CONTROLLED DOCUMENT

Title:

Windermere Decommissioning Project

Environmental Statement

Notes:

FINAL

Revision Record:

3	18/03/21	RoS	P Jones	Head of SHEQ	P Jones	18/03/21
2	19/01/18	Orbis Energy	P Jones	HSE Advisor	P Jones	26/01/18
1	12/10/15	Orbis Energy	P Jones	HSE Advisor	P Jones	16/10/15
0	31/03/15	Orbis Energy	-	-	-	-
Rev.	**Date Prepared**	**Author**	**Name**	**Title**	**Signed**	**Date App'd**
Document Origination			**Document Approval for INEOS**			

Table of Contents

Tables

Figures

Standard Information Page

Project Name	Windermere Decommissioning Environmental Statement
Type of Project	Decommissioning
Undertaker Name	INEOS UK SNS Limited
Undertaker Address	Anchor House, 15-19 Britten Street, London. SW3 3TY
Short Description	INEOS is proposing to decommission the infrastructure associated with the Windermere Development which is located within UKCS Blocks 49/9, 49/4 and 49/5 in the Southern North Sea (SNS). Production ceased in April 2016. The pipeline and umbilical were cleaned and flushed in 2017 and remain in a flooded condition. The wells were plugged and abandoned in 2019. This Environmental Statement (ES) has been prepared to support the Decommissioning Programme (DP). In accordance with UK guidance the potential options for decommissioning of the export pipeline and umbilical were assessed during a Comparative Assessment and it was determined the most viable option for this infrastructure would be to: 1. partially remove the pipeline and leave the remainder *in situ* with the ends buried; 2. partially remove the umbilical and leave the remainder *in* situ with the ends buried. With regard to the stabilisation material, an attempt shall be made to remove any exposed concrete mattresses and grout bags. Where this cannot be undertaken, a proposal will be made to BEIS to leave them *in situ*. The other stabilisation materials (i.e. rock) will be left *in situ*.
Previously Submitted Environmental Documents	None
Significant Environmental Impacts Identified	None
Statement Prepared By	INEOS UK SNS Limited (in conjunction with Orbis Energy Limited)

Abbreviations

Abbreviation	Explanation
ALARP	As low as reasonably practicable
ATOC	Acoustic Thermometry of Ocean Climate
BAC	Background Assessment Concentration
BC	Background Concentration
BMS	Business Management System
BOD	Biological oxygen demand
BRS	Behavioural Response Score
ca.	Circa
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CH_4	Methane
cm	Centimetre
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CoP	Cessation of Production
DECC	Department of Energy and Climate Change
DEFRA	Department of Environment, Food and Rural Affairs
DP	Decommissioning Programme
DSV	Dive Support Vessel
DTI	Department of Trade and Industry (now Department of Energy and Climate Change)
EA	Environment Agency
EEMS	Environmental and Emissions Monitoring System
EEZ	Exclusive Economic Zone
EHS	Environmental, Health & Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
ERL	Effects Range-Low
ERRV	Emergency Response and Rescue Vessel
ES	Environmental Statement
EUNIS	The European Nature Information System
FPSO	Floating Production, Storage and Offloading
GJ	Gigajoules
GWP	Global Warming Potential
H_2S	Hydrogen Sulphide
HLV	Heavy Lift Vessel

HS&E	Health, Safety & Environment
HSE	Health and Safety Executive
ICES	International Council for the Exploration of the Sea
ISO	International Standards Organization
ITOPF	International Tanker Owners Pollution Federation Ltd
JNCC	Joint Nature Conservation Committee
km	Kilometre
km^2	Kilometres Squared
KP	Kilometre Point
LAT	Lowest Astronomical Tide
LSA	Low Specific Activity
m	Metre
m^3	Cubic Metre
MARPOL	International Convention for the Prevention of Pollution from Ships
MCV	Monohull Crane Vessel
MCZ	Marine Conservation Zone
MLWM	Mean Low Water Mark
mm	Millimetre
MMO	Marine Mammal Observers
MoD	Ministry of Defence
MODU	Mobile Offshore Drilling Unit
MPA	Marine Protected Area
MSDF	European Marine Strategy Framework Directive
NFFO	National Federation of Fishermen's Organisation
Nm^3	Normal Cubic Metres
NO_2	Nitrous Oxide
NOx	Oxides of Nitrogen
NOAA	National Oceanic and Atmospheric Administration
NTS	Non-Technical Summary
NUI	Normally Unmanned Installation
OCNS	Offshore Chemical Notification System
ODE	Offshore Design Engineering Limited
OGUK	Oil & Gas UK
OMR	Offshore Marine Regulations
OPEP	Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
P&A	Plug and Abandon
PAH	Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
PEXA	Practice and Exercise Area
PL	Pipeline
PLONOR	Poses Little Or No Risk
POB	Persons on Board

PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SCANS-II	Small Cetaceans in the European Atlantic and North Sea
SCI	Site of Community Importance
SCOS	Special Committee on Seals
SEA	Strategic Environmental Assessment
SEL	Sound Exposure Level
SHE	Safety, Health and Environment
SLV	Shear Leg Vessel
SNS	Southern North Sea
SO_2	Sulphur Dioxide
SoS	Secretary of State
SPA	Special Protection Area
SPL	Sound Pressure Level
SSSI	Site of Special Scientific Interest
THC	Total Hydrocarbon Concentration
TOC	Total Organic Carbon
TOM	Total Organic Matter
TTS	Temporary Threshold Shift
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association (now Oil & Gas UK)
UTM	Universal Transverse Mercator
VOC	Volatile Organic Chemicals
WFD	Waste Framework Directive
WGT	West Gate Transport

Non-Technical Summary

Introduction

INEOS UK SNS Limited (hereafter referred to as 'INEOS') is planning to decommission the Windermere development. Windermere lies in the United Kingdom Continental Shelf (UKCS) Block 49/9b of the southern North Sea (SNS).

INEOS is preparing a Decommissioning Programme (DP) to be submitted to BEIS for approval under the Petroleum Act 1998, as amended by the Energy Act 2008. In support of the DP, this Environmental Statement (ES) presents the findings of the Environmental Impact Assessment (EIA) carried out for the Windermere decommissioning project, as required under the Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2011 and in line with Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines (BEIS 2018).

This section of the document forms the Non-Technical Summary (NTS) to the EIA.

Project Overview

The Windermere Development is located in the SNS and spans three UKCS Blocks (49/4e, 49/5a and 49/9b). The offshore facilities, installed in 1997, consist of a Normally Unmanned Installation (NUI) platform, which produced gas (until April 2016) from the Leman / Rotliegendes sandstone reservoir, two platform wells and one 8 inch export pipeline to the former Spirit Energy operated Markham ST-1 platform (now removed) (6.8 kilometres long). Electrical power, control and chemicals were supplied to the Windermere NUI by a 3.7" umbilical from the ST-1 Platform. There is no processing equipment on the NUI platform – during production operations, gas flowed directly from the wells via the production manifold to the export pipeline.

Both platform wells were plugged and abandoned in 2019.

Decommissioning activities will include the removal of the Windermere NUI platform from the seabed (as required under OSPAR Decision 98/3).

In accordance with UK guidance, the potential options for decommissioning of the export pipeline and umbilical have been assessed by INEOS. Following a cleaning, flushing and flooding workscope that was completed on both the pipeline and umbilical in 2017, it has been determined that the most viable decommissioning option for this infrastructure would be to:

1. partially remove the pipeline (exposed pipeline sections near to the platforms and tie-in spools) and leave the remainder *in situ* with the ends buried; and
2. partially remove the umbilical (exposed sections near to the platforms) and leave the remainder *in situ* with the ends buried.

An attempt will be made to remove all of the concrete mattresses and grout bags (stabilisation material placed over the export pipeline and umbilical). However, where this cannot be performed safely, INEOS shall make a proposal to BEIS to leave them *in situ*. The other stabilisation materials (i.e. rock) will be left *in situ*.

Project Schedule

It is currently envisaged that offshore decommissioning scope will be completed by 2023.

The Existing Environment

A key consideration when planning and finalising the Windermere DP is a clear understanding of the surrounding environment. This section provides an overview of the physical, biological and socio-economic environment both within UKCS Blocks 49/4e, 49/5a and 49/9b (the Blocks of Interest), as well as in the wider SNS area.

In order to obtain an accurate baseline, a pre-decommissioning site survey was undertaken at the Windermere Development in July 2014. The main objectives of the pre-decommissioning survey were to:

1. Establish sediment, habitat type and general environmental conditions and identify any features of importance such as potential Annex I habitats at/around the Windermere platform and along the pipeline/umbilical route corridor to the location of the former ST-1 platform which has been removed; and
2. Identify whether there are any discernible impacts on the environment from the Windermere development.

Physical Environment

The Windermere platform is located approximately 140 km north east of the nearest UK landfall, near to the town of Cromer on the north Norfolk coastline and 9 km to the west southwest of the UK/Netherlands transboundary line.

The water depth at the Windermere platform location is approximately 36 metres (m) to lowest astronomical tide (LAT) (*Fugro, 2014a*).

Seabed sediments across the survey area are predominantly sand. Megaripples characterise the area to the north of the Windermere platform and along much of the pipeline route corridor while the area to the south is relatively featureless (*Fugro, 2014a*).

Chemical analysis of the seabed samples taken during the pre-decommissioning survey found that total organic carbon, total organic matter and hydrocarbon concentrations are generally low throughout the survey area (*Fugro, 2014a*). Several heavy and trace metals exceeded sediment quality guideline thresholds, however, this is typically expected within the North Sea and is not considered indicative of contamination due to drilling at Windermere (*Fugro, 2014a*). In addition, distributions of n-alkanes were consistent with predominantly terrestrial hydrocarbon inputs, indicating that the sediments have not been contaminated by hydrocarbons from drilling and production activities (*Fugro, 2014a*).

Biological Environment

<u>Seabed communities</u>

Biotopes are areas of uniform environmental conditions which provide a characteristic habitat for certain species to live in. Biotopes provide a way of defining biological communities that may be expected to occur in an area based on other physical or biological characteristics.

Analysis of data obtained during the Windermere pre-decommissioning survey found the majority of the seabed was broadly characterised as Sublittoral Sand. Three EUNIS habitats were identified: 'A5.27: Deep Circalittoral Sand', which covered the majority of the survey area; 'A5.26: Circalittoral Muddy Sand', found in the southern most region of the survey area; and 'A5.15: Deep Circalittoral Coarse Sediment', located in one area to the north of the pipeline. These habitats vary slightly according to their relative proportions of fine material, but the faunal assemblages present are similar (*Fugro, 2014a*).

Mobile fauna are more common in coarser sediments and infaunal burrowing organisms, such as bivalves and worms, tend to dominate in finer sediments with an increased organic content. Abundant taxa in the Windermere pre-commissioning survey area included the polychaetes *Spiophanes bombyx*, *Galathowenia oculata*, *Lagis koreni* and *Diplocirrus glaucus*, bivalves *Mactra stultorum*, *Corbula gibba*, *Kurtiella bidentata*, *Cochlodesma praetenuae* and *Goodallia* *triangularis*, along with *Amphiura filiformis* of the family Ophiuroidea. All these taxa are commonly recorded from similar habitats in the SNS region (e.g*. EMU, 2013, 2011; Rees et al., 2007; Kunnitzer et al., 1992*).

Fish spawning and nursery grounds

Several fish species use the shallow waters of the SNS as spawning and nursery grounds. The Windermere Development is located within a potential spawning area for cod, herring, lemon sole, mackerel, *Nephrops*, plaice, sandeels, sole, sprat and whiting. The area is also a potential nursery ground for anglerfish, cod, herring, horse mackerel, lemon sole, mackerel, *Nephrops*, sandeels, sprat, spurdog, tope shark and whiting (*Coull et al., 1998; Ellis et al., 2012*).

Herring are a commercially important fish species and protection is afforded to grounds which are identified as herring spawning grounds to prevent habitat degradation. As part of the pre-decommissioning survey, an assessment of the suitability of the sediments for herring spawning was undertaken. All stations were classified as having none or low herring spawning potential, which was consistent with a previous assessment conducted in 2014 in UKCS Block 49/5a (*Fugro, 2014a*).

The majority of other fish species of conservational significance (e.g. anadromous / catadromous fish species, sea lamprey, allis shad and twaite shad), are coastal and occur in greatest abundance in relatively shallow coastal water (*DTI, 2002*). They are therefore unlikely to be present in the vicinity of the Windermere infrastructure (approximately 140 km east of the nearest UK landfall).

Shellfish

There are a number of shellfish species that are commercially important to the SNS and may be present within the vicinity of the Windermere Development, these include the Norway lobster, European lobster, the brown (or edible) crab, crawfish, the spider crab, brown shrimp, scallops, queen scallops and mussels.

Elasmobranch species

Elasmobranchs are a group of fish which encompasses sharks, skates and rays. Based on a survey conducted by CEFAS, eight species of elasmobranch may be present within the general vicinity of the Windermere Development; blond ray, cuckoo ray, lesser spotted dogfish, spotted ray, spurdog, starry skate, thornback ray and tope shark (*Ellis et al., 2004*).

Basking sharks are also known to frequent the offshore waters of the North Sea between April and September, therefore this species may also occur, albeit infrequently (*DTI, 2002*).

Seabirds

The Windermere Development is located in an area of moderate importance for international concentrations of birds (*DTI, 2002*). Fulmar are present in highest numbers during the early and late breeding seasons, leading to peak densities in September. Kittiwakes are widely distributed throughout the year. Lesser black-backed gull are mainly summer visitors, while in contrast guillemot numbers are greatest during winter months. In addition, substantial numbers of terns migrate northwards through the offshore North Sea in April and May, with return passage from July to September (*DECC, 2009*).

The Seabird Oil Sensitivity Index (SOSI) (*Webb et al., 2016*) combines seabird data collected between 1995 and 2015 and individual seabird species sensitivity index values to create a single measure of seabird sensitivity to oil pollution. The SOSI score for each UKCS Block can be ranked into sensitivity categories, from 1 (extremely high sensitivity) to 5 (low sensitivity). An assessment of the median SOSI scores indicates that the sensitivity of seabirds to oil pollution within Block 49/4 are ‘very high’ in July and ‘high’ during November to January. The remainder of the year has a 'low' sensitivity. Similarly, Block 49/5 has a 'high' sensitivity recorded during November to January with the remainder of the year recorded as 'medium' to 'low' sensitivity. Block 49/9 has a 'low' sensitivity throughout the year, with the exception of February to April where no data is available.

Marine mammals

According to Reid *et al.* (*2003*) three species of cetaceans (whales, dolphins, and porpoises) have been previously been sighted in the area around the Windermere Development; harbour porpoise, minke whale and white-beaked dolphin. The harbour porpoise is the most common cetacean species in UK waters (*DECC, 2009*) and have been recorded in low numbers from February to August and in November. White-beaked dolphins have been observed in the vicinity of the Windermere Development in moderate numbers during April and November, with low numbers also observed in June to July, October and November. Low numbers of minke whale have been recorded during August.

Two species of seals; grey seal and the harbour (or common) seal are found in the North Sea around the east English coast. Satellite tagging studies suggest that grey seals may undertake foraging trips to the offshore waters surrounding the Windermere Development, but if present would only be encountered in very low numbers (0-1 individuals at any time). Populations of the harbour seal are more discrete than grey seals. However, satellite tagging studies suggest that harbour seals may also undertake foraging trips to the offshore waters surrounding the Windermere Development, but again would only be encountered in very low numbers (*SCOS, 2012*).

In addition, leatherback turtles have occasionally been sighted in the SNS, with the majority of sightings occurring in October and November (*Pierpoint, 2000*).

Protected areas and habitats

There are four protected areas within 40 km of the Windermere Development; Klaverbank Special Area of Conservation (SAC), Markham's Triangle Marine Conservation Zone, the North Norfolk Sandbanks and Saturn Reef SAC and the Southern North Sea SAC.

The Klaverbank SAC is located within the Netherlands exclusive economic zone (EEZ) approximately 2.5 km to the east of the former ST-1 platform location. The Klaverbank is currently an area of special ecological significance and has been designated as a Special Area of Conservation. The site falls under the Annex I habitat type, 'Reefs' (1170). It is also designated for the protection of harbour porpoise, grey seal and common seal (all listed in the Annex II of the EC Habitats Directive). The Klaverbank is the only gravel bank in the Dutch sector of the North Sea and comprises a mixture of gravel, sand and larger rocks. Potentially this area is important for the propagation of fish species like ray and herring which both require hard substrates. Birds and harbour porpoises are sometimes observed in large concentrations within the boundaries of the Klaverbank.

The MCZ, Markham's Triangle, lies approximately 3 km to the northeast of the former ST-1 platform location. This site contains two broad-scale habitats that are recommended for designation: subtidal coarse sediment and subtidal sand. The abundance of burrowing species provides ideal prey for mobile predators such as crab, seal and dolphin (the latter two are listed in Annex II of the EC Habitats Directive). Shallow sandy sediments are also an ideal habitat for sand eel, which form an important diet constituent for marine mammals and seabirds (*JNCC, 2020a*).

The North Norfolk Sandbanks and Saturn Reef SAC is located approximately 25.5 km south-west of the Windermere platform. This site is designated due to the presence of Annex I shallow sandbank habitats, which form a series of ten main sandbanks and associated smaller banks, and also *Sabellaria spinulosa* biogenic reef. The North Norfolk Sandbanks is the most extensive example of offshore linear ridge sandbank type in UK waters (*Graham et al., 2001*). The Saturn Reef comprises thousands of tubes formed by the tube building Ross worm (*Sabellaria spinulosa*) which forms a microhabitat attracting a more diverse assemblage of species compared to the surrounding area.

The Southern North Sea SAC lies approximately 15km south-west of the Windermere field at its closest point. This site is designated for the Annex II species 'Harbour Porpoise'. The Southern North Sea SAC lies along the east coast of England, predominantly in the offshore waters of the central and southern North Sea, from north of Dogger Bank to the Straits of Dover in the south. It covers an area of 36,951 square kilometres, designated for the protection of harbour porpoise. This area supports an estimated 17.5 percent of the UK North Sea Management Unit population. Approximately two thirds of the site, the northern part, is recognised as important for porpoises during the summer season, whilst the southern part support persistently higher densities during the winter (*JNCC, 2019*).

The SAC ranges in depth from Mean Low Water down to 75 metres, with the majority of the site shallower than 40 metres, and is characterised by its sandy, coarse sediments which cover much of the site. These physical characteristics are thought to be preferred by harbour porpoise, likely due to availability of prey (*JNCC, 2019)*.

As part of the environmental scope of the site survey, the presence or absence of Annex I habitats within the Windermere Development area was also assessed. The survey did not identify any evidence of biogenic reefs or sandbanks (*Fugro, 2015*).

Socio-Economic environment

Commercial fisheries landings and effort are split into sectors called International Council for the Exploration of the Sea (ICES) Rectangles. The Windermere Development lies within ICES Rectangles 36F2. Between 2014 and 2018, the mean annual fishing effort for ICES Rectangle 36F2 was 106 days, which is low and consistent with fishing effort for large areas of the SNS. Fishing effort (days) was dominated by gear falling to the category trawls (*Marine Scotland, 2020*).

According to OGA (2016), shipping density within UKCS Blocks 49/4 and 49/5 is high and in 49/9 is low, although a 500 metre (m) zone currently exists around the Windermere platform.

Oil and gas activity surrounding the Windermere Development is generally low to moderate (*UKOilandGasData, 2018*). The nearest platforms is the Spirit Energy operated JA6 platform (located 11.5 km to the east) within the Dutch EEZ. No pipelines or cables cross the Windermere subsea infrastructure.

There are no offshore dredging sites within the Blocks of Interest. The nearest site is the aggregates application area, 'Humber 5', located 31 km to the south west of the Windermere platform (**Figure 4-24**) (*Crown Estate, 2017*).

There are no active windfarms in close proximity to the Windermere Development, however the Development Consent Order for the Orsted Energy Hornsea Project Three located within Blocks 49/4 and 49/9 was approved in 2020 (**Figure 4-24**) (Orsted, 2020).

The Blocks of Interest also lie within a Royal Air Force practice and exercise area (*DECC, 2009*).

No wrecks were identified in the survey area during the Windermere pre-decommissioning survey (*Fugro, 2014a*).

Leisure based and tourist activities are fairly widespread along the east coast of England. Given the distance of the Windermere Development from the coast, the tourism industry is not expected to be impacted significantly by the operations of the Windermere Decommissioning Programme.

In addition, the outputs from modelling the worst case oil spill scenario, of the instantaneous loss of the fuel tank capacity of a heavy lift vessel (2,000 cubic metres (m^3) of diesel) at the Windermere platform location, indicate that the diesel would not beach.

Summary of environmental sensitivities

A summary of the key seasonal environmental sensitivities in the vicinity of the Windermere Development is show in Table 1 below.

Table 1 Key Sensitivities within the Vicinity of the Windermere Development

Activity in the Blocks of Interest, surrounding waters and adjacent coastline													
Component	Abundance/Activity	J	F	M	A	M	J	J	A	S	O	N	D
Plankton	Phytoplankton and zooplankton												
Benthic Fauna	Benthic faunal communities												
Fish Note 1	Anglerfish			N	N	N	N	N	N				
	Cod			N	N	N	N						
	Herring										N	N	N
	Horse mackerel					N	N	N	N	N	N		
	Lemon sole						N	N	N	N	N	N	
	Mackerel							N	N	N	N		
	Nephrops	N	N	N	N	N	N	N	N	N	N	N	N
	Plaice												
	Sandeels	N	N	N	N								
	Sole												
	Sprat							N	N	N	N		
	Spurdog	N	N	N	N	N	N	N	N	N	N	N	N
	Tope shark	N	N	N	N	N	N	N	N	N	N	N	N
	Whiting				N	N	N	N	N				
Seabirds Note 2	Block 49/4 offshore vulnerability	3*	5*	5	5*	5*	5	2	5	5	5*	3*	3
	Block 49/5 offshore vulnerability	3*	5*	5	5*	5*	5	3	4	5	5*	3*	3
	Block 49/9 offshore vulnerability	5*	-	-	-	5*	5	5	5	5	5*	5*	5
Cetaceans	Harbour porpoise												
	Minke whale												
	White-beaked dolphin												
Resource Users	Commercial fishing (ICES rectangle 36F2)												
	Shipping and ports												
	Military activity												
	Oil and gas activity (including pipelines)												
	Telecommunications cable												
	Dredging and dumping												

Activity in the Blocks of Interest, surrounding waters and adjacent coastline													
Component	**Abundance/Activity**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
	Offshore windfarms	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
	Marine protected areas	High/Peak	High/Peak	High/Peak	High/Peak	High/Peak	High/Peak	High/Peak	High/Peak	High/Peak	High/Peak	High/Peak	High/Peak
	Coastal protected sites	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
	Tourism, recreation & leisure activities	Low	Low	Low	Low	High/Peak	High/Peak	High/Peak	High/Peak	High/Peak	Low	Low	Low

Key									
	High/Peak		Medium		Low		Very Low		No Activity

Note 1: N = Nursing
Note 2: 1 = Extremely High; 2 = Very High; 3 = High; 4 = Medium; 5 = Low; - = No Data.
SOSI sensitivity category marked * indicates an indirect assessment of SOSI scores, in light of coverage gaps.

