Project Title	Seagreen Wind Energy Ltd
Document Reference Number	LF000009-CST-OF-LIC-REP-0005

Seagreen Alpha and Bravo Site UXO, boulder and debris clearance – Marine Licence Application

Supporting Environmental Information

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List of Acronyms

ADD	Acoustic Deterrent Device
AEZ	Archaeological Exclusion Zones
AIS	Automatic Identification System
DDV	Drop-Down Video
EIA	Environmental Impact Assessment
EOD	Explosive Ordnance Disposal
EPS	European Protected Species
ES	Environmental Statement
FTRAG	Forth and Tay Regional Monitoring Group
HE	High Explosive
HYDRA	Hyper High-Pressure Water Jet Disintegration Technique
IAC	Inter-Array Cables
ICES	International Council for the Exploration of the Seas
km	Kilometres
km^2	Square kilometres
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
LSE	Likely Significant Effect
m	Metre
MBES	Multi-Beam Echosounder
MCC	Marine Coordination Centre
MMMP	Marine Mammal Mitigation Plan
MMO	Marine Mammal Observer

MOD	Ministry of Defence
MPA	Marine Protected Area
MS-LOT	Marine Scotland Licensing Operations Team
MSS	Marine Scotland Science
NEQ	Net Explosive Quantity
Nm	Nautical Mile
OSP	Offshore Substation Platform
OTA	Offshore Transmission Asset
OWF	Offshore Wind Farm
PAM	Passive Acoustic Monitoring
PEMP	Project Environmental Monitoring Programme
PLGR	Pre-Lay Grapnel Run
pSPA	Proposed Special Protection Area
RIB	Rigid Inflatable Boat
ROLS	Remote Ordnance Lifting System
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SD	Secure Digital
SPA	Special Protection Area
SWEL	Seagreen Wind Energy Limited
UTROV	Utility Remotely Operated Vehicle
UXO	Unexploded Ordnance
WROV	Work-Class Remotely Operated Vehicle
WTG	Wind Turbine Generator

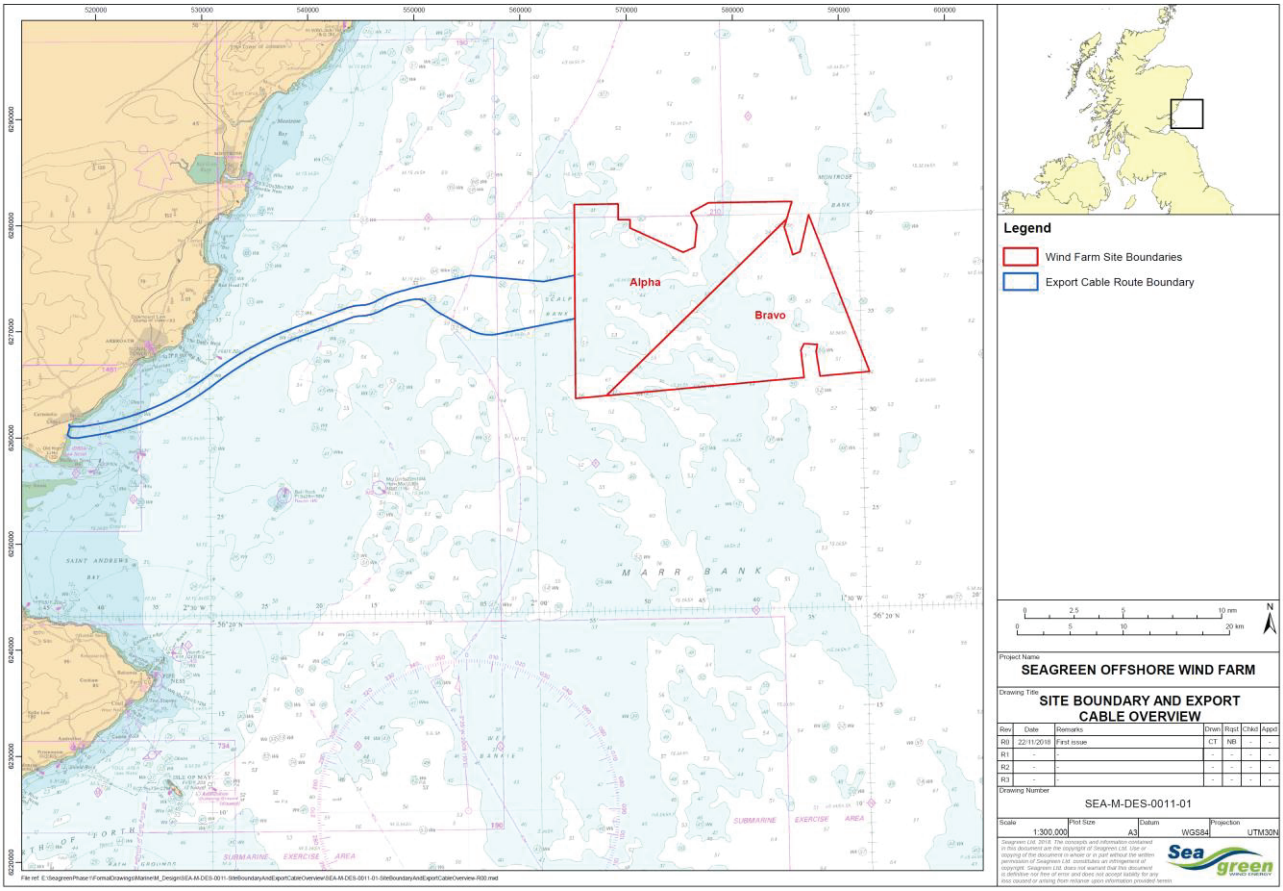
WW1	World War 1
WW2	World War 2

1. Introduction

1.1 Project Background

Seagreen Wind Energy Limited (SWEL, hereafter referred to as 'Seagreen') was awarded Consents by Scottish Ministers in October 2014 for the Seagreen Alpha and Seagreen Bravo Offshore Wind Farms (OWFs) and the Offshore Transmission Asset (OTA), including wind farm export cables (Figure 1-1). Seagreen Alpha and Seagreen Bravo, comprising 150 wind turbine generators (WTGs) in total are located in the North Sea, in the outer Firth of Forth and Firth of Tay. The OWF site (WTGs and offshore substation platform) is entirely within offshore Scottish waters (>12 nm from shore), with a minimum distance of approximately 27 km to shore near Johnshaven on the Aberdeenshire coast. The primary export cable landfall is at Carnoustie on the Angus coast, with a potential additional export cable (Seagreen 1A) making landfall at Cockenzie in the Firth of Forth.

Figure 1-1 Project location



1.2 Document Purpose

Offshore installation is due to commence in June 2021 at the first Offshore Substation Platform (OSP) location, with installation of the WTG starting in September 2021. In advance of these works, Seagreen propose to undertake seabed clearance activities given the potential for unexploded ordnance (UXOs), boulders or other debris to be present within the Seagreen OWF Site which may cause a safety issue to the

construction phase of the project. The clearance activities covered in this application focus on Phase 1 of the Seagreen project. Therefore, clearance activities are required at the location of 114 WTGs (and 23 spare locations). Clearance activities at the OSP will start in mid-May 2021 and is covered under the Offshore Transmission Asset (OTA) Marine Licence.

Seabed preparation and clearance works will involve the clearance of boulders or other debris and clearance (i.e. removal and/or potential detonation) of any potential UXOs and (hereafter collectively referred to as targets). These works are anticipated to commence in June 2021.

Seabed clearance includes the removal of targets which represent a potentially major risk to safety during the construction of the project. Seagreen will therefore, need to clear any identified target prior to commencement of the main construction activities within the vicinity of the wind farm area (hereafter referred to as the Seagreen OWF Site).

In order to undertake the clearance works within the Seagreen OWF Site, a Marine Licence is required from Scottish Ministers under Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009.

The clearance of UXO by detonation requires a European Protected Species (EPS) Licence under the provisions of the Conservation of Offshore Marine Habitats and Species Regulations 2017. An application for an EPS Licence to cover the impacts caused by the clearance works, specifically the potential detonation of UXOs, will be submitted separately.

This Supporting Environmental Information Document has been prepared in support of the Marine Licence application for the clearance works. This document is intended to provide the regulatory authorities (and their statutory advisers, where relevant) with the necessary supporting information to inform the Marine Licensing process.

1.3 Consultation

Seagreen consulted with Marine Scotland and NatureScot on the 12 February 2021 to discuss the EPS Risk Assessment and Marine Licence application for the clearance works. During the meeting Marine Scotland Science (MSS) referred to migratory fish and the potential for site clearance activities to overlap with smolt migration periods. This has been discussed in Section 4.4.2.

Following consultation with Marine Scotland and NatureScot, the assessments (Section 4) supporting the Marine Licence application will include sediments, benthic ecology, fish and shellfish ecology, ornithology, marine mammals, protected sites, commercial fisheries, shipping and navigation and marine archaeology.

2. Description of proposed works

2.1 Introduction

Seagreen are undertaking a geophysical survey of the OWF Seagreen OWF Site, which commenced in mid-March 2021, to identify potential UXOs, boulders, debris and other potential obstacles (collectively referred to as targets). To enable safe installation of the Seagreen OSPs and the WTGs, any identified targets will need to be confirmed and potentially removed prior to construction. The geophysical survey works will be undertaken by the vessel *Geo Ranger*. The preferred vessel choice for the clearance works is the *Wind of Pride*, which will use dynamic positioning. Further details on the clearance vessel and potential alternatives are provided in Section 2.5.

The following sections describes the potential for UXO and boulders to be encountered in the Seagreen OWF Site and details the proposed removal methods.

2.2 Potential UXO

There is the potential for UXOs to be present on the seabed in the area of the Seagreen OWF site. UXOs may present an obstacle and a health and safety risk during construction activities and installation of the WTGS and OSPs. A full list of UXOs present at the site will not be available until the March 2021 geophysical survey (covered under a separate approved EPS Risk Assessment) is completed and the data has been fully analysed. The March 2021 survey will provide information of the location, type and size of potential UXOs, as well as other debris and boulders.

