MORAY WEST
OFFSHORE WINDFARM

Licensing Technical Report

Moray Offshore Windfarm (West) Limited

European Protected Species (EPS) Risk Assessment - January 2019

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Liability

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Acronyms	
Acronym	**Expanded Term**
AUV	Autonomous underwater vehicle
BSF	Below the Sea Floor
EDPR UK	EDPR UK Limited
EPS	European Protected Species
HRA	Habitats Regulations Appraisal
MBES	Multi-beam Echo-sounders
MS LOT	Marine Scotland Licensing Operations Team
NCMPA	Nature Conservation Marine Protected Areas
OSP	Offshore Substation
PTS	Permanent Threshold Shift
ROV	Remotely Operated Vehicle
SBES	Single-beam Echo-sounders
SNCBs	Statutory Nature Conservation Bodies
SNH	Scottish Natural Heritage
TTS	Temporary Threshold Shift
USBL	Ultra-short Baseline
UXO	Unexploded Ordnance
WTG	Wind Turbine Generator
ZDA	Zone Development Agreement

1 Introduction

1.1 Project Overview

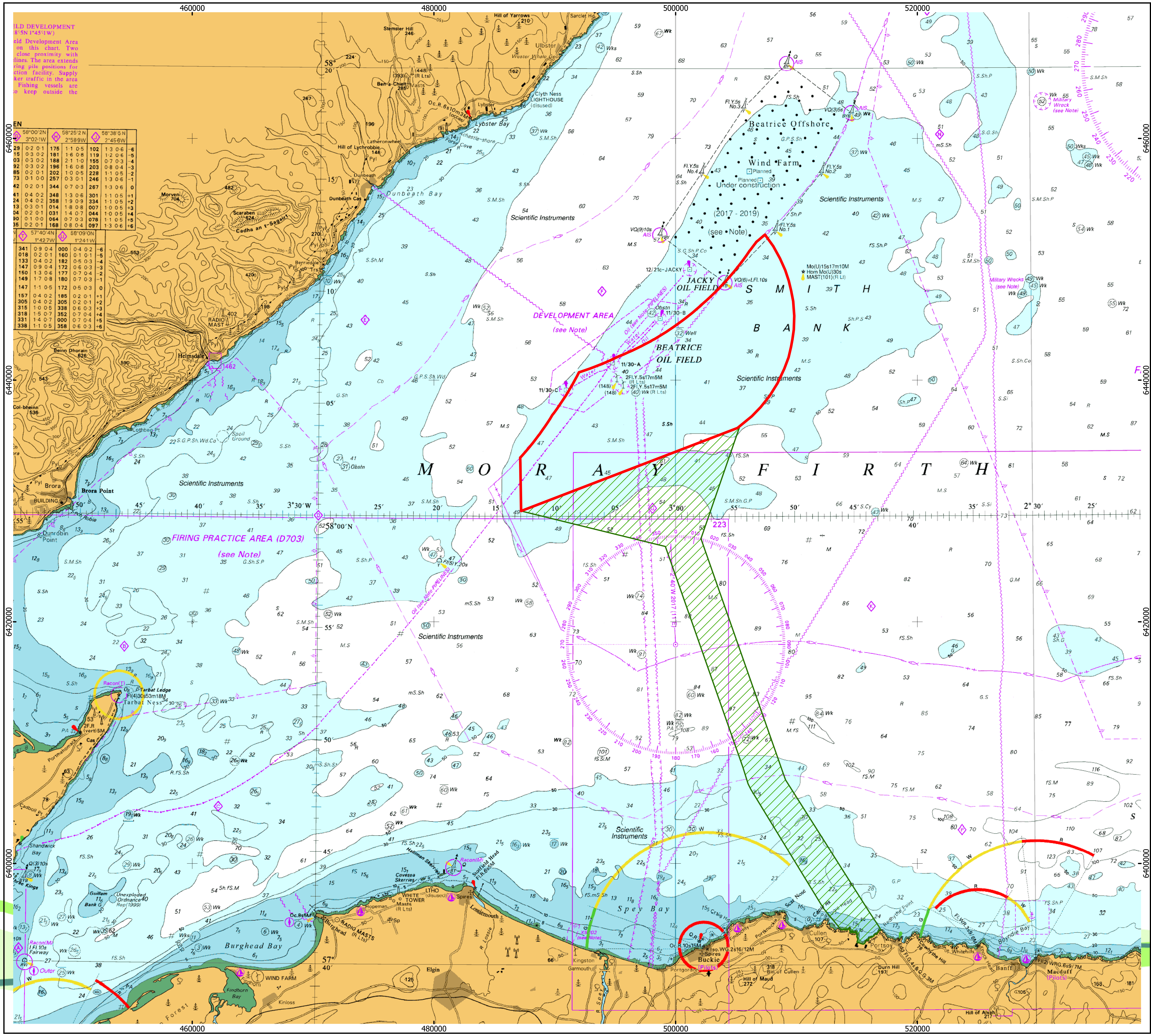
Moray Offshore Windfarm (West) Limited (known as Moray West) is owned by Moray Offshore Renewable Power Limited ('Moray Offshore'). Moray Offshore holds the Zone Development Agreement (ZDA) under which it has exclusive rights to investigate and develop offshore wind farms in the Moray Firth Zone. In March 2017, Moray West signed an Agreement for Lease (AfL) with The Crown Estate for the Moray West Site.

The Moray West Site is located on the Smith Bank in the Outer Moray Firth, approximately 22.5 km from the Caithness coastline. The Moray West site is the location of the proposed Moray West Offshore Wind Farm for which Moray West is developing.

The Moray West Offshore Wind Farm will comprise up to 85 Wind Turbine Generators (WTGs), 2 Offshore Substation Platforms (OSPs), inter-array cables, OSP interconnector cables and offshore export cables which will come ashore at a point within the Landfall Area.

Moray West has identified the need to undertake further geophysical surveys of both the Moray West Site and the Offshore Export Cable Corridor (Figure 1.1). These surveys are due to commence in March 2019. As a part of the geophysical surveys, Moray West will also conduct an Unexploded Ordinance (UXO) survey within both the Moray West Site and along the Offshore Export Cable Corridor.

Further details of the proposed marine surveys are provided in Chapter 2.



MORAY WEST
OFFSHORE WINDFARM

Survey Area

- Moray Wesy Site
- MW Export Cable Corridor

Horizontal Scale: 1:300,000 A3 Chart

0 6,000 12,000 Meters

N

Geodetic Parameters: WGS84 UTM Zone 30N

Produced: MG
Reviewed:
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Figure 1.1: Survey Area
Moray West

Moray Offshore
Windfarm (West) Ltd

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

1. An application for a European Protected Species (EPS) Licence.
    a. Within 12 nautical miles: An EPS Licence is required under the Conservation (Natural Habitats, &c) Regulations 1994 (as amended) where there is potential for the presence of vessels or underwater noise from the proposed survey activities to injure or cause disturbance to an EPS. Specifically, this assessment considered cetaceans and otters.
    b. Outwith 12 nautical miles: An EPS Licence is required under the Conservation of Offshore Marine Habitats and Species Regulations 2017 where there is potential for the presence of vessels or underwater noise from the proposed survey activities to injure or cause significant disturbance to an EPS (population level effect rather than individual animals).

1.2 European Protected Species (EPS)

1.2.1 EPS Protection

All species of cetacean (whale, dolphin and porpoise) occurring in UK waters and otters are listed in Annex IV of the Habitats Directive as European Protected Species (EPS), meaning that they are species of community interest in need of strict protection, as directed by Article 12 of the Directive. Other species listed as EPS include otters.

This protection is afforded in Scottish territorial waters (out to 12 nautical miles) under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Regulation 39(1) of these Regulations make it an offence to:

a. Deliberately or recklessly capture, injure or kill a wild animal of an EPS;
b. Deliberately or recklessly:
    i. Harass a wild animal or group of wild animals of an EPS;
    ii. Disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;
    iii. Disturb such an animal while it is rearing or otherwise caring for its young;
    iv. 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;
    v. 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;
    vi. 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
    vii. Disturb such an animal while it is migrating or hibernating.

Further protection is afforded through an additional disturbance offence given under Regulation 39(2) which states that “it is an offence to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)”.

Outside of 12 nautical miles, the extent of legislative protection against injury is the same as within 12 nm. However, the definition of disturbance outside of 12 nautical miles does not extend to individual animals. Therefore, whilst disturbance of a single animal within 12 nautical miles may be considered an offence and thus require an EPS licence, for an EPS licence to be required outside of 12 nautical miles there must be disturbance of a significant group of animals.

1.2.2 What constitutes disturbance?

1.2.2.1 Within 12 nautical miles

Whether or not a specific activity could cause 'disturbance' (for the purpose 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, Marine Scotland (2014) 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 this 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 that could be considered an offence may occur in other circumstances and therefore be covered under Regulation 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 disturbance to any individual EPS occur, an EPS Risk Assessment must be carried out and the need for a Marine EPS Licence determined.

1.2.2.2 Outside of 12 nautical miles

As Regulation 39(2) of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) is not applicable to offshore waters, disturbance of an individual animal would not necessarily qualify as significant disturbance requiring a Marine EPS Licence. Instead, under the Conservation of Offshore Marine Habitats and Species Regulations 2017 disturbance must occur to a sufficiently large or important group of animals that the ability of that group of animals to survive, breed or rear or nurture their young would be compromised. Alternatively, disturbance could be also considered to occur if the local distribution or abundance of the species was significantly changed.

[1] The Habitats Directive defined the conservation status of a species to be taken as 'favourable' when population 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.

1.2.3 Determining the need for a Marine EPS Licence

The purpose of the EPS Risk Assessment presented in this report is to determine whether, when considering appropriate mitigation as presented in Chapter 4, there is still potential for the marine survey activities to cause deliberate harm or inadvertently cause disturbance to cetaceans or other protected species. The need for a Marine EPS Licence will be determined by the Marine Scotland Licencing Operations Team (MS LOT) with advice from Scottish Natural Heritage (SNH) based on findings from the EPS Risk Assessment. MS LOT'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 licencing of the activity will not be detrimental to the maintenance of the population of the species concerned at a *Favourable Conservation Status*.

1.3 Document structure

This document provides the information to support the EPS licensing process:

- Chapter 2: provides a description of the proposed survey activities and their proposed location;
- Chapter 3 provides an assessment of the risk to cetaceans and otters; and
- Chapter 4 outlines the proposed mitigation measures to be implemented.

2 Description of Activities to be Licenced

2.1 Locations of activities

As stated in Section 1.1, and illustrated in Figure 1.1 the geophysical survey will be carried out in both the Moray West Site and along the Offshore Export Cable Corridor. Information about the proposed survey activities within each survey area is also provided below.

2.1.1 Moray West Site

The Moray West Site comprises a north-easterly trending area, approximately 30 km long and approximately 10 km wide. This area occupies the southern part of a seabed referred to as Smith Bank, covering a total area of 225 km^2. Water depths vary from a minimum of approximately 35 m near the northern boundary, with Moray East to a maximum of 54 m near the southern limit of the site.

2.1.2 Offshore Export Cable Corridor

The Offshore Export Cable Corridor is 65 km long and covers an area of 185 km^2. Due to uncertainties in the location, and number of, Offshore Substation Platforms (OSPs) the Offshore Export Cable Corridor widens as it reaches the Moray West Site. This is to allow for the export cables to be routes from both sides of the Beatrice Offshore Wind Farm Export Cable Corridor which extends north south through the centre of the Moray West Site.

2.1.3 Landfall and Nearshore Area

Landfall Area extends west from the eastern end of Sandend Bay to Redhythe Point on the Aberdeenshire Coast between Sandend and Portsoy. Water depths on the approach to the Landfall Area range between 5 m and 20 m.

For the purpose of this survey the nearshore are has been defined as the section of the Offshore Export Cable Corridor which extends from the 20 m LAT contour to 5 m water depth at the landfall. The awarded contractor may specify a different limit if they can ensure safety and quality of the work.

2.2 Survey vessels

The type and number of vessels required to complete the geophysical (including UXO) surveys will vary depending on the different activities associated with each survey and site characteristics.

The contractor that will be employed to undertake the surveys have not been selected yet, therefore exact details on the vessels to be used are not available. The vessels detailed in Table 2.1 below are of a similar type and size that could be used and have been used as proxy vessels for the purpose of this EPS Risk Assessment. The vessels encompass to the maximum size that could be provided by the contractors (thereby offering maximum flexibility in the survey contractor procurement process), however it is not expected that the larger vessels be utilised within the nearshore area.

