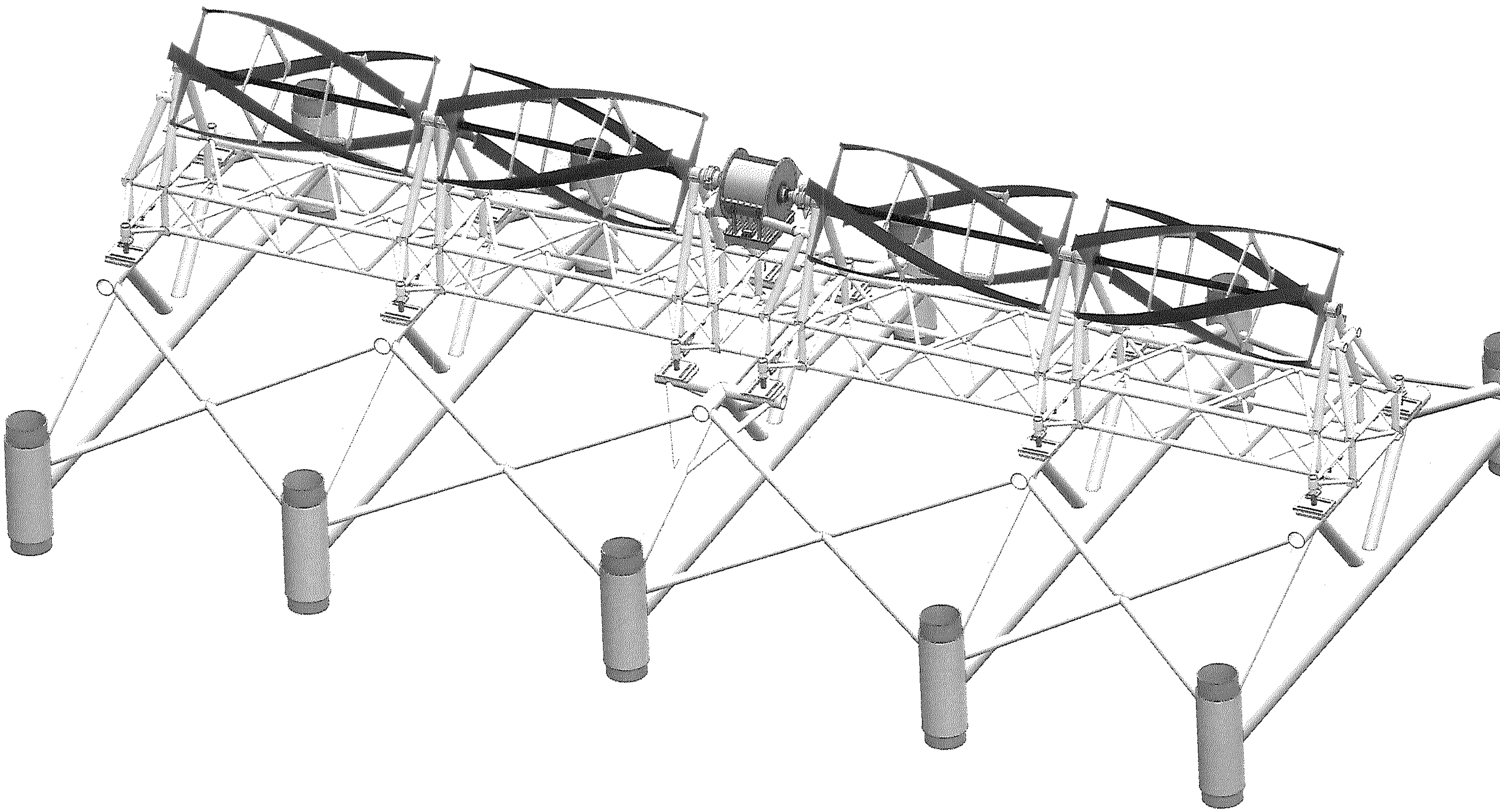
		AW32	AW46	AW68		
ISO Grade:		32	46	68		
Specific Gravity:		.913	.913	.913		
Viscosity	ASTM D445					
@ 40°C, cSt:		32	46	68		
Viscosity Index:	ASTM D2270	>188	>200	>200		
Pour Point °F (°C):	ASTM D97	-20 (-28)	-6 (-21)	-6 (-21)		
Flash Point °F (°C):	ASTM D92	>325(163)	>500 (260)	>500 (260)		
Copper Corrosion:	ASTM D4048	1A	1A	1A		
Rust Test, A & B:	ASTM D665	Pass	Pass	Pass		
Biodegradability, %:	CEC-L-33-A-94	>95	>95	>95		
Suggested Operating Range		Zero to 170F	20F to 170F	20F to 170F		
Dielectric Breakdown Voltage	ASTMD877	>55 kV	>55 kV	>55 kV		
Aquatic Toxicity, Fathead						
Minnow, LC50, 48hrs., ppm	EPA-821-R-02-012	>10,000	>10,000	>10,000		

AVAILABLE PACKAGING:

5 Gallon Pails, 55 Gallon Steel or Plastic Drums, 275 Gallon Totes, and Bulk.

AMERIgreen

Amerigreen
55 Doe Run Road
Manheim, PA 17545 / 888-423-8357 (Bioblend Mfg.)



TID-GEN BASE

Subject: FW: decibel readings
Date: Tuesday, August 23, 2011 9:23:25 AM ET
From: Herb Scribner
To: 'Martha Gray'

The vibratory hammer levels are in the email string
Herb

From: Doug Haverkamp [mailto:doughaverkamp@aol.com]
Sent: Tuesday, August 16, 2011 4:56 PM
To: hscribner@orpc.co
Subject: Fwd: decibel readings

Doug Haverkamp V.P.
Midwest Vibro Inc.
H&M Vibro Inc.
office.800-648-3403
cell.616-822-3651
p.o.box 224 Grandville,M.I.49468-0224
3715 28th sw Grandville,M.I.49418
www.midwestvibro.com

-----Original Message-----
From: Doug Haverkamp <doughaverkamp@aol.com>
To: hsribner <hsribner@orpc.co>
Sent: Tue, Aug 16, 2011 12:23 pm
Subject: Fwd: decibel readings

Herb nice talking with you today,here is the info on the H-1700 vibro that C.P.M. is using.If can help you with anything else please call.

Thanks Doug

Doug Haverkamp V.P.
Midwest Vibro Inc.
H&M Vibro Inc.
office.800-648-3403
cell.616-822-3651
p.o.box 224 Grandville,M.I.49468-0224
3715 28th sw Grandville,M.I.49418
www.midwestvibro.com

-----Original Message-----
From: Doug Haverkamp <doughaverkamp@aol.com>
To: j.zito <j.zito@american-equipment.com>
Sent: Thu, Aug 4, 2011 10:52 am
Subject: decibel readings

John we did a decibel reading on our H-1700 power unit today,the readings are as follows. at the operators position db was 112 ,15' 94 db,at 40' 82 db, at 80' 78 db.The engine was at full throttle position.

John if you need more readings please feel free to contact me.

Thanks Doug

Doug Haverkamp V.P.
Midwest Vibro Inc.
H&M Vibro Inc.
office.800-648-3403
cell.616-822-3651
p.o.box 224 Grandville,M.I.49468-0224
3715 28th sw Grandville,M.I.49418
www.midwestvibro.com

From:	Peter Stein
To:	hscribner@orpc.co; Patrick Edson; "Martha Gray"
Subject:	Pile driving zones of influence
Date:	Thursday, August 18, 2011 6:08:53 PM
Attachments:	pile_driving_snd_comp9_27_07.pdf

Herb,

I have been able to come up with a good estimate of pile driving noise and zones of influence based on the in-air estimates you sent me (112 dB at the operator) and Table 1.2-1 (impact pile driving) and Table 1.2-2 (vibratory pile driving) of the attach report.

On a constant radiated energy level, one can transfer in-air data to in-water data by adding 62 dB to account for differences in reference levels and specific acoustic impedance (ratio of particle velocity to pressure). Thus your 112 dB in-air vibratory source level at the operator (presume 1 m away) equates to roughly 174 dB re μPa^2 @ 1 m in water. The 131 dBA from the plate on the impact hammer would equate to 193 dB re μPa^2 @ 1 m in water.

From the tables in the attached report we are looking at source levels (rms) that average around 190 dB re μPa^2 @ 1 m for impact measurements (190 dB for a 1 meter diameter pipe) and 175 dB re μPa^2 @ 1 m for the vibratory hammer. So this is very consistent with the in-air measurements you passed to me once adjusted for energy conversion into the water. Thus these are good estimates to determine your mitigation requirements.

Presuming Level A harassment is above 180 dB for the impact hammer, your zone of influence for level A harassment is roughly 30-100 m. You will therefore need mitigation measurements to insure that no marine mammals get within 100 m of the pile driving.

Presuming Level B harassment levels for the continuous vibratory source is 120 dB, and we assume 15logR propagation loss in shallow waters (cylindrical spreading would be 10logR and spherical spreading would be 20logR), then the 175 dB vibratory levels do not attenuate to 120 dB until you are 4600 meters, or roughly 2.5 miles from the source. This is basically the entire bay. So you need an IHA for level B harassment for the bay area.

Please give me a call if you need anything further.

Peter

Dr. Peter J. Stein
President
Scientific Solutions, Inc.
99 Perimeter Road
Nashua, NH 03049
603-880-3784

Hydrophone TC4013

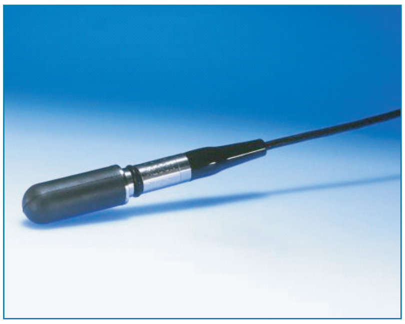
Miniature Reference Hydrophone

TC4013

- High sensitivity
- Omnidirectional to high frequencies
- Broad banded
- O-ring sealed mounting
- Individually calibrated

The TC4013 offers a usable frequency range of 1Hz to 170kHz and a high sensitivity relative to its size. It further more provides uniform omnidirectional sensitivities in both horizontal and vertical planes up to high frequencies. The TC4013 is an excellent transducer for making absolute sound measurements and calibrations within a broad frequency range. It can also be applied as an omnidirectional reference projector.
The overall characteristics makes TC4013 extremely applicable for laboratory as well as industrial uses.

TECHNICAL SPECIFICATIONS	
Usable Frequency range:	1Hz to 170kHz
Receiving Sensitivity:	-211dB ±3dB re 1V/μPa
Transmitting Sensitivity:	130dB ±3dB re 1μPa/V at 1m at 100kHz
Horizontal Directivity Pattern:	Omnidirectional ±2dB at 100kHz
Vertical Directivity Pattern:	270° ±3dB at 100kHz
Nominal capacitance:	3.4nF
Operating depth:	700m
Survival depth:	1000m
Operating temperature range:	-2°C to +80°C
Storage temperature range:	-40°C to +80°C
Weight (in air):	75g
Cable length:	Standard length 6m Optional cable lengths available on request
Encapsulating material:	Special formulated NBR



NBR means Nitrile Rubber

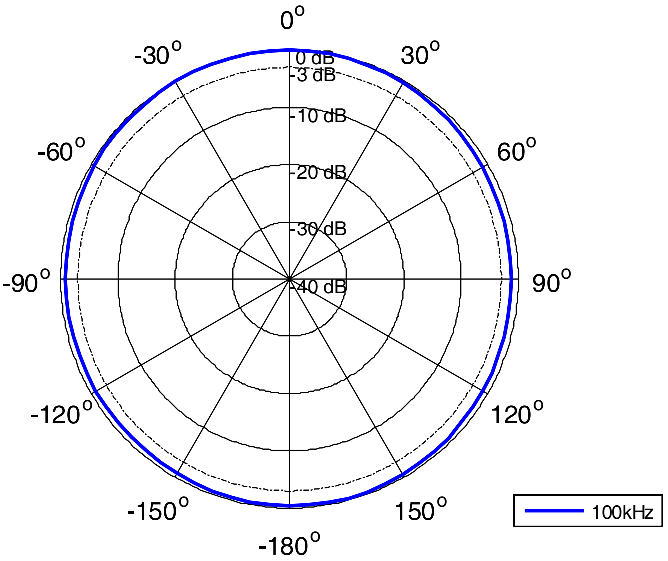
The NBR rubber is first of all resistant to sea and fresh water but also resistant to oil. It is limited resistant to petrol, limited resistant to most acids and will be destroyed by base, strong acids, halogenated hydrocarbons (carbon tetrachloride, trichloroethylene), nitro hydrocarbons (nitrobenzene, aniline), phosphate ester hydraulic fluids, Ketones (MEK, acetone), Ozone and automotive brake fluid.

Hydrophone TC4013

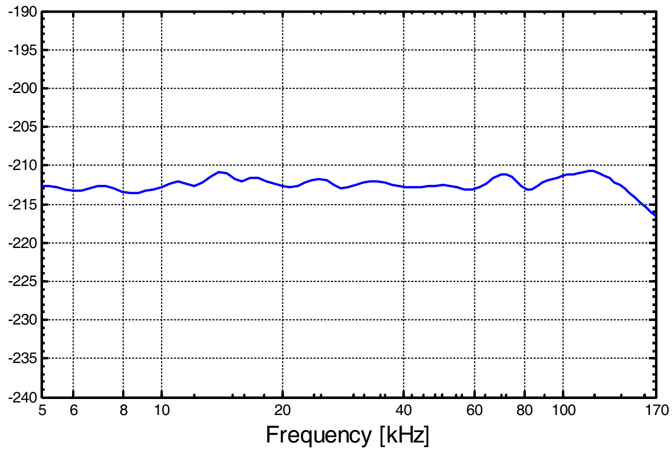
Miniature Reference Hydrophone

RESON

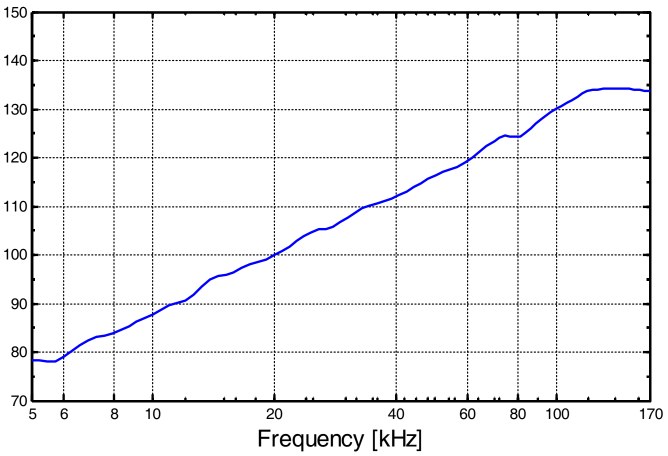
Horizontal directivity pattern



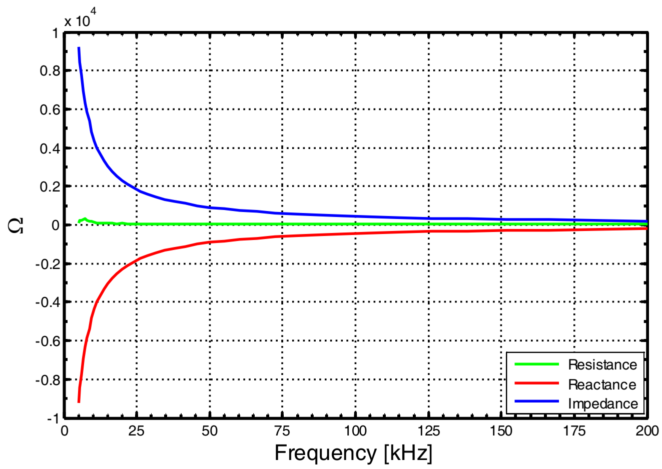
Receiving Sensitivity [dB re 1V/µPa @ 1m]



Transmitting Sensitivity [dB re 1µPa/V @ 1m]



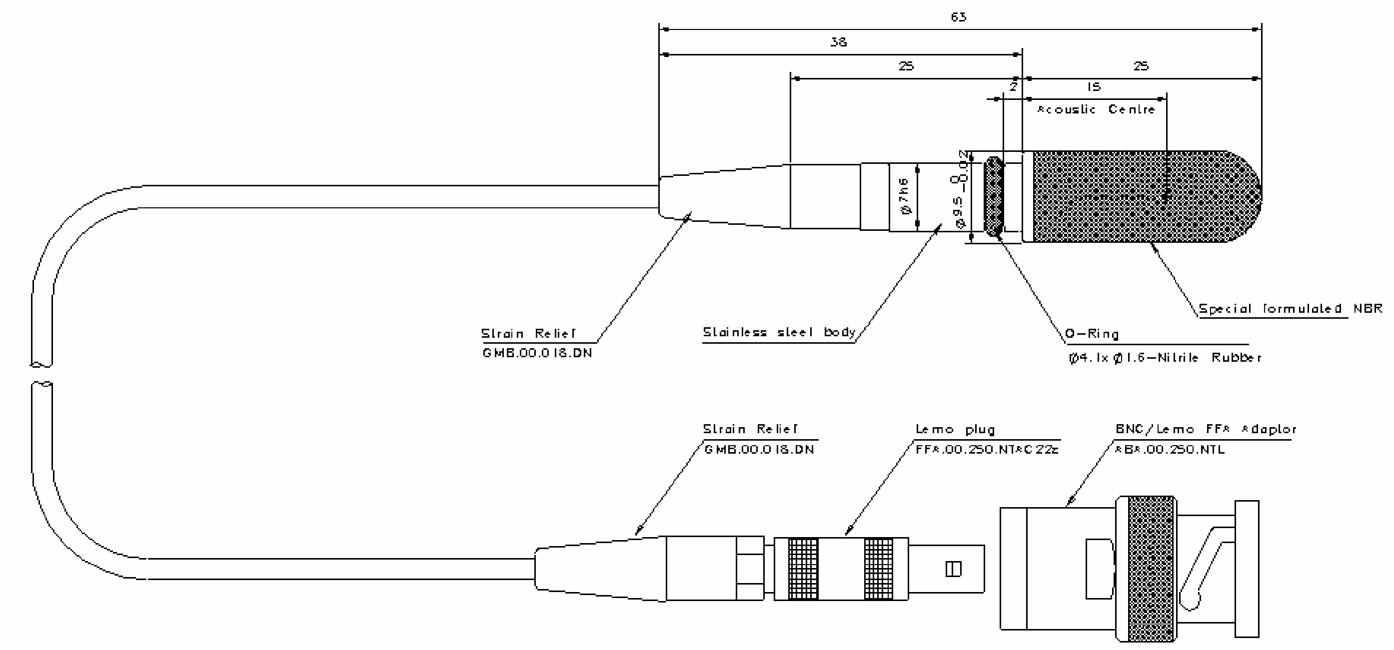
Impedance



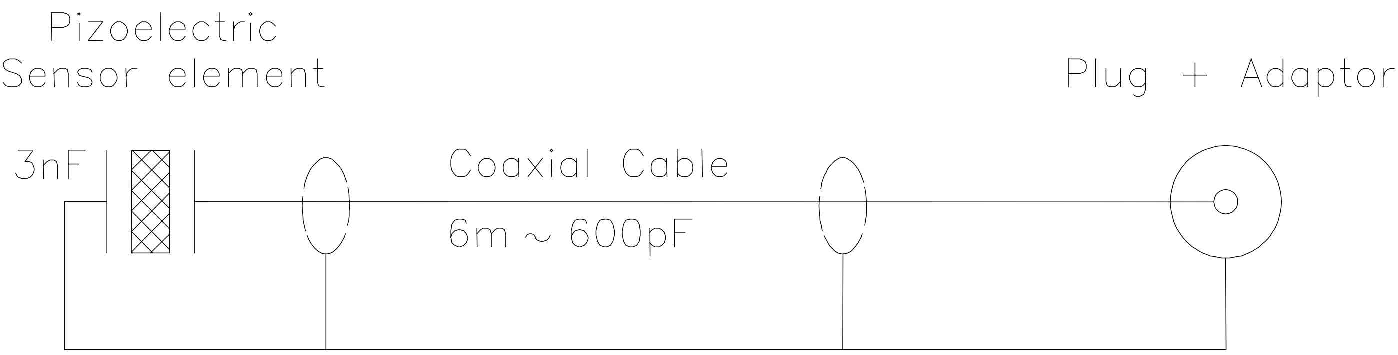
Hydrophone TC4013

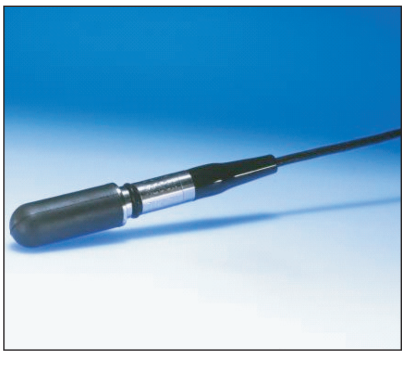
Miniature Reference Hydrophone

Outline Dimensions



Electrical Diagram





For Acoustical Measurement Accuracy please refer to www.reson.com or contact sales.

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info@reson.nl

RESON (Pte.) Ltd
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Tel: +65 6725 9851
sales@reson.com

Version: B108 070711 / A4

WaveBook/516E

Ethernet-Based Portable High-Speed Waveform Acquisition

MEASUREMENT COMPUTING

Features

- 16-bit/1 MHz A/D
- 1 µs/channel scanning of any combination of channels
- Single and multichannel analog triggering with programmable level & slope
- Digital TTL-level and pattern triggering
- Pulse trigger and external clock
- Programmable pre- and post-trigger sampling rates
- Sixteen digital inputs can be scanned synchronously with analog signals
- Operable from AC line, a 10 to 30 VDC source, such as a car battery, or optional compact rechargeable battery module
- Expandable up to 288 high-speed channels
- SYNC connection allows multiple units to sample synchronously
- Add up to 854 lower-speed thermocouple channels
- DSP-based design provides real-time digital calibration on all channels

Signal Conditioning Options

- IEPE dynamic signal inputs
- Strain gages
- Programmable filtering
- Simultaneous sampling
- Quadrature encoder inputs
- Pulse/frequency measurements
- Thermocouples
- High-voltage measurements
- Vehicle bus network

Software

- Includes WaveView for *Out-of-the-Box* setup, acquisition, & real-time display:
  - Scope mode for real-time waveform display
  - Logger mode for continuous streaming to disk
- Comprehensive drivers for DASYLab®, LabVIEW®, MATLAB®, Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET
- WaveCal software application for easy user calibration
- Supported Operating Systems: Windows 7/Vista/XP SP2, 32-bit or 64-bit

The WaveBook/516E is ideal for measuring dynamic signals in portable and laboratory applications

The WaveBook/516E digitizer offers multichannel waveform acquisition and analysis for portable or laboratory applications. The WaveBook includes 8 built-in channels expandable up to 72 channels of voltage, accelerometer, microphone, strain gage, thermocouple, position encoder, frequency, high voltage, and other signal types. For applications beyond 72 channels, up to four WaveBooks can be combined within one measurement system, for a total capacity of 288 channels. You can also add up to 854 thermocouples, without consuming measurement bandwidth of the WaveBooks, using the WBK40 Series, and DBK90 signal conditioning options.

WaveBooks are supported with a wide variety of software to address different applications and skill levels. Included WaveView software allows effortless set-up, time-domain waveform viewing, and real-time storage of acquired data to disk*. Also included is PostView, a post-acquisition waveform viewing application, allowing you to visually scroll through multiple waveforms on your PC screen. For users who prefer to program, the WaveBook also includes comprehensive drivers for DASYLab, LabVIEW, MATLAB, Visual C++, Visual C#, Visual Basic, and Visual Basic .NET.

Also included is DaqCOM, an ActiveX/COM-based set of development tools that allow users to easily develop their own custom applications in either Visual Basic, or C/C++. DaqCOM allows users to distribute WaveBooks throughout a facility of net-enabled PCs, allowing data acquired on any WaveBook attached on the network to be viewed on other PCs on the network.

DASYLab is also available for the WaveBook, allowing a user to simply connect icons to develop custom test and analysis applications.

WaveBook system with 8 strain inputs and 8 accelerometer inputs

* WaveView supports up to 72 high-speed input channels. Applications with multiple WaveBooks, or with WBK40/41 thermocouple options, should use DASYLab or other programming applications supported by the WaveBook, including C++, Visual Basic, or LabVIEW.

WaveBook/516E

General Information

A family of 8-channel WBK expansion options provide volts, accelerometer, strain gage, frequency, and quadrature encoder measurements. Other WBK options provide isolated inputs as well as temperature measurement capability. Most WBK options are fully programmable for gain/range, filter cut-off frequency, AC/DC coupling, etc.

The WaveBook's design is optimized for expansion, reconfiguration and portability. There are no bulky expansion chassis that must be purchased in anticipation of future applications. The compact, all-metal chassis features a low-profile package with front panel inputs.

The WaveBook provides sophisticated multichannel triggering, usually associated with larger, more expensive waveform recorders. The DSP-based design also makes the system more compact than others of similar performance.

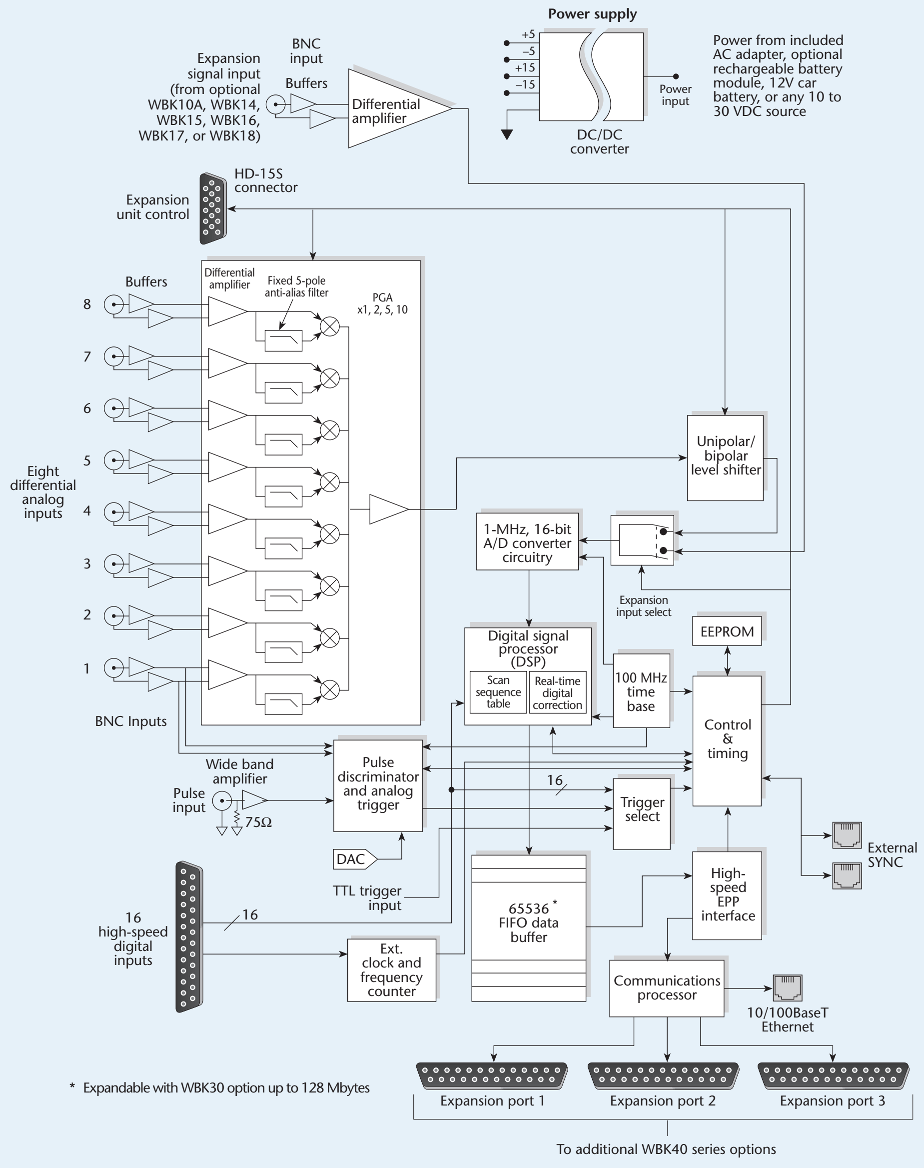
The WaveBook operates on a wide range of power sources, such as a standard AC line, an optional rechargeable battery supply, or even a 12V car battery.

All WaveBooks feature an input buffer amplifier on each of its eight channels. This architecture isolates the input signals from any multiplexing transients and greatly improves frequency response. It also provides far less sensitivity to input-signal source impedance.

To achieve superior signal fidelity, excellent noise immunity, and greater accuracy, the WaveBook follows the input buffer amplifier with individual differential and programmable gain amplifiers on each channel. In addition, a 5-pole, 20 kHz Butterworth anti-aliasing filter can be software-enabled on a per-channel basis to protect against aliasing of high-frequency signal components. For additional gain and filtering, the WaveBook can be factory configured with a WBK11A, WBK12A, or WBK13A.

The WaveBook's DSP automatically compensates for offset and gain errors in each of its amplifiers, including those found in the WBK expansion options on a per-reading, real-time basis. This compensation is based on calibration constants calculated during the system's calibration process. The constants are stored in the system's non-volatile memory. The DSP also permits the WaveBook to accept user-supplied calibration constants, enabling it to automatically scale the input signal for gain and offset individually on every channel.

WaveBook/516E Block Diagram



The WaveBook offers both bipolar and unipolar input ranges, which are per-channel programmable via the sequencer. Bipolar ranges can extend from ±0.05V to ±10V. Unipolar ranges can span from 100 mV to 10V.

The WaveBook also features a 16-bit high-speed TTL digital I/O port for recording discrete TTL-level signals at the beginning of each scan, providing time correlation with the analog inputs.

WaveBook/516E

Triggering

Triggering

The WaveBook offers a variety of trigger modes. Selection of the optimal trigger mode for your particular application requirements saves time and disk space by ensuring that you capture only the data of interest.

A wide selection of programmable analog and digital trigger modes are available for starting an acquisition. All trigger modes, along with the number of scans and the sample rate for pre- and post-trigger data, are software programmable prior to the start of a scan sequence. The WaveBook also supports digital pattern and pulse triggering. Trigger latency (the maximum time from the trigger to the first reading of a scan group) and jitter (the variation of the latency from acquisition to acquisition) depend on the specific trigger source and type of acquisition. Descriptions of each trigger source and the various trigger modes follow.

Software Trigger. A software trigger is issued by the PC, and causes the WaveBook to begin scanning the setup predefined in the scan buffer. The trigger latency in this mode is longer than in other trigger modes and is a direct function of the PC's performance. It is typically 100 µs or less in post-trigger acquisitions.

Digital TTL Trigger. The WaveBook accepts a single TTL-level signal input to the DB25 digital I/O connector with rising- or falling-edge trigger sensitivity selected through software. Trigger latency in this mode is less than 300 ns for post-trigger acquisitions.

Digital Pattern Trigger. In addition to digital trigger, the WaveBook supports digital pattern triggering. This allows data collection to start when a user-defined 16-bit digital pattern is matched on the digital I/O connector. For example, it is useful when trying to capture noise, vibrations, or some other physical disturbance which occurs at a particular point in a digitally sequenced process, from a PLC or relay logic control system. Trigger latency of the digital pattern trigger is less than 300 ns for post-trigger acquisitions.

Pulse Trigger. This high bandwidth input enables the triggering and the correlation of lower speed waveforms with the occurence of a high speed pulse. With Pulse Trigger, the user defines a pulse by an amplitude between ±5V and a pulse width from 300 ns to 0.8 sec.

Analog Trigger Source. Analog sources are the most commonly used triggers. The WaveBook supports both single-channel analog triggers for quick captures, as well as multichannel analog triggering.

Single-Channel Analog Trigger. Simple single-channel trigger performs analog comparison of channel one to a programmable 12-bit DAC value. You can also select rising- or falling-edge criteria. Trigger latency is less than 500 ns.

When a WBK11A, WBK12A, or WBK13A option is installed (providing simultaneous sample and hold or filtering), the trigger input signal is amplified by the simultaneous sample and hold amplifier before being compared against the analog trigger level. This can increase the trigger signal's sensitivity by a factor of 100.

Multichannel Analog Trigger. Multichannel triggering eliminates spurious data by letting you enter a more selective trigger condition to capture events of specific interest. In multichannel mode, any combination of up to 72 analog channels can contribute to the trigger condition. You can individually program each channel to satisfy its trigger criteria using one of eight states from a combination of above/below level, rising/falling edge, and instantaneous/latched duration. In addition, you can also define a hysteresis band for each channel, reducing false triggers when used with auto re-arm. Finally, you can join all trigger channels together using "ANY" (logical "OR" condition) or "ALL" (logical "AND" condition) Boolean logic operands to form a single, unified trigger condition.

The maximum latency possible in post-trigger acquisitions of the multichannel trigger mode is 2 µs per designated trigger channel, plus 4 µs. For example, if five trigger channels are designated, the maximum latency is 14 µs. The minimum latency in this mode is half the maximum rate; thus, the multichannel trigger jitter time is 1 µs per trigger channel, plus 2 µs.

Acquisition Modes

The WaveBook lets you select one of several acquisition modes for collecting your pre- and post-trigger data. The system offers four post-trigger modes and two pre-trigger modes. The WaveBook uses a combination of internal memory, PC RAM, and your PC's hard disk to seamlessly record all acquired data during the acquisition process.

Post-Trigger Acquisition

In post-trigger acquisition, the WaveBook acquires data only after a trigger condition has been met. You have a choice of four post-trigger acquisition modes, each offering benefits suited to particular applications.

Infinite Linear Mode. In infinite linear mode, the system acquires data for an infinite amount of time after a trigger occurs. This mode is most useful for chart-recorder replacement applications that require long recordings. Once started, the system keeps digitizing until a "stop" command is issued by your PC. The amount of data you can acquire depends on your PC's available memory resources.

Infinite Circular Mode. In infinite circular mode, the system acquires data into a circular buffer indefinitely until it receives a "stop" command from the PC. When the circular buffer is full, it overwrites previously acquired data; thus the buffer always contains the most recently acquired data. This mode is most useful for applications in which file size is limited by PC resources, or an indeterminate number of scans will occur before the stop condition occurs and only the last scans are required. A typical application is destructive testing in which acquisition is complete when the device fails, and only the final failure mode characteristics need to be captured.

Finite Linear Mode. When operating in finite linear mode, the system acquires data after receipt of the trigger until a specified number of scans (from 1 to 100 million) are acquired. Finite linear mode is suitable for applications in which the duration of the event is known.

Re-arm. Finite linear mode permits the specification of the "re-arm" condition. Under such a condition, after a specified number of scans is acquired, the system automatically prepares for a new acquisition by re-arming and re-enabling the trigger, and then capturing a new finite number of scans without the need for either user or computer intervention. This capability is useful in emulating a DSO (Digital Storage Oscilloscope), which typically offers continuous retrace. It is also beneficial for unattended captures in which critical trigger events occur at indeterminate intervals, making manual re-arms awkward. It is further useful for applications in which trigger events occur so quickly that it is difficult to respond manually or under software control.

Finite Circular Mode. In this mode, the WaveBook acquires data into a circular buffer until a specified number of scans (from 1 to 100 million) is acquired. When the circular buffer becomes full, it writes over previously acquired data, and thus always contains the most recently acquired data. This mode is useful for trigger delays; for example, the unit can be pre-configured to record 100,000 scans (after the trigger) at 10 µs intervals and to save only the last 10,000 of the 100,000. In this example, the final record would contain only data acquired 900 ms after the trigger.

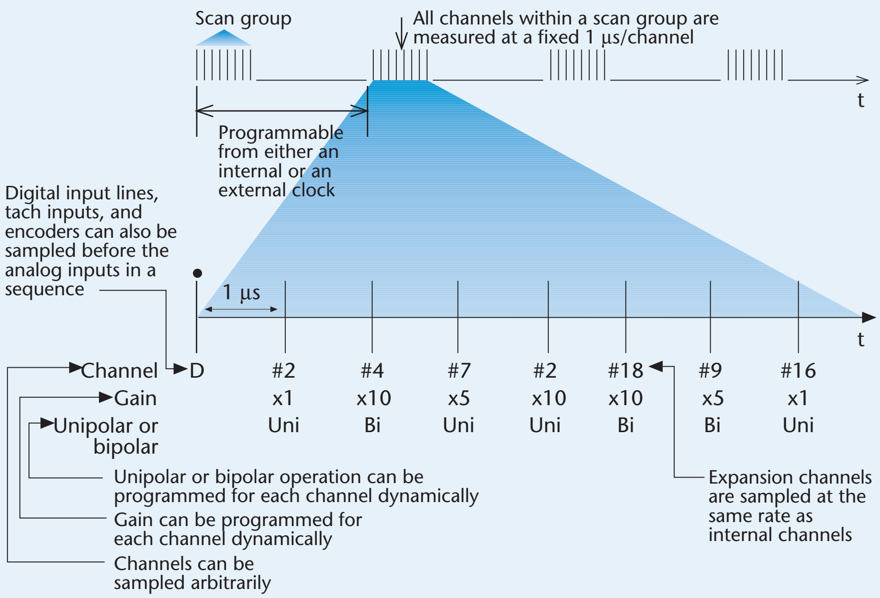
Channel-Scanning Flexibility

The WaveBook provides maximum scanning flexibility via a programmable channel/range sequencer. You can load the sequencer with any combination of channels and associated ranges. Once loaded, the sequencer waits for the trigger condition to be satisfied, after which it begins scanning and digitizing. When scanning begins, the WaveBook selects the appropriate channel and gain, digitizes the input signal, calibrates the reading, and transmits it to the PC via the on-board, 65 Kword FIFO buffer (or into optional internal memory, up to 128 Mbytes). This process is repeated at a 1 µs/sample rate until all channels within a scan group are completed.

Upon completion of a scan group, the WaveBook can be configured to proceed in one of several fashions. For example, the system can be programmed to begin the next scan after a period of 1 µs to 100s, programmable in 0.05 µs increments. It can also be programmed to wait indefinitely until the trigger condition is next satisfied, after which it will again perform a specified number of scans, from 1 to 100 million.

The WaveBook also supports pre-triggering, and is capable of acquiring up to 100 million scans prior to satisfaction of the trigger condition. The pre-trigger buffer is circular, and thus always provides the most recently acquired readings prior to the occurrence of the trigger. In addition, the system permits pre-trigger scan group repetition at one rate and post-trigger scan group repetition at another rate. For example, the system can be configured to repeat scans 1,000 times per second prior to the trigger, and then 100,000 times per second after receipt of the trigger.

WaveBook Scanning Example



WaveBook/516E

Triggering

Pre-Trigger Acquisition

Pre-trigger permits the acquisition of readings prior to the receipt of a trigger condition. Pre-trigger can be used with any of the four trigger modes described above.

When pre-trigger is selected, the rate at which a scan group repeats can differ before and after a trigger*. (Please note while the sample rates between pre- and post-trigger scan groups can differ, the time between consecutive samples within a group is fixed at 1 µs.) For example, a scan group of 8 channels can be repeated at 1000 scans per second prior to a trigger condition, and at 100,000 scans per second after the trigger. The number of scans acquired during both time periods is also programmable.

The WaveBook first acquires a specified number of pre-trigger scans at the pre-trigger scan rate, and then arms the trigger, guaranteeing that at least the specified number of scans have been acquired before the trigger. The system continues to collect scans at the pre-trigger scan rate until the trigger occurs. Once the trigger is detected, the system finishes collecting the current pre-trigger scan, switches to the post-trigger scan rate, acquires readings using one of the four post-trigger modes described above, and then stops the acquisition. The number of pre-trigger and post-trigger scans are each independently programmable from 1 to 100 million.

Pre-Trigger Circular Mode (requires WBK30 installed). In this mode, data is placed into a circular buffer until the buffer fills, after which the buffer writes over previously acquired data. The system stays in this mode, waiting for the pre-set trigger condition to be met, until the condition occurs or the acquisition is halted by the PC. Upon detection of the trigger condition, the system begins the post-acquisition readings. Since, for practical applications, the WaveBook is only limited by the PC's resources, extremely deep circular buffers can be configured for both the pre- and post-trigger data.

Pre-Trigger Linear Mode.** In this mode, the WaveBook continues collecting data without writing over old data. Since the amount of pre-trigger data can be nearly infinite (if the trigger takes a very long time to occur), this mode may require extensive PC resources to avoid data loss. Unlike the pre-trigger circular mode, which delays the trigger arm condition until a predefined number of scans is collected, the pre-trigger linear mode permits the WaveBook to begin recording post-trigger data as soon as the trigger condition is met, regardless of the number of pre-trigger scans collected. This mode is useful for applications in which the desired number of pre-trigger scans is indeterminate prior to the start of acquisition and all data must be acquired.

