EDF RENEWABLES

Neart na Gaoithe Offshore Wind Farm

Nearshore Geophysical, UXO and Seismic Refraction Surveys – European Protected Species Risk Assessment

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1 Introduction

1.1 Background

1. Neart na Gaoithe Offshore Wind Limited (NnGOWL) is currently planning to undertake geophysical, Unexploded Ordnance (UXO) and seismic refraction surveys along the Neart na Gaoithe Export Cable Corridor to inform final detailed design of the Project. The surveys are planned to start in July 2019 and last around three months, with a planned end date in September 2019, dependent on weather.

1.2 Objectives of this Document

2. NnGOWL has confirmed with Marine Scotland Licensing Operations Team (MS-LOT) that survey activities are exempt from the requirement to obtain a marine licence under the Marine (Scotland) Act 2010.

3. NnGOWL has defined a survey scope of works and is currently procuring a survey contractor. NnGOWL has determined that the survey will utilise equipment that emits underwater noise and has confirmed with MS-LOT that the survey is subject to European Protected Species (EPS) licensing requirements under the Conservation of Habitats and Species Regulations 2017. This document has been prepared to support an application to MS-LOT for an EPS Licence.

2 Survey Scope and Methodology

4. The survey will focus on the nearshore section of the 300 m wide Export Cable Corridor from the landfall at Thorntonloch, south-east of Torness power station out to approximately 1.5 km. Whilst survey data will only be gathered within the 300 m Export Cable Corridor, in making turns to achieve parallel survey lines, the survey vessel and towed equipment will be required to manoeuvre up to 1 km out with these boundaries. Therefore, the survey area shown in Figure 1 encompasses both the Export Cable Corridor and the required vessel turning areas.

2.1 Geophysical and UXO survey

5. The planned geophysical and UXO survey will provide an improved understanding of seabed conditions and any potential UXO targets presence across the export cable corridor provide the following:
   - High-resolution survey data that identifies depths, seabed surface geology, slopes and bathymetric features including boulders;
   - Information on the geology below the surface of the seabed; and
   - Information on the presence of UXO and debris.

6. A single dedicated geophysical survey vessel will undertake the survey. The survey vessel will tow an array of equipment several metres above the seabed in parallel lines across the defined survey areas. The array will include underwater noise-emitting equipment, of which the following devices are expected to be indicative:
   - Reson 7125 Multi-beam echosounder (MBES);
   - EdgeTech 4200 Side Scan Sonar (SSS);
   - Sub-bottom profiler (SBP);
   - Ultra-Short Baseline (USBL) positioning equipment; and
   - Mini airgun.

7. For the SBP survey a total of three survey lines will be undertaken 75 m apart within the 300 m wide central corridor (Export Cable Corridor shown in Figure 1). The gradiometer survey used for UXO detection shall be full corridor width. The UXO survey will be undertaken along predefined survey lines spaced 4 m apart.

8. The MBES will gather detailed bathymetry data. The SSS will provide information on seabed debris and features. The SBP gathers information on the shallow sub-surface geology. The USBL system is commonly used by offshore industries to provide accurate positional data and in this case will be used to accurately determine the position of the towed device.

9. The equipment will continuously record seabed data which are relayed with positional data to an on-board data acquisition system via a data cable. Data is quality-checked in real-time such that the survey plan can be adjusted depending on the results. It is later processed in full.

2.2 Seismic refraction survey

10. The planned seismic refraction survey will provide an improved understanding of subsurface geological conditions and provide the following:

    - Information on the geology and rock structure below the surface of the seabed, to a depth of 25m below seabed level.

11. The survey will use the following underwater noise-emitting equipment:

    - Mini-G Gun; and
    - Ultra-Short Baseline (USBL) positioning equipment.

12. A single dedicated survey vessel will undertake the survey. The survey will be carried out along two 600 m lines spaced at 75 m either side of the central line, i.e. 150 m apart and similarly along two 300 m crossing lines. Unlike a typical seismic survey, data will be collected at points along each of the survey lines by placing the airgun in a cage suspended 10 cm above the seabed at the time of firing. At each location the airgun will be fired between two and four times over a period of a minute before being turned off and moved to the next location, where upon the process is repeated. The exact number of locations within the survey area that data will be collected is unknown but is estimated to be at approximately 121 locations over the six-day period. i.e. it is estimated that the airguns will be operated on average at 20 locations per day.