Table 2.1: Example types of vessels that could be used during the geophysical (and UXO) surveys of the Moray West Site and Offshore Export Cable Corridor

Example vessel	Description	Landfall	Offshore Export Cable Corridor	Moray West Site
Fugro Skandi	The Skandi Carla is a purpose-designed vessel for ROV surveys, IRM and		✓	✓

Table 2.1: Example types of vessels that could be used during the geophysical (and UXO) surveys of the Moray West Site and Offshore Export Cable Corridor				
Carla	construction support. It is diesel-electric, DP2 vessel and has advanced DGPS, ultra-short baseline (USBL) acoustic system and a Seapath 200. It has a moon pool which allows safe launching of work class ROVs by the use of a Rolls-Royce Launch and Recovery System (LARS). The vessel is fitted with a heave compensated Hydramarine 50T/15m knuckle boom deck crane with optimum deployment and recovery speeds at depth down to 3,000 m. The length is 83.85 m, breadth 19.7 m, deck area is 632 m^2 and the draft is 6.2 m, the vessel was delivered in 2001.			
Fugro Pioneer	The Pioneer has been constructed to the highest standards demanded of a modern multi-purpose vessel. It has diesel-electric propulsion and a specially designed hull. The rudder propellers maximise station keeping and navigational control while the vessel is kept acoustically quiet during surveys. It is suitable for geophysical survey operations up to 1,000 m WD. The length is 53.7 m, beam 12.5 m, deck area is 50 m^2 and the draught is 3.1 m.		✓	✓
Fugro Proteus	The Proteus is a new-build DP1 vessel designed for multi-purpose survey operations in shallow and medium water depths. The vessel is suitable for shallow seismic and analogue geophysical surveys, bathymetric surveys, ROV support operations for up to light Work-Class vehicles, and environmental surveys. The vessel has been certified "Green Passport" by IMO. It has an auxiliary workboat/survey launch that can perform operations independently from the mother vessel. This enables close inshore survey and support work. The length is 53.7 m, beam 12.5 m, deck area is 250 m^2 and the draught is 3.35 m.		✓	✓
Fugro Seeker	The Seeker is a purpose-built vessel for hydrographic and geophysical surveys. It is equipped for 12 h operations up to 60 NM from safe haven. It has two hull mounted multibeam echosounders in a manner which enables work in very shallow water. The length is 12 m, beam 4.88 m and the max draft is 1.07 m.	✓		
Fugro Galaxy	The Galaxy is the newest geophysical survey vessel in Europe. It is equipped with permanently mobilised geophysical and hydrographic survey spreads. It has diesel-electric propulsion and a specially designed hull. The rudder propellers maximise station keeping and navigational control while the vessel is kept acoustically quiet during surveys. The equipment includes multibeam echo sounders, singlebeam echo sounders, sub-bottom profilers and side scan sonar. The length is 65.2 m, beam 14 m, deck area is 250 m^2 and the draught is 5.2 m.		✓	✓
Global Valkyrie	The Valkyrie is a purpose-built vessel for hydrographic and geophysical surveys. It is equipped for 12 h operations up to 60 NM from safe haven. It has two permanently mobilised multibeam echo-sounders and one sub-bottom profiler. It also has two removable side arms that can be mobilised with an Applied Acoustics USBL and sub-bottom profiler. The vessel has the ability to soft-tow magnetometers and side scan sonar. The length is 12 m, beam 4.88 m and the max draft is 1.07 m.	✓		

2.3 Survey techniques

A range of different survey techniques could be employed during the geophysical (and UXO) surveys. These different techniques are summarised in Table 2.2 below.

Table 2.2: Summary of geophysical (and UXO) survey techniques to take place in the Moray West Site and Offshore Export Cable Corridor				
System/ survey equipment	**Description**	**Landfall**	**Offshore Export Cable Corridor**	**Moray West Site**
Positioning Equipment				
Ultra-low baseline (USBL) positioning transponders	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 hull-mounted transducer to a subsea transponder, thereby introducing sound into the marine environment. A complete USBL system consists of a small transducer array, which is mounted under a ship, and a transponder attached to the subsea unit. An acoustic pulse is transmitted by the transducer, travels through the water and is detected by the shipboard transducer on an onboard computer calculates the time from the transmission of the initial acoustic pulse until the reply is detected and is measures by the USBL system. This is converted into a range and bearing, 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. This survey technique **does not** interact with the seabed. *This survey technique will also be employed for the preliminary UXO survey.*	✓	✓	✓
Geophysical Survey				
Side scan sonar (SSS)	Side-scan sonar is used to generate an accurate image of the seabed. An acoustic beam is used to obtain an accurate image of a narrow area of 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 on 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 (JNCC, 2010). The higher frequency systems provide higher resolution, but shorter-range measurements. This survey technique **does not** interact with the seabed. *This survey technique will also be employed for the preliminary UXO survey*	✓	✓	✓
Multibeam Echosounder (MBES)	Multi-beam echo-sounders are used to obtain detailed 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. This survey technique **does not** interact with the seabed. *This survey technique will also be employed for the preliminary UXO survey.*	✓	✓	✓

Table 2.2: Summary of geophysical (and UXO) survey techniques to take place in the Moray West Site and Offshore Export Cable Corridor

System/ survey equipment	Description	Landfall	Offshore Export Cable Corridor	Moray West Site
Single beam Echosounder (SBES)	In addition to the multibeam system, a dual frequency hydrographic single beam echo sounder shall be operated. Single-beam echo-sounders operate in a similar manner to MBES; rather than measuring multiple points per acoustic echo wave (echo) emitted, SBES can only measure one point at a time. SBES specifications are defined by beam angle and frequency of transmitted acoustic wave from the transducer as well as many other sonar parameters which may be selected in order to provide water depth capabilities from less than 1 m. This survey technique **does not** interact with the seabed.	✓	✓	✓
Sub-bottom profiler, including Sparker	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. Sub-bottom profilers comprise sparkers, which use an electrical discharge to generate sound similar to boomers, but their use is now infrequent. A high voltage impulse generates a spark across a pair of electrodes forming a gas bubble whose oscillations generate the sound. Sparkers are powerful devices and can be used to penetrate seabed layers up to 1 km (JNCC, 2017). In this case, this technique will be used to interpret the sub-surface sediment conditions to a minimum depth of 60 m. This survey technique **does not** interact with the seabed.	✓	✓	✓
Magnetometer	Magnetometer surveys are used to detect any ferrous metal objects on the seabed, such as wrecks, unexploded ordinance (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. This survey technique **does not** interact with the seabed. *This survey technique will also be employed for the preliminary UXO survey.*	✓	✓	✓
Jackup rig	A jackup rig is a self-elevating mobile platform unit. It includes a buoyant hull with moveable legs which can elevate the hull above the sea surface. The moveable legs have footings which may penetrate BSF or make use of suctions or mats. The footing types are largely dependent on the seabed sediments present but are anticipated to be between 3-5 m in diameter each. This survey technique **does** interact with the seabed.	✓		✓

2.4 Activity schedule

Geophysical surveys are required to inform on the bathymetric, geological, and sedimentary characteristics of the seabed within the site. The geophysical and UXO surveys are to take place between 1st March 2019 and 31st March 2020.

The UXO surveys are required to check for the presence of UXO in a number of locations (approximately 28) where boreholes are planned as part of the geotechnical survey campaign which is due to commence in April 2019. The UXO survey will therefore commence in the Moray West Site in March 2019 and is expected to take up to 3 weeks to complete The main equipment to be deployed during this survey will be the magnetometer. However, it is assumed that there may be a requirement to deploy the full suite of geophysical survey equipment in certain locations. The EPS Risk Assessment therefore assumes the full suite of geophysical equipment will be deployed during this three week period.

Further geophysical survey work will then be undertaken in the Moray West Site during Q2 to Q3 2019. This survey will take up to two weeks to complete. This is on the basis that it is focusing on collecting additional information to supplement the data collected in 2018, rather than a complete new survey.

The geophysical surveys along the Offshore Export Cable Corridor are also expected to be carried out in Q2 to Q3 2019. These surveys will take approximately six weeks to complete.

All survey activities are scheduled to be on a 24-hour working basis. Vessels are expected to be present throughout the survey period.

Survey activities will determined based on a number of factors including weather and port of mobilisation. In the event of delays (e.g. from poor weather conditions or equipment malfunctions), there may be a requirement to extend the period of time over which the surveys are completed, although the actual total number of survey days (survey duration) will not change and the nature of the survey activities will not change.

3 EPS Risk Assessment

3.1 Introduction

The primary function of the EPS risk assessment is to identify the potential for injury and disturbance generated by geophysical and UXO survey activities within the Moray West Site and along the Offshore Export Cable Corridor (geophysical survey only). The two sources of injury and disturbance are: underwater noise and collision.

Two EPS taxa (cetaceans and otters) inhabit the waters of the Moray Firth where the proposed marine surveys will take place. Of these, cetaceans are particularly susceptible to impacts from both underwater noise and collision. The proposed activities associated with the marine surveys are summarised in Section 3.4 below and consider all activities with the potential to emit underwater noise and / or cause injury to cetaceans and otters.

3.2 Cetaceans

Annex IV of the Habitats Directive lists all cetacean species as species of community interest in need of strict protection as EPS. Harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncatus*) are listed individually, while the remaining cetacean species are encapsulated in the Directive as "All other cetacea". These species are fully protected in Scottish territorial waters under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Bottlenose dolphin and harbour porpoise are also listed on Annex II of the Habitats Directive and thus require Special Area of Conservation (SAC) designation.

A total of 19 cetacean species have been recorded in UK waters (Reid *et al.*, 2003). There are twelve cetacean species known to be present in the Moray Firth, including: harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), white-beaked dolphin (*Lagenorhynchus albirostris*), killer whale (*Orcinus orca*), Risso's dolphin (*Grampus griseus*), fin whale (*Balaenoptera physalus*), sperm whale (*Physeter microcephalus*), humpback whale (*Megaptera novaengliae*), long-finned pilot whale (*Globicephala melas*), white-sided dolphin (*Lagenorhynchus acutus*), minke whales (*Balaenoptera acutorostrata*), short-beaked common dolphin (*Delphinus delphis*) (NMPI, 2018; Hammond *et al.*, 2018; Reid *et al.*, 2003). Of these, harbour porpoise, bottlenose dolphins, common dolphins, white-beaked dolphins, and minke whales regularly occur within the Moray Firth (Reid *et al.,* 2003; Robinson *et al.*, 2010; Hammond *et al.,* 2017). The following section provides a summary of the most common species in the marine survey area.

3.2.1 Cetacean species potentially present in the marine survey area

Harbour porpoise are the most abundant cetacean species in Scottish waters (Reid *et al.* 2003; Hammond *et al.* 2017). They are also the most frequently encountered species in both visual and acoustic surveys around the proposed Moray West Offshore Wind Farm Site and are pervasive throughout the Moray Firth throughout the year (Moray Offshore Renewables Ltd, 2018). They often appear in small groups of two to three individuals, though they may form larger groups to forage (SNH, 2014). The European population of harbour porpoise is listed in the IUCN Red List of Threatened Species as *Least Concern* and have a *Favourable Conservation Status* in UK waters (Hammond *et al.*, 2008; Pinn, 2010).

The Moray Firth also serves as important habitat to the last known resident population of bottlenose dolphins in the North Sea, the Coastal East Scotland Management Unit[2] population (Moray Offshore Renewables Ltd, 2018). Whilst occupation of the Moray Firth by this population varies between years, recent survey data has confirmed that approximately half of the estimated population occupy the area regularly (Graham *et al.*, 2016). The protection of bottlenose dolphins and their habitat motivated the designation of the Moray Firth SAC, with the aim of maintaining the *Favourable Conservation Status* of this species in UK waters (SNH, 2006; Moray West, 2018). The resident bottlenose dolphins of the Moray Firth SAC predominantly utilise the nearshore environment. Habitat modelling of survey data indicates that the southern coastline of the Firth is particularly important habitat to this population (Thompson *et al.*, 2014).

White-beaked dolphins frequent the eastern extent of the Moray Firth year-round, predominantly occupying depths of 50 – 100 m (Reid *et al.*, 2003). The density of white-beaked dolphin in the waters in and around the Moray Firth is 0.021 animals/km^2, which is low compared to regions in the east and north of Scotland (Hammond *et al.*, 2017). They are usually found in small groups of 10 or less but have also been observed in large groups of 50 and more.

Common dolphins are abundant along shelf breaks and in deeper waters on the west coast of the UK and Europe (Reid *et al.*, 2003). Recent data suggests an increasing occurrence of short-beaked common dolphins in the northern North Sea, including the Moray Firth (Robinson *et al.*, 2010; Moray Offshore Renewables Limited, 2018). Abundance estimates for this species occurring in the Moray Firth is approximately 0.074 individuals/km^2 (Robinson *et al.*, 2010), which is roughly equivalent to abundance estimates in the waters west of Shetland (Hammond *et al.*, 2017). Common dolphins are amongst the most gregarious cetacean species, often forming groups of 50 or more individuals, though groups of 200 or more are not uncommon (Robinson *et al.*, 2010).