Impact Assessment

During the EIA, the Windermere Decommissioning project activities with the potential to cause environmental impacts were identified from discussions with the INEOS project team, an informal scoping exercise with key stakeholders and from the EIA team’s previous oil and gas project experience. Potential impacts from both planned and unplanned events were considered, as well as transboundary impacts (i.e. impacts experienced in one country as a result of activities in another) and cumulative impacts (i.e. impacts acting together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the project).

The impacts identified during this process were grouped under the following headings:

1. Physical Presence;
2. Seabed Impacts;
3. Noise;
4. Atmospheric Emissions;
5. Marine Discharges;
6. Unplanned Releases;
7. Solid Wastes.

Each predicted environmental impact was then assessed to define the level of potential risk (major, moderate, minor, negligible or positive) to the environment. Risk was determined by combining the likelihood of an impact occurring with the magnitude of the impact (consequence) on the environment.

Those impacts given a significance ranking of minor or negligible before the application of mitigation measures were considered insignificant and were therefore scoped out from further assessment in the EIA.

Where potentially significant impacts were identified (i.e. those impacts considered to pose a major or moderate risk to the environment), mitigation measures were defined in order to remove, reduce or manage the potential impacts to reduce the risk to as low as is reasonably practicable.

Where appropriate mitigation measures are to be applied, the potential impacts were then reassessed to determine if the overall impact significance had been reduced. These remaining impacts are referred to as **residual impacts** (i.e. the impact that is predicted to remain once mitigation measures have been designed into the intended activity).

A summary of the residual risk for those impacts identified as potentially significant is provided in Table 2 below.

Table 2 Windermere Decommissioning Project Potentially Significant Environmental Impacts

Environmental Aspect	Environmental Receptor(s)	Description of Potential Impacts	Impact Before Mitigation	Proposed Mitigation Measures	Residual Impact
Physical Presence					
Removal of the Windermere platform	Shipping Commercial Fishing	Once the removal of the Windermere platform is complete, the existing exclusion zones around the platform will be removed. This will free up an area of approximately 0.8 km^2 to other sea user and is expected to have a minor positive impact to fishermen who regularly already fish in the area.	Positive	• None required.	Positive
Removal of stabilisation material (concrete mattresses and grout bags)	Commercial Fishing	The removal of the concrete mattresses and grout bags (if safe to do so) will reduce the number of foreign objects on the seabed.	Positive	• None required.	Positive
Partial removal of the pipeline/umbilical and subsequent monitoring and potential remedial operations – Buried pipeline/umbilical section left *in situ*	Commercial Fishing	Over time, it is possible that parts of the pipeline or umbilical may become exposed, presenting a hazard to activities, such as fishing. Going forwards, there will be a minor impact from vessels conducting surveys along the pipeline length as part of the long-term monitoring programme. Should remedial work be required, there will also be a minor impact from the physical presence of vessels conducting remedial burial work along the pipeline length. Please note, at the time of writing this ES,	Moderate	• INEOS will monitor the status of the decommissioned pipeline at appropriate intervals (agreed with BEIS) and take appropriate remedial actions, as required, to ensure that it does not become a hazard to other activities, such as fishing over time; • A Fisheries Liaison Officer (FLO) will be assigned, where necessary, who will be responsible for the distribution of all key information to fishermen; • Other sea users will also be informed of the decommissioning activities, as necessary, and therefore the presence of additional vessel traffic in the area, through Notices to Mariners to enable early warning and planning of proposed activities;	Minor

Environmental Aspect	Environmental Receptor(s)	Description of Potential Impacts	Impact Before Mitigation	Proposed Mitigation Measures	Residual Impact
	Shipping	the exact method of remediation for any exposed parts of the pipeline is not known.	Moderate	• Communications with Fisheries and Maritime agencies will be maintained, as necessary, throughout the DP; • The crew of the Emergency Response and Rescue Vessel (ERRV) attending the jack-up vessel should be experienced in traffic monitoring duties and should be briefed on the main routes of concern in the area; • A collision risk management plan should be developed for the decommissioning operations to record the pre-planning measures taken to minimise the risk of ship collision, and to define the guarding role of the ERRV whilst on location. INEOS will actively seek to minimise the amount of material used for pipeline stabilisation should remedial work be required in the future.	Minor
Disturbance to the Seabed					
Removal of subsea infrastructure	Water Quality Seabed Sediments Benthic Flora and Fauna	Removal of these structures by high energy methods may disturb sediments and lead to an increase in sedimentation, potential destabilisation of the surrounding sediments (if the explosives are placed below the seabed) and a localised increase in turbidity. This can have an impact on water quality and benthic suspension feeders. It is estimated that the removal of the subsea infrastructure could result in a total seabed area of 20,348 square metres (m^2) and a sediment volume of 12,182 m^3 experiencing disturbance.	Moderate	• Subsea infrastructure removal methods will be assessed prior to decommissioning operations beginning, with a view to implementing the removal method, with the least impact to the seabed; • Post-decommissioning a debris survey will be undertaken to remove any objects remaining on the seabed.	Minor

Environmental Aspect	Environmental Receptor(s)	Description of Potential Impacts	Impact Before Mitigation	Proposed Mitigation Measures	Residual Impact
Removal of stabilisation material (concrete mattresses and grout bags)	Water Quality Seabed Sediments Benthic Flora and Fauna	As a 'worst-case' assessment, it is assumed that all 48 of the concrete mattresses and 300 grout bags will be removed from the Windermere Development. Mattress and grout bag removal may disturb sediments and lead to an increase in sedimentation, potential destabilisation of the surrounding sediments and a localised increase in turbidity. This can have an impact on water quality and benthic suspension feeders. It is estimated that the removal of all 48 of the concrete mattresses and all of the 300 grout bags will disturb a total area of seabed of approximately 1,845 m^2.	Moderate	• Concrete mattress and grout bag removal methods will be assessed prior to decommissioning operations beginning, with a view to implement the removal method, with the least impact to the seabed; • Post-decommissioning a debris survey will be undertaken to remove any concrete mattresses and grout bags remaining on the seabed.	Minor
Deployment of jack-up vessel spud cans	Seabed Sediments	Prior to activities starting, the vessel legs need to be jacked down onto the seabed with the hull raised on the legs above the water, providing a stable platform. Excessive penetration by the legs into a soft seabed is prevented by large round feet called spud cans, at the bottom of the legs. Spud-cans typically have a diameter of 18 m and therefore four spud-cans will disturb an area of seabed of approximately 1,020 m^2 to a depth of 0.5 m (giving a sediment volume of 510 m^3), directly below the vessel. Once the vessel has moved off station, it is expected that the indentations	Moderate	• INEOS will actively seek to position the jack-up vessel in a single location during decommissioning. This will reduce the number of instances that jack-up spud cans will be deployed on the seabed.	Minor

Environmental Aspect	Environmental Receptor(s)	Description of Potential Impacts	Impact Before Mitigation	Proposed Mitigation Measures	Residual Impact
		of the spud cans will naturally fill in with sediment.			
Jack-up vessel stabilisation material (rock placement)	Seabed Sediments Benthic Flora and Fauna	Once the vessel is on location, there may be a requirement for the jack-up legs and spud cans to be stabilised by the placement of rock to maintain the integrity of the legs in place and prevent scouring. If rock placement is required, it is estimated that a maximum of 1,000 tonnes of rock would be needed per leg / spud can (totalling 4,000 tonnes of rock). If rock placement is required, operations will have a localised impact on the local sediment faunal communities, potentially smothering any flora and fauna directly beneath it.	Moderate	• INEOS will actively seek to minimise the amount of rock required for jack-up vessel stabilisation, if required.	Minor
Deployment of HLV anchors	Water Quality Seabed Sediments	If the HLV requires anchoring, both the anchors and the anchor chains may disturbed the seabed. It is estimated that a seabed area of 25,444 m^2 and a sediment volume of 13,496 m^3 may experience disturbance as a result of the deployment and removal of the HLV anchors.	Moderate	• INEOS will actively seek to position the HLV in a single location during decommissioning. This will reduce the number of instances that anchors and anchor chains will be deployed on the seabed.	Minor
Remedial action to address pipeline exposures	Seabed Sediments Benthic Flora and Fauna	The pipeline will be partially removed and the remainder will be left *in situ* with the ends buried, after the tie-in spools have been removed. The preferred method of burial for the pipeline ends is trench and bury. The CA concluded that rock dumping	Moderate	• INEOS will actively seek to minimise the amount of material required for pipeline stabilisation.	Minor

Environmental Aspect	Environmental Receptor(s)	Description of Potential Impacts	Impact Before Mitigation	Proposed Mitigation Measures	Residual Impact
		of the two pipeline ends, would only be suitable as a contingency option in the event that the trench and bury approach fails. In addition to burying the pipeline ends, some areas may become exposed and require additional remediation in the future. This can be achieved by one of three methods; rock placement, reburial using jetting or removal of the exposure sections. All three methods will impact the seabed to varying degrees. However, it is considered highly unlikely that any free spans will develop in flooded pipelines. At the time of writing this ES, the exact method of remediation for any (both current and future) exposed parts of the pipelines is not known. Both trench and bury and rock placement operations would result in localised sediment re-suspension and have a localised impact on sediment faunal communities, potentially smothering any flora and fauna in the immediate vicinity of the operations.			
Noise and Vibration					
Surface and subsurface noise generated by decommissioning vessels	Marine Mammals	Generally noise generated during decommissioning activities is likely to be localised, of lower intensity and shorter duration than that generated during installation operations. The greatest source of noise produced during the Windermere decommissioning activities would be from:	Moderate	• In order to minimise any potential impact on marine cetaceans from the proposed Windermere Decommissioning operations, INEOS will seek to conform to the JNCC protocol for minimising the risk of disturbance and injury to marine mammals from underwater noise throughout operations;	Minor
Surface and subsurface noise generated by	Fish		Moderate		Minor

Environmental Aspect	Environmental Receptor(s)	Description of Potential Impacts	Impact Before Mitigation	Proposed Mitigation Measures	Residual Impact

cutting and explosive techniques	Marine Mammals	• The jack-up vessel (on location for an estimated maximum of 275 days);
		• The HLV, which will maintain its position by using thrusters (dynamic positioning) when carrying out operations (on location for 18 days).
		• Cutting techniques used to sever the piles of the Windermere jacket from the seabed, and, if this is unsuccessful the use of explosives.
		
		Noise and vibration generated by these offshore activities can impact some groups of marine organisms, including fish and marine mammals. Some of the extreme affects include physical injury and hearing impairment (when marine organisms are in close proximity to the sound source), masking, and various levels of behavioural disturbance (both direct and indirect).
		
		For Windermere the use of explosives may have the capacity to cause injury to cetaceans and pinnipeds within 24 m and 95 m, respectively, of the noise source (assuming spherical spreading). It may also elicit a behavioural response in cetaceans and pinnipeds within 50 m and 200 m, respectively, of the noise source (assuming spherical spreading). If explosives are not used, the impacts on marine fauna are likely to be reduced and the radius of impact for all species will be lower.
				• Vessel movements and the use of dynamic positioning thrusters will be minimised where possible to reduce the potential impacts on fish and marine mammals;
				• If explosives are required to be used, in addition to complying with the JNCC guidelines, INEOS will:
				  • Use trained Marine Mammal Observers (MMOs) to identify if there are any vulnerable cetaceans in the vicinity of the explosive source. It is recommended that a 1 km radius mitigation zone be set up around the explosion source. If marine mammals are sighted within this area, operations should be ceased / halted until they have left the area at a safe distance;
				  • Use Passive Acoustic Monitoring (PAM), in conjunction with MMOs, to determine the presence of cetaceans in high sea states, poor visibility, during low light conditions and to identify those which may not surface regularly enough to be sighted;
				  • Use the minimum amount of explosive required to achieve the task based on sound planning and engineering;
				  • Implement a 'soft start' procedure whereby small amounts of explosives are used to scare fish and marine mammals from the vicinity.	

Environmental Aspect	Environmental Receptor(s)	Description of Potential Impacts	Impact Before Mitigation	Proposed Mitigation Measures	Residual Impact
Atmospheric Emissions					
Exhaust gas emissions from offshore decommissioning operations.	Air	Emissions to atmosphere may contribute to climate change (CH_4, CO_2) and acid effects (SOx, NOx). Potential for localised smog formation (VOC, NOx). In addition, there could be minor increases of the atmospheric greenhouse concentrations over the transboundary line. However, these will be temporary and due to atmospheric dispersion, the concentrations are expected to be minute over a few kilometres from source.	Moderate	• Advanced planning to ensure efficient operations; • Emissions controlled to MARPOL Annex VI standards through the use of cleaner low emission fuels; • Speed of vessels will be managed to minimise fuel consumption; • Generators will be running on the minimum power for the job task to avoid unnecessary emissions; • Well maintained and operated power generation equipment; and • Regular monitoring of fuel consumption;	Minor
Decommissioning emissions and energy balance from onshore processing of materials.	Air	Emissions to atmosphere may contribute to global warming (CH_4, CO_2) and acid effects (SOx, NOx). Potential for localised smog formation (VOC, NOx).	Positive	• None required. Although INEOS recognise that the onshore processing of decommissioning materials will result in increased atmospheric emissions, the impact from these is expected to be positive as the recycling of the common materials requires less energy and produces less atmospheric emissions, when compared to producing the same weight of the new material	Positive
Discharges to Sea					
Discharge of Pipeline Chemicals and Residual Hydrocarbons to Sea	Seabed Sediments Water Quality	On cutting the pipeline, there will be a release of hydrocarbons to the environment. As above this has the potential to contaminate sediments and degrade water quality. Short term degradation in water quality may affect viability of plankton stocks, recruitment for fish stocks and base of food chain.	Moderate	• When the pipeline and umbilical were flushed and cleaned in 2017, washwaters were injected into the wells on Windermere.	Minor

Environmental Aspect	Environmental Receptor(s)	Description of Potential Impacts	Impact Before Mitigation	Proposed Mitigation Measures	Residual Impact
Discharge of food waste and sewage to sea	Water Quality	Discharge of food waste and sewage to sea will cause transient organic enrichment of the water column and an increase in biological oxygen demand (BOD). This could lead to: • A minor increase in plankton and fish populations; • Short term degradation of water quality; • Potential for localised significant toxic effects; • Mortality of individuals; • May affect viability of plankton stocks, recruitment for fish stocks and base of food chain.	Moderate	• INEOS Representative will also ensure good housekeeping standards are maintained onboard the vessels; • Each vessel will have a Garbage Management Plan in place; • All the drains from the vessel decks will be directed to a containment tank and the fluids processed/filtered to remove hydrocarbons; • As part of the SHE Plan, INEOS will ensure that the vessel contractor knows how to react to spills, which the necessary spill kits are onboard vessels in suitable locations and personnel are trained in their use.	Minor
Discharge of grey water to sea	Water Quality	Discharge of food waste and sewage to sea will cause transient organic enrichment of the water column and an increase in biological oxygen demand (BOD). This could lead to: • A minor increase in plankton and fish populations; • Short term degradation of water quality; • Potential for localised significant toxic effects; • Mortality of individuals; • May affect viability of plankton stocks, recruitment for fish stocks and base of food chain.	Moderate	• INEOS Representative will also ensure good housekeeping standards are maintained onboard the vessels; • Each vessel will have a Garbage Management Plan in place; • All the drains from the vessel decks will be directed to a containment tank and the fluids processed/filtered to remove hydrocarbons; • As part of the SHE Plan, INEOS will ensure that the vessel contractor knows how to react to spills, which the necessary spill kits are onboard vessels in suitable locations and personnel are trained in their use.	Minor
Discharge of drainage water	Water Quality	Release of drainage water or deck water from the rig may have minor localised toxicity impacts on the local fauna in the water column.	Moderate	• INEOS Representative will also ensure good housekeeping standards are maintained onboard the vessels; • Each vessel will have a Garbage Management Plan in place; • All the drains from the vessel decks will be directed to a containment tank and the fluids processed/filtered to remove hydrocarbons; • As part of the SHE Plan, INEOS will ensure that the vessel contractor knows how to react to spills, which the necessary spill kits are onboard vessels in suitable locations and personnel are trained in their use.	Minor
Unplanned Releases					
Unplanned release of gas and associated condensate from the pipeline	Water Quality Seabirds	Stochastic modelling of the worst case spill scenario, the complete instantaneous loss of the HLV fuel inventory (i.e. 2,000 m^3 of diesel) at the Windermere platform location, indicates that the spill would not beach. There would be a 10 percent probability of the slick crossing the UK / Netherlands transboundary line during autumn (Sep – Nov) and winter (Dec – Feb). The minimum time it took for the surface oil, with a minimum thickness of 0.04 µm, to cross this transboundary line was 3 hours in autumn and 5 hours in winter.	Minor	• Establishment of 500 m exclusion zone around the jack-up vessel and HLV and presence of stand-by vessel; • A collision risk management plan will be in place for the development; • Co-ordination of all support vessel movements; • Notices to Mariners, NAVTEX and NAVAREA warnings; • Oil Pollution Emergency Plan (OPEP) is in place, alongside other Emergency Response documents. • INEOS will also ensure that operations staff are fully aware of their responsibilities under	Minor
Accidental spillage of diesel resulting from a collision between	Water Quality Seabirds	Stochastic modelling of the worst case spill scenario, the complete instantaneous loss of the HLV fuel inventory (i.e. 2,000 m^3 of diesel) at the Windermere platform location, indicates that the spill would not beach. There would be a 10 percent probability of the slick crossing the UK / Netherlands transboundary line during autumn (Sep – Nov) and winter (Dec – Feb). The minimum time it took for the surface oil, with a minimum thickness of 0.04 µm, to cross this transboundary line was 3 hours in autumn and 5 hours in winter.	Minor	• Establishment of 500 m exclusion zone around the jack-up vessel and HLV and presence of stand-by vessel; • A collision risk management plan will be in place for the development; • Co-ordination of all support vessel movements; • Notices to Mariners, NAVTEX and NAVAREA warnings; • Oil Pollution Emergency Plan (OPEP) is in place, alongside other Emergency Response documents. • INEOS will also ensure that operations staff are fully aware of their responsibilities under	Minor

Environmental Aspect	Environmental Receptor(s)	Description of Potential Impacts	Impact Before Mitigation	Proposed Mitigation Measures	Residual Impact
vessels during decommissioning		In the event of a diesel spill, degradation in water quality may affect viability of plankton stocks, recruitment for fish stocks, and base of food chain. There may also be smothering, physical contamination and toxic effects on benthic organisms. Oiling of a birds plumage destroys its integrity as insulation and may cause the animal to die of hypothermia or by drowning. However, it is extremely unlikely that the entire inventory of a vessel would lost instantaneously. In addition, diesel is highly volatile and easily biodegradable and therefore does not persist in the marine environment for any great time.		the OPEP, are trained in the appropriate response techniques and are involved in at least one response exercise at the beginning of the programme to ensure that the OPEP can be implemented effectively.	
Solid Waste					
Onshore disposal andoperational waste management	Land Use	The Windermere Decommissioning activities will result in the generation of decommissioning materials that will need to be brought to shore for appropriate disposal and processing. In addition, waste will be generated from the vessels used during the decommissioning activities. The effects associated with onshore disposal are dependent on the nature of the site or process. If sent to landfill, land take, nuisance, emissions (methane), possible leachate, and limitations on future land use are all potential impacts. If sent to a treatment plant, impacts may include nuisance, atmospheric emissions and potential for site contamination.	Moderate	• INEOS will ensure that an effective waste management plan is put in place prior to decommissioning activities commencing; • INEOS will ensure all waste contractors are audited and meet relevant legislation; • INEOS will actively seek to reduce the amount of recovered materials that are sent to landfill.	Minor
Onshore disposal of decommissioning materials	Land Use		Moderate		Minor

Transboundary Impacts

At its closest point, the Windermere Development is located approximately 2.5 km to the west of the UK / Netherlands transboundary line. Transboundary impacts may therefore result from unplanned hydrocarbon release, atmospheric emissions i.e. exhaust gas emissions generated from the decommissioning vessels) and chemical and planned hydrocarbon discharges. However, all transboundary impacts will be temporary in nature and are therefore expected to be minor.

Cumulative Impacts

Given the distance to other offshore activities in the vicinity of the Windermere Development, it is possible that cumulative impacts may arise. The Orsted Hornsea Project Three wind farm site is in 5 km of Windermere, however it is assumed that the Windermere Decommissioning Programme will be completed prior to any pre-construction/construction offshore activities commencing on the wind farm. As such no cumulative impacts are anticipated.

The Ketch platform, located 30km north west of Windermere and owned by DNO North Sea (ROGB) Limited, is in the process of being decommissioned, with similar timelines to those proposed for Windermere (DNO, 2019). An assessment of the potential for cumulative impacts with this operation indicates that, other than noise, there are no cumulative impacts that are significant. Noise disturbance generated by both platforms at the same time will potentially cause disturbance of marine mammals in both areas, however comparison with the overall area of the harbour porpoise SNS SAC indicates that this temporary disturbance will not be significant. INEOS will consult with DNO North Sea prior to commencing operations and a further impact assessment will be conducted if it is determined that there will be any overlap in operations. The residual cumulative impact is considered to be minor.

Environmental Management

INEOS operates under an integrated Health, Safety & Environmental Management System (HS&EMS) which is a component of the INEOS UK SNS Limited overall Business Management System (BMS).

The environmental component (i.e. the Environmental Management System) defines the organisational structure, planning activities, responsibilities, procedures, business processes and resources required for developing, implementing, achieving, reviewing and maintaining the INEOS Environmental Policy.

INEOS's EMS applies to all aspects of the proposed Windermere DP. As such, INEOS shall require each of its contractors and suppliers to:

- Operate an effective EMS relevant to their scope of work/supply; and
- Comply with the INEOS environmental requirements including appropriate planning, hazard identification, risk control, performance monitoring and reporting.

Conclusion

In conclusion, the majority of the residual impacts (including transboundary and cumulative impacts) are considered to pose a risk to the environment that is minor or less (and in some instances positive) and therefore are not considered significant, provided the proposed mitigation and management measures, as identified within the ES, are implemented during the Windermere Decommissioning Project.

