The Sizewell C Project

6.3 Volume 2 Main Development Site

Chapter 22 Marine Ecology and Fisheries

Appendix 22N - Sizewell C Draft Marine Mammal Mitigation Protocol (MMMP)

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Sizewell C draft Marine Mammal Mitigation Protocol (MMMP)

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Please note that the red line boundary was amended after this document was finalised, therefore figures in this document do not reflect the boundaries in respect of which development consent has been sought in this application. However, amendments to the red line boundary does not have any impact on the findings set out in this document and all other information remains correct.

1 Introduction

1.1 Project background

EDF Energy proposes to construct and operate a new nuclear power station immediately to the north of the existing operational and decommissioned stations (Sizewell B and Sizewell A, respectively) at Sizewell on the Suffolk coast (Figure 1).

Impact pilling represents the primary construction issue for marine mammals at Sizewell. Construction of the Beach Landing Facility (BLF) is the only activity that requires pile driving.

The BLF would be used to receive large deliveries into Sizewell C by barge. The BLF will consist of a piled jetty, fenders and ramp and mooring dolphins. Jetty piles would be positioned in the shallow subtidal. One pair of jetty piles is close to the low tide mark, and three pairs are seaward of low tide. Two fenders would be piled at the end of the jetty and two mooring dolphins would be positioned at approximately 66 m and 128 m from MHWS. The jetty piles would be 1m in diameter and the fender/dolphin piles would be 1.52 m in diameter. A total of 12 piles would be installed within the marine environment below MHWS at a maximum water depth of -3.4 m ODN (Figure 2).