Minke whales are wide-ranging baleen whales which are present in the Moray Firth primarily in the summer months (June – September) (Reid *et al.,* 2003; Hammond *et al.,* 2017). They prefer water depths of up to 200 m and are often solitary or found in pairs, though they occasionally form larger groups (up to 15 individuals) while feeding. Minke whale are also one of the protected features of the proposed Southern Trench Nature Conservation Marine Protected Area (pNCMPA), through which the Offshore Export Cable Corridor passes.

The general distribution and abundance of the cetacean species which regularly occur in the Moray Firth is described in Table 3.1 below.

Table 3.1: Distribution, density and abundance estimates for three regularly occurring cetacean species in the Moray Firth

Species & scientific name	General distribution	Density estimates (individuals/km2)	Estimated population abundance in the Moray Firth and greater North Sea	References
Harbour porpoise *Phocoena phocoena*	Individuals can be found in nearshore and offshore waters throughout the North	0.152	6,147; 227,298	IAMMWG (2015); Hammond (2017)

[2] Management Units (MUs) are agreed upon spatial scales at which the impacts of proposed activities on the UK's seven most common cetacean species are assessed by UK Statutory Nature Conservation Bodies (SNCBs)

Table 3.1: Distribution, density and abundance estimates for three regularly occurring cetacean species in the Moray Firth				
Species & scientific name	**General distribution**	**Density estimates (individuals/km2)**	**Estimated population abundance in the Moray Firth and greater North Sea**	**References**
	Sea			
Bottlenose dolphin *Tursiops truncatus*	Predominantly nearshore species	0.004	151; 195	Cheney *et al.* (2012); Hammond (2017)
Common dolphin *Delphinus delphis*	Predominantly offshore species	0.074	1,218; 56,556	Robinson *et al*. (2010); IAMMWG (2015)
White-beaked dolphin *Lagenorhynchus acutus*	Predominantly nearshore species	0.021	868;	Hammond (2017)
Minke whale *Balaenoptera acutorostrata*	Individuals can be found in nearshore and offshore waters throughout the North Sea. Protected feature of the Southern Trench NCMPA	0.010	383; 23,528	IAMMWG (2015); Hammond (2017)

3.3 Otters

Otters are small, semi-aquatic mammals which historically occupied riverine environments throughout the UK. In recent decades, habitat loss, hunting and toxic contamination have reduced their historic range to the northern extent of the UK. The majority of the British otter population can be found in Scotland, which is a recognised stronghold for the species within Europe. The greatest densities of otter occur in Shetland and the northern and western parts of the country, though otters have been confirmed in the Spey River approximately 20 km to the west of the nearshore export cable survey area (NMPI, 2018).

Otters utilise both freshwater and marine environment. Their marine habitat comprises low, peat-covered coastlines with a good freshwater supply and shallow, seaweed rich waters (DECC, 2016). Otters present in the nearshore may be disturbed by the presence of vessels but are not particularly sensitive to noise and tend to occur in the shallow waters of the very nearshore, thereby reducing collision risk. The survey activities will span a short period of time within the nearshore area. Whilst some level of temporary disturbance is possible in the very nearshore, mitigation approaches will be implemented to minimise potential disturbance to this EPS (see Chapter 4).

3.4 Noise sources and potential impacts

Table 3.2 below provides an overview of the main sources of noise associated with the proposed survey based on example equipment since specific equipment is typically not known until survey execution. Information about the duration of proposed survey activities is provided in Chapter 2.

Table 3.2: Overview of potential impacts of marine survey activities on EPSs in the Moray Firth			
Activity / Equipment	**Potential impacts**	**Predicted source levels and frequencies relevant to the marine environment**	**Further information required as part of the EPS Risk Assessment?**
Vessels			
Survey vessels	Propellers, engines, and propulsion activities form the primary noise sources of survey vessels. Vessel noise is generally continuous and comes in both narrowband and broadband emissions. Potential impacts on cetaceans depend on the duration of the survey activities, location of the surveys routes and species of cetacean potentially present in the area. Increased vessel activity additionally has the potential to cause injury from collisions. The risk of collision with an EPS is influenced by the dimensions of the vessel and its speed.	Vessels emissions typically range from 160 – 175 dB re 1µPa (rms). Acoustic energy vessel noise emissions are strongest at frequencies <1 kHz	Yes – although source levels are likely to be too low to result in injury, they will be audible to most species, and thus have the potential to result in disturbance (see Section 3.5.2). Vessels will be moving at less than 4 knots in a defined pattern, limiting the potential for collision to occur. However, mitigation strategies will be in place to further reduce potential collision risk (see Sections 4.4 and 4.5)
Positioning Equipment			
Ultra-low baseline (USBL) positioning transponders	USBL systems are used to determine the position of subsea items. This involves the emission of 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.	USBL source levels range from 190 – 235 dB re 1µPa (rms), with a frequency range of 18 – 36 kHz	Yes – source levels have a minimum peak pressure level which has been identified as having the potential to cause injury to harbour porpoise (200 dB re 1µPa) and a maximum peak pressure level which has been identified as having the potential to cause injury to bottlenose dolphins (230 dB re 1µPa) (see Table 3.4)
Geophysical Survey			
Side scan sonar (SSS)	Side-scan sonar equipment produces sound emissions through high frequency pulses used to image the seabed habitat. Potential impacts to cetaceans depend upon the frequency, location, and duration of the pulses.	SSS source levels range from 200 – 230 dB re 1µPa (rms). The SSS specifications report frequencies between 100 -500 kHz.	Yes – source levels have a minimum peak pressure level which has been identified as having the potential to cause injury to harbour porpoise (200 dB re 1µPa) and a maximum peak pressure level which has been identified as having the potential to cause injury to bottlenose dolphins (230 dB re 1µPa) (see Table 3.4)
Multibeam echosounder	High frequency pulses created by multi-beam echo sounder equipment generate	MBES source levels range from	Yes – source levels have a minimum peak pressure

Table 3.2: Overview of potential impacts of marine survey activities on EPSs in the Moray Firth			
Activity / Equipment	**Potential impacts**	**Predicted source levels and frequencies relevant to the marine environment**	**Further information required as part of the EPS Risk Assessment?**
(MBES)	sound waves which produce underwater noise. Depending on the frequency of the pulses, location and duration of the operations, and the species present, there could be potential impacts on cetaceans.	190 – 240 dB re 1µPa (rms), The equipment specifications describe the MBES to emit noise at a frequency of 240 kHz. For the UXO survey, a MBES will be employed with an operating frequency of 400 kHz (minimum) and a sampling rate of 30 Hz or more.	level which has been identified as having the potential to cause injury to harbour porpoise (200 dB re 1µPa) and a maximum peak pressure level which has been identified as having the potential to cause injury to bottlenose dolphins (230 dB re 1µPa) (see Table 3.4)
Single beam echosounder (SBES)	Single-beam echo-sounders operate in a similar manner to MBES; rather than measuring multiple points per acoustic echo wave (echo) emitted, SBES can only measure one point at a time. The preferred equipment is a Knudsen 320M dual.	SBES source levels typically range between 190 – 240 dB re 1µPa (rms) The Knudsen 320M emits noise within the frequency range 3.5 – 250 kHz.	Yes – source levels have a minimum peak pressure level which has been identified as having the potential to cause injury to harbour porpoise (200 dB re 1µPa) and a maximum peak pressure level which has been identified as having the potential to cause injury to bottlenose dolphins (230 dB re 1µPa) (see Table 3.4)
Sub-bottom profiling	Sub-bottom profiling involves the vertical emission of sound pulses 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. 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	Sparker source levels range from 140 – 170 dB re 1µPa (rms). The GeoResources GeoSpark Sparker 200 emits noise at frequencies between 250 Hz and 5 kHz. Sub bottom profilers typically emit noise within	Yes – although source levels are likely to be too low to result in injury, they will be audible to most species, and thus have the potential to result in disturbance (see Section 3.5.2).

Table 3.2: Overview of potential impacts of marine survey activities on EPSs in the Moray Firth			
Activity / Equipment	**Potential impacts**	**Predicted source levels and frequencies relevant to the marine environment**	**Further information required as part of the EPS Risk Assessment?**
	generate the sound. This technique will be used to interpret the sub-surface sediment conditions to a minimum depth of 60 m. The preferred equipment is the GeoResources GeoSpark Sparker 200. A shallow sub-bottom profiler will also be deployed. The equipment will be either a CHIRP or a pinger.	the frequency range 1 – 24 kHz.	
Magnetometer	A magnetometer will be employed to detect magnetic anomalies in the seabed.	Not applicable	No – magnetometers do not emit noise as a part of their normal functioning, so there is no possibility of injury or disturbance from noise emissions.
Remotely Operated Vehicle (ROV)	An ROV is a tethered underwater mobile device. ROVs are commonly used for visual surveys of the seafloor. For underwater positioning, a USBL system is typically used. The ROV is maneuverable by the use propellers.	Not applicable	No - the main noise source during ROV use is the USBL system which is employed for positioning purposes. ROV equipment is not considered further with respect to potential injury or disturbance to EPS.
Side scan sonar (SSS)	Side-scan sonar equipment produces sound emissions through high frequency pulses used to image the seabed habitat. Potential impacts to cetaceans depend upon the frequency, location, and duration of the pulses.	SSS source levels range from 200 – 230 dB re 1µPa (rms). The SSS specifications report frequencies between 100 -500 kHz.	Yes – source levels have a minimum peak pressure level which has been identified as having the potential to cause injury to harbour porpoise (200 dB re 1µPa) and a maximum peak pressure level which has been identified as having the potential to cause injury to bottlenose dolphins (230 dB re 1µPa) (see Table 3.4)
Multibeam echosounder (MBES)	High frequency pulses created by multi-beam echo sounder equipment generate sound waves which produce underwater noise. Depending on the frequency of the pulses, location and duration of the operations, and the species present, there could be potential impacts on cetaceans.	MBES source levels range from 190 – 240 dB re 1µPa (rms), The equipment specifications describe the MBES to emit noise at a frequency of 240 kHz.	Yes – source levels have a minimum peak pressure level which has been identified as having the potential to cause injury to harbour porpoise (200 dB re 1µPa) and a maximum peak pressure level which has been identified as having the potential to cause injury to bottlenose dolphins (230

Table 3.2: Overview of potential impacts of marine survey activities on EPSs in the Moray Firth			
Activity / Equipment	**Potential impacts**	**Predicted source levels and frequencies relevant to the marine environment**	**Further information required as part of the EPS Risk Assessment?**
		For the UXO survey, a MBES will be employed with an operating frequency of 400 kHz (minimum) and a sampling rate of 30 Hz or more.	dB re 1µPa) (see Table 3.4)

3.5 Noise impact assessment process

3.5.1 Overview

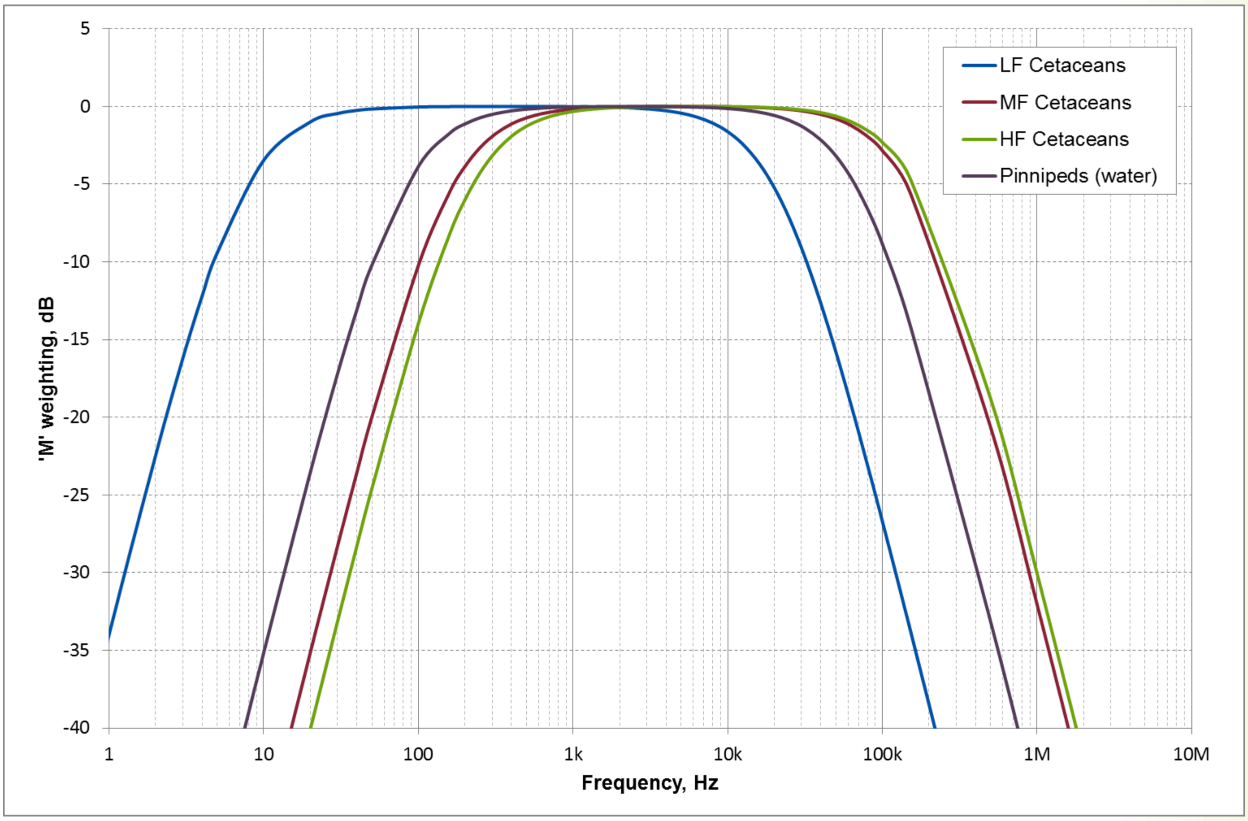
Noise has the potential to impact cetaceans in two ways:

- 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.