1 Introduction

INEOS UK SNS Limited (hereafter referred to as INEOS) has ceased production from the Windermere installation (situated in United Kingdom Continental Shelf (UKCS) Block 49/9b of the southern North Sea) and are therefore preparing a Decommissioning Programme (DP) to be submitted to BEIS for approval under the Petroleum Act 1998, as amended by the Energy Act 2008.

In support of the Decommissioning Programme, this Environmental Statement (ES) presents the findings of the Environmental Impact Assessment (EIA) carried out for the Windermere decommissioning project, as required under the Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2011 and in line with Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines (BEIS 2018).

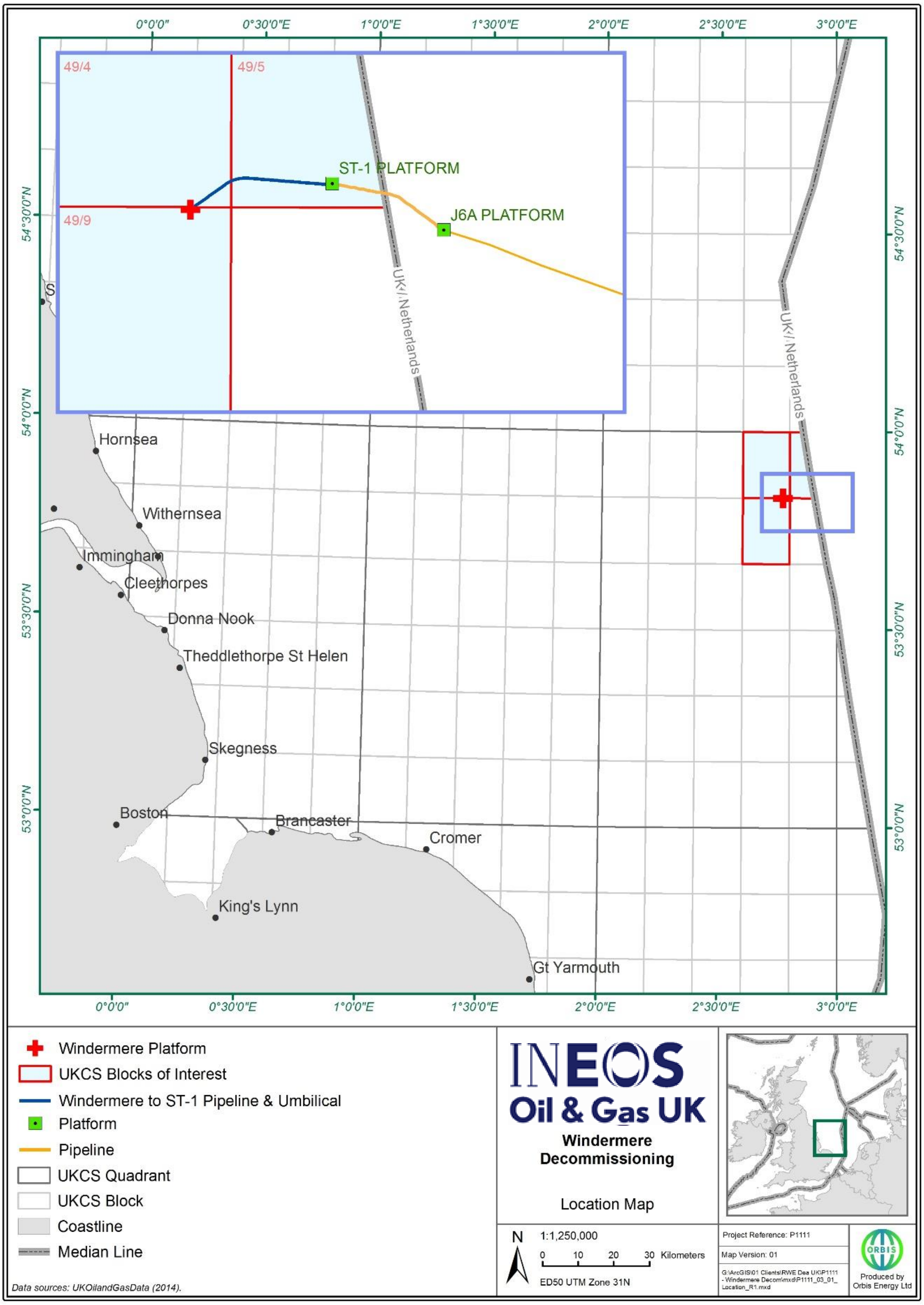
1.1 Project Background

The Windermere platform is located offshore in the UKCS SNS Block 49/9b (Figure 1.1) in 36 metres (m) of water at Geographical co-ordinates N 53°49'56.411", E 02°46'21.607". The platform produced gas from the Leman / Rotliegendes sandstone reservoir.

The offshore facilities installed in 1997 consist of a Normally Unmanned Installation (NUI) platform, two platform wells, one 8” export pipeline to the Markham ST-1 platform (6.8 kilometre (km) long), and a 3.7” umbilical from ST-1 to Windermere. Electrical power, control and chemicals were supplied by an umbilical from the ST-1 Platform. Both the pipeline and umbilical were cleaned and flushed in 2017 and currently reside in a flooded condition. There is no processing equipment on the topsides - gas flowed directly from the wells via the production manifold to the export pipeline, with the pig launcher being the only pressurised vessel.

Both wells were plugged and abandoned in 2019.

Figure 1.1 Windermere Development Location Map



1.2 Overview of Decommissioning Programme

INEOS, the operator of the Windermere Field, wishes to decommission the facility.

The Windermere Development is located across three (3) United Kingdom Continental Shelf (UKCS) Blocks (49/9b, 49/4e and 49/5a) in the SNS.

The infrastructure included and considered within the Decommissioning EIA are:

1. Platform topsides;
2. Three-legged jacket;
3. Two platform wells (49/9b-W1 and 49/9b-W2z);
4. One 8 inch diameter pipeline (approximately 6.8 km);
5. One 3.7 inch diameter umbilical (approximately 7.0km);
6. Associated stabilisation materials.

1.3 INEOS UK SNS Limited

INEOS is global manufacturer of petrochemicals, speciality chemicals and oil products. It is one of the UK's largest manufacturing businesses, employing some 4,000 people across 7 sites. INEOS UK SNS Limited is part of the INEOS Upstream Group which is the INEOS exploration and production business.

INEOS's principal producing interests were the Cavendish, Topaz, Clipper South and Breagh SNS gas fields, however currently only Clipper South and Breagh remain in production.

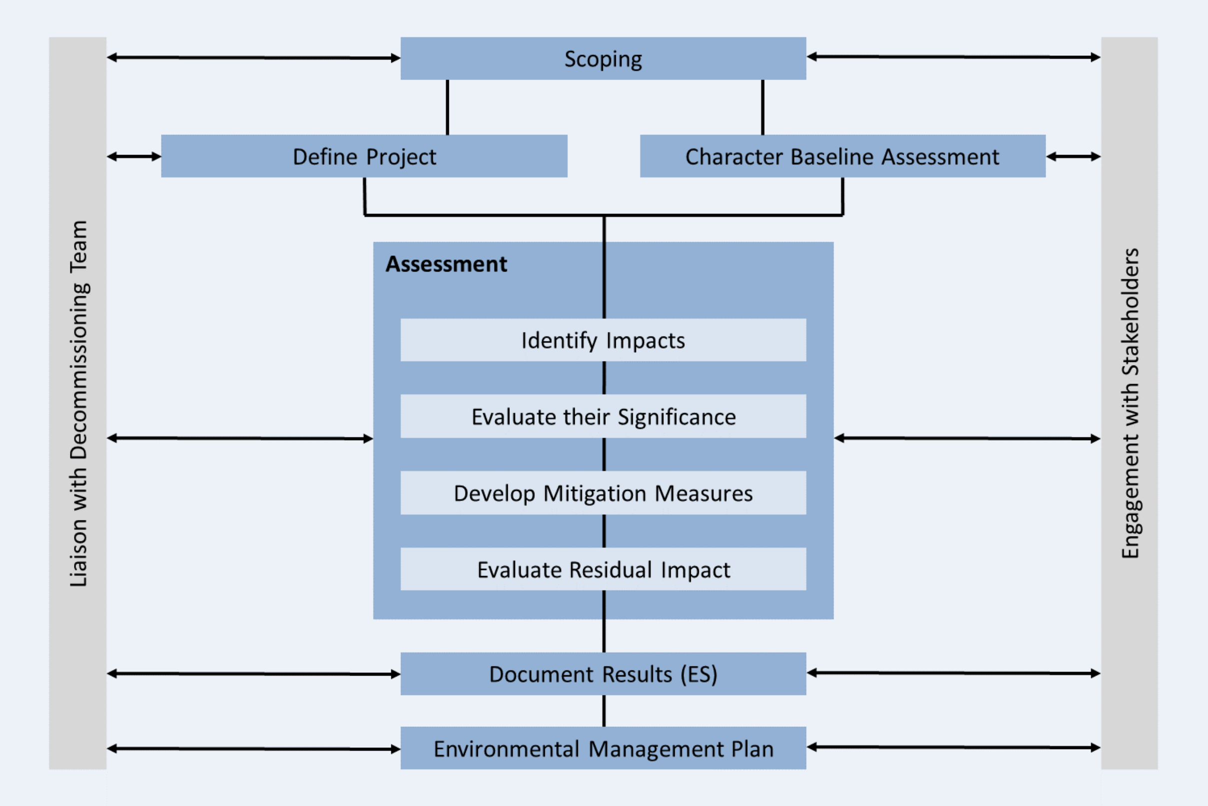
INEOS operates under an Environmental Management System (EMS) which is a component of the overall Business Management System (BMS). The EMS, which is certified under ISO 14001, defines the organisational structure, planning activities, responsibilities, procedures, business processes and resources required for developing, implementing, achieving, reviewing and maintaining the Environmental Policy.

1.4 The EIA Process

EIA is a systematic process that identifies and evaluates the potential impacts a proposed project may have on aspects of the physical, biological and socio-economic environment. Mitigation measures are then developed and incorporated into the project to eliminate, minimise or reduce adverse impacts and, where practicable, to enhance benefits. The process also ensures that planned activities are compliant with legislative requirements and with the Operator's Environmental Policy and EMS (refer to Section 15).

The overall EIA process, which has been followed for the Windermere Decommissioning project, is shown schematically in Figure 1.2. The key elements of this process are described below.

Figure 1.2 Overview of EIA Process



Scoping and Consultation: Scoping is undertaken in the early stages of the EIA process and aims to determine the scope of the EIA and the subsequent ES by identifying the issues that are likely to be of most importance during the EIA and eliminating those that are of little concern. For the Windermere Decommissioning project an informal scoping letter was sent to DECC (at the time) and a number of other key statutory consultees on the 4th March 2015 (refer to Section 1.5). INEOS will continue to engage with stakeholders throughout the EIA process to discuss potential issues, project goals and environmental strategies.

Project Definition: The identification and, where necessary, quantification of activities and aspects of the project which might have an impact on the environment has been undertaken in consultation with the INEOS decommissioning team. Alternative decommissioning solutions have also been considered and the chosen options justified.

Baseline Characterisation: Baseline data, appropriate to the proposed project's potential impacts, have been gathered to describe the relevant existing conditions (e.g. physical, biological, and socio-economic). Published information sources have been referenced along with data gathered from recent surveillance surveys undertaken to assess the condition of the existing infrastructure. The most recent survey was the pre-decommissioning site survey undertaken in July 2014.

Assessment: Impact assessment and development of mitigation measures is an ongoing process that commences during the scoping stage and continues throughout the EIA process. The key objectives of the assessment process are to:

1. Analyse how the project may interact with the baseline environment in order to identify and evaluate the likely significant impacts of the proposed project on the environment;
2. Define mitigation measures in order to avoid, reduce, control or compensate for adverse impacts or enhance positive benefits;

3. Evaluate the residual impacts of the project (i.e. the impact that is predicted to remain once mitigation measures have been designed into the intended activity).

The impact assessment methodology which has been used for the Windermere Decommissioning Programme is described in detail in Section 5.

Reporting: The outcome of the EIA process is documented in this ES, which has been written with reference to the DECC guidance notes 'Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998' dated March 2011 and updated in line with BEIS Guidance (2018).

Environmental Management Plan (EMP): An EMP is a project specific plan developed to ensure that appropriate environmental management practices are followed during implementation of the project. An EMP will be developed for the Windermere Decommissioning Programme to ensure compliance with the INEOS Environmental Policy and EMS, as well as with statutory requirements. The EMS will incorporate all the mitigation measures which INEOS has committed to implement, as identified during the EIA process, and will outline the processes INEOS will follow in order to monitor compliance.

Areas of Uncertainty: At present, INEOS has not finalised the contracts to carry out the required work, thus some details of the exact methodology to be employed in the decommissioning methodology may be subject to future modification. Any variations to the operations as described in this document will be evaluated for potential to alter the conclusions drawn by the EIA in updated environmental permit applications.

1.5 Consultations

During preparation of this ES, the views of a number of organisations were solicited by an informal scoping letter on the 4th March 2015. These organisations included:

1. DECC;
2. Centre for Environment, Fisheries and Aquaculture Science (Cefas);
3. Crown Estate;
4. Global Marine Systems;
5. Joint Nature Conservation Committee (JNCC);
6. Ministry of Defence (MoD);
7. National Federation of Fishermen's Organisation (NFFO).

The main issues raised during this informal consultation exercise, and how INEOS has or is proposing to address them, are summarised in Table 1.1. Where these issues are discussed further within this ES the relevant section reference has been provided.

Of note is that consultations and liaison with interested parties is a continuous part of the environmental management process and will continue throughout the Windermere Decommissioning project.

Table 1.1 Summary of the Consultation Responses for the Windermere Decommissioning Project

Consultee	Issues Raised	INEOS's Response	ES Section
DECC	No response	-	-
Cefas	No response	-	-
Crown Estate	No response	-	-
Global Marine Systems	Though at present no cables should be directly affected in the immediate vicinity. If any interaction were unexpectedly to be necessary in the course of engineering the project, then it would be necessary to liaise with specific cable owners.	INEOS will liaise with all other users of the sea as required throughout the DP.	-
	The closest cable is NSC-1 owned by Tampnet approximately 26 km west of the Windermere facility. Contact details and general cable information can be found using KIS-ORCA cable awareness charts/interactive map.	Included in Section 4.	Section 4.4.3
	We're unaware of any planned telecommunications / power cables planned to be installed in the area, however there is the possibility that new cables will be installed, and so it would be advisable to include telecommunications / power cables within the ES.	Included in Section 4	Section 4.4.3
	When notice to mariners are arranged for the offshore works, then the kingfisher fortnightly bulletin should be notified to include details of the works to inform sea users as well as notifying the relevant authorities and UKHO.	-	Section 6.2

JNCC	**Designated Sites**: the proposed decommissioning operations will not take place within designated/proposed nature conservation sites. **Environmental Survey**: The ES should provide a clear description of the survey(s) undertaken for the EIA. In the baseline sections of the ES or PON15, an interpretation of the site specific survey should be provided. Include: • Sediment map of the area and/or, at a minimum, a description of the sediments present within the development areas. • Where seabed imagery has been collected, representative images should be included in the ES. • In terms of impact assessment, the data presented in the baseline sections should be evaluated in relation to the sensitivity and importance of the environmental features likely to be impacted, including seasonal variations. **Marine Mammals**: Where relevant for the EIA, we are now advising the use of marine mammals management units (MMMUs) which represent more up to date data on reference populations for marine mammals. Potential impacts on marine mammals can be related to the use of explosives to remove the platform. **Seabirds**: Seabirds' vulnerability to oiling in the blocks affected by the operations is moderate on average (rank 3) with high vulnerability from January to May. The main hydrocarbon produced from the installations is however gas and the main risk to oil spill will derive by an accidental event involving vessels. **Additional Comments**: As advised on the survey scope stage (OIA 1758 dated 16th June 2014) the site specific environmental survey must be based on good geophysical data that can allow targeted sampling for both infauna (grabs) and epifauna (video or camera) in relation to the acoustic signature and seabed texture. Within the ES, assessment of cumulative impacts with other projects/plans occurring in the area of the Windermere Decommissioning needs to be presented.	Included in Section 4 Included in Section 4 Included in Section 4 Included in Section 4 Included in Sections 6-14 INEOS is aware of this data but due to the lack of area / density data, this data has not been included in this EIA. SCANS-III (2017) data has been used in the density assessments. Included in Section 4 Included in Section 4 and Section 6-14 Included in Section 4 Included in Sections 6-14	Section 4.3.6 Section 4.2 and Section 4.3 Section 4.2.3 Section 4.3.2 Sections 6-14 - Section 4.3.4 Section 4.3.4 and Section 11 Section 4.2 and Section 4.3 Section 14
MoD	No response	-	-
NFFO	No response	-	-

1.6 Structure of the Statement

The ES document is laid out in following sections:

Non-Technical Summary

Section 1	Introduction - provides a background to the project and the applicant.
Section 2	Regulatory and Policy Background – provides overview of legislation relevant to decommissioning activities on the UKCS.
Section 3	Project Description – outlines the proposed Windermere Decommissioning project, providing details on the options considered, schedule, project lifecycle activities and key discharges and emissions to the environment.
Section 4	Environment Baseline Description – provides an overview of the existing physical, biological and socio-economic environment within the zone of influence of the Windermere Decommissioning project.
Section 5	Environmental Impact Assessment Methodology – describes the assessment methodology that has been used to identify, describe and assess the likely significant impacts of the proposed Windermere Decommissioning project on the environment.
Section 6 - 14	Assessment of Potentially Significant Environmental Impacts and Mitigation Measures – assesses the identified potentially significant environmental impacts and determines suitable mitigation measures to demonstrate that the residual impact is as low as reasonably practicable (ALARP).
Section 15	Environmental Management – provides an outline of how INEOS will manage the project to ensure the protection of the environment throughout the life of the development.
Section 16	Conclusions
Section 17	References

Appendices

1.7 Contact Address

Any questions, comments or requests for additional information regarding this ES should be addressed to:

Phillip Jones
HS&E Advisor
INEOS UK SNS Limited
Anchor House, 15-19 Britten Street
London
SW3 3TY

Email: phillip.jones@ineos.com

Telephone: +44 (0) 203 935 5278

2 Regulatory and Policy Background

2.1 Regulatory Context

The UK's international obligations in relation to decommissioning are governed principally by the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention). Under the terms of OSPAR Decision 98/3 on Disposal of Disused Offshore Installations, there is a prohibition on the dumping and leaving wholly or partly in place of offshore installations. The topsides of all installations must be returned to shore. All installations with a jacket weight less than 10,000 tonnes (as is the case for the Windermere platform) must be completely removed for reuse, recycling or final disposal on land.

The provisions of OSPAR Decision 98/3 do not apply to pipelines and there are no international guidelines on the decommissioning of disused pipelines.

On the UKCS, the decommissioning of offshore oil and gas installations and pipelines is controlled through the Petroleum Act 1998, as amended by the Energy Act 2008.

Under the Petroleum Act 1998, before the owners of an offshore installation or pipeline can proceed with its decommissioning, they must obtain approval of a decommissioning programme (DP) from BEIS. As detailed within the BEIS guidance notes 'Decommissioning of Offshore Oil and Gas Installations and Pipelines', the chosen decommissioning option must be supported by an EIA. The BEIS guidance notes states that the EIA should include:

- All potential impacts on the marine environment, including exposure of biota to contaminants associated with the installation, other biological impacts arising from physical effects, conflicts with the conservation of species, with the protection of their habitats, or with mariculture, and interference with other legitimate uses of the sea;
- All potential impacts on other environmental compartments, including emissions to the atmosphere, leaching to groundwater, discharges to surface fresh water and effects on the soil;
- Consumption of natural resources and energy associated with reuse and recycling;
- Other consequential effects on the physical environment which may be expected to result from the option;
- Potential impacts on amenities, the activities of communities and on future uses of the environment.

This document presents the results of the EIA undertaken in support of the Windermere DP and has been conducted in accordance with The Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2011.

Other relevant legislation includes:

- The Offshore Petroleum Activities (Conservation of Habitats) Regulation 2001;
- The Offshore Chemical Regulations 2002;
- The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005;
- The Merchant Shipping (Oil Pollution Preparedness, Response and Cooperation Convention) Regulations 1998;
- The Offshore Installation (Emergency Pollution and Control) Regulations 2002;
- Marine and Coastal Access Act 2009 (MCAA);
- The Environment Protection Act 1990.

This legislation, and how it relates to the Windermere DP, is further discussed in Appendix A.

2.2 National Marine Policy

Following the implementation of the MCAA, the UK government introduced a number of measures to manage and protect the seas around the UK in order to deliver its vision of "clean, healthy, safe, productive and biologically diverse oceans and seas". These measures included introducing a marine planning system designed to manage the resources, activities and interactions (natural and anthropogenic) which occur offshore. The Marine Management Organisation (MMO) were given marine planning functions by the Secretary of State (the marine plan authority) in April 2010. Marine plans, together with the Marine Policy Statement (MPS), underpin this planning system for English seas (*MMO, 2014b*). It is intended that this system will help ensure the sustainable development of the marine area.

The Windermere Development lies within the East Offshore Marine plan area, which the MMO published plans for in 2014 along with the East Onshore Marine area. In terms of seascape the Windermere Development lies within the 'Dogger Deep Water Channel' area (Character Area 2; *Natural England, 2012*).

The vision for the East Inshore and East Offshore marine areas is that "*By 2034, sustainable, effective and efficient use of the East Inshore and East Offshore Marine Plan Areas has been achieved, leading to economic development while protected and enhancing the marine and coastal environment, offering local communities new jobs, improving health and well-being. As a result of an integrated approach that respects other sectors and interest, the East marine plan areas are providing a significant contribution, particularly through offshore wind energy projects, to the energy generated in the United Kingdom and to targets on climate change*" (*MMO, 2014a*).