External Clock Input***

The WaveBook supports an external clock input, allowing the scanning of data to be dependent upon an external pulse train. This feature is useful in rotating machine or motion applications where data collection is dependent upon rotational speed or axial position. In addition to allowing one scan per pulse, the WaveBook's external clock input features a programmable divider capable of reducing the incoming clock by up to 255. This is useful when the external clock source is faster than the optimum sample rate for the data collection task.

External Clock Timer†. The WaveBook features an internal timer capable of reporting the period of the external clock input. This value can be read with each scan†† of the analog data and is reset by the rising edge of the incoming clock. This is often beneficial in later analysis where physical phenomena needs to be correlated to speed.

Multi-Unit Synchronization

Multiple WaveBook/516Es and WBK40/41s can be synchronized via the rear-panel SYNC ports. Simply connect 2, 3, or 4 WaveBooks together using SYNC cables (CA-74-1). WaveBook software establishes one of the WaveBooks as the *master* and the others as *slaves*. Master WaveBooks can run at the full 1 MHz aggregate sampling rate; slave WaveBooks must have 0.1 µs of unassigned sampling time in the scan group (some trigger modes are not supported in multi-WaveBook systems).

Simultaneous Sampling†††

The WaveBook samples each channel in sequence, at a fixed 1 µs/channel rate. For example, when eight channels are scanned sequentially, the time between sampling the first channel and the eighth channel is 7 µs. For applications that require simultaneous sampling (within 100 ns) of all channels, the optional WBK11A eight-channel simultaneous sample and hold card and the WBK13A programmable low-pass filter card with simultaneous sample and hold are available. The WBK11A or WBK13A can be installed in the WaveBook, or the WBK10A expansion chassis; they provide simultaneous sampling of all channels in a module. Even when multiple WBK11A or WBK13A cards are used within one system, all channels with simultaneous sample and hold active are sampled within 100 ns of one another. Some WBK options include built-in simultaneous sampling, including the WBK16/SSH and WBK18.

* PostView software does not support pre-trigger scan rates that differ from post
** Pre-trigger linear mode and auto re-arm in the WaveBook hardware are not supported in WaveView
*** Full 1M rate not available with external clock
† External clock counter and the high-speed digital inputs are mutually exclusive; adding the external clock counter to the scan list is equivalent to adding two analog channels
†† Requires two locations in the scan sequencer
††† The maximum scan rate when using SS&H is $\frac{1\text{ MHz}}{(n+1)}$ where n=number of channels in the scan list

WaveBook/516E

System Power Connection

The WaveBook and its associated WBK modules offer the flexibility to be powered either directly from a 10V to 30V DC source or via the included TR-40U AC power adapter. Options such as the WBK11A, WBK12A, and WBK13A signal conditioning cards install directly into the WaveBook or WBK10A and derive their power from those units.

Table 1

Input	Maximum Output
DBK30A	1.9 Amps
DBK34A	5.0 Amps
TR-40U	3.3 Amps

If you are operating each module with its included TR-40U AC power adapters, then no calculations are required; just connect the power adapters. In certain applications, however, it may be advantageous or more convenient to operate all components from a single source such as a battery or UPS such as the DBK34A. In those cases, the following worktables provide the necessary information for calculating current requirements for your particular system.

The table below shows the current draw available from IOtech's DBK30A rechargeable battery module, the DBK34A DC UPS, and the included TR-40U AC power adapter. To minimize cabling, each module has a pass-through connector allowing a number of modules to be daisy chained, up to the 5-ampere limit of the connector and CA-115 power expansion cable. The exact number of daisy chained modules is dependent upon your exact configuration.

Calculating the Current

Table 2 provides the approximate required amperage for each component in your system when using a 15V supply. Using this table, calculate the maximum amount of amperage your system will draw by multiplying the quantity of components used by the amperage. Total the values in the last column to arrive at the maximum amperage; then verify that your power source has enough current capacity (see Table 1).

Table 2: Wavebook & Option Current Usage

Units	Qty.	Amps	Total
WaveBook/516E	x	2.10	=
WBK10A, 8-channel expansion module	x	0.30	=
WBK11A, 8-channel simultaneous sample & hold card	x	0.45	=
WBK12A, 8-channel programmable low-pass filter card	x	0.45	=
WBK13A, 8-channel programmable low-pass filter card with SS&H	x	0.50	=
WBK15, 8-channel 5B signal conditioning module	x	0.10	=
WBK15, with 8 5B strain modules (max load)	x	0.75	=
WBK16, 8-channel strain gage module (no load)	x	1.00	=
WBK16/SSH, 8-channel simultaneous sample & hold module	x	1.20	=
WBK17, 8-channel counter/encoder module	x	0.52	=
WBK18, 8-channel dynamic signal conditioning module	x	1.20	=
WBK30, memory option for the WaveBook	x	0.01	=
WBK40 series, modules for WaveBook/516E, with no expansion	x	0.60	=
WBK40 series, modules for WaveBook/516E, with five DBK84's	x	1.30	=
DBK65, 8-channel transducer interface module	x	0.83	=
DBK70, vehichle network interface*	x	0.50	=
		Max. Amps:	

* Typically draws power from diagnostic connector

WaveBook/516E

General Information

External Power Modules

DBK30A

For small, portable applications, the optional DBK30A rechargeable battery module provides up to 3.5 hours of operation at 2.0A current draw. The DBK30A, which is housed in a rugged metal enclosure of the same footprint as the WaveBook, and can be mounted under the system by using the built-in mounting brackets. The DBK30A includes an AC charging supply.

The DBK30A rechargeable battery/excitation module

DBK34A

The DBK34A provides back-up power as an uninterruptible power supply (UPS) to the WaveBook. If DC power is interrupted during an acquisition, this module provides temporary power so the measurement is not disturbed. The DBK34A is powered from an external DC power supply; it does not include an AC charger.

The DBK34A rechargeable lead-acid battery/UPS (uninterruptible power supply) module

The CA-116 optional cigarette-lighter power adapter provides DC power to the WaveBook in automotive applications

Ethernet Features

The WaveBook/516E includes a 10/100BaseT Ethernet interface

The WaveBook/516E transfers acquired data to the PC via 10/100BaseT Ethernet, allowing a continuous stream of a virtually unlimited amount of data to be collected and stored in a PC's memory or hard drive.

The 8-channel WaveBook/516E can be expanded up to 72 channels using 8-channel WBK expansion options. The WaveBook/516E also has 3 built-in parallel expansion ports, permitting connection of up to three additional WBK40 Series units. A sync signal between all devices insures that multi-device systems acquire data synchronously. In total, up to 288 channels of high-speed input can be measured via one Ethernet link*. Also, additional channels are possible using an Ethernet expansion hub, allowing multiple WaveBook/516E units to be attached to one PC.

The WBK40 Series of options connect to one of the WaveBook/516E's parallel expansion ports. Since the WBK40 has its own 200 kHz A/D converter, it does not consume bandwidth from the WaveBook's 1 MHz A/D. The SYNC connection insures that both A/Ds measure synchronously.

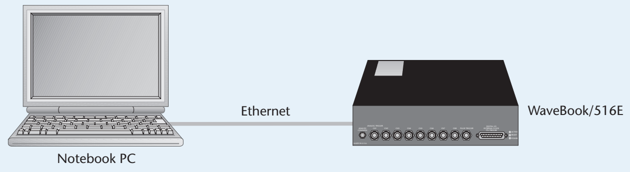
There are two advantages of seamlessly supporting multiple WaveBooks in one system. First is the ability to expand beyond the 72 channel capacity of a single WaveBook. Second, if the per-channel sampling rate of a single WaveBook system is inadequate, then additional WaveBooks can provide more bandwidth per channel.

* The maximum continuous data transfer rate from a multiple WaveBook system to the PC on a dedicated Ethernet link is 2 Mreadings/s

WaveBook/516E

General Information

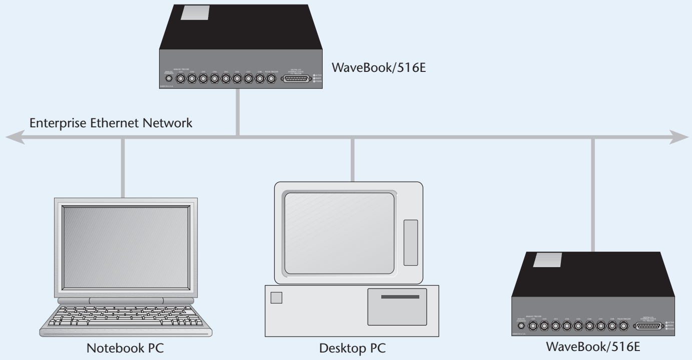
The most common and highest-performance WaveBook/516E connection is with dedicated, point-to-point Ethernet link between the PC and the WaveBook/516E. Data transfer rates in this configuration will accommodate continuous, 1 Mreading/s transfers from the WaveBook/516E to the PC.



Point-to-point Ethernet connection

With an enterprise-wide Ethernet network connection, any number of WaveBook/516E's can be connected to the network, which is shared amongst a potentially large number of Ethernet-connected devices. In this mode, the data transfer rates from the WaveBook/516E will be dependent on other network traffic at the time of data transfer.

This connection method is not recommended when continuous, 1 Mreading/s transfers from the WaveBook/516E are required. To improve the data transfer performance of WaveBook/516E's in this configuration, the WBK30 memory options may be installed into the WaveBook.

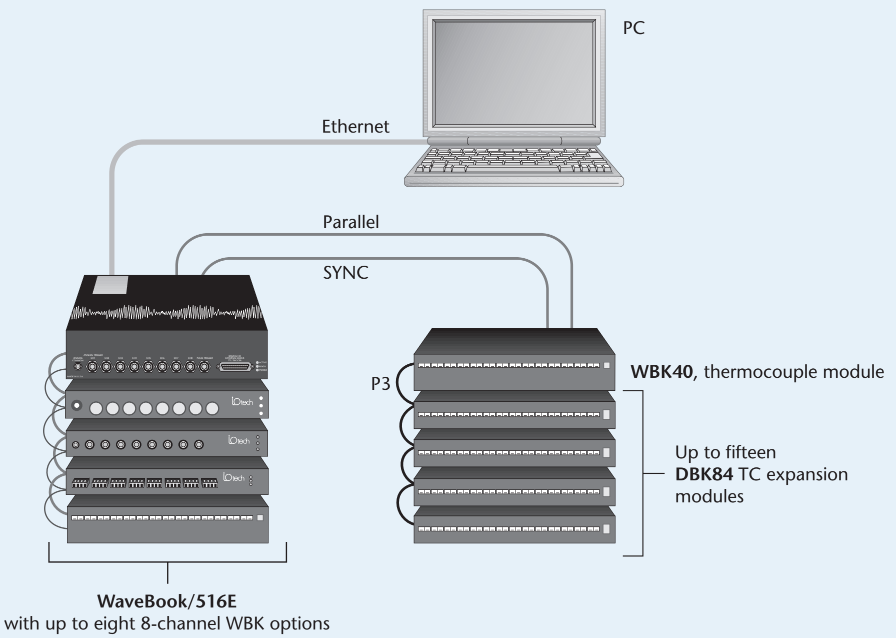


Enterprise-wide Ethernet connection

The parallel expansion ports on a WaveBook/516E can also be used to attach a fourteen channel WBK40 thermocouple interface module. The WBK40 has an internal A/D converter, so that it does not consume valuable bandwidth from the WaveBook516E's 1 MHz A/D converter. The SYNC signal on the WaveBook attaches to the SYNC input on the WBK40, insuring that both A/D's are operating synchronously to one another. The WBK40 can be expanded up to 244 thermocouple channels using DBK84 14-channel TC interface modules.

In synchronous master/slave systems or when using a WBK40/41 module, it is possible to run the slave units at a slower clock rate than that of the master device in the system. This configuration may be necessary when it is desirable to have a system which has signals that need to be sampled at widely varying rates while remaining time synchronous to the master unit.

WBK40 Example



Note: The WBK40 and WBK41 are not currently supported in WaveView. We recommend using DASYLab® when using these modules, which includes full support for the WBK40/41. The WBK40/41 are also supported in LabVIEW®, and DaqCOM. If it is necessary to use these modules in conjunction with a WaveView application, then it is necessary to launch a second, concurrent application to acquire data from the WBK40/41 into separate data files.

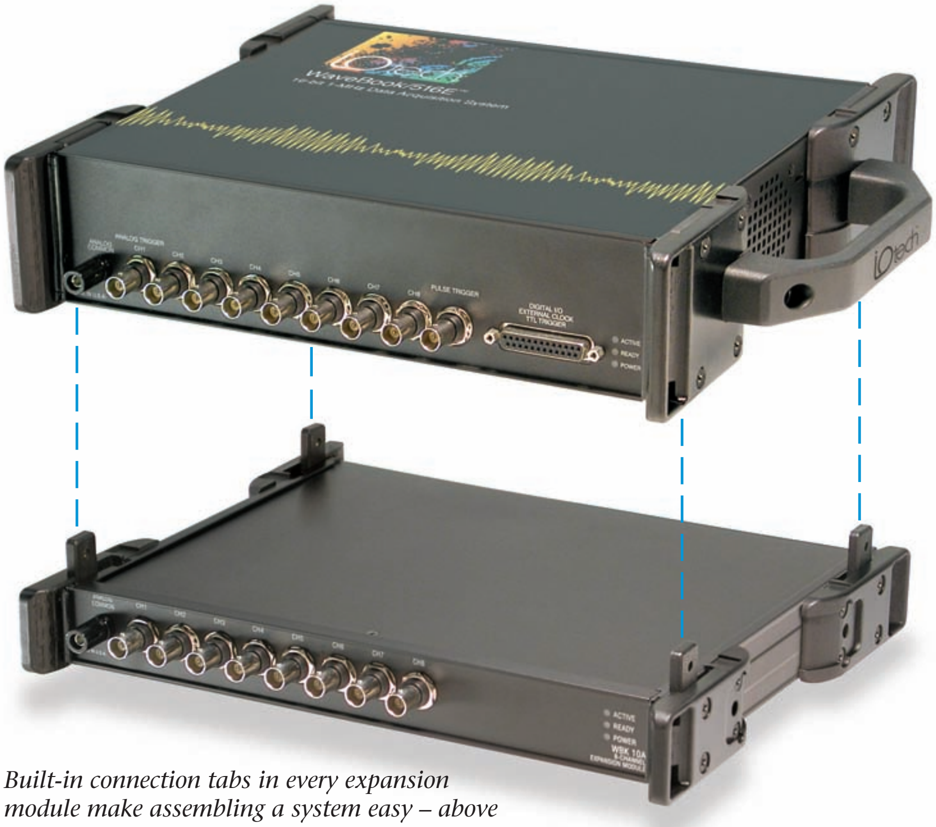
Module-to-Module Connection

for WaveBook Systems

Assembling a WaveBook system is easy with our new packaging and module-to-module connection system. Every WaveBook and WBK option is housed in an all-metal enclosure, and is encased with rugged molded bumpers on all corners. The bumpers serve to protect the connectors as well as to attach multiple modules together. Within each bumper is a tab which can be rotated 90˚ to lock with other modules attached to either the top or bottom of each module.

One handle is included with each WaveBook, and additional handles can be purchased for in-vehicle applications where a handle on both sides of the system is desirable for securing the system to the vehicle. When multiple modules are attached in a system, the handle can be easily moved from the WaveBook to any other module in the system.

For owners of existing WaveBook and/or WBK systems, the new bumpers can be easily added to your existing hardware. Contact IOtech or your local IOtech representative for details.



Built-in connection tabs in every expansion module make assembling a system easy – above illustrates how a WBK18 would attach to a WaveBook/516E

An assembled system consisting of a WaveBook/516E plus one WBK18 accelerometer module plus one WBK16 strain gage module

WaveView

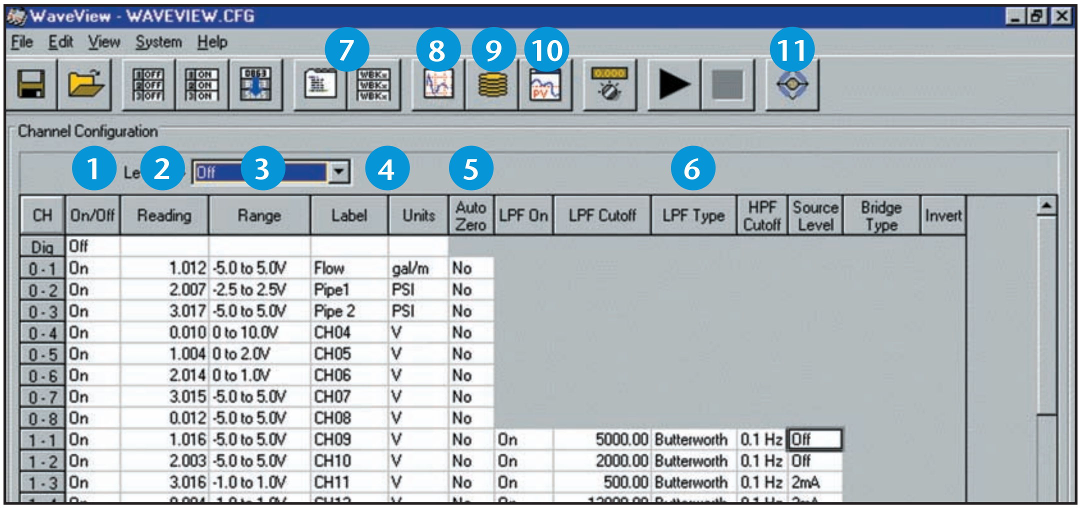
Out-of-the-Box Software

WaveView

WaveView* is a Windows-based setup and acquisition application that allows you to configure, display, and save data to disk within minutes of taking the WaveBook *Out-of-the-Box*. WaveView provides a point-and-click interface that simplifies operation of the WaveBook by allowing setup of all hardware, including the field-installable WBK options, without programming or connecting icons.

Unlike the mere example programs that many suppliers provide with data acquisition hardware, WaveView is a full-featured acquisition and display engine that provides all the functionality needed for many data-logging and display applications. For more frequency-domain analysis applications, use DASYLab®.

WaveView's intuitive approach to hardware control simplifies system setup by automatically querying the WaveBook upon connection to your PC. As WBK options are added for signal conditioning or increased system channel count, WaveView's channel configuration spreadsheet automatically expands to accommodate the additional channels. Specific channel characteristics, such as gain, unipolar/bipolar, and channel labels, are automatically updated, and any additional functionality (such as low-pass filtering, filter cutoff, or excitation output), also automatically appear in the channel-configuration spreadsheet. WaveView is also designed for easy operation with display and analysis packages. WaveView provides data in formats compatible with a variety of sophisticated display and analysis packages, including MATLAB®.



Included WaveView is an Out-of-the-Box setup, acquisition, and real-time display program

Note: The WBK40 and WBK41 are not currently supported in WaveView. We recommend using DASYLab® when using these modules, which includes full support for the WBK40/41. The WBK40/41 are also supported in LabVIEW®, and DaqCOM. If it is necessary to use these modules in conjunction with a WaveView application, then it is necessary to launch a second, concurrent application to acquire data from the WBK40/41 into separate data files.

1. Designate an individual data channel as active or inactive by clicking on a select channel.
2. Reading column provides quick indication of sensor condition before acquisition begins.
3. Choose different ranges or gains for each channel, based on the particular WBK options installed. Bipolar and unipolar scales can also be selected for each channel.
4. Assign each channel a unique label, which will be automatically referenced throughout WaveView. Choose the desired engineering units in which to display acquired data, based on the installed WBK options. Parameters can also be entered to perform mX+b scaling on each reading before displaying it.
5. Use auto-zero to remove small offsets such as transducer drift or pre-load conditions prior to acquisition.
6. Enhanced features such as filter type, cutoff frequency, IEPE current source, and bridge configuration automatically appear when hardware is added to the WaveBook system. There are no switches to set and WaveView automatically updates itself for new configurations.
7. Click to review system configuration and acquisition parameters such as scan rate, pre- and post-trigger usage, and trigger criteria.
8. Scope Mode allows customizing and displaying of multiple traces; it supports cursors, re-scaling, and more.
9. Store data to disk in real-time; the auto re-arm function, with automatic file naming, supports back-to-back acquisition of over one million captures without user intervention.
10. Review acquired waveforms with a strip chart style display via PostView.
11. Strain gage setup to calibrate WBK16 strain gage channels.

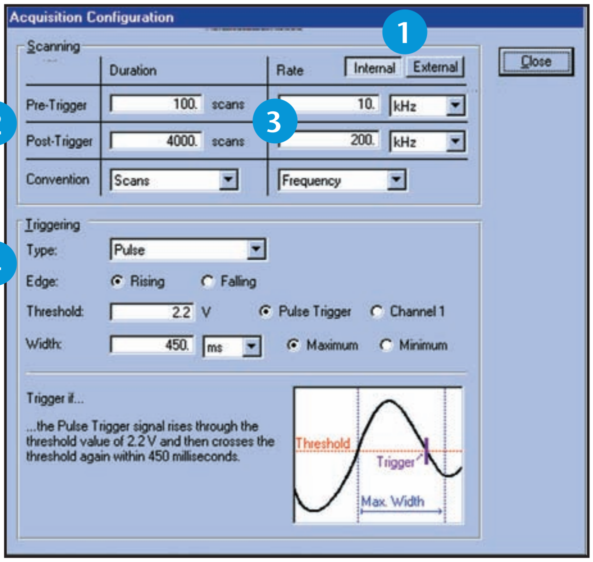
* **Supported Operating Systems:** Windows 7/Vista/XP SP2, 32-bit or 64-bit

WaveView

Out-of-the-Box Software

Scan and Trigger Configuration. The WaveBooks' powerful event-capture capability is made available through the simple, fill-in-the-blank style boxes in WaveView. In addition to single-channel, manual, and external TTL, advanced triggering for multichannel, digital pattern, and pulse trigger is also available. When using multichannel trigger all channels can be combined with boolean "AND" & "OR" operators to begin the acquisition at just the right time. In digital pattern mode, the WaveBook triggers on a user-defined bit pattern making it easy to associate analog data with digital sequences.

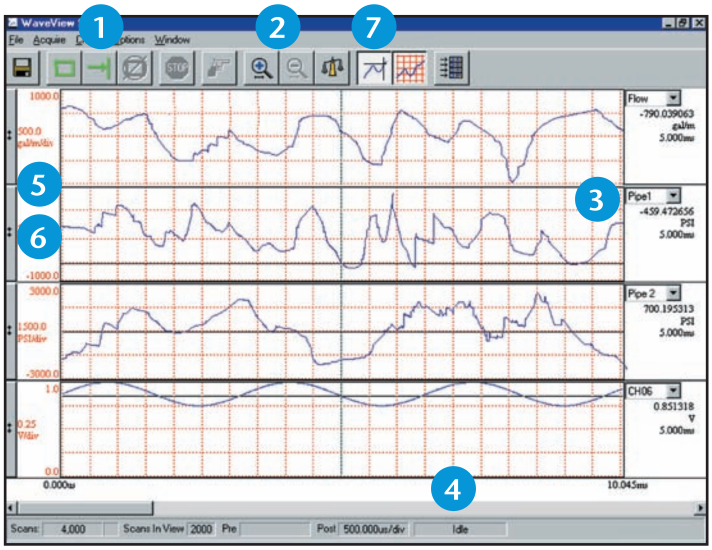
Unique to the WaveBook is the pulse trigger capability shown below. Typically available in systems many times its price, pulse trigger allows capturing that elusive event by defining the level of the signal and pulse width criteria. Now "runt" pulses or glitches buried in apparently good signals can be easily captured.



You can configure the WaveBook via WaveView's scan and trigger configuration screen

1. Allows selection of internal or external clock.
2. Lets you individually set acquisition duration for both pre- and post-trigger data.
3. Offers separate scan rates for both pre- and post-trigger data.
4. Select the trigger mode you need: immediate, manual, multichannel, digital pattern, or pulse.

Scope Mode. Unlike a traditional scope with only two to four channels, WaveView's Scope Mode allows any eight channels to be displayed. Furthermore, WaveView is not handicapped by the small memory limitations of DSOs. In fact, WaveView dynamically and transparently allocates a PC's RAM prior to beginning an acquisition. A simple point-and-click is all that's necessary to initiate multi-Msample acquisitions. In addition, because the data is already in the PC's RAM, a second point-and-click on the disk icon automatically saves this data to disk for import into PostView, a post-acquisition waveform review package, or into analysis packages, such as MATLAB®, DADiSP®, or Excel®.



Scope Mode allows you to display any eight of the WaveBooks' channels

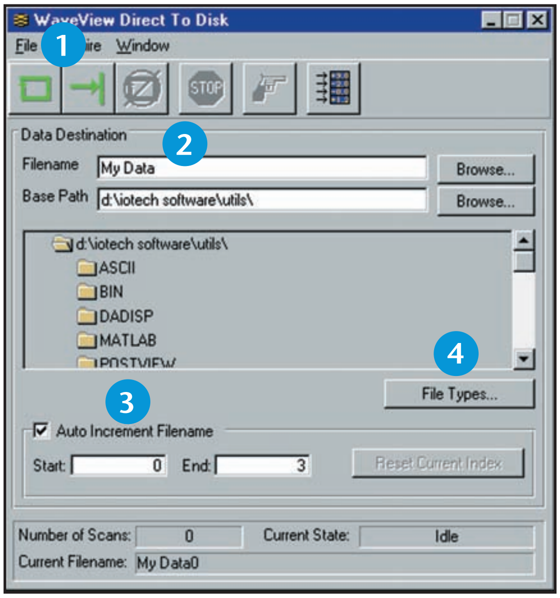
1. Supports continuous or single-shot capture and display modes.
2. Provides zoom-in and zoom-out window control of the x-axis.
3. Displays user label and cursor data values.
4. Scroll through all data.
5. Provides auto-scale for quick maximization of the y-axis display.
6. Automatically scales axis in user-defined engineering units.
7. Enables cursor for on-screen measurements.

WaveView

Out-of-the-Box Software

Logger Mode. For applications where PC RAM is insufficient to record the entire test or where rapid back-to-back recordings need to be saved to disk, WaveView provides a Logger Mode. It complements WaveView's Scope Mode by allowing continuous* recording data directly to disk.

Logger Mode can auto-increment file names to provide the unattended capture of millions of back-to-back events, without user intervention. Acquired data can be stored in several data formats for direct import to packages such as Excel® or PostView.

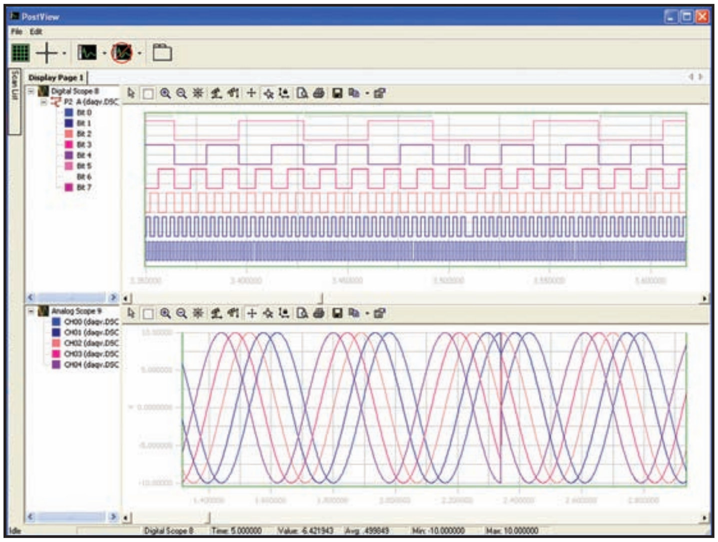


WaveView's Logger Mode can stream data direct to disk in a variety of formats

1. Allows the collection of single-shot or auto-increment file names for back-to-back acquisitions.
2. File name, path, and auto-increment index can be entered by simply filling in the blank.
3. Auto increment creates multiple data files, one per trigger.
4. Choose from an ever-growing list of data file formats for easy importing into other software packages such as DADiSP, DASYLab, MATLAB, Snap-Master, ASCII/Excel Universal File Format (UFF) 58A (ASCII), Universal File Format (UFF) 58B (Binary), and .WAV.

PostView

PostView is a time-domain post-acquisition data viewing package which is integrated and ready to use from within your View package when you install it. PostView provides easy to use basic time-domain data viewing for IOtech data acquisition *Out-of-the-Box* View packages.



PostView, a Windows®-based, post-acquisition waveform viewing application

WaveCal

The WaveBook is also shipped with WaveCal, an application that facilitates periodic calibration of the system. Although all WaveBook components are factory-calibrated to their rated accuracies prior to shipment, annual recalibration is recommended. WaveCal's simple on-screen instructions and direct access to the WaveBook's components, make recalibration fast and easy.

* For acquisitions in excess of 100 million scans, use DASYLab® or other available software

WaveBook/516E

Specifications & Ordering Information

General Specifications

Warm-up: 30 minutes to rated specifications
Environment
Operating: 0 to 50 °C, 0 to 95% RH, non-condensing
Storage: -20 to 70 °C
Power Consumption: 1.8A max @ 15 VDC
Input Power Range: 10 to 30 VDC
Vibration: MIL STD 810E
PC Communication: 10/100BaseT Ethernet (300 ft. max)
Channel Capacity: 8 built-in voltage channels, expandable to 72 channels with WBK options. Also can accommodate up to 3 additional WBK40 Series options (any combination). Maximum WBK41 capacity is 854 TC input channels, 4 analog output channels, 272 digital I/O channels, and 6 counter/timer channels (see WBK40 on for details).
Dimensions: 285 mm W x 220 mm D x 70 mm H (11″ x 8.5″ x 2.70″)
Weight: 1.9 kg (4.2 lbs)
Handle: One carrying handle is included with each WaveBook

Analog Inputs (18 to 28 °C)*

Channels: 8 differential, expandable up to 72 differential
Connector: BNC
Resolution: 16 bit
Ranges: Unipolar/bipolar operation is software selectable via sequencer
Unipolar*: 0 to +10V, 0 to +4V, 0 to +2V
Bipolar: ±10, ±5V, ±2V, ±1V
Maximum Overvoltage: ±35 VDC
Input Bandwidth: DC to 500 kHz
Input Impedance
Single-Ended: 5M Ohm in parallel with 30 pF
Differential: 10M Ohm in parallel with 30 pF
Accuracy
±2 to ±10V: ±0.012% of reading; 0.006% of range
±1V: ±0.018% of reading; 0.008% of range
Input Noise: <2 LSB (RMS)
Total Harmonic Distortion: -84 dB typ
Signal to Noise and Distortion: +74 dB typ
CMRR: 80 dB typ; 70 dB min; DC to 20 kHz

Anti-Alias Filter**

Type: 5-pole Butterworth; 20 kHz, low-pass software enabled

* The following applies when outside 18 to 28 °C and is additive to the above specification:

Range	±Gain Error	±Offset Error
±10V	24 ppm/°C	60 µV/°C
±5V or 0 to 10V	24 ppm/°C	30 µV/°C
±2V or 0 to 4V	24 ppm/°C	12 µV/°C
±1V or 0 to 2V	36 ppm/°C	8 µV/°C

** No unipolar mode or anti-alias filter with WBK11A, WBK12A, or WBK13A installed

Triggering

Channel 1 Analog & Pulse Trigger
Input Signal Range: -10 to +10V
Bandwidth: 1 MHz
Latency: 300 ns
Multi-Channel Analog Trigger (up to 72 channels)
Range: Selectable per channel to input range
Latency: 2 µs/channel, plus 4 µs max
TTL Trigger
Input Signal Range: 0 to 5V
Input Characteristics: TTL-compatible with 10k Ohm pull-up resistor
Latency: 300 ns
Software Trigger
Latency: 100 µs typical
Pulse Trigger Input
Input Signal Range: ±5V
Input Characteristics: 75 Ohm
Input Protection: ±10V max
Minimum Pulse Width: 100 ns
Maximum Pulse Width: 0.8 sec
Latency: 300 ns

External Clock

Connector: Available on DB25 digital input
Input Signal Range: 5V TTL compatible
Input Characteristics: 50k Ohms pull up (to +5V) in parallel with 50 pF
Input Protection: Zener clamped -0.7 to +5V
Delay: 200 ns
Signal Slew Rate Requirement: 20V/µs min
Rate: Up to 1 MHz
Divisor Ratio: Divide by 1 through 255, selectable
Clock Counter Accuracy: <0.02% error
Clock Counter Range: 0.01 Hz to 100 kHz

Sequencer

Operation: Programmable for channel, gain, and for unipolar/bipolar range in random order
Depth: 128 location
Channel-to-Channel Rate: 1 µs to 1.1 µs/channel, all channels equal
Maximum Repeat Rate: 1 MHz
Minimum Repeat Rate: 100 seconds per scan
Expansion Channel Sample Rate: Same as on-board channels, 1 to 1.1 µs, fixed

High-Speed Digital Inputs/General-Purpose Outputs

Connector: DB25 Female
Configuration: 16 TTL-compatible pins, selectable for input or output
Input Characteristics: TTL-compatible
Output Characteristics: ALS TTL output in series with 33 Ohms
Output Updates: Outputs may be changed via program control
Input/Output Protection: Diode clamped to ground and +5V

Ordering Information

Description	Part No.
16-bit Ethernet, 1 MHz portable data acquisition system includes WaveView, and PostView; comprehensive drivers for DASYLab®, LabVIEW®, MATLAB®, Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET; WaveCal software application; and AC adapter	WaveBook/516E

Accessories

Tough, rugged, and lightweight carrying case	HA-212
Rack mount kit for WaveBook/516E	RackDBK4

Cables

Ethernet patch cable, 1.5 ft.	CA-242
Ethernet patch cable, 7 ft.	CA-242-7
DB25 male to DB25 female parallel cable, 2 ft.	CA-35-2
SYNC cable, 1 ft.	CA-74-1
5-pin male DIN to 5-pin male DIN	CA-115
5-pin DIN to automobile cigarette lighter power cable, 8 ft.	CA-116
DB25 to external clock BNC	CA-178

CE Compliant Cables

1 male BNC to male BNC	CA-150-1
8 male BNC to male BNC	CA-150-8

Software

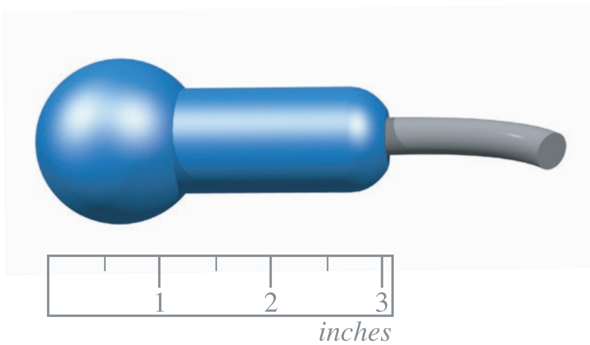
Icon-based data acquisition, graphics, control, and analysis software with WaveBook driver	DASYLab

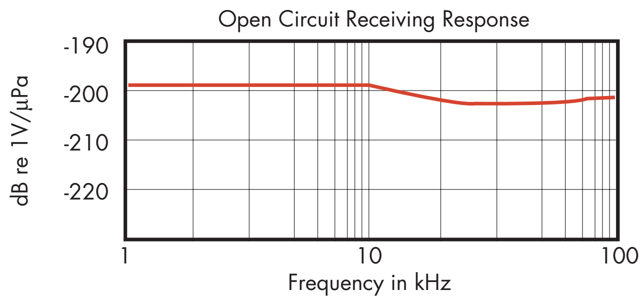
Model ITC-1042

Spherical Omnidirectional Transducer

Model ITC-1042

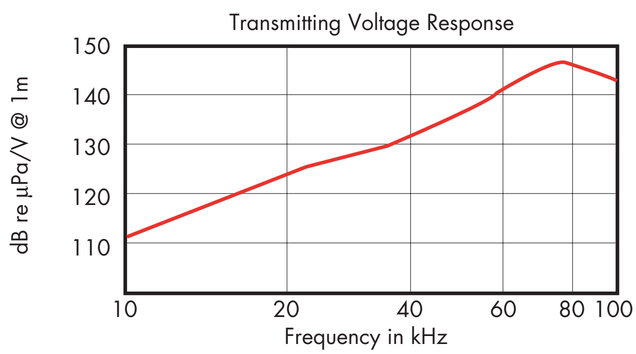
The Model ITC-1042 spherical transducer offers broadband omnidirectional transmitting and receiving response with efficiencies of over 50%. This transducer is fabricated of Channelite-5400 lead zirconate titanate ceramic and is particularly well suited for noise sources as a broadband hydrophone and applications where an omnidirectional response is required. This unit can be supplied with Channelite-5800 for high power applications.

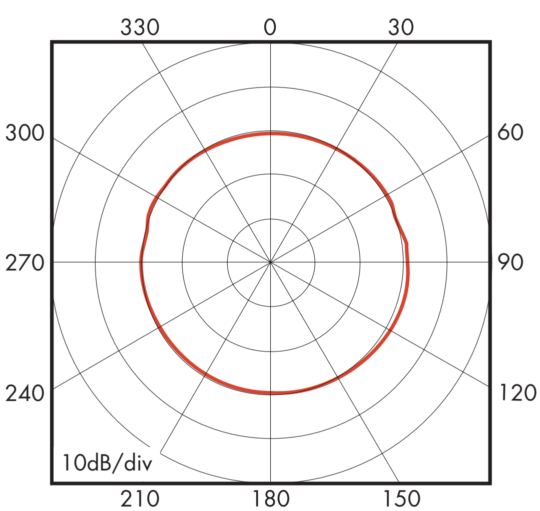




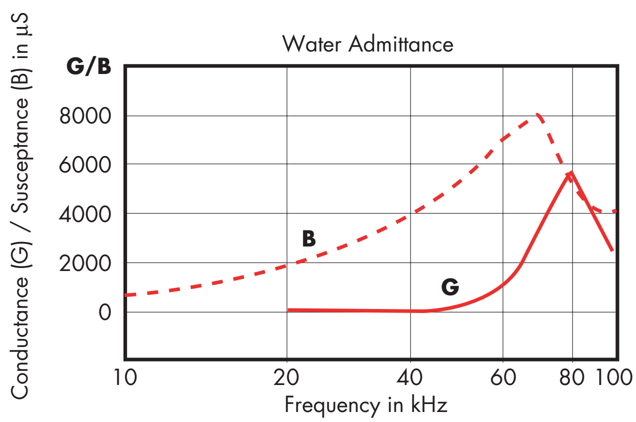
Specifications (Nominal)

Type	Projector/Hydrophone
Resonance Frequency f_r	79 kHz
Depth	1250 meters
Envelope Dimensions (in.)	1.4D
TVR at f_r	148 dB//µPa/V@1m
Midband OCV	-200 dB//1V/µPa
Suggested Band	.01 - 100 kHz
Beam Type	Spherical
Input Power	100 watts





Directivity Pattern at 20.0 kHz



International Transducer Corporation
869 Ward Drive, Santa Barbara, CA 93111
805.683.2575 • 805.967.8199 FAX
www.itc-transducers.com

LGR-5320 Series

Stand-Alone, High-Speed, Multifunction Data Loggers

Features

- Up to 200 kS/s correlated sampling of all data
- 16 analog inputs up to ±30 V
- 16-bit resolution
- 16 industrial digital inputs up to 30 V
- Single Form C relay digital output configurable for triggering/alarming
- 4 counter inputs (quadrature available)
- 4 GB SD memory card included, supports up to 32 GB
- Multi-channel analog and digital triggering
- Push-button controls for field operation

Software

- Includes DAQLog™ software for easy setup, configuration, and data retrieval
- Multiple trigger and alarming functions
- Ability to save data in .csv format for easy import into Excel®

LGR-5320 Series of high-speed, stand-alone data loggers allow users to collect correlated analog and digital data without a computer

Overview

The LGR-5320 Series are high-speed, stand-alone data loggers for analog and digital signals. Each module offers 16 analog inputs, 16 digital inputs, one single Form C relay (0.5A) digital output for triggering/alarming, and four counter/encoder inputs. These devices allow users to collect high-speed correlated analog and digital data without a computer.

LGR-5320 devices perform high-speed, correlated measurements, up to 200 kS/s, directly to a Secure Digital (SD) or SDHC memory card. Utilizing the advanced analog and digital triggering options, users can collect data to monitor systems and events without dedicating a PC. The LGR-5320 loggers include easy-to-use DAQLog software to configure the devices and retrieve data via the USB interface or SD memory card.

Three models are available in the LGR-5320 Series. The LGR-5325 features up to ±10 V analog inputs, 100 kS/s sampling, four conventional counter inputs (non-quadrature), and single-channel trigger modes. The LGR-5327 features up to ±30 V analog inputs, 200 kS/s sampling, four quadrature encoder inputs, and multi-channel trigger modes. The LGR-5329 includes all the functionality of the LGR-5327 plus isolated digital inputs.