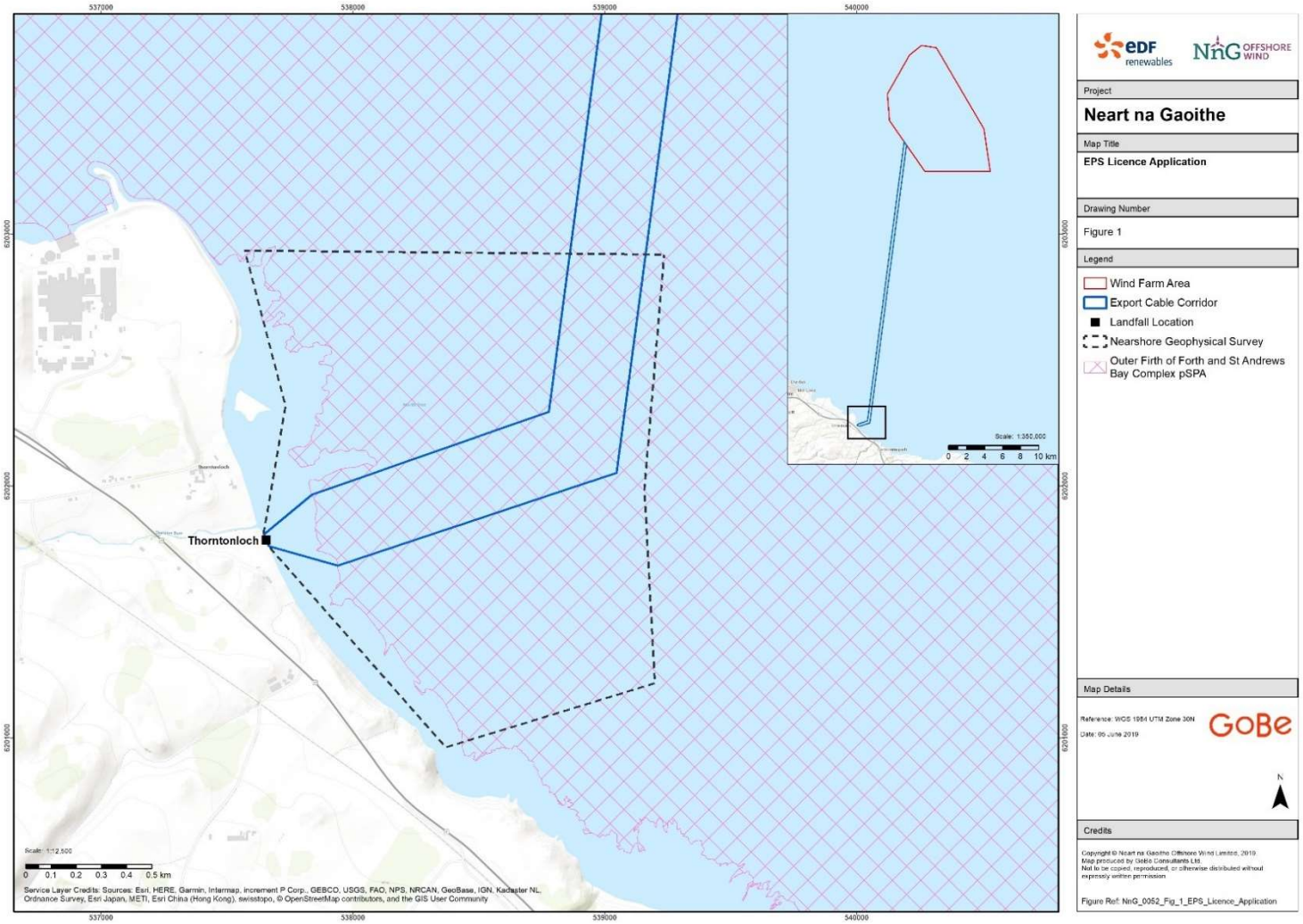

Figure 1: Neart na Gaoithe nearshore geophysical survey area and export cable corridor.

3 Underwater Noise Sources

13. The contractor undertaking the planned survey is still to be selected. Consequently, the precise details of all of the equipment to be used during the geophysical survey is not yet available and will depend on the outcome of the contract tendering process currently being undertaken. However, the broad types of equipment that will be required to undertake a successful geophysical survey are known and the assessment is based on a realistic worst-case scenario. Representative examples of the equipment are presented in Table 1 below, and a number of devices are listed where the specific device to be used is yet to be confirmed.

Table 1: Operating frequency and sound source level of planned geophysical equipment.

GEOPHYSICAL EQUIPMENT	OPERATING FREQUENCY	SOURCE LEVEL REPORTED BY MANUFACTURER (DB)
Multibeam Echosounder		
Reason Seabat 7125	400 kHz	220 (rms)
Subsea Positioning USBL (note only one of these devices will be used)		
Sonardyne Ranger USBL	35 – 50 kHz	200 (peak), 188 (rms)
Sonardyne Ranger 2 USBL HPT 3000	19 – 34 kHz	194 (peak), 188 (rms)
Sonardyne Scout	30 – 35 kHz	193 (peak)
Easytrak Nexus 2 USBL	18 – 32 kHz	198 (peak), 192 (rms)
Kongsberg HiPAP	21 – 31 kHz	190 (peak)*
Ix Blue GAPS	19 – 30 kHz	191 (rms)
Side-scan Sonar		
EdgeTech 4200 dual frequency SSS	300 or 900 kHz	115 or 230 (peak), 113 or 226 (rms)
Sub-bottom profiler (Pingers, Sparkers, Boomers, Chirps)		
EdgeTech 3200 XS 216	2 – 16 kHz	208 – 213 (peak), 205 – 210 (rms)
Innomar SES 2000 medium	2- 22 and 85-115 kHz	247 (peak)
Airgun		
Mini-G Gun	1-20 Hz	179 (SEL)

*note the HiPAP USBL has the capability to operate to up to 207 dB. However, if the HiPAP USBL is selected for the proposed survey it would only operate to a maximum sound source level of 190 dB with operating frequency of 21-31 kHz.