Appendix A identifies the objectives of the East Inshore and East Offshore Marine Plans that are relevant to the Windermere Decommissioning

3 Project Description

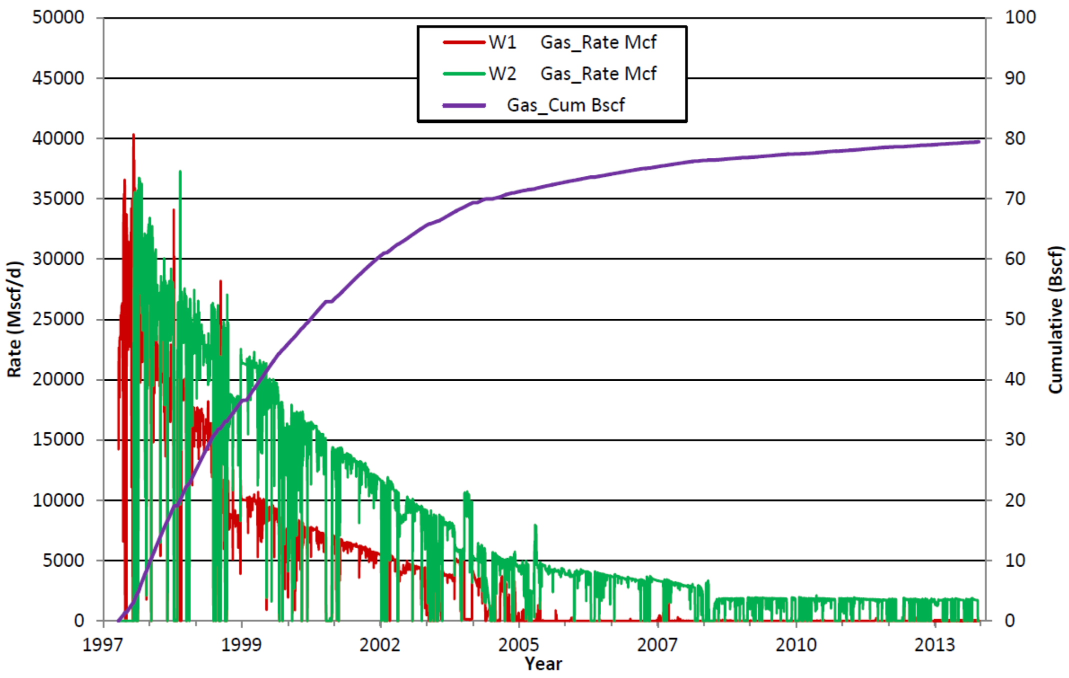
3.1 The Windermere Gas Field

The Windermere gas field was discovered in 1989 and produced gas (until April 2016) from the Leman / Rotliegendes sandstone reservoir via a normally unattended installation (NUI) platform located in UKCS Block 49/09b in the SNS (Figure 1.1). The NUI platform was tied back to the Spirit Energy operated ST-1 platform, located in UKCS Block 49/5a, which formed part of the Markham field complex (the ST-1 platform was removed in 2019). Electrical power, control and chemicals were supplied by an umbilical from the ST-1 Platform. There is no processing equipment on the NUI platform – during production operations, gas flowed directly from the wells via the production manifold to the export pipeline.

The Windermere offshore facilities were installed in 1997 and consisted of the NUI platform, 2 platform wells (49/09b-W1 and 49/09b-W2z, which were plugged and abandoned in 2019) and an 8 inch pipeline and 2 inch umbilical to the Markham ST-1 platform (removed in 2019). The ST-1 platform was tied back to the J6-A manned central Markham platform by a 12 inch pipeline. There is no processing equipment on the NUI, with separation and compression taking place on the J6-A platform when Windermere was in production.

Production profiles show that gas supplies at Windermere are significantly depleted (see Figure 3.1). During 2006, 37,624,576 normal cubic metres (Nm^3) of gas were produced via the Windermere platform (*RDUK, 2007*). This decreased to 13,240,737 Nm^3 of gas in 2013 (*RDUK, 2014*).

Figure 3.1 Production History of the Windermere Development



The remainder of this section outlines the Windermere infrastructure that will be decommissioned; discusses the feasible decommissioning options that have been assessed; and describes the chosen decommissioning plan.

3.2 Windermere Infrastructure

The Windermere infrastructure which is to be decommissioned comprises:

- 1 x topsides;
- 1 x small tripod jacket;
- 2 x platform wells (49/09b-W1 and 49/09b-W2z);
- 1 x 8 inch pipeline from Windermere to the former ST-1 location (PL1273) (6.8 km);
- 1 x 3.7 inch umbilical (electrical power, control and chemicals) from the former ST-1 location to Windermere (7.0 km);
- associated stabilisation materials (48 concrete mattresses, 300 grout bags and rock).

A detailed description of this infrastructure is provided below. Please note, no drill cuttings piles are present at Windermere.

3.2.1 Platform

The Windermere minimum facilities platform is located at 02º 46' 21.607" E, 53º 49' 56.409" N (ED50, UTM Zone 31 N, CM 3ºE) in a water depth of 36 m Lowest Astronomical Tide (LAT). An overview of the platform items to be decommissioned is provided in Table 3.1.

Table 3.1 Windermere Surface Facilities Information

Facility Type	Topsides / Facilities		Jacket		Jacket Piles	
	Weight	No of Modules	Weight	No. of Legs	No. of Piles	Weight of Piles
Fixed Platform (NUI)	452 tonnes	1	382 tonnes	3	3	285 tonnes (total for the three piles)

3.2.1.1 Topsides

The topside structure is a small (30 m x 30 m overall plan area) integrated deck unit, consisting of three deck levels, as shown in Figure 3.2:

- Cellar deck (Top of Steel elevation +18.0 m above LAT);
- Mezzanine deck (Top of Steel elevation +21.5 m above LAT);
- Weather deck (Top of Steel elevation +26.0 m above LAT).

Figure 3.2 The Windermere Platform

The Temporary Refuge / emergency accommodation is located on the cellar deck at the west of the platform while the wellheads are located centrally above the cellar deck with the Xmas trees above the mezzanine deck and the process area is located on the east of the platform. The wellhead area accommodated primarily the Xmas trees (now removed), wellhead isolation valves and the production manifold. The process area contains the pig launcher, the export riser emergency shut down valve and the hydraulic wellhead control panel. There is no processing equipment on the topsides. Gas flowed directly from the wells via the production manifold to the export pipeline, with the pig launcher being the only pressurised vessel. A diesel engine pedestal crane is located at the south-east corner on the weather deck.

The topsides are designed for day visits for planned maintenance, with a helideck located at the upper level on the north side of the platform (elevation +27.5 m above LAT). The helideck has been decommissioned and access is now only via walk to work vessel

3.2.1.2 Jacket

The Windermere substructure comprises a three-leg steel jacket with a skirt pile at each leg. The jacket structure supports the platform topsides, four well conductors (each of 26 inch diameter), one 20 inch diameter sea water lift caisson, one 8 inch export riser and one 12 inch j-tube (containing the umbilical). The top of the jacket is welded to the topside legs projecting below the cellar deck.

3.2.2 Wells

The two platform wells summarised in

Table 3.2 below were both plugged and abandoned in 2019.

Table 3.2 Windermere Platform Wells Information – Now both Plugged and Abandoned

Well Number	Type	Status
49/9b-W1	Production	Shut-in (since 2005), P&A (2019)
49/9b-W2z	Production	Shut-in (April 2016), P&A (2019)

3.2.3 Pipeline and Umbilical

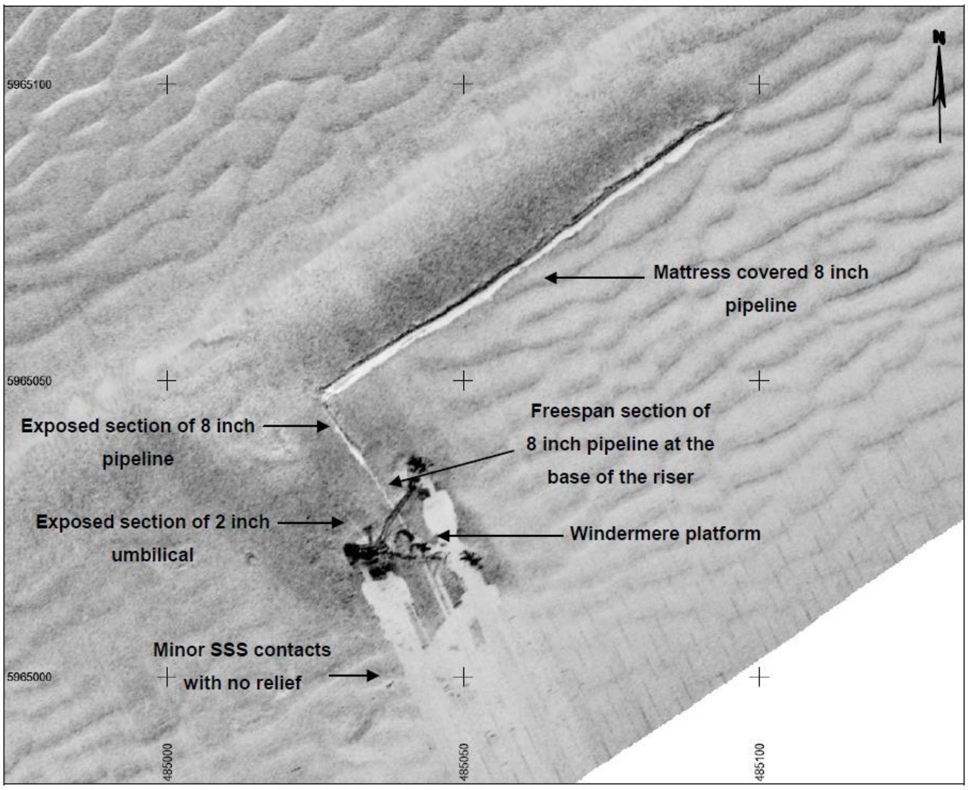
One gas pipeline and one umbilical (conveying electrical power, control and chemicals) are to be decommissioned at Windermere as outlined in Table 3.3. The umbilical runs parallel to the north of the pipeline with an offset of approximately 25 m (*Fugro, 2010*). The pipeline contains no side-taps, pipeline / cable crossings, or other engineering features. The pipeline and umbilical were flushed and cleaned in 2017 and now reside in a flooded (water filled) condition.

Table 3.3 Windermere Pipeline and Umbilical Information (*INEOS, 2021a)*

Pipeline	From – To	Composition	Diameter	Length (km)	Condition	Status	Historic Contents
Export Pipeline (PL1273)	Windermere to (former) ST-1 location	Steel	8 inches	6.8	Trenched and Buried (apart from at each platform end) (average depth 1.06 m)	Water filled	Hydrocarbons (Gas / Condensate), Water
Umbilical (PL1273.1 to PL1273.3)	Former ST-1 location to Windermere	Umbilical	3.7 inches	6.8	Trenched and Buried (average depth 0.71 m)	Water filled	Chemicals (methanol / corrosion inhibitor)

A pre-decommissioning survey along the route of the Windermere export pipeline, conducted by Fugro Survey B.V. (Fugro) on behalf of DEA UK (formerly RDUK) in 2014, found that the pipeline and umbilical were observed to be exposed and in freespan near the Windermere platform location (refer to Figure 3.3).

Figure 3.3 Detailed Side Scan Sonar Image of the Windermere Platform Area (*Fugro, 2014a*)



The export pipeline was found to be in freespan for a distance of 8m, and exposed for a total distance of 22m, at the base of the Windermere platform riser, with the umbilical observed to be exposed for 12m at the departure from the Windermere platform. A possible exposure of export pipeline was also observed within a depression at KP 1.085 (*Fugro, 2014a*).

The most recent pipeline survey shows the average burial depth of the export pipeline and the umbilical to be 1.06 m and 0.71 m respectively (*INEOS, 2021a)*.

3.2.4 Stabilisation Material

The stabilisation features to be decommissioned at Windermere are outlined in Table 3.4.

Table 3.4 Windermere Stabilisation Features (*INEOS, 2021a*)

Pipeline (Pipeline Number)	Stabilisation Feature	Total No.	Weight (tonnes)	Condition (Exposed/ Buried)
Windermere Export Pipeline (PL1273)	Concrete Mattresses	40	5.75 (each)	Exposed
	Grout Bags[1]	195	6.45 (total)	Exposed
	Rock Dump[2]	42 metres length	78.5 (estimated total)	Exposed

Pipeline (Pipeline Number)	Stabilisation Feature	Total No.	Weight (tonnes)	Condition (Exposed/ Buried)
Umbilical (PL1273.1 to PL1273.3)	Concrete Mattresses	8	6 (each)	Exposed
	Grout Bags[1]	105	3.15 (total)	Exposed

[1] Please note, the exact number of grout bags is not known. Diver's records were used to provide an estimate.
[2] The rock dump weight has been excluded from the inventory of materials calculations.

Along the Windermere export pipeline there is one section of rock dumping approximately 2km from the Windermere end, of 42m in length, and a total of 40 mattresses. The mattresses are split between two sections (each of approximately 100 m in length), one at either end of the pipeline (starting near the platform riser base). There are also 45 grout bags providing both spool support and protection at the Windermere end of the Windermere export pipeline and 150 grout bags at the ST-1 end of the export pipeline providing protection over the flange connection, gooseneck, spool and pipeline (*INEOS, 2021a*).

Along the umbilical there are 8 mattresses and 105 grout bags. The grout bags are located at the Windermere end.

3.2.5 Drill Cuttings

No evidence of drill cuttings were found in the immediate vicinity of the Windermere platform during the 2014 pre-decommissioning survey (*Fugro, 2014*a). This is consistent with the high energy environment of the Southern North Sea. Drill cuttings that were generated during drilling activity are considered to have been distributed widely during drilling due to the local currents. This is further supported by the low levels of barium that have been recorded in the area (*Fugro, 2014a*). Although there are no advisory contamination levels for barium, it is a relatively inert metal that is widely used in drilling muds to add weight, and can therefore be used as an indicator for possible contamination by drilling activities (including cuttings piles).

3.3 Assessment of Decommissioning Options

3.3.1 Introduction

Under the terms of OSPAR Decision 98/3, there is a prohibition on the dumping and leaving, wholly or partly in place, of offshore installations. The topsides of all installations must be returned to shore. All steel installations with a jacket weight less than 10,000 tonnes, as is the case for the Windermere Platform, must also be completely removed for reuse, recycling or final disposal on land. The feasible removal and disposal options for the Windermere topsides and jacket were considered taking into account the requirements of the waste hierarchy. The waste hierarchy gives priority to preparing waste for re-use, then recycling, then other forms of recovery (including for energy production) and last of all disposal (e.g. landfill) (*Defra, 2011*).

However, the provisions of OSPAR Decision 98/3 do not cover pipelines, umbilicals or stabilisation material. Instead, INEOS has conducted a Comparative Assessment (CA) to assess all feasible decommissioning options relating to this infrastructure. The CA was conducted following BEIS guidelines, considering the BEIS comparison criteria and took into account safety, technical, environmental, societal and economic aspects.

The following sub-sections present the removal and disposal options for the topsides and jacket along with the decommissioning options that were considered during the CA for the pipeline, umbilical and stabilisation material. Table 3.5 provides a summary of the main conclusions. Full details of the CA are provided within the Windermere Decommissioning Project Comparative Assessment document (Ref: RD-WIN-ZPL002).

3.3.2 Decommissioning Options

In line with the waste hierarchy, the re-use of an installation (or parts thereof) is first in the order of preferred decommissioning options. Consideration has therefore been given to the re-use of the complete Windermere facilities, however, this is considered to be impractical for the following reasons:

- The facilities on the topsides are no longer supported by the suppliers;
- The helideck is not suitable for re-use / conversion as it is not compliant with the current specification for helidecks;
- The life boat requires hoist facilities that are no longer supported by the supplier.

Alternative uses for the Windermere facilities for renewable power generation and CO_2 sequestration were also considered but were not found to be viable.

It is considered, however, that the crane may potentially be re-used once the topsides are returned to a recycling yard and the platform equipment inventory will be assessed for use as spares for INEOS's asset portfolio.

With the option to re-use the Windermere facilities considered impractical, the options for the removal and disposal of the Windermere infrastructure were considered.

3.3.2.1 Removal Options for Topsides and Jacket

The topsides will be completely removed and returned to shore. Removal options considered were as follows:

- <u>Single lift removal by heavy lift vessel (HLV) / monohull crane vessel (MCV) / shear leg vessel (SLV):</u> Removal of topsides as complete unit and transportation to shore for re-use of selected equipment, recycling, break up, and / or disposal;
- <u>Single lift removal with jacket by HLV / MCV / SLV:</u> Removal of topsides and jacket as a single unit and transportation to shore on the HLV / MCV / SLV slings for re-use of selected equipment, recycling, break up, and / or disposal;
- <u>Single lift removal by jack-up:</u> Removal of topsides as complete unit by the jack-up used for well plug and abandonment and transportation to shore for re-use of selected equipment, recycling, break up, and / or disposal.

The jacket will be completely removed and returned to shore. Removal options considered were as follows:

- <u>Single lift removal by HLV / MCV / SLV:</u> Removal of jacket as complete unit and transportation to shore for recycling;
- <u>Single lift removal with jacket by SLV</u>: Removal of topsides and jacket as a single unit and transportation to shore on the SLV slings for recycling;
- <u>Single lift removal by jack-up</u>: Removal of jacket as complete unit by jack-up used for well plug and abandonment and transportation to shore recycling.

3.3.2.2 Decommissioning Options for the Pipeline and Umbilical

The BEIS guidance notes (*BEIS, 2018*) recommend the following pipelines (inclusive of any "piggyback" lines and umbilicals that cannot easily be separated) may be considered for *in situ* decommissioning:

- Those which are adequately buried or trenched and which are not subject to development of spans and are expected to remain so;
- Those which were not buried or trenched at installation but which are expected to self-bury over a sufficient length within a reasonable time and remain so buried;
- Those where burial or trenching of the exposed sections is undertaken to a sufficient depth and it is expected to be permanent;
- Those which are not trenched or buried but which nevertheless are candidates for leaving in place if the comparative assessment shows that to be the preferred option (e.g. trunk lines);
- Those where exceptional and unforeseen circumstances due to structural damage or deterioration or other cause means they cannot be recovered safely and efficiently.

It is also noted that small diameter pipelines, including flexible flowlines and umbilicals, which are neither trenched nor buried should normally be entirely removed.

Based on the above, the CA considered three main options for both the export pipeline and the umbilical: Complete Removal, Partial Removal and Leave *in situ*. Within the Complete Removal and Partial Removal options a number of sub-options were assessed.

The CA considered the following seven decommissioning options for the export pipeline (*INEOS, 2021b*):

- Option 1: Complete removal - expose the pipeline at the cutting locations, cut the pipeline on the seabed and lift ;
- Option 2: Complete removal – expose the pipeline and reel onto a vessel;
- Option 3: Complete removal – expose the pipeline, lift and cut the pipeline onboard a vessel;
- Option 4: Partial removal – only remove the two tie-in spool sections and unburied sections of the pipeline near the platforms, trench and bury the exposed and insufficiently buried sections of the pipeline and ends;
- Option 5: Partial removal – only remove the two tie-in spool sections and unburied sections of the pipeline near the platforms, rock dump the exposed and insufficiently buried sections of the pipeline and ends;
- Option 6: Partial removal – remove all exposed or insufficiently buried sections of the pipeline, either lift and cut the pipeline on board a vessel or expose the pipeline at the cutting locations, cut the pipeline on the seabed and lift (exposed pipeline ends would require burial or rock placement);
- Option 7: Leave all of the pipeline *in situ*, monitor and periodic debris clearance.

The CA considered the following seven decommissioning options for the umbilical (*INEOS, 2021b*):

- Option 1: Complete removal – expose the umbilical at the cutting locations, cut the umbilical on the seabed and lift;
- Option 2: Complete removal – expose the umbilical, lift onto vessel and cut into sections on deck;

- Option 3: Complete removal – pull the umbilical straight from the seabed onto vessel and cut into sections on deck;
- Option 4: Partial removal - remove the umbilical at the two platform ends and leave the remainder of the line *in situ*, trench and bury the two platform ends and any exposed areas of the line;
- Option 5: Partial removal - remove the umbilical at the two platform ends and leave the remainder of the line *in situ*, rock dump the exposed area at the two platform end and any exposed areas of the line;
- Option 6: Partial removal – remove the exposed sections of the umbilical, either lift and cut the umbilical onboard a vessel or expose the umbilical at the cutting locations, cut the umbilical on the seabed and lift (exposed umbilical ends would require burial or rock placement);Option 7: Leave all of the umbilical *in situ*, monitor and periodic debris clearance.

3.3.2.3 Decommissioning Options for Stabilisation Material

The BEIS guidance notes (*BEIS, 2018*) recommend that any mattresses or grout bags which have been installed to protect pipelines during their operational life should be removed for disposal onshore. If the condition of the mattresses or grout bags is such that they cannot be removed safely or efficiently than any proposal to leave them in place must be supported by an appropriate CA of the options. In the case of rock dump that has been used to protect a pipeline it is assumed that this will remain in place, unless there are special circumstances that would warrant consideration of removal.

The removal of the mattresses and grout bags has been determined as the base case for the Windermere Decommissioning Programmes and therefore the decommissioning of stabilisation materials was not subject to a comparative assessment (*INEOS, 2021b*).

Where technically feasible, an attempt to remove all of the concrete mattresses and grout bags from the seabed will be made. If the mattress and grout bag recovery operation is unsuccessful, due to the state of the mattresses and grout bags, a proposal will be made to BEIS to leave the mattresses and grout bags *in situ*.

3.3.3 Summary of the Proposed Decommissioning Programme

The chosen decommissioning options for the topsides, jacket, wells and stabilisation materials along with the outcomes from the CA for the pipeline and umbilical are summarised in Table 3.5.

In addition to the outcomes in Table 3.5, three issues of interdependency were identified:

1. The casing of well 49/9b-W1 was installed prior to the installation of the platform jacket and the diameter of this casing being greater than the jacket's guide rings. Therefore it is planned that the casing will be removed after the jacket;
2. A temporary power supply may be installed on board the platform during the decommissioning preparation activities to allow for a power supply after the umbilical is removed;
3. Mattresses and grout bags will be removed as part of the partial pipeline and complete umbilical removal activities.

Table 3.5 Summary of the Proposed Decommissioning Programme (*INEOS, 2021a)*

Infrastructure	Selected Option	Reason for Selection	Proposed Decommissioning Solution
Topsides	Complete removal.	To comply with OSPAR requirements. To remove all structures and leave a clean seabed.	Remove topsides as complete unit by small HLV, or equivalent, and transport to shore. Cleaned equipment will be refurbished for re-use where possible. Equipment which cannot be re-used will be recycled or go to other disposal routes as appropriate.
Jacket	Complete removal	To comply with OSPAR requirements. To remove all structures and leave a clean seabed.	Remove jacket as complete unit by small HLV and transport to shore. Recovered material will be recycled or go to other disposal routes as appropriate.
Pipeline	Partial removal (Option 4)	The potential pipeline decommissioning options were subject to a qualitative and quantitative CA. Option 4 was selected on the basis of minimal seabed disturbance, lower energy use and reduced risk to personnel. The pipeline is sufficiently buried and stable, posing no hazard to marine users. Surveys indicate that the pipeline will remain buried. Degradation will occur over a long time period within the seabed sediment, and this is not expected to represent a hazard to other users of the sea.	Remove the two tie-in spool sections and unburied sections of the pipeline near the platforms, leaving the remainder of the pipeline *in situ*. Trench and bury the remaining exposed or insufficiently buried sections of the pipeline and the pipeline ends to a depth of at least 0.6 m. Transport the removed tie-in spools and pipeline sections to shore for recycling and/or disposal. The specific engineering solution should be determined during the detailed design stage of the project, however, the base case method should be as above unless it can be demonstrated that this approach is not possible. The CA also concluded that rock dumping should only be pursued as a contingency, if the trench/bury approach fails, rather than a base case option.