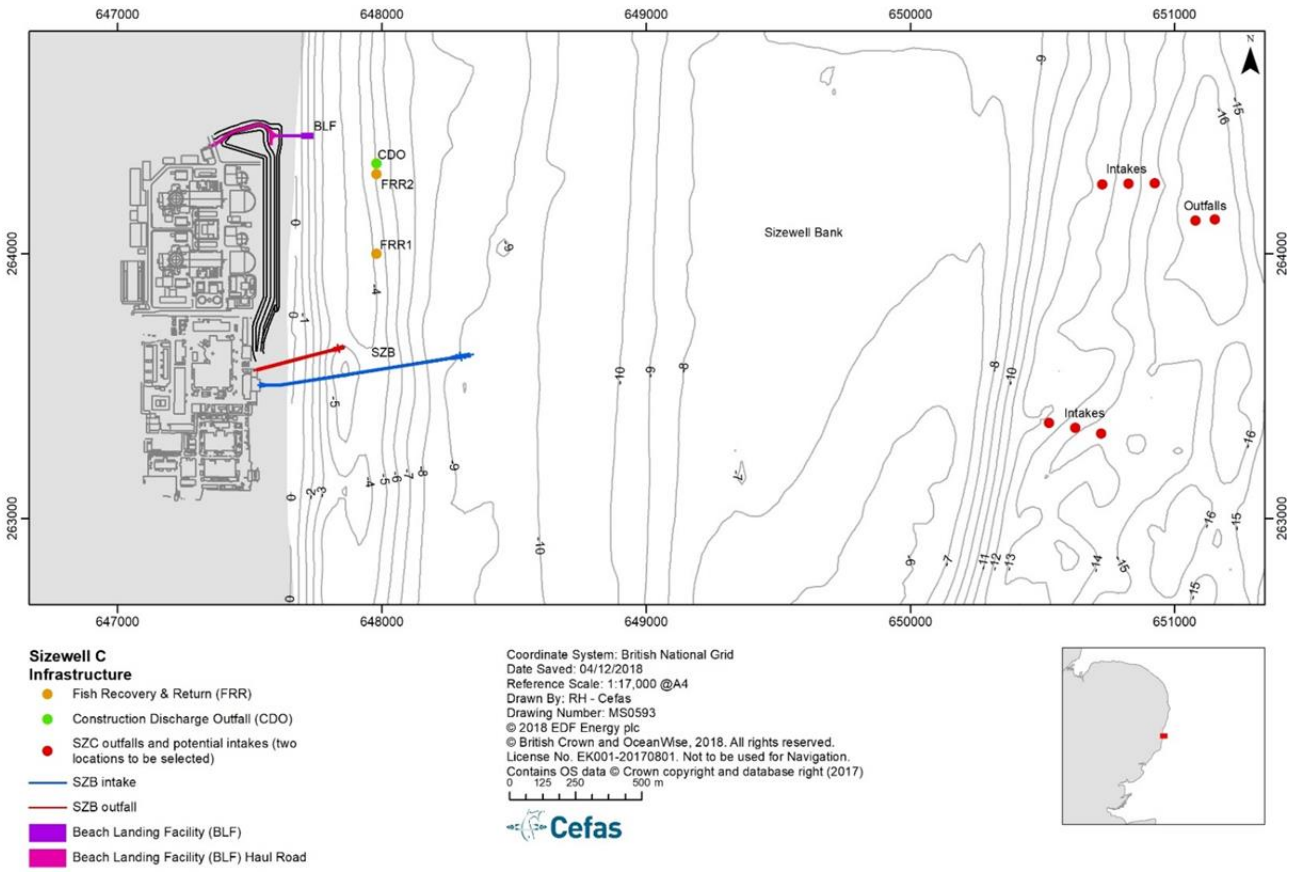

Figure 1: Schematic of the proposed location of development infrastructure in the marine environment with indicated location of the BLF.