To determine the potential for noise to impact cetaceans, perceived sound levels are compared to available estimated thresholds for injury or disturbance.

A number of threshold criteria and methods for determining how sound levels are perceived by marine mammals are available (e.g. the dBht method and other hearing weighted and linear measures) and each has its own advantages and disadvantages. JNCC guidance (JNCC, 2010) recommends using the injury criteria proposed by Southall *et al.* (2007) which are based on a combination of linear (i.e. un-weighted) peak pressure levels and mammal hearing weighted (M-weighted) sound exposure levels (SEL). The M-weighting function is designed to represent the frequency bandwidth of hearing sensitivity for marine mammal groups (see Figure 3.1 below).

Figure 3.1: M-weighting functions for pinnipeds and cetaceans in water (LF = low-frequency, MF = mid-frequency, HF = high-frequency (Southall *et al.* 2007)



If a sound emission is composed of frequencies which lie outside the estimated auditory bandwidth for a given species, then disturbance to that individual is unlikely. However, noise sources which are sufficiently high can still cause physical damage, including damage to hearing, even when the frequencies lie outside an animal's 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.*, 2007; Scottish Government, 2013; NMFS, 2018)

Hearing group	Estimated auditory bandwidth
Low-frequency cetaceans (deep diving species – e.g. minke whale, pilot whale, etc.)	7 Hz to 35 kHz, with peak sensitivity around 100 – 200 Hz
Mid-frequency cetaceans (small dolphins – e.g. bottlenose dolphin, common dolphin, white-beaked dolphin, etc.)	150 Hz to 160 kHz, with peak sensitivity above 10 kHz; Except for killer whales: 50 Hz to 100 kHz
High-frequency cetaceans (only harbour porpoise are within UK waters)	200 Hz to 180 kHz, with peak sensitivity above 4 kHz

3.5.2 Acoustic assessment criteria

3.5.2.1 Injury

Injury criteria are proposed in Southall *et al.* (2007) for three different types of sound:

- **Multiple pulsed sound**—sound comprising two or more discreet acoustic events in a 24 hour period (e.g. from a multi-beam echo sounder, side scan sonar, or sub-bottom profiler);

- **Single pulse sound**—sound comprising a single discreet acoustic event in a 24 hour period (e.g. an underwater explosion); and

- **Continuous sound**—non-pulsed sound (e.g. vessel engines).

For multiple pulsed sounds, Southall *et al.* (2007) suggested injury criteria of 230 dB re 1 µPa (peak pressure level) and an M-weighted Sound Exposure Level (SEL) of 198 dB re 1 µPa^{2}s for all cetaceans except harbour porpoise (see below). The SEL is the cumulative energy for all sound pulses a 24-hour period (normalised to a single second interval). These injury criteria values are derived from measurements of Temporary Threshold Shift (TTS) onset in different cetacean species, with a buffer of +6 dB for peak sound and +15 dB for SEL added to estimate the potential onset of Permanent Threshold Shift (PTS). Southall *et al.* (2007) states that these thresholds are appropriate for applying a precautionary approach to marine noise as they enable a worst-case assessment.

Lucke *et al.* (2008) reported a lower threshold for the onset of TTS in harbour porpoise than was reported by Southall *et al.* (2007) (200 dB re 1 µPa peak-peak, equivalent to 194 dB re 1 µPa peak and a sound exposure level of 164.3 dB re 1 µPa2s, un-weighted). This work has been supported by additional recent studies (e.g. Kastelein *et al.* 2014; Kastelein *et al.* 2012). JNCC (2010) guidance on injury and disturbance to marine EPSs suggests that these lower thresholds for TTS may provide an estimate of PTS for this species by applying the PTS onset calculation from Southall *et al.* (2007). This re-calculation results in a peak level injury criterion of 200 dB re 1 µPa (i.e. by adding +6 dB to the peak level for TTS) and a SEL injury criterion of 179.3 dB re 1 µPa2s (i.e. by adding +15 dB to the SEL level for TTS). However, the resulting SEL value is un-weighted, thus it is necessary to apply a correction factor to make them comparable to the HF M-weighted SELs. Lucke *et al.* (2008) suggested applying a correction factor of -2.5 dB to the resulting un-weighted SEL to generate a PTS value similar to that which would be calculated by the HF M-weighted SELs. Accordingly, an M-weighted SEL criterion of 177 dB re 1 µPa2s has been adopted to estimate the potential injury ranges for harbour porpoise.

The injury criteria used in this assessment are summarised in Table 3.4 below. For disturbance, a qualitative approach has been taken, based on consideration of source level, mitigation measures, length of operations and other factors likely to influence interaction between the survey and cetaceans and otters.

Table 3.4 Criteria considered in this assessment for onset of injury					
Hearing Group	**Type of sound**	**Injury criteria**			
		Peak pressure dB re 1 µPa		**SEL dB re 1 µPa2s (M-weighted)**	
Reference		**Southall (2007); Lucke (2008)**	**NMFS (2018)**	**Southall (2007); Lucke (2008)**	**NMFS (2018)**
Low-frequency cetaceans (deep diving species – e.g. minke whale, pilot whale, etc.)	Single or multiple pulses	230	219	198	183
	Non-pulses (e.g. continuous sound)	230	199	215	199
Mid-frequency cetaceans (small dolphins – e.g. bottlenose dolphin, common dolphin, white-beaked dolphin, etc.)	Single or multiple pulses	230	230	198	185
	Non-pulses (e.g. continuous sound)	230	198	215	198
High-frequency cetaceans (only harbour porpoise are within UK waters)	Single or multiple pulses	200	202	177	155
	Non-pulses (e.g. continuous sound)	230	173	215	173

3.5.2.2 Disturbance to groups of animals both within and beyond of 12 nautical miles

The Marine Scotland (2014) guidance specifies disturbance as occurring if the activity is likely "to significantly affect the local distribution or abundance of the species to which it belongs." The relevant European Commission guidance (2007) suggests that a disturbance must significantly impact the local distribution or abundance of a species, including temporary impacts. The JNCC (2010) guidance proposes that "any action that is likely to increase the risk of long-term decline of the population(s) of (a) species could be regarded as disturbance under the Regulations."

To consider the possibility of a disturbance offence resulting from the proposed survey techniques, it is necessary to consider the likelihood that exposure of the animal(s) elicits a response which is likely to generate a significant population-level effect. Assessment of population-level impacts from a temporary disturbance is made complicated by the highly variable nature of the introduced disturbance (e.g. the complex nature of sound and its propagation in the marine environment), the variability of behavioural response in different species and individuals, and the availability of population estimates for EPSs in the eastern North Sea.

The preeminent method for assessing a potential disturbance is to compare the circumstances of the situation with empirical studies (Southall *et al.*, 2007). As such, noise propagation modelling has not been undertaken for this assessment. The JNCC (2010) guidance indicates that a score of 5 or more on the Southall *et al.* (2007) behavioural response severity scale could be significant (Table 3.5). The more severe the response on the scale, the less time animals will likely tolerate the disturbance before there could be significant negative effects which could constitute a disturbance under the relevant Regulations. The assessment of disturbance by the proposed survey methods considers the potential of the behaviours described by Southall *et al.* (2007) occurring within the limited duration of the survey activities.

Subsequently, the potential for those behaviours to result in a population-level effect (i.e. to commit an offence under Regulation 39(1)) is discussed.

3.5.2.3 Disturbing any individual within 12 nautical miles (i.e. Regulation 39(2))

This Regulation (for which a comparable offence is not found in offshore waters or in English or Welsh inshore waters) goes beyond the specific disturbance circumstances set out in Regulation 39(1). It provides protection to individuals of a species by making it an offence to deliberately or recklessly disturb a single cetacean in Scottish Territorial Waters (i.e. where some of the proposed activities will take place). Where there is a possibility of disturbing an individual animal within 12 nautical miles, it is necessary to apply for a Marine EPS Licence to ensure that an offence is not committed. However, in issuing a Marine EPS Licence, Marine Scotland must consider whether or not the *Favourable Conservation Status* of any species will be affected.

Table 3.5: Behavioural disturbance scale (Southall *et al.*, 2007)

Response score	Corresponding behaviours in free-ranging subjects
0	No observable response.
1	Brief orientation response (investigation / visual orientation).
2	Moderate or multiple orientation behaviours; Brief or minor cessation/modification of vocal behaviour; and Brief or minor change in respiration rates.
3	Prolonged orientation behaviour; Individual alert behaviour; Minor changes in locomotion speed, direction, and/or dive profile but no avoidance of sound source; Moderate change in respiration rate; Minor cessation or modification of vocal behaviour (duration < Duration of source operation).
4	Moderate changes in locomotion speed, direction, and/or dive profile but no avoidance of sound source; Brief, minor shift in group distribution; Moderate cessation or modification of vocal behaviour (duration more or less equal to the duration of source operation).
5	Extensive or prolonged changes in locomotion speed, direction, and/or dive profile but no avoidance of sound source; Moderate shift in group distribution; Change in inter-animal distance and/or group size (aggregation or separation); and Prolonged cessation or modification of vocal behaviour (duration > duration of source operation).
6	Minor or moderate individual and/or group avoidance of sound source; Brief or minor separation of females and dependent offspring; Aggressive behaviour related to sound exposure (e.g. Tail/flipper slapping, fluke display, jaw clapping/gnashing teeth, abrupt directed movement, bubble clouds); Extended cessation or modification of vocal behaviour; Visible startle response; and Brief cessation of reproductive behaviour.
7	Extensive or prolonged aggressive behaviour; Moderate separation of females and dependent offspring; Clear anti-predator response; and Severe and/or sustained avoidance of sound source.

Table 3.5: Behavioural disturbance scale (Southall *et al.*, 2007)	
Response score	**Corresponding behaviours in free-ranging subjects**
	Moderate cessation of reproductive behaviour.
8	Obvious aversion and/or progressive sensitisation; Prolonged or significant separation of females and dependent offspring with disruption of acoustic reunion mechanisms; Long-term avoidance of area (> source operation); and Prolonged cessation of reproductive behaviour.
9	Outright panic, flight, stampede, attack of conspecifics, or stranding events; and Avoidance behaviour related to predator detection.

3.6 Assessment of potential impacts of survey methods

The following sections present the results of the impact assessment of underwater noise from the proposed geophysical and UXO survey activities with respect to both injury impacts and disturbance.

3.6.1 Vessels

During the proposed operations, the use of vessels will result in sound emissions being introduced into the marine environment. Moreover, they introduce the potential for collisions to occur with protected species. The potential impacts of sounds emissions and the potential risk of collision is discussed below.

3.6.1.1 Injury impact

Experience from modelling studies conducted to support EPS applications suggests that injury to cetaceans from vessel noise (where peak emissions are between 160 – 175 dB re 1µPa (Richardson *et al.* 1995)) occurs at a range of '0 m', based on an animal swimming at a constant speed of 1.5 ms^{-1} from the noise source. Consequently, it is not possible for an animal to be exposed to sufficiently high noise levels to cause injury without being within the boat engine. The vessels proposed for the survey works will be at the smaller end of the scale typical of offshore surveys, so noise emissions will be reduced. It should also be noted that movement speeds for marine mammals have been recorded well in excess of the 1.5 ms^{-1} modelled, and can be doubled if the animal is being evasive (Au and Perryman, 1981). As such, there is likely to be no significant risk of injury to marine mammals from noise emissions from vessels.

Movements of vessels may pose the risk of injury from direct contact with animals nearby. Marine EPSs which may be at risk are cetaceans and otters. Survey vessels will be moving along defined survey routes at a very slow speed of 4 knots. As described above, cetaceans are capable of moving very quickly when taking evasive action (between 5.1 – 8.8 knots has been recorded for certain dolphin species) (Au and Perryman, 1981). Otters are primarily riverine, but may intermittently enter the marine environment to forage, though this is typically very temporary.

Given the limited spatial and temporal overlap between vessel movements and EPSs in the survey area, there is predicted to be no risk of injury to any species and thus no potential to commit an offence with regards injury. There will therefore be no impact on the *Favourable Conservation Status* of any EPS species. As such, there is no offence and thus no requirement for a Marine EPS licence in this respect.