A desk-based study (Ordtek, 2017, 2019) has identified UXO categories that could be present in the Seagreen area and their probability of occurrence. The results of this desk-based study are presented in Table 2.1. The overall probability of UXO presence at the Seagreen is low. The most likely UXO types to be encountered ('possible' probability) within the Seagreen OWF Site include:

- Artillery and naval projectiles: most 2-5 kg Net Explosive Quantity (NEQ); lower likelihood of up to 25 kg;
- Large High Explosive (HE) air-dropped bombs: Unlikely to exceed 250 kg NEQ, but potentially up to maximum 900 kg; and
- British and German buoyant mines: 145-300 kg NEQ.

The most powerful UXO which may be present and require clearance would be 930 kg NEQ; however, it is unlikely that UXOs will exceed 300 kg NEQ and most are likely to be considerably smaller.

As discussed in Section 2.1, Seagreen are undertaking a geophysical survey of the Seagreen OWF Site. This survey has started in mid-March 2021 and therefore survey results are not available to inform this Marine Licence application. An earlier geophysical survey was carried out in 2018 and identified 100 magnetic anomalies across the site (Figure 2-1). Not all magnetic anomalies will be potential UXOs. At the time of submission (and prior to completion and analysis of the site-specific surveys), the worst-case estimate for the number of confirmed UXOs that could be present within the Seagreen OWF Site is considered to be up to 20 individual items which may require clearance or potential detonation.

Figure 2-1 Magnetic Anomalies Recoded during the 2018 Geophysical Survey

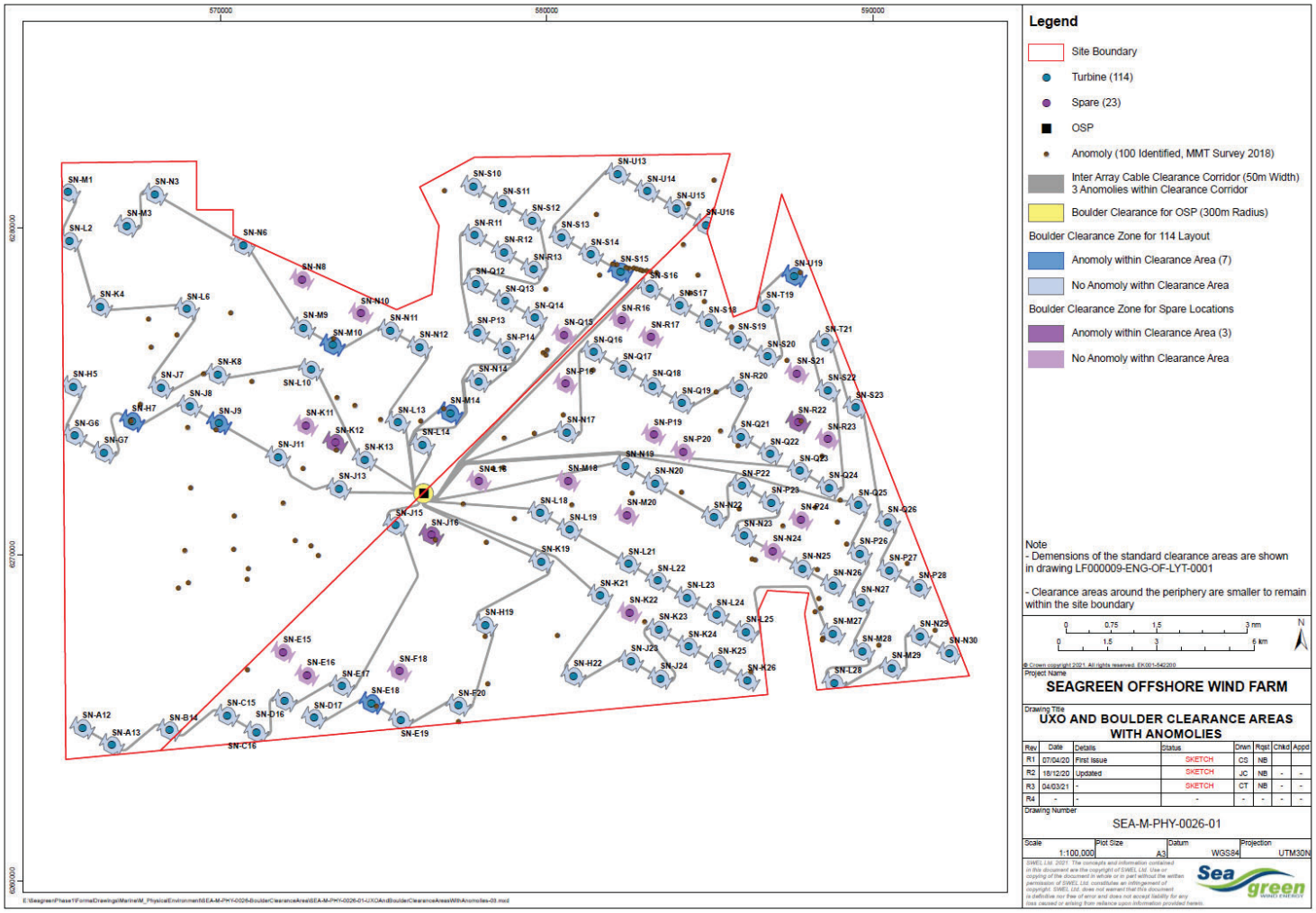


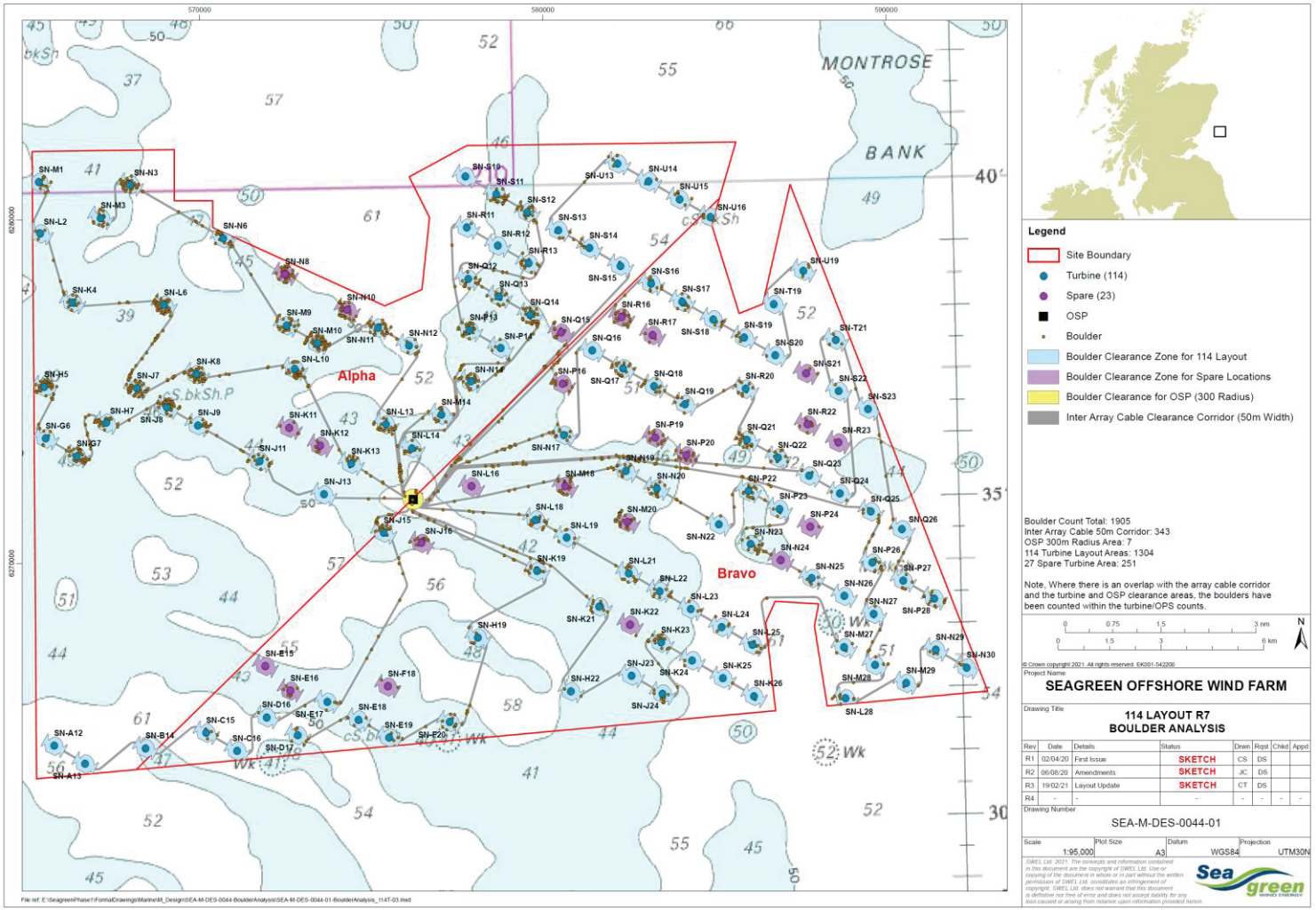
Table 2.1 Anticipated UXO NEQs and Probability of Occurrence (Ordtek, 2017, 2019)

UXO category	Probability of occurrence in Seagreen site	Net explosive quantity (NEQ) anticipated in the region
German ground mine	Unlikely	460 kg or 795 kg; low chance of 860-930 kg
British ground mine	Very unlikely	227-499 kg
British and German WW1 mines	Unlikely	N/A
Artillery and naval projectiles	Possible	Most 2-5 kg; lower likelihood of up to 25 kg
Small HE bombs (50 kg)	Unlikely	Most 25 kg
Large HE bombs (250 kg and greater)	Possible	Rarely exceeding 250 kg, but potentially up to maximum 900 kg
Depth charges and torpedoes	Unlikely	50-200 kg (depth charges); 250-280 kg (torpedoes)
British and German WW2 buoyant mines	Possible	145, 227 or 300 kg NEQ
Land service ammunition	Very unlikely	n/a (small)

2.3 Potential Boulders

As per the UXOs, a full list of obstructing boulders will not be available until the March 2021 geophysical survey is completed and the data fully analysed. However, based on recent 2018 survey data, it is expected that approximately 1,900 boulders are located across the Seagreen OWF Site. Figure 2-2 below indicates the potential boulders in the Seagreen area where there is overlap with the WTG layout and inter-array cable routes.