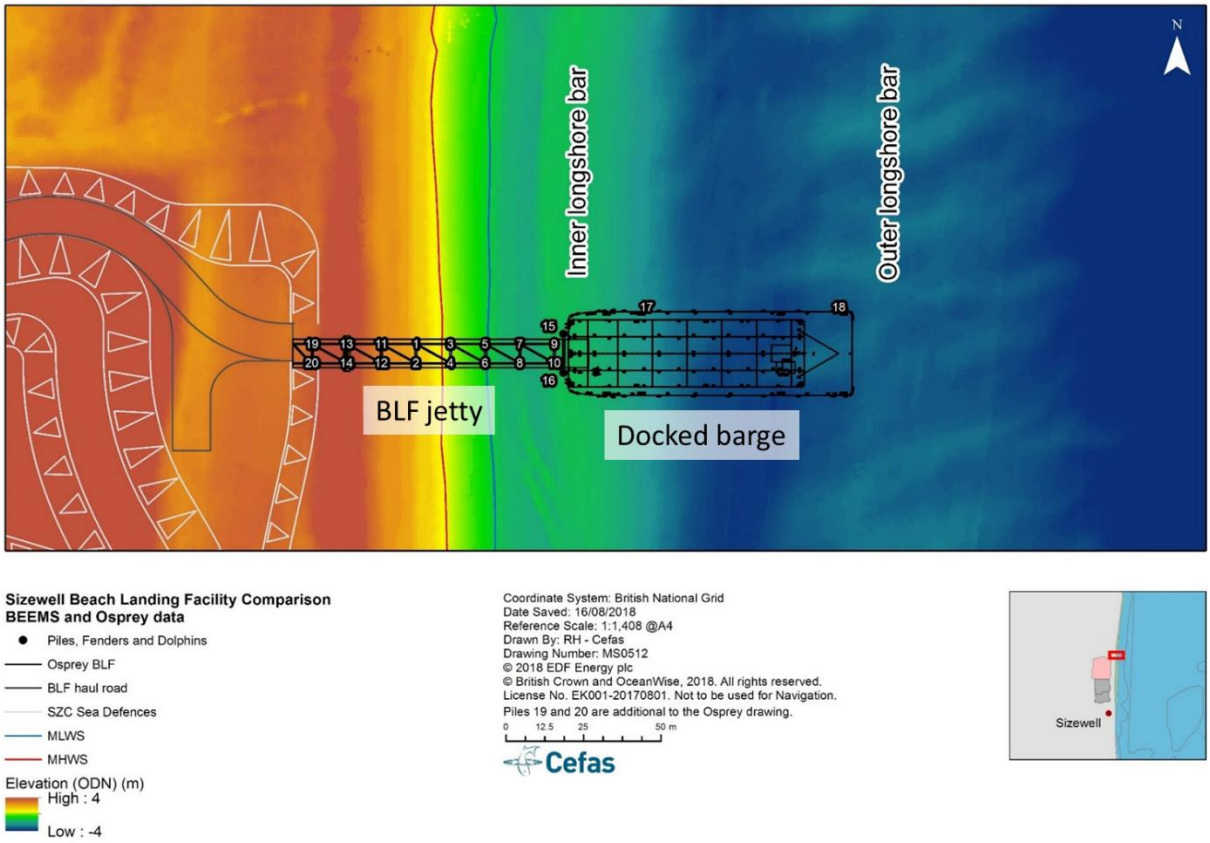

Figure 2: The Beach Landing Facility (BLF) showing the position of the jetty piles, fenders (points 15 and 16) and dolphins (points 17 and 18) relative to the longshore bars and MHWS.

Construction of the BLF in the marine environment would be undertaken from either a temporary rock platform or using a walking jack-up barge or similar. Dolphins could be installed from a standard jack-up barge if a walking jack-up barge were not to be used.

Impact piling is the anticipated piling method for installing the 12 marine piles. Indicative piling specifications are:

a) Maximum hammer energy of 90 kJ;

b) Strike rate of 46 strikes per minute;

c) Each pile would require approximately 1,500 hammer blows to install (lasting 33 minutes);

d) A maximum of five piles would be installed in each 24-hour period.

1.2 Background on pile driving

Pile driving activities are performed to establish foundation support for different structures in the marine environment. Piles are driven into the seabed by means of a hydraulic hammer. The sounds from pile driving enters the water column directly because the impact of the hammer strike will create waves in the pile wall, which combine with the surrounding fluid (water) (Popper and Hastings, 2009). Furthermore, the pulse propagating down the pile may combine to the substrate at the bottom, causing waves to propagate outward through the seabed sediment (Popper and Hastings, 2009). Acoustic energy can radiate back into the water column from the seabed at some distance away from the pile (Erbe, 2012). The propagation of pile driving noise varies according to the seabed type (Hildebrand, 2009), pile characteristics (size, shape, length and material), the size and energy of the hammer, water depth, bathymetry, temperature and salinity (Erbe, 2012). Pile driving activities are of particular concern as they generate loud, impulsive sounds, at low

frequencies and high source levels (Hildebrand, 2009). Pile-driving operations have been identified as producing sufficiently high noise levels, capable of causing physical injury to marine mammals (Nedwell *et al.*, 2007).

The best practice for mitigating the impacts of anthropogenic sound on marine mammals includes the following mitigation options:

a) Establishment of appropriate mitigation zone around the sound source, encompassing the area within which mitigation measures are applicable;

b) When possible, the implementation of a soft start procedure to build up the sound source slowly over time and permit marine mammals to leave the area prior to maximum exposure;

c) The use of dedicated personnel to undertake visual and/or acoustic monitoring in order to detect marine mammals and implement a suite of real-time mitigation measures.

The Joint Nature Conservation Committee (JNCC) '*Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise*' (2010) provides guidance for the mitigation measures required during pile-driving operations. The marine mammal mitigation measures proposed for the piling during this project follow the JNCC (2010) piling protocol.

