



Marine Mammal / Sea Turtle Monitoring Report (PAM VSP)

Newfoundland & Labrador Orphan Basin Exploration Drilling Program

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Marine Mammal / Sea Turtle Monitoring Report (VSP)

Vessel: Stena IceMax

Position: 50° 34.05' North, 49° 44.16' West (Ephesus)

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Table of Contents

| | | |
|------|---|----|
| 1. | Introduction | 6 |
| 2. | Purpose | 7 |
| 3. | Follow-up Program Summary | 9 |
| 4. | Mitigations and Monitoring | 10 |
| 4.1. | Mitigation Measures | 10 |
| 4.2. | Monitoring Procedures | 10 |
| 5. | Monitoring Equipment..... | 11 |
| 5.1. | Visual Monitoring Station..... | 11 |
| 5.2. | Acoustic Monitoring Station | 11 |
| 6. | VPAM Testing and Deployment | 12 |
| 6.1. | Tap Test | 12 |
| 6.2. | Cable Preparation..... | 13 |
| 6.3. | Safety Procedures for Cable Deployment | 14 |
| 6.4. | Cable Deployment..... | 14 |
| 7. | Data Collection | 16 |
| 7.1. | Data Sheets..... | 16 |
| 7.2. | Quality Assurance | 16 |
| 7.3. | Data Backup and Storage | 16 |
| 8. | Results..... | 17 |
| 8.1. | Monitoring Effort..... | 17 |
| 8.2. | Marine Mammal Detections (Visual and Acoustic)..... | 17 |
| 8.3. | Mitigation Actions | 17 |
| 9. | Environmental Effects Summary | 18 |
| 10. | EIS Decision Statement Condition Compliance | 18 |

List of Tables

Table 2-1: EIS Decision Statement Conditions for the Protection of Marine Mammals During VSP Operations..... 8
Table 6-1: PAM Deployment Hazards and Mitigations 14

List of Figures

Figure 1-1: Stena IceMax 6
Figure 1-2: Ephesus Wellsite Within EL1168 7
Figure 6-1: Seiche Hydrophone Cable 712 12
Figure 6-2: PAMGuard VSP Configuration - Hydrophone Tap Test Detections Displayed Across the Full Frequency Range of the Main Spectrogram Display..... 13
Figure 6-3: 1kg Weight Secured to Hydrophone Cable 712..... 13
Figure 6-4: Cover to Minimize Cable Damage and Tripping Hazards. 15
Figure 6-5: Cable Secured to the Rope Using a Chinese Finger Knot (Roman Sandal Tie) to Reduce Cable Tension. 15
Figure 6-6: Pipe Used to Prevent Cable Abrasion and Keep the Cable Vertical 16

1. Introduction

bp Canada Energy Group ULC (bp) contracted the Stena IceMax drilling vessel (Figure 1-1) to conduct an exploratory drilling program at the Ephesus wellsite in May and June 2023. The wellsite is 395 km northeast of St. John's in the West Orphan Basin in Exploration License (EL) 1168 (a consolidation of EL1145 and 1146) (Figure 1-2).

For a detailed description of the drilling program, see Section 2.0 of the September 2018 Newfoundland Orphan Basin Exploration Drilling Program Environmental Impact Statement (EIS), which was conducted under the Canadian Environmental Assessment Act 2012 (CEAA 2012) (registration number 80147) and can be found at the website Environmental Impact Statement – Canada.ca (ceaa-acee.gc.ca).

The drilling program included the implementation of a vertical seismic program (VSP) which is used to calibrate actual well data to seismic data, giving an accurate depth measure of geological features. This effectively allows an accurate correlation of seismic reflectivity events to actual geological formations encountered in the wellbore. The VSP program involved a stationary acoustic sound source deployed from the Stena IceMax while several receivers, positioned at different levels within the wellbore, measured the travel time of the sound generated at the source as it arrives at those receivers.

This report reflects the environmental monitoring completed during VSP operations to ensure the protection of marine mammals and sea turtles. bp contracted PAL Aerospace (PAL) to provide experienced offshore observers to conduct marine mammal and sea turtle monitoring and to provide guidance on the implementation of required mitigation protocols as described in the bp Marine Mammal / Sea Turtle Monitoring Plan CN002-EV-PLN-600-00015.