LGR-5320 Series Module Overview

Feature	LGR-5325	LGR-5327	LGR-5329
Sample rate*	100 kS/s	200 kS/s	200 kS/s
Analog inputs	16 SE/8 DE	16 SE/8 DE	16 SE/8 DE
Analog input range	up to ±10 V	up to ±30 V	up to ±30 V
Digital inputs**	16-channel TTL	16-channel TTL	16-channel industrial isolated
Counters	4 conventional	4 quadrature	4 quadrature
Triggering	single-channel	multi-channel	multi-channel

* Sample rates aggregate
** Each logger includes one single Form C relay output

Analog Input

16SE/8DE analog inputs are included on each data logger. The LGR-5325 features multiple analog input gain ranges up to ±10 V. The LGR-5327 and 5329 add a ±30 V analog input range for increased measurement capability. Each data logger provides 16-bit resolution.

Correlated, High-Speed Sampling

The LGR-5327 and LGR-5329 can sample input data at up to 200 kS/s while the LGR-5325 offers a 100 kS/s sample rate. Each module can sample all analog, digital, and counter data synchronously, making it easy to compare time between all channels.

Configuration, Data Storage, and Retrieval

Each data logger can be configured through the SD memory card or via the on-board USB port. Simply configure the logging session with the included DAQLog software. All logging parameters are captured on the SD memory card. A 4 GB SD memory card is included with each data logger. Memory cards up to 32 GB are supported for extended data collection. Data is retrieved by removing the SD memory card from the logger and uploading to a PC or by connecting to the USB port on the logger.

LGR-5320 Series

General Information

Triggering

LGR-5320 Series data loggers offer multiple triggering options for starting and stopping a data scan. These options vary by model. The LGR-5325 features single-channel analog and digital triggering. The LGR-5327 and LGR-5329 offer multi-channel and pattern triggering options. Multiple trigger options allow collection of only the desired data. External clocking is also supported.

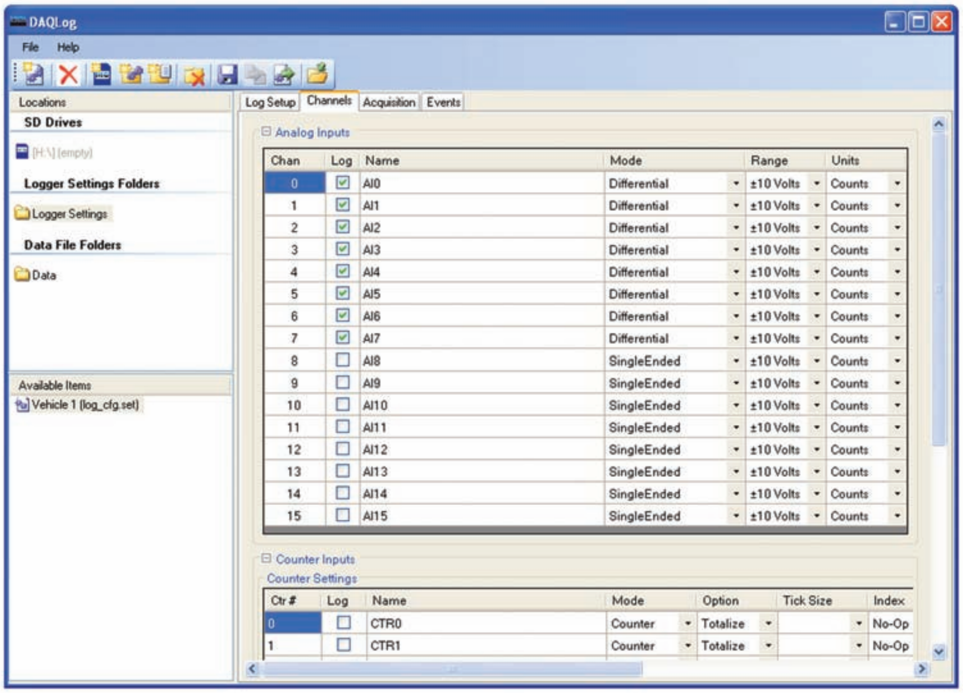
Digital I/O

16 digital inputs are included with each data logger. These inputs can be sampled synchronously with analog input data. The LGR-5325 and LGR-5327 feature up to 28 V digital inputs while the LGR-5329 features up to 30 V digital inputs. The digital inputs on the LGR-5329 also provide 500 VDC isolation.

Each data logger also features one digital output relay channel. The Form C relay can be programmed via the included DAQLog software to alarm when desired conditions are met.

Counters

Four counter inputs are built into the LGR-5320 Series. The LGR-5325 features conventional up/down counters. The LGR-5327 and LGR-5329 include quadrature and conventional counter inputs. Multiple count modes are also supported.



Included DAQLog software for configuration, channel setup, logging parameters, and data retrieval

Push Button Logging Controls

Onboard one touch logging controls are featured on each module for quick and simple operation. These controls can be used for a variety of functions including:

- Configuration loading from SD memory card
- Start/stop logging
- Force trigger/user event
- Device reset
- Control of status LEDs

LEDs on each module provide instant logging and trigger status and activity state.

DAQLog Software

DAQLog Software is an easy to use application included with each LGR-5320 Series data logger. DAQLog uses a spreadsheet style interface that allows simple setup of channel and logging parameters.

DAQLog includes the following functions:

- Data logger configuration
- Channel setup
- Trigger setup
- Data conversion
- Scan rate and acquisition length
- Trigger, event, and alarm parameters

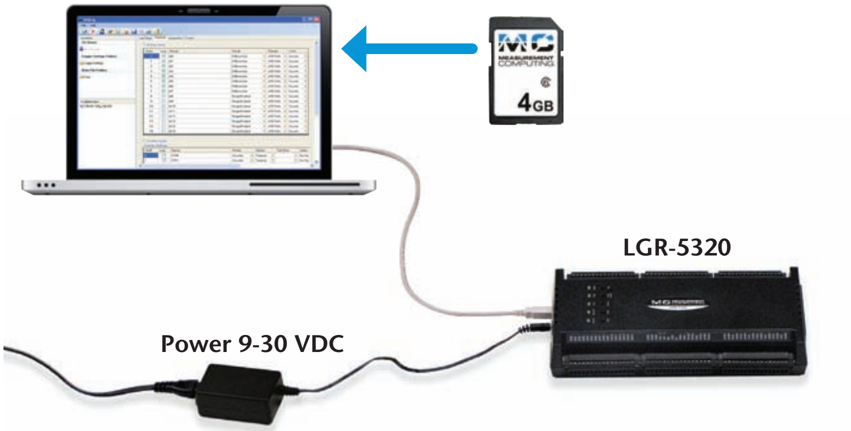
Data can be saved in .csv format for easy import into Excel®.

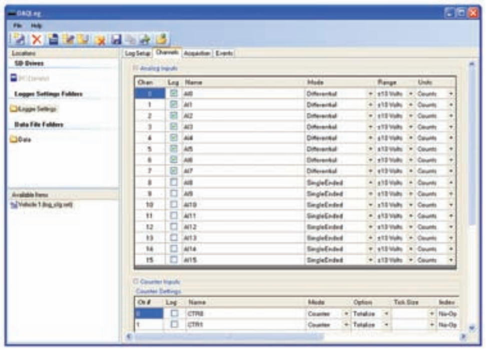
LGR-5320 Series

General Information

Configuration, Data Logging, and Retrieval

Configuration via USB or SD Memory Card





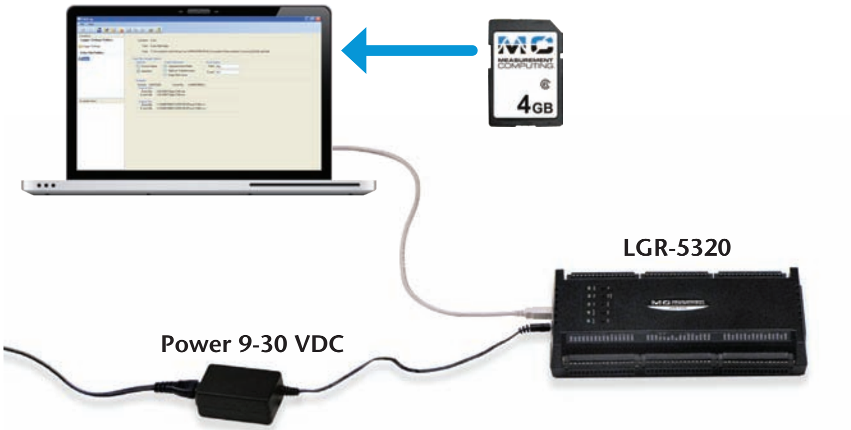
Logging parameters are configured via DAQLog software. The LGR-5320 Series data logger can be setup via USB or by inserting the SD memory card into a PC.

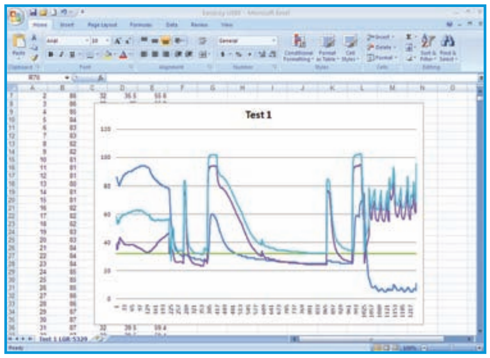
Data rate, scan length, channel parameters, triggers, and alarms are all quickly and easily configured using spreadsheet style setup pages in DAQLog.

Data Logging

The LGR-5320 Series will log data when pre-defined trigger conditions are met. You can also start/stop logging and set trigger, alarm, and event conditions with the push-button controls located on top of the module.

Data Retrieval and Analysis





Retrieval of data can be done by connecting the logger to a PC via USB or by removing the SD memory card and inserting it into a PC.

Once data is uploaded to a PC, the .csv file can be opened in programs such as Excel.

LGR-5320 Series

Specifications

All specifications are subject to change without notice.
Typical for 25°C unless otherwise specified.

Analog input

A/D Converter: 16-bit successive approximation type
Input Ranges: Software selectable per channel;
  5325: ±10 V, ±5 V, ±1 V
  5327, 5329: ±30 V, ±10 V, ±5 V, ±1 V
Number of Channels: 8 differential/16 single-ended, software configurable
Input Configuration: Multiplexed
Absolute Max Input Voltage
  5325: CH_x to AGND, ±25 V max (power ON/OFF)
  5327, 5329: CH_x to AGND, ±38 V max (power ON/OFF)
Input Impedance
  5325: ±10 V, ±5 V, ±1 V range, 10 GΩ (power ON), 1 kΩ (power OFF)
  5327, 5329: ±30 V range, 1 MΩ (power ON), 1 GΩ (power OFF);
    ±10 V, ±5 V, ±1 V range, 10 GΩ (power ON), 1 GΩ (power OFF)
Input Leakage Current: ±100 pA
Input Capacitance: ±30 V range, 90 pf; ±10 V, ±5 V, ±1 V range, 55 pf
Max Working Voltage (signal+ common mode): ±30 V range, ±30.05 V;
  ±10 V, ±5 V, ±1 V range, ±10.2 V
Common Mode Rejection Ratio: fin = 60 Hz, ±30 V range, 65 dB min;
  fin = 60 Hz, all other ranges, 75 dB min
Crosstalk: DC to 25 kHz, adjacent differential mode channels, -80 dB
ADC Resolution: 16 bits
Input Bandwidth (-3 dB): All input ranges, 450 kHz min
Input Coupling: DC
Max Sample Rate
  5325: 100 kHz
  5327, 5329: 200 kHz
A/D Pacing Sources: See input sequencer section
Warm Up Time: 30 minutes, min
Absolute Accuracy: All ranges, 0.07% FSR
Noise: Differential mode, 2 LSB rms

Analog Input Calibration

Calibration Method: Factory calibration
Calibration Interval: 1 year

Triggering

Mode
  External Digital via DTRIG (pin 76): Software configurable for rising or falling edge
  External Analog via ATRIG (pin 78): See external analog trigger
  5327, 5329:
    Multi-Channel Analog: Level-sensitive based on acquired data. Up to 16 channels may be used as independent trigger sources.
    Digital Pattern Trigger: Trigger when a user-defined 1 to 16 bit digital pattern is matched on the DIN0-DIN15 pins. Programmable mask bits.
External Digital Trigger Latency
  Non-Pretrigger Acquisition: 100 ns typical, 1 µs max
  Pretrigger Acquisition: 1 scan period max
External Trigger Pulse Width: 1 µs min
Internal Trigger Latency: 2* (1/per-channel sample rate)

External Analog Trigger

External Analog Trigger Source: ATRIG input (pin 78)
Analog Trigger Input Ranges
  5325: ±10 V
  5327, 5329: ±30 V, ±10 V, software selectable
Absolute Maximum Input Voltage
  5325: ATRIG_IN to AGND, ±25 V max (power ON/OFF)
  5327, 5329: ATRIG_IN to AGND, ±38 V max (power ON/OFF)
Input Impedance
  5325: ±10 V range, 10 GΩ (power ON), 1 kΩ (power OFF)
  5327, 5329: ±30 V range, 1 MΩ (power ON), 1 GΩ (power OFF);
    ±10 V range, 10 GΩ (power ON), 1 GΩ (power OFF)
Trigger Modes: Configurable for positive or negative slope, level
Trigger/Hysteresis Resolution: 12 bits, 1 in 4096
Trigger/Hysteresis Levels: ±10 V/4096 or ±30 V/4096, software selectable
Trigger/Hysteresis Accuracy: ±2% of reading, ±50 mV offset
Latency: 1.5 µS
Full Power Bandwidth (-3 dB): 1 MHz

Digital Input

Number of Inputs: 16 channels
5325
  Input Type: TTL
  Input Voltage Range: 0 to +28 V
  Input Characteristics: 47 kΩ pull-down resistor, 39.2 kΩ series resistor
  Max Input Voltage Level: 0 to +32 V (power ON/OFF)
  Min High Level Input Voltage Threshold: 2.0 V max
  Max Low Level Input Voltage Threshold: 0.8 V min
5327
  Input Type: TTL
  Input Voltage Range: 0 to +28 V
  Input Characteristics: 47 kΩ pull-down resistor, 39.2 kΩ series resistor
  Max Input Voltage Level: 0 to +32 V (power ON/OFF)
  Min High Level Input Voltage Threshold: 2.0 V max
  Max Low Level Input Voltage Threshold: 0.8 V min
  Event Logging: Change of state, pattern recognition; event time stamped using real time clock
5329
  Input Type: Industrial
  Input Voltage Range: 0 to +30 V
  Input Characteristics: Resistor divider 39.2 kΩ series resistor and 10 kΩ shunt resistor connected to IGND
  Max Input Voltage Level: +36 V (power ON/OFF)
  Min High Level Input Voltage Threshold: 10.04 V max
  Max Low Level Input Voltage Threshold: 3.85 V min
  Event Logging: Change of state, pattern recognition; event time stamped using real time clock
  Isolation: 500 VDC min

Digital Output

Number of Outputs: 1
Type: Mechanical relay, NEC ED2/EF2 series
Relay Configuration: 1 Form C
Relay Contact Resistance: 0.075 Ω
Relay Contact Operate Time: 3 mS (excluding bounce)
Relay Contact Release Time: 2 ms (excluding bounce)
Relay Insulation Resistance: 1000 MΩ at 500 VDC
Relay Contact Ratings
  Max Switching Voltage: 220 VDC/250 VAC
  Max Switching Current: 1.0 A
  Max Carrying Current: 2.0 A

LGR-5320 Series

Specifications and Ordering Information

Counters

5325

- **Counter Type:** Conventional
- **Number of Channels:** 4
- **Inputs:** Counter, Up/Down, Gate
- **Resolution:** Fixed 32-bit or as sized by the modulo register
- **Count Modes:** Up/down, period/frequency, Modulon
- **De-Bounce Times (programmable):** 16 steps from 500 ns to 25 ms; positive or negative edge sensitive; glitch detect mode or de-bounce mode
- **Time-Base Accuracy:** 50 ppm
- **Input Voltage Range:** 0 to 5.5 V
- **Input Type:** TTL
- **Input Characteristics:** 49.9K pull-down resistor
- **Max Input Voltage Range:** -0.5 V to +7.0 V
- **Input High Voltage:** 2.0 V
- **Input Low Voltage:** 0.8 V

5327, 5329

- **Counter Type:** Quadrature and conventiobal (x1, x2, x4)
- **Number of Channels:** 4
- **Inputs:** Phase A+/A-, Phase B+/B-, Index ±
- **Resolution:** Fixed 32-bit or as sized by the modulo register
- **Count Modes:** Quadrature, up/down, period/frequency, Modulon
- **De-Bounce Times (programmable):** 16 steps from 500 ns to 25 ms; positive or negative edge sensitive; glitch detect mode or de-bounce mode
- **Time-Base Accuracy:** 50 ppm
- **Receiver Type:** Quad differential receiver
- **Configuration:** Each channel consists of Phase A input, Phase B input and Index input; each input switch selectable as single-ended or differential
- **Differential:** Phase A, Phase B and Index (+) inputs at user connector routed to (+) inputs of differential receiver. Phase A, Phase B and Index (-) inputs at user connector routed to (-) inputs of differential receiver.
- **Single-Ended:** Phase A, Phase B and Index (+) inputs at user connector routed to (+) inputs of differential receiver. Phase A, Phase B and Index (-) inputs at user connector routed to ground. (-) Inputs of differential receiver routed to +3 V reference.
- **Common Mode Input Voltage Range:** ±12 V max
- **Differential Input Voltage Range:** ±12 V max
- **Input Sensitivity:** ±200 mV
- **Input Hysteresis:** 50 mV typ
- **Input Impedance:** 12 kΩ min
- **Absolute Maximum Input Voltage:** Differential, ±14 V max

Power

External Power Supply: +9 V min, +30 V max

Enironmental

Operating Temperature Range: 0 to 55 °C
Storage Temperature Range: -40 to 85 °C
Humidity: 0 to 90% non-condensing

Mechanical

Dimensions: 9.5" L x 5.0" W x 1.75" H

Shock and Vibration Specifications

Mechanical Shock

- **Operating:** 50 g, 3 msec half sine; 30 g, 11 msec half sine; 3 hits per face for a total of 18 hits (18 hits at 50 g, 18 hits at 30 g)
- **Standard:** IEC 60068-2-27

Random Vibration

- **Frequency Hz:** 10-500
- **Vibration Level:** 5 g_{rms}
- **Test Time:** 100 minutes/axis
- **Standard:** IEC 60068-2-64

Ordering Information

Description	Part No.
Stand-alone, high-speed 100 kS/s, multifunction data logger; includes a 4 GB SD memory card, USB cable, and external power supply	LGR-5325
Stand-alone, high-speed 200 kS/s, multifunction data logger; includes a 4 GB SD memory card, USB cable, and external power supply	LGR-5327
Stand-alone, high-speed 200 kS/s, multifunction data logger with isolated digital inputs; includes a 4 GB SD memory card, USB cable, and external power supply	LGR-5329

Accessories

DIN-rail kit	ACC-202
DST kit with 6 detachable screw terminals	ACC-216
External power supply	PS-9V1AEPS230V

BUY NOW!

For complete product specifications, pricing, and accessory information, call 1-800-234-4232 (U.S. only) or visit **mccdaq.com/LGR**.

Preliminary Technical Specifications

STANDARD AND APPROVALS	
Acoustics:	EN/IEC 61672, ANSI S1.4-1983, ANSI S1.43-1997 EN/IEC61260, ANSI S1.11-2004, (Also fulfills all requirements of IEC 60651 and IEC 60804)
European:	EMC: Pending testing on production products.
GENERAL	
Key Pad:	14 pushbuttons
Display Type:	Transflective 128 x 64 dot matrix
Backlighting:	Fiber-optic
Languages:	English, Spanish, German, French, Italian, Portuguese
MEASUREMENTS	
Available Measurements:	SPL, MAX, MIN, Peak, Ln, Leq, Lavg, Sel, TWA, Taktm, DOSE,PDOSE, Ldn, CNEL, Exposure
Ranges: Frequency: Amplitude: Maximum PEAK Level:	 Class 1: 3Hz – 22.4 kHz; Class 2: 20Hz – 8Khz; Filters: 1/1 octave (Optional); 1/3 octave (Optional) Broadband: (8) selectable 100 dB Dynamic Ranges . RTA: (8) selectable 80 dB Dynamic Ranges. 3dB above full scale reading
Parameters: Weighting: Response Time: Octave Band Filters (Optional): Class/Type 1: Threshold: Exchange Rates:	 A, C, Z, (Linear) Fast, Slow, Impulse Class 1, ANSI S1.11-2004, EN/IEC61260 Center Frequencies: (1/3 Mode) 33 center frequencies from 12.5 Hz to 20 kHz. (1/1 Mode) 11 center frequencies from 16 Hz to 16kHz 0 – 140dB 3,4,5,6dB
Run Modes:	Level triggered Run/Pause, Clock/Date triggered power on and Run for programmed duration, External logic input Run/Pause, Keypad initiated Run/Pause for programmed duration.
References: SPL: Frequency: Direction:	 114 dB 1 kHz 0 degrees using a Free Field response microphone.
CALIBRATION	Calibration history is maintained and post study verification logged with calibration history
Calibrators:	QC-10 (114 dB, 1 kHz), QC-20 (94 dB, 114 dB, 250 Hz, 1 kHz)
DATALOGGING OPTION	Requires SD Card
Summary Data and Time History Data Logged:	MAX, MIN, Peak, Ln, Leq/ Lavg
Exceedence Level Data Logged:	2 user selectable Ln levels
Memory Capacity:	Size of installed SD memory card
Intervals:	1sec, 10sec, 15sec, 30sec, 60sec, 5min, 10min, 15min, 30min, 60min
SPECIAL FUNCTIONS	
Back-Erase:	Selectable 1 sec to 20 seconds.
Storage System:	Removable secure digital memory card (SD-Card). Required to store multiple session/studies, setup storage, and for the datalogging option. File formats are PC compatible binary files. QuestSuite is required to interpret data files.
PORTS AND CONNECTIONS	
Secure digital (SD) card:	Used for datalogging, storing setups, and storing session/studies.
Power Jack:	External power supply 9-16 Vdc
AC/DC output:	3.5MM stereo (tip AC, Ring 1 DC, Ring 2 Gnd)
10 pin auxiliary connector :	RS-232, 3 digital outputs, 1 digital input
USB :	Conforms to USB 2.0, Mini B connector

Preliminary Technical Specifications (cont'd)

ENVIRONMENTAL CHARACTERISTICS	
Temperature:	
Operating:	(< ±0.5dB effect) - 10ºC to + 50ºC
Storage:	-25ºC to + 70ºC
Humidity:	TBD
Shock & Vibration:	Magnetic:80 A/m, 50/60 Hz, no effect
External Fields:	Electric: 10 V/m, 1 kHz modulated, 30 MHz – 1 Ghz, < 55 dBC

ELECTRICAL CHARACTERISTICS	
Batteries:	(4) disposable AA Alkalines: 10 hours minimum continuous use depending on configuration/options. Excludes use of backlight.
External DC Power Input:	Voltage: 9 – 16 VDC
External DC Power Supply:	Input: 90 – 264VAC 50/60Hz Output: 9 VDC
Microphones:	Type/Class 2: QE7052 Type/Class 1: BK4936 (Standard)
Meter Input:	50 Kohm nominal input impedance
Preamplifier:	Directly accepts 1/2 in. (0.52" or 13.2 mm) microphone. Other sizes require an adapter
Pre-Amp Assembly:	Preamp is removable
Cable:	Will drive up to 30 meters of cable with negligible signal loss
Input Impedance:	Greater than 1Gohm with 1pf loading
Signal Limit:	11VAC

MECHANICAL CHARACTERISTICS	
Tripod Mount:	A threaded insert on back of the meter accepts a standard 1/4" – 20 tripod mounting screw
Housing:	Stainless fiber filled ABS/Polycarbonate with internal EMC shielding
Size:	3.1" W x 11.1" H (w/preamp no microphone) x 1.6" Thick
Weight:	0.54Kg or 1.2 lbs (including batteries)

Specifications subject to change without notice. For the most current specifications and additional information about Quest Technologies visit our web site at www.Quest-Technologies.com.

Appendix C

Marine Mammal Observation Plan for Pile Driving Activities

MARINE MAMMAL OBSERVER AND REPORTING PLAN FOR PILE PLACEMENT

INCIDENTAL HARASSMENT AUTHORIZATION
COBSCOOK BAY TIDAL ENERGY PROJECT
FERC PROJECT NO. 12711
ORPC MAINE, LLC

February 21, 2012

Ocean Renewable Power Company, LLC
120 Exchange Street, Suite 508
Portland, ME 04101
Phone (207) 772-7707
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1.0 INTRODUCTION

1.1 General Description: Cobscook Bay Tidal Energy Project

ORPC Maine, LLC, a subsidiary of Ocean Renewable Power Company (collectively, ORPC), has applied to the Federal Energy Regulatory Commission (FERC) for a pilot project license for the Cobscook Bay Tidal Energy Project (Project) on September 1, 2011. The Project will evaluate the potential for a new source of clean, renewable energy generation using tidal energy resources in Cobscook Bay, Maine. ORPC obtained an initial preliminary permit for the project area in Cobscook Bay from FERC on July 23, 2007; FERC issued a successive preliminary permit on January 13, 2011. Feasibility studies, including environmental surveys, and pre-filing consultation were conducted, resulting in ORPC's filing of a draft pilot license application (DPLA) with FERC for the Eastport Tidal Energy Project on July 24, 2009. The DPLA included project areas within Cobscook Bay and Western Passage. Since submitting the DPLA, ORPC has conducted extensive consultation with regulatory and resource agencies as well as other stakeholders, has collected additional environmental data, and has continued to refine its proprietary technology. As a result of these additional studies and consultations, ORPC now plans to deploy a commercial-scale hydrokinetic power system in gradual stages, with the Project, a small pilot project, as the first stage. The FERC preliminary permit Project boundary for the Cobscook Bay Tidal Energy Project (FERC Project No. 12711) encompasses the proposed development area.

The Project will be carried out in two separate phases over an expected eight-year pilot license term. In Phase I, ORPC will deploy, monitor and test a single-device TidGen™ Power System for one year. In Phase II, ORPC will add four additional TidGen™ devices to the power system, for a total of five. During both phases, ORPC will deploy environmental monitoring equipment on the TidGen™ Power System and within the Project boundary (Figure 1).

The core component of the TidGen™ Power System is ORPC's proprietary turbine generator unit (TGU). The TGU utilizes four advanced design cross flow (ADCF) turbines to drive a permanent magnet generator mounted between the turbines on a common driveshaft. The ADCF turbines rotate in the same direction regardless of tidal flow direction; rotational speed of the turbines is directly related to water flow speed. The TGU is 98 feet in length, 17 feet high and 17 feet wide. It is attached to a bottom support frame, which holds the TGU in place approximately 15 feet above the sea floor. The bottom support frame is 98 feet long by 50 feet wide by 15 feet high. The bottom support frame is constructed of steel and the TGU is constructed of steel and composite material. Together, the coupled TGU and bottom support frame comprise the TidGen™ device (Figure 2 shows the conceptual design for the TidGen™ device). The depth at the proposed Deployment Area is 85 feet at Mean Lower Low Water (MLLW); the TidGen™ devices will thus be placed 49 feet below the surface at MLLW. Each TGU will have a maximum design capacity of 180 kilowatts (kW). During the Project each TGU will operate at a rated capacity of 60 kW. The five-device TidGen™ Power System will have a maximum design capacity of 900 kW and a rated capacity of 300 kW. The power generated will be connected to the grid using a single subsea transmission cable with a line voltage of 13 kilovolts (kV) DC. The total cable length is approximately 4,200 feet (3,700 feet from the TidGen™ Power System to the shore in Lubec, Maine and approximately 500 feet from shore to the on-shore station). ORPC has chosen an underwater cable route that avoids abrupt changes in bottom topography. Based on consideration of environmental concerns, ORPC proposes to bury the cable at all feasible locations along the cable route. The power generated by the TidGen™ Power System will be conditioned at the on-shore station and delivered to the Bangor Hydro Electric Company power grid.

Figure 1. Cobscook Bay Tidal Energy Project location map.

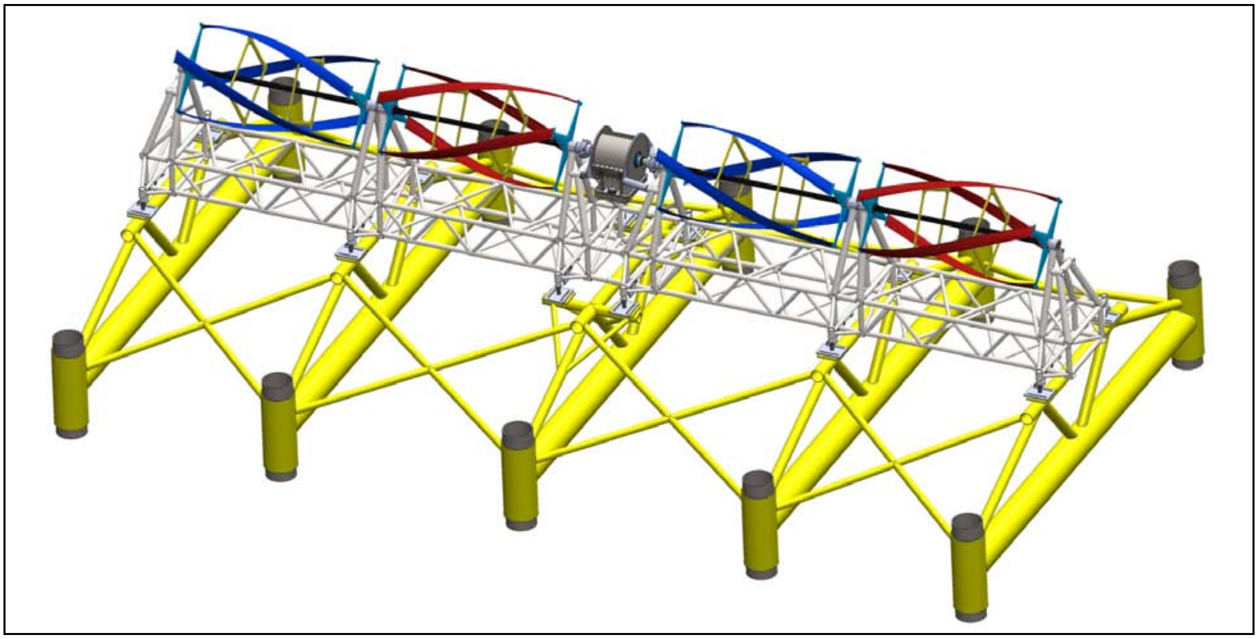


Figure 2. TidGen™ device.

In preparation for the Project, ORPC designed, built, deployed and tested a beta pre-commercial TidGen™ Power System (Beta TidGen™ System) in Cobscook Bay in 2010 (see Figure 3). The Beta TidGen™ System was comprised of a beta pre-commercial TGU (Beta TGU); ORPC's Energy Tide 2 research, testing and deployment vessel; a mooring system for the Energy Tide 2; and data acquisition and environmental monitoring equipment. Rather than being mounted on a bottom support frame, the Beta TGU was deployed top-down from the Energy Tide 2 and suspended 21 feet below the water surface.

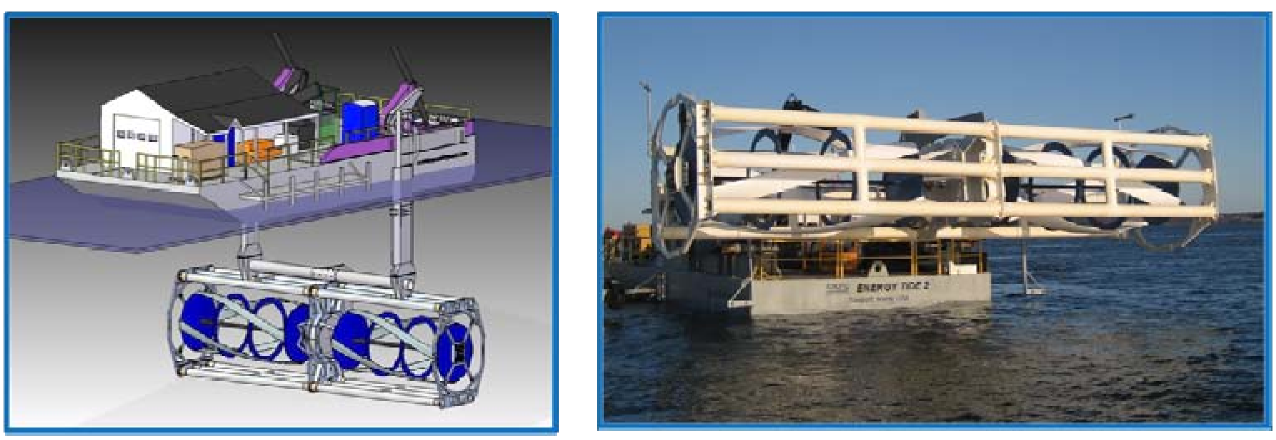


Figure 3. Beta TidGen system.

1.2 Installation Site and Deployment

The TidGen™ Power System installation site is located in the eastern entrance to Cobscook Bay between Goose Island and Seward Neck at 44˚54'.597547 N x 67˚02'.756085 W (Figure 1). The distance between the two closest land masses is 0.500 nm (926 m, 3,038 ft) at low tide and 0.620 nm (1,148 m, 3,766 ft) at high tide (Figure 1).

Deployment activities for the placement of 11 pilings will be carried out between March 1, 2012 and April 9, 2012. Pile driving will only occur during slack tides and is restricted to daylight hours. ORPC estimates that, with installation of one piling per slack tide, the 11 pilings will be installed over 7-12 days.

2.0 Incidental Harassment Authorization Process

ORPC has applied for an Incidental Harassment Authorization (IHA) for the placement of foundation piles below the mud line at the deployment site, due to the potential for the associated noise levels generated by the use of the vibratory hammer (and possibly a diesel impact hammer) during pile installation to exceed NOAA's guidelines for continuous and impact noise. In addition, although ORPC does not anticipate the incidental taking of any marine mammals as a result of pile placement, there are specific activities during pile placement that could theoretically pose a risk to marine mammals, including lowering piles into the water; installing the foundation; installing the bottom support frame; and installing environmental monitoring equipment. The goal of the Marine Mammal Observer and Reporting Plan for Pile Placement (Plan) is to minimize loud noise-generating activities if marine mammals are observed in Cobscook Bay, and to cease such noises if the animals come within 152 m (500 ft) of the installation site until the marine mammal moves 305 m (1000 ft) away from the installation site or 30 minutes has passed since the last observation. In addition, behavioral monitoring of marine mammals will be conducted out to a distance of 1 nm from the installation site.

ORPC incidental visual monitoring of marine mammals in Cobscook Bay area between 2007 and 2010 indicated that harbor porpoise (*Phocoena phocoena*), Atlantic white-sided dolphins (*Lagenorhynchus acutus*), grey seals (*Halichoerus grypus)* and harbor seals (*Phoca vitulina*) could be present in the vicinity. Other species that may occur in the vicinity of the project include North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaengliae*), fin whale (*Balaenoptera physalus*), minke whale (*Balaenoptera acutorostrata*), and sei whale (*Balenoptera borealis*). These marine mammals are generally associated with open ocean habitats and occur locally in more offshore locations in the Bay of Fundy. Thus, the four species with the greatest likelihood of occurring in the project area are harbor and grey seals, harbor porpoise and to a lesser extent, Atlantic white-sided dolphins. ORPC does not expect to create noise at levels that harasses marine mammals for prolonged periods of time. There may be some limited peripheral harassment if a marine mammal comes into the work area underwater and is not spotted by our observers.

This Plan provides additional details to ORPC's Marine Mammal Monitoring Plan and includes the Protected Species Observer (PSO) skills, PSO training program, equipment needed, survey methods, data collection and management protocols and associated data sheets, and an incident reporting form. Marine mammal observations will be conducted 30 minutes prior to, during, and 30 minutes after deployment activities. In the event that a marine mammal is observed entering or within a 152 m (500 ft) marine mammal exclusion zone around the installation site during pile deployment activities, a mitigation action plan and curtailment of deployment activity is provided. A summary report of the data collection will be provided to NMFS at the conclusion of pile placement.

3.0 MARINE MAMMAL OBSERVATION AND REPORTING PLAN

3.1 Protected Species Observer Skills

The ideal trainee for the PSO is an individual who is comfortable on the water, has some previous experience observing wildlife, pays close attention to detail, and is available for training on two days in mid February and for working on the observer program from March 1, 2012 through April 9, 2012. ORPC will be responsible for coordinating suitable installation events based on weather and tide, scheduling PSOs, end of day data proofing and management, and end of installation data management and preparation of summary report to NMFS. Four PSOs are required for each deployment event. In the event of illness or a change in PSO availability, 10 PSOs will be trained for this program.

3.2 Observation Platform

Two boats are required for the observer program. The ideal boat will be 30-40 ft in length, have a wheelhouse, an operational head (or suitable replacement), room on deck for two PSOs, and the capability of powering an independent data computer on board. The captain will be available for PSO and computer training for two days in mid February and for the observation program March 1, 2012 through April 9, 2012. The captain and team on the observer boat will depart with the equipment for the observation program from Eastport, Maine, deploy and anchor several reference markers around the installation site, and anchor at the appointed location. The boat will be required for about three hours per installation event. The captain will be trained to set up and run the data computer and record redundant paper data. In the event of illness or a change in the boat or captain's availability, three boats and captains will be selected for training. Recorder/captain training will take one day and include the lead PSO.

3.3 Protected Species Observer and Boat Captain Training Program

Goal: To train PSOs in the identification of the marine mammal species known to occur in and around the waters of Cobscook Bay Seward Neck in Lubec, Maine and Shackford Head in Eastport, Maine. Each PSO will be provided with a waterproof whale identification guide that includes the common species in the area with their unique identifying features. The PSO training will require two days.

3.3.1 Syllabus

1. *Species Identification*: The instructor will present several images of each one of the species known to occur in the area and identify the specific characteristics unique to each one to determine species identification. Each image shown will be ones that were obtained from a vessel platform to most closely approximate what the PSOs will see. Additional information will be given on typical seal and whale behaviors and on the legal status of each species.

Table 1. *Common and Less Common Species in Cobscook Bay.*

Common species in Cobscook Bay	Less Common Species
Harbor seal	Minke whale
Grey seal	Fin whale
Harbor porpoise	Sei whale
Atlantic white-sided dolphin	Humpback whale
	Right whale

2. *PSO skills*: The instructor will provide the PSOs with specific guidelines on how to set up the PSO team for maximum coverage of the area, how the PSOs should scan the surface of the water, which sighting cues to focus on, and how to distinguish whale species from other marine life (e.g. basking sharks, tuna, ocean sunfish).

3. *Data recording*: The recorder/boat captains will receive additional training on how to record data on paper data sheets. PSOs will be familiarized with the program and data entry and protocols. Paper data sheets will be summarized and digitized into a database for further analysis and reporting.

4. *Distance estimation*: Distance estimation is difficult, and varies between individuals; the PSOs will be introduced to a range finder device and given an opportunity to practice with the device outdoors. PSOs will be trained to use a compass to get a bearing to the marine mammal. The range finder distance and compass bearing will permit calculation of a sighting to provide for higher resolution data for mapping the sightings collected for the summary report.

4. *Testing*: The PSOs will be shown a series of images of marine mammal species expected in the area and be asked to write down their own species identification for each test image. There will be a mix of images they have seen before and novel images. The PSO will be expected to identify 80% of the test images correctly to be considered qualified.

See Appendix A, Cobscook Bay TidGen™ installation Marine Mammal Observer Training Course: February 16-17, 2012; Appendix B, Training Attendees; and Appendix C, PSO Training Applications.

3.3.2 Equipment List

The following table lists the equipment required for the PSOs, data collection on the observer boats and for setting up the reference markers. If possible, it would be prudent to have extra equipment available in case of damage or loss overboard.