1.3 Marine mammals in the area

Three species of marine mammal are known to occur in the Great Sizewell Bay (GSB). These include one cetacean species: harbour porpoise (*Phocoena phocoena*) and two pinniped species: harbour seal (also known as common seal) (*Phoca vitulina*) and grey seal (*Halichoerus grypus*). Other species of cetaceans are present in the southern North Sea, although, these species are infrequently observed within the GSB (BEEMS, 2019b).

1.3.1 Harbour porpoise

The harbour porpoise is the only cetacean species regularly present in the GSB with majority of acoustic detections occurring during winter months (i.e. between October and March). Their presence is more pronounced in offshore waters (10-20 km from the coast) will lower detection rates in inshore waters (1-2 km from the coast) (BEEMS, 2014).

The area of open sea adjacent to the eastern boundary of the proposed development is located within the Southern North Sea Special Area of Conversation (SAC) designated solely for the purpose of aiding the management of the Annex II[1] species harbour porpoise. The designated area is of high importance to harbour porpoise in both the summer and winter months. The conservation objective of the site is to ensure site integrity making an appropriate contribution to maintaining Favourable Conservation Status (FCS) for harbour porpoise in UK waters.

1.3.2 Harbour seal

The harbour seal is found around the UK coast but is more widespread around the west coast than in the North Sea. The nearest sites of relevance to the proposed development area are The Wash and Blakeney Point to the north and the Thames Estuary to the south. Tagging studies have revealed that the harbour seals do transit along the coastline between the Thames and north Norfolk (Sharples *et al.*, 2012; Barker et al., 2014) suggesting a certain level of at-sea usage of the area close to the proposed development area. Generally, habitat use is considered to be low to moderate in the proposed development area with low haul out usage (SCOS, 2012).

[1] Annex II species require designation of SACs under the Habitat Directive (92/43/ECC).

1.3.3 Grey seal

Previous surveys conducted in the wider area suggest that grey seals are present reasonably regularly around the proposed development area (Kowalik et al, 2008; Galloper Wind Farm Limited, 2011; Fugro EMU, 2015). However, they do not utilise the area heavily and appear present mostly during winter and spring (Fugro EMU, 2015). The nearest SAC to the proposed development that includes grey seal as a qualifying feature is the Humber Estuary, circa 220 km to the north.

1.4 Assessment of potential impacts and underwater noise modelling

Underwater noise modelling was undertaken to determine the potential effects of pilling on marine mammals (BEEMS, 2019a). The modelling considered the indicative piling specifications provided (as outlined in Section 1.1) as well as an additional 200 kJ hammer energy option, to represent a precautionary scenario and to envelope potential engineering options. Additionally, modelling incorporated precautionary assumptions that the piling energy remains constant throughout the piling event (i.e. no soft start) and that all piling is completed at highwater.

The low energy impact piling associated with the BLF resulted in no instantaneous Temporarily Threshold Shift (TTS) for harbour porpoise or seals outside the standard 500 m mitigation zone at the onset of piling. As such instantaneous impacts from piling are considered minimal (Table 1).

The predicted cumulative[2] auditory impact zones extended over wider areas. The Permanent Threshold Shift (PTS) zone for stationary harbour porpoise extended up to 2.1 km offshore, while the stationary TTS zone exceeded 12 km offshore from the impact piling activity. The corresponding PTS and TTS ranges for stationary seals were smaller, at 0.3 km and 3.1 km, respectively. This indicates a risk of disturbance to marine mammals in the area if impact piling is carried out for extended periods. This cumulative assessment is precautionary in that it does not assume fleeing behaviour, and for effects to occur, the animal must remain within the impact zone for the duration of the piling activities (five piles within a 24-hour period). When fleeing behaviour is incorporated into the model impact zones diminish. With fleeing included in the assessments, no auditory effect zones were predicted for the seal species. For harbour porpoise fleeing behaviours result in no predicted cumulative PTS. The largest TTS effect zone extended to 4.8 km from the BLF piling location.