Collision risk has been considered in the EPS Protection Strategy through the management of vessel speed and education of survey crew on the Scottish Marine Wildlife Watching Code and Guide to Best Practice for Watching Marine Wildlife (Chapter 4). These measures, coupled with the deployment of a trained MMO to monitor for the presence of cetaceans, work to further reduce the risk of injury to animals.

3.6.1.2 Disturbance impact

While the predicted source levels associated with the survey vessels have the potential to elicit a behavioural response in concurrent cetacean species, the vessel noise would need to be emitted over a period of months to cause a disturbance offence as defined under the Regulations 39(1) or 39(2). As the survey vessels will not be stationary, animals within a particular area will not be exposed to extended periods of noise from the vessels. They would have to follow the vessels to be subjected to lasting or prolonged periods of noise, which would preclude their being disturbed.

Given the temporary and transient nature of the surveys, it is highly unlikely that vessel noise emissions would influence the ability of an animal to survive or reproduce or result in significant impacts to the population abundance or distribution. As such, vessel noise is not anticipated to negatively impact upon the *Favourable Conservation Status* of any EPSs.

While negative impacts on the survival, reproduction or population abundance or distribution are not expected to result from noise emissions from the survey vessels, it is possible that individual animals may experience some level of disturbance for the short period they may encounter noise emissions from a vessel. As such, a Marine EPS Licence is required for these activities within 12 nautical miles (as per Regulation 39(2)).

3.6.2 Side scan sonar (SSS), Singlebeam (SBES) and Multibeam Echosounders (MBES)

Singlebeam and multibeam echo sounders and side scan sonar will be required during the proposed surveys. The potential impacts of continuous sound from SSS, SBES or MBES on cetaceans that are potentially present along the survey routes are discussed below.

3.6.2.1 Injury impact

The JNCC guidelines (2010) confirm the potential for echosounders operating in mid-range and full ocean depth to cause injury when very close to cetaceans of the mid-frequency hearing group. In the shallower depths where the proposed surveys will take place, sound emitted by SBES and MBES may be audible to some cetaceans, particularly high frequency species such as harbour porpoise. However, higher frequency sounds attenuate faster such that the received sound level rapidly decreases with distance from the source. As such, the animals would have to remain in close proximity to the sound source for potential physical injury to occur. The likelihood of this occurring is low, particularly as the source will be emitted from a moving vessel, thus the subsequent risk to cetaceans in the survey area is very low (DECC, 2011; JNCC 2010).

SSS, SBES, and MBES also operate at high frequencies. For the proposed surveys, the expected frequency range for such operations is likely to be between 300 kHz and 600 kHz. These frequencies are generally beyond the hearing range of most cetaceans, including high-frequency sensitive species such as harbour porpoise (Table 3.3). Given the increased attenuation associated with these high frequencies, it can be concluded that use these survey technologies present a negligible risk of injury to cetaceans (JNCC, 2010; DECC, 2011). Consequently, the potential to commit an offence is negligible and thus there is no requirement for a Marine EPS licence in this respect.

The available noise emission mitigation measures for multi-beam surveys are not specifically designed for geophysical surveys in less than 200 m water depth (JNCC, 2017). However, their implementation in shallower waters bolsters mitigation against injury to cetaceans around the survey area. Consequently, the mitigation measures outlined in the JNCC guidelines (2017) have been incorporated into the EPS Protection Strategy (Chapter 4). These measures include deployment of a MMO to monitor for the presence of cetaceans within a 500 m mitigation zone prior to commencement of, and during, the surveys.

3.6.2.2 Disturbance impact

In addition to physical injury, noise emissions have the potential to modify the behaviours of animals in the vicinity of the noise source. As outlined in Section 3.5, significant disturbance may occur when an animal is at risk of a sustained or chronic disruption of behaviour or habitat use resulting in population-level effects. SSS, SBES and MBES largely operate beyond the most sensitive frequencies of most cetaceans (Table 3.3) (JNCC, 2010); thus, the potential for a disturbance having negative repercussions on the *Favourable Conservation Status* of a species is extremely low.

The geophysical survey programme will extend over an initial period of three weeks (for the UXO within the Moray West Site) followed by an eight week geophysical survey campaign (two weeks in the Moray West Site and six weeks along the Offshore Export Cable Corridor), with SSS, SBES and MBES surveys taking place intermittently throughout the survey areas. For a disturbance to occur during the intermittent geophysical surveys, the animals would have to stay in close proximity to, and potentially follow, the vessels using SSS, SBES and MBES while they were actively emitting noise.

Given the temporary and short-term nature of the survey activities, it is highly unlikely that SSS, SBES and MBES would negatively impact upon the *Favourable Conservation Status* of any of the cetacean species which may be present in the survey area. This is on the basis that the level of disturbance caused is unlikely to affect the ability of an animal to survive or reproduce or result in a significant population-level impact (e.g. by modifying the abundance or distribution of a localised population). However, it is possible that a small number of individual animals may experience some disturbance for a short period that they encounter noise emissions. As such, a Marine EPS Licence is required for the proposed survey activities within 12 nautical miles (as per Regulation 39(2)).

As with the injury impacts discussed above, implementation of mitigation measures outlined in the JNCC guidelines (2017) (as incorporated into the EPS Protection Strategy (Chapter 4)) will help to minimise potential disturbance impacts. In particular measures to minimise potential effects on bottlenose dolphin and minke whale in nearshore areas (associated with the Moray Firth SAC and Southern Trench pNCMPA respectively).

3.6.3 Ultra-low baseline (USBL) positioning transponders

USBL systems will be required for the execution of the majority of survey activities. The length of time the USBL system will be required will depend on the specific survey activities, but there is potential that a USBL could be used continuously throughout a survey. The potential impacts of continuous sound from USBL systems on cetaceans that may be present in the survey area are outlined below.

3.6.3.1 Injury impact

The USBL system is used for determining the position of subsea equipment during the survey. The system operates by emitting a low frequency acoustic pulse between the transponder on the vessel and the transducer on the subsea unit. Since low frequency emissions propagate further than high frequency sounds, cetaceans may be exposed to these noise emissions over a greater spatial area than they would higher frequency sounds (such as those from MBES or SSS). However, the cetacean species most likely to be in the survey area are less sensitive to low frequency sounds, so the potential for an injury occurring should be lower.

Continuous sound emissions from the USBL system throughout the initial three week UXO survey and the following eight week geophysical survey period would present a worst-case scenario that would increase the risk of injury to nearby animals. Fortunately, the USBL system is likely to be employed intermittently, with time in-between noise emissions, offering animals to move away from the source and avoid exposure. Considering that the surveys themselves will be transient (i.e. the vessel will be moving while the USBL is employed), the cumulative exposure level for the USBL system (as measured by the M-weighted SEL) will be lower to animals, as they are highly unlikely to follow the noise source. As such, this eliminates the potential to commit an offence with regards injury or to affect the *Favourable Conservation Status* of any the cetacean species; thus, there is no offence and a Marine EPS licence will not be required.

The available noise emission mitigation measures are not specifically designed for geophysical surveys in 200 m (JNCC, 2017). However, their implementation in shallower waters bolsters mitigation against injury to cetaceans around the survey area. Consequently, the mitigation measures outlined in the JNCC guidelines (2017) have been incorporated into the EPS Protection Strategy (Chapter 4). These measures include deployment of a MMO to monitor for the presence of cetaceans within a 500 m mitigation zone prior to commencement of, and during, the surveys.

3.6.3.2 Disturbance impact

The low noise frequency sound emissions generated by the USBL system are within the hearing range of the cetaceans anticipated to be within the project area. For this reason, there is potential for USBL survey activities to potentially illicit a disturbance response in animals that are present during the surveys (JNCC, 2010).

The survey period is anticipated to span over three weeks initially (UXO in the Moray West Site) followed by a further eight weeks (two weeks in the Moray West Site and six weeks along the Offshore Export Cable Corridor), but the survey vessel will be traversing the survey routes during that time, so noise emissions will be localised and temporary. For a disturbance impact to occur, the animals would have to stay in close proximity to, and potentially follow the USBL, for the duration of the survey.

Even if the short-term operations result in a response by an animal on its own, this would not be likely to impair the ability of an animal to survive or reproduce or result in any significant impacts to the local populations or distribution. As such, there would be no impact on the *Favourable Conservation Status* of any cetacean species at a population level. However, it is possible that a small number of individual animals may experience some disturbance for the short period they may encounter noise emissions. As such, a Marine EPS Licence is required for activities within 12 nautical miles (as per Regulation 39(2)). Potential disturbance impacts will be minimised with the implementation of mitigation measures set out in Chapter 4. In particular measures to minimise potential effects on bottlenose dolphin and minke whale in nearshore areas (associated with the Moray Firth SAC and Southern Trench pNCMPA respectively).

3.6.4 Sub-bottom profiling

Sub-bottom profilers will be required intermittently throughout the survey. The potential impacts of sound emissions from sub-bottom profilers on the relevant cetacean species are outlined below.

3.6.4.1 Injury impact

Sparkers used for sub-bottom surveys operate by emitting a low frequency sound to maximise seabed penetration. Cetaceans may be exposed to the low frequency sounds over a greater spatial area than they would higher frequency sounds (such as those from SSS, SBES and MBES). Experience of such modelling studies suggests for a typical sub-bottom profiler system[3], based on an animal swimming at a constant speed of 1.5 ms^{-1} from the noise source, showed that injury may occur at a range of 20 m for most cetaceans and up to 400 m for harbour porpoise. However, these results are contingent on the animal swimming within the direct and very narrow 'beam' from the transducer.

As the majority of the species likely to be found near the survey route are less sensitive to low frequency sounds, the potential for impact can be considered low. Furthermore, the majority of the acoustic energy will be directed downward toward the seabed, as opposed to being emitted horizontally. This further reduces the potential for sound emissions to injure animals nearby.

As with the SSS, SBES and MBES survey activities, the implementation of the mitigation measures outlined in Chapter 4 dramatically reduce the risk of injury to animals as a result of sub-bottom profiling operations. These measures include deployment of a MMO to monitor for the presence of cetaceans within a 500 m mitigation zone prior to commencement of, and during, the surveys. Accordingly, the noise-emission characteristics of the sub-bottom profiler coupled with the EPS Protection Strategy, mitigation strategies preclude the potential to commit an offence with regards to injury or to affect the *Favourable Conservation Status* of any cetacean species and thus there is no requirement for a Marine EPS licence.

3.6.4.2 Disturbance impact

Although the programme of geophysical surveys will initially take place over three weeks (UXO survey within the Moray West Site) with further geophysical survey work in the Moray West Site and along the Offshore Export Cable Corridor extending over a period of approximately up to eight weeks, use of sub-bottom profilers will be intermittent therein. There will be periods of inactivity during weather downtime. For a disturbance impact to result from sub-bottom profiling methods, animals would have to stay in close proximity to, and potentially follow, the vessels operating the sub bottom profilers. Even if the short-term geophysical survey operations result in a behavioural response, it is not likely that such a response would impair the ability of the animal to survive or reproduce or generate significant population-level impacts. As such, there would be no impact on the *Favourable Conservation Status* of any cetacean species. However, it is possible that a small number of individual animals may experience some level of disturbance while they encounter noise emissions. As such, a Marine EPS Licence is required for activities within 12 nautical miles (as per Regulation 39(2)). Potential disturbance impacts will be minimised with the implementation of mitigation measures set out in Chapter 4. In particular measures to minimise potential effects on bottlenose dolphin and minke whale in nearshore areas (associated with the Moray Firth SAC and Southern Trench pNCMPA respectively).

[3] The specific equipment modelled was the Knudsen "Chirp 3260".

4 EPS Protection Strategy (EPS PS)

4.1 Overview

A European Protected Species Protection Strategy (EPS PS) has been prepared to reduce injury and disturbance to EPSs, including cetaceans and otters, from the proposed marine survey activities. The EPS PS contains mitigation strategies which incorporate both visual and acoustic monitoring programmes of EPSs located within the vicinity of the project. The mitigations strategies of the EPS PS are outlined in the sections below and are based on mitigation measures presented in the JNCC guidelines for minimising the risk to marine mammals from geophysical surveys (JNCC, 2017) where appropriate.

4.2 Cetaceans

The key components of the EPS PS in relation to cetaceans include:

- Deployment of a Marine Mammal Observer (MMO) to monitor for the presence of cetaceans prior to the commencement of, and during, marine geophysical operations;
- For activities that take place in hours of darkness and/or in periods of poor visibility and/or during periods when the sea state is greater than Code 3, deployment of a Passive Acoustic Monitoring (PAM) system prior to soft starts to detect for the presence of cetaceans that cannot be detected by the MMO;
- Pre-soft start search;
- 500 m mitigation zone for cetaceans;
- Nearshore transect orientation;
- Deployment of soft-start techniques; and
- Reporting.