Figure 2-2 Expected boulders locations across Project Alpha and Bravo



2.4 Target Clearance Requirements

A Marine Licence is required prior to the clearance of identified targets so as to avoid any delay or safety issues to the main WTG installation works. Any targets identified may need to be removed from the following areas:

- A bow-tie shaped area around each of the 114 plus 23 'spare' WTG locations (137 total), each extending up to 380 m from the WTG location and covering an area of approximately 0.26 km^2. The shape reflects the area that would need to be cleared of obstructions for WTG installation and inter-array cables (IACs) to be laid from the WTG in any direction; therefore, given refinement of the IAC configuration, these areas represent a conservative maximum around each WTG location;
- An area of approximately 300 m radius around the OSP location; and
- A 50 m wide corridor centred on each of the inter-array cables.

Error! Reference source not found. details the equipment that are expected to be used for the clearance w orks. Works will be undertaken by a vessel, as outlined in Section 2.5.

Table 2.2 Disposal and Removal Option

	Disposal Solution
Surface Object Identification	Work-Class Remotely Operated Vehicle (WROV) with Secure Digital (SD) colour zoom camera and low light black and white camera
Buried Object Location	Teledyne TSS 440 on WROV
Detection and Identification of pUXO	6" Piranha dredge pump
Removal and Relocation	Remote Ordnance Lifting System (ROLS)- Tornado 5.5 m Rigid Inflatable Boat (RHIB)
UXO Disposal System	Low Yield (HYDRA System) High Order (Barracuda Bomb and Mine Disposal System)
Clearance of Non-UXO	WROV 5 / 7-function manipulator
As-Left Survey	TSS 440 and Multi-Beam Echosounder (MBES) on WROV
Pre-Lay Grapnel Run (PLGR)	Vessel towed grapnel

2.5 Vessels

A single vessel will be used for the proposed clearance activities. The preferred vessel is the *Wind of Pride*, with the *Noordhoek Pathfinder* as an alternative. **Error! Reference source not found.** provides further details o n the vessel(s) to be used for the clearance activities. Vessels will be using dynamic positioning to maintain their position over the work site.

Table 2.3 Vessels used during clearance works

Vessel Name	Vessel Description
Wind of Pride	The Wind of Pride is a Remotely Operated Vehicle (ROV) support vessel which has been used in offshore wind projects and will be used in the clearance works. The Wind of Pride is the preferred option and will use dynamic positioning.
Noordhoek Pathfinder	The Noordhoek Pathfinder is equipped for ROV, diving and survey projects, with integrated air diving systems, vessel mounted USBL, multibeam, sub-bottom profiler, ROV and ROTV as standard. The vessel will be used for UXO and debris clearance.

The vessel will transit from an appropriate port to the site via the safest route. Once on site the vessel will move between target locations on site.

2.6 Schedule

Clearance activities are planned to take place between June 2021 and the end of August 2021, following analysis of the geophys survey results and subsequent inspections of identified targets to confirm any UXOs requiring clearance.

UXO clearance activities are expected to occur over an estimated maximum of approximately 20 days within this period (assuming up to 10 UXO to clear). Boulder clearance, the removal of other debris and PLGR will take place throughout this period.

2.7 UXO Clearance Methodology

The following sections summarise the proposed methodology for the clearance of UXO targets, including pre-clearance investigations and a number of options for clearance. Further detail is provided in the UXO Clearance EPS Risk Assessment (LF000009-CST-OF-LIC-REP-0007) submitted in support of an EPS Licence Application for this activity.

2.7.1 Investigation of Potential UXO Targets

Potential UXOs (pUXOs), as identified during the March 2021 geophysical survey, will be subject to further visual inspection survey (using a ROV) to confirm the presence and details of these targets. Following the ROV inspection and expert assessment, details on the exact nature, including type, size and presence of the targets in the Seagreen OWF Site will be known.

The ROV inspection may require some limited excavation of the seabed (up to 2 m below seabed level) using a ROV-mounted pump to facilitate the visual assessment of the potential targets. Excavation of the seabed will only be required when the target is hidden from the ROV cameras due to complete or partial burial.

An immediate risk assessment will be carried out by the UXO manager on board the vessel to enable a decision on the appropriate response for each confirmed UXO target identified.

2.7.2 Clearance of Confirmed UXOs

Following investigation, a mitigation strategy will be implemented for the confirmed UXOs, in order to facilitate the future installation of the WTGs and the OSP. The selected UXO contractor has developed various approaches to dealing with confirmed UXOs which are outlined below, It is not possible to determine which clearance methodology will be required until the identification and investigation of the pUXOs is carried out and methodology will be selected on a case by case basis.

2.7.2.1 Avoidance of UXO Target

Prior to considering if UXOs require detonation, Seagreen will seek to avoid any confirmed UXO target. Some elements of the project infrastructure (e.g. IAC) may be able to be micro-sited to avoid identified targets preventing the need to remove them.

Removal (via relocation or detonation as outlined below) will only be considered when avoidance is not possible.

This will be done on a case-by-case basis; however, for the purpose of this Marine Licence application, it is assumed that removal of all targets may be required.

2.7.2.2 Relocation of Confirmed UXO

Relocation of confirmed UXO targets will be considered if the obstruction is in close proximity to an area where installation activities to be carried out. If the UXO is deemed safe to relocate following a risk assessment (i.e. it is in good structural condition), the relocation will be carried out using a remote Ordnance Lifting System (including Explosive Ordnance Disposal (EOD) grabs and surface initiation floats). Any UXOs that are relocated will be moved to an area outside the installation areas and corridors and to an area clear of any other known constraints (i.e. archaeological sensitivities, other assets etc). The location of the relocated UXOs will be confirmed and an exclusion area will be established around the UXO

2.7.2.3 Low Yield Disposal - Hyper High-Pressure Water Jet Disintegration Technique (HYDRA)

Where it is not possible to relocate the UXO, it will require to be disposed of in situ.

A low yield disposal is the preferred approach for UXO disposal. This technique involves using two non-electric Barracuda systems which will generate two counteracting high-pressure water jets targeting the vulnerable components and main explosive filling of the UXO. This will result in the rupture or split of the UXO casing and disintegration of the primary energetic component without combustion of the explosive material within the UXO into either:

- Thousands of minute pieces of material (explosively stable), which will dissipate over a few months. This outcome is expected in ground mines and some high explosive bombs where the casings have not been compromised by the ingress of seawater; or
- Production of an emulsion of tiny fragments of material, which forms a cloud and dissipates almost immediately. This outcome is expected in moored mines, high-explosive bombs and ground mines with severely corroded casings, depth charges, torpedo warheads where casings have been compromised by the ingress of seawater.

Following the disintegration of the UXO, residual explosive materials will remain on the seabed. These will be recovered to the vessel and wet-stored onboard. Eventually, the recovered residual explosive materials will be disposed onshore in a specialised registered facility.

2.7.2.4 High Order Disposal Operations

If the UXO is not deemed suitable for low yield or low-order disposal, a high order Barracuda UXO disposal system will be used (Figure 2-3).

Figure 2-3 Barracuda UXO disposal system

The high-order disposal option uses an explosive donor charge and non-electric detonators and shock tube lines. The high-order Barracuda system will be deployed using a ROV deployment and will be fitted to the concrete clump seabed and anchoring system. This method is designed to penetrate the UXO shell and trigger a detonation of the main explosive filling of the UXO. It is expected that there will be minimal residue left following detonation, and recovery requirements are low. After detonation, collection and recovery of any debris will be undertaken.

Safety management of vessels in the vicinity will be governed by the Seagreen Marine Coordination Centre (MCC), EOD superintendent, and vessel Master who will liaise with the authorities for the area before detonating any UXO. After successful detonation, the vessel will return to the vicinity of the UXO location and deploy the ROV to perform an as-left survey.

After a maximum of three failed attempts to detonate, a risk assessment will be carried out. Once the device is confirmed safe, a decision will be made whether to remove for disposal on shore if practicable, relocate or leave in situ.

2.8 Boulder and Debris Clearance Methodology

2.8.1 Orange-Peel Grab

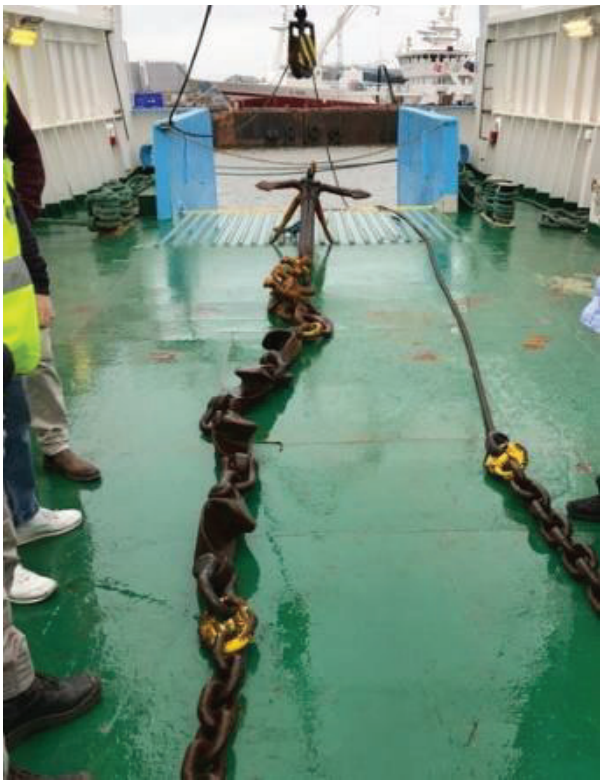
If necessary, an Orange-peel grab (**Error! Reference source not found.**Figure 2-4) or a Utility Remotely O perated Vehicle (UTROV) will be used to remove boulders that have the potential to disrupt construction. Any obstructing boulders will be relocated outside of the IAC corridor and WTG/OSP boulder free areas.