EDF Energy conducted an assessment of potential impacts of underwater noise during construction of BLF to marine mammals as part of the Environmental Impact Assessment (EIA) (Chapter 22, Section 22.9 Marine Mammals). Considering the predicted impact ranges of the underwater noise modelling as well as short duration and small scale of the projects, it was assessed that the impact of increased underwater noise due to the piling activities would have a minor negative effect on marine mammals. Effects are therefore not significant and are predicted to be short-lived and return to baseline conditions after piling activity ceases.

[2] Cumulative modelling assumed a highly precautionary scenario whereby all piles are located at the deepest location at high water.

Table 1 Marine mammal auditory impact zone maximum ranges for impact piling activities.

Piling Energy	Threshold	Instantaneous		Stationary Cumulative		Fleeing Cumulative	
		Harbour porpoise	Phocid seals	Harbour porpoise	Phocid seals	Harbour porpoise	Phocid seals
90 kJ	PTS	27 m	6 m	1,297 m	206 m	No effect	No effect
	TTS	45 m	10 m	6,624 m	1,882 m	2,765 m	No effect
200 kJ	PTS	41 m	9 m	2,081 m	303 m	No effect	No effect
	TTS	67 m	16 m	12,450 m	3,104 m	4,795 m	No effect

1.5 Purpose of this protocol

This document outlines the monitoring and mitigation requirements for minimising the impacts on marine mammals during the construction of the BLF. It aims to ensure, as far as practically possible, that marine mammals occurring around the proposed development site are not exposed to potentially damaging levels of underwater noise during piling operations, with its primary focus on avoiding, wherever possible, injurious impacts during piling.

The marine mammal mitigation protocol (MMMP) is based on the statutory advice on minimising the risk of injury to marine mammals from piling noise provided by the JNCC (2010). The protocol:

a) Identifies the area known as the mitigation zone (MZ);

b) Outlines the mitigation measures that will be implemented to limit potential impacts on marine mammals;

c) Describes the communication plan in place to implement the mitigation measures quickly and effectively;

d) Sets out the roles of the Marine Mammal Observer (MMO) and the Designated Person (DP) in relation to piling activity (i.e. their authority in terms of pile driving activity).

Please note, this document presents a draft protocol demonstrating the principles and methods related to minimising potential impacts associated with piling of the BLF. The proposed protocol is in line with current best practice and will be updated once final construction methods have been confirmed. The final MMMP will be agreed upon the consultation with the relevant SNCBs.

The protocol presented in the final MMMP must be followed for all piling operations during the piling activities for construction of BLF in the marine environment. EDF Energy and its contractors are responsible for ensuring the agreed MMMP is implemented.

2 Marine mammal monitoring

The predicted instantaneous impact ranges from BLF piling are at worst case 16 m for seals and 67 m for harbour porpoise (see Section 1.4).

Both visual and acoustic monitoring methods are generally considered as standard mitigation tools for piling projects.

For this project, visual monitoring is deemed as practical and effective for seals and harbour porpoise in the relatively sheltered waters with low wave heights inshore of the Sizewell-Dunwich Bank.

Acoustic monitoring using passive acoustic monitoring system (PAMS) is not effective for harbour and grey seals but can be useful for harbour porpoise. However, due to the ultrasonic nature of harbour porpoise clicks and their rapid attenuation in seawater, the maximum range of click detection is likely to be no more than 300 m in good acoustic propagation conditions. With pilling due to take place in the intertidal to shallow subtidal zone (maximum water depth 3.4 m ODN) with two nearshore bars, the range of detection would be most likely less than 300 m. In such shallow waters there would also be difficulty in deploying an effective PAMS due to the need to use a buoy mounted system in the channels which will be used by construction vessels. Given the precautionary nature of the assessment, the limited instantaneous impact ranges and the logistical difficulties in deployment of an effective PAMS at the site, acoustic monitoring is not considered necessary or effective for this project.