Table 2. *Equipment List.*

Description	Minimum Number Required
Floater coat – USCG approved Type III	4 – 1 per PSO
Binoculars 8-10 power	4 – 1 per PSO
Range finder – distance measurement to sighting	4 – 1 per PSO
Compass – bearing to sighting	4 – 1 per PSO

VHF radio – either a handheld or boat radio for communication with installation operators	2 – 1 per observer boat
Data logging computer	2 – 1 per observer boat
External hard drive for data back up	1 unit
Handheld GPS, computer cable and batteries	2 – 1 per observer boat
Inverter for powering computer on boat	2 – 1 per observer boat
Clipboard, data sheets, pencils	2 sets
Digital SLR camera with telephoto lens	2 – 1 per observer boat
Equipment case for binoculars, range finders, computers, GPS, cameras, and data sheets	2 – 1 per observer boat
Polyform buoys (5) for reference markers, anchor rope and anchors	5 sets
Option – combined range finder binoculars Bushnell Fusion 1600	2 - 1 per observer boat for use by PSO looking outward to 1 nm

4.0 PILE DRIVING

4.1 Pile Driving Event Planning and Coordination

ORPC will be responsible for coordinating the scheduling of pile driving events. The constraints are that the pile driving will be done around slack tide only and during daylight hours (see Table 5 for tide and daylight hours) in suitable weather conditions. Weather conditions that would preclude pile driving include gale force winds, blizzard snow conditions, or torrential rains.

Once a suitable start time for piling driving is determined, ORPC will contact observer boat captains and 4 PSOs to be available per event (preferably the day prior to an event). The team will meet at the ORPC office in Eastport, collect the observer and reference marker equipment, load the boat and depart from Eastport in time to be anchored in position to start observations 30 minutes before pile driving activity begins.

4.2 Protocol for setting up the Marine Mammal Exclusion Zone and Observer Plan

For each pile driving event, the two observer boats will depart from Eastport and head to the pile driving (hereafter installation) site, approximately75 - 90 minutes before the start of pile driving activities. The team on each vessel will be comprised of two PSOs and one recorder/boat captain.

Once the observer boats have arrived in the vicinity of the project site, the team on each vessel will deploy several reference buoys to help identify when marine mammals are entering or within the exclusion zone (152 m, 500 ft) and have departed the vicinity (305 m, 1000 ft).

The downstream observer boat will deploy reference buoys 1 and 2 and then anchor on the downstream edge of the exclusion zone. The upstream observer boat will deploy reference buoys 3 and 4. When installation activities are taking place at high tide, the upstream boat will deploy an additional reference buoy 5 before anchoring on the upstream edge of the exclusion zone. At low tide, it will not be possible to install reference buoy 5. Instead PSOs will use the low tide shoreline of Goose Island for this reference point. The final reference buoy 6 will be the green can navigational marker no. 7.

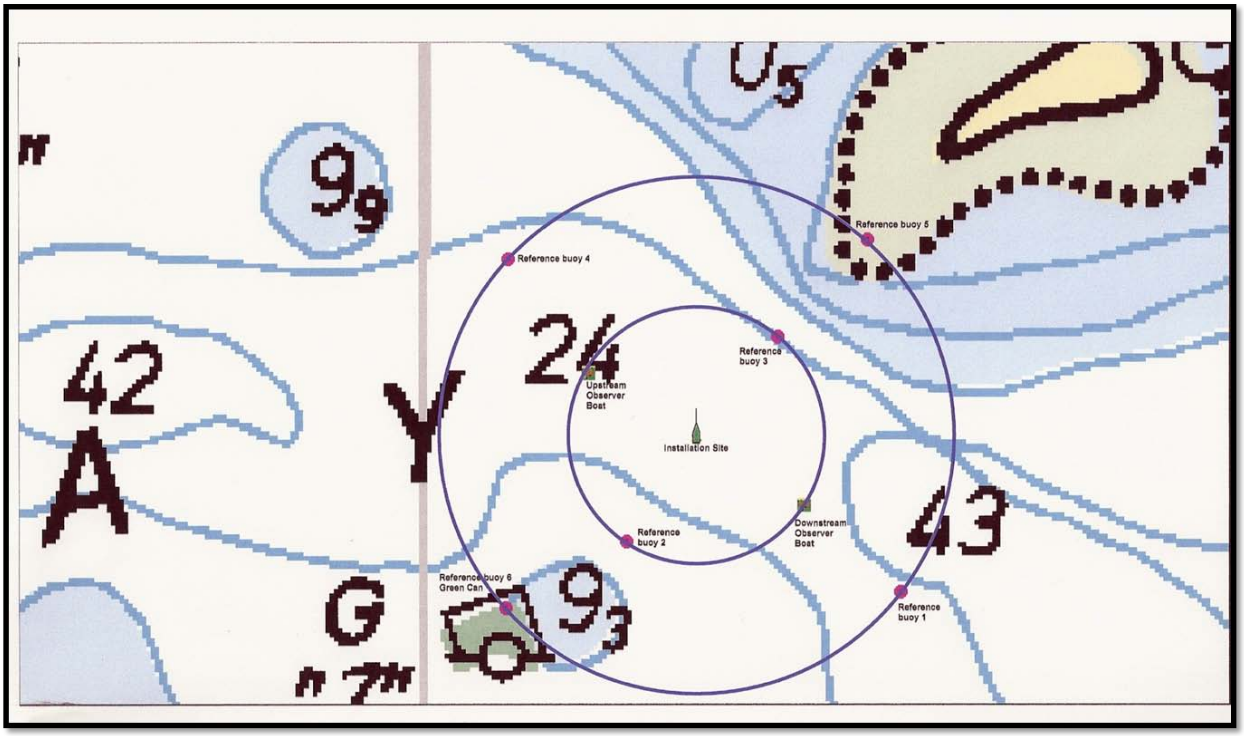
Thus reference buoys 2 and 3 and the two anchored observer boats will denote the 152 m (500 ft) marine mammal exclusion zone, and reference buoys 1, 4, and 5 (at high tide only) or the shoreline of Goose Island and the green can no. 7 will denote the 305 m (1000 ft) zone.

Table 3. *Anchoring positions, in latitude and longitude, for the reference buoys and the two observer boats. Cross referenced with Figure 4.*

Reference Markers	Distance from Installation Site 152 m (500 ft, or 0.082nm)	Distance from Installation Site 305 m (1000 ft, or 0.165 nm)
Buoy 1		44 54.498 N x 67 02.574 W
Buoy 2	44 54.530 N x 67 02.817 W	
Buoy 3	44 54.659 N x 67 02.683 W	
Buoy 4		44 54.707 N x 67 02.922 W
Buoy 5		44 54.720 N x 67 02.603 W At high tide only (shoreline at low tide)
Buoy 6		Use green can navigational marker no. 7 44 54.488 N x 67 02.925 W
Boat	Downstream observer boat 44 54.553 N x 67 02.660 W	
Boat	Upstream observer boat 44 54.632 N x 67 02.855 W	

The vessels must be in place and the team ready to start the observation period no later than 30 minutes prior to the start of pile driving activities for the event. Once anchored, the recorder on each boat will start up the data logging computer, enter environmental conditions and the time the observation period begins. Data sheets will be provided to the recorder in case there is a failure in the computer logging system. A data sheet with an example is provided on page 18.

Figure 4. The location of reference buoys (pink circles) and observer boats (labeled upstream and downstream positions on 152 m edge of the marine mammal exclusion zone) around Cobscook Bay installation site. Cross reference with Table 3 for anchoring positions of the reference buoys and observer boats.



5.0 SURVEY METHODS

Four PSOs will be stationed on two observer boats, one boat anchored at 152 m (500 ft) upstream and one at 500 ft downstream from the installation site (Figure 4). On each boat, the two PSOs will be positioned so that one PSO will survey inward toward the installation site (i.e. two PSOs dedicated to scanning continuously only the 152 m, 500 foot exclusion zone) while the second PSO on each boat will scan outward to a distance of 1 nm to conduct behavioral monitoring . The reference marker buoys (Table 3) anchored at 152 m (500 ft) and 305 m (1,000 ft) are located around the installation site to help the PSOs identify when marine mammals are entering or within the exclusion zone. For behavioral observations from the 305 m (500 ft) marine mammal exclusion zone out to 1 nm, natural land marks can be used (Figure 5). There is water at a distance of 1 nm outward from the installation site on three sides of the installation site, to the southeast, west, and northwest (Table 4 – Boundary A, B and C at 1 nm respectively).

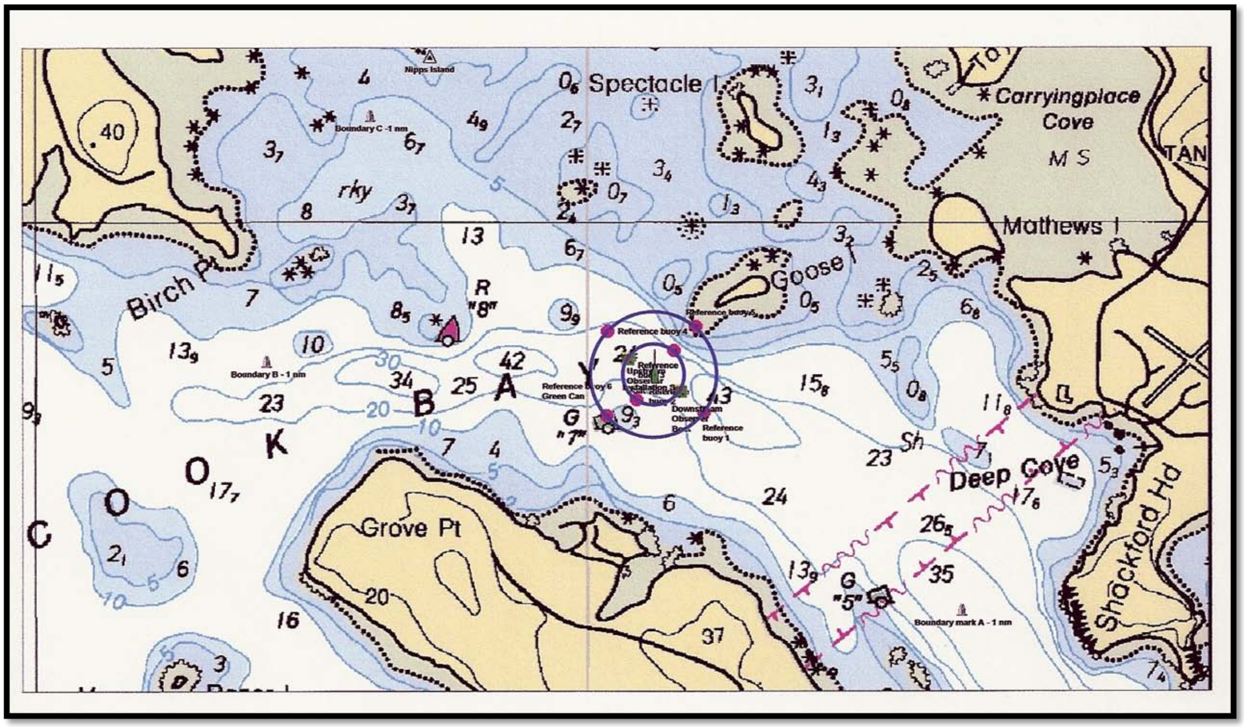
Table 4. *The location of the 1 nm boundaries A, B and C and the natural landmarks.*

1 nm Boundary	Position	Landmark
Boundary A – southeast of installation site	44 53.985 N x 67 01.640 W	Between Shackford Head and Green can #5
Boundary B – west of installation site	44 54.630 N x 67 04.159 W	Between Grove Point on Seward Neck and Birch Point on mainland
Boundary C – northwest of installation site	44 55.265 N x 67 03.783 W	Between Birch Point on mainland and Nipps Island

All sightings of marine mammals will be reported to the recorder who will log an entry on the data computer for each sighting, including the species, number, and behavior. The location of the marine mammal(s) will be estimated using a compass to determine the magnetic bearing to the animal and a range finder to determine the distance from the observation vessel to the animal. The information will be entered on the paper data; the actual geo-referenced location will be calculated after the observation period has been completed and entered into the computerized record.

The exclusion zone will be monitored continuously during impact pile driving to ensure that any marine mammals that enter the area will be seen, recorded and if within the exclusion zone, lead to the cessation of pile driving activities until the marine mammal observed is beyond 305 m (1000 ft) or 30 minutes have passed with no further sighting. The PSOs will continue scanning the marine mammal exclusion zone and outwards to 1 nm until 30 minutes after the pile driving activity has ceased for that event. At the conclusion of the observation period, the team will return to Eastport. The reference buoys and anchoring system will remain in place for the duration of the pile installation.

Figure 5. The location of the 1 nm mark and natural landmarks for reference. There are three boundary markers indicated on Chart A - southeast at 1 nm off Shackford Head, B is west at 1 nm between Grove and Birch Points, and C is northwest at 1 nm between Birch Point and Nipps Island. Cross Reference with Table 4 for boundary positions and summary of landmark reference.



6.0 Pile Driving Delay and Shutdown Procedures

1. In the event that a PSO sees a marine mammal within or approaching the 152 m (500 ft) exclusion zone prior to start of impact pile driving, the PSO will notify the on-site project lead (or other authorized individual) who will then be required to delay pile driving until the marine mammal has moved 305 m (1,000 ft) from the sound source or if the animal has not been resighted within 30 minutes.

2. If a marine mammal is sighted within or on a path toward the 152 m (500 ft) exclusion zone during pile driving, pile driving would cease until that animal has moved beyond 305 m (1,000 ft) and is on a path away from the exclusion zone or 30 minutes has lapsed since the last sighting.

7.0 REPORTING TO NMFS

7.1 Incident Reporting to NMFS

In the unanticipated event that the pile driving activity clearly causes the take of a marine mammal in a manner prohibited by the IHA, such as an injury (Level A harassment), serious injury, or mortality, ORPC would immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources and the Northeast Regional Stranding Coordinator, NMFS. The lead PSO will be equipped with the list of NMFS personnel, their emails and telephones numbers for reporting an incident. The report will include the following:

- Time, date, and location (latitude/longitude) of the incident
- If the incident is a vessel strike of a marine mammal
    - Name and type of vessel involved
    - Vessel's speed during and leading up to the incident
- Description of the incident
- Status of all sound source use in the 24 hrs preceding the incident
- Water depth
- Environmental conditions (e.g., wind speed and direction, Beaufort sea state (page 20), cloud cover, and visibility)
- Description of all marine mammal observations in the 24 hrs preceding the incident
- Species identification or description of the animal(s) involved
- Fate of the animal(s)
- Photographs or video footage of the animal(s) (if available)

ORPC will not resume activities until NMFS is able to review the circumstances of the prohibited take and have determined how to minimize the likelihood of further prohibited take and ensure MMPA compliance.

In the event that ORPC discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition), ORPC would immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources and the Northeast Regional Stranding Coordinator, NMFS. The report will include the same information identified above. However, ORPC activities will continue while NMFS reviews the circumstances of the incident and work with ORPC to determine whether modifications in the activities are appropriate. A blank incident report form is provided on page 17.

7.2 Data Management

At the completion of the observer program for each pile driving event, the observer boats will return to Eastport. The lead PSO will download the electronic data from both computers, proof the data, and store the data on a designated computer in the ORPC office with back up to an external hard drive. Paper data will be proofed against the electronic data, scanned and stored on a computer as a PDF and backed up on an external hard drive. Original paper data will be filed by date and time of deployment event. All optical equipment will be cleaned, dried and stored.

7.3 Final Report

Ninety days after the completion of the pile driving activity, the ORPC marine mammal consultant and the lead PSO will submit a report to NMFS. The report will include the details of the observation methods employed by the PSOs including the following:

- Data on the PSO effort by day of activity
    - Date and time of pile driving activity
    - Time on watch
    - Duration on watch before start up, during pile driving activities, and after pile driving is completed for the day
- Environmental data for each data of activity
    - Wind speed and direction
    - Beaufort sea state (page 20)
    - Cloud cover

- Visibility

Observation data on marine mammals that were collected before, during and after pile driving activities each day will be recorded on a computer for each pile driving event and will be provided in an electronic format (Excel™ file):

- Date of pile driving event
- Time of pile driving event (on some days there may be two events)
- Location in latitude and longitude (based on calculation using compass and range finder from fixed observation station) of any marine mammals observed
- Species of marine mammal observed (indicate if photos were obtained)
- Group size
- Behavior
- Any observed reactions to construction
- Distance to operating pile hammer
- Construction activities occurring at time of sighting

The written report will be provided in electronic format following standard reporting procedures and include the following sections: introduction, methods, results, and discussion. The marine mammal data will be presented in a table (date, time, location, species, behavior etc) and a geo-referenced figure.

Table 5**.** *Projected pile driving events based on Eastport Tide Table. Slack tide occurs 30-40 minutes later at the installation site than at the Eastport tide station.*

Date 2012 March/April		**High**				**Low**					
		am	**ft**	**pm**	**ft**	**am**	**ft**	**pm**	**ft**	**rise**	**set**
1	Thu	4:23	16.9	4:55	15.8	10:48	2.6	11:10	3.3	6:01	5:18
2	Fri	5:20	16.8	5:53	15.7	11:46	2.6			5:59	5:19
3	Sat	6:18	17	6:51	16.2	12:08	3.2	12:45	2.3	5:58	5:20
4	Sun	7:15	17.6	7:46	17	1:07	2.7	1:41	1.6	5:56	5:22
5	Mon	8:08	18.5	8:36	18	2:02	1.8	2:33	0.6	5:54	5:23
6	Tue	8:58	19.5	9:24	19.2	2:54	0.7	3:22	-0.4	5:52	5:24
7	Wed	9:45	20.4	10:09	20.3	3:43	-0.5	4:09	-1.4	5:51	5:26
8	Thu	10:31	21.1	10:54	21.2	4:30	-1.5	4:54	-2	5:49	5:27
9	Fri	11:17	21.5	11:39	21.7	5:16	-2.3	5:40	-2.4	5:47	5:28
10	Sat			12:04	21.5	6:03	-2.7	6:26	-2.3	5:45	5:30
11	Sun	12:25	21.9	1:52	21.2	7:52	-2.7	8:14	-1.9	6:43	6:31
12	Mon	2:14	21.7	2:43	20.4	8:42	-2.3	9:05	-1.2	6:41	6:32
13	Tue	3:06	21	3:38	19.5	9:36	-1.5	9:59	-0.2	6:40	6:34
14	Wed	4:02	20.2	4:37	18.5	10:34	-0.6	10:58	0.7	6:38	6:35
15	Thu	5:03	19.3	5:41	17.7	11:36	0.2			6:36	6:36
16	Fri	6:09	18.6	6:48	17.3	12:02	1.4	12:41	0.7	6:34	6:37
17	Sat	7:17	18.4	7:55	17.5	1:09	1.6	1:47	0.8	6:32	6:39
18	Sun	8:22	18.5	8:56	17.9	2:15	1.4	2:50	0.6	6:30	6:40
19	Mon	9:20	18.8	9:49	18.5	3:15	0.9	3:45	0.2	6:28	6:41
20	Tue	10:12	19.2	10:36	19	4:08	0.3	4:34	-0.2	6:27	6:43
21	Wed	10:57	19.4	11:17	19.4	4:55	-0.1	5:17	-0.3	6:25	6:44
22	Thu	11:39	19.5	11:56	19.6	5:37	-0.4	5:57	-0.3	6:23	6:45
23	Fri			12:17	19.4	6:17	-0.5	6:34	-0.1	6:21	6:46
24	Sat	12:33	19.6	12:55	19.1	6:54	-0.4	7:11	0.3	6:19	6:48
25	Sun	1:10	19.4	1:33	18.7	7:32	-0.1	7:48	0.8	6:17	6:49
26	Mon	1:48	19.1	2:11	18.2	8:10	0.3	8:26	1.3	6:15	6:50
27	Tue	2:27	18.6	2:52	17.6	8:50	0.8	9:07	1.8	6:13	6:51

28	Wed	3:08	18.1	3:35	17	9:32	1.3	9:50	2.4	6:12	6:53
29	Thu	3:54	17.6	4:23	16.5	10:19	1.8	10:39	2.8	6:10	6:54
30	Fri	4:44	17.2	5:16	16.2	11:10	2.2	11:32	3	6:08	6:55
31	Sat	5:39	17	6:12	16.3			12:06	2.3	6:06	6:56
1	Sun	6:37	17.2	7:10	16.7	12:30	2.9	1:04	2	6:04	6:58
2	Mon	7:35	17.7	8:07	17.6	1:29	2.4	2:01	1.4	6:02	6:59
3	Tue	8:32	18.5	9:00	18.7	2:27	1.4	2:56	0.5	6:00	7:00
4	Wed	9:25	19.5	9:50	19.9	3:21	0.2	3:48	-0.5	5:59	7:02
5	Thu	10:16	20.4	10:39	21.1	4:13	-1	4:38	-1.3	5:57	7:03
6	Fri	11:05	21.1	11:27	21.9	5:04	-2.1	5:27	-2	5:55	7:04
7	Sat	11:54	21.5			5:53	-2.9	6:15	-2.3	5:53	7:05
8	Sun	12:15	22.4	12:43	21.5	6:42	-3.3	7:04	-2.2	5:51	7:07
9	Mon	1:04	22.4	1:34	21.1	7:33	-3.2	7:54	-1.7	5:49	7:08

ORPC COBSCOOK BAY MARINE MAMMAL OBSERVER DATA SHEET

Date: ________________________ **Time:** start ________________ end ____________

Observer boat name: __________________ downstream / upstream (circle one)

Observer names: _____________________ (inward) _____________________ (outward)

(MM exclusion zone) (Out to 1 nm)

Environmental Conditions

Wind Speed and Direction ______________________ Cloud cover ____________

Visibility _________________ Beaufort sea state ___________________________

Recorder's name: ______________________________________

Time (24 hour time)	**Species and number**	**Behavior and direction of travel**	**Bearing to animal (magnetic)**	**Distance to animal (meters)**
11:10	Harbor Porpoise – 5	Swimming toward exclusion zone	170˚	220 m

INCIDENT REPORTING FORM

TIME ____________ DATE ____________

LOCATION ______________________________________ (Latitude/longitude)

WATER DEPTH ___________

ENVIRONMENTAL CONDITIONS

- WIND SPEED AND DIRECTION ____________________________
- BEAUFORT SEA STATE ____________________________
- CLOUD COVER ____________________________
- VISIBILITY ____________________________

NAME AND TYPE OF VESSEL INVOLVED ____
VESSEL'S SPEED DURING AND LEADING UP TO THE INCIDENT __________________

DESCRIPTION OF THE INCIDENT

____
____
____
____
____

STATUS OF ALL SOUND SOURCE USE IN THE 24 HRS PRECEDING THE INCIDENT

____
____
____
____

DESCRIPTION OF ALL MARINE MAMMAL OBSERVATIONS IN THE 24 HRS PRECEDING THE INCIDENT

____
____
____
____

SPECIES IDENTIFICATION OR DESCRIPTION OF THE ANIMAL(S) INVOLVED

____
____

FATE OF THE ANIMAL(S) ____
PHOTOGRAPHS OR VIDEO FOOTAGE OF THE ANIMAL(S) (IF AVAILABLE)

____

Beaufort Sea State scale

Beaufort number	Description	Wind speed	Wave height	Sea conditions	Land conditions
0	Calm	< 1 mph < 1 kn	0 ft	Flat	Calm. Smoke rises vertically
1	Light air	1–3 mph 1–2 kn	0–1 ft	Ripples without crests	Smoke drift indicates wind direction and wind vanes cease moving
2	Light breeze	4–7 mph 3–6 kn	1–2 ft	Small wavelets. Crests of glassy appearance, not breaking	Wind felt on exposed skin. Leaves rustle and wind vanes begin to move
3	Gentle breeze	8–12 mph 7–10 kn	2–3.5 ft	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	Moderate breeze	13–17 mph 11–15 kn	3.5–6 ft	Small waves with breaking crests. Fairly frequent whitecaps	Dust and loose paper raised, small branches begin to move
5	Fresh breeze	18–24 mph 16–20 kn	2–3 m	Moderate waves of some length. Many whitecaps. Small amounts of spray.	Branches of a moderate size move. Small trees in leaf begin to sway

Wind speed: Estimate speed in knots, and direction with compass
Cloud cover: < 10%, 10 – 50%, 50 – 90%, >90%.
Visibility: measured in nautical miles 0 nm, 1 nm, 2 nm, 3 nm, 4 nm, 5 nm to unlimited
Weather conditions: clear, haze, patchy fog, fog, drizzle, light rain, both rain and fog, snow

Course Syllabus:

Cobscook Bay TideGen™ installation Marine Mammal Observer Training Course: February 16-17, 2012

Instructor: Moira Brown, New England Aquarium, Boston, MA

Goal: To train observers in the identification of the marine mammal species known to occur in and around the waters of Cobscook Bay Seward Neck in Lubec Maine and Shackford Head in Eastport Maine. Training to include instruction on data recording (paper and electronic), distance estimation, observer plan for pile driving delay and shutdown procedures, communication procedures, and data storage.

Each observer will be provided with a waterproof whale identification guide that includes the common species in the area with their unique identifying features.

Syllabus:

1. Introductions and review of experience of trainees.
2. Presentation from ORPC on the project and need for the marine mammal observer program
3. Review of Survey Area and Observation Plan
4. Species Identification: Review of marine mammal species that are seen in the area and their identifying features. The instructor will present several images of each one of the species known to occur in the area and identify the specific characteristics unique to each one to determine species identification. Each image shown will be ones that were obtained from a vessel platform to most closely approximate what the observers will be seeing. Additional information will be given on typical seal and whale behaviors.

   Common species:
   Harbor seal
   Gray seal
   Harbor Porpoise
   White-sided dolphin
   Minke whale
   Fin whale
   Humpback whale

   Less common species:
   Right whale
   Pilot whale
   Sperm whale

   Rare Species:
   Orca (killer whale)
   Beluga

5. Observer skills: The instructor will provide the observers with specific guidelines on how to set up the observer team for maximum coverage of the area, how the observers should scan the surface of the water, which sighting cues to focus on, how to distinguish whale species from other marine life (e.g. basking sharks, tuna, ocean sunfish) and how to record their data.
6. Distance estimation: Distance estimation is difficult and variable between individuals; the observers will be introduced to a range finder device and given an opportunity to practice with the device out of doors. Distance estimation to the sighting will provide a higher resolution of data for mapping the sightings collected.
7. Review of communication procedures between observer vessels and barge for pile driving delay and shut down procedures.

8. Testing: The observers will be shown a series of images of the marine mammal species expected in the area and be asked to write down their own species identification for each test image. There will be a mix of images they have seen before and novel images.
9. For data recorders: Instruction in data recording on paper, data storage.

Course Plan:

Feb 16 and 17 – Observer Training Program – Instructor: Moira Brown and ORPC staff

	Thursday, Feb 16		Friday, Feb 17
8:30 - 10:15	Introductions Overview of TideGen™ Project (ORPC) Why a marine mammal observer program is needed	8:00 - 9:15	Review species id for common species Data recording Distance Estimation
10:15 - 10:30	Break	9:15 - 9:30	Break
10:30 - 12:00	Survey area and observation plan Marine mammal survey methods	9:30 - 10:30	Communication protocol between observer vessels and barge, pile driving delay and shut down procedures (ORPC)
		10:30-12:00	Data recording and processing
12:00 - 1:00	Lunch	12:00 - 1:00	Lunch
1:00 - 2:15	Species identification	1:00 - 2:15	Species id test
2:15 - 2:30	Break	2:15 - 2:30	Break
2:30 - 4:00	Species identification	2:30 - 4:00	Review of species id and course material, Q and A.

Attendee	Contact number 1	Email
Alethea (Lee) Leddy	207-853-2341	Aletha.LeeLeddy@gmail.com
Aubrey Jollotta	207-853-2095	daddybear1978@yahoo.com
Bob Lewis	207-233-1256	blewis@orpc.co
Butch Harris	207-853-4859	N/A
Cecil Cates	207-853-4300	pennamaquaw@localnet.com
Chris Bartlett	207-214-7061	cbartlett@maine.edu
Darius Neptune	207-853-2459	dneptune718@gmail.com
David Turner	207-231-4988	dturner@orpc.co
Fiona Jensen	814-933-9504	fjensen@orpc.co
Jaime Mitchell	207-233-8262	jmitchell@orpc.co
Jesse Smith	207-853-4790	nijeguhz@yahoo.com
Jim Mitchell	207-712-2919	jmitchell2@orpc.co
John Turner	207-358-4986	jturner@orpc.co
Matt LaCasse	207-214-2568	mlacasse1@gmail.com
Nate Johnson	207-712-2927	njohnson@orpc.co
Nathan Spear	207-214-3828	nathan-spear@hotmail.com
Ralph DeWitt	207-853-0662	N/A
Royce Richards	207-263-4822	dentalgals@gmail.com
Sean Anderton	207-400-7090	sanderton@orpc.co
Steve Erwin	207-853-9430	mr.smallhat@maine.rr.com
Tessa Ftorek	207-454-2130	tfortek@pwless.net

ORPC

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Jaime Mitchell Date: 2-7-12

Address: 45 Old County Rd. Pembroke Me. 04666
Number Street City State Zip

Phone: 726-9520 Email: jmitchell@orpc.co

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Eastport Elementary

Middle School: Eastport Elementary

High School: Shead High School 1998-2002 H.S. Diploma: ☒ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): business admin. University of Maine Machias

Work History (Please list your most recent employment and include dates of employment)

ORPC - Jan 2010 to present
Eastport Health Care - Jan. 2006 to Jan. 2010
Machias Motor Inn - June 2004 to Jan. 2006

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

Have lived on the water my entire life. Spend many days on the water observing marine mammals.

Jaime L M 2/7/12
Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Nathan Johnson - ORPC Date: February 7, 2012

Address: Ocean Renewable Power Company, 120 Exchange St, Suite 508, Portland, ME 04101

Phone: 207-712-2927 Email: njohnson@orpc.co

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☐ Yes ☐ No
Current ORPC full-time employee

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Long Island Elementary School, Long Island, Maine

Middle School: King Middle School, Portland, Maine

High School: Portland High School, Portland, Maine, 1994 H.S. Diploma: ✓ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended):

Tufts University, Medford, Massachusetts, B.S. Geology, 1998

Work History (Please list your most recent employment and include dates of employment)

Commercial lobsterman, Long Island, Maine – 1990 to 1998

AECOM (formerly Earth Tech), Environmental Engineer/Geologist, 1998 to December, 2011

Ocean Renewable Power Company (ORPC), Environmental Affairs Manager, January 2012 to present

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

Extensive experience working on the ocean, knowledge of marine ecosystems and marine hydrokinetic devices. Live on Long Island in Casco Bay, Maine.

[signature] 2/7/2012
Please Sign Here Date

ORPC

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Fiona Jensen Date: 2/7/12

Address: 8 Burnham St. Apt 5B South Portland ME 04106
Number Street City State Zip

Phone: 814-933-9504 Email: Fjensen@orpc.co

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☑ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Greenwood Friends School

Middle School: University School of Nashville

High School: University School of Nashville H.S. Diploma: ☑ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): Connecticut College - Government, Spanish, Environmental Studies

Work History (Please list your most recent employment and include dates of employment)

Appalachian Mountain Club - Trail Crew leader Summer 2011

Appalachian Mountain Club - Conservation Policy Intern Fall 2011

Randolph Mountain Club - Trail Crew Summers 2008, 2009, 2010

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

I participated in a Manatee observation project in San San Pond Sak Wetlands, Panama in 2010. I am also an aquarium enthusiast.

[signature] 2/7/12

Please Sign Here Date

ORPC

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: David W Turner Date: 2/6/12

Address: 214 So Meadow Rd Perry ME 04667
Number Street City State Zip

Phone: 231-4988 Email: dturner@orpc.co

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? (€ Yes) € No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: __________

Middle School: __________

High School: Shead 84-88 H.S. Diploma (€ Yes) € No

Higher Education (Please indicate course of study, when and where attended): WCTC Calais 1990-1

Work History (Please list your most recent employment and include dates of employment)

With ORPC since 2009

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

David W Turner 2/6/12
Please Sign Here Date

ORPC

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: John Turner Date: 2-7-12

Address: 172 Golding rd Perry ME 04667
Number Street City State Zip

Phone: 853-4770 Email: jTurner@orpc.co

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? € (Yes, circled) € No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: wildwood elementary sch

Middle School: wildwood elementary sch

High School: 4 years Wilmington high Sch H.S. Diploma: € (Yes, circled) € No

Higher Education (Please indicate course of study, when and where attended): ____________________

Work History (Please list your most recent employment and include dates of employment)

orpc Jan 23 - Present

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

4 years state of Maine boat operator

[signature] 2-7-12

Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Capt Ralph DeWitt Date: 2-6-12

Address: 9 High Eastport Me 04631
Number Street City State Zip

Phone: Home 207 853 0662 Cell 263 6402 Email: ____________

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Eastport Elementary

Middle School: Eastport Grammar

High School: Shead High School H.S. Diploma: ☐ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): W.C.C.C.

Marine Paint Applacation Techuition 1981 1982

Work History (Please list your most recent employment and include dates of employment)

R.J. Peacock Lubec 1991-2010

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

20 years Pilot Boat Captain

10 years painting fiberglass repair

Capt Ralph DeWitt 2-6-12

Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: James Smith Date: 2-6-12

Address: 9 High St. Eastport ME 04631
Number Street City State Zip

Phone: 207-853-0662 Email: nijeguhz@yahoo.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☑ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: ______

Middle School: ______

High School: Calais High H.S. Diploma: ☐ Yes ☑ No

Higher Education (Please indicate course of study, when and where attended): 100GT Master's Lisence, AB certification

Work History (Please list your most recent employment and include dates of employment)

Deckhand - Eastport Pilot Boat

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

Refer to higher education and work history

James Smith 2-6-12
Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Nathan Spear Date: 2-6-12

Address: 9 high St Eastport ME 04631
Number Street City State Zip

Phone: 853-0662 Email: nathan_spear@hotmail.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Calais Elementary

Middle School: Calais middle/high School

High School: Calais high School H.S. Diploma: ☒ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended):

University of Maine Liberal arts

Work History (Please list your most recent employment and include dates of employment)

Blue Iris Agust 11 - Sept 11

Dunkin Donuts Feb 11 - July 11

Walmart April 2010 - Jan 11

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

I Have taged Bear Cubs with Maine National Wildlife Rangers. I have alot of interest with animal field work and considering getting a degree.

Nathan Spear 2-6-12

Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Cecil Cates Date: 2-7-2011

Address: 4 Wilson St. Eastport Me 04631
Number Street City State Zip

Phone: 853 4300 Email: Pennamaquaw@localnet.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Eastport

Middle School: Eastport

High School: Shead Eastport H.S. Diploma: ☒ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): Trades school
100T capt. course

Work History (Please list your most recent employment and include dates of employment)

D.M.R. Biotoxin monitoring 2 yrs to present
Quoddy Pilots 1989 to date
Capt. Lubec Eastport Ferry June-Sept 2011

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

I have lived and worked on the bay all my life. I been involved in salmon, urchins, shell fish and nori Aquaculture, Field rep. for Airmar sea mamal protection and controll systems from 1985-2002

Cecil Cates 2/7/2011
Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Matt Lacasse Date: 2/2/12

Address: 3 (Number) Evans St. (Street) Eastport (City) ME (State) 04631 (Zip)

Phone: 207 214 2568 Email: MLacasse1@Gmail.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Calais Elem.

Middle School: Calais Middle

High School: Calais High Class of 2002 H.S. Diploma: ☒ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): WCTC "The Boat School" Eastport ME

Work History (Please list your most recent employment and include dates of employment)

Moose Island Marine Yard Manager, Commercial Fisherman, Tug crew, Harbormaster Eastport, AB on ocean going tug, Tradewinds towing, seaweed harvester, Boat Builder.

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

Years of experience on the water, trained in safety CPR, First Aid, 100 GT Licenced Captain, very familiar with the area.

Matt Lacasse 2/2/12

Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Darius J. Neptune Date: 2/3/12

Address: Po box 65 Perry ME 04667
Number Street City State Zip

Phone: (207) 853-2459 Email: DNeptune718@Gmail.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☑ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Beatrice Rafferty School

Middle School: Beatrice Rafferty

High School: Washington Academy H.S. Diploma: ☑ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): Washington County Community College Starting July 2012

Work History (Please list your most recent employment and include dates of employment)

Butch Harris 07 - Present

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

Worked on a whale watching boat for 5 years

Worked On water for 5 Years

Darius Neptune 2/3/12
Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: George HARRIS Jr Date: 2/1/12

Address: 13 Old Redoubt Rd Eastport Me 04631
Number Street City State Zip

Phone: Cell 207-214-8783
Home 207-853-4859
Email:

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☐ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Eastport Elementary

Middle School: Eastport Elementary

High School: Shead High Eastport H.S. Diploma: ☒ ~~Yes~~ ☐ No

Higher Education (Please indicate course of study, when and where attended): None

Work History (Please list your most recent employment and include dates of employment)

Owner operator of whale watching & fishing charter business for 25 years, 100 Ton Master near coastal with sail endorsement, Selfemployed Fisherman + Boat Builder

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

I have worked on the wate my entire life, I have been involved in many fisheries including scalloping, urchins, lobster & herring. I'm a member of the Marine Advisory Council, Have owned & operated my charter business for over 25years Have built Boat ranging from 12' up to 118 schooners. I think my knowledge & experience will be useful on this project.

George Harris Jr 2/1/12

Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Sean Anderton Date: 1-31-2012

Address: 58 Crossing Brook Rd. Cumberland, ME 04021
Number Street City State Zip

Phone: 207-221-6336 Email: sanderton@orpc.co

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Southlake Elementary 85-87, Strawberry Knoll Elem. 87-92

Middle School: Gaithersburg Middle School 92-94

High School: Gaithersburg High School 94-98 H.S. Diploma: ☒ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): Weber State University Communication/Broadcasting/Sales 98-99, 2001-2004

Work History (Please list your most recent employment and include dates of employment)

Ocean Renewable Power Company 2008-Present

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

I am the site assessment manager for ORPC. As part of my work duties I spend a lot of time on the water working, measuring current speeds, mapping

Sean Anderton Digitally signed by Sean Anderton
DN: cn=Sean Anderton, o, ou, email=sanderton@orpc.co, c=US
Date: 2012.01.31 15:03:49 -05'00' 1-31-2012

Please Sign Here Date

✓

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Royce F. Richards Date: 01/11/2012

Address: P.O. Box 126 East Machias Me. 04630
Number Street City State Zip

Phone: (207) 255-8727 (207) 263-4822 (mobile) Email: dentalgals@gmail.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☑ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Rose M. Gaffney Machias, Me. 1-8

Middle School: " "

High School: Machias Memorial High School H.S. Diploma: ☑ Yes ☐ No (1991)

Higher Education (Please indicate course of study, when and where attended):

B.A. Biology (Marine Concentration) University of Maine at Machias (2001)

Work History (Please list your most recent employment and include dates of employment)

Self Employed Carpenter (2007 - present) Acadia National Park 04/10 - 10/2010
Dunbar Custom Homes 12/2005 - 3/2007 Shawn Johnson (Owner lobster Vessel) - sternman 10/2004 - 11/200[illegible]
Charles Huntley (lobster Vessel owner) sternman 04/2004 - 10/2004 Atlantic Salmon of Maine Fisheries Technician + Diver 12/2001 - 12/2003

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

1) Extensive experience Working aboard Commercial Fishing Vessels in all Weather Conditions (Winter, high Seas + winds, Thick Fog, slippery decks, etc) Safely.

2) Extensive experience Working in the Salmon Aquaculture Industry - Working on Ocean year round in all Weather conditions + operation of Vessels up to 65 ft. in length.

[signature] 1/11/2012

Please Sign Here Date

3) Earned B.A. In Biology (Marine Concentration) - Intense Courseload in Marine areas including Ichthyology, Invertebrate Biology, Taxonomy, Marine [illegible] etc. [illegible]

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Christopher Bartlett Date: 1/31/12

Address: 6 County Rd Eastport ME 04631
Number Street City State Zip

Phone: 207 214 7061 Email: cbartlett@maine.edu

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Lake St. School, Auburn, ME

Middle School: Castner Middle School, Damariscotta, ME

High School: Lincoln Academy, Newcastle, ME H.S. Diploma: ☒ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended):

B.S. Microbiology, University of Maine

Work History (Please list your most recent employment and include dates of employment)

Marine Extension Associate, University of Maine Sea Grant
Feb. 1995 – Present.

