



FLOVENTIS
ENERGY

Llyr 1 and 2 Offshore Demonstration Project – Protected Species and Protected Sites Risk Assessment

Prepared by Cierco Ltd

Date: May 2022

ACRONYMS

Abbreviation	Full Name
MW	Megawatt
HRA	Habitat Regulations Assessment
EIA	Environmental Impact Assessment
EPS	European Protected Species
WCA	Wildlife and Countryside Act 1981
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
NNR	National Nature Reserve
MCZ	Marine Conservation Zone
FCS	Favourable Conservation Status
LSE	Likely Significant Effect
AA	Appropriate Assessment
IROPI	Imperative Reason of Overriding Public Interest
NRW	Natural Resources Wales

1. INTRODUCTION

1.1. Introduction

Floventis Energy is developing a proposal for two 100 megawatt (MW) floating offshore wind developments (200 MW) in total in the Celtic Sea, known as Llyr 1 and Llyr 2 (hereafter referred to as ‘the proposed Project’). The proposed Project is a floating offshore wind development within Welsh Waters, offshore from the Pembrokeshire coastline. At its closest point, the boundary of the proposed Project is approximately 38 km from the Lundy Island shore and 21 km from the Welsh coastline.

The proposed Project has come through The Crown Estate’s Test and Demonstration leasing opportunity, created to support the development and commercialisation of pioneering floating wind technologies. Each of the Llyr projects will test new floating platform and mooring technologies and explore innovative designs, materials and construction approaches.

In order to complete the environmental impact assessment associated with the proposed Project, offshore marine surveys must be undertaken to gather the relevant environmental information. Floventis Energy is planning to undertake geophysical, geotechnical and environmental surveys.

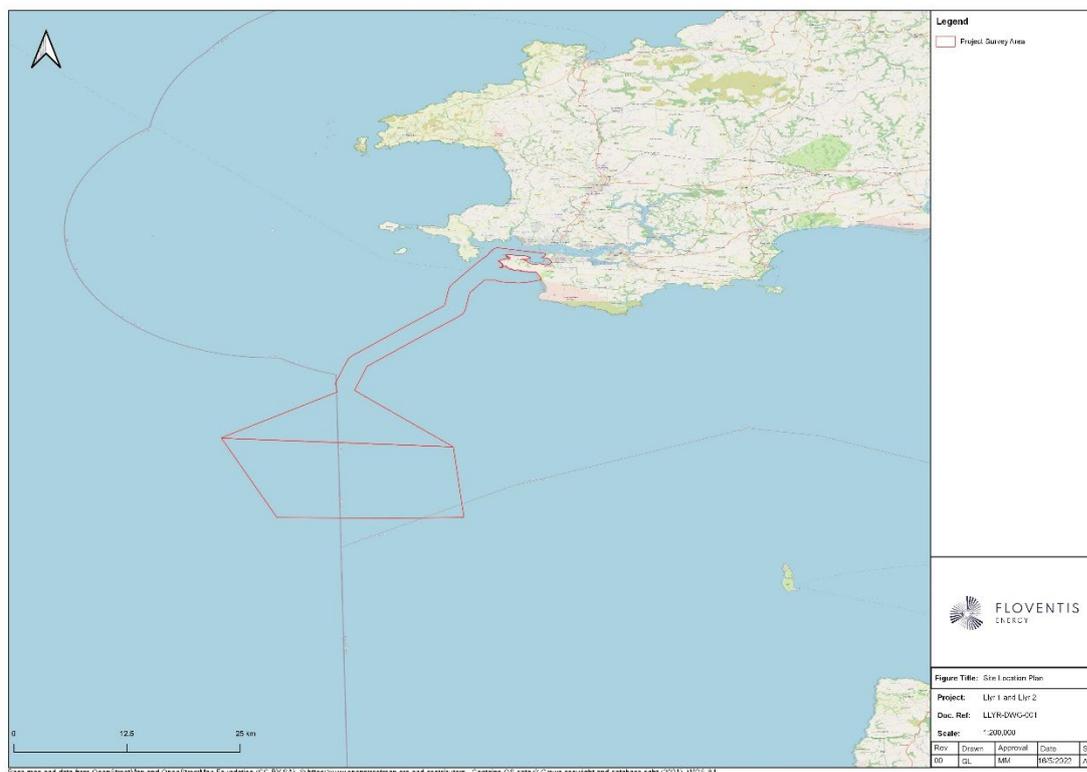
The proposed survey activities will enable Floventis to:

- Acquisition of geophysical, geotechnical and benthic ecology data
- Utilise the environmental data to inform the Environmental Impact Assessment (EIA) and Habitat Regulations Assessment (HRA) which will support consent applications (planned December)
- Utilise the geotechnical and geophysical data to inform the concept design for the projects.

1.2. Llyr 1 and Llyr 2 Areas

Floventis Energy are planning to undertake the geophysical and environmental surveys for the proposed Project. Table 1.1 provides a breakdown of the proposed Project area. In total, the area to be surveyed is 255 ha. The Project Area is shown on Figure 1.1 below.

Figure 1.1 – Proposed Survey Area



The survey activities for the proposed Project are scheduled to be undertaken sometime between July and September 2022. Further information regarding the activity schedule of the proposed surveys is included within Section 2.2.4.

1.3. Consents and Licences

Ahead of any surveys, all relevant consents and licences need to be in place. This document provides the necessary information to support the following:

- An application for an EPS Licence. An EPS Licence is required under the Conservation of Habitats and Species Regulations 2010 (the Habitats Regulations) where there is potential for the presence of vessels or underwater noise from the proposed survey activities to injure or cause disturbance to a European Protected Species (EPS).
- The Habitats Regulations Appraisal (HRA) process, which is conducted by the Competent Authority as prescribed by the Habitats Regulations, to assess if the cable inspections or any subsequent surveys have the potential to result in likely significant effects on a Natura site (either alone or in combination with other plans or projects). The Habitats Regulations state that ‘the effects of a project on the integrity of a European site need to be assessed and evaluated as part of the HRA process’. This includes any European sites with a marine component as well as any terrestrial or coastal European sites with qualifying features that could potentially be impacted; and
- Notice of intention to carry out a Marine Licence exempted activity for geotechnical sampling of less than 1 m³ volume per sample.

1.4. Protected Species

1.4.1. European Protected Species

1.4.1.1. Cetaceans and Marine Turtles

All species of cetacean (whale, dolphin and porpoise) occurring in the UK waters and marine turtles are listed in Annex IV of the Habitats Directive as EPS, meaning that they are species of community interest in need of strict protection, as per Article 12 of the Directive. This protection is afforded in Welsh territorial waters (out to 12 nm) under the Habitats Regulations. Regulation 39(1) of the Habitat Regulations make it an offence to:

- Deliberately or recklessly capture, injure or kill a wild animal of a EPS;*
- Deliberately or recklessly:*
 - Harass a wild animal or group of wild animals of an EPS;*
 - Disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;*
 - Disturb such an animal while it is rearing or otherwise caring for its young;*
 - Obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place;*
 - Disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs;*
 - Disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young; or*
 - Disturb such an animal whilst it is migrating or hibernating.*

Further protection is afforded through an additional disturbance offence provided under Regulation 39(2) which states that “it is an offence to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)”. An EPS Licence is therefore required for any activity that might result in disturbance or injury to cetaceans.