Infrastructure	Selected Option	Reason for Selection	Proposed Decommissioning Solution
Umbilical	Partial removal (Option 4)	The potential umbilical decommissioning options were subject to a qualitative and quantitative CA. The umbilical is sufficiently buried and stable, posing no hazard to marine users. Surveys indicate that the pipeline will remain buried. Degradation will occur over a long time period within the seabed sediment, and this is not expected to represent a hazard to other users of the sea.	Remove the unburied sections of the umbilical near the platform ends, leaving the remainder of the umbilical *in situ.* Trench and bury the remaining exposed sections of the umbilical ends to a depth of at least 0.6 m. Transport the removed sections of umbilical to shore for recycling and/or disposal. The specific engineering solution should be determined during the detailed design stage of the project, however, the base case method should be as above unless it can be demonstrated that this approach is not possible.
Stabilisation Material	Remove mattresses and grout bags where technically feasible otherwise leave *in situ.*	Limit seabed disturbance and operational risk.	Mattresses and grout bags will be removed where technically feasible. Rock dump will be left *in situ*. Transport the removed mattresses and grout bags to shore. It is expected that mattresses will be crushed and recycled and grout bags will be re-used or recycled. Any remains will be landfilled if required.
Drill Cuttings	-	Not present.	-

3.4 Decommissioning Programme

3.4.1 Introduction

This section presents the proposed programme of work that will be conducted offshore to decommission the Windermere infrastructure.

It is proposed that all decommissioning activities will be conducted using a combination of a jack-up vessel, a Dive Support Vessel (DSV), a HLV, a tug and a barge vessel. Other support vessels will also be required, such as support and guard vessels.

At the time of writing this ES, INEOS had yet to finalise competitive tenders for the decommissioning work and therefore the final decommissioning methodology may vary depending on the contractor selected.

3.4.2 Well Abandonment

Both platform wells were plugged and abandoned in 2019.

3.4.3 Topsides

The Windermere topsides will be completely removed and returned to shore. When the work to flush and clean the pipeline and umbilical was undertaken in 2017, the topsides pipework was also purged and flushed clean and left ‘air gapped’ from the wells. Prior to removal the topsides will be flushed, purged or cleaned, using the methods outlined in Table 3.6.

Table 3.6 Cleaning of Topside Prior to Removal (*INEOS, 2021a*)

Material Type	Detail	Preparatory Activity
On-board hydrocarbons	Process fluids, fuel and lubricants	Flushing of bulk hydrocarbons will be conducted offshore. Fuels and lubricants will be drained onshore for re-use / disposal.
Bulk liquids	Pipework and sumps	Platform pipework and sumps will be drained offshore and shipped in accordance with maritime transportation guidelines.
Other hazardous materials	Any evidence of NORM will be identified	NORM, if present, will be disposed of under an appropriate permit.
Original paint coating	Zinc Silicate primer, Tie-Coat, Aluminium epoxy resin, High Build Epoxy and polyurethane topcoat	Painted items will be disposed of onshore with consideration given to any toxic components.
Asbestos and ceramic fibre	Asbestos is not present	-

Further to this it is proposed that the topsides will be removed as a complete unit by a HLV and transported to shore (be it in the UK or Europe) for appropriate re-use of selected equipment, recycling, break up and/or disposal. Should the topsides be taken to the Netherlands, an application under the Transfrontier Shipment of Waste Regulations shall be made to the Environment Agency. INEOS has identified that the crane can potentially be re-used once the topsides are returned to a recycling yard. The platform equipment inventory will be assessed for use as spares for INEOS’s asset portfolio.

It is also important to note that there are a number of interfaces (including the two well conductors, seawater pump caisson, 8 inch riser and J-tube containing the 3.7 inch umbilical) between the topsides and the jacket that will need disconnecting before the topsides can be lifted (*ODE, 2014*).

3.4.4 Jacket

The legs of the platform jacket will be cut at an appropriate elevation and new lift aids created[1] for the complete removal of the jacket in a single lift. It is proposed that a HLV will be used for this. The jacket will then be transported to shore for recycling. Should the topsides be taken to the Netherlands, an application under the Transfrontier Shipment of Waste Regulations shall be made to the Environment Agency.

It is proposed that the piles will be cut 3m below the seabed (to ensure that any remains are unlikely to become uncovered as they will be left *in situ*) before the jacket is returned to shore. There are two main methods of severance; using either a cutting tool to sever the jacket piles (such as a grit-cutter) or by the use of explosives. As detailed engineering design is yet to be completed, both methods could be employed for the Windermere jacket. If explosives are required, and as part of the programme to manage the potential environmental impacts of decommissioning, the JNCC guidelines on minimising the risk of disturbance and injury to marine mammals would be followed (refer to Section 8).

The final methodology detailing how the jackets will be severed from the piles and removed will be decided once detailed engineering studies and contractor selection have been completed.

It is important to note that before the jacket can be removed, the two well conductors, the 8 inch riser, the J-tube and the seawater pump caisson will need to be cut off at or below seabed level (as appropriate) (*ODE, 2014*).

3.4.4.1 Marine Growth

The fully submerged and intermittently immersed parts of offshore man-made structures are frequently colonised by opportunistic marine organisms, these colonies are referred to as marine growth or fouling (*Comber et al., 2002*). Marine growth is considered a waste by-product from decommissioning offshore infrastructure.

A survey conducted by Bluestream in 2010, on behalf of Centrica, confirmed the presence of marine growth on the Windermere platform. Using data from the Bluestream survey, it is estimated that approximately 67 tonnes (wet weight) of marine growth may be attached to the Windermere platform jacket (includes the 2 conductors, 8 inch riser, seawater pump caisson and J-tube) (*ODE, 2015a)*.

During the decommissioning of the Windermere platform jacket, it is expected that while some limited quantities of marine growth will be removed offshore to facilitate access to key parts of the structure, the majority of the material will be removed at the onshore disposal yard (*INEOS, 2021a)*.

[1] Subject to detailed engineering. However, the current expectation is that new lift points will be drilled into the jacket legs to enable lifting bars to be installed.

Data from previous decommissioning projects shows that the actual weight of marine growth received at the disposal yard is often much lower than the estimated wet weight (*BMT Cordah, 2011*). For example, during the decommissioning of seven individual gas platform jackets in the SNS, 40 to 50 tonnes of marine growth was expected per platform. However only around 7 tonnes of material per platform were actually received, approximately 80 to 85% less than expected (*BMT Cordah, 2011*). This difference is primarily the result of the natural drying out process that begins once marine growth is removed from the sea. The water content of marine growth is typically between 70 to 90% of its total weight (*Tvedten, 2001*) and depending on local weather conditions, the natural drying process can proceed quickly. Other losses of marine growth can occur as a result of removal and dislodgement during the cutting, lifting and transportation of infrastructure (*BMT Cordah, 2011*).

Given the above, it is unlikely that the estimated 67 tonnes (wet weight) of marine growth will be received by the disposal yard. For the purposes of this assessment, a conservative loss of 70% of the estimated wet weight will be assumed. Therefore, it is calculated that the decommissioning yard will receive approximately 20 tonnes of marine growth with the Windermere platform jacket.

3.4.5 Pipeline and Umbilical

The decommissioning options for the pipeline and the umbilical were subject to a CA. The assessment is summarised in Table 3.7 and the proposed methodology is discussed further below.

Table 3.7 Summary of the Comparative Assessment and Outcome (*INEOS, 2021b*)

Pipeline	Summary of the Comparative Assessment	Comparative Assessment Outcome
Pipeline (PL1273)	The pipeline is stable and buried at an average depth of approximately 1 m below the seabed for the majority of the route, apart from relatively short exposed sections where the two tie-in spools join at each platform end and in the transition trench areas where the pipelines approach the two platforms (approximately 100 m long). The pipeline does not have a viable re-use potential. Leaving the entire pipeline *in situ* was not considered a practical long-term solution due to the ongoing risk to other sea users (e.g. fisheries) and the associated ongoing responsibilities for INEOS. Complete removal would present a greater technical challenge and result in a higher degree of environmental disturbance than partial removal.	Option 4: Partial removal – only remove the two tie-in spool sections and unburied sections of the pipeline near the platforms, trench and bury the exposed and insufficiently buried sections of the pipeline and ends.
Umbilical (PL1273.1 to PL1273.3)	The umbilical is buried, apart from exposed lengths at each platform end. No spans have been detected during previous surveys. Between 1997 and 2014 the umbilical was shown to be buried throughout, with the exception of one isolated reading in 2014. The umbilical does not have a viable re-use potential. Partial removal will require interventions at each platform end.	Option 4: Partial removal – only remove the two unburied sections of the umbilical near the platforms, trench and bury the exposed and insufficiently buried sections of the umbilical ends.

The CA of the seven potential decommissioning options for the export pipeline concluded that partial removal (Option 4) is the most appropriate option based on the assessment criteria. Therefore, it is proposed that only the two tie-in spool sections and unburied sections of the pipeline near to the platforms will be removed and the remainder of the pipeline will be left *in situ*. The cut pipeline ends and any insufficiently buried sections of the pipeline (less than 0.6m below the seabed) will be trenched and buried. The removed tie-in spools and pipeline sections will be transported to shore for recycling and/or disposal. (*INEOS, 2021b*).

The CA also concluded that rock dumping should only be pursued as a contingency, if the trench/bury approach fails, rather than a base case option (*INEOS, 2021b*).

The export pipeline was cleaned and flushed in 2017 and currently resides in a flooded condition. The flushing/cleaning work confirmed an oil in water content of <30 milligrams per litre for the flushed waters.

The CA of the seven potential decommissioning options for the umbilical concluded that partial removal (Option 4) is the most appropriate option based on the assessment criteria. Therefore, it is proposed that the umbilical will be removed at the two platform ends and unburied sections of the umbilical near to the platforms will be buried. The remainder will be left *in* situ.

The CA also concluded that rock dumping should only be pursued as a contingency, if the trench/bury approach fails, rather than a base case option (*INEOS, 2021b*).

The umbilical was cleaned and flushed in 2017 and currently resides in a flooded condition. The flushing/cleaning work confirmed an oil in water content of <30 milligrams per litre for the flushed waters.

Please note, the specific engineering solution for the decommissioning of the pipeline and umbilical should be determined during the detailed design stage of the project, however, the base case methods should be as above unless it can be demonstrated that these approaches are not possible.

3.4.6 Stabilisation Material

The concrete mattresses and grout bags that are situated on the export pipeline and umbilical, will be assessed for integrity.

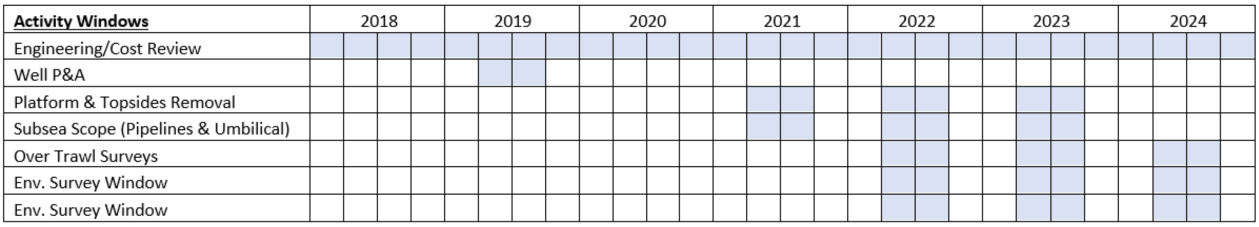
An attempt to remove the mattresses and grout bags safely will be made and where this is not possible INEOS will discuss further options with BEIS. For the purposes of the EIA, a ‘worst-case’ scenario has been assumed (in terms of seabed disturbance and atmospheric emissions) whereby all concrete mattresses and grout bags are removed.

In the case of rock dump that has been used to protect a pipeline it is assumed that this will remain in place, unless there are special circumstances that would warrant consideration of removal.

3.5 Decommissioning Schedule

It is currently envisaged that the platform removal works will take place between 2021 and 2023, depending on availability of contractor vessels and equipment. The decommissioning approach will be to combine workscopes with other INEOS assets wherever possible. Figure 3.4 provides an overview of the outline project schedule for the Windermere Decommissioning Programme.

Figure 3.4 Outline of the Proposed Schedule for the Windermere Decommissioning Programme



3.6 Inventory of Materials

During the decommissioning of the Windermere infrastructure, there will be a wide range of materials that will need to be processed and, where possible, recycled. Table 3.8 presents the total tonnage of the infrastructure to be decommissioned and the portion that will be recovered and left *in situ* while Table 3.9 gives a summary of the expected materials that make-up the infrastructure.

The topsides have been designed to minimise hydrocarbon inventories, therefore, normal shutdown procedures will be employed to make the asset hydrocarbon free. There are no issues with toxic gases such as hydrogen sulphide (H_2S) or carbon monoxide (CO) and well fluids have reported no carbon dioxide (CO_2). There should be a minimal build-up of sands on the topsides, therefore, a very small quantity of produced solids on the topsides should require disposal.

Table 3.8 Inventory Disposition (*INEOS, 2021a*)

Infrastructure	Total Inventory Tonnage	Planned Tonnage to Shore	Planned Tonnage Left *in situ*
Topsides	452.3	452.3	0.0
Jacket	382.0	382.0	0.0
Piles[1]	285.0	75.0	210.0
Pipeline[2]	818.4	29.0	789.4
Umbilical	105.0	10	95
Concrete Mattresses[3]	278.0	278.0	0.0
Grout Bags[3]	9.6	9.6	0.0
Total	**2,330.3**	**1,235.9**	**1094.4**

[1] Assumes each pile will be cut 3 m below the seabed, leaving around 75% of each pile *in situ*

[2] It is proposed that the two tie-in spools (approximately 50 m and 25 m in length) and the unburied sections of pipeline near to the platforms will be returned to shore. At the time of writing this ES it was unknown how much of the unburied pipeline would be recovered. It is estimated that between 9 to 29 tonnes of unburied pipeline could be removed, therefore to assess the worst case impact the maximum estimate of 29 tonnes will be used in this assessment..

[3] Assumes the worst case impact, that all mattresses and grout bags are removed from the seabed.

Table 3.9 A Summary of the Expected Materials from the Windermere Decommissioning Project (*INEOS, 2021a)*

Item	Material Weight (Tonnes)					
	Steel	Plastics / Rubber	Non-Ferrous Metals	Concrete / Cement	Other	Total (tonnes)
Topsides	403.7	10.8	33.2	-	4.7	**452.3**
Jacket	382.0	-	-	-	-	**382.0**
Piles	285.0	-	-	-	-	**285.0**
Pipeline	810.3	8.2	-	-	-	**818.4**
Umbilical	99.8	5.3	-	-	-	**105**
Concrete Mattresses	-	-	-	278.0	-	**278.0**
Grout Bags[1]	-	-	-	9.6	-	**9.6**
Total (tonnes)	**1980.8**	**24.2**	**33.2**	**287.6**	**4.7**	**2330.3**

[1] For the purposes of this weight assessment grout bags will be included with concrete mattresses.

The proposed fate of the recoverable materials from the Windermere decommissioning project is shown in Table 3.10. Please note, at the time of writing this ES the contract for waste management has yet to be selected and therefore the table below provides the current proposed estimates for the percentage of each material that will be recycled, reused and disposed of. As part of INEOS's contract strategy they will prioritise environmental performance and the opportunity to maximise recycling. This will be stipulated in the invitations to tender for waste contractor selection. Therefore the final percentages may differ to the estimates presented in Table 3.10.

Table 3.10 A Summary of the Proposed Fates of the Recovered Materials from the Windermere Decommissioning Project (all values are approximate)

Material	Total Weight to be Recovered (Tonnes)	Proposed Fate (%)		
		Recycle	Disposal	Reuse
Steel	1,000 (approx)	> 90	< 5	< 5
Plastics / Rubber	16 (approx.)	> 85	< 10	< 5
Non-Ferrous Metals	33 (approx.)	> 95	0	< 5

Material	Total Weight to be Recovered (Tonnes)	Proposed Fate (%)		
		Recycle	Disposal	Reuse
Concrete / Cement[1]	288 (approx.)	100	0	0
NORM	unknown	0	100	0

[1] This value assumes that all of the concrete mattresses and grout bags will be removed from the seabed.

All waste will be disposed of in accordance with relevant legislation and company policy. Where possible, INEOS will endeavour to ensure that materials and equipment are re-used or recycled onshore, thereby minimising the volume of materials destined for incineration/landfall. This will be in accordance with the waste hierarchy principles and INEOS's waste management principles. Materials will be segregated for ease of handling and to reduce the energy used when transporting different materials to their respective recycling, reuse or disposal facilities. INEOS will ensure that all waste is handled in a manner that will minimise the threat to personnel and the environment.

Naturally Occurring Radioactive Material (NORM) is present within the earth's crust and can be concentrated and enhanced by oil and gas recovery as it may be present in drilling sludges, muds and pipe scale and accumulate in dead spaces in equipment over time (*OGP, 2008*). During decommissioning, INEOS will ensure that this material is disposed of separately. Any NORM-contaminated material returned to shore will be treated, recycled or disposed of as appropriate. The selected contractor will have the experience and management procedures in place to handle and dispose of NORM in a responsible way and in accordance with the relevant legislation. Generally, special wastes will be transported from the site in sealed containers. Procedures for NORM, low specific activity (LSA) scale and radioactive components will be in accordance with company procedures.

Table 3.11 approximates the amount of material that will remain *in situ* on completion of the Windermere Decommissioning programme.

Table 3.11 A Summary of the Materials from the Windermere Decommissioning Project that will remain In Situ (all values are approximates)

Material	Total Weight to remain *in situ* (tonnes)
Steel	1,000 (approx.)
Plastics / Rubber	10 (approx.)

3.7 Emissions Arising from Decommissioning Operations

During the Windermere decommissioning programme, emissions (atmospheric and waste) will arise from offshore decommissioning activities and from the processing of the waste materials onshore.

3.7.1 Other Decommissioning Activities

A small amount of atmospheric emissions will result from fuel burnt for power generation on the decommissioning vessels. In addition, the vessels will also produce waste water (sewage and grey water) and solid wastes (e.g. garbage, scraps etc.).

An overview of the emissions from the typical vessels that may be used during the Windermere decommissioning programme are provided in Table 3.12. Please note that at the time of writing this ES, INEOS had yet to finalise competitive tenders for the decommissioning work and therefore the final combination of decommissioning vessels may vary depending on the contractor selected.

Table 3.12 Estimated Total Fuel Use and Waste Generation from Vessels during the Windermere Decommissioning Project and the Calculation Assumptions

Vessel Type	Calculation Assumptions				Aspect		
	Approximate Duration (days)	Fuel Consumption (tonnes / day)	Average POB	Solid Waste Generated (tonnes / month)	Total Estimated Power Generation (tonnes of diesel burnt)	Total Estimated Waste Water Discharged to Sea[1] (tonnes)	Total Estimated Solid Waste Retuned to Shore (tonnes)
Jack-up vessel	275	10	90	24	2,750	1,080	216
Guard Vessel[2] for Jack-up vessel	275	4	20	5	1,100	240	45
Supply Vessel[3] for Jack-up vessel	275	5	20	5	1,375	240	45
HLV[4]	18	30	75	Negligible	540	270	Negligible
Guard Vessel[2] for HLV	18	4	20	Negligible	72	72	Negligible
Supply Vessel[3] for HLV	18	5	20	Negligible	90	72	Negligible
Anchor Handling Vessel[5]	18	5	20	Negligible	90	72	Negligible
Tug[6] for HLV	18	25	20	Negligible	450	72	Negligible
Barge[7] for HLV	18	22	60	Negligible	396	216	Negligible
DSV[8]	10	18	70	Negligible	180	140	Negligible
Guard Vessel[2] for DSV	10	4	20	Negligible	40	40	Negligible
Supply Vessel[3] for DSV	10	5	20	Negligible	50	40	Negligible
Survey Vessel[8]	7	18	20	Negligible	126	28	Negligible
Helicopter[9]	275	-	-	-	108	-	-
				Total	**7,367**	**2,582**	**306**

[1] Estimation based on 200 litres waste water /man / day
[2] Fuel use rate based on *IoP, 2000* (Safety vessel – working)
[3] Fuel use rate based on *IoP, 2000* (Supply vessel – working)
[4] Fuel use rate based on *IoP, 2000* (Semi-submersible crane vessel – working (100,000 tonnes))
[5] Fuel use rate based on *IoP, 2000* (Anchor Handling Vessel – working)
[6] Fuel use rate based on *IoP, 2000* (Cargo barge tug – working)
[7] Fuel use rate based on *IoP, 2000* (Cargo barge – working)
[8] Fuel use rate based on *IoP, 2000* (DSV - working)
[9] Fuel use rate based on *IoP, 2000* (Helicopter Sikorsky); calculation based on 3 return flights/week, 400 km return flight, traveling at 240 km/hour.

3.7.2 Processing of Waste Materials Onshore

In addition to vessel emissions, there will also be atmospheric emissions from the disposal, processing and / or recycling of the Windermere infrastructure onshore.

At the time of writing, the waste disposal contractor has not been selected, but it is assumed the waste materials will be processed in a similar way, whether the waste materials are processed in Europe or within the UK

Material quantities, as they pass through processing operations, can be described by material balances. Such balances are statements on the conservation of mass. Similarly, energy quantities can be described by energy balances, which are statements on the conservation of energy (*Earle and Earle, 2004*). As materials are processed, energy is required to recycle that material into a reusable form. This is usually represented as energy spent in gigajoules (GJ). The energy consumption to process one tonne of said material is often then compared to the energy consumption required to manufacture one new tonne of the material.

The Institute of Petroleum have produced a paper *(IoP, 2000*) on the energy use and gas emissions in the decommissioning of offshore structures. A summary of data from this paper is presented in Table 3.13, which shows the estimated energy consumption and gas emissions to convert a selection of common decommissioning materials and how the values compare to the production of new materials.