Figure 1-1: Stena IceMax

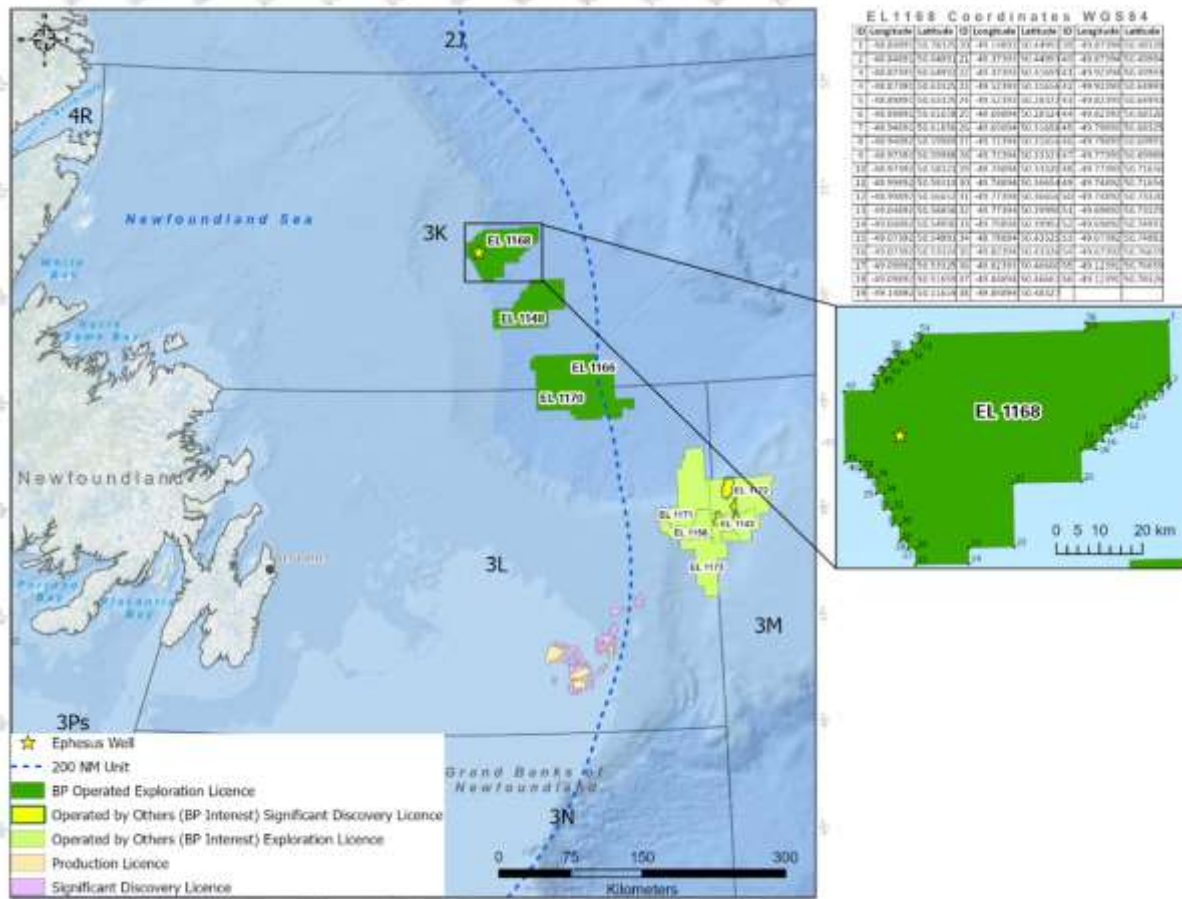


Figure 1-2: Ephesus Wellsite Within EL1168

2. Purpose

The EIS for the bp Canada Energy Group ULC Newfoundland Orphan Basin Exploration Drilling Program was initiated in September 2018 and progressed in accordance with the requirements of the Canadian Environmental Assessment Act, 2012.