1.4.2. Pinnepeds

The harbour seal *Phoca vitulina* and grey seal *Halichoerus grypus* are listed under Annex V of the Habitats Directive, which requires any exploitation to be managed. Both grey and harbour seal species are protected under the Conservation of Seals Act (1970) which provides closed seasons during which it is an offence to take or kill any seal except under licence.

1.4.3. Seabirds

The primary legislation for the protection of birds in the UK is the WCA. Under this Act it is an offence to disturb those species listed in Schedule 1 of the WCA at their nest while it is in use.

The proposed Project activities are unlikely to result in the intentional or reckless killing of wild birds or the destruction of their nests, but if carried out during the breeding season, such works could result in an offence by disturbance nesting Schedule 1 bird species. Licensing for wild birds does not cover development purposes, so any activity that could result in disturbance of a nesting Schedule 1 species should not proceed unless outwith the breeding season.

1.5. Protected Sites

1.5.1. Natura 2000 Sites

The European Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC) which are transposed into Welsh Law in the terrestrial environment and out to 12 nm by the Habitats Regulations.

European sites protected under this legislation (Natura Sites) include Special Protected Areas (SPA), Special Area of Conservation (SAC) and Ramsar Sites. The European Habitats Directive (92/43/EEC) aims to promote the maintenance of biodiversity, by requiring EU Member States to maintain or restore representative natural habitats and wild species at a *Favourable Conservation Status* (FCS), through the introduction of robust protection for those habitats and species of European importance.

As part of these protection measures, Member States are required to undertake assessments to determine whether a plan or project is likely to have an adverse effect on the integrity of a European Site. This is implemented in Wales through the HRA process. The HRA process requires that any proposal which has the potential to result in a negative likely significant effect (LSE) to a Nature site or its designated features, to be subject to an HRA by the Competent Authority, and if necessary an Appropriate Assessment (AA). The HRA and AA processes ensure that no activity can be consented if it may cause adverse effects on the integrity of a Natura Site, unless there are no alternatives, and there is an Imperative Reason of Overriding Public Interest (IROPI) for the development to be considered.

1.5.2. Marine Conservation Zones (MCZ)

Under Regulations 39 of the Conservation of Offshore Marine Habitats and Species Regulations 2017, Natural Resources Wales (NRW) is required to consider whether a licensable activity is capable of affecting (other than insignificantly) a protected feature in a MCZ, or any ecological or geomorphological process on which the conservation of any protected feature in an MCZ is dependent.

It is an offence to intentionally or recklessly kill, remove, damage, or destroy any protected feature of an MCZ. NRW must be sure that consenting/licensing decisions do not cause a significant risk to the conservation objectives of any MCZ.

1.6. Determining the Need for an EPS Licence

The purpose of the assessments presented in this report is to determine whether, when consideration appropriate mitigation as presented in Section 5, there is potential for the marine survey activities to injure or disturb cetaceans, or other protected species. Where there is still potential for harm or disturbance to occur, an EPS Licence may be required. The need for an EPS Licence will be determined based on findings from the EPS Risk Assessment. NRW's consideration of whether an EPS Licence will be required will comprise three tests:

1. To ascertain whether the licence is to be granted for one of the purposes specified in the Regulations.
2. To ascertain whether there are no satisfactory alternatives to the activity proposed (that would avoid the risk of offence); and

3. That the licensing of the activity will not be detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status.

1.6.1. What constitutes a Disturbance

Whether or not a specific activity could cause 'disturbance' (for the purposes of Article 12(1) (b) of the Habitats Directive) depends on the nature of the particular activity and the impact on the particular species. Whilst 'disturbance' is not defined in the Habitats Regulations, NRW advise that the following matters should be taken into account when considering what constitutes disturbance:

- 'Disturbance' in Article 12(1) (b) should be interpreted in light of the purpose of the Habitats Directive to which this Article contributes. In particular, Article 2(2) of the Directive provides that measures taken pursuant to the Habitats Directive must be designed to maintain or restore protected species at Favourable Conservation Status.¹;
- Article 12(1)(b) affords protection specifically to species and not to habitats;
- The prohibition relates to the protection of 'species' not 'specimens of species';
- Although the word 'significant' is omitted from Article 12(1)(b) in relation to the nature of the disturbance, that cannot preclude an assessment of the nature and extent of the negative impact and ultimately a judgement as to whether there is sufficient evidence to constitute prohibited 'disturbance' of the species;
- It is implicit that activity during the period of breeding, rearing, hibernation and migration is more likely to have a sufficient negative impact on the species and constitute prohibited 'disturbance' than activity at other times of the year;
- Article 12(1)(b) is transposed into domestic legislation by Regulation 39(1) and (2) of the Habitats Regulations 1994. Therefore, when considering what constitutes 'disturbance', thought should be given to Regulation 39(1)(b) which provides a number of specific circumstances where an EPS could be disturbed and which can potentially have an impact on the status of the species; and
- Disturbance which could be considered an offence may occur in other circumstances and, therefore be covered under Regulations 39(2) of the Habitats Regulations which state that it is an offence to: deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)'.

Where there is the possibility for injury or disturbance to occur, an EPS Risk Assessment must be carried out and the need for an EPS Licence determined. The injury and disturbance criteria for EPS are described in Section 3.4.1.

1.7. Document Structure

This document provides the information to support the EPS licensing, protected species and protected sites assessment process:

- Section 2 provides a description of the proposed survey activities and their proposed location;
- Section 3 provides an assessment of the risk to EPS and other protected species;
- Section 4 provides an assessment of potential impacts on protected sites;
- Section 5 outlines the proposed species protection measures to be implemented; and
- Section 6 presents the overall conclusions of the assessment.
- Appendix A – Proposed Development area coordinates.

2. DESCRIPTION OF PROJECT ACTIVITIES

2.1. Location of Activities

¹ The Habitats Directive defined the conservation status of a species to be taken as 'favourable' when populations dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, when the natural range of the species is not being reduced for the foreseeable future and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The total survey area covered by the Proposed Development is 255km². The Proposed Development is shown on Figure 1.1.

2.2. Summary of Project Activities

2.2.1. Overview

The objective of the surveys is the acquisition of geophysical, geotechnical and benthic ecology data to underpin the EIA and HRA, which will support the Llyr 1 & 2 consent applications.

2.2.1.1. Geophysical and Geotechnical Surveys

The marine surveys will be undertaken by three vessels covering all phases of the works, in differing water depths to ensure the most efficient schedule.

Survey vessel selection and deployment will be informed both prior to and during survey operations by a number of factors including environmental considerations, weather and sea state, survey requirements and water depth. In addition to the survey vessels there may also be small supporting vessels in attendance, depending on the activity.

Table 2.1 presents the types of activity that are associated with the Proposed Development geophysical, geotechnical and environmental surveys.