4.2.1 Marine Mammal Monitoring

There will be MMO coverage for the duration of the marine geophysical activities, with adequately trained and experienced MMO(s) working standard 12-hour shifts. They will have experience of working in nearshore areas and, for offshore surveys will also be JNCC trained. All MMOs will have also successfully deployed and used PAM equipment previously.

4.2.1.1 Marine Mammal Observer (MMO)

During daylight hours the MMO(s) will carry out visual observations to monitor for the presence of cetaceans before the soft-start commences and will recommend delays in the commencement of the geophysical operations should any species be detected within the 500 m mitigation zone (see below).

4.2.1.2 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 prior to soft starts.

4.2.2 Nearshore transects

For surveys in the nearshore waters (defined as the area from the landfall [5 m water depth contour] out to 20 m water depth contour), all survey transects (perpendicular to the coast and parallel to the coast) will start at the coast and move seaward to reduce the likelihood that marine mammals are trapped near the shore.

4.2.3 Pre-soft-start Search

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

4.2.4 Mitigation Zone

Should any cetaceans be detected within 500 m of the survey vessel, commencement of marine geophysical operations will be delayed until their passage, or the transit of the vessel, results in the cetaceans being more than 500 m away from the vessel. In both cases, there will be a 20-minute delay from the time of the last sighting within 500 m of the source to the commencement/recommencement of the operations. *Note: once started, geophysical operations will not cease should cetaceans approach the survey vessel.*

4.2.5 Soft Start

The geophysical source will, where feasible, not be operated at full power straight away, but the power will be built up slowly over at least 20 minutes to give any cetaceans adequate time to leave the area. Build-up of power will occur in uniform stages to provide a constant 'ramp-up' in amplitude. The soft start procedures will be undertaken if the source is stopped for longer than 10 minutes, to avoid injury to any cetaceans which have entered the area during this 'downtime'. MMO or PAM observations will only take place prior to any soft start. Once operations have commenced there will be no further observations until another soft start is required.

4.2.6 Reporting

All recordings of cetaceans will be made using JNCC Standard Forms. At the end of the operations, a monitoring report detailing the cetaceans recorded, methods used to detect them, and details of any problems encountered will be submitted to Marine Scotland and SNH. 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. If the MMOs have any queries on the application of the guidelines during the works they will contact Marine Scotland and SNH for advice.

4.3 Otters

In the nearshore, the MMO will also monitor for the presence of otters in the water and delay the start of the marine geophysical activities if any are seen in the water within 100 m of the vessel or rig.

4.4 Survey Vessel Speed and Course

The project survey vessels will be moving at a maximum speed of approximately 4 knots during surveys to allow cetaceans or otters to move away from the vessel should they be disturbed by the vessel presence or noise emissions. During transit times, when survey vessels are moving between sites, the survey vessels will be travelling at speeds greater than 4 knots. However, these movements are not considered to deviate from normal vessel traffic in the project area. Should an EPS be found to be in the direct path of a survey vessel, during or outside of survey times, the survey vessel will slow down or, if possible, alter course to avoid collision.

4.5 Tool Box Talks

Survey crew will be made aware of all EPSs they might encounter and good practice measures for boat control near wildlife through the Scottish Marine Wildlife Watching Code and Guide to Best Practice for Watching Marine Wildlife.

5 Conclusions

While the geophysical and UXO surveys associated with the Moray West Site and Offshore Export Cable Corridor presents a temporary disturbance to a localised marine environment, this work is an important addition to Scotland's growing contributions to the UK's renewable energy sector. It will provide additional support to the UK government's national and international commitments to reduce greenhouse gasses.

The assessment above demonstrates that, with the implementation of the mitigation measures detailed in Chapter 4, there will be no injury resulting from the proposed activities and thus no offence related to injury of any cetacean species under either the inshore or offshore regulations. In this context, a Marine EPS Licence would not be required. However, it is possible that a small number of animals may experience some level of disturbance for the short period they may encounter noise emissions from the geophysical survey operations. Therefore, a Marine EPS Licence is thus required for activities where there is potential for disturbance to cetaceans as per Regulation 39(2). While this relates wholly to waters within 12 nm, Moray West acknowledges the extent of the survey works covering both the Moray West Site and Offshore Export Cable Corridor and as such, provides this information in support of an application for a Marine Licence covering all geophysical and UXO survey activities and locations.

The assessment also demonstrates that survey operations would not compromise the *Favourable Conservation Status* of any cetacean species, meaning one of the three key tests of the Marine EPS Licence assessment process has already been met. Reductions to the potential disturbance of EPSs from survey operations are further bolstered by the mitigation measures outline in Chapter 4.

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Appendix A Survey Area Coordinates

ID	OSGB36 British National Grid			WGS84 Latitude - Longitude				WGS84 UTM Zone 30N	
	X_BNG	Y_BNG	NGR	Lat (DM.m)	Lon (DM.m)	Lat (DD)	Lon (DD)	X_UTM30N	Y_UTM30N
0	346215.08	908884.32	ND4621508884	58° 3.946' N	2° 54.796' W	58.06576	-2.91327	505117.13	6436034.64
1	346215.13	908884.34	ND4621508884	58° 3.946' N	2° 54.796' W	58.06576	-2.91327	505117.18	6436034.66
2	346215.12	908884.33	ND4621508884	58° 3.946' N	2° 54.796' W	58.06576	-2.91327	505117.17	6436034.64
3	346215.08	908884.32	ND4621508884	58° 3.946' N	2° 54.796' W	58.06576	-2.91327	505117.13	6436034.64
4	346215.08	908884.32	ND4621508884	58° 3.946' N	2° 54.796' W	58.06576	-2.91327	505117.13	6436034.64
5	343065.64	899771.65	NJ4306599771	57° 59.012' N	2° 57.866' W	57.98353	-2.96443	502103.18	6426876.94
6	346020.50	890913.13	NJ4602090913	57° 54.261' N	2° 54.747' W	57.90434	-2.91245	505188.59	6418063.71
7	347687.11	885916.90	NJ4768785916	57° 51.580' N	2° 52.994' W	57.85967	-2.88324	506928.77	6413092.98
8	349641.31	880058.65	NJ4964180058	57° 48.437' N	2° 50.944' W	57.80728	-2.84907	508969.21	6407264.62
9	349760.87	879700.26	NJ4976079700	57° 48.245' N	2° 50.819' W	57.80408	-2.84698	509094.04	6406908.05
10	356531.54	868675.19	NJ5653168675	57° 42.346' N	2° 43.864' W	57.70577	-2.73107	516026.38	6395984.75
11	356575.59	868603.46	NJ5657568603	57° 42.308' N	2° 43.819' W	57.70513	-2.73032	516071.48	6395913.68
12	357329.81	867424.28	NJ5732967424	57° 41.676' N	2° 43.047' W	57.69461	-2.71745	516842.98	6394745.82
13	357464.82	867183.80	NJ5746467183	57° 41.548' N	2° 42.909' W	57.69246	-2.71515	516981.51	6394507.36
14	357452.79	867109.61	NJ5745267109	57° 41.508' N	2° 42.920' W	57.69179	-2.71534	516970.58	6394433.01
15	357451.72	867103.02	NJ5745167103	57° 41.504' N	2° 42.921' W	57.69173	-2.71535	516969.61	6394426.40
16	357170.49	866866.26	NJ5717066866	57° 41.375' N	2° 43.202' W	57.68958	-2.72003	516691.92	6394185.53
17	357161.52	866858.71	NJ5716166858	57° 41.371' N	2° 43.211' W	57.68951	-2.72018	516683.06	6394177.85
18	357081.94	866791.72	NJ5708166791	57° 41.334' N	2° 43.290' W	57.68890	-2.72150	516604.48	6394109.69
19	357060.19	866815.68	NJ5706066815	57° 41.347' N	2° 43.312' W	57.68912	-2.72187	516582.38	6394133.33
20	357057.40	866818.75	NJ5705766818	57° 41.349' N	2° 43.315' W	57.68914	-2.72192	516579.55	6394136.36
21	357025.69	866853.67	NJ5702566853	57° 41.367' N	2° 43.347' W	57.68945	-2.72245	516547.33	6394170.81
22	356917.28	866769.54	NJ5691766769	57° 41.321' N	2° 43.455' W	57.68869	-2.72426	516440.18	6394085.09
23	356917.11	866768.37	NJ5691766768	57° 41.321' N	2° 43.456' W	57.68868	-2.72426	516440.02	6394083.92
24	356913.86	866745.80	NJ5691366745	57° 41.308' N	2° 43.459' W	57.68847	-2.72431	516437.11	6394061.30
25	356905.75	866689.54	NJ5690566689	57° 41.278' N	2° 43.466' W	57.68797	-2.72444	516429.83	6394004.93
26	356904.86	866683.30	NJ5690466683	57° 41.275' N	2° 43.467' W	57.68791	-2.72445	516429.03	6393998.68
27	356903.13	866671.30	NJ5690366671	57° 41.268' N	2° 43.469' W	57.68780	-2.72448	516427.48	6393986.66
28	356778.17	866595.99	NJ5677866595	57° 41.227' N	2° 43.593' W	57.68712	-2.72656	516303.65	6393909.52
29	356774.29	866593.65	NJ5677466593	57° 41.226' N	2° 43.597' W	57.68709	-2.72662	516299.80	6393907.12
30	356728.65	866566.14	NJ5672866566	57° 41.211' N	2° 43.643' W	57.68684	-2.72738	516254.58	6393878.94

31	356721.33	866561.73	NJ5672166561	57° 41.208' N	2° 43.650' W	57.68680	-2.72751	516247.33	6393874.43
32	356701.28	866549.64	NJ5670166549	57° 41.202' N	2° 43.670' W	57.68669	-2.72784	516227.45	6393862.04
33	356513.36	866485.38	NJ5651366485	57° 41.166' N	2° 43.859' W	57.68610	-2.73098	516040.51	6393795.01
34	356501.00	866481.15	NJ5650166481	57° 41.163' N	2° 43.871' W	57.68606	-2.73119	516028.22	6393790.61
35	356485.47	866396.80	NJ5648566396	57° 41.118' N	2° 43.886' W	57.68530	-2.73143	516013.93	6393706.04
36	356485.15	866395.05	NJ5648566395	57° 41.117' N	2° 43.886' W	57.68528	-2.73144	516013.64	6393704.29
37	356475.34	866341.81	NJ5647566341	57° 41.088' N	2° 43.895' W	57.68480	-2.73159	516004.62	6393650.91
38	356473.70	866332.89	NJ5647366332	57° 41.083' N	2° 43.897' W	57.68472	-2.73162	516003.11	6393641.96
39	356471.66	866321.82	NJ5647166321	57° 41.077' N	2° 43.899' W	57.68462	-2.73165	516001.23	6393630.87
40	356469.07	866307.76	NJ5646966307	57° 41.070' N	2° 43.901' W	57.68450	-2.73169	515998.85	6393616.77
41	356379.75	866263.03	NJ5637966263	57° 41.045' N	2° 43.991' W	57.68409	-2.73318	515910.21	6393570.74
42	356221.14	866183.61	NJ5622166183	57° 41.001' N	2° 44.149' W	57.68336	-2.73582	515752.79	6393488.98
43	356215.56	866178.25	NJ5621566178	57° 40.999' N	2° 44.155' W	57.68331	-2.73592	515747.29	6393483.55
44	356152.30	866117.52	NJ5615266117	57° 40.965' N	2° 44.218' W	57.68276	-2.73697	515684.93	6393421.89
45	356054.44	866023.58	NJ5605466023	57° 40.914' N	2° 44.315' W	57.68190	-2.73859	515588.48	6393326.53
46	355792.92	866068.54	NJ5579266068	57° 40.937' N	2° 44.579' W	57.68228	-2.74298	515326.34	6393367.61
47	355522.31	866115.06	NJ5552266115	57° 40.960' N	2° 44.852' W	57.68267	-2.74753	515055.08	6393410.13
48	355499.46	866172.11	NJ5549966172	57° 40.991' N	2° 44.875' W	57.68318	-2.74792	515031.40	6393466.84
49	355483.51	866211.95	NJ5548366211	57° 41.012' N	2° 44.892' W	57.68354	-2.74820	515014.86	6393506.44
50	355494.76	866275.51	NJ5549466275	57° 41.047' N	2° 44.881' W	57.68411	-2.74802	515025.17	6393570.16
51	355506.49	866341.79	NJ5550666341	57° 41.082' N	2° 44.870' W	57.68471	-2.74784	515035.92	6393636.59
52	355508.92	866355.54	NJ5550866355	57° 41.090' N	2° 44.868' W	57.68483	-2.74780	515038.15	6393650.38
53	355531.25	866468.49	NJ5553166468	57° 41.151' N	2° 44.847' W	57.68585	-2.74745	515058.81	6393763.64
54	355507.01	866549.20	NJ5550766549	57° 41.194' N	2° 44.872' W	57.68657	-2.74787	515033.38	6393843.98
55	355475.11	866612.20	NJ5547566612	57° 41.228' N	2° 44.905' W	57.68713	-2.74841	515000.56	6393906.50
56	355472.51	866658.90	NJ5547266658	57° 41.253' N	2° 44.908' W	57.68755	-2.74847	514997.27	6393953.16
57	355456.28	866850.39	NJ5545666850	57° 41.356' N	2° 44.926' W	57.68927	-2.74877	514978.21	6394144.38
58	355448.68	866940.04	NJ5544866940	57° 41.405' N	2° 44.935' W	57.69008	-2.74892	514969.29	6394233.90
59	355447.12	866958.39	NJ5544766958	57° 41.414' N	2° 44.937' W	57.69024	-2.74895	514967.47	6394252.22
60	355442.11	867017.50	NJ5544267017	57° 41.446' N	2° 44.943' W	57.69077	-2.74904	514961.58	6394311.25
61	355427.02	867016.28	NJ5542767016	57° 41.445' N	2° 44.958' W	57.69076	-2.74929	514946.51	6394309.80
62	355419.86	867015.69	NJ5541967015	57° 41.445' N	2° 44.965' W	57.69075	-2.74941	514939.36	6394309.11
63	355407.76	867014.71	NJ5540767014	57° 41.445' N	2° 44.977' W	57.69074	-2.74962	514927.27	6394307.95