The EIS stated routine project activities and components have the potential to interact with marine mammals and sea turtles primarily due to underwater sound associated with the presence and operation of a MODU, VSP survey, Project Supply Vessels (PSV) operations, and to a lesser extent, helicopter overflights. These potential disturbance sources and operational discharges could result in direct and indirect (e.g., changes to habitat quality) effects on marine mammals and sea turtles.

In the February 2020 Decision Statement issued for that EIS, the Minister of Environment determined that the proposed project, with implementation of mitigation measures, was not likely to cause significant adverse environmental effects. The Decision Statement contained conditions which required bp to develop and implement a follow-up program to monitor marine mammals during VSP operations to verify the effectiveness of mitigations and the accuracy of the environmental assessment. Table 2-1 below reflects the EIA Decision Statement conditions placed upon the drilling program to ensure protection of marine mammal and sea turtles.

The purpose of this report is to provide the results of the marine mammal follow-up program that was implemented.

Table 2-1: EIS Decision Statement Conditions for the Protection of Marine Mammals During VSP Operations

| Condition Number | Conditions for Marine Mammal Follow-up Program |
|-------------------------|--|
| 2.5 | The Proponent shall, where a follow-up program is a requirement of a condition set out in this Decision Statement, determine the following information, for each follow-up program: |
| 2.5.1 | the methodology, location, frequency, timing and duration of monitoring associated with the follow-up program as necessary to verify the accuracy of the environmental assessment predictions as they pertain to the particular condition and to determine the effectiveness of any mitigation measure(s); |
| 2.5.2 | the scope, content, and frequency of reporting of the results of the follow-up program |
| 2.5.3 | the levels of environmental change relative to baseline conditions and predicted effects as described in the environmental impact statement, which would require the Proponent to implement modified or additional mitigation measure(s), including instances where the Proponent may be required to stop Designated Project activities; and |
| 2.5.4 | the technically and economically feasible mitigation measures to be implemented by the Proponent if monitoring conducted as part of the follow-up program shows that the levels of environmental change have reached or exceeded the limits referred to in condition 2.5.3 |
| 2.6 | The Proponent shall submit the information referred to in condition 2.5 to the Board prior to the implementation of each follow-up program. The Proponent shall update that information in consultation with relevant authorities during the implementation of each follow-up program and shall provide the updated information to the Board within 30 days of the information being updated |
| 2.7 | The Proponent shall, where a follow-up program is a requirement of a condition set out in this Decision Statement: |
| 2.7.1 | conduct the follow-up program according to the information determined pursuant to condition 2.5 |
| 2.7.2 | undertake monitoring and analysis to verify the accuracy of the environmental assessment as it pertains to the particular condition and/or to determine the effectiveness of any mitigation measures |
| 2.7.3 | determine whether modified or additional mitigation measures are required based on the monitoring and analysis undertaken pursuant to condition 2.7.2; |
| 2.7.4 | if modified or additional mitigation measures are required pursuant to condition 2.7.3, develop and implement these mitigation measures in a timely manner and monitor them pursuant to condition 2.7.2 |
| 3.8 | The Proponent shall apply Fisheries and Oceans Canada's Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment during the planning and the conduct of vertical seismic surveys. In doing so, the Proponent shall establish a safety zone of a minimum radius of 500 metres from the seismic sound source. |
| 3.9 | The Proponent shall develop, in consultation with Fisheries and Oceans Canada and the Board, a Marine Mammal Monitoring Plan that shall be submitted to the Board at least 30 days prior to the commencement of any vertical seismic survey. The Proponent shall implement the plan during the conduct of vertical seismic surveys. As part of the plan, the Proponent shall: |

| Condition Number | Conditions for Marine Mammal Follow-up Program |
|------------------|---|
| 3.9.1 | develop and implement marine mammal observation requirements, including the use of passive acoustic monitoring, or equivalent technology, and visual monitoring by marine mammal observers throughout vertical seismic surveys; |
| 3.9.2 | ensure that observation requirements specify the requirement for shut down of the seismic sound source if any marine mammal or sea turtle is observed within the safety zone established in condition in 3.8; |
| 3.9.3 | ensure that observation requirements specify that the start of the seismic sound source can only begin once marine mammals have not been observed within the safety zone established in condition 3.8 for 60 minutes; and |
| 3.9.4 | submit the results of the activities undertaken as part of the marine mammal observation requirements to the Board within 60 days of the end of the vertical seismic surveys. |