Figure 2-4 Orange-peel grab

2.8.2 PLGR

A PLGR run will be undertaken to ensure the inter-array cable routes are clear of debris. The grapnel will be towed from the stern of the PLGR vessel to "snag" and recover any debris. The PLGR vessel will tow the grapnel rig along the centreline of the cable route with a tolerance of +/- 5 m giving a 10 m corridor. The majority of debris encountered will be placed to the side of the cable route. Larger debris (i.e. rock outcrops) will be left in-situ and the cable route diverted around it. Any debris to be recovered and disposed of onshore in a licensed facility is anticipated to be limited to linear debris (e.g. abandoned ropes, fishing gear) that would impede the burial tool as it tracks along the seabed. The grapnel will consist of a seabed riding element and a hook/share that engages with the seabed, and ultimately the item of debris. The grapnel hooks will be dragged across the seabed and are expected to penetrate <1 m into the seabed, subject to soil type.

Figure 2-5 Grapnel Assembly



3. Embedded Mitigation Measures

There are a number of embedded mitigation measures that will be implemented for the proposed clearance works to help reduce any potential impacts. Table 3.1 below details these mitigation measures. Further detail is provided in the UXO Clearance EPS Risk Assessment (LF000009-CST-OF-LIC-REP-0007) submitted in support of an EPS Licence Application for this activity.

Table 3.1 Embedded Mitigation Measures

Mitigation Measure	Description
Notification of clearance works to appropriate parties	The Seagreen MCC in Montrose will be operational from April 2021. Seagreen will issue Notice to Mariners to assets owners, HM coastguard, Royal Navy, Marine Scotland, the fishing industry and other marine users and the Kingfisher charts in advance of any clearance works. A Weekly Notice of Operations is also issued routinely including all ongoing and planned operations.
Guard Vessel	Guard vessels (if required) will be deployed prior to commencement of the operations and will remain in situ at a safe stand-off distance as directed by the EOD Superintendent located on the selected vessel.
Safety distances	A safety distance of 1 km will be implemented to ensure all clearance work vessels are outwith this distance prior to any detonation. This safety distance will also be implemented in the notification to the appropriate parties. The selected vessel will set-up in position at the requisite safe range from the intended UXO target before detonation. This is determined by the NEQ which will be confirmed during the as-found survey. This distance can vary from 50 to 350 m.
Deterrents	In order to discourage marine mammals from approaching the disposal area, Acoustic Deterrent Device (ADDs) and seal scarers may be used. Marine Mammal and fish Pre-Blast BX-30 is a small charge that can be lowered at least 5 m below the vessel and will be used before the initiation of the main charge in order to deter marine mammals and fish. LofiTech Seal Scarers are an acoustic seal repellent system. The system consists of a control unit and a transducer (sound head). The control unit contains a pulse generator and an amplifier and transmits random bursts of audio frequency signals to the transducer, where they are converted into

Mitigation Measure	Description
	intense sound. This sound is on a frequency which is extremely unpleasant for seal. Fish, however, will not react to it at all. The timings of these deterrents and more information is provided in the EPS Risk Assessment.
MMOs and PAMs	Dependent on the UXO clearance licence, prior to detonation a marine mammal observer (MMO) will perform a 360-degree observation on possible marine mammals. Passive Acoustic Monitoring (PAMS) equipment will be operated in conjunction with operations in accordance with the project requirements as detailed in the Project Execution Plan. This will be based on consent requirements, environmental constraints, MMO requirements and EPS Licence. More information is provided in the EPS Risk Assessment.
Marine Archaeological Exclusion Zones	Appropriate buffer zones have been established around identified marine archaeology and cultural heritage receptors forming Archaeological Exclusion Zones (AEZs). Further details are provided in the Marine Archaeology WSI and PAD (LF000009-CST-OF-PLN-0002)
Pollution Prevention	No vessels associated with the proposed clearance surveys will be re-fuelled in the Seagreen OWF Site to avoid any accidental spills.
Vessel Management Plan	Vessel management mitigation measures to be implemented during clearance works which are detailed in the vessel management plan (LF000009-CST-OF-PLN-0006).

4. Environmental Assessment

4.1 Introduction

A detailed description of the baseline environment is available from the original Seagreen Offshore Environmental Statement (ES) (Seagreen, 2012) and the Seagreen Optimised Project Environmental Impact Assessment (EIA) Report (Seagreen, 2018). The following sections provide an overview of the key receptors that may be potentially affected by any clearance activity required within the Seagreen OWF Site. Where pre-construction monitoring has taken place, in accordance with the approved Project Environmental Monitoring Programme (PEMP) this is summarised in the relevant section.

Effects on environmental receptors associated with the clearance works are anticipated to be:

- Temporary habitat disturbance during investigation of and resulting from boulder clearance and UXO detonation;
- Habitat loss;
- Disturbance due to presence of vessels; and
- Underwater noise resulting from vessel presence and UXO detonation(s).

The following key points have been considered which have a bearing on the magnitude of effect and sensitivity of receptor:

- The footprint of the clearance works of UXO, boulder and debris will be localised and the impact on the seabed will be significantly smaller than that resulting from the main construction works assessed within the Original ES (Seagreen, 2012) and in the Optimised Project EIA Report (Seagreen, 2018);
- The total duration of the clearance works (including survey and target investigations) will be approximately 3.5 months (weather dependent) within the licence period being applied for. UXO disposal works will be intermittent over this period and anticipated to last approximately 20 days.
- Detonation of UXOs will be the last resort, the low yield method is the preferred option for UXO clearance;
- The actual undertaking of the potential UXO detonations at each location will be a quick process with the source of the disturbance being instantaneous (i.e. a single explosion in most cases) (with a maximum of one detonation per day); and
- Mitigation has been designed into the clearance works (through the application of the UXO Marine Mammal Mitigation Plan (MMMP) and the embedded mitigation detailed in Section 3).

4.2 Screening of Potential Effects

Each of the receptors, as assessed in the 2012 ES and in the Optimised Project EIA Report (Seagreen, 2012, 2018), that have the potential to be impacted by the proposed operations have been subject to a screening

exercise. Table 4.1 details the results of this screening on the receptors that may be sensitive to the proposed clearance works.

Table 4.1 Screening of Potential Environmental Receptors

Receptor	Disturbance to Seabed	Presence of Vessel	Underwater Noise	Justification
Physical Environment	✓	×	×	Due to the localised and temporary nature of the clearance works there are no potential impacts expected on the physical environment that could be impacted by vessel presence or underwater noise.
Benthic Ecology	✓	×	×	Due to the localised and temporary nature of the clearance works there are no potential impacts expected on benthic ecology that could be impacted by vessel presence or underwater noise.
Fish and Shellfish Ecology	✓	×	✓	Due to the localised and temporary nature of the clearance works there are no potential impacts on fish and shellfish with regards to presence of vessels.
Marine Mammals	×	✓	✓	Due to the localised and temporary nature of the clearance works there are no potential of impacts on marine mammals resulting from seabed disturbance. Indirect effects on marine mammal prey species is therefore not considered further.
Ornithology	×	✓	×	Due to the localised and temporary nature of the clearance works there are no potential impacts expected on ornithology resulting from seabed disturbance or underwater noise.

Receptor	Disturbance to Seabed	Presence of Vessel	Underwater Noise	Justification
Protected Sites	✓	✓	✓	All potential impacts associated with the works have the potential to impact upon protected sites in the area.
Commercial Fisheries	×	✓	×	There are no potential impacts on commercial fisheries in the area resulting from seabed disturbance or underwater noise.
Shipping and Navigation	×	✓	×	Due to the localised and temporary nature of the clearance works there is no potential impact expected on shipping and navigation resulting from the disturbance to the seabed or underwater noise.
Marine Archaeology	✓	×	×	Due to the localised and temporary nature of the clearance works there is no potential impact expected on archaeological receptors resulting from the presence of associated vessels or underwater noise.
Aviation and Ministry of Defence (MOD)	×	×	×	There are no aviation and MOD receptors that could be impacted by the clearance works and is, therefore, not assessed further in this application.
Infrastructure	×	×	×	There are no infrastructure receptors that could be impacted by the clearance works and is, therefore, not assessed further in this application.
Key: ✓= Scoped in; ×= Scoped out				

4.3 Physical Environment

4.3.1 Summary of Baseline

The tidal regime along the Seagreen OWF Site is semi-diurnal in nature and characterised by a variable mean spring tidal range. Tidal range varies spatially along the coast in response to the interaction of tidal energy, bathymetry, and orientation of the coastline (Seagreen, 2012).

Bathymetry across the Seagreen OWF Site ranges from 40 – 60m at Lowest Astronomical Tide (LAT). The maximum depth (86.2m LAT) is observed to the north-west of Seagreen Alpha where a relatively deep north-east to south-west orientated channel crosses the sea floor.

Analysis of the geophysical datasets identified seabed substrate and features including isolated boulders and sand bars, sand waves and megaripples. Megaripples are the predominant feature across the seabed, with isolated sand waves in the Seagreen Alpha area. Boulders are prevalent across the area and are either represented as isolated boulders or as clusters. All of the features are characteristic of various stages of sediment erosion and transportation produced by fluid movement (waves and currents) over sediments.