2.1 Visual monitoring

Visual methods using trained[3] and experienced MMOs are likely to be most effective during daylight hours, good visibility and calm (Beaufort Sea state <4) weather conditions. Therefore, visual monitoring for the piling of BLF would be conducted during daylight hours in favourable weather conditions[4] by a dedicated[5] MMO. The MMO would be observing from a suitable vantage point[6] allowing a clear and unobstructed view of the MZ.

The MMO will conduct diligent observations focusing on the area around the pile scanning with the naked eye and using binoculars to focus on points of interest where required. The MMO will have field experience of detecting and identifying marine mammals in UKCS waters. The MMO will be equipped with a range-finder stick for measuring the distance as well as with binoculars, digital camera and field guides to aid species identification. Additionally, the MMO will be provided with a VHF radio to enable clear communication with the DP.

The JNCC protocol provides standardised data recording forms for ‘Operations’, ‘Effort’ and ‘Sightings’[7], and these will be used to record data on marine mammal monitoring carried out, the time that pile-driving operations start and cease, and any sightings observed.

[3] A trained MMO is defined as one who has attended a JNCC-approved MMO course.
[4] Weather conditions allowing a clear view of minimum 500m around the pile are considered as ‘favourable’.
[5] A dedicated MMO is defined as one whose only role on board is to conduct visual watches for marine mammals.
[6] The exact location of the MMO will be established once piling platform is confirmed.
[7] Recording forms can be found at http://jncc.defra.gov.uk/page-1534

3 Role and responsibilities

3.1 Marine Mammal Observer

The MMO will ensure that visual monitoring commences in good time to conduct minimum of a 30 minute pre-piling monitoring and continue monitoring throughout the entire piling process in order to avoid unnecessary operational delays.

The maximum duration of each observer's shift will be 12 hours in any 24-hour period, including time needed for reporting requirements.

The MMO should give effective briefing on the marine mammal mitigation requirements to crew members at the start-up meeting and provide continuous advice throughout the project and tool-box talks.

3.2 Designated person

A designated person (DP) will be assigned who will be situated on the piling vessel and will be responsible for liaising with the MMO. The DP will have authority, based on the advice of the MMO, to delay/stop piling if it is deemed necessary in accordance with the requirements of the MMMP. The contractor responsible for piling activity will be made aware of the jurisdiction of the DP during the start-up meeting.

The DP will be briefed at the beginning of the project on the mitigation protocol to ensure the requirements are clear.

Communications between the MMO and DP will be conducted via VHF radios. The radios should be tested prior to the commencement of the survey as clear communication is essential.

4 Mitigation principles

4.1 Mitigation zone

The mitigation zone (MZ) refers to the radius around the pile-driving source where primary visual monitoring effort should be focused. This area is also the area in which mitigation procedures should be implemented if marine mammals are observed within.

The results of the underwater noise modelling indicate that the instantaneous impacts from piling are considered minimal (BEEMS, 2019) and well within standards MZ prescribed within the JNCC piling protocol (JNCC, 2010). Thus, the MZ for this project is established to precautionary 500 m from the centre of the pile (Figure 3).

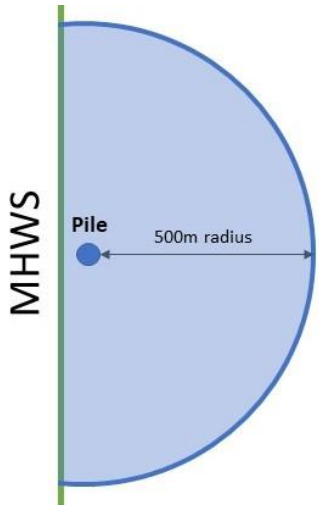

Figure 3 Schematic illustration of the mitigation zone.

4.2 Pre-piling monitoring

The MMO should be notified at least one hour prior to the commencement of piling operations. Visual monitoring will be conducted for at least 30 minutes in advance of piling. At the completion of pre-piling monitoring, if no marine mammals were observed within the MZ, the MMO will inform the DP that piling (with a soft start) can commence.