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

I'm competent at identifying the marine mammal species common to the Cobscook Bay area. I have served as a fisheries observer on several research and monitoring efforts and I'm experienced with safe watercraft operations

C Bartlett 1/31/12
Please Sign Here Date

Limited availability

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Alethea (Lee) Leddy Date: 11/11/11

Address: 1348 US Rt 1 Perry Me 04667
Number Street City State Zip

Phone: 207-853-2341 Email: Alethea.LeeLeddy@gmail.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Jamaica Queens NY - cant remember #

Middle School: P.S. 117 - N.Y

High School: Southampton H.S. - N.Y. H.S. Diploma: ☒ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): S.U.N.Y. Cobleskill 1972-1974 - animal husbandry

Work History (Please list your most recent employment and include dates of employment)

Naturalist onboard schooner ADA C LORE for Butch Harris - 2010/2011 season

Veterinary technician at Perry Vet. Clinic 1994-2007

CNA/per diem Atlantic Rehab nursing home - 2008-2011

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

worked for 8 years in NY as volunteer onboard whale watch research vessel recording/photographing finback/minke behavior, Was on tri state marine mammal stranding network during those years helping in live strandings, necropsies of whales, seals, dolphins, sea turtles, Am trying to photo ID the finbacks and minkes in our waters as no one in this vicinity is doing them only humpbacks and rights
marine mammals my passion
hold maine vet. tech license

Please Sign Here: Alethea Leddy Date: 11/11/11

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Brian M Duffy Date: 1/19/12

Address: PO Box 177 Eastport ME 04667
Number Street City State Zip

Phone: 853-6111 Email: BDuffy@Roadrunner.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☑ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: ______

Middle School: ______

High School: The Heights School, Potomac, MD H.S. Diploma: ☑ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): University of Maryland, BA in Economics, 1997 WCTC Marine Technology Center, 2000

Work History (Please list your most recent employment and include dates of employment)

The Boat School, Husson University, Boat Building instructor
2009- present
Shead High School 2007-2009

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

Lifelong interest in outdoor activities including, rowing, sailing, powerboating and fishing. Experience as sailing instructor with Hurricane Island Outward Bound School.

Please Sign Here ______ Date ______

✓

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Stephen Erwin Date: 11/29/11

Address: 27 Washington St. Eastport, ME 04631

Number Street City State Zip

Phone: 207-853-9430 Email: mr.smallhat@maine.rr.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☑ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Kenilworth Elem (5th, 6th grade) Bowie, MD.

Middle School: Belair Jr. High (7-9) Bowie, MD

High School: Bowie High (10-12) Bowie H.S. Diploma: ☑ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): Maryland Univ. Music Major College Park, MD.

Work History (Please list your most recent employment and include dates of employment)

Shop N' Save - Calais, ME. 2-10 to present

Royal Books · Baltimore, MD. 12-2001 - 7-2007

Whole Foods - Baltimore, MD 1-~~2007~~ 1997 - 12-2007

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

Attention to detail. Interest in marine life. A love of being on the water.

[signature] 11/29/11

Please Sign Here Date

✓

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: PATRICIA CAYA Date: 11/18/2011

Address: 27 WASHINGTON ST, EASTPORT ME 04631
Number Street City State Zip

Phone: 207 853 9430 Email: stellavoce@maine.rr.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Columbia Park Elementary, Columbia Park, MD 1961-67

Middle School: Kent Jr. High School, Palmer Park, MD 1967-1970

Largo Sr. High, Largo, MD - Autumn 1970

High School: Bowie Sr High - 1971 - 1973 H.S. Diploma: ☒ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): ① ST MARY'S COLLEGE OF MD ST MARY'S CITY, MD BA/ENGLISH 1973-197

② ACADEMY OF MUSIC + DRAMATIC ARTS, VIENNA, AUSTRIA 1982 + 1988 - VOICE, OPERA, ORATORIO PERFS

Work History (Please list your most recent employment and include dates of employment)

QUODDY TIDES - MARCH 2010 - PRESENT; U MAINE MACHIAS JAN 2011 - present;

US CENSUS - JAN 2010 - JULY 2010; please see attached resume for

more details.

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

I am an avid kayaker and sailor. I love being out on the water, and love watching and observing wildlife. I am at home on the water, and I can carry out instructions. I also have experience photographing on the water.

[signature] 11/18/2011

Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Tessa Ftorek Date: Dec. 21, 2011

Address: 13 Woodcock Way Robbinston ME 04671
Number Street City State Zip

Phone: 454-2130 Email: tftorek@pwless.net

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Eastport Grammar School

Middle School: ______

High School: Shead Memorial High School, Eastport H.S. Diploma: ☐ ~~Yes~~ ☐ No 1969

Higher Education (Please indicate course of study, when and where attended): University of Maine at Presque Isle, B.S. in education, graduated 1973

Work History (Please list your most recent employment and include dates of employment)

Washington County Community College 1987-present

Cobscook Hikes and Paddles 2000-present

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

Registered Maine Guide-certifications in sea Kayaking, boat operation and recreation; volunteer water quality monitor; member of board of Cobscook Bay Resource Center

Tessa Ftorek 12-21-2011

Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Aubrey Rosslin Jollotta Date: 7 Feb 12

Address: 79 County rd Eastport Maine 04631

Number Street City State Zip

Phone: 207-853-2093 Email: daddybear1978@yahoo.com

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? ☒ Yes ☐ No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: ______

Middle School: ______

High School: Dexter Christian Acadamy H.S. Diploma: ☒ Yes ☐ No

Higher Education (Please indicate course of study, when and where attended): Colorado School of Trades Gunsmith

Work History (Please list your most recent employment and include dates of employment)

U.S Army retired 2001 - 2009 Disabled veteran

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

worked on several boats; I enjoy whales; seals A Avade Animal Lover, been working on Boats repair and service

[signature] 7 Feb 12

Please Sign Here Date

APPLICATION FOR MARINE MAMMAL OBSERVER TRAINING

Name: Jim Mitchell Date: 2/10/2012

Address: 45 (Number) Old County Rd (Street) Pembroke (City) ME (State) 04666 (Zip)

Phone: 207-726-9520 Email: Jmitchell2@ORPC.CO

This temporary position requires 4 to 6 hours on the water daily. Can you meet this expectation? € Yes € No

Formal Education (Please indicate name of school, location and years you attended school):

Grammar: Perry Elementary, Robbinston Elementary, Eastport Elementary

Middle School: Calais Middle

High School: Shead High School Eastport, ME 4 yrs H.S. Diploma: (€ Yes) € No

Higher Education (Please indicate course of study, when and where attended):

Work History (Please list your most recent employment and include dates of employment)

Ocean Renewable Power Company Oct 2010 - Present

What attributes and experience would make you a marine mammal observer if you complete the training? (List any on the water experience, volunteer work, courses, hobbies, special interest, etc.)

Captain 50T Master, Near Coastal Mate

Captain for ORPC

James R Mitchell II 2/10/2012

Please Sign Here Date

Appendix D

Impact of TidGen™ Power System Installation on Birds, Center for Ecological Research, April 2012

Report to ORPC on Impact of TidGen™ Power System Installation on Birds

in the Deployment Area

in Cobscook Bay, Maine

Period of Investigation

March 31, 2012

Prepared by
Peter D. Vickery, Ph.D.
Center for Ecological Research

April 2012

Introduction

The Center for Ecological Research (CER) conducted seabird inventories off the waters of North Lubec where Ocean Renewable Power Company (ORPC) was installing the underwater foundation for the first TidGen™ Power System in Cobscook Bay (Fig. 1). CER monitored the waters off North Lubec on March 31, 2012, to determine if the construction and deployment of the support pilings would adversely affect seabirds using the Deployment Area. We determined the species and numbers of seabirds that used the proposed Deployment Area, and then determined if the behaviors of the seabirds in the area were affected by construction activities, particularly the noises generated when using a vibratory hammer and a diesel impact hammer to drive foundation piles. These results should help ORPC minimize potential impacts when it deploys future TidGen™ systems.

Figure 1. Land-based surveys were conducted from the Landing Site in North Lubec, Maine. The surveys were separated into the near shore area (A) just offshore from the Landing Site and the mid-channel area (B) where the TidGen™ Power System was deployed in late March and early April 2012.

Background

Cobscook Bay is a rich marine environment with 5-7 meter tides and strong currents (Larsen 2004). This bay is an important fishing area and we regularly observed 12-20 scallop draggers and fishing vessels in the bay during our surveys. Numerous salmon pens are also scattered throughout the bay; boats service these pens on a daily basis.

We paid special attention to federal and state endangered, threatened, and special-concern species and communicated with the Maine Department of Inland Fisheries and Wildlife to confirm that the updated list of these bird species in Maine was accurate (http://www.maine.gov/ifw/wildlife/species/endangered_species/state_federal_list.htm; see Appendix 1).

STUDY OBJECTIVES

The objective of this study was to determine if the seabirds that use the proposed Deployment Area of the TidGen™ Power System were affected by the installation of the support structure for the TidGen™ on March 31, 2012.

SURVEY SITE

ORPC Landing Site - North Lubec

We used the ORPC Landing Site in North Lubec as the location for our land-based observations. These surveys were conducted from the defunct landing dock (Fig. 1).

The land-based survey area for the nearshore Landing Site and the mid-channel was delineated by an imaginary line extending from the ORPC Landing Site to the east end of Goose Island (Fig. 1). The west side of the survey area was defined by a line extending from the western boundary of the Landing Site to a white building on a salmon farm directly northwest of the Landing Site. The northern edge of the inshore area (A) was marked by a green navigation buoy north of the Landing Site. The mid-channel area (B) was delimited by the green buoy and a white marker west of Goose Island. The beach and adjacent pond to the east of the Landing Site were clearly visible from this position.

SURVEY METHODS

This phase of this study documented the number of seabirds that used the general Deployment Area on March 31, 2012 during both vibratory and diesel impact hammer operations and compared the results to previous survey data from the area.

Wintering Waterfowl and Seabirds

CER conducted two surveys from the Landing Site at North Lubec on March 31, 2012. Each survey was conducted for a period of 2 hours. Each survey was divided into 15-minute periods and the maximum number of each species and its behavior (see below) were recorded during each period. For reporting purposes, CER condensed the 15-minute observation periods into 30-minute units by selecting the largest count in each of the two 15-minute periods, e.g., if 7 eiders were counted in the first 15 minute period and 11 eiders were counted in the second period, CER used the higher number, in this case, 11 individuals. We used a continuous scan method to identify and count all species present (Martin and Bateson 1986). Observers used 8x or 10x binoculars and a 20-60x telescope for the land-based surveys.

Behaviors

We registered all behaviors of birds on the water's surface. Birds were identified as Loafing (floating on the surface), Diving (active feeding below the surface), or Surface Feeding (active feeding on the surface) (Holm and Burger 2002). We noted when construction activities were initiated and recorded bird movements and behaviors during those construction activities.

RESULTS

CER conducted two land based surveys from North Lubec on March 31, 2012 The first survey was conducted between 10:30 and 12:30 hrs during the vibratory hammer phase of the construction (Fig. 2). The second survey was conducted between 16:30 and 18:30 hrs when the diesel impact hammer was used (Fig. 3).

The responses of seabirds to the vibratory hammer noises were generally minimal or of short duration, except for three Canada Geese (Branta canadensis) in the near shore that appeared to be disturbed by the noise and departed the study site at 11:00. Red-necked Grebe (Podiceps grisegena) numbers did not change during vibratory hammer operation. Common Loon (Gavia immer) numbers declined from 3 to a single individual during vibratory hammer operation and then returned to three individuals within 15 minutes. There were 7 Common Eiders (Somateria mollissima) in the Deployment Area at 10:45 am, the number increased to 15 eiders at 11:00, then declined to 5 individuals at 11:15 when a loud fishing boat passed through the Deployment Area and displaced the eiders that had been foraging adjacent to the barge. The fishing vessel overwhelmed the noise of the vibratory hammer. After the fishing boat passed through the Deployment Area, the eiders circled and returned to the same area, increasing to 17 eiders by 11:30. There were no Red-breasted Mergansers (Mergus serrator) in the Deployment Area at 10:45. Six mergansers were observed at 11:00, but had departed by 11:15. These mergansers appeared to be moving through the Deployment Area (Fig. 2).

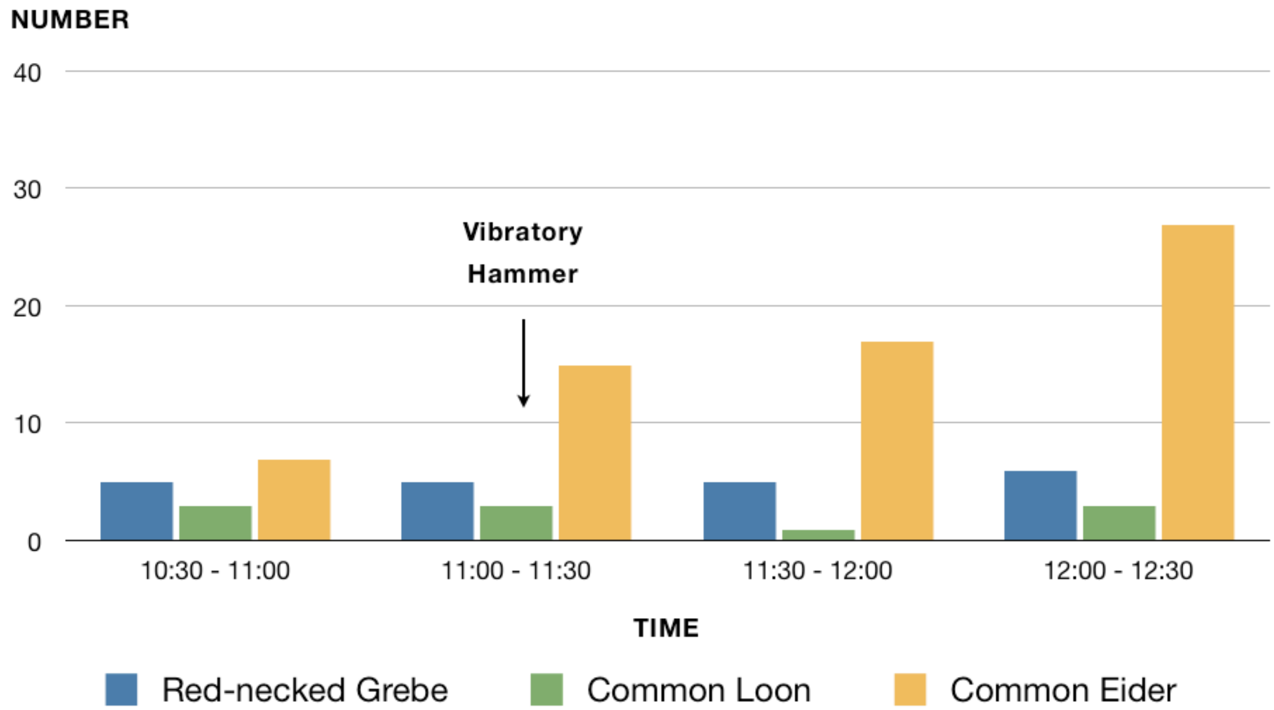


Figure 2. Red-necked Grebe (blue) numbers did not change during the use of the vibratory hammer at the TidGen™ Power System Deployment Site in North Lubec, Maine, March 31, 2012. Common Loons (green) declined from three individuals to a single loon for a 15 minute period after the use of the vibratory hammer. Common Eider (orange) numbers increased during the survey period.

Seabirds did not seem to be affected by diesel impact hammer noise and the number of birds did not change appreciably during operation (Fig. 3). Diesel impact driving began at 18:00 hrs, when there were 3 sets of 3 hammer strikes and 1 set of 4 hammer strikes. Impact driving was completed by 18:31. Red-necked Grebes increased slightly from 2 to 3 individuals during operation, and a single Red-necked Grebe was observed foraging within 100 m of the barge at this time. A single Common Loon was present throughout the survey. Common Eiders numbers ranged between 4 and 8 individuals during this survey. At 18:00 hrs, Common Eiders declined from 8 to 5 individuals when the diesel impact hammer was in operation.

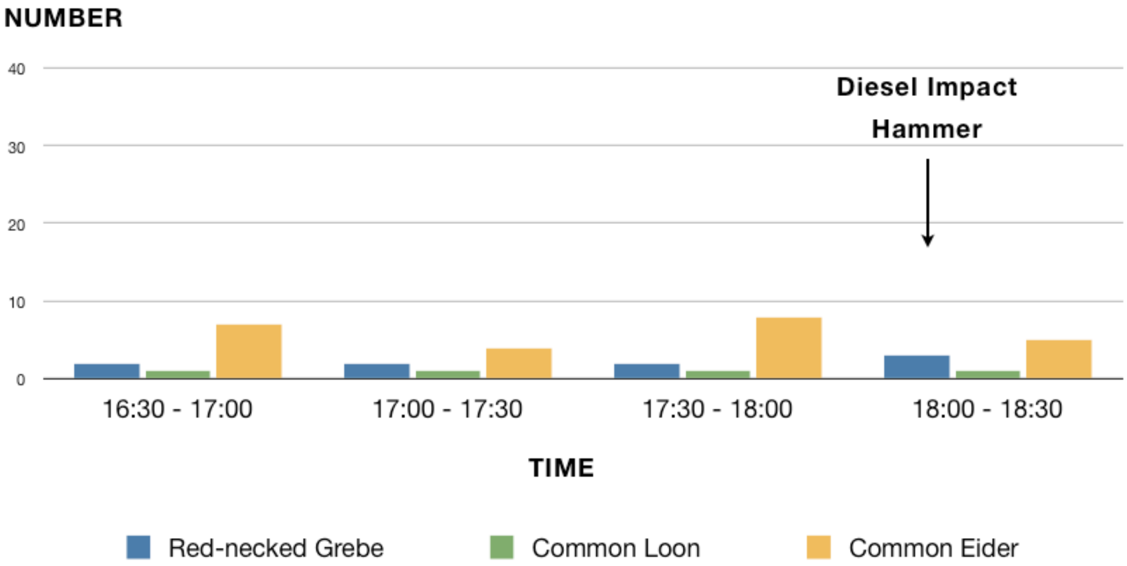


Figure 3. Red-necked Grebe (blue) numbers did not change during the use of the diesel impact hammer at the TideGen Deployment Site in North Lubec, Maine, March 31, 2012. A single Common Loon (green) remained in the area during the use of the vibratory hammer. Common Eider (orange) numbers decreased from seven to four individuals during the use of the diesel impact hammer and then increased to 8 individuals within 30 minutes post use.

Diving Behavior

All the seabirds were observed feeding (diving) actively. The use of the vibratory and the diesel impact hammer did not change this behavior, other than the three Canada Geese that departed the area.

Bald Eagle:

No Bald Eagles (Haliaeetus leucocephalus) were seen during the two surveys in the study area on March 31, 2012. This species is regular in this area and is usually seen flying over the study area. Formerly, Bald Eagle was listed as federally and state endangered, but because eagle numbers have recovered, this species was down-listed to threatened and is no longer listed at any level (http://www.maine.gov/ifw/wildlife/species/endangered_species/state_federal_list.htm).

DISCUSSION

There was little response of seabirds to the vibratory hammer noises. Any effects were generally minimal or of short duration. Given the general boat activity in the area, CER could only detect brief displacements that were less than 15 minutes long and it was not possible to determine if the seabird response was precipitated by the installation activities. Three Canada Geese near the Landing Site appeared to be disturbed by the vibratory hammer and departed the area when this equipment started operation. Common Eiders were displaced by a fishing vessel that passed through the Deployment Area while the vibratory hammer was in use but these birds quickly settled in the same area where they had been foraging. This suggests that eiders were not impacted by the noise or action on the barge.

We observed no obvious seabird response to the louder diesel impact hammer. Common Eider numbers declined from 8 to 5 individuals during operation but this was within the normal fluctuation of this species in this area at the time (Fig. 3). Common Loon numbers declined briefly but it was not clear whether this was in response to the diesel impact hammer noise or it was part of the normal loon movements in this area. Loon numbers returned to previous levels (3 individuals) within 15 minutes.

All seabirds were actively feeding prior to and during installation activities. The fact this behavior did not change when the vibratory or diesel impact hammers were in use seems to indicate that the seabirds present were not affected by the noise.

Endangered and Threatened Species:

CER surveys did not find any federal or state endangered or threatened species on March 31, 2012. Bald Eagles are regular in the study area but this species was removed as a threatened species in 2009 (Charles Todd, pers. comm.; MDIF&W).

Potential Impact for ORPC Activities in Winter:

Early spring, between March and April, is an excellent time of year to conduct installation activities because there are few seabirds in the Deployment Area and along the near shore at the Landing Site. Given that CER staff observed a general lack of seabird response to these installation activities, it seems unlikely that installation activities will have any adverse affect on non-breeding seabirds at any season. It also seems unlikely that general maintenance activities will disturb seabirds at this site. It does appear that major installation and maintenance activities could affect Canada Geese but previous observations confirm that this species geese is rare in the study area at any season, and Canada Geese have not been observed in the Deployment Area. CER staff did not observe any Canada Geese during winter surveys from November 2010 through May 2011, nor from September 2011 through February 2012. The three individuals on March 31, 2012 were the only geese seen on CER surveys.

Literature Cited

Maine Department of Inland Fisheries and Wildlife. http://www.maine.gov/ifw/wildlife/species/endangered_species/state_federal_list.htm

Holm, K. J., and A. E. Burger. 2002. Foraging Behavior and Resource Partitioning by Diving Birds during Winter in Areas of Strong Tidal Currents. Waterbirds 25:312-325.

Larsen, P. F. 2004. Introduction to ecosystem modeling in Cobscook Bay, Maine: a boreal, macrotidal estuary. Northeastern Naturalist 11:1-12.

Martin, P., and P. Bateson. 1986. Measuring behaviour: an introductory guide. Cambridge University Press, Cambridge.

Appendix E

Final Acoustic Report for Pile Driving Activities

SCIENTIFIC SOLUTIONS, INC.
INNOVATIVE RESEARCH AND ENGINEERING

ACOUSTIC MONITORING RESULTS FOR PILE DRIVING ACTIVITIES

INCIDENTAL HARASSMENT AUTHORIZATION

COBSCOOK BAY TIDAL ENERGY PROJECT

FERC PROJECT No. 12711

ORPC MAINE, LLC

April 24, 2012

Scientific Solutions, Inc.
99 Perimeter Road
Nashua, NH 03063
Tel: +001 603 880 3784
http://www.scisol.com

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EXECUTIVE SUMMARY

Measurements of the in-water noise level related to pile driving activity prior to April 09, 2012 during installation of the TidGen™ Power System demonstrate that near-source sound level limits (peak pressure level or sound exposure level) for operation after a work window ending April 09, 2012 were not exceeded for impact hammer activity, and were marginally exceeded for sound exposure level during two of five activities using a vibratory hammer.

It was noted that vibratory hammer levels were exceeded during the first two vibratory driving activities after which time the connections between the hammer, follower, and piling itself were improved. In addition, a mitigation method was identified to limit the likelihood of exceeding the sound exposure level limit with the vibratory hammer given the improper hammer connection. However, this mitigation is deemed unnecessary for future operations due to the use of best management practices related to the hammer, follower, and pile connections.

Measurements in the mid- to far-field indicate that the Level A and Level B harassment isopleths are closer than the conservative estimates provided in the original Acoustic Monitoring Plan.

In-air measurements at the Lubec come-ashore location and on Goose Island indicated that the pile driving activity was detectable for both vibratory and impact hammer sources based on the ambient noise level during the pile driving. As both the pile driving noise levels and ambient noise levels were variable, the results varied from pile activity being completely masked by ambient noise to levels 5 – 10 dB above ambient.

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

ORPC Maine, LLC, a subsidiary of Ocean Renewable Power Company, LLC (collectively, ORPC), received a pilot project license for the Cobscook Bay Tidal Energy Project (Project) from the Federal Energy Regulatory Commission (FERC) on February 27, 2012 (FERC Project No. P-12711). The Project will evaluate the potential for a new source of clean, renewable energy generation using tidal energy resources in Cobscook Bay, Maine. ORPC obtained an initial preliminary permit for the project area in Cobscook Bay from FERC on July 23, 2007; FERC issued a successive preliminary permit on January 13, 2011. Feasibility studies, including environmental surveys, and pre-filing consultation were conducted, resulting in ORPC's filing of a draft pilot license application (DPLA) with FERC for the Eastport Tidal Energy Project on July 24, 2009. Since submitting the DPLA, ORPC has conducted extensive consultation with regulatory and resource agencies as well as other stakeholders, has collected additional environmental data, and has continued to refine its proprietary technology. As a result of these additional studies and consultations, ORPC now plans to deploy a commercial-scale hydrokinetic power system in stages, with the Project, a small pilot project, as the first phase. The FERC preliminary permit Project boundary for the Cobscook Bay Tidal Energy Project (FERC Project No. 12711) encompasses the proposed development area. The FERC pilot project license boundary for the Cobscook Bay Tidal Energy Project encompasses the proposed development area.

Figure 1: Cobscook Bay Tidal Energy Project location map.

1.2 FOUNDATION DESIGN AND INSTALLATION

The foundation design for the TidGen™ devices at the project site consists of a pile bent arrangement consisting of ten steel piles, each with a 30-inch diameter and ½-inch wall thickness. The piles were designed to vary in length due to bottom sediment depth with each driven to the top of the bedrock and protruding 15+ ft above the seafloor.

The bottom support frame (BSF) for the first TidGen™ device was deployed on the seabed on March 20, 2012 (Figure 2). The deployed BSF acted as a template for the driving of piles to secure the foundation in place.

The Contractor's deployment plan included the use of both a vibratory and diesel impact hammer to drive the piles to refusal. Hammers specifications were included in the Acoustic Monitoring Plan for Pile Driving Activities submitted to NOAA NMFS, Office of Protected Resources on March 1, 2012.

Figure 2: Bottom Support Frame (BSF) deployment, March 20, 2012.

1.3 Restrictive Work Window for Endangered Species

ORPC anticipated the use of driven piles to fix the TidGen™ to the sea floor during the Final Pilot License Application process. In our consultation with NOAA NMFS, Protected Resource Division, it was identified that the potential sound levels of driving such piles may emit sound levels that could damage young salmon. Below is an excerpt from correspondence from Dan Tierney, NOAA NMFS, to Herb Scribner, ORPC on October 28, 2011.

> *Pile driving that occurs within Cobscook Bay between November 8th and April 9th will not affect listed salmon because they are not anticipated to be present in the action area. The piles driven for Phase 1 of the proposed project (ten of the fifty) will be driven during March 2012; therefore, their installation is not anticipated to adversely affect listed salmon. Although ORPC will endeavor to install the piles for Phase 2 during the preferred work window (November 8th and April 9th), it will likely not be possible to install all forty of the remaining piles during that timeframe. Therefore, ORPC will conduct acoustic monitoring during the driving of the Phase 1 piles to determine if noise levels are below the thresholds of injury to fish as described above. If it is determined that the noise levels exceed these thresholds, ORPC will work within the recommended November 8th to April 9th work window and/or use a combination of attenuation devices (cushion or bubble curtain) to reduce levels to a point where they will not harm listed fish. So, if during the monitoring of Phase 1 pile driving it is determined that noise levels are significantly below the thresholds for injury, the work window and the attenuation methods will be unnecessary.*

As a condition of a subsequent Incidental Harassment Authorization (See Section 1.5) from NOAA NMFS, Office of Protected Resources, ORPC included a separate Acoustic Monitoring Plan for Pile Driving Activities that included monitoring during initial pile placement by several methods and mitigation measures that covered the range that NMFS had indicated in their correspondence. It was intended by NMFS to require ORPC to drive the initial piles and collect data regarding the monitored sound levels when no salmon were present.

1.4 Incidental Harassment Authorization (IHA)

ORPC applied for an IHA for pile placement because the pile's vibratory hammer setting and diesel impact hammer could potentially generate noise levels above NOAA's guidelines for continuous and impact noise under the Marine Mammal Protection Act of 1972.

ORPC's IHA application included the estimation of noise source levels and associated isopleths based on calculations performed by SSI on in-air hammer specifications and nameplate information provided by the manufacturer.

On a constant radiated energy level it was determined that in-air data can be transferred to in-water data by adding 62 dB to account for differences in reference levels and specific acoustic impedance (ratio of particle velocity to pressure). Thus the 112 dB in-air vibratory source level at the operator (presume 1 m away) equated to roughly 174 dB re µPa2 @ 1 m in water. The 131 dBA from the plate on the impact hammer equated to 193 dB re µPa2 @ 1 m in water.

Based on Level A harassment above 180 dB for marine mammals for the impact hammer, the Level A harassment isopleths was determined to be roughly 30 to 100 m from the source. Therefore mitigation measurements were recommended to insure that no marine mammals be within 100 m of the pile driving.

Based on Level B harassment levels for the continuous vibratory source at greater than 120 dB, and assumed 15logR propagation loss in shallow waters (cylindrical spreading would be 10logR and spherical spreading would be 20logR), SSI determined the 175 dB source levels for the vibratory hammer do not attenuate to 120 dB until a distance of 4600 meters, or roughly 2.5 miles from the source.

NOAA NMFS grants authorization for incidental takings of marine mammals if it finds that the taking will have a negligible impact on the species or stock(s), will not have an immitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined "negligible impact" in 50 CFR 216.103 as "...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

Except with respect to certain activities not pertinent here, the MMPA defines "harassment" as:

> *any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].*

ORPC consulted with NMFS prior to submittal of an IHA for the CBTEP and subsequently prepared and submitted detailed Acoustic Monitoring and Marine Mammal Observation Plans for the pile driving activity.

ORPC was granted an IHA by NMFS on March 8, 2012 for the take, by Level B harassment only, 72 total grey and harbor seals (Halichoerus grypus and Phoca vitulina), 72 harbor porpoises (Phocoena phocoena), and two Atlantic white-sided dolphins (Lagenorhynchus aculus) incidental to pile driving associated with the tidal turbine project. The IHA included specific monitoring and reporting requirements to determine actual source levels and harassment isopleths ranges.

2.0 ACOUSTIC MONITORING OBJECTIVES

ORPC conducted pile-driving activities between March 24th, 2012 and April 4th, 2012. Of concern was the effect of the pile driving noise on endangered species of fish (primarily Atlantic salmon) and marine mammals. Acoustic monitoring was conducted to quantify noise levels generated from various pile driving techniques and to determine the effectiveness of mitigation methods to ameliorate the April 10th through November 7th work-window. The following were the specific objectives of the acoustic monitoring:

- Measure near field noise levels in dB re1µPa peak pressure and sound exposure levels (SEL) to confirm impact hammer levels are maintained at less than 206 dB re1µPa@1m peak and below 187 dB re 1µPa^{2}s SEL at a range of 10 m. In addition, vibratory hammer levels were to be maintained at less than 206 dB re1µPa@1m peak.
- Establish the 180 dB re 1µPa@1m rms pressure isopleth for both vibratory and impact hammers (thresholds for Level A harassment are 190 dB for pinnipeds and 180 dB for cetaceans).
- Establish the 160 dB re 1µPa@1m rms pressure isopleth for impact (level B transient source) using sound attenuation devices.
- Establish the 120 dB//1µPa@1m rms pressure isopleth for vibratory (level B continuous source).
- Monitor ambient air noise levels with a sound level meter at Goose Island and at the Lubec shore station to identify in air noise levels at a potential bird rookery and seal haul-out areas within this area of Cobscook Bay concurrent with bird surveys being conducted by others.

These limits are summarized in Table 1 and

Table 2.

Table 1: Thresholds for injury at 10 m for fish[1].

Peak Absolute Pressure Limit (Threshold for Injury)	Sound Exposure Level (SEL) Limit (Threshold for Injury)
206 dB re 1 µPa	187 dB re 1 µPa^{2}s

Table 2: NOAA guidelines for root men square (rms) pressure levels for Level A and Level B harassment of marine mammals due to continuous (vibratory hammer) and transient (impact hammer) sources.

Type	Level A	Level B
Vibratory	180	120
Impact	180	160

[1] Correspondence between Herb Scribner and Dan Tierney, NOAA NMFS "*The noise produced by driving 3 foot or 6 foot piles with an impact hammer will likely exceed the injury thresholds for noise (206 dB Peak and 187 dB SEL) set by the Fisheries Hydroacoustic Working Group, an interagency (USFWS and NMFS included) work group on the West coast that considers the effects of pile driving on fish,*" October 4, 2011.

3.0 METHODOLOGY

3.1 STUDY AREA

The geographic scope of the study generally includes the Cobscook Bay Deployment Area (Figure 1).

Piles were driven by vibratory or diesel impact hammer in nominally 100 feet of water during high slack periods and approximately 85 feet of water during low slack periods (Figure 3 and Figure 4).

Figure 3: Diesel impact hammer and pile, March 25, 2012.

Figure 4: Vibratory hammer and pile, April 1, 2012.

3.2 Measurement System Methods and Equipment

ORPC and Scientific Solutions Inc. (SSI) utilized in-water methods to measure the pile-driving noise in the environment related to the TidGen™ Power System installation. Underwater measurements were made at both a fixed position on the deployment barge approximately 10 meters from the pile and on a drifting boat at varying distances from the pile activity.

Figure 5: Acoustic monitoring from barge (right) and vessel at 100m (left), April 25, 2012

3.2.1 In-Air Noise Measurement System Equipment and Methods

In-air measurements were performed using a sound level meter mounted on an industrial tripod at a fixed location during a particular pile activity. A GPS recording device was also attached to the tripod to determine the distance to the pile activity. The sound level meter was a Quest Technologies SoundPro DL-1-1/3 Octave-20 sound level meter that meets Type 1 requirements of the American National Standards Specifications for sound level meters, SI.4-1971.

Each day the sound level meter was deployed on either Goose Island or at the Lubec shore station location. The meter was calibrated prior to and after each day of recording using the methods and calibrator provided by the meter manufacturer. An observer remained with the unit (at a distance) to ensure that the equipment was not engaged by wildlife and to note if boats passed near or between the barge and the measurement location during the driving activity.

3.2.2 In-Water Noise Measurement Equipment and Methods

In-water measurements consisted of near-source barge measurements at approximately 10 meters from the pile and boat measurements ranging from 100 meters to 2 km. Barge measurement involved deploying a pair of hydrophones approximately 10 and 20 ft below the surface. Measurements were made as a series 75 second (s) records with approximately 10 s between records using an IOTech WaveBook/516E data acquisition system. Boat measurements were made using a similar pair of hydrophones at similar depths and captured as a series of 60 s records without breaks using a Measurement Computing LGR-5320 data acquisition system. Specification sheets for the equipment can be found in the appendices of the Acoustic Monitoring Plan.

Barge Data Acquisition Component Summary

- Hydrophones: 2 X Reson TC4013
- Preamplifiers: 2 X low-noise 1-100 kHz battery operated preamplifier (EPAC)
- Data Acquisition: IOTech Wavebook/516E to laptop computer over Ethernet

Boat Data Acquisition Component Summary

- Hydrophones: 2 x Reson TC4013
- Preamplifiers (stage 1): 2 X low-noise 1-100 kHz battery operated preamplifier (EPAC)
- Preamplifiers (stage 2): SSI custom low-noise preamplifier
- Data Acquisition: Measurement Computing LGR-5320 (2-channels @ 100kHz/channel sampling rate)

Prior to every deployment of the barge and boat measurement systems, the hydrophone sensitivity was calibrated through the entire system using a pistonphone recommended by the hydrophone manufacturer. A calibration was also performed at the end of each deployment. This ensured that there was no degradation in the performance of the hydrophones or acquisition system.

3.3 IN-WATER MITIGATION EQUIPMENT

Figure 6 shows the mitigation equipment used during impact hammer activity. For the first impact pile, a single, ¾" piece of plywood was used. Subsequent drives used two layers for 1-½" total.

Figure 6: Plywood sound mitigation measures for the diesel impact hammer after pile driving. The first file used ¾" thick plywood (right photo). Subsequent impact drives used two layers for 1-½" total (shown on left and center in photo in various stages of assembly).

4.0 IN-AIR MONITORING RESULTS

In-air noise data was collected on Goose Island and the Lubec shore for impact hammer and vibratory hammer activity. The Goose Island monitoring equipment was located at a distance approximately 1,500 ft northeast of the pile driving. The monitoring at the Lubec come-ashore location was approximately 3,250 ft southwest of the pile driving. The ability to detect the activity with in-air measurements depended largely on the level of background noise at the time.

Figure 7 shows the measurements on Goose Island during the first impact hammer activity on March 25th. Here the hammer noise level is readily observable over the ambient sound level by approximately 10 dB. Figure 8 shows the measurements on the Lubec shore during later impact hammer activity March 31st where the hammer sound was not observable.

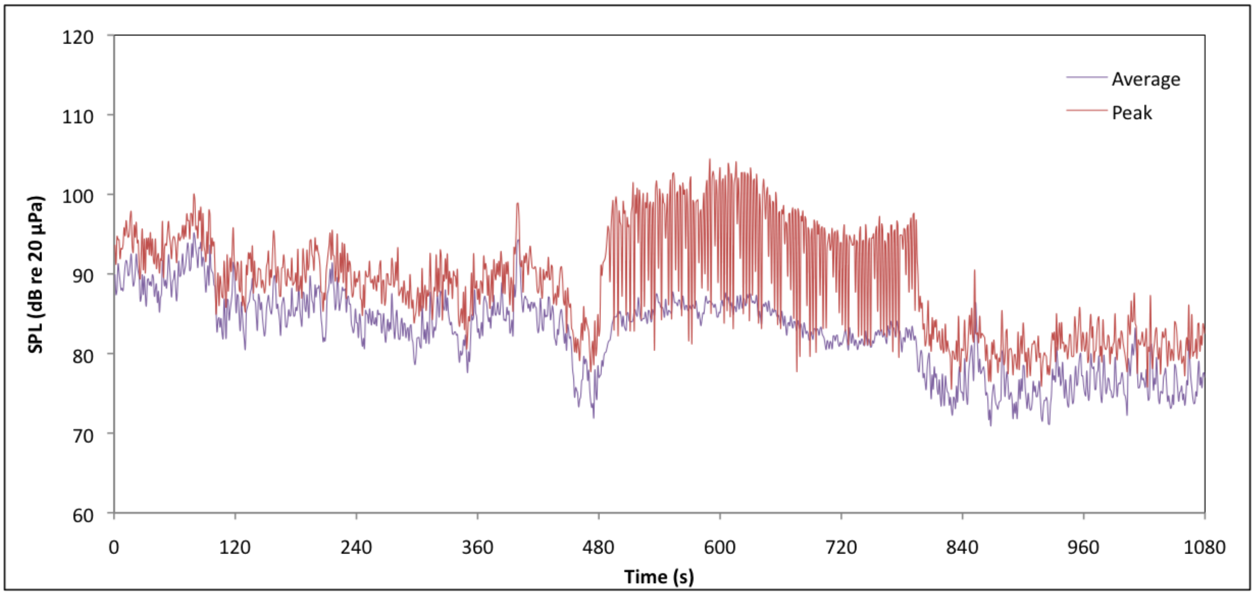


Figure 7: In-air measurements on Goose Island during impact hammer activity, March 25th starting at approximately 2:07 pm.

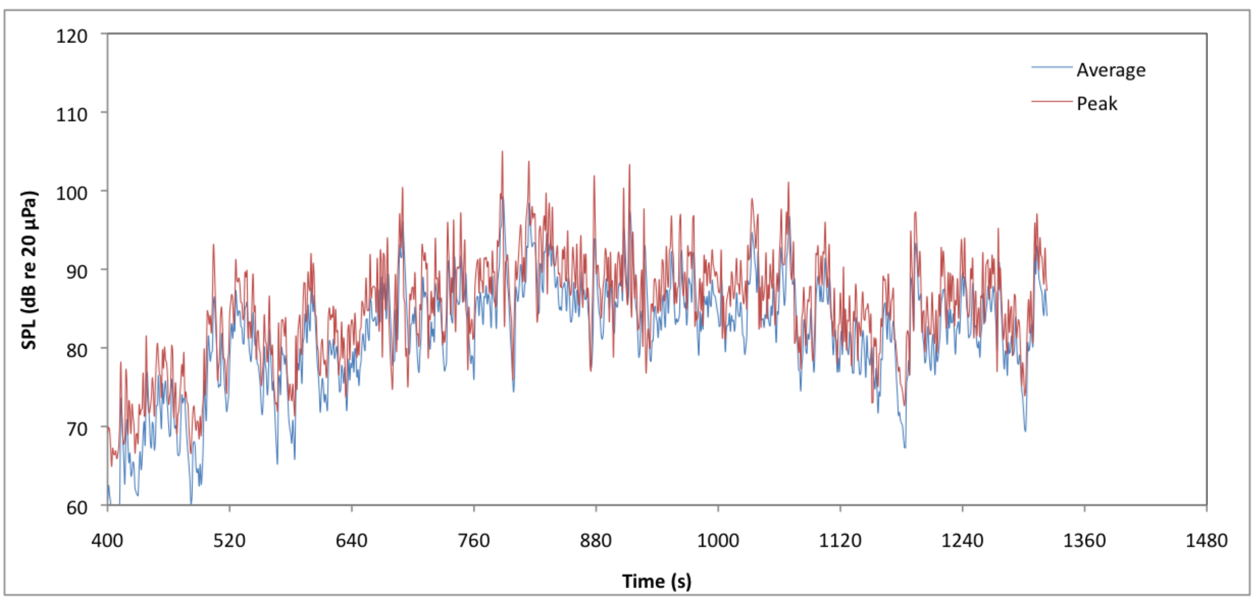


Figure 8: In- air measurements at the Lubec shore station location during impact hammer activity, March 31st starting at approximately 6:00 pm.