64	355401.49	867014.20	NJ5540167014	57° 41.444' N	2° 44.983' W	57.69074	-2.74972	514921.02	6394307.35
65	355348.03	867009.85	NJ5534867009	57° 41.442' N	2° 45.037' W	57.69069	-2.75062	514867.63	6394302.22
66	355339.89	867009.19	NJ5533967009	57° 41.441' N	2° 45.045' W	57.69069	-2.75075	514859.50	6394301.43
67	355280.65	867004.38	NJ5528067004	57° 41.438' N	2° 45.105' W	57.69064	-2.75175	514800.34	6394295.74
68	355256.86	867002.44	NJ5525667002	57° 41.437' N	2° 45.129' W	57.69062	-2.75215	514776.59	6394293.46
69	355219.31	866999.39	NJ5521966999	57° 41.435' N	2° 45.167' W	57.69059	-2.75278	514739.08	6394289.85
70	355206.94	866998.38	NJ5520666998	57° 41.435' N	2° 45.179' W	57.69058	-2.75298	514726.73	6394288.67
71	354993.11	866981.00	NJ5499366981	57° 41.424' N	2° 45.394' W	57.69040	-2.75657	514513.20	6394268.13
72	354920.41	867031.80	NJ5492067031	57° 41.451' N	2° 45.468' W	57.69085	-2.75779	514439.76	6394317.85
73	354892.42	867127.63	NJ5489267127	57° 41.502' N	2° 45.497' W	57.69170	-2.75828	514410.35	6394413.25
74	354888.71	867140.30	NJ5488867140	57° 41.509' N	2° 45.501' W	57.69182	-2.75835	514406.46	6394425.87
75	354886.61	867368.30	NJ5488667368	57° 41.632' N	2° 45.505' W	57.69387	-2.75842	514401.00	6394653.80
76	354857.01	867331.60	NJ5485767331	57° 41.612' N	2° 45.535' W	57.69353	-2.75891	514371.94	6394616.67
77	354781.67	867252.48	NJ5478167252	57° 41.569' N	2° 45.610' W	57.69282	-2.76016	514297.78	6394536.45
78	354777.11	867247.70	NJ5477767247	57° 41.566' N	2° 45.614' W	57.69277	-2.76024	514293.30	6394531.60
79	354710.51	867214.30	NJ5471067214	57° 41.548' N	2° 45.681' W	57.69247	-2.76135	514227.20	6394497.22
80	354237.48	867167.14	NJ5423767167	57° 41.520' N	2° 46.156' W	57.69199	-2.76927	513754.94	6394443.09
81	354157.91	867267.40	NJ5415767267	57° 41.573' N	2° 46.238' W	57.69289	-2.77063	513673.90	6394542.16
82	354152.81	867269.05	NJ5415267269	57° 41.574' N	2° 46.243' W	57.69290	-2.77071	513668.78	6394543.73
83	352750.57	869026.32	NJ5275069026	57° 42.512' N	2° 47.675' W	57.70854	-2.79458	512240.84	6396280.03
84	346876.87	878957.78	NJ4687678957	57° 47.825' N	2° 53.720' W	57.79708	-2.89534	506221.50	6406123.09
85	346660.26	879415.51	NJ4666079415	57° 48.070' N	2° 53.945' W	57.80116	-2.89908	505998.16	6406577.54
86	346248.08	880812.16	NJ4624880812	57° 48.819' N	2° 54.380' W	57.81365	-2.90633	505565.43	6407967.86
87	345641.56	882626.06	NJ4564182626	57° 49.792' N	2° 55.017' W	57.82987	-2.91695	504932.22	6409772.48
88	343023.31	890456.63	NJ4302390456	57° 53.992' N	2° 57.774' W	57.89987	-2.96291	502198.67	6417562.96
89	340110.82	899167.54	NJ4011099167	57° 58.663' N	3° 0.854' W	57.97772	-3.01424	499157.84	6426229.21
90	338901.07	899484.42	NJ3890199484	57° 58.824' N	3° 2.086' W	57.98040	-3.03477	497943.63	6426528.12
91	338901.06	899484.42	NJ3890199484	57° 58.824' N	3° 2.086' W	57.98040	-3.03477	497943.62	6426528.12
92	338083.61	899698.54	NJ3808399698	57° 58.932' N	3° 2.919' W	57.98221	-3.04865	497123.14	6426730.11
93	338083.60	899698.54	NJ3808399698	57° 58.932' N	3° 2.919' W	57.98221	-3.04865	497123.14	6426730.11
94	328204.94	902286.14	ND2820402286	58° 0.237' N	3° 12.986' W	58.00395	-3.21644	487208.08	6429170.97
95	328204.94	902286.27	ND2820402286	58° 0.237' N	3° 12.986' W	58.00396	-3.21644	487208.08	6429171.10
96	328204.94	902335.31	ND2820402335	58° 0.264' N	3° 12.987' W	58.00440	-3.21645	487207.36	6429220.14

97	328204.94	904979.08	ND2820404979	58° 1.688' N	3° 13.035' W	58.02814	-3.21726	487168.21	6431863.38
98	328204.94	905456.08	ND2820405456	58° 1.945' N	3° 13.044' W	58.03242	-3.21740	487161.15	6432340.28
99	328204.94	906265.01	ND2820406265	58° 2.381' N	3° 13.059' W	58.03968	-3.21765	487149.17	6433149.04
100	328204.94	906701.90	ND2820406701	58° 2.616' N	3° 13.067' W	58.04361	-3.21778	487142.70	6433585.85
101	328248.14	906747.19	ND2824806747	58° 2.641' N	3° 13.024' W	58.04402	-3.21707	487185.22	6433631.77
102	328282.17	906783.98	ND2828206783	58° 2.661' N	3° 12.990' W	58.04436	-3.21650	487218.69	6433669.06
103	328311.49	906815.70	ND2831106815	58° 2.679' N	3° 12.961' W	58.04465	-3.21601	487247.54	6433701.20
104	328511.67	907032.19	ND2851107032	58° 2.797' N	3° 12.761' W	58.04662	-3.21269	487444.48	6433920.62
105	328769.66	907320.98	ND2876907320	58° 2.955' N	3° 12.504' W	58.04926	-3.20841	487698.14	6434213.17
106	329023.08	907614.46	ND2902307614	58° 3.116' N	3° 12.252' W	58.05193	-3.20420	487947.16	6434510.34
107	329270.98	907912.57	ND2927007912	58° 3.279' N	3° 12.006' W	58.05465	-3.20009	488190.59	6434812.07
108	329514.38	908215.46	ND2951408215	58° 3.445' N	3° 11.764' W	58.05741	-3.19606	488429.46	6435118.51
109	329751.30	908521.20	ND2975108521	58° 3.612' N	3° 11.528' W	58.06019	-3.19214	488661.80	6435427.69
110	329793.82	908577.64	ND2979308577	58° 3.642' N	3° 11.486' W	58.06071	-3.19144	488703.47	6435484.75
111	329822.11	908614.03	ND2982208614	58° 3.662' N	3° 11.458' W	58.06104	-3.19097	488731.22	6435521.56
112	330054.44	908924.46	ND3005408924	58° 3.832' N	3° 11.227' W	58.06386	-3.18712	488958.91	6435835.36
113	330280.39	909239.53	ND3028009239	58° 4.004' N	3° 11.003' W	58.06673	-3.18339	489180.15	6436153.71
114	330501.74	909557.48	ND3050109557	58° 4.177' N	3° 10.784' W	58.06962	-3.17973	489396.74	6436474.88
115	330717.57	909880.13	ND3071709880	58° 4.353' N	3° 10.570' W	58.07255	-3.17617	489607.75	6436800.67
116	330909.06	910178.29	ND3090910178	58° 4.515' N	3° 10.381' W	58.07525	-3.17301	489794.78	6437101.61
117	331058.06	910371.16	ND3105810371	58° 4.621' N	3° 10.233' W	58.07701	-3.17054	489940.89	6437296.64
118	331290.20	910682.37	ND3129010682	58° 4.790' N	3° 10.002' W	58.07984	-3.16670	490168.38	6437611.23
119	331516.88	910996.49	ND3151610996	58° 4.962' N	3° 9.777' W	58.08270	-3.16295	490390.36	6437928.65
120	331701.21	911262.47	ND3170111262	58° 5.107' N	3° 9.594' W	58.08511	-3.15990	490570.71	6438197.31
121	331759.13	911346.19	ND3175911346	58° 5.152' N	3° 9.537' W	58.08587	-3.15895	490627.38	6438281.87
122	331801.39	911407.29	ND3180111407	58° 5.186' N	3° 9.495' W	58.08643	-3.15825	490668.73	6438343.59
123	332016.07	911728.94	ND3201611728	58° 5.361' N	3° 9.282' W	58.08935	-3.15470	490878.60	6438668.35
124	332226.25	912055.27	ND3222612055	58° 5.539' N	3° 9.074' W	58.09231	-3.15123	491083.90	6438997.73
125	332429.96	912385.36	ND3242912385	58° 5.719' N	3° 8.872' W	58.09531	-3.14787	491282.68	6439330.78
126	332628.21	912718.27	ND3262812718	58° 5.900' N	3° 8.676' W	58.09833	-3.14460	491475.96	6439666.57
127	332820.94	913055.01	ND3282013055	58° 6.083' N	3° 8.486' W	58.10138	-3.14143	491663.66	6440006.10
128	333007.27	913394.58	ND3300713394	58° 6.268' N	3° 8.302' W	58.10446	-3.13837	491844.92	6440348.36
129	333166.18	913696.80	ND3316613696	58° 6.432' N	3° 8.146' W	58.10720	-3.13576	491999.33	6440652.88