4.3 Delay procedures

Should marine mammal/s be observed within the MZ during the pre-piling monitoring period, the MMO will immediately alert the DP who will then ensure that a delay of the piling occurs.

The piling (with a soft start) will commence only if: a) the animal(s) have left the MZ and MMO is fully confident that they are outside of the MZ; or b) at least 20 minutes have passed since the last sighting within the MZ.

4.4 Soft start

Soft start is a gradual increase of hammer energy at the onset of piling. The JNCC (2010) protocol recommends that the soft start should last no less than 20 minutes. The purpose of soft start is to allow animals to move away from the noise source before full power is reached thus reducing the likelihood of exposing the animals to injurious sound levels.

If operationally feasible, a full 20-minute soft start will be undertaken for all piling events during the construction of the BLF. However, it must be noted that the maximum hammer energy during this project is expected not to exceed 90 kJ (200 kJ as wort case scenario). Such energy is comparatively smaller than usual energy for piling of offshore windfarms (generally ranging between 240 kJ and 4000 kJ). It is the best practice to commence soft start with 10 % of the maximum hammer energy, which in this case would be 9 kJ. If such low energy is not operationally feasible or if a gradual increase of energy throughout the full duration of soft start is not possible, then an alternative soft start method will be applied whereby the frequency of hammer blows is increased during the first 20 minutes of piling.

The exact soft start methodology will be confirmed by the piling contactor when final technical and operational capabilities are considered.

Each soft start will be carried out in a consistent manner and timings will be logged by the MMO. A hammer energy report will be produced by a piling contractor and provided to MMO post-piling for inclusion in the mitigation report.

4.5 Marine mammals within MZ during soft start

Marine mammal monitoring will continue throughout the soft start procedure. If a marine mammal is detected/observed within the MZ during the soft start, then the MMO will inform the DP and the power and frequency will not be further increased until: a) the animal(s) have left the MZ and MMO is fully confident that they are outside of the MZ; or b) at least 20 minutes have passed since the last sighting within the MZ.

4.6 Breaks in piling

The DP will inform the MMO immediately if breaks in pile-driving operations occur. Following a pause in pile-driving of less than 10 minutes, operations may resume immediately at required power if no marine mammals have been observed within the MZ during the time of no piling activity. However, if any marine mammals are observed during the break in piling, then piling operations may only resume following the agreed soft start procedure if: a) the animal(s) have left the MZ and MMO is fully confident that they are outside of the MZ; or b) at least 20 minutes have passed since the last sighting within the MZ.

As per JNCC protocol (2010) pauses in pile-driving operations of more than 10 minutes in duration require full pre-piling monitoring period of 30 minutes followed by a full soft start procedure. However, if continuous monitoring has been undertaken for the previous 30 minutes, and no marine mammals have been seen within the MZ, the soft start may resume immediately as long as MMO has given ‘All clear’. If marine mammals have been observed, then the delay and soft start procedures described above should be implemented.

As such, it is recommended that the MMO remains on watch during entire duration of the piling operations.

4.7 Poor visibility

JNCC guidelines recommends that piling should not commence during period of darkness or poor visibility (such as fog or sea state associated with Beaufort wind force 4). Therefore, piling should not occur during times of reduced visibility affecting effective observation of entire 500 m MZ.

5 Communication protocol

The communication protocol (as outlined in Figure 4) will be introduced at a start-up meeting with the DP, MMO and construction team representatives in attendance, to ensure that everyone understands the communication channels and specific role and responsibilities.