The ES indicated that the predominant sediment types within the Seagreen OWF Site are rippled medium to fine sand with varying amounts of coarse shell, and mixed mosaics of gravel, cobbles and coarse shell lying on or embedded within the sand. Gravel sediments derived from erosion of Quaternary Formations present at the seabed are widespread across the south-western extent of Seagreen Alpha (Seagreen, 2012). These general conclusions regarding seabed characteristics have been supported by subsequent site surveys.

4.3.2 Assessment of Potential Effects on the Physical Environment

The proposed operations could result in the suspension of a small amount of sediment in the water column. The volume of suspended sediment concentrations released into the water column will depend on the mobility of the seabed, the transportation of sediment within a plume, and the presence, or absence, of any sensitive receptors. The greatest suspended sediment concentrations will likely be towards the seabed (rather than extensively through the water column right to the water surface) and deposition would occur when current speeds fall below the critical threshold for sediment transport. Furthermore, due to the mobility of the seabed in these areas, any effects are potentially reversible and natural processes would be likely to infill any depressions excavated in the seabed in these mobile sedimentary areas. In areas of the seabed that are devoid of mobile bedforms, it is anticipated that the proposed work would have a negligible effect.

The ES (Seagreen, 2012) concluded that construction over the site could result in potential changes to seabed conditions, in particular sediment distribution patterns and mobile bedforms. Removal or displacement of material from the seabed has the potential to damage or destroy mobile bedforms, if they are present, in the area affected. For work to be done in, or within close proximity to, areas characterised by mobile bedforms (such as megaripples and sand waves) it is anticipated that the construction phase would result in a low magnitude adverse effect caused by the flattening of these features.

Based on the conclusions of the ES (Seagreen, 2012) and in consideration of the methods employed for the seabed clearance (including the embedded mitigation measures), effects are expected to be localised, and therefore not significant.

4.4 Benthic Ecology

4.4.1 Summary of Baseline

The Seagreen ES found that infauna was dominated by polychaetes such as *Capitella capitate* and *Chone* spp., mollusc with *Morella pygmaea* and *Cochlodesma praetenue* as the dominant species and crustaceans such as the amphipod *Atylus vedlomensis*, and the squat lobster *Galathea intermedia*. The epifauna was dominated by crustaceans such as the shrimp *Crangon allmani* and the hermit crab *Pagurus bernhardus*.

In general, the communities present across the Seagreen OWF Site were representative of areas of the North Sea that have been subject to fishing with ground contacting gears (such as dredges) for a number of years. As these benthic habitats have been widely impacted by fishing, they are not considered to be either natural, or particularly sensitive to physical impacts.

The most sensitive habitats were '*Sabellaria*' (equivalent biotope SBR.PoR.Ssp iMx) located mainly in the western part of the Seagreen Alpha OWF Site and dense *Amphiura*/*Phoronis* (equivalent Joint Nature Conservation Committee (JNCC) biotope SS.SMu.CSaMu.AfilMysAn). It is possible that the colonisation of suitable areas by *Sabellaria* increases the species richness of habitats; however, there was no evidence that this species forms extensive or well-developed aggregations at this site, which would potentially qualify as 'reefs' under the Habitats Directive or criteria developed by Gubbay (2007). In addition, a Drop-Down Video (DDV) survey was undertaken in October 2020 to examine areas considered to have potential reef habitats. No evidence of biogenic reefs was identified during the 2012 ES or in the 2020 survey (LF00009-CST-OF-REP-0029).

Arctica islandica was recorded at the Seagreen OWF site; however, only juveniles were found, with a maximum abundance of four specimens per grab sample. The presence only of juveniles suggests that more mature animals may have been removed by external disturbance mechanisms over a period of many years. The main activity causing seabed disturbance within the site is commercial fishing, in particular with seabed operating mobile gear such as trawls and dredges (Seagreen, 2012).

4.4.2 Assessment of potential effects on the benthic ecology

Potential effects on benthic ecology during clearance activities may arise from direct physical disturbance to the seabed and habitat loss or alteration. However, the majority of subtidal species and biotopes identified at the site exhibit good potential to recover from physical disturbance, particularly as proposed works will be localised and short-term. It is anticipated that the benthic community impacted will recover and species richness, with re-establishment, improved following subsequent spawning and recruitment periods. Monitoring studies at operational wind farms support this conclusion. Some more disturbed areas may be slower to recover than others, but it is anticipated that all areas will recover over time. It is therefore considered that the impact of direct physical disturbance of benthic species and habitats during clearance activities will be of negligible significance.

Increased suspended sediment load has the potential to impact on benthic species through blockage to the sensitive filter feeding apparatus of certain species and / or smothering of sessile species upon deposition of the sediment. However, the Seagreen OWF Site currently experiences scallop dredging activities, an activity which is known to elevate suspended sediment. In addition, wave and tidal currents action on the seabed sediment during storm events can also increase forces acting on the seabed and initiate motion, becoming

mobilised and dispersed during spring tides and storm events. All habitat types identified across the Seagreen OWF Site are considered to have low sensitivity or are not sensitive to smothering (Seagreen, 2012); therefore, the clearance activities are not expected to have a significant negative effect on the benthic ecology in the Seagreen OWF Site.

Direct and indirect impacts assessed in the ES (Seagreen, 2012) for construction activities were considered to be negligible and not significant.

Whilst there is the potential for localised direct habitat disturbance and suspended sediment loading as a result of the clearance activities (including PLGR), it is expected that any impacts on the seabed will be very limited. Given the localised nature of the works and the low sensitivity of the benthic communities it is considered that there will be no significant impacts on benthic ecology from the clearance works.

4.5 Fish and Shellfish Ecology

4.5.1 Summary of Baseline

Both Project Alpha and Project Bravo are within high intensity herring nursery grounds, cod, sprat, whiting and lemon sole nursery and spawning grounds and low intensity nursery grounds for mackerel, plaice, saithe, spotted ray, and tope. Three species of sandeel were found to be present within the Seagreen OWF Site with the most abundant species being *Ammodytes marinus*. The Project Alpha and Bravo area is not within recorded herring spawning sites according to Coull *et al*. (1998). However, according to Ellis *et al*. (2012) herring spawning grounds have been recorded north of the site, extending to within 6 km of this site.

Spawning and nursery grounds for scallops, Norway lobster (*Nephrops*), crab, whelks and squid has been recorded in the Seagreen Alpha and Bravo areas as well.

Marine Scotland highlighted migration of Atlantic salmon smolts during consultations (see Section 1.3). The ES did not record Atlantic salmon in any of the site-specific surveys; however, salmon are rarely caught offshore, so this is to be expected. Salmon are known to spawn in a number of East coast rivers discharging into the Firth of Forth and the Firth of Tay, in the vicinity of the Seagreen OWF Site, and therefore adults on return migration or smolts migrating from their natal rivers may pass through. Sea trout, European eel, sea lamprey and river lamprey were not recorded in the Seagreen OWF Site; however, as they are migratory species they may pass through the area during their migration as well.

4.5.2 Assessment of Potential Effects on the Fish and Shellfish Ecology

The proposed clearance works have the potential to directly affect fish and shellfish ecology in terms of direct disturbance to the seabed and habitat loss along with the subsequent sediment deposition and underwater noise. This in turn may affect associated spawning, nursery, feeding habits and migration.

Detonation of potential UXO may cause hearing damage and potential disturbance to fish in the Seagreen OWF Site. This is dependent on the hearing ability of fish. Physical injury will occur in close proximity to the detonation with behavioural effects occurring much further afield. As described in Section 2.7, if possible, UXOs will be avoided. If clearance of the UXOs is required, the preferred approach is to dispose of in situ using a low yield method, which results in the rupture disintegration of the UXO using two counteracting high-pressure water jets. The low yield approach does result in the combustion and detonation of the explosive material (see Section 2.7.2.3).

The 2012 ES and the 2018 Optimised Project EIA report (Seagreen, 2012; 2018) and both the Offshore Wind Farm (Ref: LF000009-CST-OF-PLN-0022) and Offshore Transmission Asset (Ref: LF000009-CST-OF-PLN-0003) Piling Strategies assessed underwater noise impacts on fish from piling operations. The assessments concluded that while there is potential for mortality, injury and behavioural effects from piling operations, the impact to sensitivity fish species was negligible and not significant. This was due to the short nature of piling activities.

As a worst-case, up to 20 UXOs would require to be removed over July-August 2021 following target identification and confirmation of UXOs during May-June 2021. This period coincides with herring spawning (Seagreen, 2012, 2018). The 2012 ES concluded that the behavioural impacts from piling could be medium in terms of affecting behaviour during spawning; however, the magnitude of impact is expected to be low. The proposed clearance activities will be short-term, localised and temporary. Based on the implementation of the embedded mitigation measures in Section 3 and the fact that the preferred removal method is low yield, the operations are not expected to cause a significant impact on a population level to any fish or shellfish species. Therefore, the potential for a large proportion of the fish populations present in the Seagreen OWF Site is low and the effects are considered to be negligible and not significant.

The clearance activities have the potential to result in the loss of habitat, spawning substrate or prey. Few pelagic species will be directly affected by temporary loss of habitat as they have the ability to move away during the proposed clearance works. Of the species recorded in the Seagreen OWF Site sandeel spawn on the seabed and may be most affected by the proposed clearance works. Sandeels are known to have high intensity spawning in the vicinity of the Seagreen OWF Site between November and February (Coull *et al*., 1998; Ellis *et al*., 2012). However, due to the timing of spawning, the proposed clearance works is not expected to affect the spawning of sandeels. As herring spawning grounds were recorded approximately 6 km away, there is a chance they may be in the area. Clearance activities will be highly localised and the potential for loss of suitable habitat will be of low importance. The impacts on fish and shellfish species from loss of habitat is expected to be negligible and not significant

Increased suspended sediment load may impact species of fish and shellfish through blockage of their feeding filters or through smothering. The most affected are expected to be species with limited mobility such as bivalves as fish are expected to swim away from any work taking place. The impact to shellfish was considered to be negligible and not significant in the 2012 ES (Seagreen, 2012) as scallop recoverability, for example, is high and the proposed clearance work is of a temporary nature. In addition, crabs and lobster are known to be caught in the Seagreen OWF Site but it is expected these species would move away from the area during any disturbance. Clearance activities will be highly localised and the potential for increase in suspended sediment is limited. The impacts on fish and shellfish species from increase in suspended sediments is predicted to be negligible and not significant.