Table 3.13 A Comparison of Energy Consumption and Gas Emissions between Recycling and Manufacturing from New for Common Decommissioning Materials

Material	Recycle				Manufacture from New			
	Energy Consumption (GJ/Tonne material)	Gas emitted (kg/tonne material)			Energy Consumption (GJ/Tonne material)	Gas emitted (kg/tonne material)		
		CO_2	NO_x	SO_2		CO_2	NO_x	SO_2
Steel[1]	9	960	1.6	3.8	25	1,889	3.5	5.5
Copper[1]	25	300	-	120	100	7,175	20	200
Concrete / Cement[1]	1[3]	880	5.4	0.1	1	880	5.4	0.1
Plastic[2]	20	693	-	-	105	3,179	-	-

[1] Source: *IoP (2000)*.

[2] Source: *Harvey (2010)* & *DEFRA / DECC (2011)*.

[3] Concrete can be crushed and recycled into aggregates but new cement is still needed to turn this back into concrete. Cement production accounts for ca. 94% of the energy required to create concrete. Therefore, for the purposes of this assessment, it is assumed that the energy requirement and gas emissions to recycle concrete are the same as manufacturing from new (source: *BuildingGreen, 1993*).

No data represented by a dash (-).

These values can be used to estimate the energy use and gas emissions likely to result from the processing of the Windermere Development material inventory that is recovered to shore. A detailed breakdown and discussion of atmospheric emissions from the Windermere Decommissioning activities can be found in Section 9.

3.8 Summary of the Expected Wastes

The wastes that are expected to be generated by the proposed decommissioning methods discussed above for the Windermere Development are summarised in Table 3.14.

Table 3.14 Summary of the Expected Wastes that will be Generated as a Result of the Proposed Windermere DP (excluding gaseous emissions)

Material	Estimated Total Quantity	Leave / discharge *in situ* (%)	Ship to Shore (%)
Steel	2,000 tonnes (est.)	50	50
Plastics / Rubber	24 tonnes (est.)	33	67
Concrete / Cement	287.6 tonnes	0	100
Non-Ferrous Metals	33.2 tonnes	0	100
Other	4.7 tonnes	0	100
NORM	Unknown	0	100
Marine Growth (wet weight on jacket)[1]	67 tonnes	Unknown	30
Waste Water	2,510 tonnes	100	0
Solid Waste	48 tonnes	0	100

[1] Following losses to sea during the jacket removal and transportation (including through the evaporation of water) a maximum of approximately 30% of the original mass is expected to be received on shore.

3.9 Post-Decommissioning Inspection Surveys

3.9.1 Debris Clearance

A post decommissioning site survey will be carried out in a 500 m radius area around the platform site and along a 50m corridor centred on the route of the export pipeline and umbilical. Significant seabed debris will be recovered and transported to shore for disposal or recycling in line with existing disposal methods.

To ensure safety for fishing activity in the area, independent verification of the seabed state will be obtained by trawling the platform and pipeline area. This will be followed by a statement of clearance to all relevant governmental departments and non-governmental organisations (*INEOS, 2021a*).

3.9.2 Environmental Seabed Survey

A post-decommissioning environmental seabed survey, centred around the installation site, will also be carried out. They survey will focus on chemical and physical disturbances of the decommissioning and will be compared to the findings of the pre-decommissioning survey.

3.9.3 Ongoing Monitoring and Evaluation

As the export pipeline and umbilical are to be left in situ, and INEOS will remain responsible for it, it will be the subject to on-going surveys when the Windermere decommissioning activities have been concluded. After the initial post-decommissioning site survey reports have been sent to BEIS and reviewed, a post monitoring survey regime will be agreed by both parties. Typically this would involve one (or more) post-decommissioning environmental and structural pipeline surveys.

4 Environmental Baseline Description

4.1 Introduction

A key consideration when planning and finalising the Windermere DP is a clear understanding of the surrounding environment. In order to understand the potential for the DP to interact with the environment, so that appropriate controls can be adopted to mitigate negative impacts, the physical, biological and socio-economic environments have been assessed and reported in this section.

The assessment is largely based on data provided in published information sources, including:

- The DECC (formerly DTI) Offshore Strategic Environmental Assessment (SEA) Reports (*2002-2016*);
- The UK Digital Marine Atlas (*UKDMAP, 1998*);
- Fisheries Sensitivity Maps in British Waters (*Coull et al., 1998*);
- Spawning and Nursery Grounds of Selected Fish Species in UK waters (*Ellis et al., 2012*);
- The JNCC Cetacean Atlas of Cetacean distribution in north-west European waters (*Reid et al., 2003*);
- Scientific Advice on Matters Related to the Management of Seal Populations by the Special Committee on Seals (*SCOS, 2012; SCOS, 2016; SMRU and Marine Scotland, 2017)*;
- SCANS-III data (*Hammond et al., 2017*);
- Seabird Vulnerability in UK Waters (*Webb et al., 2016*);
- Fishing Effort and Quantity and Value of Landings by ICES Rectangle (*Marine Scotland, 2009-2013*); and
- UK Oil and Gas Data (*2018*).

In addition to the above, INEOS commissioned Fugro Survey B.V. (hereafter referred to as Fugro) to undertake an environmental pre-decommissioning survey between 13th - 17th July 2014 in an area 1,000 m by 1,000 m centred around the Windermere platform and along a 500 m wide corridor centred on the export pipeline to ST-1 (*Fugro, 2014a*).

The main objectives of the survey were to:

- Establish sediment, habitat type and general environmental conditions and identify any features of importance such as potential Annex I habitats at/around the Windermere platform and along the pipeline/umbilical route corridor to ST-1; and
- Identify whether there are any discernible impacts on the environment from the Windermere development.

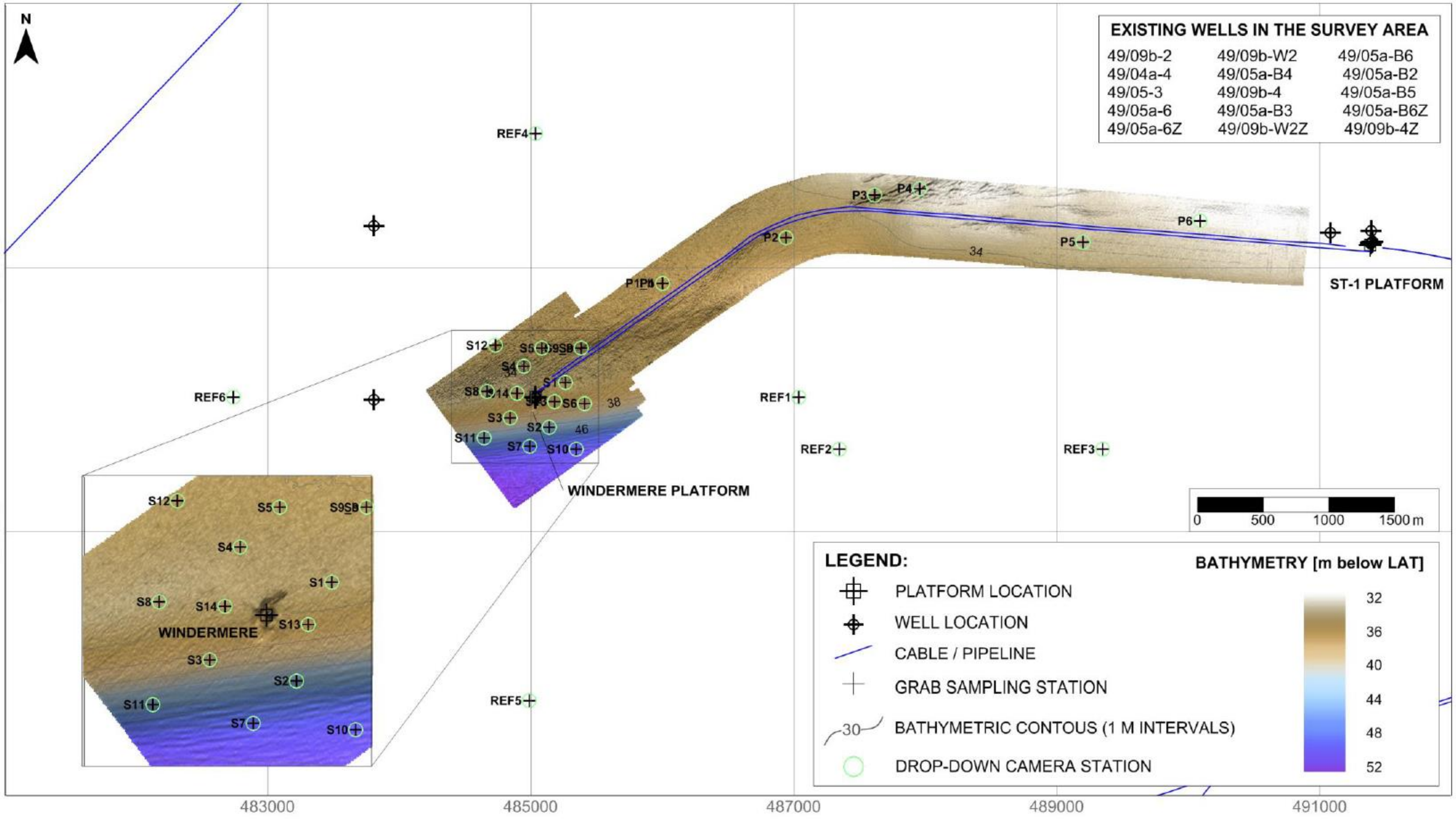
Twenty-six environmental stations were proposed for benthic grab sampling and camera investigation from a review of the side scan sonar and bathymetric data, with fourteen stations located within 1 km of the Windermere platform, six along the pipeline corridor and a further six within the wider area chosen as reference stations for comparison purposes (Figure 4-1). At each station seabed videos and photographs were acquired and four grab samples were collected; one physico-chemical sample (PC) and three macrofaunal replicates (FA, FB and FC). The PC sample was subsampled for particle size analysis (PSA), hydrocarbon (HC), and heavy and trace metal samples (HM). The exception to this was at stations R1 and R3 where the grab failed to trigger (*Fugro 2014a*).

The results from the Windermere pre-decommissioning survey are included where relevant throughout this section of the ES.

Reference has also been made to the environmental data collected during the following historic surveys:

- A pre-decommissioning survey within UKCS Blocks 49/10c and 49/10b and Netherlands Continental Shelf (NLCS) Block J6 in April 2014 (*Fugro, 2014f*), approximately 5 km to the southeast of the Windermere survey area;
- A survey for a proposed well and pipeline route conducted by Fugro within UKCS Block 49/10a and NLCS Block J6 in April 2014 (*Fugro, 2014e*), approximately 6 km to the southeast of the Windermere survey area;
- A pre-decommissioning survey within UKCS Block 49/5a in September 2013 (*Fugro, 2014d*), approximately 6 km to the north of the Windermere survey area;
- An annual pipeline and platform survey within UKCS quadrant 49 and NLCS Block J in April 2010 (*Fugro, 2010*), which partly overlaps with the Windermere survey area; and
- A survey for a proposed pipeline route from UKCS Block 49/4a to NLCS Block J6 in 2006 (*Fugro, 2007*), approximately 11 km southeast of the Windermere survey area.

Figure 4-1 Location of Environmental Survey Stations (*Fugro, 2014a*)



4.2 Physical Environment

4.2.1 Geography

The Windermere infrastructure is situated in UKCS Blocks 49/4e, 49/5a and 49/9b (hereafter referred to as the 'Blocks of Interest') in the SNS. The Windermere platform is located approximately 140 km north east of the nearest UK landfall, near to the town of Cromer on the north Norfolk coastline and 9 km to the west southwest of the UK/Netherlands transboundary line (Figure 1.1).

4.2.2 Bathymetry

The water depth at the Windermere platform location is 36 m LAT. To the south of the platform the seabed notably deepens to depths of around 50 m, with gradients of up to 5^{o} (Figure 4-2). In contrast, the Windermere pipeline route is relatively flat, with water depths ranging between 31 m and 38 m LAT (Figure 4-3) (*Fugro, 2014b*).

Figure 4-2 Multibeam Echo Sounder image of the Platform Area (*Fugro, 2014b*)

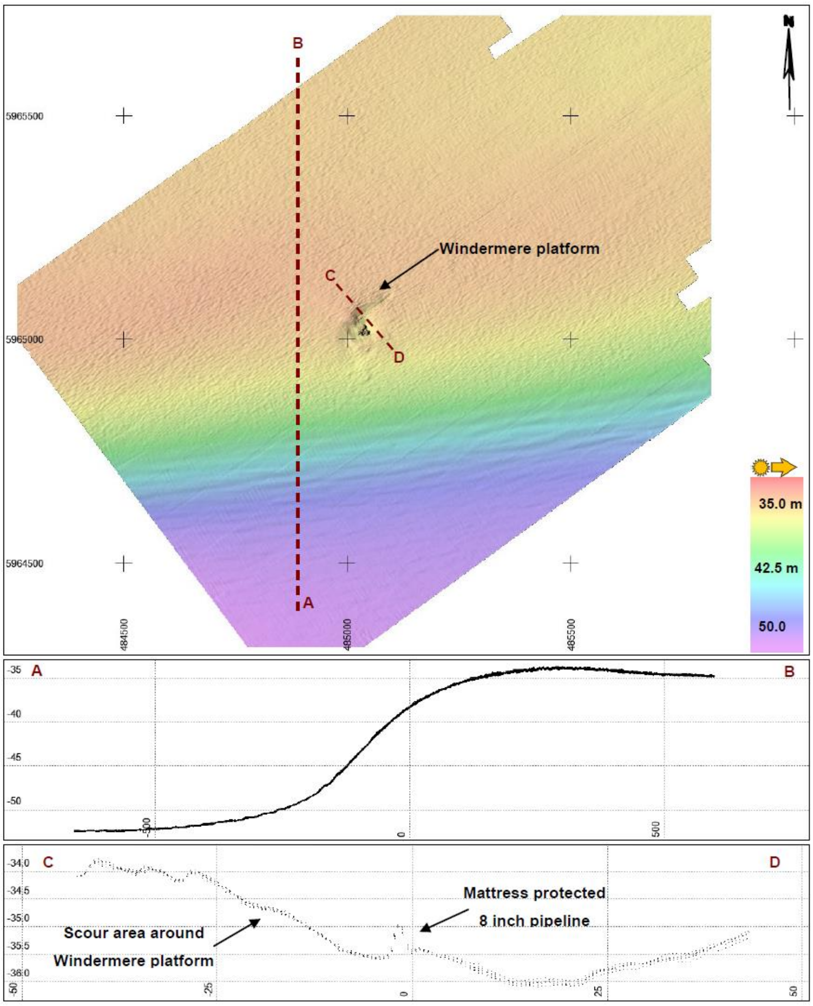
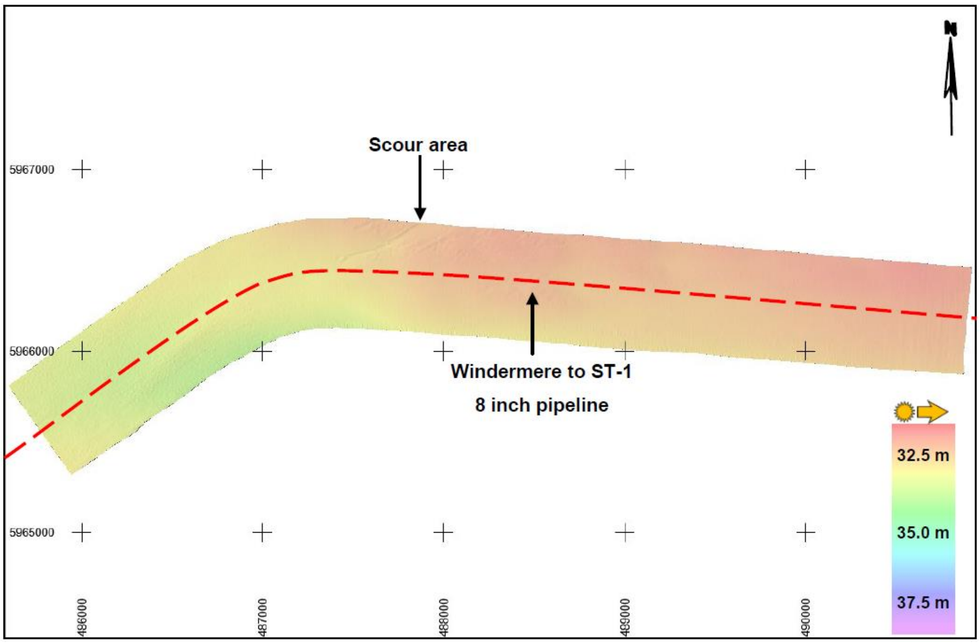


Figure 4-3 Multibeam Echo Sounder Image of Pipeline Route (*Fugro, 2014b*)



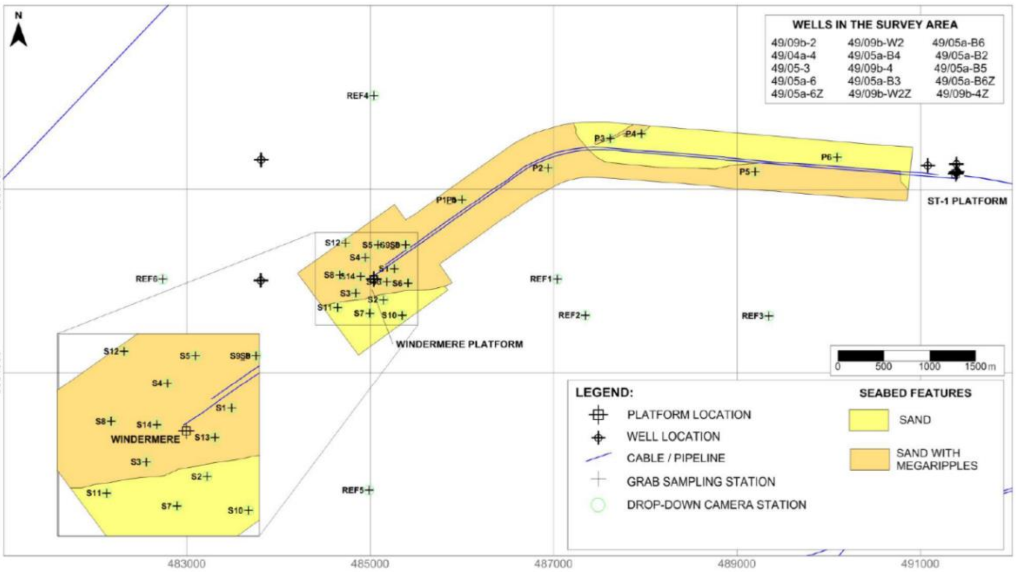
During the Windermere pre-decommissioning survey, scouring to a maximum depth of 2.0 m (relative to the surrounding seabed) was identified around the platform, as shown in Figure 4-2. In addition, a scour area up to 1.2 m deep was observed to the north of the pipeline, as shown in Figure 4-3.

Depressions at both the Windermere and the former ST-1 platforms were previously observed during an annual inspection survey in 2010, with a 'minor topographic depression' noted at Windermere and a depression up to a metre deep noted at the former ST-1 location. These depressions were thought to be caused by scouring as a result of a localised increase of water currents around the platforms (*Fugro, 2010*).

4.2.3 Seabed Sediments

The pre-decommissioning survey results identified that the seabed across the survey area displayed low acoustic reflectivity, which was interpreted as a continuous cover of sand. The area to the north of the Windermere platform, and along much of the pipeline route corridor, is characterised by megaripples (indicating a high level of sediment transportation) with heights between 0.2 m and 0.3 m (Figure 4-4). The area to the south of the platform is relatively featureless, although several trawl scars were also observed along the edge of the survey area (*Fugro, 2014b*).

Figure 4-4 Windermere Interpreted Seabed Features (*Fugro, 2014a*)

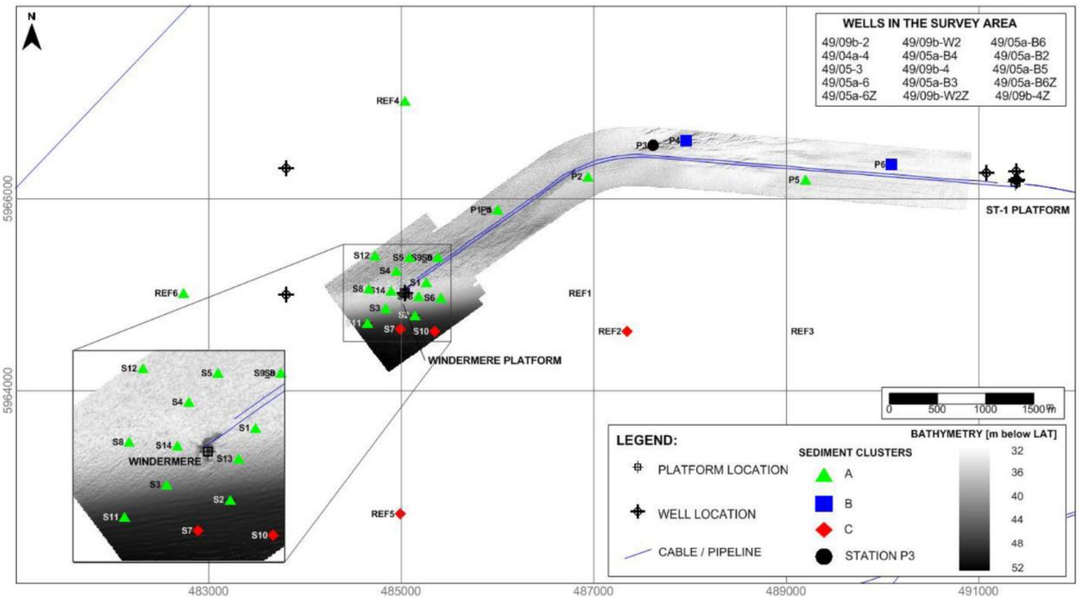


Particle size analysis indicated that sediment granulometry is similar across the survey area, comprising predominantly sand (63 µm to 2 mm diameter), which proportionally made up 67.4% to 100% of sediments, with minimal proportions of gravel sediment at all but one station (P3); consistent with the soft sediments generally observed within the seabed photographs. The proportion of fines was consistently low (0% to 4.2%) at all but four stations (S7, S10, R2 and R5), which had 32.6%, 22.4%, 20.9% and 24.4% fines respectively; these stations were consequently classified as slightly gravelly muddy sand and muddy sand under the Folk (1954) description. Sorting also followed this pattern with S7, S10, R2 and R5 being very poorly sorted, which may indicate a low energy environment, while the majority of the remaining stations were classified as moderately well sorted, indicating higher energy levels. Stations S7, S10, R2 and R5 were notably amongst the deepest stations within the survey area (*Fugro, 2014a*).