Figure 9 shows measurements on Goose Island and Figure 10 shows measurements on the Lubec shore during vibratory activity. During the pile driving associated with the Lubec measurement, the ambient noise was much lower (likely due to lower wind speeds) and noise due to the pile driving is up to 5 dB higher between 10 and 15 minutes of the displayed data record. The vibratory hammer was not detectable over the ambient noise levels on Goose Island during the collection times.

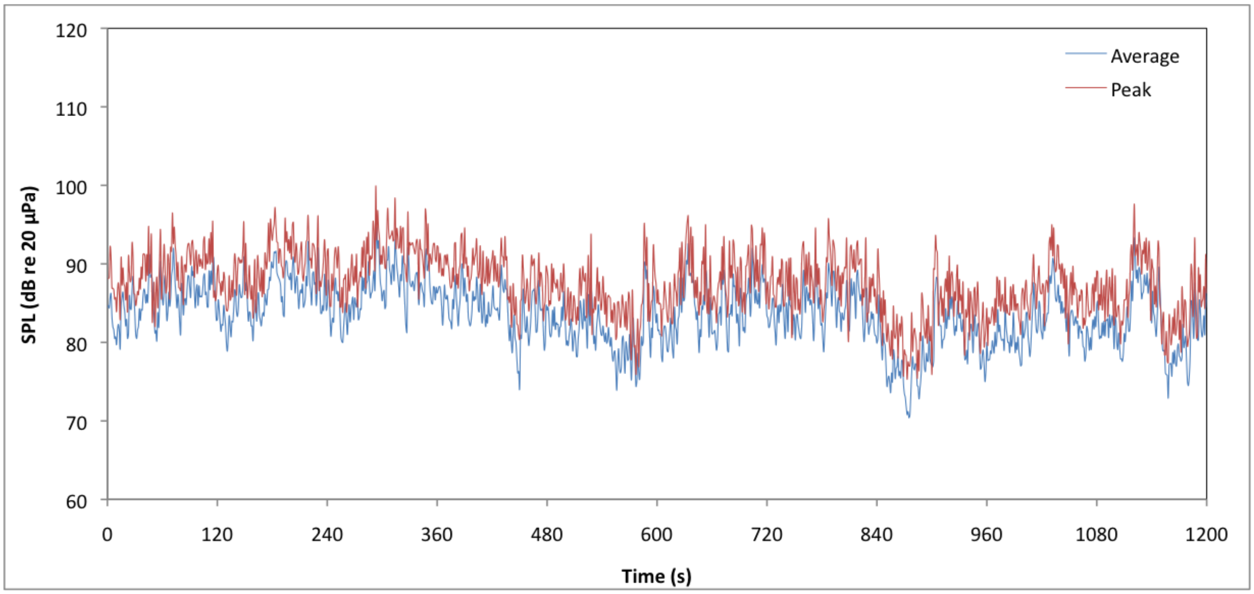


Figure 9: In-air measurements on Goose Island during vibratory hammer activity, March 29th starting at approximately 10:25am.

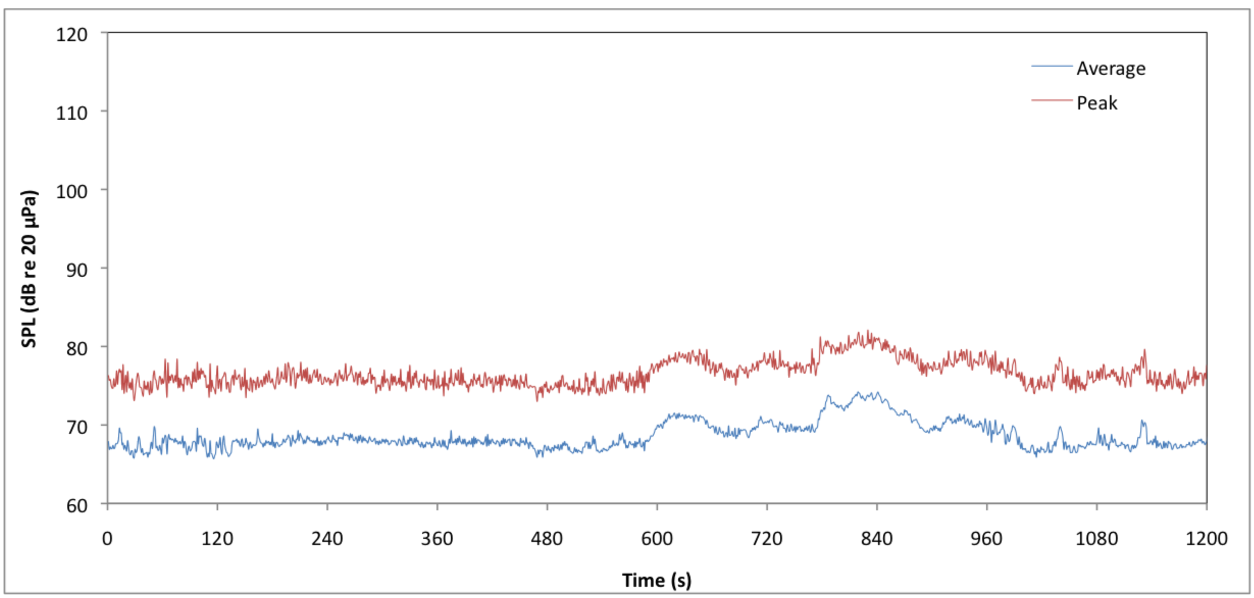


Figure 10: In- air measurements at the Lubec shore station location during vibratory hammer activity, April 1st starting at approximately 6:25am.

5.0 IN-WATER MONITORING RESULTS

5.1 BARGE MEASUREMENTS (NEAR-SOURCE)

Near-source measurements are intended to determine the peak absolute pressure level and the sound exposure level. Peak absolute pressure is determined by evaluating the measured pressure across all time records during pile-driving activity. For impact hammer activity, the sound exposure level is calculated in a window containing 90% of the relative cumulative energy (SEL_{90}) for various individual impacts to determine a nominal value. For the vibratory hammer, the sound exposure level is calculated as a function of time based on the full duration of the activity.

5.1.1 IMPACT HAMMER

Figure 11 shows the time series of the measured pressure (linear scale) for a subset of the impact hammer activity for pile 8. This is the raw data collected approximately 20 meters from the pile. All subsequent plots of the impact hammer data, and all analysis are performed using a correction for spreading losses to determine the sound level at 10 meters (whether in linear or decibel scale).

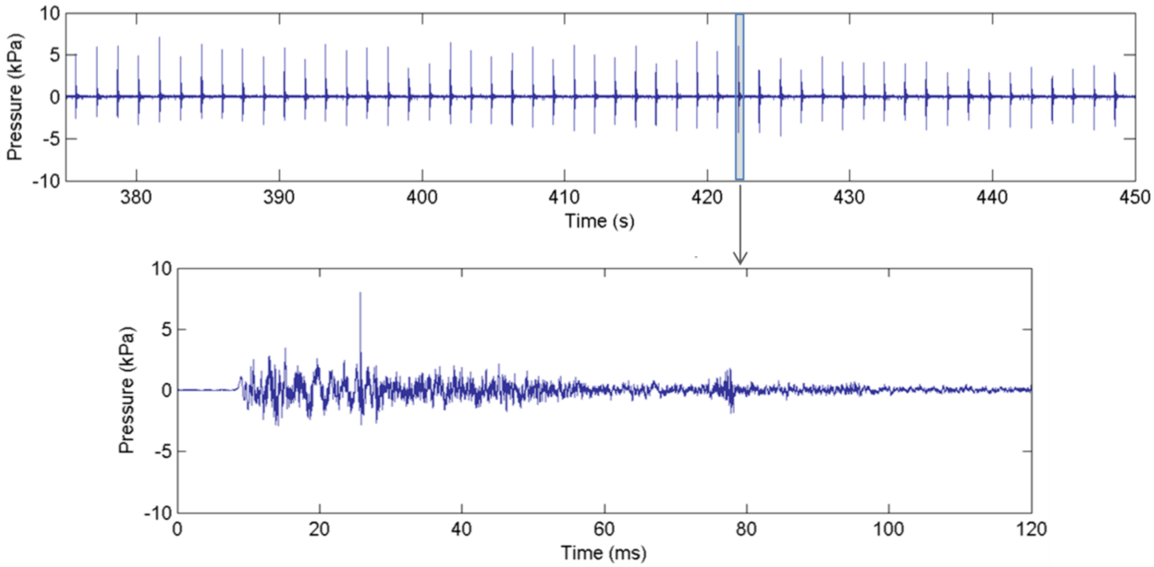


Figure 11: Example impact hammer time series data (not corrected for 10 meter range). The upper plot shows a series of discrete impact hammer "hits". The bottom plot shows an expanded view of a single hit (highlighted in top plot), for pile 8 on March 25th.

Given the nature of the source (the pile and follower), the water depth, and the range between the pile and hydrophones, cylindrical spreading is assumed when correcting for the relatively small (less than 10 meters in all cases, typically 5 meters) variation in the actual pile to hydrophone distance from 10 meters. In general this results in a correction on the order of 3 dB re 1µPa or less.

Figure 12 shows the peak absolute pressure as a function of recorded time for the impact hammer activity on pile 8. Note that recorded time indicates the sum of the 75 second data records collected over the course of the activity without the approximately 10 second intervals between each record.

Note that for these barge-data figures, the data from all records have been plotted consecutively (without gaps for these ~10 second intervals between records). Therefore it is important to note that the elapsed time seen in these plots between the start and end of activity will generally be 10-15% less than the noted time for the activity as a whole. This must be accounted for when comparing the apparent elapsed time in these figures with the known real-time duration of each hammer activity.

The pile 8 measurement contained the highest peak pressure value of all recorded impact hammer data with a value of 202 dB re 1µPa for a single hit. Across more than 200 hits between multiple piles, the average peak pressure of the individual hits was less than 200 dB re 1µPa.

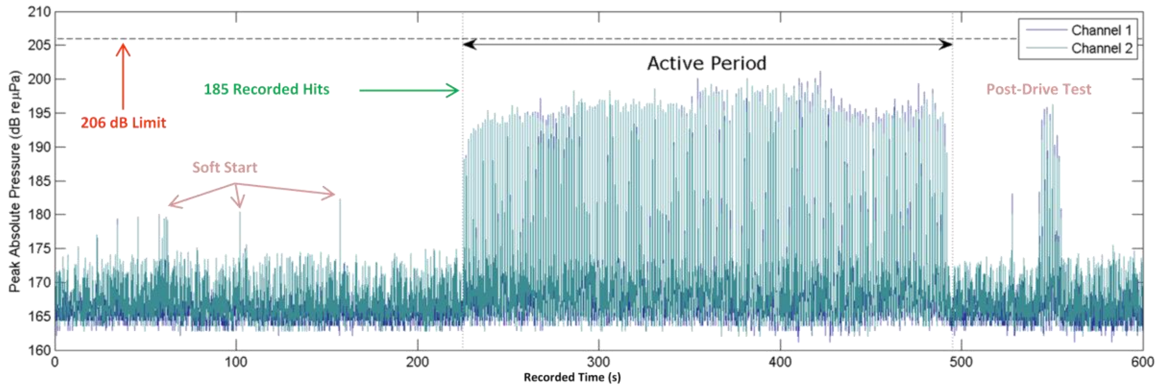


Figure 12: Peak absolute pressure as a function of recorded time for impact hammer activity of pile 8 on March 25th, including soft-start. The peak amplitudes of the impacts never reach or exceed to the 206 dB peak absolute pressure limit.

The SEL_{90} value for the 202 dB impact is 168 dB re $1\mu Pa^2s$ and the associated time series, relative cumulative energy, and window boundaries are shown in Figure 13. This value is representative of the impact hammer hits which were consistently well below the 187 dB SEL limit.

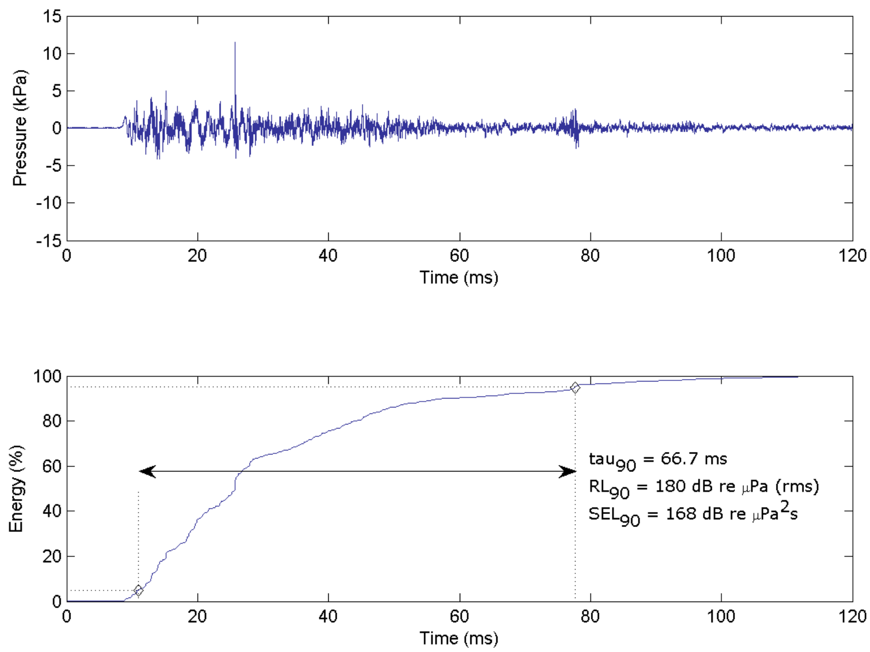


Figure 13: Sound exposure level in a window containing 90% of the energy of the transient impact (SEL_{90}) for the strongest peak (highest peak absolute pressure) of pile 8 on March 25th. The time series data in the top plot has been corrected to the pressure at 10 meters based on the measurement range and spreading loss. Note that the RMS_{90} pressure at nominally 10 meters is 180 dB re 1 µPa, or the Level A harassment level for transients.

5.1.2 Vibratory Hammer

Figure 14 shows the time series data for ambient data prior to vibratory hammer activity, the vibratory hammer at 50% power during a soft-start process, and at 100% power. Unlike the impact hammer, it is a continuous source after the soft-start process and any breaks at 100% power.

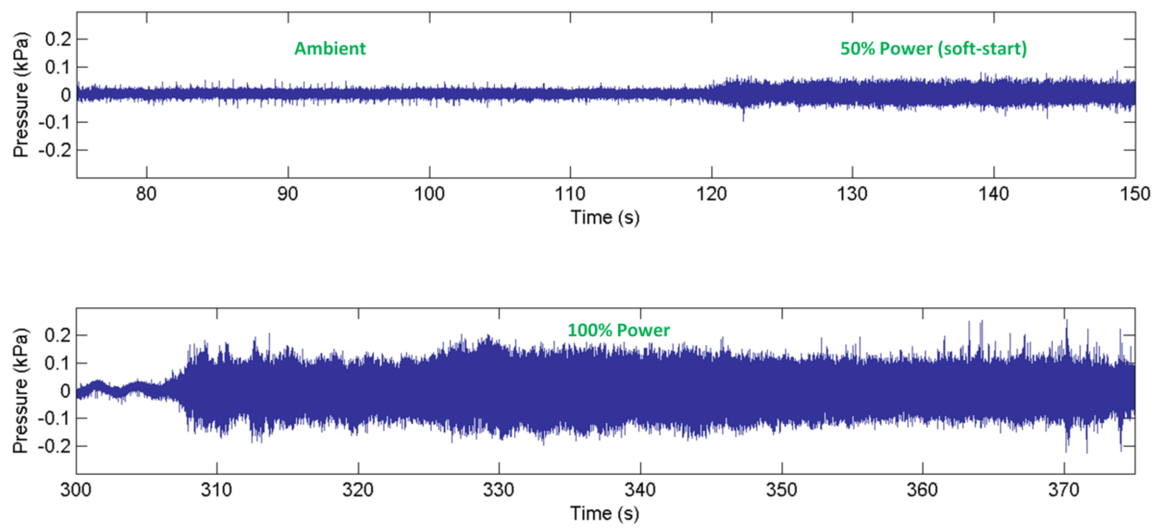


Figure 14: Time series data for vibratory hammer during ambient, soft start (~50% power) and full power periods for pile 1 on April 1st.

Several pile-driving issues were noted during the initial pile driving activity that contributed to noise levels higher than found with later piles. Issues noted with the first pile driven (skirt 8) included the attachment between the vibratory head and pile being looser than expected. This pile was not driven to refusal using the vibratory driver as a result. During vibratory pile driving over the next several piles some unexpected behavior was also observed. Ramping from 50% of hammer power to 100% hammer power led to a loss of pressure in the pile gripper attachment. On April 1st, during vibratory pile driving at skirt 7 the hammer grippers became disconnected from the pile. An examination of the vibratory hammer hydraulics system by a mechanic on April 2nd showed an air bubble in the hydraulic lines, which was vented by the mechanic. From this point forwards the pile gripper provided full hydraulic pressure at all times and no further issues were noted when using the vibratory pile driver.

In addition, during vibratory and impact pile driving the pile was connected to the follower using a bolted joint. For the first pile driven using the vibratory hammer the nuts on the bolts connecting the pile and the follower vibrated loose and the connection between the pile and follower loosened. The lack of connectivity between the pile and the follower caused the follower to cant over relative to the pile. These two factors reduced the efficiency with which energy was transferred from the vibratory hammer to the pile. The lack of connectivity between the pile and the follower was most likely a contributing factor in the increase of RMS peak pressures detected.

For all later piles driven with either the vibratory or impact hammers the bolted connection between the pile and pile follower was tightened to a higher torque level, and this addressed the joint separation issues. Figure 15 and Figure 16 illustrate what is likely the difference between well connected and driven piles and two initial piles-those where issues with the connections between the hammer and the follower as well as the follower and pile were identified and later corrected.

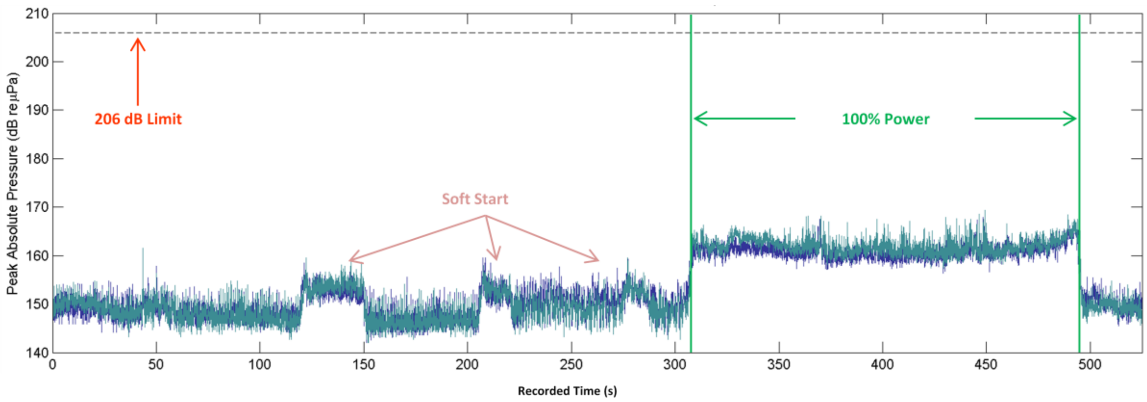


Figure 15: Peak absolute pressure as a function of recorded time for vibratory hammer activity after improving connections between the hammer and follower and the follower and pile. Under normal conditions the vibratory hammer showed fairly consistent output at 100% power. Pile 1, April 1st.

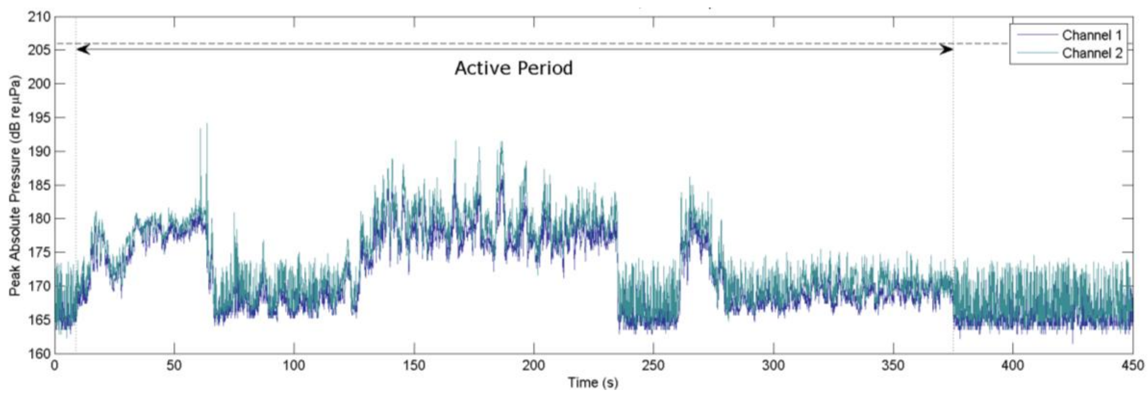


Figure 16: Peak absolute pressure as a function of recorded time for vibratory hammer activity of pile 8. For this first pile a number of issues with connectivity of the hammer to the follower and follower to the pile were identified. As a result, the pressure levels were higher overall, were not as consistent in level, and included occasional peaks that were higher than any other level recorded during vibratory operations. Pile 8, March 24th.

Peak Absolute Pressure

In all cases, the peak absolute pressure fell far below the near-source limit of 206 dB re 1µPa for the vibratory hammer.

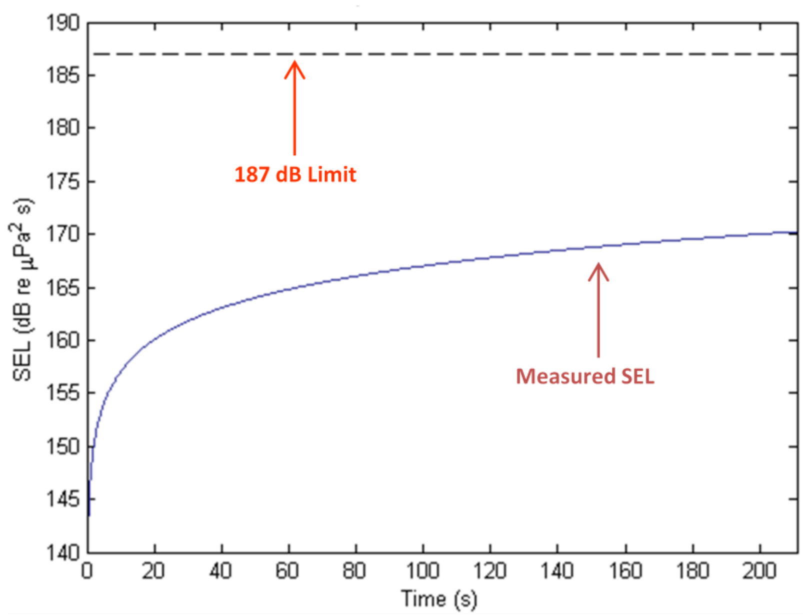


Figure 17: Sound exposure level as a function of time for pile 7, April 1st. This example was typical for the last 3 piles monitored.

Sound Exposure Level

The last three piles monitored did not exceed the sound exposure limit, and in fact would not have for vibratory activity lasting several times longer (Figure 17). However, the first two piles (piles 8 and 5) did exceed the SEL limit by approximately 25%. The results for pile 8 can be seen in Figure 18. In this case the SEL limit was reached after 5 minutes and 16 seconds of activity. The cause of the higher noise levels associated with these piles was most likely the improper connection between the vibratory hammer head and the pile and was rectified for further operations.

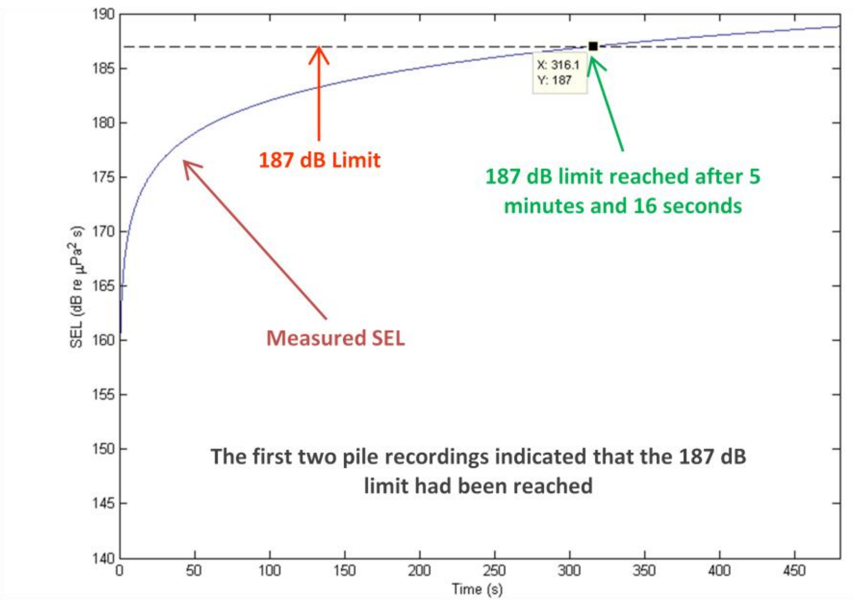


Figure 18: Sound exposure level as a function of time for pile 8, March 24th. Poor connections between the hammer and follower and the follower and pile led to higher pressure levels and associated sound exposure levels.

5.1.3 Vibratory Hammer Mitigation

During initial pile driving where hammer connections issues with the follower and pile were documented, hydroacoustic monitoring indicated sound exposure levels that exceeded thresholds. The sound exposure level is a function of the rms sound pressure level and the duration of the activity. In the case of the first two piles, the limit was exceeded after approximately 5 minutes of activity. Therefore ORPC tested a mitigation strategy to prevent exceedance during subsequent pile driving.

To minimize the likelihood of exceeding any sound exposure level thresholds for injury during any restricted periods, vibratory activity could be limited to interval of 4 minutes in duration before requiring a break in activity for a minimum of 1 minute. As seen in Figure 19, limiting activity to 4 minutes is a conservative approach that would limit sound exposure levels to 50% of the acceptable limit, and therefore allow for rms pressure levels 25% than any recorded value (even during the “worst” piles) and still not exceed the threshold.

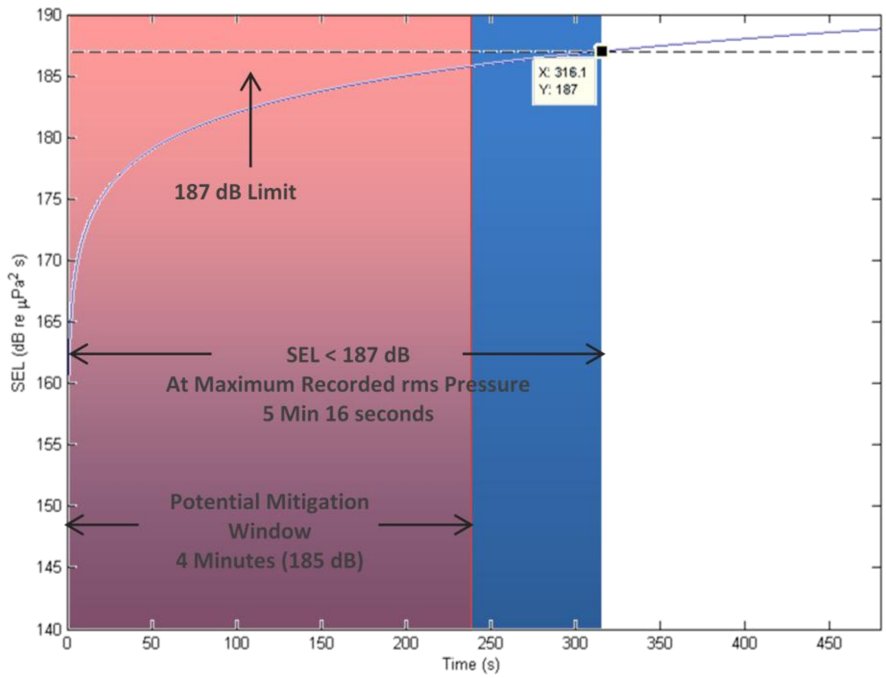


Figure 19: Sound exposure level as a function of time and associated time windows where the limit was exceeded in the first two piles and for the proposed mitigation strategy.

ORPC and its contractor implemented the 4-minute duration mitigation measure for pile 5 on March 29th to demonstrate that the strategy was effective in reducing the SEL. The results of the demonstration were successful in maintaining an SEL below the threshold.

In addition to the mitigation strategy, the Contractor made modifications to the pile assembly (hammer, follower, and pile) to tighten connections and prevent flexibility. These modifications proved vibratory hammer operation could continue for durations longer than 4 minutes without exceeding the SEL threshold for injury. Moving forward ORPC will incorporate the hammer assembly best management practices in order to prevent excessive noise levels and the need for 4-minute restrictive drive operations.

5.2 Boat Measurements

To identify the Level A and B isopleths for marine mammal harassment, receive level measurements were made at distances ranging from (nominally) 100 m to 2 km from the pile driving activity. The configuration (as listed in Section 3.2.2) was very similar to the near-source measurements on the pile-driving barge. The primary differences were additional amplification components to compensate for greater transmission loss and continuous data acquisition that did not require 10 second breaks between data records.

Table 3 lists the boat measurements with the associated range, hammer type, receive level measured at 10 meters with the barge measurement system, and a nominal source level based on the 10 meter measurement. These measurements, in addition to the near-source measurements, provide direct measurements for the vibratory and impact hammer Level A and B harassment isopleths (with the exception of Pile 9).

Table 3: Measured receive level as a function of range with the associated barge measurement at 10 meters (where applicable) and a nominal source level assuming cylindrical spreading losses between the source and 10 meters.

Pile	Type	Range (m)	Receive Level (dB re 1 µPa rms)	Receive Level @ 10 m (dB re 1 µPa rms)	Source Level (dB re 1 µPa rms)
5	Vibratory	100	150	160	170
1	Vibratory	500	120	147	157
7	Vibratory	1000	116	147	157
9	Vibratory	2000	104	Not measured	Not measured
8	Impact	100	169	180	190

Based on the near-source measurements in Section 5.1, it can be determined that the vibratory Level A harassment isopleth range is less than 10 meters. The rms pressure levels for the vibratory hammer do not exceed the Level A threshold for a continuous source. Similarly, near-source measurements of the impact hammer show that the Level A harassment isopleths range is approximately 10 meters based on the approximately 190 dB re 1 µPa rms source level.

As shown in

Table 3, the vibratory Level B harassment isopleths range is approximately 500 meters. This was observed for pile 1 and is consistent in the values measured from a distance of 1 km and 2 km that show approximately a 6 dB loss as the range doubles, consistent with expected spreading losses.

Table 4: Transmission loss based on various models for spreading loss using source levels from Table 3. The mixed model assumes a spreading loss of 15log(r). The fitted model assumes a transition from primarily cylindrical spreading to primarily spherical losses at 75 meters and provides slightly better overall agreement with the data.

	Receive Level for Transmission Loss Model				
Pile	Cylindrical	Spherical	Mixed Model	Fitted Model	Measured
5-V	150	130	140	149	150
1-V	131	104	117	122	120
7-V	127	97	112	116	116
9-V†	124	91	108	110	104

† Assumes the same source level as 1-V and 7-V from the previous day in a similar location.

8-I	170	150	160	169	169

For the final harassment isopleths range (Level B impact/transient), the measurements were used to determine an approximate model for the transmission loss as a function of range. From this transmission loss as a function of range, the source level for the impact hammer for pile 8, and the measured pressure level at 100 m during impact hammer activity for pile 8 the Level B range can be extrapolated.

Table 4 shows the relative agreement between various models for spreading loss using source levels from

Table 3. Cylindrical spreading uses a loss term of 10log(r) and spherical uses 20log(r). The mixed model assumes a combination of cylindrical and spherical in an unknown combination by using 15log(r). Finally, the fitted model assumes a transition from primarily cylindrical spreading (10log(r)) to primarily spherical losses (20log(r)) at 75 meters and provides slightly better overall agreement with the data. Using the fitted model, the Level B harassment isopleth range is approximately 275 meters from the source.

6.0 Summary of Findings

6.1 Air Monitoring Summary

In-air measurements at the Lubec come-ashore location and on Goose Island indicated that the pile driving activity was detectable for both vibratory and impact hammer sources based on the ambient noise level during the pile driving. As both the pile driving noise levels and ambient noise levels were variable, the results varied from pile activity being completely masked by ambient noise to levels 5 – 10 dB above ambient.

6.2 Near-Source Summary

Table 5 summarizes the near-source measurements, associated pile activity and relevant noise threshold levels (peak absolute pressure level and sound exposure level). The measurements show that ORPC did not exceed either noise threshold during the observed impact hammer activity and did not exceed either threshold during the majority of the vibratory hammer activity. For the two initial vibratory hammer piles that exceeded the SEL limit, the cause is attributable to an improper connection between the vibratory hammer and the pile, which was addressed in later vibratory pile driving events. Upon correction of the connection issue the SEL for vibratory pile driving was within allowable limits.

Table 5: Summary of pile driving activity including hammer type, duration, drive depth and near-source receive levels (peak absolute pressure and sound exposure level) at 10 m.

Pile	Type	Drive Distance (vertical ft)	Duration (min)	Peak Pressure (206 dB re 1 µPa Threshold for Injury)	SEL re 1 $\mu Pa^2 s$ (187 dB Threshold for Injury)
8	Vibratory	32	7:30	195	188 (25% over limit)
8	Impact	15	5:17	202	168
5	Vibratory	38	8:09‡	184	188 (25% over limit)
3	Vibratory	36	8:30†	177	180
3	Impact	0	3:00	200	170
5	Impact	0	1:00	198	169
1	Vibratory	29	7:31†	170	171
7	Vibratory	48.5	13:30†	171	178

6.3 Isopleth Summary

Table 6 summarizes the isopleth ranges for Level A and B harassment using the vibratory hammer (continuous source) and impact hammer (transient source) based on direct measurements and the measured transmission loss. These values show that measured Level A and B ranges were significantly closer to the pile driving than the conservative ranges included in the Acoustic and Marine Mammal Observation Plans.

‡ Includes soft start period of 2 minutes at 50% energy

† Includes soft start period of 4 minutes at 0% (off) and 50% energy

Table 6: Summary of isopleth ranges based on near-source and far-field measurements for Level and B harassment of vibratory and impact hammer types.

Type	Level A range (m) (Vibratory 180 dB re 1 µPa rms) (Impact 180 dB re 1 µPa rms)	Level B range (m) (Vibratory 120 dB re 1 µPa rms) (Impact 160 dB re 1 µPa rms)
Vibratory	N/A	500
Impact	10	275

Figure 20: Level B harassment isopleth for vibratory hammer.

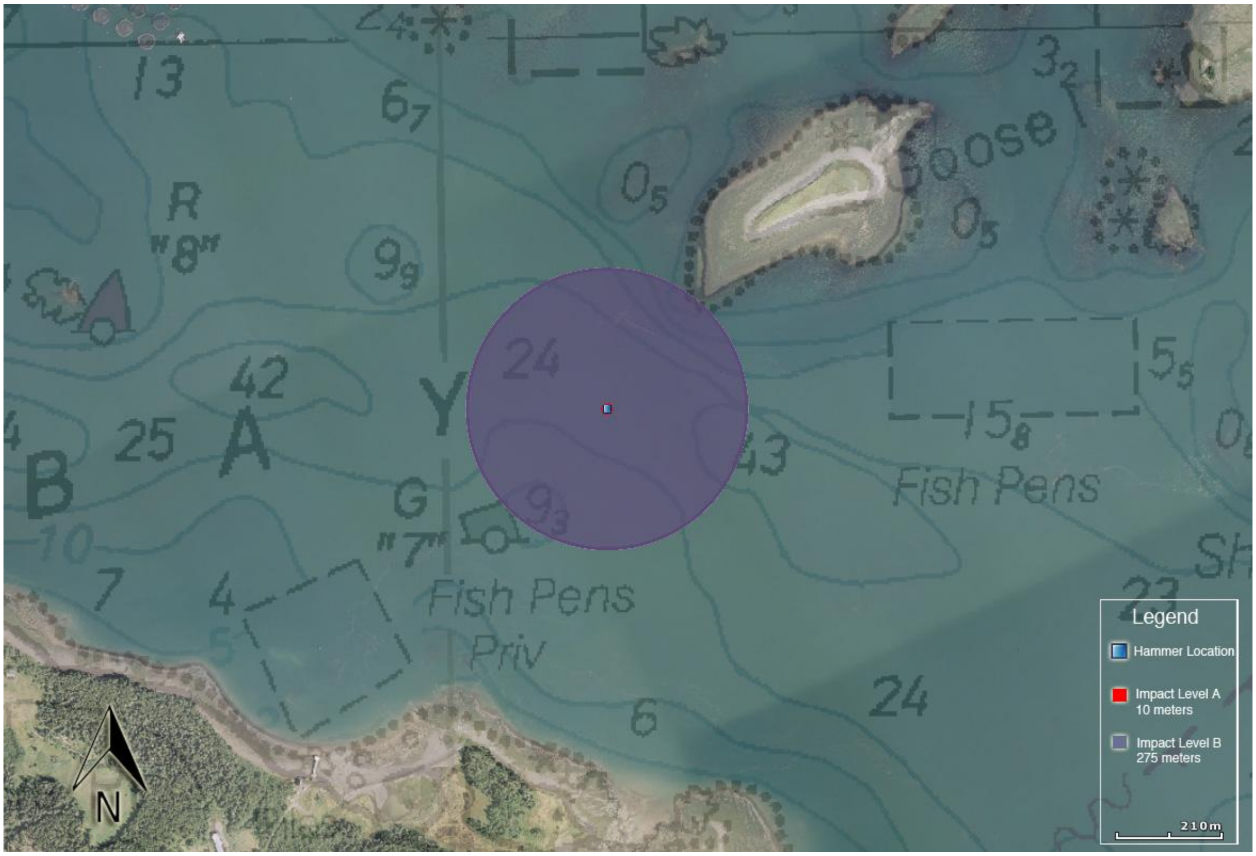


Figure 21: Level A and B harassment isopleths for diesel impact hammer.