4.6 Marine Mammals

4.6.1 Summary of Baseline

A relatively wide range of cetacean species can potentially occur in Scottish waters; for example, Marine Scotland state that at least 23 species of whales, dolphins and porpoise occur in the nation’s inshore waters (Marine Scotland, 2014) and a similar diversity can be expected in the offshore area. Notwithstanding this,

based on the available literature (Hague *et al*., 2020), as well as site-specific surveys, the 2012 Seagreen ES (Seagreen, 2012) identified a restricted sub-set of four cetacean and two seal species as key marine mammals in relation to the focus of the impact assessment. The same species were the focus of the 2018 Optimised Project EIA report (Seagreen, 2018). The species are as follows:

- Harbour porpoise (*Phocoena phocoena*);
- Bottlenose dolphin (*Tursiops truncatus*);
- Minke whale (*Balaenoptera acutorostrata*);
- White-beaked dolphin (*Lagenorhynchus albirostris*);
- Harbour seal (*Phoca vitulina*); and,
- Grey seal (*Halichoerus grypus*).

Pre-construction marine mammal monitoring has been underway since March 2019, through the deployment of five moorings including C-PODs and broad band noise recorders in an array extending from the Angus coastline out to the wind farm site. Two of the locations are within the site boundary. The data is being downloaded at intervals from the deployed devices and analysed for the presence of harbour porpoise and dolphin species. Interim reports have been provided to the Forth and Tay Regional Advisory Group (FTRAG) Marine Mammals subgroup. Nearshore bottlenose dolphin photo identification surveys have also taken place during March to September 2020. These monitoring activities are expected to continue through the construction phase of the project.

4.6.2 Assessment of potential effects on Marine Mammals

There is a potential for vessel presence and noise from UXO detonations to impact marine mammals in the area during the time of this proposed clearance works. As mentioned in Section 1.2, an application for an EPS Licence will be submitted to assess the potential of disturbance to marine mammals during this clearance works. Therefore, impacts on marine mammals from the UXO detonations are not considered further in this report.

Increase in vessel traffic associated with the seabed clearance activities has the potential to impact marine mammals. The 2012 ES (Seagreen, 2012) assessed the noise produced from vessels during construction activities to be of negligible significance; this was not scoped into the Optimised Project 2018 EIA (Seagreen, 2018).

The 2012 ES concluded that marine mammals in the Seagreen OWF Site are already experiencing vessel noise (due to existing activities) and their sensitivity to vessel noise was predicted to be low. The seabed target inspection and clearance activities will be temporary (maximum of two to three months on site) and will be localised. A single vessel will be used as part of the operations. Therefore, it is considered that effects on marine mammals from increased vessel traffic will not be significant.

In addition, collision risk due to increased traffic during construction was also assessed as part of the 2012 ES (Seagreen, 2012) as being negligible and not significant. A single vessel will be used as part of the clearance

works and a Vessel Management Plan will both be in place. It can be concluded that the risk of collision due to the clearance works is also negligible and not significant.

4.7 Ornithology

4.7.1 Summary of Baseline

Boat-based surveys have been undertaken between December 2009 and November 2011 to inform the 2012 ES (Seagreen, 2012). In addition, previously carried out aerial surveys were used to supplement the information gathered during the 2009 – 2011 surveys in the Seagreen OWF Site. A total of 39 species were recorded at the Alpha site, while 37 species were identified at the Bravo site during the boat-based surveys. Common guillemots (*Uria aalge*), black-legged kittiwakes (*Rissa tridactyla*) and gannets (*Morus bassanus*) were the species identified in the highest numbers during the surveys. These species accounted for approximately 69% of all individuals recorded during the surveys. Auks in general dominated the assemblage of bird species throughout the year (Seagreen, 2012). Further boat-based surveys were undertaken in 2017 to inform the Optimised Project EIA Report (Seagreen, 2018). A total of 20 species were observed during the 2017 survey. As per the 2009 – 2011 surveys, common guillemot, black-legged kittiwake and northern gannet were the dominant species, accounting for an overall of 71% of all sightings. Other species of importance recorded included razorbill and Atlantic puffin. High densities of common guillemot, black-legged kittiwake and northern gannet were observed in 2017 in July. This high July density is thought to be linked to an abundance of prey in the area at that time and with the beginnings of post-breeding dispersal and passage (Seagreen, 2018). Further pre-construction aerial surveys of the site were undertaken between March 2019 and September 2020. The resulting data is still being processed.

Tagging and colony monitoring for key seabird species during the breeding season at the Isle of May was completed during June and July 2020. Monitoring of gannet was also undertaken at the Bass Rock during the same period. This work will be repeated during the construction phase and will also include tagging and colony monitoring at the Fowlsheugh and St.Abbs Head SPA colonies. The results of the monitoring studies will be reported to the FTRAG Ornithology subgroup.

4.7.2 Assessment of Potential Effects on Ornithology

The presence of vessels in the Seagreen OWF Site during the proposed target clearance activities has the potential to impact birds through disturbance and displacement from foraging activities.

The 2012 ES (Seagreen, 2012) and the subsequent 2018 Optimised Project EIA report (Seagreen, 2018) assessed the potential for displacement, and indirect impacts on prey availability, during construction. Displacement due to presence of vessels in the Seagreen OWF Site was assessed as negligible or minor and not significant for all species types recorded. The number of vessels in the Seagreen OWF Site will be limited to those listed in Section 2.5 and any guard vessel(s). In addition, operations will be very localised and of short duration, resulting in very limited displacement of foraging activities relative to the overall area available. Given that the overall footprint of activities and their short duration, it is concluded that impacts on ornithology through displacement due to vessel presence is not significant and negligible.

4.8 Protected Sites

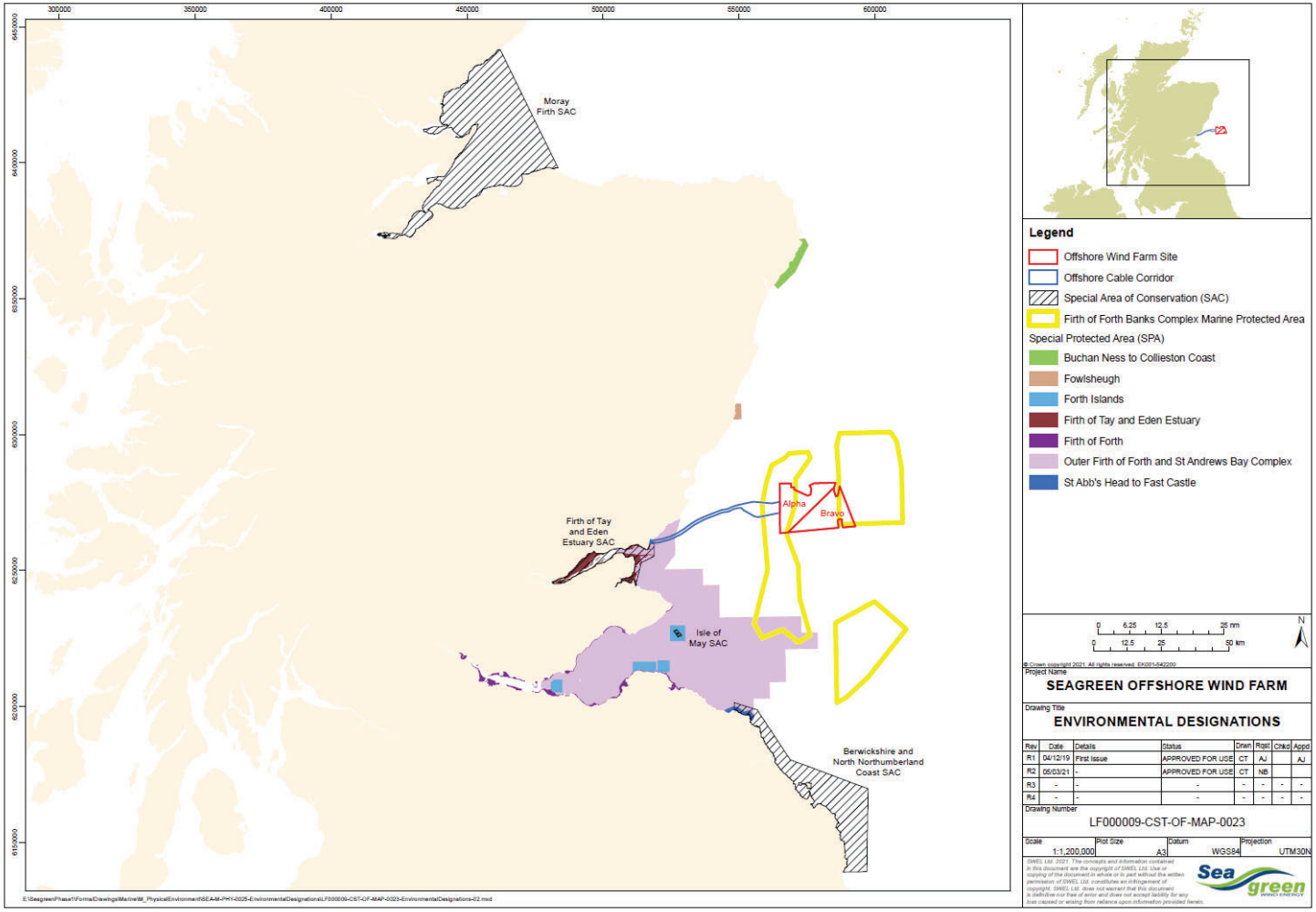
A number of European designated sites with connectivity to the Seagreen OWF site were considered in the EIA (Seagreen, 2018). All sites that could be affected by construction of the project are listed in Table 4.2 and are presented in Figure 4-1.