Table 2.1 – Summary of the activities associated with the different survey types.

Activities	
Vessels and Vehicles	Survey Vessel – Class II Multipurpose offshore support vessel
	Nearshore geophysical vessel
	Nearshore environmental vessel
	Unmanned Surface Vessel (USV)
Geophysical Survey	Side Scan Sonar (SSS)
	Multi Beam Echosounder (MBES)
	Sub-bottom profiler (SBP)
	Magnetometer (MAG)
Benthic Habitat Analysis	Drop-down camera video / photo
	Benthic sediment grab sampling
Geotechnical survey	Cone Penetration Testing (CPT) (5m) – 21 locations in the array area

Examples of the potential vessels utilised during both inshore and offshore survey activities are provided in Table 2.2, in Section 2.2.2 below.

2.2.2. Vessels and Vehicles

Vessels will be mobilised as required from an agreed mobilisation port depending on the Contractor. As noted above, the type and number of vessels required to complete the works will vary depending on parameters such as weather and water depth.

The contractors that will be employed to undertake the surveys have not been selected yet, and therefore exact details of the vessels to be used are not available. The vessels detailed in Table 2.2 below are of a similar type and size that could be deployed and have been used as proxy vessels for the purposes of the EPS and Protected Sites Risk Assessment. The vessels detailed go up to the maximum size that could be provided by the contractors, thereby providing the worst-case scenario and offering maximum flexibility in the survey procurement process.

Table 2.2 – Example vessels and vehicles that could be used during inspections and surveys.

Example vessel / vehicle	Description
Surveys	
Multi-purpose vessel – both geophysical and geotechnical survey	Multi-purpose vessel which will typically have diesel-electric propulsion and a specially designed hull. Vessel will be suitable for geophysical and geotechnical survey operations up to 1000m water

Example vessel / vehicle	Description
	depth. Typical length is expected to be 54 m, beam 12.5m, deck area is 250 m ² and the draught 3m.
Nearshore geophysical vessel	A nearshore geophysical vessel will typically have an outboard motor and will typically be a road transportable workboat. The boat will be approximately 7.4 m in length, with a beam of 2.5 m and shallow draft of 0.75m
Nearshore environmental vessel	A nearshore environmental vessel will be designed for survey operations in shallow to medium water depths.
USV	A 2 – 3 m long remotely-operated untethered vehicle which floats on the water's surface as a platform of deployment for geophysical survey equipment used in seabed or water column mapping.

2.2.3. Survey Techniques

A range of different equipment will be employed during the surveys of the proposed Project (see Table 2.3). The survey techniques are described in table in Table 2.3, below. They have also been assessed for their potential to introduce noise into the marine environment and/or interact with protected species or seabed habitat. The most significant noise related aspects potentially generated by this project are detailed within Table 2.3, along with a determination as to whether each requires further assessment.

Table 2.3 – Details of the equipment to be employed for the surveys of the proposed Project

System / survey equipment	Description
Geophysical Survey	
Multi-beam echo-sounder (MBES)	Multi-beam echo-sounders are used to obtain detailed 3-dimensional (3D) maps of the seafloor which show water depths. They measure water depth by recording the two-way travel time of a high frequency pulse emitted by a transducer. The beams produce a fanned arc composed of individual beams (also known as a swathe). Multi-beam echo-sounders can typically, carry out 200 or more simultaneous measurements. With regards to the proposed Development, the MBES specifications are to be high resolution. Frequency levels below 200 kHz will not be used during survey activities and have therefore been scoped out of further assessment on the basis that they are outwith the generalised hearing range for EPS and other protected species likely to be affected by underwater noise.
Sidescan Sonar (SSS)	Side-scan sonar is used to generate an accurate image of the seabed, which may include 3D imagery. An acoustic beam is used to obtain an accurate image of a narrow area of the seabed to either side of the instrument by measuring the amplitude of back-scattered return signals. The instrument can either be towed behind a ship at a specified depth or mounted to a ROV. The frequencies used by side-scan sonar are generally very high and outside of the main hearing range of all marine species (NOAA, 2018). The higher frequency systems provide higher resolution but shorter-range measurements.
Sub-bottom profiler	Sub-bottom profiling / shallow seismic systems are used to identify and characterise layers of sediment or rock under the seafloor. A transducer emits a sound pulse vertically downwards towards the seafloor, and a receiver records the return of the pulse once it has been reflected off the seafloor. SBPs comprise of either pingers or boomers. Pingers operate at a higher frequency but smaller bandwidth than boomers, which operate on a lower broadband frequency spectrum. The higher frequencies of operation provide the highest resolution but are limited in amount of penetration below the seafloor. The main high frequency profilers are particularly useful for delineating shallow features such as faults, gas accumulations and relict channels. The lower frequencies yield more penetration but provide less resolution; lower frequency

System / survey equipment	Description
	<p>systems are more general-purpose tools that provide a good compromise between penetration capacity and resolution.</p> <p>Parts of the sound pulse from both systems will penetrate the seafloor and be reflected off the different sub-bottom layers, providing data on the sub-floor sediment layers.</p> <p>Unlike the pinger system which has a combined transducer/transceiver deployed in-water from the vessel, the boomer system requires the deployment of a boomer plate and a receiver array that is a separate floating unit from the emission source.</p>
Magnetometer	<p>Magnetometer surveys are used to detect any ferrous metal objects on the seabed, such as wrecks, unexploded ordnance (UXO), or any other obstructions. Marine magnetometers come in two types: Surface towed and near-bottom. Both are towed a sufficient distance (about two ship lengths) away from the ship to allow them to collect data without it being polluted by the ship's magnetic properties. Surface towed magnetometers allow for a wider range of detection at the price of precision accuracy that is afforded by the near-bottom magnetometers. These surveys use equipment to record spatial variation in the Earth's magnetic field.</p>
Ultra Short Baseline (USBL)	<p>USBL systems are used to determine the position of subsea survey items, including ROVs, towed sensors, etc. This involves the emission of sound from a vessel-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. A USBL system consists of a transducer, which is mounted on the vessel and a transponder attached to the ROV. The transducer transmits acoustics through the water and the transponder sends a response which is detected by the transducer. The USBL calculates the bearing and time taken for the transmissions to be completed and thus the position of the subsea unit / sampling equipment is determined. These systems can either be used continuously or intermittently through the operation they are supporting. In the shallowest regions of the nearshore environment, alternative positioning methods (e.g. layback and position calculations) may need to be considered.</p>
Benthic habitat analysis	
Benthic sediment sampling	<p>Grab samples will be taken of the seabed to provide detail on the sediment itself and infauna (animals living within the substrate) which cannot be provided by the use of video and photography (see above).</p> <p>Approximately 62 sample stations of 0.1m² and samples collected will be suitable for PSA and faunal analysis.</p> <p>Grab samples will not be collected on hard substrates or at locations with sensitive habitats (e.g. Maerl); therefore, grab sampling will be preceded with video/camera drops. Grabs will be collected at selected video/photo sites on sedimentary substrate unless they support sensitive habitats; data collected will therefore be complementary and allow biotope classification to include consideration of infaunal components. A sediment sub-sample will also be retained from the grab for Particle Size Analysis (PSA) with the remainder sieved for infaunal analysis. The benthic sediment sampling equipment does not generate potentially significant levels of noise. Therefore, this technology does not require any further consideration with respect to potential injury or disturbance of protected species.</p>
Drop down video	<p>Ground-truthing of acoustic data will be undertaken using drop-down video/photography (drop frame and/or ROV) and grab sampling techniques (see below). This survey technique does not interact with the seabed. Required to</p>

System / survey equipment	Description
	provide detail on epifaunal species (animals living on the surface of the substrate), habitats and geological features. Methodology will follow the SNH Guidance Notice No. 45 – Subsea Cable and Oil and Gas Pipeline Proposals – Benthic Habitat and Species Survey Requirements and consultation will be undertaken with SNH and Marine Scotland to ensure sufficient sampling frequency.