4 Favourable Conservation Status

14. The favourable Conservation Status (FCS) is defined under Article 1 (i) of the Habitats Directive as follows:
    - Conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2.
15. The conservation status will be taken as 'favourable' when:
    - Population dynamics data on the species concerned indicates that it is maintaining itself on a long-term basis as a viable component of its natural habitats,

- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future,
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

16. Table 2 summarises the conservation status of cetaceans in the area of potential disturbance. The status of a population becomes unfavourable should it decline by more than 1% per year or if there is an overall decrease in the population by more than 25% (European Commission 2005).

Table 2: Favourable Conservation Status and regional Management Unit population of cetaceans relevant to this application.

SPECIES	FCS ASSESSMENT	MANAGEMENT UNIT POPULATION
Harbour porpoise	Favourable	227,298 (95% CI 176,360 - 292,948) 333,808
Bottlenose dolphin	Unfavourable	195 (95% HDPI 162 – 253)
White-beaked dolphin	Favourable	15,895 (95% CI 9,107 – 27,743) 35,908
Minke whale	Favourable	23,528 (95% CI=13,989-39,572) 11,819

Regional Management Unit population is based on IAMMWG (2015). Bottlenose dolphin population is based on the Coastal East Scotland population from Cheney *et al*. (2013).
Favourable Conservation Status assessment from JNCC (2010) and JNCC (2013).
Figures in bold are the latest management unit population estimates (JNCC 2017a).

5 Potential Impacts on European Protected Species

5.1 European Protected Species Present in the Survey Area

17. Site specific marine mammal surveys were undertaken for three years between November 2009 and October 2012. Monthly surveys were undertaken by boat along a series of transects running in a north west to south easterly direction across the offshore site plus an 8 km buffer area and spaced 2 km apart.

18. A total of 10,400 km of transect was surveyed for marine mammals over a period of three years. The total number of European Protected Species recorded during each survey including within the 8 km buffer area are presented in Tables 3 to 5.

Table 3: Number of European protected Species recorded each month during Year 1 surveys (Shaded area covers period when survey may be undertaken).

SPECIES	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	TOTAL
Harbour porpoise	15	37	2	1	7	7	0	0	0	8	1	11	89
White-beaked dolphin	0	0	0	0	0	0	0	0	0	0	0	0	0
Minke whale	0	0	0	0	0	0	0	0	0	0	0	2	2
Unidentified dolphin	0	5	0	0	0	0	0	0	0	0	0	0	5

Table 4: Number of European Protected Species recorded each month during Year 2 surveys (Shaded area covers period when survey may be undertaken).

SPECIES	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	TOTAL
Harbour porpoise	0	1	0	6	15	15	0	0	4	22	11	9	83
White-beaked dolphin	0	0	1	0	0	0	12	3	0	0	0	0	16
Minke whale	0	0	0	0	0	0	0	3	0	4	1	1	9
Orca	0	0	0	0	0	0	0	0	0	0	0	1	0
Unidentified dolphin	0	0	1	0	0	0	0	0	0	0	0	0	0

Table 5: Number of European Protected Species recorded each month during Year 3 surveys (Shaded area covers period when survey may be undertaken).

SPECIES	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	TOTAL
Harbour porpoise	7	0	4	51	14	16	2	0	0	4	2	7	107
White-beaked dolphin	6	0	0	0	0	0	1	1	0	0	0	0	8
Minke whale	0	0	0	0	0	0	0	2	0	0	0	0	2
Unidentified dolphin	0	0	0	0	0	0	0	2	0	0	0	0	2

19. The results show that during the period when the proposed surveys are likely to be undertaken, between July and September, small numbers of European Protected Species were observed during the three years of baseline data collection.

20. Data from the East Coast Marine Mammal Acoustic Study (ECOMMAS) C-POD arrays located along the east coast of Scotland including off St Andrews and St Abb's, the closest locations to the proposed surveys, indicate there is greater potential for harbour porpoise and bottlenose dolphin to occur in nearshore waters. Between 2013 and 2016 harbour porpoise were recorded on a daily basis at the C-PoD arrays located at both St Andrews and St Abb's. Bottlenose dolphins were less frequently recorded with detections typically less than 5% of the days and no more than 8% of the time at St Abb's and 18% at St Andrews (Brookes 2017).

21. Evidence indicates that it may be possible for a European Protected Species to be present during the period in which the proposed inshore surveys will be undertaken with harbour porpoise the more frequently occurring species and bottlenose dolphin occurring for no more than 20% of the time.