Examination of past survey data showed that sediments within the surrounding area were highly variable, with variable degrees of sorting identified and sediments that ranged in mean particle size classification from coarse silt to granule (gravel). The 2006 survey of UKCS Block 49/4 identified predominantly gravel sediments and the 2013 survey of UKCS Block 49/5a identified variable sand sediments, similar to those recorded during the current survey. The 2014 survey of UKCS blocks 49/10a and NLCS Block J6 identified coarse silt to fine sand sediments and the 2014 survey of UKCS 49/10c, 49/10b and NLCS J6 exclusively coarse silt sediment.

Multivariate analysis of the Windermere pre-decommissioning survey results identified three statistically significant clusters (using the p-value with a significance level of 5% i.e. $P<0.05$) and a single ungrouped station (P3) to the north of the pipeline. Figure 4-5 presents the spatial distribution of the multivariate groupings within the survey area.

Figure 4-5 Spatial Distribution of Sediment Cluster Groupings (*Fugro, 2014a*)



Cluster A incorporated the majority of the stations within the survey area. Sediments within this cluster comprised high proportions of medium sand to very find sand (>1 to 4 phi) with a low proportion of find sediment particles and a minimal coarse component.

Cluster B contained two stations (P4 and P6). Sediments at this station comprised the highest proportions of coarse and medium sand (>0 to 2 phi) of all the stations sampled. This cluster also had a minor coarse component and an absence of fine material.

Cluster C contained four stations (S7, S10, R2 and R5), with sediments comprising predominantly very find sand to coarse silt, ranging between >1 and 4 phi. Low proportions of fine material and a minimal coarse component were also represented.

Station P3 did not cluster with any other stations with the survey area. Sediments at this station were characterised by the highest proportion of coarse material of all of the stations sampled. This station also comprised a moderate proportion of coarse to medium sand, along with a low proportion of fine material.

The spatial distribution of the identified clusters (see Figure 4-5) indicates a correlation between the proportion of fines and depth, with cluster C, which had the finest grained sediments, being associated with the deeper section of the survey area and the reference stations to the south (*Fugro, 2014a*).

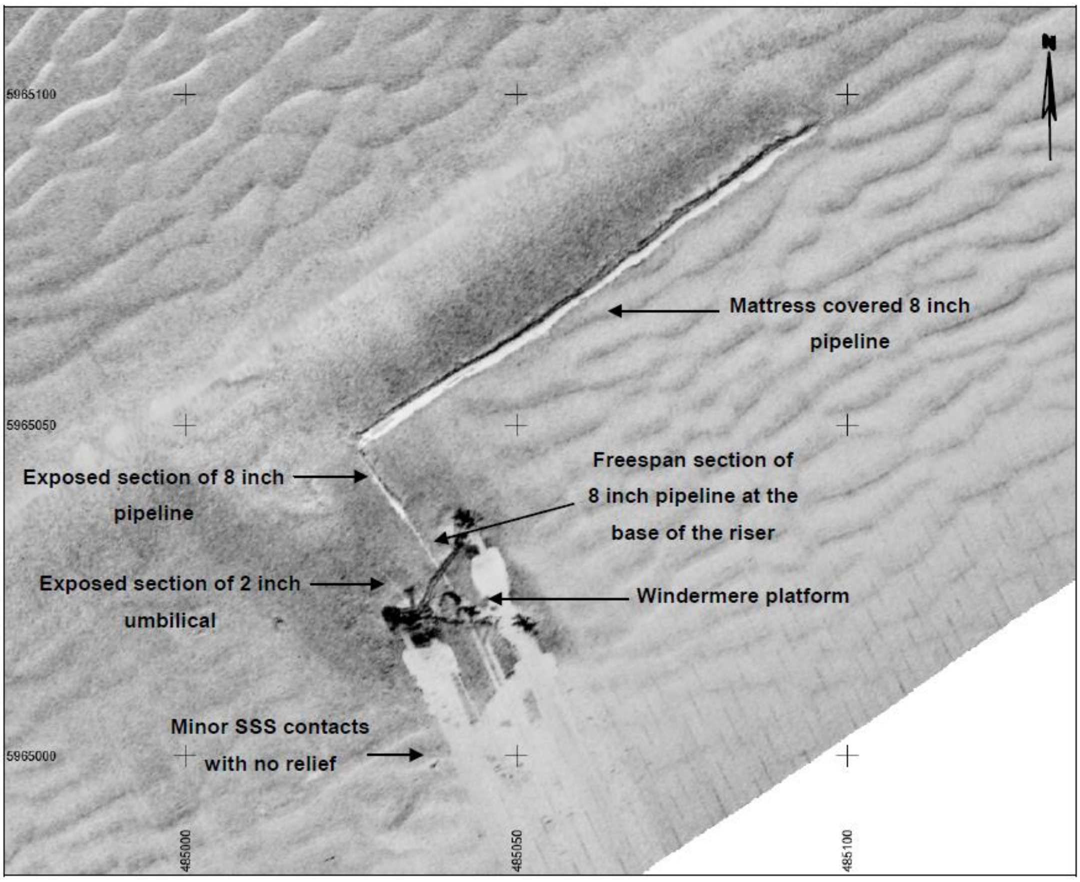
4.2.4 Seabed Features

Analysis of the side scan sonar collected during the Windermere pre-decommissioning survey identified the following:

- The pipeline to be in freespan for a distance of 8m, and exposed for a total distance of 22m, at the base of the Windermere platform riser, as shown in Figure 4-6;
- Mattresses covering the pipeline for a distance of 86m between KP 0.022 and KP 0.108, as shown in Figure 4-6;
- A possible exposure of the pipeline within a depression, observed at KP 1.085;
- The umbilical to be exposed for a distance of 12m at the departure from the Windermere platform, as shown in Figure 4-6;

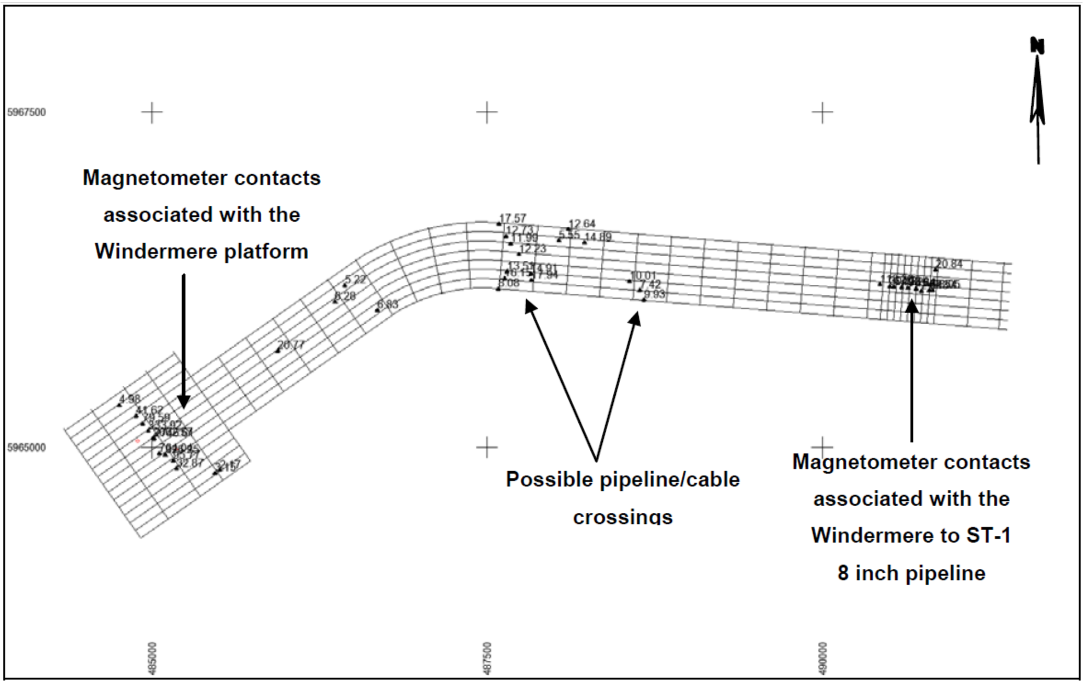
- Sections of a shallow remnant trench along the length of the 2 inch umbilical.

Figure 4-6 Detailed Side Scan Sonar Image of the Windermere Platform Area (*Fugro, 2014a*)



In addition, forty-one magnetometer contacts were recorded during the survey, the location of which are presented in Figure 4-7.

Figure 4-7 Overview of the Magnetometer Contacts in the Survey Area (*Fugro, 2014a*)



Of these, nine contacts are of unknown origin and may indicate buried ferromagnetic objects/debris. No side scan sonar contacts are associated with these magnetometer contacts. A further fourteen contacts display a degree of alignment, and may be related to existing buried pipeline/cables. However, the available database information does not indicate the presence of cables or pipelines at these locations. Of the remaining contacts, nine are associated with the Windermere platform structure; and nine are associated with the Windermere to ST-1 pipeline (*Fugro, 2014a*).

4.2.5 Shallow Geology

The shallow geological conditions at Windermere were investigated with a sub-bottom profiler (pinger) system during the pre-decommissioning survey. The maximum penetration achieved was approximately 19m.

The shallow geology across the survey area was interpreted to comprise Holocene SAND or gravelly SAND sediments (upper 2 m) overlying Bolders Bank Formation sediments (SAND/CLAY) up to 15m thick. Three units (A, B and C) have been identified, based on differences in seismic facies, presumably within the Bolders Bank Formation, as described in Table 4-1.

Table 4-1 Units Identified within the Shallow Geology of the Survey Area (*Fugro, 2014a*)

Unit	Depth Below Seabed (metres)	Reflectivity	Description
A	0 to ~ 1.5 (variable)	Seismically characterised by high continuity, high amplitude and relatively high frequency parallel to sub-parallel reflections	Holocene SAND deposits
B	~ 1.5 to ~ 5.0	Characterised by discontinuous, medium amplitude and high frequency reflections. Locally high amplitude continuous reflections are visible	Sandy CLAY sediments which are locally intercalated by SAND sheets
C	> ~ 5.0	Discontinuous and medium amplitude reflections. Within this unit, internal layers with occasionally strong reflectors were observed. The variation in strength of these reflections is dependent on the exact composition of these layers.	SAND

In addition, two possible channel structures were identified within Unit C between KP 3.000 and KP 3.500 along the Windermere to ST-1 pipeline route. The channel infill may comprise different material from the surrounding area (*Fugro, 2014a*).

4.2.6 Sediment Chemistry

Marine sediments can contain hydrocarbons from natural and human (anthropogenic) sources such as oil and gas activity, from vessels and run off from roads and land. Surveys of offshore platforms have historically found hydrocarbon levels are elevated in the immediate vicinity of the platforms, but these level rapidly fall to background levels within a short distance from the platform (*Cefas, 2001a*).

The seabed sediments collected during the Windermere pre-decommissioning survey were analysed for organic matter content, total hydrocarbons (THC) concentration and heavy and trace metals.

Across the survey area, total organic carbon (TOC) and total organic matter (TOM) levels were generally found to be low (ranging between 0.08% and 0.52%. and 0.42% to 2.25% respectively), albeit with concentrations of TOM exceeding the UKOOA (*2001*) mean at stations S7, S10, R2 and R5. These stations were located at deeper depths and recorded a higher fine component compared with the other stations within the survey area, suggesting they are located in a more depositional area (*Fugro, 2014a*).

THC concentrations were also low throughout the survey area, ranging from 0.4 μgg^{-1} to 4.0 μgg^{-1}, and were consistently below the mean UKOOA (*2001*) level for the SNS (4.34 μgg^{-1}). Distributions of n-alkanes were consistent with predominantly terrestrial hydrocarbon inputs (*Fugro, 2014a*).

Evidence of synthetic based drilling fluid / mud was observed at three stations within the survey area (S2, S3 and S14), all within 400 m of the Windermere platform, but it should be noted that no residual SBM contamination was seen at other stations within similar proximity (i.e. stations S1, S4 and S8).

4-6 ring polycyclic aromatic hydrocarbons (PAH) arise from the combustion of organic matter and are heavier than the 2-3 ring PAHs which are associated with petroleum sources and may indicate hydrocarbon contamination from drilling activities. The majority of the 2-3 ring PAH/4-6 ring PAH ratios recorded during the pre-decommissioning survey were below the UKOOA (*2001*) mean (0.87) for the SNS, indicates a dominance of inputs from the combustion of organic matter. The exception to this was station R4 which had a ratio of 1.20, however this is likely to be attributable to the overall low levels of total 2-3 ring PAHs and 4-6 ring PAHs rather than sediment contamination (*Fugro, 2014a*).

Heavy metals are naturally present in seawater and sediments but some, in elevated concentrations, can have negative environmental impacts. Table 4-2 provides a summary of the heavy and trace metal analyses alongside UKOOA (*2001*) background mean and 95th percentile concentrations for the SNS. NOAA ERL (Effects Range Low) concentrations are provided; indicating the lower threshold at which adverse biological effects have been identified from ecotoxicological studies (*Buchman, 2008*).

Table 4-2 Range of Heavy and Trace Metal Concentrations (μgg^{-1} dry weight) (*Fugro, 2014a*)

Contaminant	UKOOA		NOAA	Windermere Survey Results[1]		
	Mean (μgg^{-1})	95th % (μgg^{-1})	ERL (μgg^{-1})	Minimum Value (μgg^{-1})	Mean Value (μgg^{-1})	Maximum Value (μgg^{-1})
Aluminium (Al)	-	-	-	11,500	16,338	25,200
Arsenic (As)	-	-	8.2	6.7	23.9	43.9
Barium (Ba)	218	302	-	152.0	207.3	379.0
Cadmium (Cd)	0.5	0.5	1.2	<0.1	0.1	0.2
Chromium (Cr)	24.6	48.5	81.0	10.3	15.7	24.3
Copper (Cu)	6.6	11.8	34.0	4.1	5.3	7.2
Iron (Fe)	-	-	-	10,000	14,125	22,700
Mercury (Hg)	0.03	0.10	0.15	<0.1	0.01	0.02
Nickel (Ni)	8.0	18.7	20.9	5.4	7.7	17.2
Lithium (Li)	-	-	-	5.6	8.5	14.4
Lead (Pb)	12.7	21.1	46.7	7.3	11.8	22.9
Tin (Sn)	-	-	-	<0.5	0.9	3.0
Vanadium (V)	-	-	-	38.1	50.4	75.3
Zinc (Zn)	21.8	43.5	150.0	12.5	21.6	64.8

[1] Where the Windermere survey results exceed a threshold on the left-hand side of the table they have been highlighted accordingly.

It can be seen from Table 4-2 that mean concentrations of several heavy and trace metals from the Windermere samples were either above the UKOOA mean or 95th percentile values, or exceeded NOAA ERL thresholds which could indicate contamination arising from drilling activities. In addition, when heavy and trace metal concentrations are normalised to 5% aluminium, concentrations of arsenic, cadmium and lead were found to be above OSPAR (*2012*) BCs and BACs at the majority of stations. However, this is typically expected within the North Sea and therefore are not considered indicative of contamination due to drilling at Windermere (*Fugro, 2014a*).

Elevated levels of some metals, particularly barium, are often found around drilling platforms tend to be higher than ambient North Sea levels. Barium is a key component in barite which is used as a weighting agent in drilling muds. Although relatively inert, barium is often used as an indicator for contamination by drilling. Barium concentrations were relatively low throughout the Windermere survey area (see Table 4-2), and the majority of concentrations (with the exception of stations S2, S7, S10, P3 and R5) were below the UKOOA (*2001*) regional background values, indicating minimal metal inputs from drilling activity. The level at station S2 was higher than the UKOOA 95th percentile concentration for the SNS and coincided with the presence of synthetic based drilling fluid/mud observed in the station's gas chromatography trace. The concentration at station S2 was comparable to the maximum values observed during the 2014 survey conducted in UKCS Block 49/10c, 49/10b and NLCS Block J6, for which the mean concentrations exceeded the 95th percentile concentration. However, generally, barium concentrations within the past datasets were higher than those observed during the Windermere pre-decommissioning survey (*Fugro, 2014a*).

4.2.7 Oceanography

4.2.7.1 Waves

Waves are the result of energy being transferred between two fluids moving at different rates (*Dobson & Frid, 1998*). They are caused at sea by the differential motion of the air (wind) and the seawater. The height of a wave is the distance from the crest to trough, but as the waves at any one time are not of equal size, the significant wave height (Hs) is taken and corresponds approximately to the mean height of the highest third of the waves. The wave period is the (mean) time between two wave crests, called the zero up-crossing period and is given in seconds. The wave climate of the area provides information on the physical energy acting on structures and dictates the structural design requirements.

The worst case significant wave heights in the vicinity of the Windermere Development exceed 2.5m for 10 percent of the year (Table 4-3). However, there is considerable seasonal variation between sea states, with waves in excess of 2m recorded for 25 percent of the time in autumn and winter, but only two percent of the time in summer (*Smith, 1998*). Wave direction is variable throughout the year.

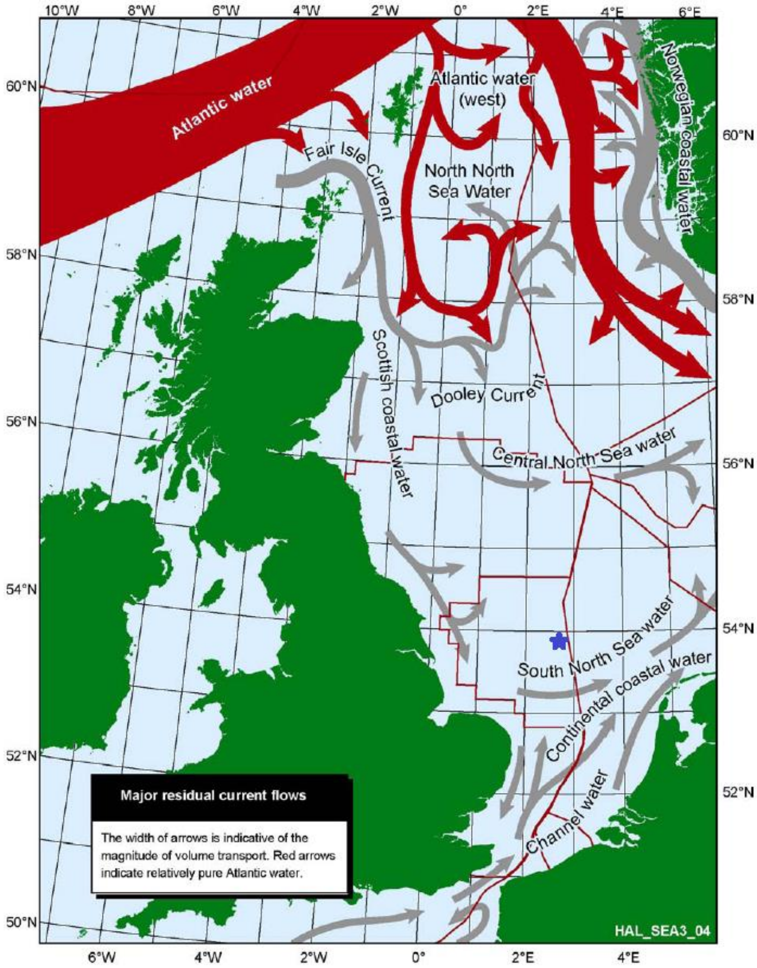
Table 4-3 Worst Case Yearly Significant Wave Height in the Vicinity of the Blocks of Interest (*UKDMAP, 1998*)

10% Exceedance	25% Exceedance	50% Exceedance	75% Exceedance
2.5 m	2 m	1.5 m	1 m

4.2.7.2 Tides and Water Circulation

The general circulation of near-surface water masses in the North Sea is cyclonic, mostly driven by the ingression of Atlantic surface water in the western inlets of the northern North Sea. As a result, residual water currents near the sea surface tend to move in a south-easterly direction along the coast towards the English Channel (*NSTF, 1993*). In addition, counter currents occur towards the English/Dutch sector median line, flowing north-east towards Denmark (Figure 4-8). The effect of this counter current in the Windermere Development area pushes the near-surface water movement towards a more southerly and easterly direction.

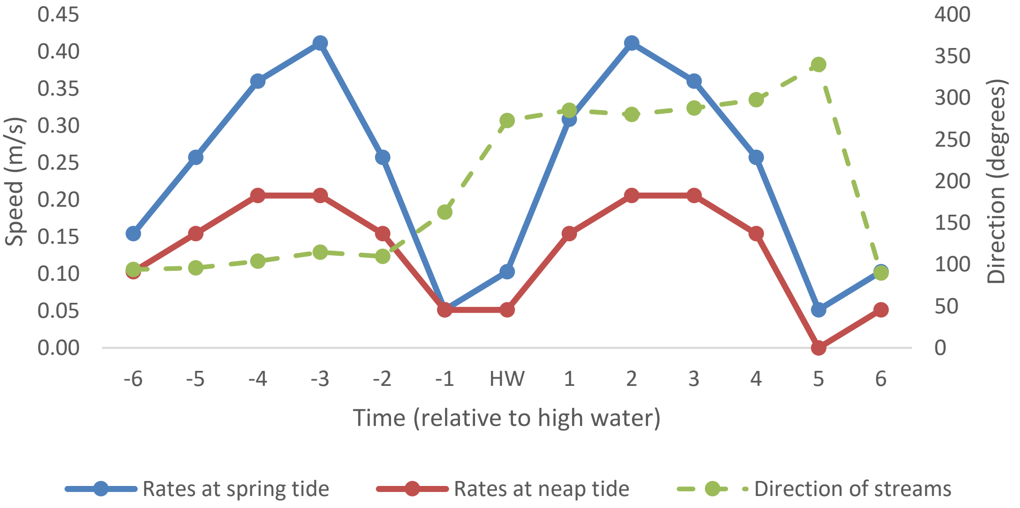
Figure 4-8 Major Water Masses and Residual Circulation in the North Sea (*DECC, 2009*)



Note: blue star indicates approximate location of Windermere infrastructure

Tides in the SNS are predominately semi-diurnal and tidal waters offshore in this area flood southwards and ebb northwards. Maximum tidal rates in the region of the Blocks of Interest are 0.41 and 0.21 m per second (m/s) respectively for spring and neap tides (Figure 4-9). Tidal streams were generally fastest for a period of two hours up to three hours prior to high water during both spring and neap tides.