2.2.4. Activity Schedule

The offshore survey activities are scheduled to be undertaken sometime between 1st July 2022 and 30th September 2022; whilst this is a period of 92 days in total, the survey activity will be for a shorter duration as detailed below.

Vessel presence is expected for up to 70 days, geophysical survey activities are expected to take approximately 23 days and geotechnical activities (i.e. grab samples) are expected to take approximately 10 days. This includes an allowance for weather downtime, waiting on tides.

This is a worst-case scenario duration in that geophysical survey activities will be undertaken separately to geotechnical activities. If possible both survey activities will be undertaken in parallel reducing the duration of vessel presence within the project area.

3. EPS AND OTHER PROTECTED SPECIES RISK ASSESSMENT

3.1. Overview

The primary function of this Protected Species and Protected Sites Risk Assessment is to identify the potential for injury and disturbance to EPS and other protected species from the geophysical surveys across the Llyr 1 and Llyr 2 project areas. This section of the risk assessment addresses potential impacts to protected species, including EPS, regardless of their inclusion as qualifying features of protected sites. An assessment of potential impacts to protected sites and their qualifying features is provided in Section 4.

A number of different survey activities will be employed as part of the geophysical surveys of the seabed with varying risk to protected species. An overview of survey activities and their potential impacts to protected species is provided in Table 3.1. Please note, the duration of activities represents a worst-case scenario.

Underwater noise emitted by survey vessels and the physical presence of the vessels during the survey period have the potential to cause injury or disturbance to EPS and other protected species.

While some survey techniques may introduce noise to the marine environment, other activities do not generate sufficient levels of noise to be considered as potential sources of noise-related injury or disturbance to protected species and have been screened out of the detailed assessment as indicated in Table 3.1.

Table 3.1 - Overview of potential impacts of marine survey activities on EPS and other Protected Species within the Llyr Project Areas

Activities / equipment	Potential Impacts	Further information required as part of the EPS risk assessment?
Vessels		
Survey vessels	Propellers, engines and propulsion activities from the primary noise sources of survey vessels. Vessel noise is generally continuous and comes in both narrowband and broadband emissions. Potential impacts on EPS and other protected species depend on the duration of the survey activities,	No – The source levels associated with vessels are likely to be too low to result in injury, and the presence of three survey vessels in the Llyr project areas does not constitute a change from baseline conditions. It is acknowledged that vessels pose a collision risk to EPS and other protected species.

Activities / equipment	Potential Impacts	Further information required as part of the EPS risk assessment?
	<p>location of the survey and species of cetacean potentially present in the area.</p> <p>Increased vessel activity additionally has the potential to cause injury from collisions. The risk of collision with an animal is influenced by the dimensions of the vessel and its speed.</p>	
USV	USVs are controlled and maneuvered using batteries which power propellers and thrusters. Noise generated by USVs is similar to other vessels (i.e. continuous to other broadband) but reduced in power due to their smaller size.	No – the predominant noise source during USV deployment is the MBES. This survey technology will mask the sounds generated by the USV and have thus been considered separately (see below).
Geophysical Survey		
Side-scan Sonar (SSS)	Side-scan sonar equipment produces impulsive sound emissions through high frequency pulses used to image the seabed habitat. Potential impacts to EPS and other marine mammals depend upon the frequency, location, and duration of the pulses.	Yes - The SSS used for the proposed survey operations may operate at frequencies below 300 kHz. This is within the hearing threshold of all marine mammals and protected species which may be present in the area, as detailed in Table 3.3. This equipment may be a source of disturbance to marine mammals.
Multibeam echosounder (MBES)	<p>High frequency noise pulses created by multi-beam echo sounder equipment generate sound waves which produce impulsive underwater noise.</p> <p>Depending on the frequency of the pulses, location and duration of the operations, and the species present, there could be potential impacts on cetaceans.</p>	Yes - The MBES used for the proposed survey operations will operate at frequencies between 200 – 700 kHz. This is within the hearing threshold of all marine mammals and protected species which may be present in the area, as detailed in Table 3.3. This equipment may be a source of disturbance to marine mammals.
Sub-bottom profiling (SBP)	<p>Sub-bottom profiling involves the vertical emission of sound pulses (impulsive noise) to characterise the layers of sediment comprising the seabed. Such activities introduce noise emissions into the marine environment. The potential impacts of this sound depend upon the type of profiler technology used, as well as the abundance, distribution and sensitivity of the species, and the duration of the operations.</p> <p>Sparkers are the profiler technology which will be employed during survey activities. They are a type of seismic airgun which use a spark across a pair of electrodes to create a gas bubble whose oscillations generate the sound. This</p>	Yes – Although source pressure levels emitted by this equipment have been identified as below the threshold to cause potential injury to any marine mammal species, this equipment may be a source of disturbance to marine mammals.

Activities / equipment	Potential Impacts	Further information required as part of the EPS risk assessment?
	technique will be used to interpret the sub-surface sediment conditions to a minimum depth of 60 m.	
USBL	USBL systems involve the emission of impulsive sound from a hull-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. The potential impacts of this sound on cetaceans depends upon the abundance, distribution and sensitivity of the species, and the duration of the operations.	Yes – The pressure levels and frequencies at which the USBL emit are not of a level where injury is expected, but have the potential to cause disturbance to marine mammals and other protected species.

3.2. European Protected Species Baseline

3.2.1. Cetaceans

All cetacean species within UK waters are deemed as ‘species of community interest’ under Annex IV of the Habitats Directive and thus require strict protection as EPS. Harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncatus*) are listed as individual EPS, while all cetaceans are listed as “All other cetacea”.

Around 28 species of cetacean have been recorded in UK waters, with 11 having a regular presence. Approximately 15 species have been recorded in the Irish and Celtic Sea (Wave Hub Limited, 2018). Three of these species are seen regularly within the proposed Project Area; the harbour porpoise *Phocoena phocoena*, bottlenose dolphin (*Tursiops truncatus*), and shortbeaked common dolphin (*Delphinus delphis*) (Baines and Evans, 2012; Wave Hub Limited, 2018). Seen less frequently is the Risso’s dolphin (*Grampus griseus*) and minke whale (*Balaenoptera acutotostrata*) (Baines and Evans, 2012).