3. Follow-up Program Summary

On June 12, 2023, prior to the onset of VSP operations, an experienced PAM operator (Amelia Lamb) and visual marine mammal observer (Teresa Best) were deployed to the Stena IceMax to conduct marine mammal mitigation monitoring during the VSP program. The Seiche Vertical PAM system and all required visual monitoring and data collection equipment were shipped to the Stena IceMax before their arrival.

Colin Reid and Calista Corbett were already onboard the facility as the designated Seabird Observers before the onset of VSP operations. Calista Corbett is cross-trained as a visual Marine Mammal Observer, and Colin Reid is cross-trained in both visual and acoustic monitoring (i.e., MMO and PAM). Colin and Calista provided appropriate breaks to the lead MMO and lead PAM Operator throughout the VSP program, so neither observer was on watch for longer than the required cumulative and continuous watch times. While covering breaks and rest time, they were on dedicated marine mammal/sea turtle watches, not simultaneously monitoring seabirds. Most of the VSP program occurred during periods of darkness, and hourly seabird surveys are only required during designated daylight hours.

The MMO and PAM operator were responsible for monitoring for marine mammals and sea turtles during VSP operations in accordance with the:

- bp Marine Mammal/Sea Turtle Monitoring Plan CN002-EV-PLN-600-00015
- C-NLOPB Geophysical, Geological, Environmental and Geotechnical Program Guidelines June 2019
- Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment 2007 (SOCP).

VSP operations commenced on June 14, 2023, and concluded on June 15, 2023, with the seismic source active for approximately 11.5 hours. No seismic sound testing was conducted before, during, or after the completion of VSP operations.

There was a total of three visual marine mammal detections prior to the activation of the source, two of which were within the 500-metre safety zone. All detections occurred prior to the required 60-minute pre-watch period; thus, startups were able to proceed as planned and

no shutdowns were required.

4. Mitigations and Monitoring

As described in the bp Marine Mammal/Sea Turtle Monitoring Plan CN002-EV-PLN-600-00015, marine mammal and sea turtle mitigations and monitoring procedures applied during VSP operations were consistent with those outlined in the Canadian Department of Fisheries and Oceans (DFO) *Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* (SOCP, 2007).

Mitigation procedures were applied to minimize any potential impact to marine mammals or sea turtles within or approaching the 500m safety zone. Monitoring procedures were implemented to identify when marine mammals or sea turtles were within or approaching the safety zone and to detect behavioural changes associated with VSP operations.

4.1. Mitigation Measures

The following mitigation measures, adopted from the SOCP, were implemented during VSP operations on the Stena IceMax:

- A 500m radius safety zone was established around the seismic source. The source could not be active while marine mammals or sea turtles were present within this zone. Following the SOCP mitigation requirements regarding safety zone size, which states that “potential impacts of seismic are greatest within short distances” and “Existing scientific evidence and the application of a precautionary approach revealed that beyond a 500m safety zone, sound energy from seismic activity is unlikely to cause adverse impacts on marine mammals and sea turtles” (SOCP, 2007).
- A 60-minute pre-watch was completed prior to source activation. During that time the MMO and PAM operator monitored for marine mammals and sea turtles within or approaching the 500m safety zone. If any marine mammal or sea turtle was detected inside the safety zone, the MMO or PAM Operator was required to immediately communicate the requirement to stop or delay activation of the seismic source.
- Seismic source ramp-up procedures were implemented. As part of the start-up sequence, a single source element of the array was activated and gradually additional source elements of the array were activated until the operating level was obtained. The ramp-up procedures took 30 minutes from 22:45 UTC to 23:15 UTC.
- Shutdown procedures were implemented as required. If the MMO or PAM operator detected any species of marine mammal or sea turtle inside the safety zone during seismic data acquisition, the seismic source would have been shut down immediately.