130	333336.49	913747.37	ND3333613747	58° 6.461' N	3° 7.973' W	58.10768	-3.13289	492168.85	6440705.96
131	333705.98	913863.62	ND3370513863	58° 6.527' N	3° 7.599' W	58.10878	-3.12665	492536.55	6440827.66
132	334056.96	913980.91	ND3405613980	58° 6.593' N	3° 7.244' W	58.10988	-3.12073	492885.72	6440950.14
133	334073.68	913986.50	ND3407313986	58° 6.596' N	3° 7.227' W	58.10993	-3.12045	492902.35	6440955.97
134	334439.58	914115.77	ND3443914115	58° 6.669' N	3° 6.856' W	58.11115	-3.11427	493266.27	6441090.64
135	334802.89	914250.75	ND3480214250	58° 6.745' N	3° 6.489' W	58.11242	-3.10815	493627.51	6441230.98
136	335164.33	914392.20	ND3516414392	58° 6.824' N	3° 6.123' W	58.11374	-3.10205	493986.78	6441377.76
137	335522.24	914540.15	ND3552214540	58° 6.907' N	3° 5.761' W	58.11512	-3.09602	494342.43	6441530.98
138	335530.59	914543.69	ND3553014543	58° 6.909' N	3° 5.753' W	58.11515	-3.09588	494350.73	6441534.64
139	335542.04	914548.55	ND3554214548	58° 6.912' N	3° 5.741' W	58.11520	-3.09569	494362.10	6441539.68
140	335639.05	914589.79	ND3563914589	58° 6.935' N	3° 5.643' W	58.11558	-3.09405	494458.48	6441582.35
141	335909.57	914706.46	ND3590914706	58° 7.000' N	3° 5.370' W	58.11667	-3.08950	494727.23	6441703.00
142	335995.14	914743.36	ND3599514743	58° 7.021' N	3° 5.283' W	58.11701	-3.08805	494812.23	6441741.16
143	336347.65	914904.36	ND3634714904	58° 7.111' N	3° 4.927' W	58.11851	-3.08212	495162.28	6441907.36
144	336457.17	914955.08	ND3645714955	58° 7.139' N	3° 4.816' W	58.11898	-3.08027	495271.03	6441959.69
145	336509.98	914975.43	ND3650914975	58° 7.150' N	3° 4.763' W	58.11917	-3.07938	495323.53	6441980.82
146	336772.50	915078.50	ND3677215078	58° 7.208' N	3° 4.497' W	58.12014	-3.07495	495584.48	6442087.76
147	336870.42	915116.94	ND3687015116	58° 7.230' N	3° 4.398' W	58.12049	-3.07330	495681.81	6442127.65
148	337009.86	915174.87	ND3700915174	58° 7.262' N	3° 4.257' W	58.12103	-3.07095	495820.37	6442187.63
149	337229.08	915265.94	ND3722915265	58° 7.313' N	3° 4.035' W	58.12188	-3.06725	496038.19	6442281.93
150	337585.05	915419.61	ND3758515419	58° 7.399' N	3° 3.675' W	58.12331	-3.06125	496391.81	6442440.86
151	337827.15	915530.30	ND3782715530	58° 7.461' N	3° 3.430' W	58.12434	-3.05717	496632.23	6442555.12
152	337843.14	915537.61	ND3784315537	58° 7.465' N	3° 3.414' W	58.12441	-3.05690	496648.10	6442562.66
153	337937.43	915580.72	ND3793715580	58° 7.489' N	3° 3.319' W	58.12481	-3.05532	496741.74	6442607.16
154	338287.99	915747.43	ND3828715747	58° 7.581' N	3° 2.965' W	58.12636	-3.04941	497089.77	6442779.04
155	338354.81	915780.49	ND3835415780	58° 7.600' N	3° 2.897' W	58.12666	-3.04828	497156.09	6442813.08
156	338419.73	915811.69	ND3841915811	58° 7.617' N	3° 2.831' W	58.12695	-3.04719	497220.52	6442845.24
157	338767.61	915984.89	ND3876715984	58° 7.713' N	3° 2.480' W	58.12856	-3.04133	497565.78	6443023.56
158	339110.94	916163.65	ND3911016163	58° 7.813' N	3° 2.133' W	58.13021	-3.03555	497906.39	6443207.38
159	339215.65	916220.19	ND3921516220	58° 7.844' N	3° 2.027' W	58.13073	-3.03379	498010.25	6443265.46
160	339393.12	916316.01	ND3939316316	58° 7.897' N	3° 1.848' W	58.13162	-3.03080	498186.26	6443363.90
161	339452.52	916348.09	ND3945216348	58° 7.915' N	3° 1.788' W	58.13191	-3.02980	498245.17	6443396.84
162	339789.56	916538.94	ND3978916538	58° 8.020' N	3° 1.447' W	58.13367	-3.02412	498579.32	6443592.66

163	339939.30	916626.99	ND3993916626	58° 8.069' N	3° 1.296' W	58.13448	-3.02161	498727.73	6443682.92
164	340123.83	916735.49	ND4012316735	58° 8.129' N	3° 1.110' W	58.13548	-3.01850	498910.62	6443794.13
165	340454.56	916937.58	ND4045416937	58° 8.241' N	3° 0.776' W	58.13734	-3.01294	499238.29	6444001.08
166	340781.60	917146.15	ND4078117146	58° 8.356' N	3° 0.446' W	58.13926	-3.00744	499562.17	6444214.46
167	340955.06	917260.57	ND4095517260	58° 8.419' N	3° 0.271' W	58.14031	-3.00452	499733.91	6444331.44
168	341105.00	917359.47	ND4110517359	58° 8.473' N	3° 0.120' W	58.14122	-3.00200	499882.35	6444432.55
169	341424.78	917579.20	ND4142417579	58° 8.594' N	2° 59.797' W	58.14323	-2.99662	500198.82	6444656.97
170	341740.95	917804.62	ND4174017804	58° 8.718' N	2° 59.479' W	58.14530	-2.99131	500511.59	6444887.04
171	342052.53	918034.64	ND4205218034	58° 8.844' N	2° 59.165' W	58.14741	-2.98608	500819.70	6445121.64
172	342360.49	918270.28	ND4236018270	58° 8.974' N	2° 58.854' W	58.14956	-2.98090	501124.11	6445361.80
173	342663.87	918511.46	ND4266318511	58° 9.106' N	2° 58.549' W	58.15177	-2.97581	501423.87	6445607.44
174	342963.71	918758.33	ND4296318758	58° 9.241' N	2° 58.247' W	58.15402	-2.97078	501719.99	6445858.71
175	343257.96	919009.81	ND4325719009	58° 9.379' N	2° 57.950' W	58.15632	-2.96584	502010.45	6446114.51
176	343332.38	919074.93	ND4333219074	58° 9.415' N	2° 57.875' W	58.15691	-2.96459	502083.90	6446180.72
177	343463.81	919189.91	ND4346319189	58° 9.478' N	2° 57.743' W	58.15796	-2.96238	502213.59	6446297.63
178	343469.43	919195.30	ND4346919195	58° 9.481' N	2° 57.737' W	58.15801	-2.96229	502219.14	6446303.10
179	343667.25	919363.86	ND4366719363	58° 9.573' N	2° 57.538' W	58.15955	-2.95897	502414.42	6446474.57
180	343764.54	919446.77	ND4376419446	58° 9.619' N	2° 57.440' W	58.16031	-2.95734	502510.47	6446558.91
181	344055.09	919703.87	ND4405519703	58° 9.759' N	2° 57.148' W	58.16265	-2.95246	502797.15	6446820.26
182	344341.14	919965.64	ND4434119965	58° 9.903' N	2° 56.860' W	58.16504	-2.94766	503079.27	6447086.22
183	344622.53	920232.00	ND4462220232	58° 10.048' N	2° 56.577' W	58.16747	-2.94295	503356.65	6447356.72
184	344731.48	920339.38	ND4473120339	58° 10.107' N	2° 56.467' W	58.16845	-2.94112	503463.99	6447465.69
185	344898.49	920503.99	ND4489820503	58° 10.197' N	2° 56.299' W	58.16995	-2.93832	503628.53	6447632.75
186	344973.93	920580.37	ND4497320580	58° 10.239' N	2° 56.223' W	58.17064	-2.93706	503702.83	6447710.24
187	345170.79	920779.69	ND4517020779	58° 10.347' N	2° 56.025' W	58.17246	-2.93376	503896.70	6447912.44
188	345437.59	921061.02	ND4543721061	58° 10.501' N	2° 55.757' W	58.17502	-2.92929	504159.28	6448197.67
189	345699.89	921347.01	ND4569921347	58° 10.657' N	2° 55.494' W	58.17762	-2.92490	504417.29	6448487.50
190	345957.53	921637.58	ND4595721637	58° 10.815' N	2° 55.235' W	58.18026	-2.92058	504670.57	6448781.85
191	346208.78	921931.99	ND4620821931	58° 10.976' N	2° 54.983' W	58.18293	-2.91638	504917.42	6449079.93
192	346430.50	922200.72	ND4643022200	58° 11.122' N	2° 54.760' W	58.18537	-2.91267	505135.11	6449351.91
193	346455.45	922230.97	ND4645522230	58° 11.139' N	2° 54.735' W	58.18565	-2.91226	505159.61	6449382.52
194	346670.63	922500.84	ND4667022500	58° 11.286' N	2° 54.520' W	58.18810	-2.90866	505370.75	6449655.54
195	346697.63	922534.70	ND4669722534	58° 11.304' N	2° 54.492' W	58.18840	-2.90821	505397.23	6449689.78

196	346933.33	922842.08	ND4693322842	58° 11.472' N	2° 54.256' W	58.19119	-2.90427	505628.34	6450000.62
197	347164.45	923153.27	ND4716423153	58° 11.641' N	2° 54.025' W	58.19402	-2.90041	505854.80	6450315.18
198	347390.05	923469.04	ND4739023469	58° 11.813' N	2° 53.799' W	58.19688	-2.89664	506075.67	6450634.24
199	347408.84	923497.28	ND4740823497	58° 11.828' N	2° 53.780' W	58.19713	-2.89633	506094.04	6450662.75
200	347428.48	923524.56	ND4742823524	58° 11.843' N	2° 53.760' W	58.19738	-2.89600	506113.27	6450690.32
201	347445.33	923548.21	ND4744523548	58° 11.856' N	2° 53.743' W	58.19760	-2.89572	506129.78	6450714.22
202	347513.49	923632.75	ND4751323632	58° 11.902' N	2° 53.675' W	58.19836	-2.89458	506196.66	6450799.75
203	347755.49	923936.43	ND4775523936	58° 12.067' N	2° 53.432' W	58.20112	-2.89053	506434.12	6451106.97
204	347991.89	924243.76	ND4799124243	58° 12.234' N	2° 53.195' W	58.20391	-2.88658	506665.92	6451417.75
205	348002.22	924258.29	ND4800224258	58° 12.242' N	2° 53.185' W	58.20404	-2.88641	506676.03	6451432.43
206	348206.43	924421.86	ND4820624421	58° 12.332' N	2° 52.978' W	58.20553	-2.88297	506877.78	6451599.01
207	348505.40	924668.76	ND4850524668	58° 12.467' N	2° 52.676' W	58.20778	-2.87794	507173.04	6451850.30
208	348728.26	924859.15	ND4872824859	58° 12.571' N	2° 52.451' W	58.20952	-2.87419	507393.03	6452043.96
209	349405.00	923891.98	ND4940523891	58° 12.055' N	2° 51.748' W	58.20091	-2.86246	508084.00	6451087.00
210	349953.00	922874.68	ND4995322874	58° 11.510' N	2° 51.175' W	58.19184	-2.85292	508647.00	6450078.00
211	350362.67	921904.44	ND5036221904	58° 10.990' N	2° 50.745' W	58.18317	-2.84575	509071.00	6449114.00
212	350487.93	921515.51	ND5048721515	58° 10.782' N	2° 50.612' W	58.17969	-2.84354	509202.00	6448727.00
213	350648.56	921017.05	ND5064821017	58° 10.514' N	2° 50.442' W	58.17524	-2.84070	509370.00	6448231.00
214	350828.01	920169.24	ND5082820169	58° 10.059' N	2° 50.248' W	58.16764	-2.83747	509562.00	6447386.00
215	350986.25	919306.75	ND5098619306	58° 9.595' N	2° 50.076' W	58.15991	-2.83460	509733.00	6446526.00
216	351006.04	918961.12	ND5100618961	58° 9.409' N	2° 50.052' W	58.15681	-2.83419	509757.91	6446180.72
217	351055.36	918099.52	ND5105518099	58° 8.945' N	2° 49.990' W	58.14908	-2.83317	509820.00	6445320.00
218	351006.41	916957.06	ND5100616957	58° 8.329' N	2° 50.026' W	58.13881	-2.83376	509788.00	6444177.00
219	350878.53	916156.82	ND5087816156	58° 7.897' N	2° 50.146' W	58.13161	-2.83577	509672.00	6443375.00
220	350757.41	915543.51	ND5075715543	58° 7.566' N	2° 50.262' W	58.12609	-2.83769	509560.00	6442760.00
221	350533.47	914672.68	ND5053314672	58° 7.095' N	2° 50.479' W	58.11825	-2.84131	509349.00	6441886.00
222	350164.40	913727.99	ND5016413727	58° 6.583' N	2° 50.842' W	58.10972	-2.84737	508994.00	6440936.00
223	349594.79	912546.23	ND4959412546	58° 5.943' N	2° 51.407' W	58.09904	-2.85678	508442.00	6439746.00
224	349506.90	912409.64	ND4950612409	58° 5.868' N	2° 51.495' W	58.09781	-2.85825	508356.15	6439608.13
225	348932.42	911516.87	ND4893211516	58° 5.383' N	2° 52.068' W	58.08972	-2.86779	507795.00	6438707.00
226	348171.61	910597.86	ND4817110597	58° 4.883' N	2° 52.830' W	58.08138	-2.88049	507047.93	6437776.87
227	348163.53	910588.11	ND4816310588	58° 4.878' N	2° 52.838' W	58.08129	-2.88063	507040.00	6437767.00
228	347863.46	910285.54	ND4786310285	58° 4.712' N	2° 53.139' W	58.07854	-2.88565	506744.46	6437460.03

229	347428.42	909846.87	ND4742809846	58° 4.473' N	2° 53.575' W	58.07455	-2.89292	506316.00	6437015.00
230	347211.58	909674.85	ND4721109674	58° 4.379' N	2° 53.794' W	58.07298	-2.89656	506101.75	6436839.80
231	346453.64	909073.57	ND4645309073	58° 4.049' N	2° 54.556' W	58.06749	-2.90927	505352.85	6436227.39
232	346215.08	908884.32	ND4621508884	58° 3.946' N	2° 54.796' W	58.06576	-2.91327	505117.13	6436034.64