Table 4.2 Protected Sites in Vicinity to the Seagreen OWF Site

Protected Site	Designation	Distance (km) from Seagreen OWF Site
Firth of Forth Banks Complex Marine Protected Area (MPA)	Ocean quahog aggregations, offshore subtidal sands and gravels, shelf banks and mounds, moraine representative of Wee Bankie Key.	0
Fowlsheugh Special Protection Area (SPA)	Supporting seabirds; guillemot, razorbill, kittiwake and herring gull	27.5
Outer Firth of Forth and St Andrews Bay Complex SPA	Supporting overwintering seabirds and other waterbirds and breeding seabirds.	29
Firth of Tay and Eden Estuary Special Area of Conservation (SAC)	Supporting harbour seals	47
Forth Islands SPA	Supporting breeding seabirds; gannet, puffin, guillemot, razorbill, kittiwake and herring gull	49
Isle of May SAC	Supporting grey seals	52
Berwickshire and North Northumberland Coast SAC	Supporting grey seals	64.5
St Abb's Head to Fast Castle SPA	Supporting breeding seabirds; guillemot, razorbill, kittiwake and herring gull	66

Protected Site	Designation	Distance (km) from Seagreen OWF Site
Buchan Ness to Collieston Coast SPA	Supporting breeding seabirds; guillemot, kittiwake and herring gull	72
Moray Firth SAC	Supporting bottlenose dolphin	142

Figure 4-1 Protected Sites



4.8.1 Assessment of potential effects on Protected Sites

The proposed clearance works has the potential to affect receptors protected under the designated sites listed above.

The closest site to the project is the Firth of Forth Banks Complex MPA which is located alongside and within Seagreen OWF Site. This site is designated for Ocean quahog aggregations, offshore subtidal sands and gravels, shelf banks and mounds, moraine representative of Wee Bankie Key. As described in Sections 4.3.2 and 4.4.2, impacts on seabed and benthic receptors are not expected to be significant.

The SPA sites in the vicinity of the Seagreen OWF Site, are not expected to be affected given the short duration of activities and the fact only one vessel will be present within the area during clearance works. Therefore, no significant effects are expected on the integrity of the designated SPA sites.

Impacts resulting from UXO detonations on marine mammals, as qualifying features of protected SAC sites, are considered in the EPS risk assessment (LF000009-CST-OF-LIC-REP-0007) which sets out mitigation measures to minimise impacts. The EPS Risk Assessment concluded there would be no effects on the integrity of any of the above sites designated for marine mammals' species.

4.9 Commercial Fisheries

4.9.1 Summary of Baseline

Commercial fisheries of relevance with regard to the Seagreen Project were identified in the 2012 ES and include the following:

- The lobster and crab fishery, using static gear;
- Demersal trawl fisheries, including *Nephrops*, squid and whitefish fisheries; and
- The scallop dredging fishery.

The majority of reported trawling or dredging activity is by vessels over 15m in length with vessels in the 10 to 15m and under 10m category accounting for a very small proportion of the overall landing's values in International Council for the Exploration of the Seas (ICES) rectangle 42E8. However, there is an active static gear fishery targeting lobster and crab at the Scalp Bank, which overlaps ICES rectangles 42E7 and 42E8, extending into the western part of the Seagreen site. Seagreen is continuing to engage with the fisheries sector locally and through the Forth and Tay Commercial Fisheries Working Group.

4.9.2 Assessment of Potential effects on Commercial Fisheries

The potential effects on commercial fisheries may arise from vessel presence and temporary exclusion areas during potential UXO detonations in the Seagreen OWF Site during clearance works. The vessel associated with clearance works may temporarily restrict access to certain areas from commercial fishery vessels, may cause safety issues and potential displacement of fish in the area.

In addition, a temporary safety distance of 1 km radius will be implemented during UXO clearance activities; this means that all commercial fisheries will be prohibited from entering this area during UXO clearance. Any exclusion will be implemented over a short period of time (less than 24 hrs) and across a small area (approximately 3.14 km^2) in relation of the wider fishing area. The main fisheries likely to be affected by the clearance works are targeting scallop, lobster and crab. The remaining fisheries active in the regional study area, namely *Nephrops* and whitefish, show negligible levels of activity in the area and therefore would remain unaffected in terms of temporary loss or restricted access to fishing grounds. In addition, a Notice to Mariners, Weekly Notice of Operations and Kingfisher bulletin updates will be issued in advance of the planned clearance works. The Seagreen MCC will be in operation to monitor and advise contractor vessels within the wind farm site.

There is a potential for vessel to become caught in fishing gear within the Seagreen OWF Site which could lead to safety and manoeuvrability issues. Seagreen has therefore sought to establish Cooperation Agreements for the removal of static fishing gear from the site during the clearance works and the subsequent construction works. Other fishing vessels using mobile gear will be required to remain clear of the vessels engaged in clearance works under COLREGS. This will be monitored by the guard vessel(s) and the MCC.

The 2012 ES and the Optimised Project EIA Report (Seagreen, 2012, 2018) concluded that temporary loss of restricted access to fishing grounds during construction activities were not significant. Due to the temporary and localised nature of the clearance works and the embedded mitigation measures listed in Section 3, it can also be concluded that the proposed clearance activities will not result in significant impacts on commercial fishing activity, and the effects are deemed to be negligible.

4.10 Shipping and navigation

4.10.1 Summary of Baseline

The 2012 ES assessed the baseline conditions of shipping and navigation and found that there are no military training areas, no restrictions on anchoring, no chartered spoil grounds and no marine aggregate dredging areas within or adjacent to the Seagreen OWF Site.

The consented Inch Cape Offshore Wind Farm and Neart na Gaoithe Offshore Wind Farm are both located to the south-west of the Seagreen OWF Site at a minimum distance of 4.6 nm.

The closest Oil and Gas infrastructure is the Buzzard platform located approximately 71nm north-west.

The 2018 EIA found, using 2017 Automatic Identification System (AIS) data, that on average, 18 vessels in winter and 20 vessels in summer pass by the Seagreen OWF Site. The main types of vessel consisted of tankers, cargo vessels and fishing vessels with the majority of these being UK registered. No recreational vessels were recorded in 2017 in winter but in summer a total of seven were recorded.

4.10.2 Assessment of Potential Effects on Shipping and Navigation

Clearance activities, in particular UXO clearance, have the potential to result in obstructions to shipping and navigation in the Seagreen OWF Site. Temporary safety distance of 1 km will be implemented during UXO clearance activities; this means that all other sea users will be prohibited from entering this area during UXO clearance. During clearance works, a single vessel will be used in the area.

Standard mitigation measures will be implemented during these works to ensure impacts to shipping and navigation is kept to a minimum. A Notice to Mariners, Weekly Notice of Operations and Kingfisher bulletin updates will be issued in advance of the planned clearance works. The Seagreen MCC will be in operation to monitor and advise contractor vessels within the wind farm site. In addition, any safety distance of 1 km (during UXO clearance) will be temporary and only required if detonations are required. As detailed in Section 2.7, the preferred method for UXO clearance is low yield disposal, which does not result in a detonation of the UXO.

Due to the standard mitigation measures mentioned above and due to the temporary and localised nature of the clearance works to be undertaken, no significant impact on shipping and navigation is predicted due to the presence of the associated vessels and UXO clearance. Effects to shipping and navigation are therefore considered to be negligible.

4.11 Marine Archaeology

4.11.1 Summary of Baseline

There are no Designated wrecks within the boundaries of the OWF site. However, in addition to known archaeological receptors (maritime and aviation), the 2012 ES identified 55 maritime receptors of high or medium archaeological potential within the marine geophysical surveys, some of which correspond with the known wrecks verified by the UKHO data and listed above. These were given individual AEZ of either 50 m or 100m depending on the potential of the anomaly. In accordance with the Original ES, a consolidated total of 33 AEZs were proposed in the WSI and PAD (LF000009-CST-OF-PLN-0002).

4.11.2 Assessment of Potential Effects on Marine Archaeology

Seabed disturbance during the clearance operations (i.e. grapnel, UXO clearance, boulders/debris removal) could impact marine archaeology. UXO clearance works will avoid AEZs unless absolutely necessary. No significant impacts were identified for the Original ES (Seagreen, 2012), either in isolation or cumulatively on the basis of the implementation of the AEZs. The WTG locations and IAC routes avoid overlap with any AEZ; therefore, no additional impacts are expected on marine archaeology.

Should any previously unknown sites or material be encountered during the works, measures will be taken to reduce the level of impact. Unexpected material that may be encountered during the course of the Seagreen Project will be addressed through measures outlined in the Seagreen WSI and PAD (LF000009-CST-OF-PLN-0002), specifically the Protocol for Archaeological Discoveries: Offshore Renewables Project (ORPAD).

Due to the planned avoidance of the AEZs, implementation of the embedded mitigation measures and localised nature of the work, the effects of clearance operations on marine archaeology are expected to be negligible.

5. Potential Cumulative Effects

Cumulative impacts can occur when the impacts from one project on an identified receptor combine (through either spatial or temporal overlap) with similar impacts from other projects on the same receptor.

The identification and subsequent clearance operations are expected to take up to three months, with up to 20 confirmed UXO detonations during this period using the preferred low-yield option if possible; therefore, the potential for any cumulative impacts arising are low. The impacts from the boulder relocation and PLGR are expected to be negligible and not significant.