4.2. Monitoring Procedures

Marine mammal and sea turtle detection was carried out by visual monitoring conducted by the MMO and acoustic monitoring conducted by the PAM operator. The combination of both visual and acoustic monitoring provides the best chance of detecting animals.

4.2.1. Visual Monitoring Procedures

A qualified MMO was on watch during daylight hours to ensure compliance with the mitigation procedures described above. Visual monitoring was carried out from the bridge of the Stena IceMax to have best possible vantage point to detect marine mammals and sea turtles.

Visual monitoring involved scanning the area with the naked eye and binoculars to identify potential sighting cues such as blows, body observations (i.e., head, back, dorsal fin, flukes, etc.), splashes, and the presence of feeding seabirds. The range was measured accurately using reticule binoculars and a range stick. The bearing of a sighting was determined by referencing the true degrees of the vessel heading. Behavioural traits of each sighting were observed and documented.

4.2.2. Acoustic Monitoring Procedures

During periods of darkness and periods of poor visibility when the full extent of the 500m safety zone was not visible, and during all pre-watch periods, a qualified PAM Operator carried out acoustic monitoring from the dedicated Seiche Vertical Passive Acoustic Monitoring (VPAM) system station. It involved monitoring sounds and visual displays for marine mammal vocalizations using an acoustic sensor (i.e., hydrophone), associated electronic equipment, and PAMGuard software. The PAM Operator conducted additional acoustic monitoring beyond what was required for the duration of VSP operations due to delays associated with the seismic source.

5. Monitoring Equipment

5.1. Visual Monitoring Station

The visual monitoring station included a workstation for data entry and the following equipment required for visual monitoring:

- Reticule binoculars
- Range estimation sticks
- Marine mammal identification guides
- VHF handheld radios
- Joint Nature Conservation Committee (JNCC) data recording forms
- Dedicated laptop for data entry

5.2. Acoustic Monitoring Station

The PAM monitoring station was located in the Bosun's Locker on deck 5 which was the ideal area for equipment setup. It was adjacent to the inactive ROV moon pool where the hydrophone cable was deployed, it had a suitable workstation for monitoring as well as a power supply for the electronic equipment. The VPAM system included the following components:

- PAMGuard software
- A buffer box, which incorporates the hydrophone interface and houses the National Instruments Data Acquisition (NI DAQ) sound card (to monitor mid-frequency to high-frequency vocalizations)
- The Behringer UMC202HD USB sound card (to monitor low-frequency to mid-frequency vocalizations)
- Intel NUC mini-PCs
- Display monitors/keyboards
- Cables and adapters
- Two 100-meter cables (one primary and one spare) with a single hydrophone element

(acoustic sensitivity range from 20 Hz – 150 kHz) located at the terminal end of each cable

A dedicated laptop was used for data entry, and a handheld VHF radio was used to communicate with the visual observer and the VSP operators.

6. VPAM Testing and Deployment

The Seiche VPAM electronic equipment was set up on the morning of June 13, 2023, and a tap (signal) test was performed on both hydrophone cables (primary and spare) to ensure a clear signal was received from the hydrophone element. The PAM cable was prepared and deployed on the afternoon of June 13, 2023.

6.1. Tap Test

The Intel NUC mini-PCs were pre-installed with PAMGuard, including a ready-to-use PAMGuard configuration file suitable for VSP operations. Once all electronic equipment was set up and connected, the main hydrophone cable (SM 6231; Cable #712; Figure 6-1) was connected to the buffer box and tap tested while monitoring the visual displays in PAMGuard (i.e., the spectrogram and the click detectors). The acoustic inputs (taps and scrapes) were detected and displayed on PAMGuard visual displays (Figure 6-2), and the sound was clear in the headphones throughout the tap test. The spare hydrophone cable was also tested with the same result. The hydrophone and cable were deployed through the inactive ROV moon pool in a quality configuration and a clear signal was confirmed both aurally and visually via PAMGuard displays.