Appendix F

Marine Mammal Recorder Sheets

ORPC Marine Mammal Sighting Log
CBTEP Phase I Pile Driving
March 24 to April 4, 2012

Date	ORPC Ref #	Time	Sighting Sequence (for figure)	After Pile Driving?	Within Level B?	Description	Species	No.	Behavior	Vessel Position - degrees latitude	Vessel Position - minutes latitude	Vessel Position - degrees longitude	Vessel Position - minutes longitude	Bearing to animal (degrees)	Distance to animal (feet)	Animal heading (degrees)
3/24/2012	pile #6 sleeve #8	12:24	1		Y	sighting	harbor seal	1		44	54.569	67	2.580	315	300	n/a
3/24/2012	pile #6 sleeve #8	12:30	2		Y	sighting	harbor seal	1		44	54.569	67	2.580	120	200	n/a
3/24/2012	pile #6 sleeve #8	12:34	3		Y	sighting	harbor seal	1		44	54.569	67	2.580	310	125	n/a
3/24/2012	pile #6 sleeve #8	12:46	4		Y	sighting	harbor seal	1		44	54.569	67	2.580	210	85	East 900
3/24/2012	pile #6 sleeve #8	12:49	5		Y	sighting	harbor seal	1		44	54.569	67	2.580	210	150	n/a
3/24/2012	pile #6 sleeve #8	12:56	6		Y	sighting	harbor seal	1		44	54.569	67	2.580	220	160	n/a
3/24/2012	pile #6 sleeve #8	13:06	7		Y	sighting	harbor seal	1		44	54.569	67	2.580	60	200	n/a
3/24/2012	pile #6 sleeve #8	13:12	8		Y	sighting	harbor seal	1		44	54.569	67	2.580	95	250	n/a
3/24/2012	pile #6 sleeve #8	13:26	9		Y	sighting	harbor seal	1		44	54.569	67	2.580	120	600	n/a
3/24/2012	pile #6 sleeve #8	13:46	10		Y	sighting	harbor seal	1		44	54.569	67	2.580	240	350	180
3/24/2012	pile #6 sleeve #8	14:02	11	Y	Y	sighting	harbor seal	1		44	54.569	67	2.580	90	75	stationary
3/25/2012	pile #6 sleeve #8	12:12	1		Y	sighting	harbor seal	1	swimming	44	54.546	67	2.580	210	400	East 900
3/25/2012	pile #6 sleeve #8	12:30*	2		N	sighting	harbor seal	1	swimming	44	54.546	67	2.580	150	750	Northwest
3/25/2012	pile #6 sleeve #8	12:46	3		N	sighting	harbor seal	1	n/a	44	54.546	67	2.580	110	300	n/a
3/25/2012	pile #6 sleeve #8	12:54	4		N	sighting	harbor seal	1	n/a	44	54.546	67	2.580	124	250	155
3/25/2012	pile #6 sleeve #8	13:24	5		N	sighting	harbor seal	1	n/a	44	54.546	67	2.580	132	250	n/a
3/25/2012	pile #6 sleeve #8	14:05	6		N	sighting	harbor seal	1	n/a	44	54.546	67	2.580	140	300	170
3/25/2012	pile #6 sleeve #8	14:10	7		Y	sighting	harbor seal	1	n/a	44	54.546	67	2.580	250	250	n/a
4/2/2012	sleeve #9	6:52	1		Y	sighting	harbor seal	1	n/a	44	54.555	67	2.604	210	200	300
4/2/2012	sleeve #9	7:07	2		Y	sighting	harbor seal	1	bottling	44	54.652	67	2.978	127	1650	n/a
4/2/2012	sleeve #9	7:08	3		Y	sighting	harbor seal	1	n/a	44	54.555	67	2.604	265	100	30
4/2/2012	sleeve #9	7:20	4		Y	sighting	harbor seal	1	n/a	44	54.555	67	2.604	130	150	n/a
4/2/2012	sleeve #9	7:26	5		Y	sighting	harbor seal	1	bottling	44	54.652	67	2.978	250	298	270
4/2/2012	sleeve #9	7:39	6		Y	sighting	harbor seal	1	n/a	44	54.555	67	2.604	264	50	n/a
4/2/2012	sleeve #9	8:11	7	Y	Y	sighting	harbor seal	1	bottling	44	54.652	67	2.978	315	525	46
4/2/2012	sleeve #9	8:18	8	Y	Y	sighting	harbor seal	1	bottling	44	54.652	67	2.978	90	470	n/a
4/4/2012	sleeve #2	8:38	1		Y	sighting	harbor seal	1	bottling	44	54.564	67	2.580	55	200	
4/4/2012	sleeve #2	8:45*	2		Y	sighting	harbor seal	1	bottling	44	54.564	67	2.580	35	50	North
4/4/2012	sleeve #2	8:54*	3		Y	sighting	harbor seal	1	bottling	44	54.564	67	2.580	95	200	North
4/4/2012	sleeve #2	9:00	4		N	sighting	harbor seal	1	bottling	44	54.564	67	2.580	110	900	
4/4/2012	sleeve #2	9:27	5		Y	sighting	harbor seal	1	bottling	44	54.564	67	2.580	230	30	West
4/4/2012	sleeve #2	9:39	6		Y	sighting	harbor seal	1	bottling	44	54.564	67	2.580	180	300	n/a
4/4/2012	sleeve #2	9:46	7		Y	sighting	harbor seal	1	bottling	44	54.564	67	2.580	110	400	n/a
4/4/2012	sleeve #2	10:25	8	Y	Y	sighting	harbor seal	1	normal	44	54.656	67	3.000	200	200	150

*Time recorded from notes in N. Johnson field book

Operation Notes - Sightings occuring during "active" observations (30 min prior to 30 min following event) colored orange above

		30 min prior	Start hammer	Stop hammer	30 min after
3/24/2012	Vibratory	13:19	13:49	13:57	14:27
3/25/2012	Impact	13:46	14:16	14:21	14:51
4/2/2012	Vibratory	7:09	7:39	7:50	8:20
4/4/2012	Vibratory	9:23	9:53	10:00	10:30

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3 /20/ 12
(dd/mm/yyyy)

ORPC Reference # BSF

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Miss Behavin' (**downstream vessel** circled) / **upstream vessel** (circle one)

Observer Vessel location (lat/long): N___° ___.___ x W ___° ___.___ *Vessel not moored, located approx. 1,000 ft. SE of site.

Observer names: Lea Leddy (inward) (500 ft exclusion zone) Steve Irwin (outward) (Out to 1 nm)

Recorder's name: Cecil Cates (vessel captain and radio operator)

Time (24 hrs): **Start observation** 15:32 **End observation** 17:45

Start construction 16:47 **End construction** 17:17

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: 90 East ° 2 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: **clear** (circled) haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: **<10%** (circled) 10-50% 50-90% >90% (circle one)

Beaufort Sea State: 0 **1** (circled) 2 3 4 5 (circle one)

Comments: 16:05 Hazing fog bank enveloping Grand Manan
17:16 wind picking up

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form)________

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/20/2012
(dd/mm/yyyy)

ORPC Reference # BSF

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Lady H. **downstream vessel** / **upstream vessel** (circled) (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 622 x **W** 67 ° 02 . 928

Observer names: Nathan Spear (inward) (500 ft exclusion zone) Darius Neptune (outward) (Out to 1 nm)

Recorder's name: James Smith (vessel captain and radio operator)

Time (24 hrs): **Start observation** 15:42 **End observation** 17:47

Start construction 16:43 **End construction** 17:17

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: SE ° 5-10 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** (circled) **haze** **cloudy** (circled) **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** **10-50%** (circled) **50-90%** **>90%** (circle one)

Beaufort Sea State: **0** **1** (circled) **2** **3** **4** **5** (circle one)

Comments:

Photographs or video collected: **Yes** **No** (circled) (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circled) (circle one)

Which species? (complete incident form) N/A

Recorder's signature at end of event: James E. Smith

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Land
Shackford Head

Date: 22/03/2012
(dd/mm/yyyy)

ORPC Reference # Pile #6 - Cancelled

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: n/a **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N**____ **°** ____.____ x **W** ____ **°** ____.____

Observer names: ________ (inward) (500 ft exclusion zone) ________ (outward) (Out to 1 nm)

Recorder's name: Alethea Leddy (vessel captain and radio operator)

Time (24 hrs):

Start observation 11:00 AM **End observation** 12:25 PM

Start construction n/a **End construction** n/a

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: SE ° 1 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: **clear** (circled) haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: **<10%** (circled) 10-50% 50-90% >90% (circle one)

Beaufort Sea State: **0** (circled) 1 2 3 4 5 (circle one)

Comments: Harbor Seal sighted approximately 2.25 mile from installation site. No pile driving occurred.

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form) ________

Recorder's signature at end of event: Alethea Leddy

Marine Mammal Observation Data
Data sheet

3/22/12

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
11:20am	Harbor Seal	Seal	1	feeding	West. Seal @ 300yds west of Red Bouy by Broad Cove	1/4-1/2 mile	South

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Land

Date: 3/22/2012
(dd/mm/yyyy)

ORPC Reference # Pile #6 - Cancelled

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Birch point **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N**____ **°** ____**.**____ x **W** ____ **°** ____**.**____

Observer names: Nathan Spear (inward) ________ (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: Nathan Spear (vessel captain and radio operator)

Time (24 hrs): **Start observation** 11:00 **End observation** 12:25

Start construction n/a **End construction** n/a

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: SW ° 5 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** (circled) **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** (circled) **10-50%** **50-90%** **>90%** (circle one)

Beaufort Sea State: **0** **1** (circled) **2** **3** **4** **5** (circle one)

Comments:________

Photographs or video collected: **Yes** **No** (circled) (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circled) (circle one)

Which species? (complete incident form)________

Recorder's signature at end of event: Nathan Spear (signature)

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/22/2012
(dd/mm/yyyy)

ORPC Reference # Pile #6 - Cancelled

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Miss Behavin' (**downstream vessel**) / **upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 567 **x W** 067 ° 02 . 591

Observer names: Royce ~~Ritchie~~ Richards (inward) (500 ft exclusion zone) Tess Ftorek (outward) (Out to 1 nm)

Recorder's name: Matt Lacasse (vessel captain and radio operator)

Time (24 hrs): **Start observation** 1100 **End observation** 1225

Start construction n/a **End construction** n/a

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: SE ° 1 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** (**unlimited**) (circle one)

Weather: (**clear**) **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: (**<10%**) **10-50%** **50-90%** **>90%** (circle one)

Beaufort Sea State: (**0**) **1** **2** **3** **4** **5** (circle one)

Comments:

Photographs or video collected: **Yes** (**No**) (circle one)

Were there incidents involving endangered or protected species? **Yes** (**No**) (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
1100	Start Watches						
1121	Sighting M.M.	H.S.		Swim/Feed	126° TN	2 KM	
1225	END M.M.O.						

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/22/17
(dd/mm/yyyy)

ORPC Reference # Pile #6 – Cancelled

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Lady H **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** 44 **°** 54 **.** 654 **x W** 67 **°** 02 **.** 954

Observer names: Steve irwin (inward) (500 ft exclusion zone) Jamie mitchell (outward) (Out to 1 nm)

Recorder's name: Darius neptune (vessel captain and radio operator)

Time (24 hrs): **Start observation** 1100 **End observation** 1225

Start construction n/a **End construction** n/a

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: Se ° 1 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** (circled) **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** (circled) **10-50%** **50-90%** **>90%** (circle one)

Beaufort Sea State: **0** (circled) **1** **2** **3** **4** **5** (circle one)

Comments:

Photographs or video collected: **Yes** **No** (circled) (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circled) (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: Darius Neptune

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 24/03/2012
(dd/mm/yyyy)

ORPC Reference # pile #6 sleeve 8

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: N/A **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N**_____ °_____ ._____ x **W** _____ °_____ ._____

Observer names: _____________ (inward) _____________ (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: Alethea Reddy-shackford (vessel captain and radio operator)

Time (24 hrs): **Start observation** 12:30 PM **End observation** 2:40 PM (14:40)

Start construction _____________ **End construction** _____________

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N ° 5 MPH (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** (circled) **haze** **cloudy** (circled) **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** **10-50%** (circled) **50-90%** **>90%** (circle one)

Beaufort Sea State: **0** **1** **2** (circled) **3** **4** **5** (circle one)

Comments: _____________

Photographs or video collected: **Yes** **No** (circled) (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circled) (circle one)

Which species? (complete incident form) _____________

Recorder's signature at end of event: Alethea Reddy

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/24/2012
(dd/mm/yyyy)

ORPC Reference # pile #6 / Sleeve #8

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Lady H **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 569 x **W** 067 ° 02 . 580

Observer names: Tess Fortek (inward) (500 ft exclusion zone) Steve Ervine (outward) (Out to 1 nm)

Recorder's name: Cecil Cates (vessel captain and radio operator)

Time (24 hrs):

Start observation 12:20 **End observation** 14:43

Start construction 13:49 **End construction** 14:06

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N 0° 5 (knots) Gusts to 10

Visibility: 0nm 1nm 2nm 3nm **unlimited** [circled] (circle one)

Weather: **clear** [circled] haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: **<10%** [circled] 10-50% 50-90% >90% (circle one)

Beaufort Sea State: 0 1 **2** [circled] + 3 4 5 (circle one)

Comments: Anchor location 44°54.564 N
067° 02.580
· Harbor Seal w/in 1nm radius during vibratory pile driving

Photographs or video collected: Yes No (circle one)

Were there incidents involving endangered or protected species? Yes **No** [circled] (circle one)

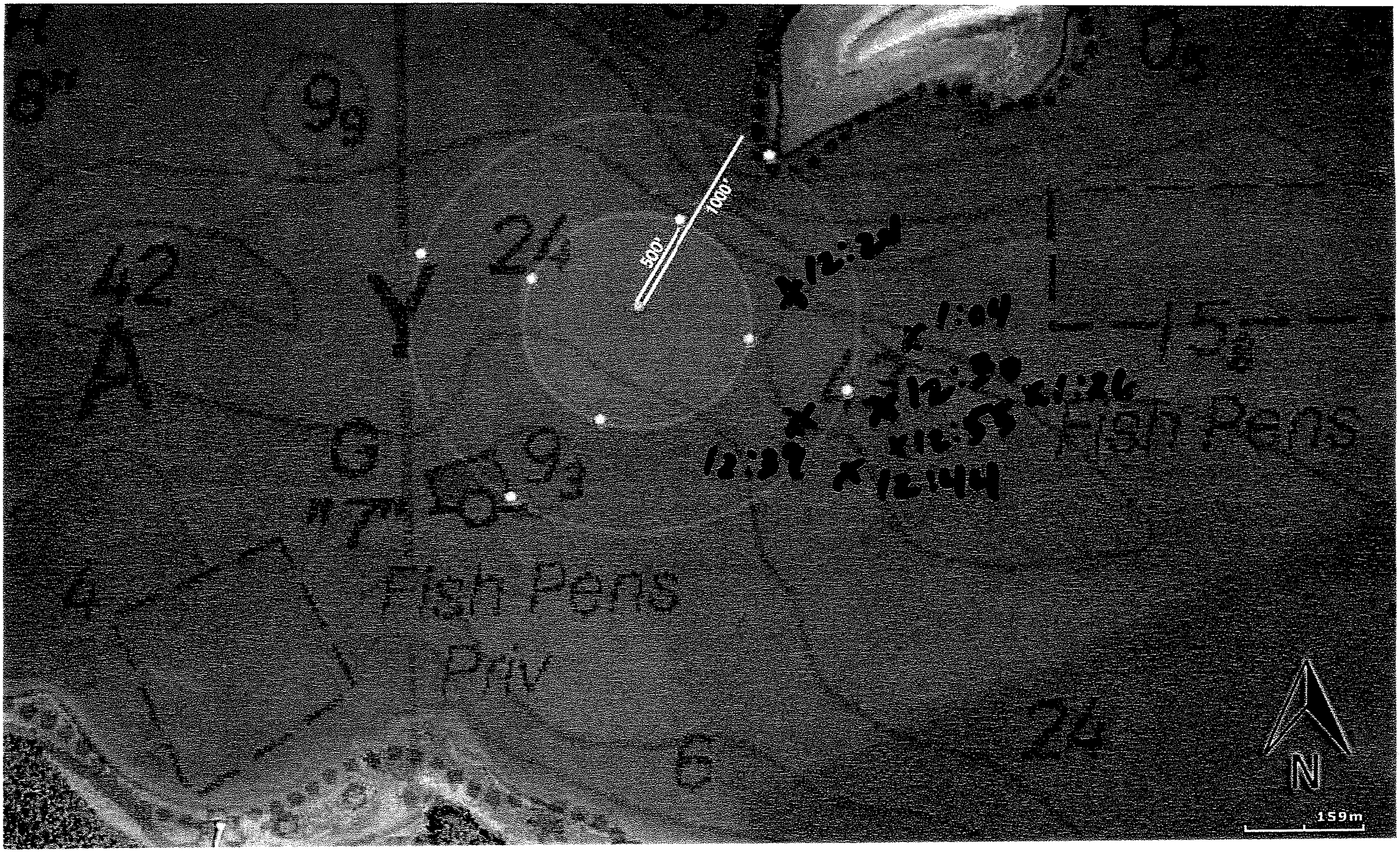
Which species? (complete incident form)

Recorder's signature at end of event: Cecil Cates

ORPC Cobscook Bay Protected Species Observer Program
Marine Mammal Observation Data
Data sheet

CE

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
12:24	Harbor Seal →		1				
12:30	"						
12:34	"	↓	↓	Hanging around	310°	125'	N/A
12:46	"			think same	210°	85'	East 90°
12:49	"				210°	150'	N/A
12:56	"				220°	160'	N/A
13:06	"				60°	200'	N/A
13:12	"				95°	250'	N/A
13:26	"				120°	600'	N/A
13:46	"				240°	350'	180°
14:02	"				90°	75'	stationary
	– See Chart –						



ORPC
OCEAN RENEWABLE POWER COMPANY

Vessel Name: Lady H

PSO: Tess Ftorek | Steve Irwin

Recorder/Captain: Cecil Cates

Vessel Location: N 44°54-569 W 067°02-58

Date: 3-24-2012

Time: 12:24-14:02

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3 / 24 / 2012
(dd/mm/yyyy)

ORPC Reference # pile #6 / sleeve #8

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Miss Behavin' **downstream vessel** / **upstream vessel** (circled) (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 657 x **W** 067 ° 03 . 008

Observer names: Darius Neptune (inward) (500 ft exclusion zone) Royce ~~Ritchie~~ Richards (outward) (Out to 1 nm)

Recorder's name: Matt Lacasse (vessel captain and radio operator)

Time (24 hrs): **Start observation** 1200 **End observation** 1440

Start construction 1349 **End construction** 1407

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N ° 5 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (underlined) (circle one)

Weather: **clear** (underlined) **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** (underlined) **10-50%** **50-90%** **>90%** (circle one)

Beaufort Sea State: **0** **1** **2** (circled) **3** **4** **5** (circle one)

Comments:

Photographs or video collected: **Yes** **No** (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program
Marine Mammal Observation Data
Data sheet

Page ______ of ______

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
1200	Start observation						
1224	Sighting (Lady H)	H.S.		Swimming	165°	1300	
1407	End const.						
1440	Depart						

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 24 / 03 / 2012
(dd/mm/yyyy)

ORPC Reference # pile # 6, # 8 hole

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: N/A **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): N ___° ___.___ x W ___° ___.___ — Birch Point - Pembroke

Observer names: — (inward) (500 ft exclusion zone) — (outward) (Out to 1 nm)

Recorder's name: Nathan Spear (vessel captain and radio operator)

Time (24 hrs): **Start observation** 12:30 **End observation** 14:40

Start construction 13:49 **End construction** 13:57

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N ° 5-10 (knots)

Visibility: (**0nm**) **1nm 2nm 3nm unlimited** (circle one)

Weather: (**clear**) **haze cloudy light rain rain snow patchy fog fog** (circle all that apply)

Cloud cover: (**<10%**) **10-50% 50-90% >90%** (circle one)

Beaufort Sea State: **0 1** (**2**) **3 4 5** (circle one)

Comments: Observations west to 2.5 mile range

Photographs or video collected: **Yes** (**No**) (circle one)

Were there incidents involving endangered or protected species? **Yes** (**No**) (circle one)

Which species? (complete incident form) ________

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/25/12
(dd/mm/yyyy)

ORPC Reference # Pile #6, #8 hole

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Miss Behavin **downstream vessel** / **upstream vessel** (circled) (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 66 x **W** 67 ° 3 . 002

Observer names: Nathan Spear (inward) (500 ft exclusion zone) Lee Leddy (outward) (Out to 1 nm)

Recorder's name: Darius Neptune (vessel captain and radio operator)

Time (24 hrs):
Start observation 1300 **End observation** 15:00
Start construction 14:00 **End construction** 1421

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: North° 5-10 (knots)

Visibility: 0nm 1nm **2nm** (boxed) 3nm **unlimited** (circled) (circle one)

Weather: **clear** (circled) haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% **10-50%** (circled) 50-90% **>90%** (circled) (circle one)

Beaufort Sea State: **0** (circled) 1 2 3 4 5 (circle one)

Comments: 1:40 visibility reduced to 2nm due to snow / incresed cloud cover to 90%

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form) ______

Recorder's signature at end of event: Darius Neptune

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3 / 25 / 2012
(dd/mm/yyyy)

ORPC Reference # pile #6, #8 hole

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Lady H — **(downstream vessel)** / **upstream vessel** (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 546 **x W** 067 ° 02 . 580

Observer names: Cecil cates (inward) (500 ft exclusion zone) — Royce Richards (outward) (Out to 1 nm)

Recorder's name: Matt Lacase (vessel captain and radio operator)

Time (24 hrs):
Start observation 1300 — **End observation** 1500
Start construction ______ — **End construction** 1430

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N ° 5 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **(unlimited)** (circle one)

Weather: **(clear)** **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** **(10-50%)** **50-90%** **>90%** (circle one)

Beaufort Sea State: **(0)** **1** **2** **3** **4** **5** (circle one)

Comments: ______

Photographs or video collected: **(Yes)** **No** (circle one)

Were there incidents involving endangered or protected species? **(Yes)** **No** (circle one)

Which species? (complete incident form) ______

Recorder's signature at end of event: [signature]

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
1213	On site						
1213	Sighting	H.S.		SW E-W @ 1000'	210°	400'	East
				from site			
	Sighting	H.S.		2000+	150°	250'	NW
1242	On Mooring						
1242	Snow						
1246	Sighting	H.S.			110°	300'	
1254	sighting	H.S			124°	250'	155°
1300	Start Activ ob.						
1324	Sighting	H.S.			132°	250'	
1340	Visibility <2NM				160°	½ M	
1405	Sighting	H.S.			140°	300'	170°
1410	Sighting	H.S.			250°	250'	
1430	Env Const.						
1500	Depart						

ORPC
OCEAN RENEWABLE POWER COMPANY

Vessel Name: Larry H
PSO: Cecil Cates
Recorder/Captain: Matt Lacroix

Vessel Location: Shackford Head site
Date: 3/23/12
Time: 12:25

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/29/2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #3 Cancelled

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Shackford Head **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N**___°___.___ x **W**___°___.___

Observer names: Steve Erwin (inward) (500 ft exclusion zone) ________ (outward) (Out to 1 nm)

Recorder's name: Steve Erwin (vessel captain and radio operator)

Time (24 hrs): **Start observation** 16.00 **End observation** 16:45

Start construction n/a **End construction** n/a

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NNE° 5 mph (~~knots~~)

Visibility: 0nm 1nm 2nm 3nm **(unlimited)** (circle one)

Weather: clear **(haze)** **(cloudy)** light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% 50-90% **(>90%)** (circle one)

Beaufort Sea State: 0 **(1)** 2 3 4 5 (circle one)

Comments: ________

Photographs or video collected: Yes **(No)** (circle one)

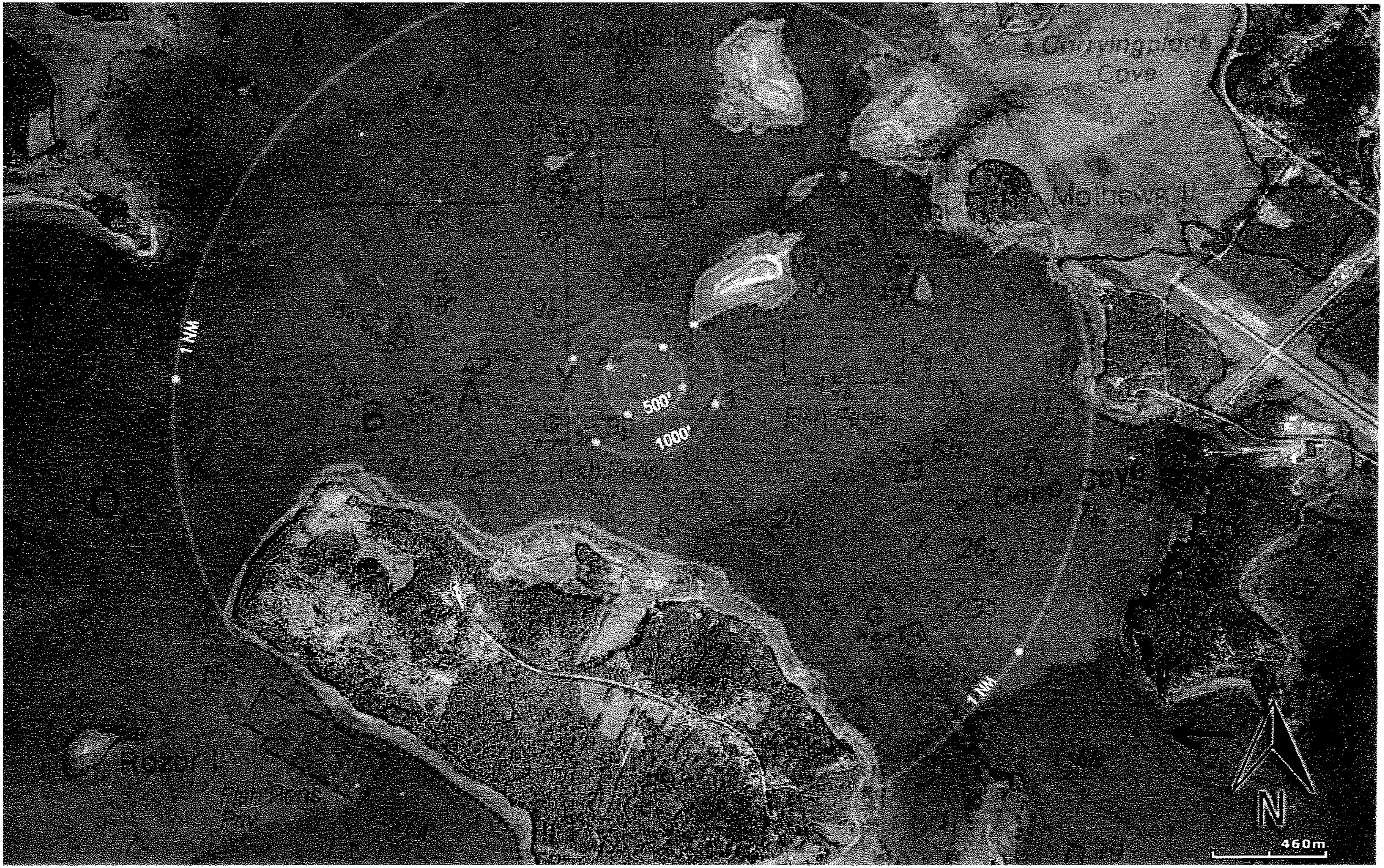
Were there incidents involving endangered or protected species? Yes **(No)** (circle one)

Which species? (complete incident form)________

Recorder's signature at end of event: [signature]

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
16:40	Harbor Seal			Normal		150 yards	NNW



ORPC
OCEAN RENEWABLE POWER COMPANY

Vessel Name: Shackford Head

PSO: Steve Erwin

Recorder/Captain: N/a

Vessel Location: ____________

Date: 3-29-12

Time: 4:00

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 03/29/2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #3 Cancelled

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Miss Behavin **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 655 x W 067 ° 03 . 001

Observer names: Tessa Ftorek (inward) Leah Leddy (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: James Smith (vessel captain and radio operator)

Time (24 hrs): **Start observation** 1600 **End observation** 1647

Start construction ______ **End construction** ______

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N ° 5 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: clear haze **cloudy** (circled) light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% **50-90%** (circled) >90% (circle one)

Beaufort Sea State: 0 **1** (circled) 2 3 4 5 (circle one)

Comments: ______

Photographs (circled) **or video collected:** **Yes** (circled) No (circle one)

Were there incidents involving endangered or protected species? Yes No (circle one)

Which species? (complete incident form) ______

Recorder's signature at end of event: James E. Smith

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/29/12
(dd/mm/yyyy)

ORPC Reference # Sleeve #3 Cancelled
ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Birch point **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N**____ ° ____.____ x **W** ____ ° ____.____

Observer names: Nathan Spear (inward) (500 ft exclusion zone) ________ (outward) (Out to 1 nm)

Recorder's name: Nathan Spear (vessel captain and radio operator)

Time (24 hrs): **Start observation** 4:00pm **End observation** 4:44
Start construction n/a **End construction** n/a

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NE ° 1 (knots)

Visibility: 0nm 1nm 2nm 3nm **(unlimited)** (circle one)

Weather: **(clear)** haze **(cloudy)** light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% 50-90% **(>90%)** (circle one)

Beaufort Sea State: 0 **(1)** 2 3 4 5 (circle one)

Comments: Alot of birds

Photographs or video collected: Yes **(No)** (circle one)

Were there incidents involving endangered or protected species? Yes **(No)** (circle one)

Which species? (complete incident form) ________

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 03/29/12
(dd/mm/yyyy)

ORPC Reference # Sleeve #3 Cancelled

ORPC Environmental Manager: Nate Jones

Observer Vessel name: Lady H ~~downstream vessel~~ (circled: **downstream vessel**) / **upstream vessel** (circle one)

Observer Vessel location (lat/long): **N**____ ° ____.____ **x W**____ ° ____.____

Observer names: Ralph DeWitt (inward) Darius Neptune (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: Cecil Cates (vessel captain and radio operator)

Time (24 hrs):
Start observation 16:00 **End observation** 17:00
Start construction n/a **End construction** n/a

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: North 0° N 5 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: clear haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% **50-90%** (circled) >90% (circle one)

Beaufort Sea State: 0 1 **2** (circled) 3 4 5 (circle one)

Comments:____________________________

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form)________________

Recorder's signature at end of event: [signature]

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
17:00	Harbor seal			at surface	250°	150 ft	

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 03 / 29 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #5

ORPC Environmental Manager: Nathan Johnson

LAND
~~**Observer Vessel name**~~: Shackford Head **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N**____ **°** ____.____ **x W** ____ **°** ____.____

Observer names: Royce Richards (inward) " " (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: ________ (vessel captain and radio operator)

Time (24 hrs): **Start observation** 09:30 **End observation** 1110

Start construction 1032 **End construction** 1039

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NE ° 10–15 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** **haze** **cloudy** (circled) **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** **10-50%** **50-90%** (circled) **>90%** (circle one)

Beaufort Sea State: **0** **1** **2** (circled) **3** **4** **5** (circle one)

Comments: ________

Photographs or video collected: **Yes** **No** (circled) (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circled) (circle one)

Which species? (complete incident form) ________

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3 / 29 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #5

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Lady H — **downstream vessel** (circled) / upstream vessel (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 515 x W 067 ° 02 . 513

Observer names: Tess Florek (inward) (500 ft exclusion zone) — Steve Erwin (outward) (Out to 1 nm)

Recorder's name: Matt Lacasse (vessel captain and radio operator)

Time (24 hrs):

Start observation	0930	**End observation**	1110
Start construction	1032	**End construction**	1039

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NE ° 10-15 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (underlined) (circle one)

Weather: **clear** (circled) haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% **50-90%** (circled) >90% (circle one)

Beaufort Sea State: 0 1 **2** (circled) 3 4 5 (circle one)

Comments: ______

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form) ______

Recorder's signature at end of event: Matt Lacasse (signature)

11:10

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 29/03/2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #5

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Miss Behavin downstream vessel / **upstream vessel** (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 652 x W 067 ° 02 . 978

Observer names: Alethea Leeroy (inward) (500 ft exclusion zone) Darius Neptune (outward) (Out to 1 nm)

Recorder's name: Ralph DeWitt (vessel captain and radio operator)

Time (24 hrs): Start observation 0930 End observation 11:30

Start construction 1032 End construction 1039

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NE ° 10-15 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circle one)

Weather: clear haze **cloudy** light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% **50-90%** >90% (circle one)

Beaufort Sea State: 0 1 **2** 3 4 5 (circle one)

Comments:

Photographs or video collected: **Yes** Test No (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: Ralph DeWitt

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/29/12
(dd/mm/yyyy)

ORPC Reference # Sleeve #5

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Birch Point **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** ____ ° ____.____ x **W** ____ ° ____.____

Observer names: Nathan Spear (inward) ____________ (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: Nathan Spear (vessel captain and radio operator)

Time (24 hrs):

Start observation 9:30 **End observation** 11:10

Start construction 1032 **End construction** 1039

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NE ° 1 (knots)

Visibility: 0nm 1nm 2nm **[3nm]** unlimited (circle one)

Weather: clear haze **[cloudy]** light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% **[50-90%]** >90% (circle one)

Beaufort Sea State: 0 **[1]** 2 3 4 5 (circle one)

Comments: ____________

Photographs or video collected: Yes **[No]** (circle one)

Were there incidents involving endangered or protected species? Yes **[No]** (circle one)

Which species? (complete incident form) ____________

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3 / 31 / 12
(dd/mm/yyyy)

ORPC Reference # piles 3-15 to refusal

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Miss Behavin **downstream vessel** / **upstream vessel** (circle one) [circled: upstream vessel]

Observer Vessel location (lat/long): **N** 44 ° 54 . 656 x **W** 067 ° 02 . 993

Observer names: Lee Leddy (inward) (500 ft exclusion zone) Steve Irwin (outward) (Out to 1 nm)

Recorder's name: Darius Neptune (vessel captain and radio operator)

Time (24 hrs): **Start observation** 1715 **End observation** 1905
Start construction 1814 **End construction** 1833

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: S ° 5-10 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circle one) [circled: unlimited]

Weather: **clear** **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply) [circled: clear]

Cloud cover: **<10%** **10-50%** **50-90%** **>90%** (circle one) [circled: <10%]

Beaufort Sea State: **0** **1** **2** **3** **4** **5** (circle one) [circled: 0]

Comments:

Photographs or video collected: **Yes** **No** (circle one) [circled: No]

Were there incidents involving endangered or protected species? **Yes** **No** (circle one) [circled: No]

Which species? (complete incident form)

Recorder's signature at end of event: Darius Neptune

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/31/2012 (PM)
(dd/mm/yyyy)

ORPC Reference # piles 3&5 to refusal

ORPC Environmental Manager: Nate ~~Thompson~~ Johnson

Observer Vessel name: Lady H — **downstream vessel** (circled) / upstream vessel (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 564 x W 067 ° 02 . 580

Observer names: Tess Ftorek (inward) (500 ft exclusion zone) — Royce Ritchie (outward) (Out to 1 nm)

Recorder's name: Matt Lacasse (vessel captain and radio operator)

Time (24 hrs):

- Start observation 1715 — End observation 1905
- Start construction 1814 — End construction 1833

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: W ° <5 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: **clear** (circled) haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: **<10%** (circled) 10-50% 50-90% >90% (circle one)

Beaufort Sea State: **0** (circled) 1 2 3 4 5 (circle one)

Comments:

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3/31/17
(dd/mm/yyyy)

ORPC Reference # Sleeve #3

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Miss bettavin **downstream vessel** / **upstream vessel** (circled) (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 646 x W 067 ° 02 . 949

Observer names: Jamie mitchell (inward) (500 ft exclusion zone) Nathan Spear (outward) (Out to 1 nm)

Recorder's name: Darius Neptune (vessel captain and radio operator)

Time (24 hrs):
Start observation 11:30 **End observation** 12:45
Start construction 12:10 **End construction** 12:16

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NE ° <5 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: **clear** (circled) haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: **<10%** (circled) **10-50%** (circled) 50-90% >90% (circle one)

Beaufort Sea State: **0** (circled) 1 2 3 4 5 (circle one)

Comments: Cloud Cover increased At 12:15 to 10-50%

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form) ______

Recorder's signature at end of event: Darius Neptune

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 31/03/2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #3

ORPC Environmental Manager: Nathan Johnson

~~**Observer Vessel name**~~: Shackford Head ____ **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** ____ ° ____ . ____ x **W** ____ ° ____ . ____

Observer names: Steve Erwin (inward) (500 ft exclusion zone) ____ (outward) (Out to 1 nm)

Recorder's name: Steve Erwin (vessel captain and radio operator)

Time (24 hrs): **Start observation** 11:30 AM **End observation** 12:45

Start construction 12:10 **End construction** 12:16

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: Calm / 0 3 mph NNE (knots)

Visibility: 0nm 1nm 2nm 3nm **(unlimited)** (circle one)

Weather: **(clear)** haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: **(<10%)** 10-50% 50-90% >90% (circle one)

Beaufort Sea State: 0 **(1)** 2 3 4 5 (circle one)

Comments: ____

Photographs or video collected: Yes **(No)** (circle one)

Were there incidents involving endangered or protected species? Yes **(No)** (circle one)

Which species? (complete incident form) ____

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 7 / 31 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #3

ORPC Environmental Manager: Nate ~~Thompson~~ Johnson

Observer Vessel name: ________ **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** ____ ° ____.____ x **W** ____ ° ____.____ Birch Point.