6 EPS Assessment

22. Under Regulation 53(9) of the Habitats Regulations licences can only be issued where the proposed activity meets certain criteria. For the purposes of any likely application they are:

- There is a licensable purpose;
- There is no satisfactory alternative; and

- The action authorised will not be detrimental to the maintenance of the population of the species concerned at favourable conservation status in their natural range.

6.1 Test 1: Licensable Purpose

23. The Scottish Government can only issue licenses under Regulation 44(2) of the Regulations (as amended) for specific purposes. These purposes include:

    - 44(2)(e) preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment; (Marine Scotland 2012).

24. When considering EPS licences under IROPI, SNH takes into account whether an activity or development is required to meet, or contribute to meeting a specific need, such as:

    - maintaining the health, safety, education or environment (sustainable development, renewable or green energy, green transport) of Scotland's people;
    - complying with national planning policies.
    - supporting economic or social development (nationally important infrastructure development projects, employment, regeneration, mineral extraction, housing etc.).

25. The Project meets the criteria for the development to be considered as one of IROPI.

26. The development of the Project demonstrates a direct environmental benefit on a national and international scale and complies with international and national environmental policies. Furthermore, the life-span of the Project is predicted to be up to a 50 year period and therefore a long-term development that will contribute to ensuring the security of energy supply, with long-term environmental benefits. It is not a development for short-term economic interests.

27. The Project will have a direct national and international environmental benefit by significantly reducing carbon emissions to the atmosphere compared to other sources of non-renewable energy generation. By replacing non-renewable energy generation, e.g. coal generation, the development of the Project will reduce annual CO_2 emissions. Over the operational period of the wind turbines, the Project will displace CO_2 from other energy sources by up to 12.61 million tonnes coal equivalent.

28. Recognising the importance of reducing carbon emissions, the EU, UK and Scottish Government have all committed to reduce emissions and increase the use of renewable energy:

    - In 2009 the EU introduced Directive 2009/28/EC on the *Promotion of the use of energy from renewable sources*, which set renewable energy targets for each member state. The Directive imposed on the UK a mandatory national target of deriving 15% of gross final energy consumption from renewable sources by 2020.
    - The Climate Change (Scotland) Act 2009, which sets additional targets for emissions reductions in Scotland than the Climate Change Act: 80% reduction by 2050, with an additional interim target of 42% by 2020;
    - The Climate Change Act 2008, which commits the UK to a net reduction in greenhouse gas emissions of 80% by 2050 and 34% by 2020.

29. The development complies with national policies and plans including:

    - The National Renewable Energy Action Plan for the UK produced under Article 4 of the Renewable Energy Directive.
    - The UK National Policy Statements (NPSs) on Energy, produced under Part 2 of the Planning Act 2008, which decision makers must have regard to when deciding an application for nationally significant infrastructure projects consented under that Act. As energy policy is a reserved matter for UK ministers, the Energy NPSs may be a relevant consideration in energy infrastructure decisions in Scotland. Of the 12 NPSs, EN-1 (overarching energy) sets out the policy for the delivery of major energy infrastructure and reflects the UK Low Carbon Transition Plan, and EN-3 (Renewable Energy) supports the development of renewable energy and offshore wind farms in particular.
    - The National Planning Framework 2 (NPF2), produced under the Planning etc. (Scotland) Act 2006, sets out a strategy for Scotland's development up to 2030. One of the main elements of the strategy is to "*realise the potential of Scotland's renewable energy resources and facilitate the generation of power and heat from all clean, low carbon sources*" (Scottish Government 2009).

- The 2020 Routemap for Renewable Energy in Scotland, which sets further targets of renewable sources to meet the equivalent of 100% of Scotland's gross annual electricity demand by 2020 (Scottish Government 2011).
- Scotland's Low Carbon Economic Strategy (LCES) aims to secure economic growth and includes an approach to guiding Scotland into a low carbon economy. The strategy focuses on Scotland's targets for reducing GHG emissions, and recognises that, *"By 2030 almost all of our electricity will have to come from low carbon technologies such as renewables and fossil fuelled plants fitted with carbon capture and storage technology"* (The Scottish Government 2010).
- A sector specific marine plan, 'Blue Seas - Green Energy: A Sectoral Marine Plan for Offshore Wind in Scottish Territorial Waters' ('the Plan') (Marine Scotland 2011) was published in March 2011 (including a SEA, HRA and an Economic Impact Assessment), and confirmed that six sites for offshore wind developments were suitable for development. Within the Plan the Neart na Gaoithe site was shortlisted as one of these sites.

30. The development of the Project identifies a direct environmental benefit and complies with both international and national policies and plans and is therefore a project of Imperative Overriding Public Interest.

31. The proposed geophysical survey is directly linked with the development of the project and therefore meets the requirements of the Regulations.