Figure 6-1: Seiche Hydrophone Cable 712



Figure 6-2: PAMGuard VSP Configuration - Hydrophone Tap Test Detections Displayed Across the Full Frequency Range of the Main Spectrogram Display

6.2. Cable Preparation

Prior to cable deployment, the most efficient cable run (in terms of distance and minimizing cable tension) from the VPAM monitoring station to the hydrophone deployment location next to the inactive ROV moon pool was determined. After measuring the distance of the decided cable route, it determined that the 100m cable length would be sufficient, and an intermediate deck cable would not be required. The hydrophone cable was measured from the hydrophone element and marked with electrical tape every 10m up to 30m to be able to achieve the required hydrophone depth easily. A 1kg weight was secured to the cable 3 meters above the hydrophone element (Figure 6-3) to keep it at an appropriate depth for marine mammal detection.



Figure 6-3: 1kg Weight Secured to Hydrophone Cable 712

6.3. Safety Procedures for Cable Deployment

Prior to hydrophone cable deployment, the personnel involved (2 PAM Operators and 1 crew member) completed a hazard assessment to identify all potential hazards and risks involved in the deployment of the VPAM cable. Personnel wore full personal protective equipment and carried handheld radios at all times during the deployment process. The following table summarizes the potential hazards that were identified prior to cable deployment and actions taken to mitigate those hazards.

Table 6-1: PAM Deployment Hazards and Mitigations

| Identified Hazards | Mitigation Action |
|-------------------------|---|
| Potential pinch points | All potential pinch points were identified and avoided |
| Electrical equipment | All electrical equipment was powered down prior to deployment |
| Simultaneous operations | Confirmed with the Barge Master that no concurrent operations were ongoing in the vicinity |
| Slips, trips, and falls | Extra caution was taken in wet or damp areas and areas where tripping hazards were present such as the cable runs |

6.4. Cable Deployment

The 100m cable was run from the VPAM station to the deployment location. Covers were placed along the cable to minimize the risk of cable damage or creating a tripping hazard (Figure 6-4). The hydrophone cable was deployed down a hatch leading to the inactive ROV moon pool to prevent entanglement with other equipment. The cable was deployed within the 500m safety zone, 103m from the source deployment location. It was deployed at a depth of 21m well under the hull of the vessel to minimize vessel noise and other ambient noise. A 1kg weight was attached 3m above the hydrophone element prior to deployment to maintain a consistent depth. Once the hydrophone element was deployed at the required depth, the cable was secured to a section of rope via a Chinese finger knot (Roman sandal tie), which was attached to a shackle around a secure rail (Figure 6-5). A section of pipe was secured above the hatch opening to protect the cable from abrasion (Figure 6-6).



Figure 6-4: Cover to Minimize Cable Damage and Tripping Hazards.



Figure 6-5: Cable Secured to the Rope Using a Chinese Finger Knot (Roman Sandal Tie) to Reduce Cable Tension.



Figure 6-6: Pipe Used to Prevent Cable Abrasion and Keep the Cable Vertical

7. Data Collection

7.1. Data Sheets

As described in the bp Marine Mammal/Sea Turtle Monitoring Plan CN002-EV-PLN-600-00015, JNCC marine mammal recording forms for both acoustic and visual monitoring, which were designed for data collection during seismic surveys, were used for data collection. The forms are contained in an Excel workbook containing the following four worksheets:

- Cover page - contains general information about the survey
- Operations - contains details of the use of the source
- Effort - contains details of your watches/ acoustic monitoring for marine mammals
- Sightings - contains details of sightings/ acoustic detections

Hard copies of the JNCC forms, known as deck forms, were used by the MMO for recording hand-written observations. These were completed while on deck to ensure all required information was documented.

7.2. Quality Assurance

The MMO and PAM Operator ensured the accurate recording and transcribing of information by checking their data prior to going off duty to ensure all required fields were filled out with the appropriate corresponding values. Additional quality assurance checks were also completed by onshore PAL Data Analysts who received the digital data, analogue recording forms and the daily report summary.

7.3. Data Backup and Storage

All electronic data was backed up daily with one copy saved on the field computer and another copy saved to a thumb drive. Hard copies of all data sheets were stored and sent to PAL onshore, and electronic forms were emailed to onshore PAL Data Analysts at the completion

of VSP operations.

8. Results

The VSP source was activated for a soft start at 2245z on June 14, 2023, and VSP operations concluded 1006z on June 15, 2023, when the source was deactivated.