The density and abundance of EPS within Welsh waters and around the Project area in the Celtic sea are described in Table 3.2 below.

Table 3.2 Population parameters of cetacean species potentially present in the project area (Hammond et al., 2017)

Species name	Estimated density across the Project area (individuals/km ²)	Estimated abundance within the Project area (514km ²)
Harbour porpoise (<i>Phocoena phocoena</i>)	0.118	60.65
Bottlenose dolphin (<i>Tursiops truncatus</i>)	0.0605	310.97
Shortbeaked common dolphin (<i>Delphinus delphis</i>)	0.3743	192.39
Risso’s dolphin (<i>Grampus griseus</i>)	Not known	Not known
Minke whale (<i>Balaenoptera acutotostrata</i>)	0.0112	5.75
Density and abundance estimates taken from SACS-III Survey Block D if available.		

3.2.1.1. Potential impacts

Noise emissions constitute the greatest potential risk to cetaceans within the vicinity of the project. Noise has the potential to impact cetaceans and other marine species in two ways:

- Injury – physiological damage to auditory or other internal organs; and
- Disturbance (temporary or continuous) – disruptions to behavioural patterns, including but not limited to: migration, breathing, nursing, breeding, foraging, socialising and/ or sheltering. This impact factor does not have the potential to cause injury.

If a noise emission is composed of frequencies which lie outside the estimated auditory bandwidth for a given species, then disturbance is unlikely. However, noise sources which are sufficiently high can still cause physical damage to hearing and other organs, even when the frequencies lie outside an animals auditory range. TO understand the potential for noise-related impacts, the likely hearing sensitivities of different cetacean hearing groups has been summarised below in Table 3.3.

Table 3.3 – Auditory bandwidths estimated for cetaceans (Southall et al., 2019; NOAA, 2018)

Hearing Group	Estimated auditory bandwidth
Low-frequency cetaceans (LF): (e.g. baleen whales, such as humpback whales, minke whales, sei whales etc.)	7 Hz to 35 kHz
High frequency cetaceans (HF): (e.g. dolphins, toothed whales, beaked whales and bottlenose whales)	150 to 160 kHz
Very-high frequency cetaceans (VHF): (e.g. marine mammal species such as harbour porpoises and other ‘true’ porpoises)	275 Hz to 160 kHz
Phocid carnivores in water (PW): (e.g. earless or ‘true’ seals, such as grey and harbour seals)	75 Hz to 100 kHz

3.2.1. Marine Reptiles

There have been no sightings of leatherback turtles (*Dermochelys coriacea*) within the vicinity of the project area (Blue Gem Wind, 2021). Based on the guidance from JNCC *et al.*, (2010); “given the apparent low density of leatherbacks within UKL waters and their highly migratory nature, the likelihood of occurrence in any area for any lengthy period of time is so low that the risk of animals being disturbed in any way that would impair their ability to survive, reproduce, migrate, rear or nurture their young could be considered negligible. Due to their occurrence in very low numbers in any given area it is also unlikely that there could be a significant effect on their local abundance or distribution as a result of an activity”.

It is understood that sea turtles are able to detect sound in water as well as sound pressure (Popper *et al.*, 2014).

3.2.1.1. Potential impacts

Due to the rarity of the species, and the very low likelihood of their presence at the project area, any potential for injury from underwater noise, or disturbance from vessel presence is considered unlikely. This will be further reduced by the implementation of mitigation measures included in Section 5.

3.3. Other Protected Species Baseline

3.3.1. Seals

There are two species of pinniped resident to the UK; the grey seal (*Halichoerus grypus*), and harbour seal (*Phoca vitulina*). Both species are known to have haul out sites along the coastline of the UK, and will forage in the surrounding waters. Grey seals typically forage at greater distances from haul out sites than harbour seals (135 km and 120 km, respectively; SCOS, 2018).

Grey seals are present throughout Welsh waters and have many haul out sites and breeding sites around the coast, some of which are designated. Conversely, harbour seals do not have any designated sites within the vicinity of the project area, and are only rarely recorded in the project area.

The pupping season of harbour seals is June to July, and their moulting season occurs in August. Grey seals pup thereafter from August / September through to December and then moult until early April (Bowen, 2016; SCOS 2018).

Similar to seabirds, seals are central-place foragers, utilising a terrestrial 'base' for important life history events (i.e. breeding, pupping, moulting, etc.) and to rest, and then head offshore on foraging trips before returning to land (Pollock, 2000). While both species are associated with shallower shelf waters, grey seals often make longer foraging trips to deeper waters than harbour seals (Pollock, 2000). However, neither species regularly occur in waters beyond 200 m (Pollock, 2000). The mean at-sea distribution of harbour seals across the project area is low in comparison to the rest of the Celtic Sea (Russel *et al.*, 2017) whilst the mean distribution of grey seals in the vicinity of the Project area is roughly average when compared to the mean distribution across the Celtic Sea (Russel *et al.*, 2017).

3.3.1.1. Potential Impacts

Potential impacts from the geophysical surveys may arise from underwater noise generated during the survey activities and physical disturbance at haul-outs (i.e. from vessel or human presence). Seals are particularly susceptible to Project-related impacts during their respective pupping and moulting seasons, when the residency of seal haul-outs and in surrounding waters elevates the relative density of each species.

Underwater noise emissions have the potential to cause physical injury or disturbance to seals, particularly if they fall within their generalised hearing range of 50 Hz to 86 kHz (NMFS, 2018). However, contemporary data suggests that even with very intense noise emissions, such as those from pile driving activity, harbour seals are likely to return to the region of the noise source once the emissions have ceased (Russel *et al.*, 2016). Where this leads to an animal avoiding their main feeding and breeding grounds this can have longer term effects on the health and breeding ability of that animal (Kastelein *et al.*, 2006).

Underwater noise emissions will not result in the killing of seals, for which the two species are protected (Section 1.5.3) and no further assessment of underwater noise in this respect is conducted. Furthermore, the only other protection for seals is against disturbance at haul-outs, which will not occur from underwater noise (since the emissions are, by definition, not airborne). On this basis and considering also the mitigation measures to be adopted from the Project (Section 5), no further assessment of underwater noise is made for seals. However, seals are protected from disturbance at designated haul-outs; such disturbance is considered in the assessment of impacts to protected sites that follows.

3.3.2. Birds

While the marine environment forms important habitat to seabirds year-round, birds are most vulnerable to human disturbance at sea during the moulting season when they become flightless and spend greater time on the water's surface. The moulting season for the majority of marine birds is after the breeding season. This at-sea period increases the likelihood of interactions with survey vessels and the potential collision risk.

3.3.2.1. Potential impacts

During the proposed activities, the physical presence of vessels may cause disturbance to birds in the Project area. Disturbance from increased vessel light also has the potential to disorientate fledgling birds, leading to collisions with vessels which may be fatal (Rodriguez *et al.*, 2015). The proposed survey is scheduled to take place between July to September and therefore could coincide with some species breeding and moulting seasons. The survey activities are estimated to take up to 13 days, with vessel presence within the project area potentially being up to 70 days (as a worst-case scenario).