6.2 Test 2: No satisfactory alternative

32. Geophysical and seismic surveys are required in order to map the seabed, measure water depth and characterise layers of sediment or rock below the seabed. They are essential when undertaking any offshore development work and projects cannot be developed without some geophysical work being undertaken. Although there may be different types of equipment that can be used, this is often constrained by the specific purpose the geophysical survey that is being undertaken and the use of alternative equipment may not be effective. There are no alternative options to the use of the geophysical equipment proposed for this survey.

33. Knowing how much, where and what type of UXO is present in the area is safety critical. If UXO is found to be present then how best to manage it can then be determined.

6.3 Test 3: That the action authorised will not be detrimental to the maintenance of the species concerned at a favourable conservation status in their natural range

34. Regulation 44(3)(b) states that a licence cannot be issued unless the Scottish Government is satisfied that the action proposed "will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range" (SNH and JNCC 2014).

35. This section considers whether the proposed activities that could require licensing will be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range. The information provided is based on the assessments presented in Chapter 8: Marine Mammals of the Neart na Gaoithe Environmental Impact Assessment (EIA) Report (March 2018).

6.3.1 Risk Assessment

36. The range at which marine mammals may be able to detect sound arising from offshore activities depends on the hearing ability of the species and the frequency of the sound. Marine mammals may be able to detect sound across a broad range of frequencies but are less sensitive at frequencies at the lower or higher end of their functional hearing range. Porpoises have a functional hearing range of between 250 Hz and 180 kHz with their most sensitive hearing at high frequencies between approximately 100 kHz and 140 kHz (Kastelein *et al.* 2002, Southall *et al*. 2007). Dolphins have a broad hearing range of between 150 Hz and 160 kHz but are most sensitive to sounds between 10 kHz and 50 kHz (Richardson *et al*. 1995). Minke whale hearing has not been studied directly. Indirect evidence suggests they are most sensitive to low to medium frequencies of between 20 Hz and 19 kHz (Erbe 2002).

37. The frequencies at which equipment planned to be used will be operated at and the hearing frequency range of marine mammals are presented in Figure 2.

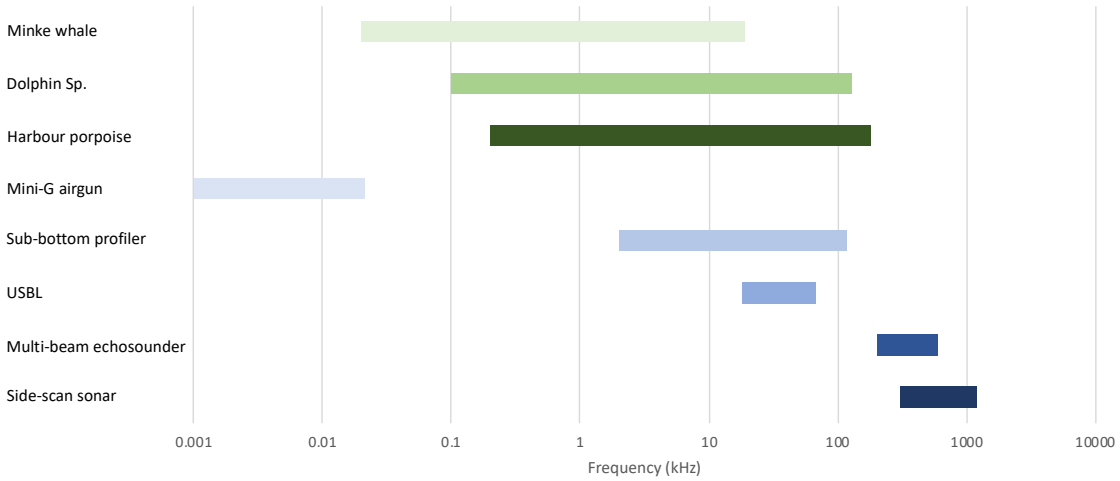

Figure 2: Marine mammal hearing frequencies and sound produced by geophysical equipment.

6.3.2 Multi-beam echosounder

38. Multi-beam echosounders are widely used in the marine environment and measure water depth by emitting rapid pulses of sound towards the seabed and measuring the sound reflected back. Emitted sound frequencies are typically between 12 – 400 kHz depending on water depth, with surveys in continental shelf applications operating at between 70 to 150 kHz, and in shallower waters of less than 200 m using multi-beam echosounders operating at between 200 and 400 kHz (Danson 2005, Hopkins 2007, Lurton and DeReutier 2011). Sound sources have been reported as ranging from 210-245 dB re 1µPa-m (Table 1) (Genesis 2011).

39. The water depths within the proposed survey will be undertaken are all less than 100 m. Consequently, the multi-beam echosounders proposed to be used will be emitting sound levels at 400 kHz and therefore outwith the hearing frequency range of all marine mammals (Figure 2). It is therefore predicted that marine mammals will be unable to hear the sound arising from the echosounder and there will be no impacts on any European Protected Species.