With respect to seabed habitat and benthic ecology disturbance, the targets found in the Seagreen OWF Site will be removed from the same limited areas that will be subsequently impacted during construction. As a result, the total amount of seabed affected will not be increased by the clearance works when compared to the impacts detailed in the previous assessments. Due to the small area of seabed that may be affected during clearance works and the fact that that no extent of sensitive habitats or species were recorded during the EIA characterisation surveys and subsequent investigations, no significant cumulative impacts on the seabed are envisaged.

The main impacts predicted in terms of fish and shellfish receptors are seabed disturbance and noise. The 2012 ES and 2018 EIA Report assessed the noise effects from pile driving would be the worst-case source of noise (see Section 4.5.2); therefore, the impacts derived from any potential detonations of UXOs is not expected to cause a significant cumulative impact given the short duration of the clearance activities.

The 2018 EIA completed a cumulative impact assessment on noise effects from pile driving from the Seagreen, Inch Cape and Neart na Gaoithe Offshore Wind Farms. This concluded equivalent negligible or minor impacts which were considered not significant. The only exception of this was for multiple piling events which were determined to potentially cause a significant impact on harbour seals. Considering any UXO detonation from the low-yield disposal, noise impact will be considerably less than the noise assessments done for the full construction of the project and the short duration, the proposed clearance works will not cause significant cumulative impacts on marine mammals.

During the construction phase of the Seagreen project, the 2012 ES and 2018 EIA Report concluded that impacts on ornithology will be minor with the potential for cumulative impacts deemed to be not significant. Due to the localised and short-term nature of the proposed operations, cumulative impacts are unlikely to occur from the presence of vessels during clearance works.

The cumulative impact assessment in the 2018 EIA concluded all impacts from the presence of construction vessels on commercial fisheries are expected to be minor and not significant. The exception to this is a moderate effect on the temporary loss of grounds for the lobster and crab fishery. Due to the temporary and localised nature of the clearance works and the embedded mitigation measures listed in Section 3, it can also be concluded that the proposed clearance activities will not result in significant cumulative impacts on commercial fishing activity, and the effects are deemed to be negligible.

In terms of shipping and navigation (particularly commercial fisheries), cumulative receptors assessed remain the same or less than those assessed for the 2012 Offshore ES. Recreational impacts were not assessed as there was no cumulative pathway identified. All impacts were concluded to be not significant within the EIA

Report and within the 2012 Offshore ES. Therefore, the proposed clearance works is not expected to cause any cumulative effects.

Given the limited number of identified developments in the wider Firth of Forth region there are few activities that could have a significant cumulative impact upon archaeology and cultural heritage. As such there is minimal potential for the indirect impacts to extend cumulatively to these developments. Therefore, the significance of impact is likely to be no greater than that identified for the Seagreen Project and is considered to be negligible and not significant.

Nearby projects in the vicinity of the Seagreen OWF Site include the Neart Na Gaoithe OWF which is currently under construction. However, as stated above, the 2018 EIA Report carried out a cumulative assessment on the Seagreen, Inch Cape and Neart na Gaoithe Offshore Wind Farms and concluded that no cumulative impacts were expected on the receptors mentioned above.

The ES (Seagreen, 2012) and EIA (Seagreen, 2018) concluded no significant adverse cumulative impacts were predicted for the above-mentioned receptors, either for Project Alpha, or Project Bravo in isolation, combined, or cumulatively with other plans and projects during construction. Conclusions from the 2012 ES and 2018 Optimised Project EIA Report are still considered to be appropriate for this assessment in support of the Marine Licence application for target clearance activities. This conclusion is reinforced by the localised and temporary nature of the proposed activities.

6. Assessment of Likely Significant Effects (LSEs) on Integrity of Protected Sites

This Section provides an assessment of potential LSE on the integrity and conservation objectives of nearby Natura 2000 sites, arising from the proposed clearance operations.

In order to avoid the deterioration of the qualifying habitats and to ensure the site's integrity is maintained, the following require to be maintained in the long term:

- Extent of the habitat on site;
- Distribution of the habitat within site;
- Structure and function of the habitat
- Processes supporting the habitat
- Distribution of typical species of the habitat
- Viability of typical species as components of the habitat
- No significant disturbance of typical species of the habitat.

6.1 Berwickshire and North Northumberland Coast SAC

The SAC regularly supports a population of 501 to 1,000 grey seals (JNCC, 2015), with a number of breeding colonies. The EPS Risk Assessment has considered the effects of noise impacts on any marine mammals in the vicinity. Due to the distances involved, no other LSEs are expected on this site.

6.2 Firth of Tay and Eden Estuary SAC

When designated (2005), the SAC regularly supported a population of 600 harbour seals, which was deemed to be important in maintaining the overall population size and was considered significant as sources of emigration to smaller or newly established groups (Scottish Natural Heritage, 2006a). However, since then, counts of harbour seals within the SAC have declined. The EPS Risk Assessment has considered the effects of noise impacts on any marine mammals in the vicinity. Due to the distances involved, no other LSEs are expected on this site.

6.3 Isle of May SAC

The SAC supports the largest grey seal breeding colony on the east coast and the fourth largest in the UK (Scottish Natural Heritage, 2011). The EPS Risk Assessment has considered the effects of noise impacts on any marine mammals in the vicinity. Due to the distances involved, no other LSEs are expected on this site.

6.4 Moray Firth SAC

The SAC supported approximately 130 bottlenose dolphins in 2016 (Cheney *et al*., 2018) and due to its small size and relative isolation, the population is vulnerable to natural and human induced environmental change (Scottish Natural Heritage, 2006b); however, the bottlenose population is usually coastally distributed. The EPS Risk Assessment has considered the effects of noise impacts on any marine mammals in the vicinity. Due to the distances involved, no other LSEs are expected on this site.

6.5 Special Protection Areas

No LSEs are expected on Fowlsheugh SPA, Forth Islands SPA, St Abb's Head to Fast Castle SPA or the Outer Firth of Forth and St Andrews Bay Complex SPA due to the distances involved and/or the temporary nature of the clearance works.

7. Conclusion

This document has been prepared in advance of the proposed target clearance works at the Seagreen OWF site to support the required Marine Licence application in respect of this activity. The clearance works will commence during June 2021 and are expected to be completed by the end of August 2021.

Consideration has been given to the potential impacts expected during these clearance works on the associated receptors. No receptors are predicted to be significantly or cumulatively impacted given the localised and temporary nature of the clearance works, especially with the mitigation measures that will be implemented.

A LSE assessment was completed for the protected SAC and SPA sites in the vicinity of the Seagreen OWF Site. The SACs in the vicinity of the Seagreen OWF Site are protected for marine mammals. Any noise related effects have been assessed in the EPS Risk Assessment. No other LSEs are expected based on the distances involved and the temporary nature of the proposed clearance works. No LSE is expected for the SPA protected sites given the distances involved and/or the temporary nature of the clearance works.

Considering the proposed mitigation mentioned above, along with the mitigation implemented in the EPS Risk Assessment in respect of any UXO clearance, if required, it is expected that no significant effects will occur to the receptors within the Seagreen OWF Site during the proposed clearance works.

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9. Appendix

9.1 Seagreen OWF Site Coordinates

Site	Latitude 30N	Longitude 30N	Latitude DD N	Longitude DD W	Latitude DDM	Longitude DDM
Alpha	565252	6263724	56.51339	-1.939632	56° 30.803' N	1° 56.378' W
	565124.8	6281999	56.67755	-1.937101	56° 40.654' N	1° 56.226' W
	569266.5	6282055	56.67747	-1.869503	56° 40.648' N	1° 52.170' W
	569266.5	6280568	56.66411	-1.869903	56° 39.847' N	1° 52.194' W
	570383.4	6280568	56.66394	-1.851685	56° 39.837' N	1° 51.101' W
	570383.4	6279789	56.65694	-1.851898	56° 39.417' N	1° 51.114' W
	575395.9	6277503	56.63563	-1.770823	56° 38.138' N	1° 46.249' W
	576479.6	6277977	56.63971	-1.753018	56° 38.383' N	1° 45.181' W
	576699.8	6280077	56.65854	-1.748805	56° 39.512' N	1° 44.928' W
	576107.1	6281262	56.66928	-1.758121	56° 40.157' N	1° 45.487' W
	577784.8	6282172	56.67717	-1.730478	56° 40.631' N	1° 43.829' W
	585625.7	6282279	56.67677	-1.602512	56° 40.606' N	1° 36.151' W
	585149.3	6280641	56.66214	-1.610828	56° 39.729' N	1° 36.650' W
	568157.5	6263993	56.51538	-1.892356	56° 30.923' N	1° 53.541' W
Bravo	568157.5	6263993	56.51538	-1.892356	56° 30.923' N	1° 53.541' W
	585149.3	6280641	56.66214	-1.610828	56° 39.729' N	1° 36.650' W
	584925.6	6279872	56.65528	-1.614729	56° 39.317' N	1° 36.884' W
	585727	6277284	56.63189	-1.60252	56° 37.913' N	1° 36.151' W
	586413.4	6277557	56.63422	-1.591244	56° 38.053' N	1° 35.475' W
	587207.9	6281044	56.66539	-1.577116	56° 39.923' N	1° 34.627' W
	592965.1	6266284	56.53172	-1.488521	56° 31.903' N	1° 29.311' W
	588286.6	6265852	56.52874	-1.564705	56° 31.724' N	1° 33.882' W
	587917.3	6268180	56.54971	-1.569919	56° 32.983' N	1° 34.195' W
	588043.3	6268824	56.55548	-1.567653	56° 33.329' N	1° 34.059' W
	586771.9	6268899	56.55639	-1.588302	56° 33.383' N	1° 35.298' W
	586493.3	6268277	56.55085	-1.593042	56° 33.051' N	1° 35.583' W
	586782.7	6265713	56.52777	-1.589193	56° 31.666' N	1° 35.352' W