Despite the potential overlap between the proposed survey and sensitive periods for birds which utilise the marine environment, the temporary nature of the activities, both spatially and temporally preclude them from introducing significant impacts to birds in the area. Finally, vessels will be travelling slowly and in a predetermined pattern over the course of the survey, which greatly diminishes the likelihood of collisions occurring. Considering that the seabirds are protected by legislation from harm to individuals, eggs and nests, no further assessment is conducted herein since these impacts will not occur from the project surveys.

Note; impacts on conservation sites within seabird features are considered below in Section 4, and mitigation to control impact on sites protected for seabirds is detailed in Section 5.

3.4. Protected species risk assessment

3.4.1. Assessment of impacts of activities on protected species

3.4.1.1. Injury impacts

For the proposed surveys, the expected frequency range for MBES, SSS, SBP, Magnetometer and USBL operations overlaps with the hearing range of all cetacean hearing groups (Table 3.3). As a worst-case scenario, for the basis of this assessment it is assumed that all geophysical survey activities have the potential to cause injury to EPS and other marine mammals. As such, survey activities associated with the project may potentially be injurious to EPS species without appropriate mitigations.

Available mitigation measures specifically designed for geophysical surveys (JNCC, 2017) have been incorporated into mitigation measures described in Section 5.2 below. These measures include deployment of a Marine Mammal Observer (MMO) to monitor or the presence of cetaceans within a 500 m mitigation zone prior to the commencement of, and during, any SBP surveys (JNCC, 2017).

On consideration of the relevant mitigation measures the survey activities are not anticipated to impair the ability of an animal to survive or reproduce or result in any significant impacts on the FCS of any EPS.

3.4.1.1.2. Disturbance impacts

In addition to physical injury, noise emissions have the potential to affect the behaviour of cetaceans in the vicinity of the noise source. Significant or strong disturbance (see Table 3.6; Southall *et al.*, 2007) may occur when an animal is at risk of sustained or chronic disruption of behaviour or habitat use resulting in population-level effects. An assessment of potential disturbance impacts from impulsive and non-impulsive sound is provided in Sections below.

The types of survey activities have the potential to generate a strong disturbance event (i.e. a disturbance offence) as described in MBES, SSS, SBP and USBL. The potential for a disturbance offence to result from these types of technology varies between activity type, though the predicted disturbance range is much greater for the low frequency noise sources which travel farther within the marine environment.

3.5. Protected species conclusion

3.5.1. Impact to EPS

Once the mitigation measures proposed in Section 5 are implemented, there will be no injurious impacts to cetaceans as a result of the project activities and no requirement to apply for an EPS Licence in that respect. However there is potential for disturbance to both cetaceans, and Floventis will therefore apply for an EPS Licence in respect to disturbance to these species. However, this disturbance is expected to be limited to one or a few individuals of a species and will therefore not result in any adverse impact on the FCS of any cetacean species or marine turtles.

The mitigations listed in Section 5 will further minimise any potential disturbance impacts to EPS.

3.5.1. Impact to seals

Project activities will not result in the catching or killing of seals, and thus the protection provided to the two species by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) will not be breached.

Furthermore, the short-term and localised nature of the proposed activities, the fact that the activities will occur outside of the important breeding and moulting periods, and that a number of mitigation strategies will also be followed to further reduce any potential impacts to seals if any are encountered during the proposed survey operations, all mean that harbour and grey seals making use of protected seal haul-outs will not be significantly disturbed.

3.5.2. Impact to seabirds

Several seabird species have the potential to be disturbed by the physical presence of the vessels during the geophysical survey activities. However, given the temporary and relatively short-term nature of the proposed activities, the potential impacts on protected seabirds will not result in killing of individuals or disturbance of

eggs and nests, and are therefore not considered significant with respect to the Wildlife and Countryside Act (as amended).

3.5.3. Final conclusion

Overall, the proposed geophysical survey operations present a trivial and temporary disturbance to a few individual animals in a limited area.

4. PROTECTED SITES ASSESSMENT

4.1. Selection criteria for assessment of protected sites

Over and above potential impacts on protected species, the potential for the geophysical surveys to impact protected sites needs to be considered. For the project area the following criteria has been used to select those designated sites where potential impacts need to be assessed:

- SACs and MCZs (including proposed and candidate sites) with cetaceans as qualifying features within 50 km of the proposed geophysical surveys;
- SACs, SSSIs and MCZs (including proposed and candidate sites) with harbour seal interests within 50 km of the proposed survey area and breeding grey seal within 20 km of the proposed survey area;
- SACs and MCZ's (including proposed and candidate sites) with otter interests that overlap with or are located within 500m of the proposed survey area;
- SPA (including proposed or candidate site) with birds as qualifying features that overlap with or are located within 2 km of the proposed survey area;
- SACs, SSSI's and MCZs (including proposed and candidate sites) with seabed / benthic protected features that overlap with the proposed survey area.

The designated sites located in the vicinity of the project area which have the potential to be impacted by the geophysical survey activities subject to the selection criteria above are outlined in Table 4.1 and shown on Figure 4.1. For each designated site that has the potential to be impacted by the geophysical survey activities, mitigation measures have been considered based upon site-specific protected features and those are also included within Table 4.1. Details of the mitigation measures are provided in Section 5. (Note: Some of the mitigation measures included in Section 5 may not be listed in Table 4.1 if they are not related to protected designated features of those sites. However, all mitigation measures in Section 5 will be applied to all activities, regardless of proximity to a protected site.

Designated Site potentially affected	Survey corridor overlaps with protected site or is within the site selection criteria distance to protected site	Distance from nearest part of survey corridor to protected site (km)	Features of designated site relevant to this assessment	Activity	Duration of activities within the site selection criteria distance to protected site (days)	Proposed mitigation measures*	Potential for likely significant effect
West Wales Marine/Gorllewin Cymru Forol SAC	The designated site overlaps with the survey area	0.0	Harbour porpoise	Vessel presence, geophysical surveys	Up to 23 days	M1 – M7	No
Skomer, Skokholm and the Seas off Pembrokeshire SPA	The designated site overlaps with the survey area	0.0	Seabird assemblage	Vessel presence	Up to 70 days	M8 and M9	No
Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC	The designated site overlaps with the survey area	0.0	Harbour porpoise	Vessel presence, geophysical surveys	Up to 23 days	M1 – M7	No
Pembrokeshire Marine / Sir Benfro Forol SAC	The designated site overlaps with the survey area	0.0	Grey seal	Vessel presence, geophysical surveys	Up to 23 days	M1 – M7	No
Dale and South Marloes Coast SSSI	The designated site is within 20 km of the geophysical survey area	0.5	Grey seal	Vessel presence, geophysical surveys	Up to 23 days	M1 – M7	No
St Bride's Bay South/De Porth Sain Ffraidd SSSI	The designated site is within 20 km of the geophysical survey area	6.4	Grey Seal	Vessel presence, geophysical surveys	Up to 23 days	M1 – M7	No

Designated Site potentially affected	Survey corridor overlaps with protected site or is within the site selection criteria distance to protected site	Distance from nearest part of survey corridor to protected site (km)	Features of designated site relevant to this assessment	Activity	Duration of activities within the site selection criteria distance to protected site (days)	Proposed mitigation measures*	Potential for likely significant effect
Skokholm SSSI/NNR	The designated site is within 20 km of the geophysical survey area	7.3	Grey Seal	Vessel presence, geophysical surveys	Up to 23 days	M1 – M7	No
Skomer MCZ	The designated site is within 20 km of the geophysical survey area	9.2	Grey Seal	Vessel presence, geophysical survey	Up to 23 days	M1 – M7	No
St David's Peninsula Coast SSSI	The designated site is within 20 km of the geophysical area	17.2	Grey Seal	Vessel presence, geophysical survey	Up to 23 days	M1 – M7	No
Cardigan Bay / Bae Ceredigion SAC	The designated site is within 50 km of the geophysical survey area	46.8	Bottlenose dolphin	Vessel presence, geophysical survey	Up to 23 days	M1 – M7	No

* Mitigation measures included in Section 5.