The seismic source was active for a total of 11 hours and 21 minutes. The following sections summarize the monitoring effort data collected during monitoring, detection data, and mitigation measures applied.

8.1. Monitoring Effort

Monitoring was carried out throughout the duration of VSP operations and during the pre-watch period prior to the activation of the source. Data was entered hourly by the MMO and PAM Operator and was also collected and entered whenever there was a change in source activity or a significant change in environmental conditions. While the lead PAM Operator (Amelia Lamb) and the lead MMO (Teresa Best) acted as the primary observers throughout the VSP program, Colin Reid and Calista Corbett filled in to provide appropriate breaks and ensure neither primary observer exceeded requirements in terms of continuous and cumulative watch times.

8.1.1. MMO Monitoring Effort

The MMO carried out visual monitoring effort during all daylight hours while the source was active and during the pre-watch period prior to source activation. The total MMO monitoring effort was 9 hours and 56 minutes. While the lead MMO acted as the primary observer, other trained observers (Colin Reid and Calista Corbett) were onboard to fill in and provide required rest periods.

8.1.2. PAM Monitoring Effort

Acoustic monitoring was carried out by the PAM operator on watch during periods of darkness, during periods of poor visibility when the full extent of the 500m safety zone was not visible and during the pre-watch period prior to source activation. The total PAM effort was 17 hours and 6 minutes. While the lead PAM Operator acted as the primary observer, another trained PAM Operator (Colin Reid) stepped in to provide appropriate breaks and ensure the required continuous watch and cumulative watch periods were not exceeded.

8.2. Marine Mammal Detections (Visual and Acoustic)

There were three visual detections of nine individual marine mammals during the monitoring period. The species, *Hyperoodon ampullatus*, commonly known as the Northern bottlenose whale, was the only species identified in all detections. All detections occurred during the pre-watch period when the source was inactive. Two of these detections were within the 500m safety zone. The 60-minute pre-watch recommenced when the marine mammals were observed leaving the zone. There were no acoustic detections.

8.3. Mitigation Actions

The 60-minute pre-watch period was re-started twice after marine mammals were seen exiting the 500m safety zone. By the time ramp-up operations were ready to commence, the safety zone had been clear for 3 hours and 5 minutes prior to source activation. There were no shutdown or delayed start mitigation actions required during VSP operations.

9. Environmental Effects Summary

In the determination of significance, the EIS stated that, based on the nature of the interactions between the project and marine mammals and sea turtles, the planned implementation of mitigation measures, and predicted residual changes to the risk of mortality or injury and to habitat quality and use, the project (including VSP operations) is unlikely to result in significant adverse effects on marine mammals and sea turtles.

Monitoring and mitigation procedures described in the bp Marine Mammal/Sea Turtle Monitoring Plan CN002-EV-PLN-600-00015 were implemented during VSP operations. Based on data collected by visual and acoustic observers, there were no apparent indications that marine mammals were significantly affected by VSP operations.

10. EIS Decision Statement Condition Compliance

This section is intended to provide a brief overview of the steps taken by bp to ensure compliance with requirements for a marine mammal monitoring follow-up program as described in the February 2020 Decision Statement issued for the drilling program environmental assessment.

The Decision Statement conditions are listed in Table 2-1. Conditions 2.5, 2.6 and 3.9.1-3.9.3, were addressed via submission of the bp Marine Mammal/Sea Turtle Monitoring Plan CN002-EV-PLN-600-00015 which was accepted by the C-NLOPB on February 9, 2023.

The information provided in this report demonstrates that bp has addressed Decision Statement conditions 2.7 and 3.9.4. The marine mammal follow-up program was implemented as described in the bp Marine Mammal/Sea Turtle Monitoring Plan CN002-EV-PLN-600-00015. The mitigations identified in the Plan were applied and, based on the visual and acoustic data collected, no modifications to existing mitigation measures or new mitigation measures were deemed necessary. Additionally, there were no apparent indications that a significant adverse effect on marine mammals occurred, thus the accuracy of the environmental assessment can be reasonably concluded to have been accurate.