Observer names: Matt Larosse (inward) ________ (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: Matt Larosse (vessel captain and radio operator)

Time (24 hrs): **Start observation** 1130 **End observation** 1245

Start construction 12:10 **End construction** 12:16

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: W ° <5 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circle one)

Weather: **clear** **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** **10-50%** **50-90%** **>90%** (circle one)

Beaufort Sea State: (0) 1 2 3 4 5 (circle one)

Comments: ________

Photographs or video collected: **Yes** **No** (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circle one)

Which species? (complete incident form) ________

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 3 / 31 / 12
(dd/mm/yyyy)

ORPC Reference # Sleeve #3

ORPC Environmental Manager: Nate ~~Jones~~ Johnson

Observer Vessel name: Lady H — **downstream vessel** (circled) / **upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 666 x **W** 067 ° 02 . 526

Observer names: Tess Fortee (inward) (500 ft exclusion zone) — Lee Leddy (outward) (Out to 1 nm)

Recorder's name: Cecil Cates (vessel captain and radio operator)

Time (24 hrs):

Start observation 11:28 — **End observation** 12:45

Start construction 12:10 — **End construction** 12:16

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: Calm ° <1 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** (circled) **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** (circled) **10-50%** **50-90%** **>90%** (circle one)

Beaufort Sea State: **0** (circled) **1** **2** **3** **4** **5** (circle one)

Comments: glass smooth surface

Photographs or video collected: **Yes** **No** (circled) (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circled) (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

7:15
5 to 6 light out
5:45

Date: 01 / 04 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #1

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Miss B **downstream vessel** / **upstream vessel** (circled) (circle one)

Observer Vessel location (lat/long): N 044 ° 54 . 652 x W 067 ° 02 . 978

Observer names: Draius (inward) Matt (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: Ralph DeWitt (vessel captain and radio operator)

Time (24 hrs):

Start observation 05:45 **End observation** 0715

Start construction 0638 **End construction** 0645

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: North ° Light (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** (circled) **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** (circled) **10-50%** **50-90%** **>90%** (circle one)

Beaufort Sea State: **0** **1** (circled) **2** **3** **4** **5** (circle one)

Comments: ______

Photographs or video collected: **Yes** **No** (circled) (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circled) (circle one)

Which species? (complete incident form) ______

Recorder's signature at end of event: Ralph DeWitt

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 01 / 12
(dd/mm/yyyy)

ORPC Reference # Sleeve #1

ORPC Environmental Manager: Nate ~~Jones~~ Johnson

Observer Vessel name: Lady H **downstream vessel** (circled) / **upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 564 x **W** 067 ° 02 . 580

Observer names: Lee Leddy (inward) Jessie Smith (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: Cecil Cates (vessel captain and radio operator)

Time (24 hrs):
Start observation 05:45 **End observation** 7:15
Start construction 6:38 **End construction** 6:45

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: calm ° <1 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: **clear** (circled) haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: **<10%** (circled) 10-50% 50-90% >90% (circle one)

Beaufort Sea State: **0** (circled) 1 2 3 4 5 (circle one)

Comments:

Photographs or video collected: Yes No (circle one)

Were there incidents involving endangered or protected species? Yes No (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: Cecil Cates

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4/1/12
(dd/mm/yyyy)

ORPC Reference # Sleeve #7

ORPC Environmental Manager: Nathen Johnson

Observer Vessel name: Miss be Havin **downstream vessel / upstream vessel** (circle one) [upstream vessel circled]

Observer Vessel location (lat/long): N 44 ° 54 . 650 x W 067 ° 02 . 950

Observer names: Jesse Smith (inward) (500 ft exclusion zone) Nathen Spear (outward) (Out to 1 nm)

Recorder's name: Darins Neptum (vessel captain and radio operator)

Time (24 hrs):

Start observation 12:20 **End observation** 1350

Start construction 1302 **End construction** 1310

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: S ° <5-10 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circle one) [unlimited circled]

Weather: **clear** haze cloudy light rain rain snow patchy fog fog (circle all that apply) [clear circled]

Cloud cover: <10% **10-50%** 50-90% >90% (circle one) [10-50% circled]

Beaufort Sea State: **0** 1 2 3 4 5 (circle one) [0 circled]

Comments: Wind Increased At 1300 to Se 5-10

Photographs or video collected: Yes **No** (circle one) [No circled]

Were there incidents involving endangered or protected species? Yes **No** (circle one) [No circled]

Which species? (complete incident form) ______

Recorder's signature at end of event: Darin Neptum

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 1 / 2012 (PM Aft)
(dd/mm/yyyy)

ORPC Reference # Sleeve #7

ORPC Environmental Manager: Nate ~~Thompson~~ Johnson

Observer Vessel name: Lady H — **downstream vessel** (circled) / **upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 524 x **W** 067 ° 02 . 319

Observer names: Tess Ftorek (inward) (500 ft exclusion zone) — Royce Ritchie (outward) (Out to 1 nm)

Recorder's name: Matt Leeass (vessel captain and radio operator)

Time (24 hrs):

Start observation 1220 **End observation** 1350

Start construction 1302 **End construction** 1320

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: E ° <5 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** (circled) **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** (circled) **10-50%** **50-90%** **>90%** (circle one)

Beaufort Sea State: **0** **1** **2** **3** **4** **5** (circle one)

Comments: __________

Photographs or video collected: **Yes** **No** (circled) (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circled) (circle one)

Which species? (complete incident form) __________

Recorder's signature at end of event: [signature]

Donna
Tess
Royce

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 02/ 04/ 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #9

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Lady H **downstream vessel** / **upstream vessel** (circle one) — circled: downstream vessel

Observer Vessel location (lat/long): N 44 ° 54 . 555 x W 067 ° 02 . 604

Observer names: Tess Florek (inward) (500 ft exclusion zone) Royce Richards (outward) (Out to 1 nm)

Recorder's name: Ralph DeWitt (vessel captain and radio operator)

Time (24 hrs):

Start observation 0640 **End observation** 0820

Start construction 0739 **End construction** 0750

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N ° 5-10 mph (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circle one) — circled: unlimited

Weather: **clear** haze cloudy light rain rain snow patchy fog fog (circle all that apply) — circled: clear

Cloud cover: <10% **10-50%** 50-90% >90% (circle one) — circled: 10-50%

Beaufort Sea State: 0 **1** 2 3 4 5 (circle one) — circled: 1

Comments: ______________________

Photographs or video collected: Yes No (circle one) 652 210w

Were there incidents involving endangered or protected species? **Yes** No (circle one) — circled: Yes

Which species? (complete incident form) Harbor Seal

Recorder's signature at end of event: Ralph DeWitt

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
6:52		H.S.	1		210°	200'	300°
7:08		H.S.	1		265°	100'	30°
7:20		H.S.	1		130	150'	—
7:39		H.S	1		264	50'	—

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 2 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #9

ORPC Environmental Manager: Nate ~~Jones~~ Johnson

Observer Vessel name: Miss Behavin' **downstream vessel** **upstream vessel** (circled) (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 652 **x W** 067 ° 02 . 978

Observer names: James Smith (inward) Leah Leddy (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: Cecil Cates (vessel captain and radio operator)

Time (24 hrs):
Start observation 06:40 **End observation** 08:20
Start construction 7:39 **End construction** 07:50

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: 300 ° <1 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: **clear** (circled) haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% **10-50%** (circled) 50-90% >90% (circle one)

Beaufort Sea State: 0 **1** (circled) 2 3 4 5 (circle one)

Comments:

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: [signature]

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
7:07	Harbor seal				127°	1650 ft	
7:26	11			Bottling	250°	398 ft	270°
8:11	11			at surface	315°	525 ft	45°
8:18	11			11	90°	470 ft	

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 2 / 12
(dd/mm/yyyy)

ORPC Reference # Sleeve #6

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Lady H — **downstream vessel** (circled) / **upstream vessel** (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 527 x W 067 ° 02 . 499

Observer names: Nathan Spear (inward) (500 ft exclusion zone) — Lee Leddy (outward) (Out to 1 nm)

Recorder's name: Darius Neptune (vessel captain and radio operator)

Time (24 hrs):

Start observation 1315 — **End observation** 1445

Start construction 1403 — **End construction** 1413

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: SE ° 5 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: clear haze **cloudy** (circled) light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% **50-90%** (circled) >90% (circle one)

Beaufort Sea State: **0** (circled) 1 2 3 4 5 (circle one)

Comments:

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: Darius Neptune

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 3 / 12
(dd/mm/yyyy)

ORPC Reference # Sleeve #4

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Lady H **downstream vessel / upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 559 x **W** 067 ° 02 . 596

Observer names: Nathan Spear (inward) (500 ft exclusion zone) John Turner (outward) (Out to 1 nm)

Recorder's name: Darius Neptune (vessel captain and radio operator)

Time (24 hrs):

Start observation 0745 **End observation** 9:30

Start construction 08 47 **End construction** 8:56

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NE ° 5-10 7 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: **clear** (circled) haze **cloudy** (circled) light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% **50-90%** (circled) >90% (circle one)

Beaufort Sea State: 0 **1** (circled) 2 3 4 5 (circle one)

Comments: Increased wind 15-20 knots

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: Darius Neptune

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
9:05am	Seal	Harbor			135	250 ft out	

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 4 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #4

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Miss Behavin' **downstream vessel** / **upstream vessel** (circled) (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 652 x **W** 067 ° 02 . 978

Observer names: Steve Erwin (inward) Lee Leady (outward)
(500 ft exclusion zone) (Out to 1 nm)

Recorder's name: Matt Carasse (vessel captain and radio operator)

Time (24 hrs):
Start observation 0745 **End observation** 0930
Start construction 0847 **End construction** 0856

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NE ° 5-10 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: **clear** (circled) haze cloudy light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: **<10%** (circled) 10-50% 50-90% >90% (circle one)

Beaufort Sea State: 0 **1** (circled) 2 3 4 5 (circle one)

Comments:

Photographs or video collected: Yes **No** (circled) (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 4 / 12
(dd/mm/yyyy)

ORPC Reference # Sleeve #2

ORPC Environmental Manager: Nathan Johnson

Observer Vessel name: Miss Behavin **downstream vessel** / **upstream vessel** (circle one) — circled: upstream vessel

Observer Vessel location (lat/long): **N** 44 ° 54 . 656 x **W** 067 ° 03 . 000

Observer names: Tess Frolek (inward) (500 ft exclusion zone) Jesse Smith (outward) (Out to 1 nm)

Recorder's name: Darius Neptun (vessel captain and radio operator)

Time (24 hrs): **Start observation** 0834 **End observation** 1030

Start construction 0953 **End construction** 1000

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N ° 10-15 (knots)

Visibility: 0nm 1nm 2nm **3nm** unlimited (circle one) — circled: 3nm

Weather: clear haze cloudy light rain rain **snow** patchy fog fog (circle all that apply) — circled: snow

Cloud cover: <10% 10-50% 50-90% **>90%** (circle one) — circled: >90%

Beaufort Sea State: 0 **1** 2 3 4 5 (circle one) — circled: 1

Comments: Wind reduce to Five-10 knots at 0950

Photographs or video collected: Yes **No** (circle one) — circled: No

Were there incidents involving endangered or protected species? Yes **No** (circle one) — circled: No

Which species? (complete incident form) ______

Recorder's signature at end of event: Darius Neptun

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (^{o})	Distance to animal	Animal heading (^{o})
10:25	seal	Harbor	1	normal	200°	200 ft	150°

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 4 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #2

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Lady H **downstream vessel** (circled) / upstream vessel (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 364 x W 067 ° 02 . 580

Observer names: Royce Ritchie (inward) (500 ft exclusion zone) Steve Erwin (outward) (Out to 1 nm)

Recorder's name: Matt Lacasse (vessel captain and radio operator)

Time (24 hrs):

Start observation 0830 **End observation** 1039

Start construction 0953 **End construction** 1000

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N ° 5-10 (knots)

Visibility: 0nm 1nm 2nm **3nm** (circled) unlimited (circle one)

Weather: clear haze cloudy light rain rain **snow** (circled) patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% 50-90% **>90%** (circled) (circle one)

Beaufort Sea State: 0 **1** (circled) 2 3 4 5 (circle one)

Comments: Coffee got cold.

Photographs or video collected: Yes **No** (circled) (circle one)

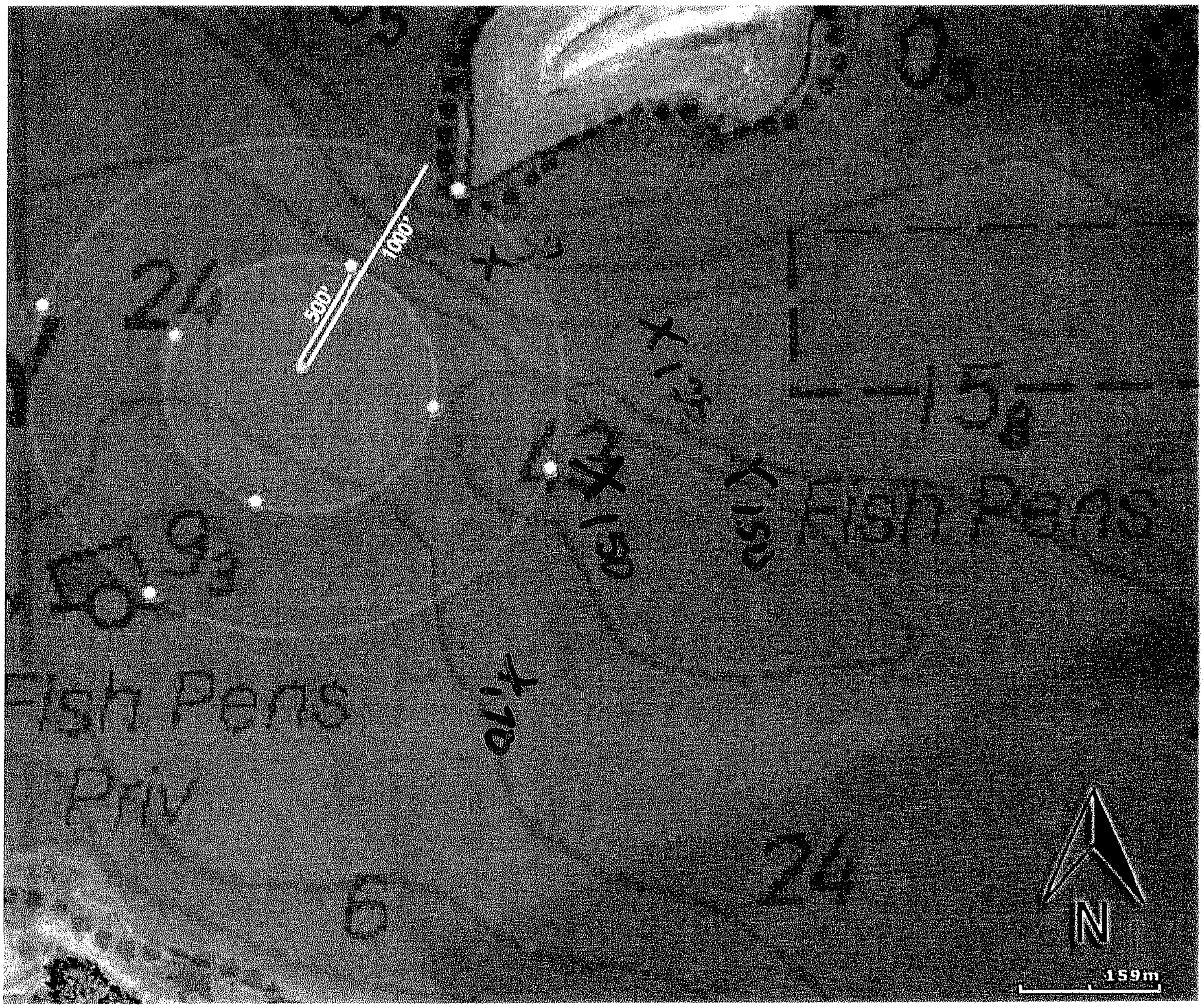
Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form) ______

Recorder's signature at end of event: Matt Lacasse

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	Animal heading (°)
0805	Depart Bar						
0829	On site						
0830	Start ob						
0837	Moored						
0838	Seal #1	H.S.		Bottle	55°	200'	
	#1	H.S			35°	50'	N
	#2				95°	200'	N
0900	#1			Bottle	110°	900'	
0924	Clearing 15-50 c.c.						
0927		H.S.			230°	70'	W
0939		H.S.		Bottle	180°	300'	
0946		H.S.		Bottle	110°	400'	
0953	Start const.						
1000	Stop const.						
1000	Sunny						
1030	Depart						



Vessel Name: Lady H

Vessel Location: Downstream

PSO: Stephen Erwin

Date: 4-4-2012

Recorder/Captain: Matt Lacava

Time: 08:30 – 10:30

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 4 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #10

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Miss Behavin' **downstream vessel** / **upstream vessel** (circled) (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 645 **x W** 067 ° 02 . 950

Observer names: Royce Richards (inward) (500 ft exclusion zone) Steve Erwin (outward) (Out to 1 nm)

Recorder's name: Matt (vessel captain and radio operator)

Time (24 hrs):

Start observation 1510 **End observation** 1647

Start construction 1611 **End construction** 1617

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: NW ° 5-10 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** (circled) **haze** **cloudy** **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** **10-50%** **50-90%** **>90%** (circled) (circle one)

Beaufort Sea State: **0** **1** (circled) **2** **3** **4** **5** (circle one)

Comments:

Photographs or video collected: **Yes** **No** (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: [signature]

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 4 / 4 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #10

ORPC Environmental Manager: Nate Johnson

Observer Vessel name: Lady H. **downstream vessel** (circled) / **upstream vessel** (circle one)

Observer Vessel location (lat/long): **N** 44 ° 54 . 529 **x W** 067 ° 02 . 502

Observer names: Lee Laddy (inward) (500 ft exclusion zone) Tessa Ftorek (outward) (Out to 1 nm)

Recorder's name: James Smith (vessel captain and radio operator)

Time (24 hrs): **Start observation** 3:10 pm **End observation** 4:47 pm

Start construction 4:11 pm **End construction** 4:17 pm

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: N ° 10-15 gust to 20 (knots)

Visibility: **0nm** **1nm** **2nm** **3nm** **unlimited** (circled) (circle one)

Weather: **clear** **haze** **cloudy** (circled) **light rain** **rain** **snow** **patchy fog** **fog** (circle all that apply)

Cloud cover: **<10%** **10-50%** **50-90%** (circled) **>90%** (circle one)

Beaufort Sea State: **0** **1** **2** (circled) **3** **4** **5** (circle one)

Comments:

Photographs or video collected: **Yes** **No** (circle one)

Were there incidents involving endangered or protected species? **Yes** **No** (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: James E. Smith

ORPC Cobscook Bay Protected Species Observer Program

Marine Mammal Observation Data
(Cover sheet)

Date: 04 / 02 / 2012
(dd/mm/yyyy)

ORPC Reference # Sleeve #6

ORPC Environmental Manager: Nate Jones

Observer Vessel name: Miss Behavin' **downstream vessel** **upstream vessel** (circled) (circle one)

Observer Vessel location (lat/long): N 44 ° 54 . 652 x W 067 ° 02 . 978

Observer names: Tess Florek (inward) (500 ft exclusion zone) Matt Lacasse (outward) (Out to 1 nm)

Recorder's name: Cecil Cates (vessel captain and radio operator)

Time (24 hrs): **Start observation** 13:15 **End observation** 14:45

Start construction 14:03 **End construction** 14:13

Environmental Conditions: (record at start of observation period, record changes to env. conditions on data sheet)

Wind Direction and Speed: 280° ° 3 (knots)

Visibility: 0nm 1nm 2nm 3nm **unlimited** (circled) (circle one)

Weather: clear haze **cloudy** (circled) light rain rain snow patchy fog fog (circle all that apply)

Cloud cover: <10% 10-50% **50-90%** (circled) >90% (circle one)

Beaufort Sea State: 0 **1** (circled) 2 3 4 5 (circle one)

Comments: Mixed rain clouds + clear sky

Photographs or video collected: Yes No (circle one)

Were there incidents involving endangered or protected species? Yes **No** (circled) (circle one)

Which species? (complete incident form)

Recorder's signature at end of event: Cecil Cates (signature)

Data sheet

Time	Description	Species	No.	Behavior	Bearing to animal (°)	Distance to animal	An imal heading (°)

Appendix G

SSI Presentation to NMFS, April 2, 2012

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TidGen™ Pile Driving Preliminary Near-Field Sound Level Results

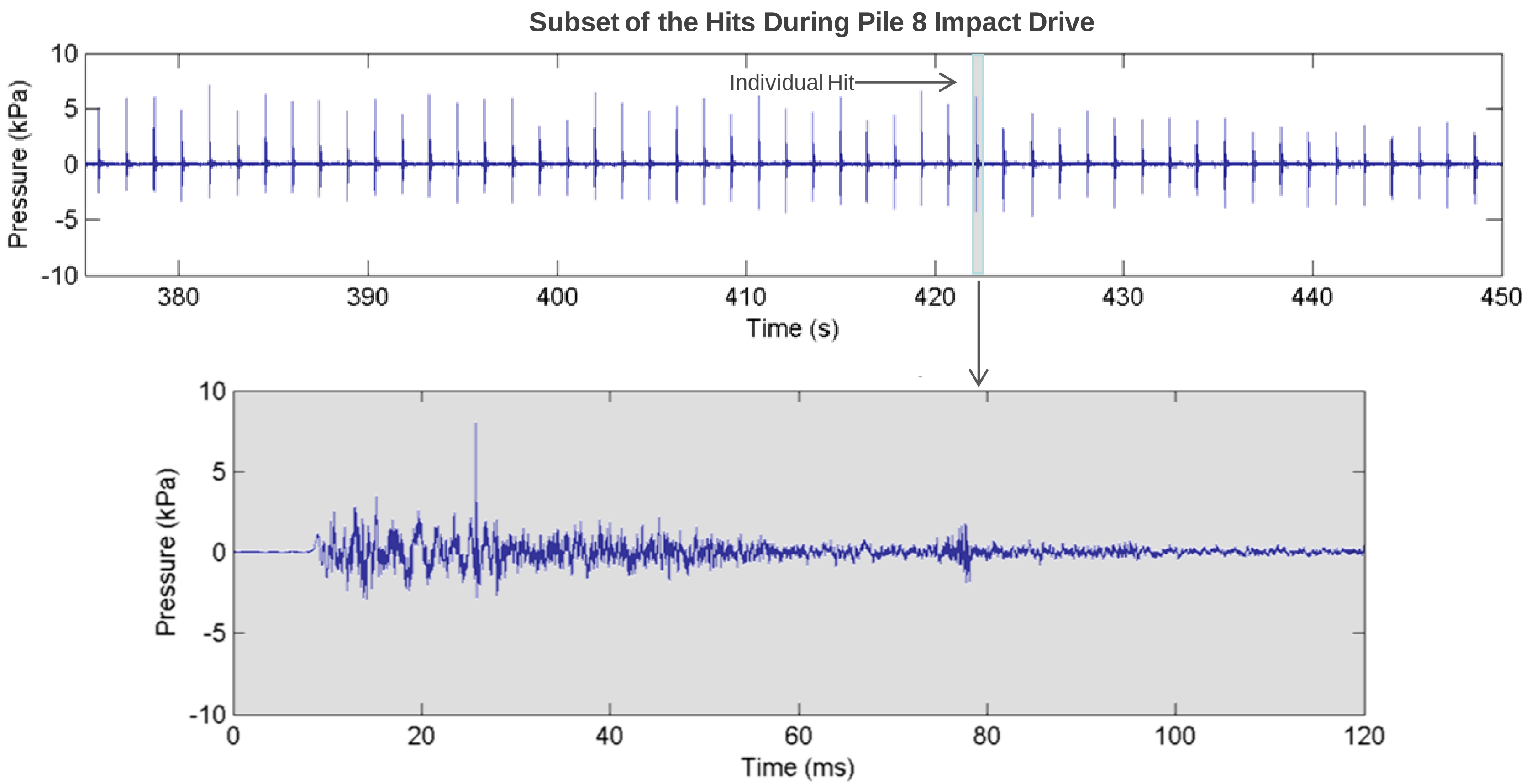
April 02, 2012

Measurement Overview

- Objective is to measure sound pressure levels on the barge (approximately 10 meters from pile)
  - During impact and vibratory hammer driving
  - Determine peak absolute pressures at 10 m
  - Determine sound exposure level (SEL) at 10 m
- Testing has shown that ORPC
  - Does not exceed the 206 dB peak pressure limit using impact or vibratory
  - Does not exceed the 187 dB SEL limit using impact
  - Has not exceeded the SEL limit using vibratory since improving hammer-follower and follower-piling connections
    - Note that a mitigation strategy exists for remaining below the threshold even under the initial conditions that led to high SEL levels

Near-Field Impact Hammer

- The impact hammer involves a series of discrete hits
  - Measure the peak pressure among each individual hit
  - Measure the SEL among each individual hit



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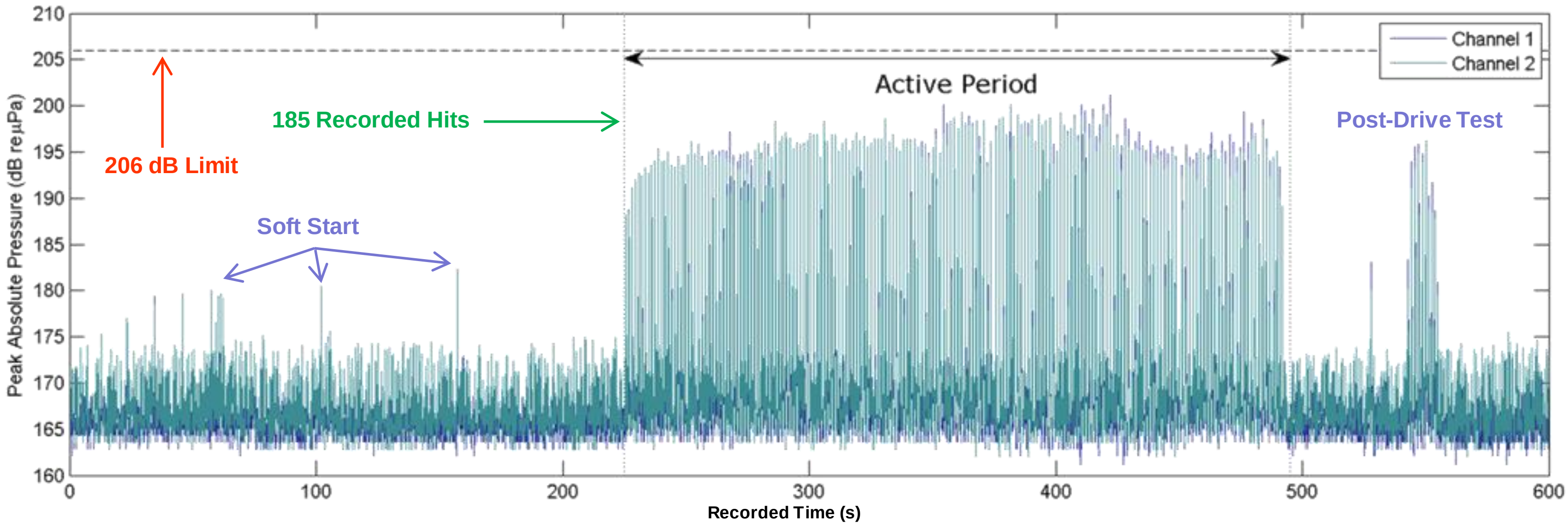
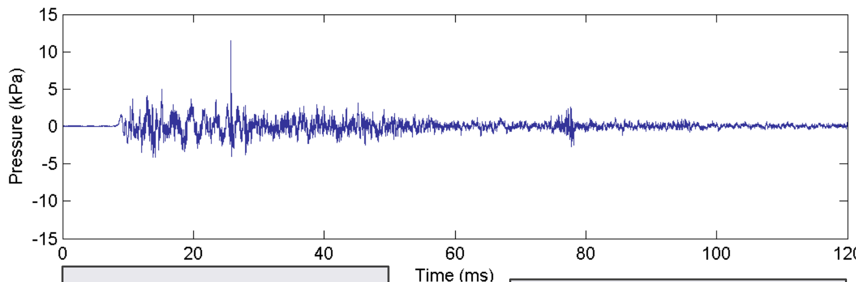
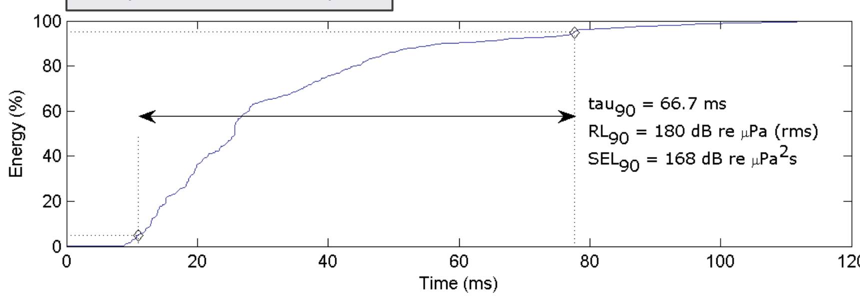
Near-Field Impact Hammer Example – Pile 8





Impact at 422.16 seconds
Peak Pressure 202 dB re μPa
(63% of 206 dB Limit)

SEL calculated in 90% relative cumulative energy window [1]



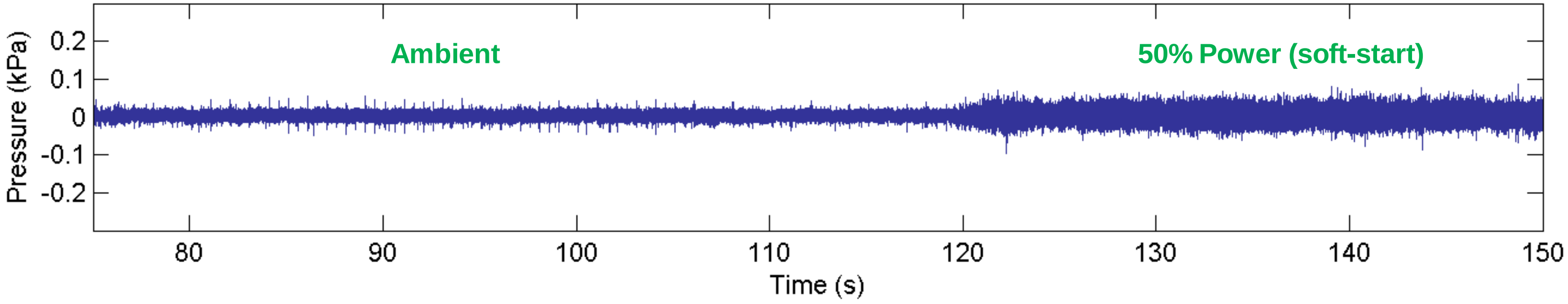
Event Summary	
Distance Driven	15 ft
Duration	5 min 17 sec
Largest (Peak) Individual Impact	
Peak Pressure	202 dB re μPa **(63% of 206 dB limit)**
RMS_{90} Pressure	180 dB re μPa
SEL_{90}	168 dB re μPa^2s **(1% of 187 dB limit)**
Ensemble	
Number of Impacts	185
Mean Peak Pressure	~197 dB re μPa

[1] Madsen, P.T., Marine mammals and noise: problems with root mean square sound pressure for transients, *J. Acoust. Soc. Am, 117, pp. 3952-3957, 2005.*

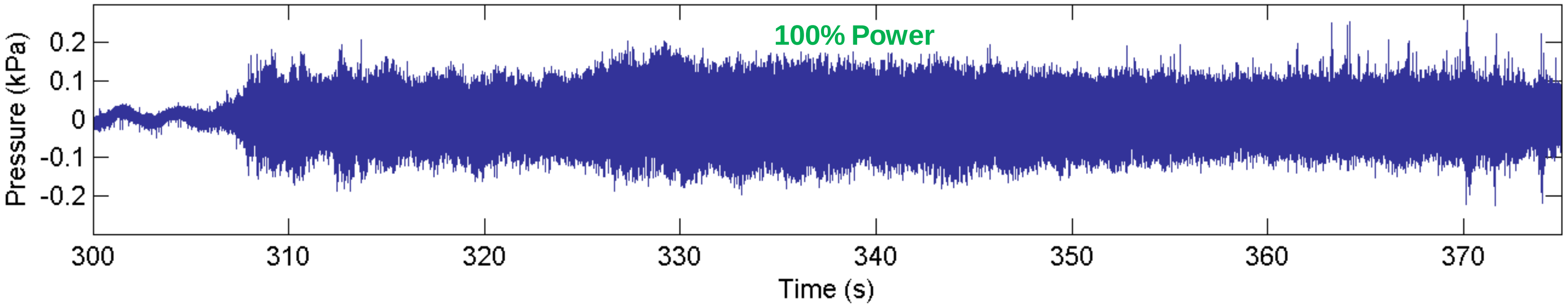
Near-Field Vibratory Hammer

- The vibratory hammer is a continuous source
  - Measure the peak pressure during entire drive
  - Measure SEL at 10 m after soft-start

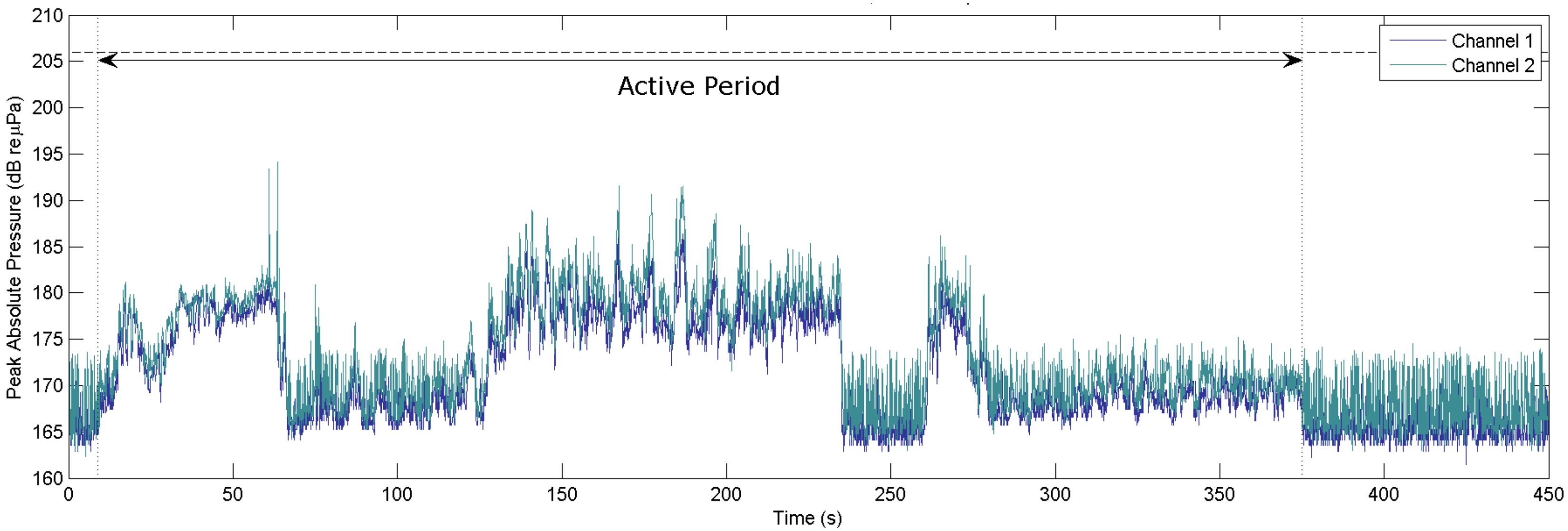
Subset of the Hammer Activity During Pile 1 Vibratory Drive

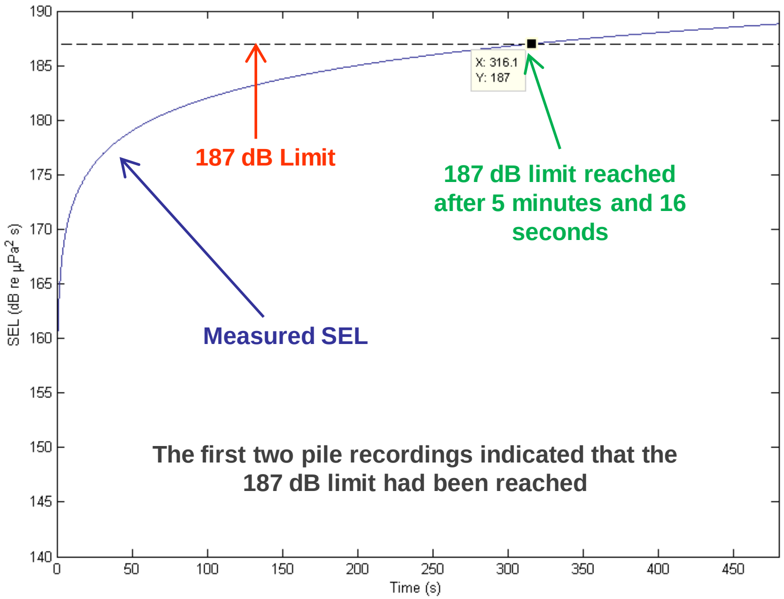


Note that there is a minimum 1 minute break between the final soft-start and full power



Near-Field Vibratory Hammer Pile 8





Event Summary	
Distance Driven	32 ft
Duration	8 min
Pressure	
Peak Pressure	195dB re µPa **(29% of 206 dB limit)**
RMS Pressure	161 dB re µPa
Sound Exposure Level	
SEL	188 dB re µPa^{2}s **(25 % *over* 187 dB limit)**
Duration$_{SEL@187}$	5 min 16 sec

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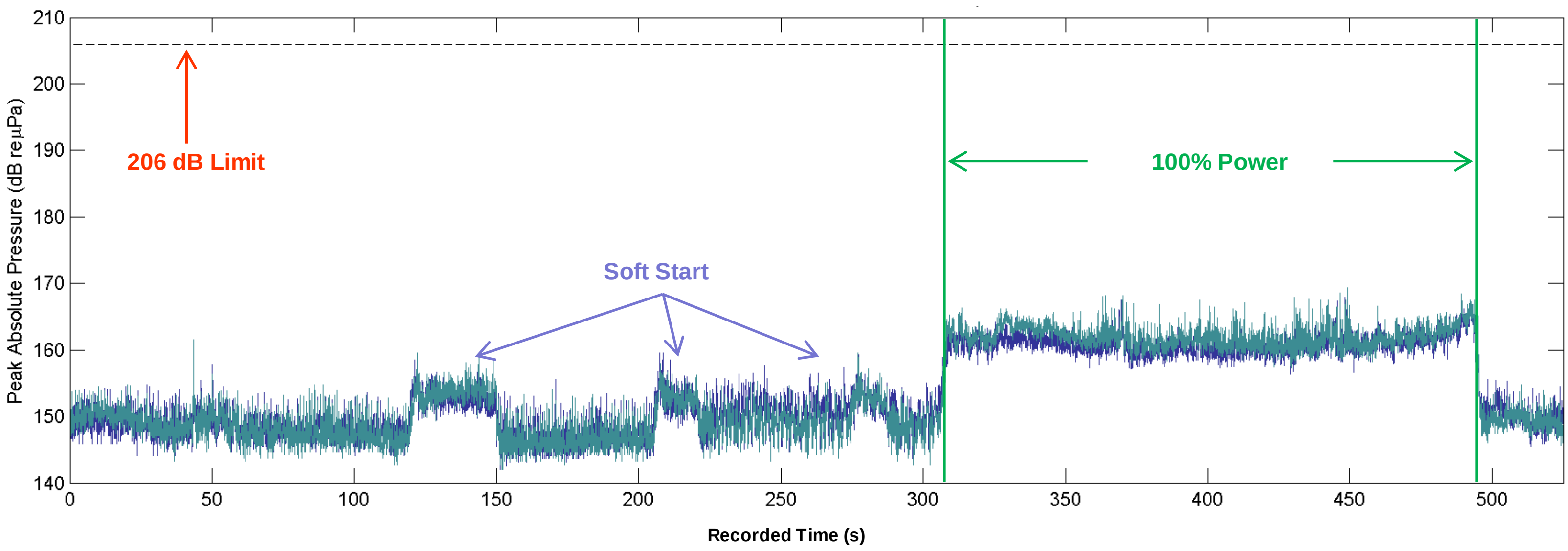
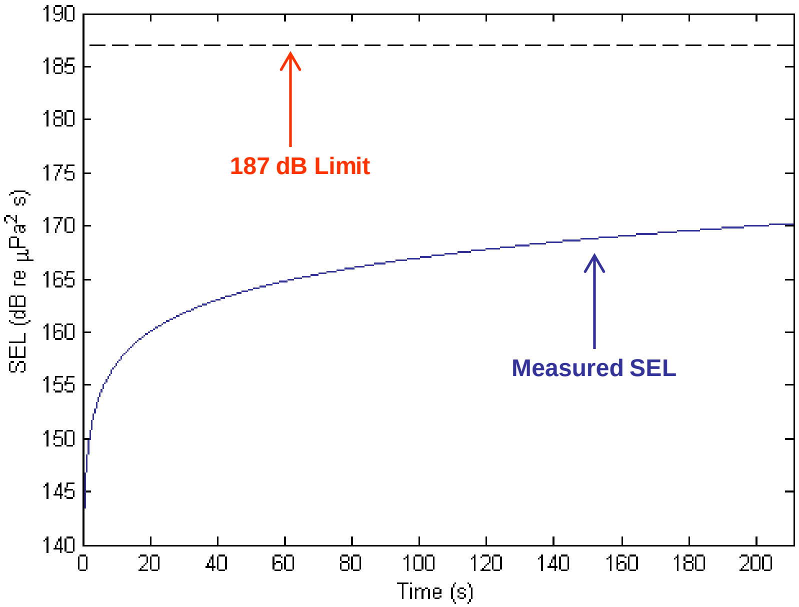
Factors Possibly Affecting Initial SEL Threshold

- The first two piles showed SEL levels in excess of the 187 dB threshold
- Issues were noted during the driving regarding the connection of the hammer to the follower and follower to pile
- Three piles have been driven and recorded after improving the connections
  - Root mean square (rms) pressure levels and associated sound exposure levels are significantly lower

Near-Field Vibratory Hammer Pile 1 – After Improved Cnxn





Event Summary	
Distance Driven	29 ft
Duration	3 min 31 sec
Pressure	
Peak Pressure	170 dB re µPa **(2% of 206 dB limit)**
RMS Pressure	147 dB re µPa
Sound Exposure Level	
SEL	171 dB re $\mu Pa^2 s$ **(16 % of 187 dB limit)**
$Duration_{SEL@187}$	> 2 hours

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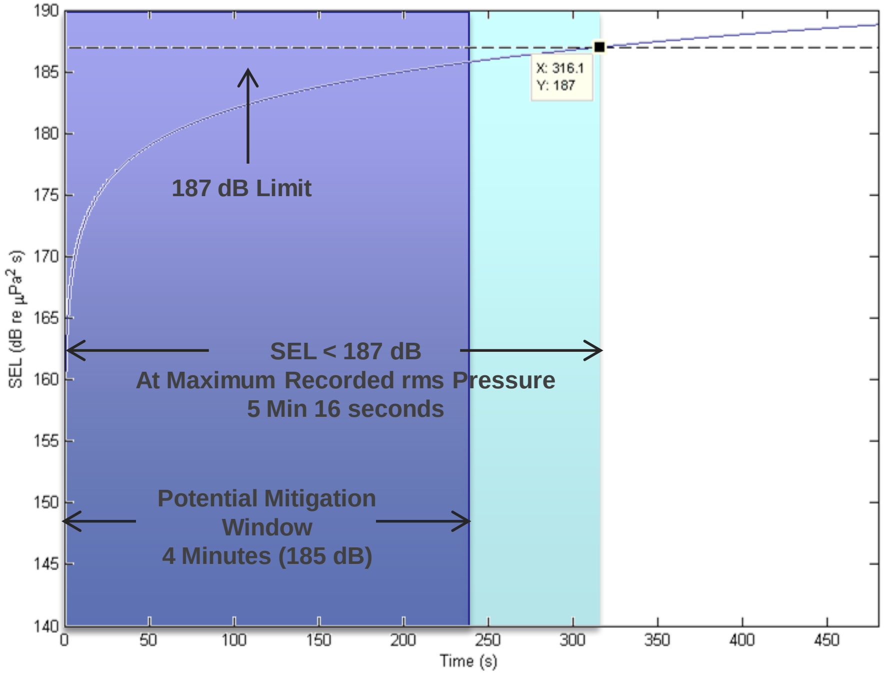
Vibratory Hammer Mitigation Strategy



- Sound exposure level is a function of the root mean square (rms) pressure and hammer activity duration
  - High rms pressures during the first two drives allowed the SEL to reach the 187 dB threshold before the activity was complete
- A conservative strategy is to limit vibratory hammer operations to a duration based on the highest measured rms pressure during vibratory activity
- A limit of the duration to 4 minutes would meet the requirement
  - This is well under the 5 min 16 second duration for an SEL of 187 dB at the highest recorded rms pressure levels
  - It allows for rms pressures 25% higher than any value recorded and still not exceed the 187 dB threshold

Near-Field Summary

Sleeve	Type	Drive Depth (ft)	Duration (min)	Peak Pressure dB re µPa (206 dB Threshold for Injury)	SEL re $\mu Pa^2 s$ (187 dB Threshold for Injury)
8	Vibratory	32	7:30	195	188 (25% over limit)
8	Impact	15	5:17	202	168
5	Vibratory	38	8:09*	184	188 (25% over limit)
3	Vibratory	36	8:30**	177	180
3	Impact	0	3:00	200	170
5	Impact	0	1:00	198	169
1	Vibratory	29	7:31**	170	171
7	Vibratory	48.5	13:30**	171	178

*Includes soft start period of 2 minutes at 50% energy
**Includes soft start period of 4 minutes at 0% (off) and 50% energy

- ORPC is below the peak pressure limit and can stay below the sound exposure limit through mitigation
  - Impact hammer has not exceeded the peak sound pressure level or the sound exposure level limits
  - Vibratory hammer has not exceeded the peak sound pressure level
  - The vibratory hammer initially exceeded the SEL limit, but subsequently has been well within limits
    - Likely difference is improved connections with hammer and follower
    - Limiting vibratory hammer operations to 4 minutes at 100% energy would not have exceeded for the first two piles the SEL threshold for injury of 187 dB re $\mu Pa^2 s$