4.2. Conclusion of protected site assessment

A summary is presented below of the potential impacts to designated sites which will be further reduced through implementation of the specific species protection measures outlined in Section 5.

4.2.1. Potential impact on SACs with cetaceans as a feature

The survey area overlaps with the West Wales Marine / Gorllewin Cymru Forol SAC, Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC for which harbour porpoise are a designated feature, as well as being 46.8 km from the Cardigan Bay / Bae Ceredigion SAC for which bottlenose dolphin is a designated feature.

Due to the relatively short duration of the proposed activities close to or within the sites, as well as the implementation of mitigation measures included within Section 5, it is considered that no adverse impact is expected on the status of the designated sites.

4.2.2. Potential impact on SACs, SSSIs, NNR and MCZs with seals as a feature

The survey area overlaps with the Pembrokeshire Marine / Sir Benfro Forol SAC, Dale and South Marloes Coast SSSI, St Bride's Bay South / De Porth Sain Ffraid SSSI, Skokholm SSSI/NNR, Skomer MCZ and St David's Peninsula Coast SSSI; sites designated for Grey Seal (*Halichoerus grypus*).

Grey seals are most sensitive to impact during the pupping and moulting season which occurs between June to early July. The proposed activities could coincide with the sensitive period, however, due to the short duration of the proposed activities, it is considered that no adverse impact is expected on grey seals during these activities.

A number of mitigation strategies will also be followed to further reduce any potential impact on seals, as provided in Section 5.

4.2.3. Potential impact on SPAs

The survey area overlaps with the Skomer, Skokholm and the Seas off Pembrokeshire SPA; a site designated for seabird assemblage.

The temporary and localised nature of the geophysical surveys are unlikely to significantly effect on the populations of the designated site, and therefore no adverse impacts are expected on the conservation status of this SPA.

4.2.4. Conclusions

The geophysical surveys will take approximately 23 days to complete. The geotechnical surveys are expected to take approximately 10 days. Factoring in weather delays, vessel presence within the project area will be approximately 70 days. The actual duration of the survey activities is likely to be shorter than this.

Although the proposed geophysical survey activities have the potential to coincide with sensitive seasons for identified species, given the relatively short-term nature of the surveys, as well as the transient nature of the activities, it is considered unlikely that the proposed works will impact significantly upon seals and bird assemblage species.

A conclusion on the assessment of potential impacts on cetaceans from the geophysical survey works is provided in Section 3.

Due to the temporary and localised nature of the proposed activities within the survey window, and the mitigation measures outlined in Section 5, no significant impact is anticipated on the conservation objectives of any protected site.

5. SPECIES PROTECTION MEASURES

5.1. Overview

This section summarises the proposed mitigation measures to be implemented for avoiding and reducing potential impacts on species that may be present in the vicinity of the geophysical surveys.

Species and task specific mitigation is provided below, however the following measures will be implemented during all survey works:

- Use of the lowest practicable power levels needed to achieve the survey objectives and seek/consider methods to reduce and/or buffer unnecessary high frequency noise produced;
- Survey crew will be made aware of all protected species within the marine environment, and their responsibility to implement the mitigation in this document.
- Survey crew will operate in accordance with the Sea Wise Code.

5.2. Marine Mammals

A Marine Mammal Protection Plan (MMPP) will be prepared in order to reduce risk of injury and disturbance to marine mammals resulting from SBP survey operations, this will be aligned to JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys. It is noted that the SBP is not capable of performing a soft-start, and hence this procedure is not included. The key components of the MMPP for SBP include:

- Deployment of a MMO to monitor for the presence of cetaceans and seals, prior to the commencement of SBP operations;
- For SBP operations during hours of darkness and/or in periods of poor visibility and/or during periods when the sea state is greater than Beaufort 3, deployment of Passive Acoustic Monitoring (PAM) system to detect for the presence of cetaceans that cannot be detected by the MMO;
- 500 m mitigation zone for cetaceans;
- 500 m mitigation zone for seals, reducing to 100 m in the event of a need to avoid critical delay to the project; and
- Reporting.

5.2.1. M1 – Marine mammal monitoring

There will be MMO coverage for the duration of the SBP activities, with adequately trained and experienced MMO(s) working standard 12 hour shifts. They will have experience of working at sea and will have successfully deployed and used PAM equipment previously, and be equipped with binoculars offering at least 8x magnification. The MMO will be located at a high point on the vessel, providing good all-round visibility.

5.2.2. M2 – Marine Mammal Observer (MMO)

During daylight hours the MMO(s) will carry out visual observations to monitor for the presence of cetaceans, seals and marine turtles before the geophysical surveys are initiated and will recommend delays in the commencement of the operations should any cetaceans, seals or marine turtles be detected within the 500 m mitigation zone for cetaceans.

5.2.3. M3 – Passive Acoustic Monitoring (PAM)

When visibility is poor (i.e. due to fog or during hours of darkness) and/or during periods when the sea state is greater than Code 3, the PAM system will be operated by a single MMO/PAM operator. The PAM system shall comprise of at least 3 hydrophone elements, allowing for directional localisation of detections, together with software allowing real time automated detection of marine mammal vocalisations (e.g. PAMGuard or equivalent).

5.2.4. M4 – Pre-start search

Visual (MMO) (and acoustic PAM) monitoring if required) will be conducted for a pre-start search of 30 minutes i.e. prior to the commencement of geophysical survey operations. This will involve a visual (during daylight hours) or PAM watch (during poor visibility or at night) to determine if any cetaceans, seals or marine turtles are within 500 m of the activities.

5.2.5. M6 – Cetacean, seal and marine turtle mitigation zone

The mitigation zone is defined as the area within 500 m of the geophysical survey. Should any cetaceans, seals or marine turtles be detected within the mitigation zone prior to the commencement of survey operations (or after breaks in survey activity of more than 10 minutes), operations will be delayed until their passage, or the

transit of the vessel, results in the cetaceans, seals or marine turtles being outwith the mitigation zone. In all three cases there will be a 20 minute delay from the time of the last sighting within the mitigation zone to all commencement/recommencement of the geophysical survey operations.