6.3.3 Side-scan sonar

40. Side-scan sonar involves the use of an acoustic beam to obtain an accurate image over a narrow area of seabed to either side of the instrument. The frequencies used by side-scan sonar are relatively very high, typically between 100 and 900 kHz. In shallower waters, such as the proposed survey area, side-scan sonar operate at frequencies at the higher end of this spectrum between 300 and 900 kHz and are therefore predominantly producing sound outwith the hearing frequency range of marine mammals (Table 1 and Figure 2). Marine mammals within the area will therefore be unable to hear sound arising from side-scan sonar and there will be no impacts on any European Protected Species.

6.3.4 Sub-bottom profiler

41. Sub-bottom profiling is used to determine the stratification of soils beneath the sea floor. Various types of instrument may be used, such as pingers, boomers, sparkers and chirpers, depending on the required resolution and seabed penetration. They produce sound source levels of between 196 and 225 dB re 1 µPa -1 m (rms SPL) and at frequencies ranging from between 0.5 and 300 kHz and are therefore audible to marine mammals (Table 1 and Figure 2) (BOEM 2016, King 2013, Danson 2005).

42. It is currently planned to use an EdgeTech 3200 XS Chirper and Innomar SES 2000 medium sub-bottom profiler. Chirpers are frequency modulated sub-bottom profilers capable of providing high penetration and high resolution data. They have largely replaced the use of sparkers and boomers when undertaking many surveys. They produce sound levels of between 189 and 214 dB re 1 µPa - m (rms SPL) at frequencies of between 2 and 24 kHz. They cover a relatively broad range of frequencies that are detectable by marine mammals. The EdgeTech 3200 XS operates at between 300 and 600 kHz and produces sound levels of between 208 and 213 $_{(0\text{-peak})}$ and 205 – 210 $_{(rms)}$. The Innomar SES 2000 is a parametric sub-bottom profiler and operates at frequencies between 2 and 22 kHz and also between 85 and 115 kHz with a sound source reported as being 247 dB µPa re 1m (rms).

43. No noise modelling has been undertaken for sub-bottom profilers for this survey. However, results from noise modelling undertaken for other assessments indicate that the potential impact on marine mammals from a sub-bottom profiler will be limited in extent. Noise modelling undertaken for BEIS as part of a Review of Consents Habitats Regulations Appraisal (HRA) was based on the maximum source levels and bandwidths obtained from a range of sub-bottom profilers. The results indicated that for harbour porpoise the onset of Permanent Threshold Shift (PTS) could arise from between 17 m and 23 m from source and potential behavioural impacts within 2.4 km and 2.5 km (BEIS 2018). This was a worst-case scenario and the use of a Chirper with a peak SPL of 267 dB re 1 µPa-m and therefore considerably louder than either the EdgeTech 3200 or Innomar 2000 that will be used for this survey.

44. Similar noise modelling undertaken for pipeline inspection surveys based on a hull mounted pinger (the Neptune T335 pinger sub-bottom profiler) with a sound source of 220 dB re 1 µPa-m $_{(0\text{-peak})}$, indicated that noise levels could cause the onset of PTS in minke whales within 5 m of the sound source and harbour porpoise within 32 m. The thresholds at which the onset of PTS in dolphins could occur were not exceeded. Disturbance to marine mammals was predicted to occur out to 1.5 km (Shell 2017). The results from this modelling are again based on equipment producing a higher level of noise than that proposed to be used during this survey and therefore estimated distances at which the onset of PTS is predicted to occur will be smaller than the maximum of 32 m estimated by noise modelling.

45. The presence of the survey vessel(s) will further reduce the very low risk of any harbour porpoise occurring within 32 m of the sub-bottom profiler. Studies on the impacts vessel have on harbour porpoise have shown that changes in harbour porpoise behaviour due to vessel noise occur when noise levels between 113 to 133 dB re 1 µPa (weighted), which can be equivalent to a vessel 1,000 m away (Dyndo *et al*. 2015). Studies undertaken in Denmark recorded harbour porpoise no closer than 60 m from seventeen recorded ship interactions (Hermannsen *et al*. 2014). Similarly, studies on harbour porpoise within the black sea reported between 40% and 80% of harbour porpoises responded to vessel less than 50 m away and this decreased with distance when at 400 m less than 10% showed any response to vessels (Bas 2017). Consequently, it is predicted that there is a very low probability of any harbour porpoise occurring within 32 m of the vessel, irrespective of whether or not the geophysical equipment is operating.

46. Based on the above it is concluded that there is a very low risk of any marine mammals occurring within range at which the onset of PTS is predicted to occur due to noise from the use of a sub-bottom profiler. The sound levels produced will be below that which are likely to cause the onset of PTS in dolphins and a baleen whale, e.g. a minke whale will have to be less than 5 m away before being at risk of the onset of PTS. There is a very small risk to harbour porpoise as it is predicted that they will avoid the vessel and not occur within the area at which the onset of PTS is predicted to occur.

47. There is potential for a relatively localised area of disturbance to occur no further than 2.5 km from the survey and more probably only within 1.5 km. Therefore, assuming a spherical radius of disturbance, the estimated area of disturbance at any one location will be between 7.0 km^2 and 19.63 km^2.