Quick and effective communications are crucial to the success of the mitigation programme. Key aspects are:

- To convey information quickly and clearly, mitigation-related communications will be between the DP and the MMO;
- The DP and MMO will be confident at utilising VHF radios;
- Appropriate working channels for communications will be determined prior to commencing the first pile-driving operation;
- The DP will have a clear and direct communication with the construction team;
- The DP will notify the MMO of planned times for piling activities;
- The DP will notify the MMO prior to commencement of piling (soft start) and request the 'All Clear' to commence operations;
- The MMO will maintain communications with the DP throughout visual monitoring, alerting them to any marine mammal sightings;
- Once piling has commenced, the DP will notify the MMO of any breaks in operations;
- Hammer logs (including information on the time of start of operations, time taken to reach full power, duration of the soft start, duration of piling, number of blows, energy of each blow and number of blows per minute) will be provided to the MMO at the end of the piling operations.

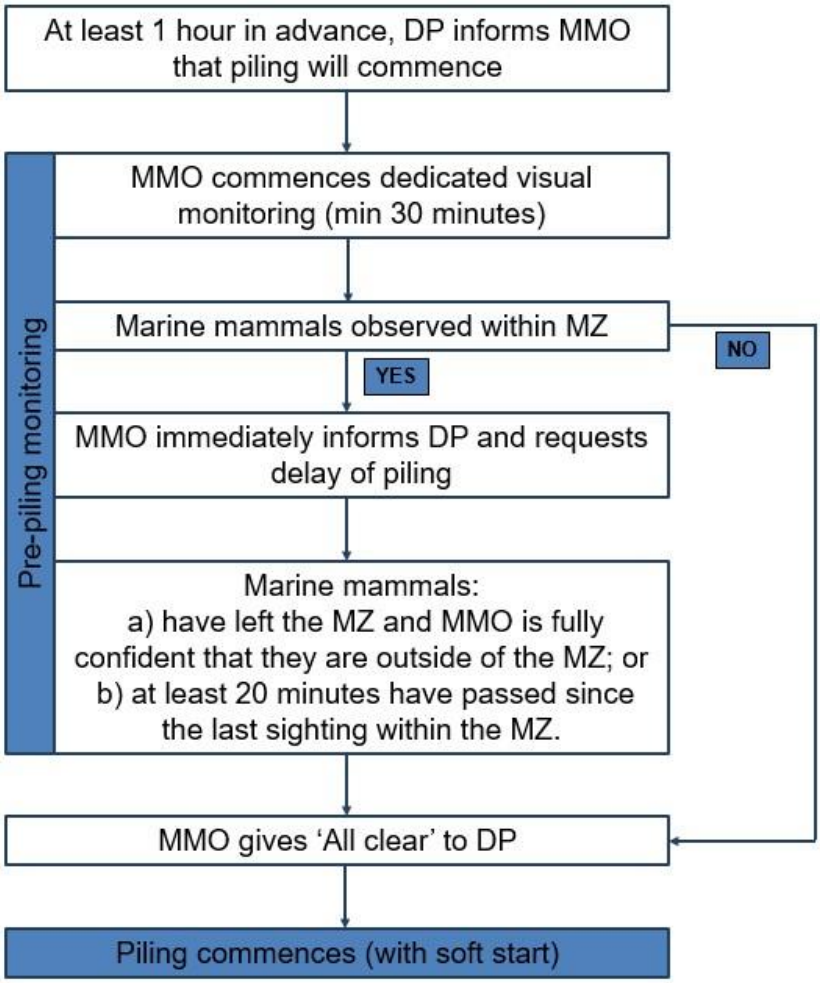

Figure 4 Communication and monitoring plan.

6 Reporting

The JNCC data recording forms will be completed throughout the survey, recording details of the visual monitoring carried out, any marine mammal sightings and pile-driving operations.

The data collected will be presented within the final report. This report will detail methods, monitoring effort, weather conditions, marine mammal sightings, pile-driving events, compliance with soft-start procedures, communications, mitigation measures taken and any recommendations. The completed JNCC survey forms will be included as Appendices. The final report will be submitted within agreed period to the client and the relevant SNCBs.

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