5.2.6. M7 – Reporting

All recordings of cetaceans, seals and marine turtles will be made using JNCC Standard Forms. At the end of the operations, a monitoring report detailing the species recorded, methods used to detect them, and details of any problems encountered will be submitted to NRW. The report will also include feedback on how successful the mitigation measures were. This requirement will be communicated to the MMOs at project start up meetings and at crew change.

5.3. Seabirds

The following mitigation measures will be implemented in order to reduce disturbance to seabirds:

5.3.1. M8 – Rafting seabirds

The survey vessels will be moving at a maximum speed of 4 knots during survey operations, to allow any rafting seabirds time to disperse before the vessel arrives. When not on survey effort, vessels will avoid bird rafts where operationally possible and it is safe to do so.

5.3.2. M9 – Light disturbance

When within an SPA and where there is potential for 24 hour working, the following measures will be implemented to minimise the potential impacts to birds:

- Lighting on-board the cable survey vessel(s) will be kept to the minimum level required to ensure safe operations; and
- Lights will be directed or shielded to prevent upward illumination and minimise disturbance; and
- Blackout blinds and/or curtains will be used where possible when working in marine SPAs.

6. CONCLUSION

The risk assessment has assessed the risk posed by the geophysical survey activities within the project area to EPS, other protected species and protected sites. This has included assessing the risk caused by noise emitted from the vessel and the geophysical survey, collision impact and disturbance to the following protected species and sites:

- Cetaceans;
- Seals;
- Birds;
- SACs;
- SSSIs;
- NNR;
- MCZs; and
- SPAs.

The proposed geophysical survey activities have the potential to injure and disturb EPS and protected species, and therefore an application for an EPS Licence will be submitted. With the implementation of the mitigation measures proposed within this EPS risk assessment, it is considered unlikely that there will be an adverse impact on the populations of protected species.

The proposed survey area is located within, and within the vicinity of several designated sites for which the designated features could be impacted by the geophysical survey activities. Due to the temporary and localised nature of the surveys no significant or adverse impact is anticipated on any of the sites. Further to this, a number of mitigation strategies will also be followed to further reduce any potential impact on protected species.

The survey corridor does not overlap with any designated sites with seabed / benthic habitat as protected features. As relatively small samples will be extracted during the project activities, (approximately 20 samples at less than 0.1 m²) an application for a Marine Licence for a low risk activity (band 1) will be made.

7. REFERENCES

Baines ME, and Evans PGH, 2012. Atlas of the Marine Mammals of Wales. Countryside Council for Wales Monitoring Report No. 68. 2nd edition. 139pp.

Blue Gem Wind, 2021. Erebus Marine Mammal & Turtle Baseline. Prepared for Blue Gem Wind

JNCC (2017). JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from geophysical surveys. April 2017.

NMFS (National Marine Fisheries Service) (2018). 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0). Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. NOAA Technical Memorandum NMFS-OPR-59. April 2018

NOAA (National Oceanic and Atmospheric Administration) (2018). Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing, Technical Memorandum NMFS-OPR-55, 2018.

Pollock, C.M., Mavor, R., Weir, C.R., Reid, A., White, R.W., Tasker, M.L., Webb, A., & Reid, J.B. (2000). The distribution of seabirds and marine mammals in the Atlantic Frontier, north and west of Scotland. Joint Nature Conservation Committee. Available at: <http://jncc.defra.gov.uk/page-2726>.

Rodríguez, A., Rodríguez, B., and Negro, J.J. (2015). GPS tracking for mapping seabird mortality induced by light pollution. Nature, Scientific Reports volume 5, Article number: 10670 (2015).

Wave Hub Limited, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report. Project No. 122674. Prepared for Wave Hub limited.

APPENDIX A – TABLE OF SURVEY AREA COORDINATES

ID	WGS84 latitude and longitude (Decimal)		WGS84 latitude and longitude (Degs, mins, secs)		Easting / Northing		National Grid Reference
	Lat	Long	Lat	Long	X	Y	
1	51.65228855	-5.05736	51°39'08"N	005°03'26"W	188602	199261	SR 88602 99261
2	51.64825887	-5.08064	51°38'54"N	005°04'50"W	186973	198881	SR 86973 98881
3	51.64722904	-5.09297	51°38'50"N	005°05'35"W	186115	198802	SR 86115 98802
4	51.64831443	-5.10651	51°38'54"N	005°06'23"W	185184	198963	SR 85184 98963
5	51.64822254	-5.11216	51°38'54"N	005°06'44"W	184792	198969	SR 84792 98969
6	51.64912035	-5.12156	51°38'57"N	005°07'18"W	184147	199097	SR 84147 99097
7	51.65162866	-5.13017	51°39'06"N	005°07'49"W	183563	199401	SR 83563 99401
8	51.65161508	-5.14751	51°39'06"N	005°08'51"W	182364	199451	SR 82364 99451
9	51.63171075	-5.17062	51°37'54"N	005°10'14"W	180669	197307	SR 80669 97307
10	51.60448522	-5.17765	51°36'16"N	005°10'40"W	180052	194302	SR 80052 94302
11	51.59603868	-5.18465	51°35'46"N	005°11'05"W	179526	193384	SR 79526 93384
12	51.51515811	-5.332	51°30'55"N	005°19'55"W	168913	184847	SR 68913 84847
13	51.47733508	-5.352	51°28'38"N	005°21'07"W	167333	180705	SR 67333 80705
14	51.38768843	-5.19629	51°23'16"N	005°11'47"W	177707	170255	SR 77707 70255
15	51.27595632	-5.17957	51°16'33"N	005°10'46"W	178331	157782	SR 78331 57782
16	51.27581147	-5.4734	51°16'33"N	005°28'24"W	157843	158696	SR 57843 58696
17	51.40194545	-5.56113	51°24'07"N	005°33'40"W	152407	173011	SR 52407 73011
18	51.4746417	-5.3788	51°28'29"N	005°22'44"W	165458	180492	SR 65458 80492
19	51.48890675,	-5.38149	51°29'20"N	005°22'53"W	165345	182086	SR 65345 82086
20	51.48880996	-5.38155	51°29'20"N	005°22'54"W	165340	182076	SR 65340 82076
21	51.5342371	-5.35154	51°32'03"N	005°21'06"W	167655	187030	SR 67655 87030
22	51.61154388	-5.21011	51°36'42"N	005°12'36"W	177839	195185	SR 77839 95185
23	51.63797625	-5.20342	51°38'17"N	005°12'12"W	178431	198103	SR 78431 98103
24	51.6463438	-5.19716	51°38'47"N	005°11'50"W	178905	199014	SR 78905 99014
25	51.69098151	-5.14276	51°41'28"N	005°08'34"W	182881	203814	SM 82881 03814
26	51.69983028	-5.13451	51°41'59"N	005°08'04"W	183493	204773	SM 83493 04773
27	51.70309049	-5.12793	51°42'11"N	005°07'41"W	183964	205116	SM 83964 05116
28	51.69393581	-5.05154	51°41'38"N	005°03'06"W	189198	203875	SM 89198 03875