48. The sub-bottom profiler will be used to provide information of the seabed conditions along the nearshore cable route. The length of the nearshore cable route is no more than 1.5 km and assuming disturbance occurs to 2.5 km either side of the sub-bottom profiler (i.e. a 5 km corridor), then a total area of 7.5 km^2 may be impacted over the course of the survey. In the more likely event that disturbance occurs over a smaller area then the impacts will be lower.

49. The densities of EPS in nearshore coastal waters along the cable route are unknown but will likely differ from those recorded during the three years of baseline offshore surveys and presented in Tables 3 to 5. However, the very localised area of no more than 7.5 km^2 across which disturbance is predicted to arise is so small that it is not be possible to impact on anything other than a very small and insignificant proportion of the species' populations.

50. The sub-bottom profilers will be used over a short period of time while it surveys the three lines within the survey corridor. The area across which disturbance occurs will be no further than 2.5 km from the survey vessels and once the vessel moves away from the area noise will reduce to below levels at which disturbance is predicted to occur. Therefore, any disturbance impacts will be temporary with evidence from other noise producing activities showing that cetaceans return relatively quickly to an area following displacement (e.g. Thompson *et al.* 2010, 2013; Pirotta *et al.* 2014).

51. It is therefore concluded that although there may be localised short term disturbance to EPS during the period the sub-bottom profilers are operating, the impacts will be temporary and will not be detrimental to the maintenance of any EPS population at a favourable conservation status within their natural range.

6.3.5 Mini-G Gun

52. A Mini-G Gun is a relatively very small airgun with a maximum capacity of 60 cu. in. It will be used by being placed on the seabed at locations within the survey area and fired between 2 and 4 times over a period of one minute. The airgun operates at frequencies of between 1 and 20 Hz with a sound source level from the airgun of 179 dB re 1µPa2-s (SEL). The noise arising from the use of the airgun will not be continuous, instead there will be a no more than four pulses undertaken over a period of 60 seconds and therefore not predicted to cause a cumulative SEL impact which occurs when noise is continuous over a longer period of time; typically, 24 hours. Instead the impacts are predicted to be more similar to that from a single impulse noise. Cumulative SEL levels at which the onset of PTS is predicted to occur are considerably lower those from a single shot.

53. The sound frequencies at which the airgun will operate are below that which dolphins and porpoises are able to detect but may be audible at the lower end of the functional hearing range of minke whale. However, the level of sound produced by the airgun, at which the onset of auditory injury is predicted to occur, is below that for dolphins and baleen whales (Southall *et al*. 2019).

54. The area of potential disturbance or displacement to minke whales is unknown. However, the level of sound produced by the Mini-G gun is below that from the proposed sub-bottom profiler and therefore it is predicted that similar or lower levels of displacement or disturbance could arise.

55. It is therefore concluded that although there is potential for localised short term disturbance to minke whale during the period the Mini-G Gun is operating, the impacts will be temporary and will not be detrimental to the maintenance of any EPS population at a favourable conservation status within their natural range.

6.3.6 Ultra-short Baseline (USBL)

56. The USBL system consists of a transceiver, which is mounted at the end of a transducer pole either to the side of, or beneath the survey vessel, and a transponder on the towed equipment. The USBL calculates the position of the equipment by measuring the range and bearing from the vessel mounted transceiver to the transponder. The transceiver emits a signal (a ping) at predetermined periods which is returned by the transponder and allows for the bearing and distance to be calculated.

57. Reported sound levels produced by USBL range from between 188 and 192 dB (rms) and 191 and 207 (peak) (Table 1). These sound levels are relatively low compared with other sources. For all but one USBL system the maximum sound levels produced are below those at which the onset of PTS is predicted to occur for all EPS species. The exception is the HiPAP USBL that can be operated at sound source levels of 207 dB $_{(0\text{-peak})}$ (Table 1). However, the sound source for this equipment can be reduced, depending on the type of survey being undertaken and it will not be operated at levels capable of causing the onset of PTS, i.e. it will only be used at levels below 202 dB re 1 µPa (Southall *et al*. 2019). Consequently, there will be no risk of any hearing injury to EPS from the operation of USBL.

58. There is limited published information on the potential impact USBL may have on marine mammals. Assessments based on NMFS (National Marine Fisheries Service) disturbance criteria indicate that there is no risk of physical injury (Level A Harassment) to any marine mammals and that disturbance (level B Harassment) will only occur to within 6 m of the USBL equipment (NOAA 2018).

59. Monitoring reports for the installation of a cable between Caithness and Moray, during which USBL was operated, reported bottlenose dolphins between 100 m and 1,200 m from the sound source and minke whale between 80 m and 2,000 m. Indicating that marine mammals were not significantly displaced beyond that which might be expected from the presence a vessel, during the time USBL was in operation. The report does not record the behaviour of the marine mammals observed during the period USBL equipment was operating and therefore it is not known whether there was disturbance that could have caused changes in behaviour. However, there were no sightings of any marine mammals within the range at which physical injury was predicted to occur (Natural Power 2018).

60. USBL equipment is widely used by offshore industries and scientific research vessels, where positional accuracy is critical and where underwater survey equipment is towed against strong/varying currents. For example, it is known that this type of equipment has been used at Hywind, Hornsea One Project, Blyth Offshore Wind Farm, Teesside Offshore Wind Farm and Rampion Offshore Wind Farm, though it can be presumed also across the majority of offshore wind farm sites during surveys where accurate positioning is required.

61. It is therefore concluded that there is no risk of physical injury to any marine mammals from the use of USBL equipment. There may be potential disturbance within a few metres of the USBL although any impacts will be temporary and will not be detrimental to the maintenance of the population at a favourable conservation status within their natural range for any European Protected Species.

6.4 Mitigation

62. Marine Scotland guidance on EPS states that 'Mitigation measures should be put in place whenever there is concern that an activity is likely to cause an offence, and should be proportionate to the risk of injury or disturbance' (Marine Scotland 2014). There is no risk of injury to any EPS from noise arising from USBL which operates at a level below which noise could cause the onset of PTS. There is no risk of physical injury to dolphins or baleen whales due to level of sound produced by the survey equipment being below levels at which the onset of PTS will occur. Due to the very localised area within which the onset of PTS is predicted to arise from the use of a sub-bottom profiler and the known behaviour of harbour porpoise to avoid vessels, there is effectively no risk of any harbour porpoise occurring within the range at which the onset of PTS is predicted to occur. Consequently, the mitigation measures proposed are proportionate to the extremely small risk of any harbour porpoise being within 32 m of the sub-bottom profiler at the start of a survey using a sub-bottom profiler.

63. Mitigation measures to reduce the risk of disturbance include ensuring that the USBL, Sub-bottom profilers and airgun operate at the lowest potential sound levels and over the shortest period of time. In the case of the USBL, this will only be operated at levels below 202 dB re 1 µPa. The survey will also be undertaken within as localised area as possible. This will reduce the potential extent and duration of any possible disturbance. If practical, the USBL equipment will be started at a lower level and ramped up over a period of time until operating at levels suitable for its purpose. This will allow any marine mammals within the potential range at which disturbance could occur to swim away.

64. The sub-bottom profilers and airgun will start at the lowest possible sound level and be gradually increased over a period of time (soft start). This will also allow any marine mammals within the potential range at which disturbance could occur to swim away. The procedure for soft start for the airgun will consist of increasing the power delivery over time, via the different size chambers (12, 40 and 60 cubic inches). A typical soft-start scenario for SBP is presented in Table 6.

Table 6: Typical soft-start scenario for the sub-bottom profiler

Duration (minutes)	Proportion of energy (%)
0 – 5	25
5 – 10	50
10 – 15	75
>15	100

65. The very limited range of no more than 32 m within which the onset of PTS is predicted to occur from the sub-bottom profiler means that a pro-longed soft-start is not necessary as, in the highly unlikely event that a marine mammal is in the immediate area, it will take a period of some tens of seconds for the marine mammal to swim beyond the range at which the onset of PTS is predicted to arise

66. The use of a Marine Mammal Observer (MMO) or Passive Acoustic Monitoring (PAM) is not considered to be necessary as there is very low, if any risk, of injury occurring due to the very low number of cetaceans recorded in the area and the very localised extent noise capable of causing the onset of PTS is predicted to occur, which as a worst-case is predicted to be within 32 m of the sound source. Furthermore, the use of a soft start and the physical presence of the vessel will further reduce the risk of any physical injury to virtually zero.

6.5 Cumulative Effects

67. Within the Firth of Forth and Tay region there are a number of consented wind farms (Inch Cape and Seagreen) that could theoretically cause a cumulative impact. However, there are currently no known activities being undertaken by the

proposed developments that will cause a cumulative impact on European Protected Species occurring within the region. No other projects are known that could cause a cumulative impact within the Firth of Forth and Tay.

7 Conclusions and Actions

68. Equipment to be used during the proposed geophysical survey is widely used by the offshore industry.

69. Sound produced by the sub-bottom profilers, Mini-G gun and USBL may be audible to cetaceans. However, the likelihood of cetaceans occurring within the survey area is relatively low and the level of sound produced by the survey equipment is below that which is capable of causing the onset of PTS for all species except for harbour porpoise. Modelling undertaken for other studies indicate that the risk of injury is limited to within a few 10s of metres from the sub-bottom profiler and disturbance to within 2.5 km. Consequently, there is virtually zero risk of any cetaceans being at risk of the onset of PTS and relatively small number of cetaceans may be disturbed by the use of survey equipment used during the survey. Any disturbance impacts will be temporary with behaviour returning to normal once the vessel moves away from the area.

70. There will be no impact on the favourable conservation status of any European Protected Species.

71. This information supports the application for an EPS licence as requested by Marine Scotland.

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