Figure 4-9 Tidal Current Speeds and Direction Measured at 54˚02'1N, 02°53'8E (*Admiralty Chart 2182A, Tidal Diamond J, Hydrographer of the Navy, 2008*)



4.2.7.3 Sea Temperature

The sea surface and seabed temperatures in the vicinity of the Windermere Development area both range between a mean winter temperature of around 5 degrees Celsius (°C) and a mean summer temperature of approximately 15°C (*UKDMAP, 1998)*.

4.2.7.4 Salinity

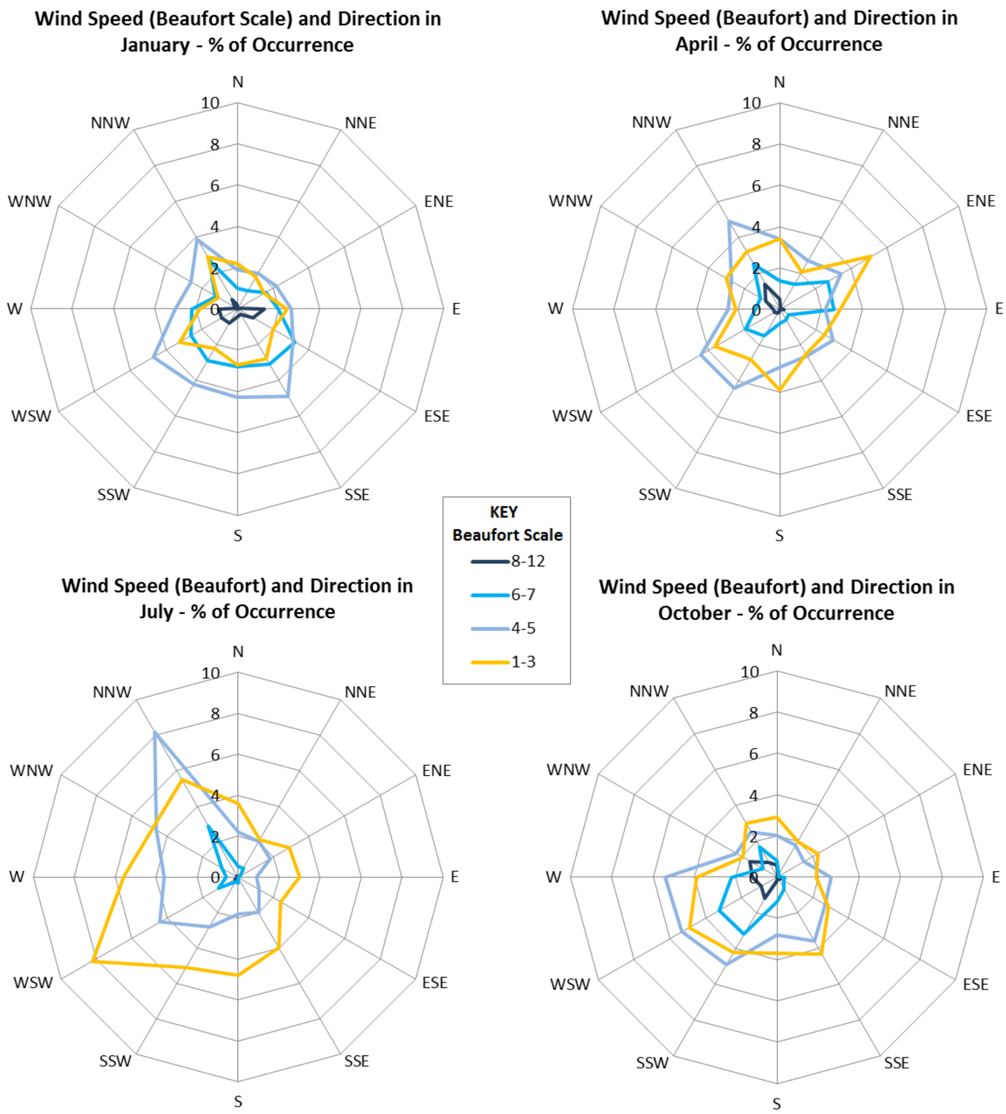
The salinity in the region of the Windermere Development area remains relatively stable throughout the year. The mean salinity of the sea surface varies between a winter mean of 34.75 parts per thousand (ppt) and a summer mean of 34.75 ppt. While the mean salinity of the bottom is 34.8 ppt in winter and 34.6 ppt in summer (*UKDMAP, 1998*).

4.2.8 Wind

The winds in the area are variable but predominantly from the west (Figure 4-10). During the winter and early summer north-easterly and south-westerly winds are most common. From July to September however, south-westerly and westerly winds predominate.

The windiest months are December and January, with wind speeds of greater than Beaufort Force 7 (14 to 16.5 m/s) achieved on six to ten days a month. The calmest months are May to August with wind speeds of Force 7 or more reached only on between one and three days (*Barne et al., 1995*).

Figure 4-10 Wind Roses for the Area 54.0N – 55.9N, 2.0E – 3.9E (*Korevaar, 1990*)



4.3 Biological Environment

4.3.1 Plankton

Plankton forms a fundamental link in the food chain and is defined as small marine or freshwater organisms, of both plants (phytoplankton) and animals (zooplankton) (*Lawrence, 2000*). The composition and abundance of plankton communities at any time is variable and is strongly influenced by several factors such as depth, tidal mixing, temperature stratification, nutrient concentrations and the location of oceanographic fronts. Species distribution is directly influenced by temperature, salinity, water inflow and the presence of local benthic (bottom dwelling) communities.

The SNS is characterised by shallow, well-mixed waters, which undergo large seasonal temperature variations. The region is largely enclosed by land and, as a result, the environment here is dynamic with considerable tidal mixing and nutrient-rich run-offs from the land (eutrophication). In these conditions, there will be relatively little stratification throughout the year and constant replenishment of nutrients, so opportunistic organisms such as diatoms are particularly successful (*Margalef, 1973 cited in Leterme et al., 2006*). Diatoms comprise a greater proportion of the phytoplankton community than dinoflagellates from November to May, when mixing will be at its greatest. The phytoplankton community is dominated by the dinoflagellate genus Ceratium (*C. fusus, C. furca, C. lineatum*), along with higher numbers of the diatom, Chaetoceros (subgenera *Hyalochaete and Phaeoceros*) than are typically found in the North Sea. The zooplankton community comprises *C. helgolandicus* and *C. finmarchicus* as well as *Paracalanus* spp., *Pseudocalanus* spp., *Acartia* spp., *Temora* spp. and cladocerans such as *Evadne* spp. (*DECC, 2009*).

Plankton are vulnerable to discharges to the sea and accidental chemical or hydrocarbon spills. Studies indicate that zooplankton appear to be the most vulnerable group to toxic effects of discharges such as produced water, whereas the phytoplankton and fish larvae tend to be more robust to any direct effects (*GESAMP, 1993*). However, planktonic organisms are generally short lived and recovery following a pollution-induced population reduction is usually rapid.

4.3.2 Benthic Communities

Seabed sediments provide support, protection and the food source for many macrofaunal species. The macrofauna, most of which are infaunal (living within the sediment), are therefore particularly vulnerable to external influences and changes in the sediment, such as those of a physical, chemical or biological nature.

Some infaunal animals are largely sedentary and are thus unable to avoid unfavourable conditions. Each species has its own response and degree of sensitivity to changes in the physical and chemical environment and consequently the species composition and their relative abundance in a particular location provides a reflection of the immediate environment, both current and historical. The recognition that aquatic contaminant inputs may alter sediment characteristics, together with the relative ease of obtaining quantitative samples from specific locations, has led to the widespread use of infaunal communities in monitoring the impact of disturbances to the marine environment over a long period of time.

Habitat Classification Analysis of the photographic data in conjunction with the geophysical data obtained during the Windermere pre-decommissioning survey identified three EUNIS habitats in the survey area. The majority of the survey area was characterised as ‘A5.27: Deep Circalittoral Sand’ with a number of areas in the southern most region characterised as ‘A5.26: Circalittoral Muddy Sand’ and one area to the north of the pipeline (Station P3) of ‘A5.15: Deep Circalittoral Coarse Sediment’ (*Fugro, 2014a*). These habitats are discussed further below and Table 4-4 summarises their EUNIS habitat hierarchy and equivalent JNCC classification.

Table 4-4 Habitat Classification Hierarchy

EUNIS Habitat Classification				Connor *et al* (2004) Classification
Environment (Level 1)	Broad Habitat (Level 2)	Habitat Complex (Level 3)	Biotope Complex (Level 4)	
Marine (A)	Sublittoral Sediment (A5)	Sublittoral Coarse Sediment (A5.1)	Deep Circalittoral Coarse Sediment (A5.15)	Offshore Circalittoral Coarse Sediment (SS.SCS.OCS)
		Sublittoral Sand (A5.2)	Circalittoral Muddy Sand (A5.26)	Circalittoral Muddy Sand (SS.SSa.CMuSa)
			Deep Circalittoral Sand (A5.27)	Offshore Circalittoral Sand (SS.SSa.OSa)

The majority of the survey area was broadly characterised as Sublittoral Sand with certain areas further classified to biotope complex as detailed below. These habitats vary slightly according to their relative proportions of fine material, but the faunal assemblages present are similar. The classification of sediments within this group of habitat types is subjective such that there is the potential for overlap between them.

- **A5.26: Circalittoral muddy sand** - This biotope complex was considered to be present at five stations (S7, S10, R2, R3, R5) within the survey area and comprises circalittoral non-cohesive muddy sands with silt content between 5 percent and 20 percent. The biotope is typically dominated by a wide variety of polychaetes, bivalves and echinoderms. Common species include the starfish (*Asterias rubens*), hermit crab (Paguridae), soft coral (*Alcyonium digitatum*) and worm casts and burrows. Other species present in this survey include the brittle star (*Ophiura albida*) and eelpout (Zoarcidae) (*Fugro, 2014a*). Figure 4-11 presents a photograph of this habitat taken during the Windermere pre-decommissioning survey.

Figure 4-11 Example of Seabed Image Showing A5.26: Circalittoral muddy sand (Station S7) (*Fugro, 2014a*)

Photograph: GE030_S7_02

Easting: 484 991 mE
Northing: 5 964 645 mN
Depth: 51 m

Sediment Type:
Muddy sand

- **A5.27: Deep circalittoral sand** - This biotope complex was observed throughout the majority of the survey area, comprising fine sands and non-cohesive muddy sands. While very little data is available on this habitat it is likely characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms. In the current survey area fauna was generally sparse, but species present included the common starfish (*Asterias rubens*), brittle star (*Ophiura albida*), hermit crab (Paguridae) and faunal burrows (*Fugro, 2014a*). Figure 4-12 presents a photograph of this habitat taken during the Windermere pre-decommissioning survey.

Figure 4-12 Example of Seabed Image Showing A5.27: Deep circalittoral sand (Station 1) (*Fugro, 2014a*)

Photograph: GEO30_S1_06

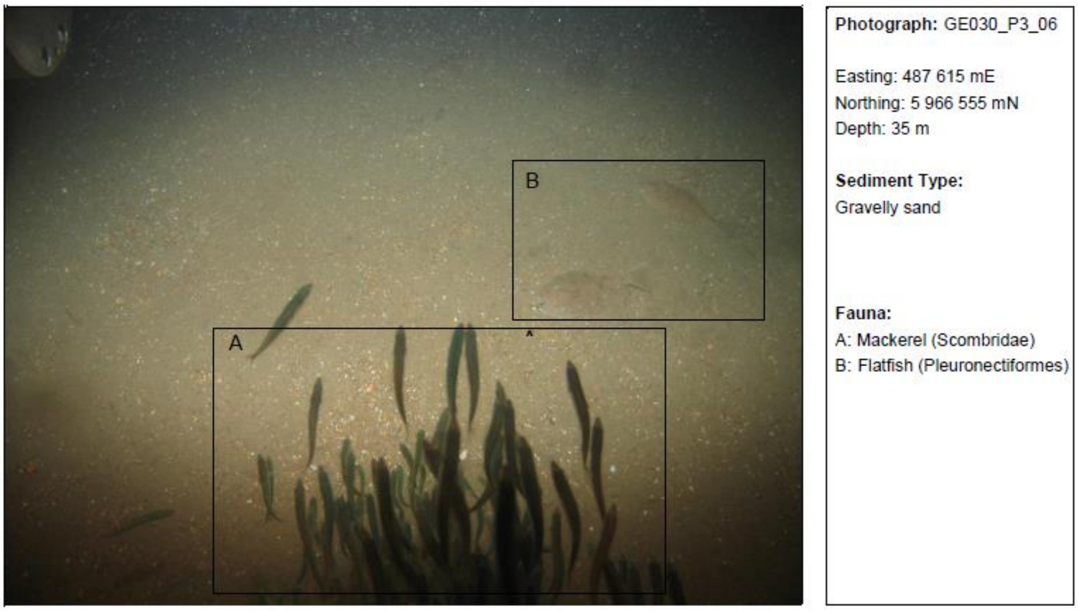
Easting: 485 267mE
Northing: 5 965 133 mN
Depth: 37 m

Sediment Type:
Sand

A5.2: Sublittoral Sand - This habitat is characterised by clean medium to fine sands, or muddy sands, but not muddy enough to become cohesive, often with a silt and clay content of less than 20%. The degree of wave action or strength of the tidal currents is regularly a factor in restricting the proportion of fine material building up. The non-cohesive nature of these sediments discourages their colonisation by certain burrowing species, such as the Norwegian lobster (*Nephrops norvegicus*). The habitat is characterised by a variety of fauna, including polychaetes, bivalves and amphipod crustaceans. In the current survey this habitat was typically found to also contain starfish (*Asteroidea*), hermit crabs (*Paguroidea*) and hydroids (*Hydrozoa*).

A5.1: Sublittoral Coarse Sediment - This habitat is characterised by coarse sediments including coarse sand, gravel, pebbles and cobbles with typically low silt content. This habitat was only characterised at one environmental station (P3) and could be further classified to biotope complex as **A5.15: Deep Circalittoral Coarse Sediment**. This station was relatively rich in epifauna in comparison to other stations, with common species including Harbour crab (*Liocarcinus depurator*), common starfish (*Asterias rubens*), flatfish (Pleuronectiformes), mackerel (Scombridae) and weever fish (Trachinidae). Figure 4-13 presents a photograph of this habitat taken during the Windermere pre-decommissioning survey.

Figure 4-13 Example of Seabed Image of A5.15 Deep Circalittoral Coarse Sediment (Station P3) (*Fugro, 2014a*)



4.3.2.1 Macrofaunal Data

Phyletic composition of the macrofaunal data collected during the Windermere pre-decommissioning survey is displayed in Table 4-5. Two hundred and four discrete macrofauna taxa were recorded from the 72 grab samples. A total of 90 taxa (44.1%) were represented by annelids, 55 taxa (27.0%) were crustaceans, 39 taxa (19.1%) were molluscs, 11 taxa (5.4%) were echinoderms and 3 taxa (1.5%) were cnidarians. Representatives of the phyla Nemertea, Sipuncula, Phoronida, Arthropoda, Chordata and Hemichordata comprised the 6 taxa (2.9%) belonging to the ‘other’ group.

Annelida were the most abundant group, contributing 37% to the total recorded individuals. Mollusca also represented a large proportion (31.2%) of the individuals. Echinodermata contributed 18.8% and Crustacea contributed 9.8%, while Cnidaria and members of the ‘other’ taxa contributed the least with 0.2% and 3% respectively.

Table 4-5 Abundance of Major Taxonomic Groups (*Fugro, 2014a*)

Group	Number of Taxa	Taxa (%)	Abundance	Abundance (%)
Annelida	90	44.1	2823	37.0
Crustacea	55	27.0	748	9.8
Mollusca	39	19.1	2380	31.2
Echinodermata	11	5.4	1437	18.8
Cnidaria	3	1.5	13	0.2
Other[1]	6	2.9	227	3.0
Total	**204**	**100**	**7628**	**100**

[1] Comprises the phyla Nemertea, Sipuncula, Phoronida, Arthropoda, Chordata and Hemichordata

The infaunal community was diverse and contained a moderately high number of individuals at each station. Annelids were the dominant taxon overall, as is often the case in marine soft-sediment ecosystems. Abundant taxa included the polychaetes *Spiophanes bombyx*, *Galathowenia oculata*, *Lagis koreni* and *Diplocirrus glaucus*, bivalves *Mactra stultorum*, *Corbula gibba*, *Kurtiella bidentata*, *Cochlodesma praetenuae* and *Goodallia triangularis*, along with *Amphiura filiformis* of the family Ophiuroidea. All these taxa are commonly recorded from similar habitats in the southern North Sea region (e.g. *Gardline, 2013; Rees et al., 2007; Künitzer et al., 1992*).

The top ten most abundant species within the Windermere pre-decommissioning survey area are displayed in Table 4-6, showing their corresponding mean abundance per grab sample, frequency of occurrence and rank dominance. The most abundant taxon was the brittlestar *Amphiura filiformis* with a mean abundance of 16 and frequency of 26.39%. The second most abundant taxon was the bivalve mollusc *Mactra stultorum* with a mean abundance of 13 individuals and frequency of 79.17%.

By ranking the taxa recorded from each sample in terms of abundance and summing the rank scores for all samples to give the overall rank dominance for each taxon, it is possible to examine which species were consistently dominant throughout the survey area. The majority of the top ten most abundant taxa were also ranked amongst the top ten most dominant taxa. The number one taxon ranked by dominance is the polychaete worm *Spiophanes bombyx* which had a frequency of 88.89% and a mean abundance of 9 individuals. The most abundant species overall, *A. filiformis*, was ranked only 8th in terms of rank dominance, with this reflecting its rather patchy distribution (26.39% frequency of occurrence).

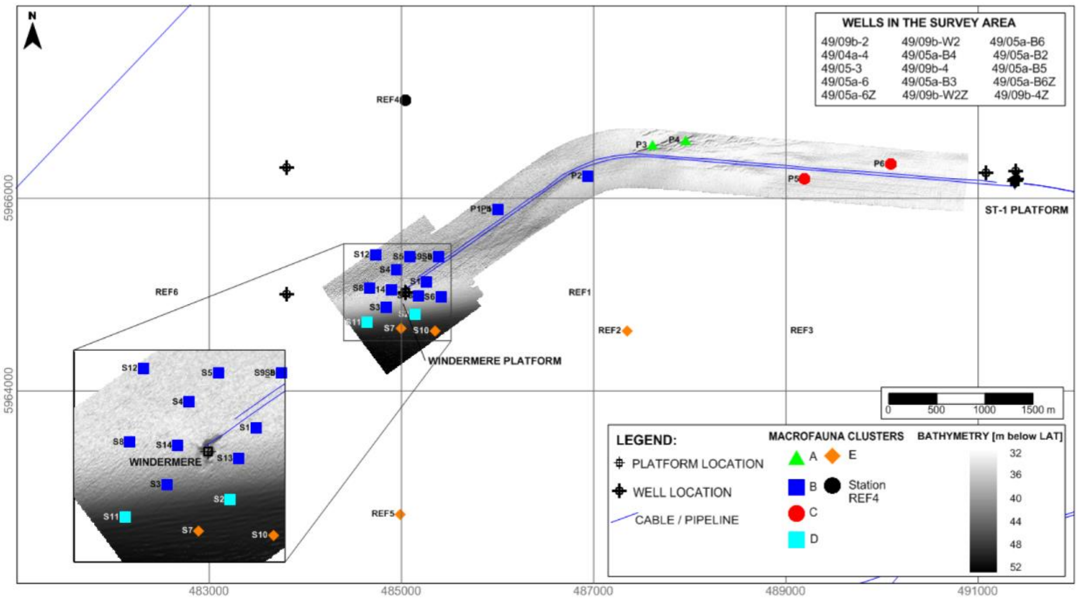
Table 4-6 Dominant Taxa and Dominance Rank for Samples (0.1m^2) (*Fugro, 2014a*)

Taxon	Rank Abundance	Mean Abundance per 0.1m^2 Grab Sample	Frequency of Occurrence (%)	Rank Dominance for Survey Area
Amphiura filiformis	1	16	26.39	8
Mactra stultorum	2	13	79.17	3
Spiophanes bombyx	3	9	88.89	1
Galathowenia oculata	4	5	47.22	9
Lagis koreni	5	5	66.67	4
Corbula gibba	6	4	94.44	2
Diplocirrus glaucus	7	3	58.33	5
Kurtiella bidentata	8	3	26.39	10
Cochlodesma praetenue	9	2	72.22	7
Goodallia triangularis	10	2	20.83	17

Multivariate analysis of the macrofaunal data separated the stations into five clusters and one ungrouped station. The majority of stations were grouped within Cluster B.

Figure 4-14 presents the spatial distribution of the identified clusters.

Figure 4-14 Spatial Distribution of Multivariant Macrofaunal Cluster Groupings (*Fugro, 2014a*)



Cluster A grouped two stations (stations P3 and P4), which were positioned midway along the route corridor between the Windermere and ST-1 platforms. This cluster was characterised by species typical of coarse to fine sand sediments, including the pea urchin *Echinocyamus pusillus*, bivalves *Goodallia triangularis* and *Thracia phaseolina,* along with the polychaetes *Polycirrus* and *Pisione remota*. The sediment analysis (section 4.2.3) showed the station P3 to comprise a higher coarse component, compared with all other stations within the survey area.

Cluster B was represented by 13 stations, comprising the largest grouping within the survey area. The majority of these stations were situated in the vicinity of the Windermere platform, and the cluster was characterised by species typical of muddy sands. The bivalves *Mactra stultorum*, *Corbula gibba* and *Cochlodesma praetenue* in addition to the polychaetes *Spiophanes bombyx* and *Scoloplos armiger* characterised this cluster.

Cluster C (stations P5 and P6) was situated along the eastern end of the pipeline route corridor and comprised a similar species assemblage to the Clusters A and B. Sediment analysis showed that each of these stations comprised high proportions of medium sand.

Cluster D also included two stations, station S2 and S11. These stations were located in the area surrounding the Windermere platform, and each station comprised poorly sorted medium sand. Taxa characterising this cluster included *Amphiura filiformis* of the Ophiuroidea, bivalves *Kurtiella bidentata* and *Nucula nitidosa* and *Corbula gibba* along with the polychaete *Lagis koreni*.

Cluster E comprised four stations to the south of the survey area (S7 S10, R2 and R5) which also make up Sediment Cluster C (Section 4.2.3). These stations recorded slightly higher depths compared with the remaining stations throughout the survey area and sediments comprised very poorly sorted very fine sand, with comparatively high fines content. The top five characterising taxa within the Cluster E were very similar to those within the Cluster D.

Station R4 was ungrouped and was positioned approximately 2,000 m to the north of the Windermere platform. The top characterising taxa were most closely comparable to the Cluster B, albeit in differing abundances, and the assemblage was differentiated by the spionid polychaete *Scolelepis bonnieri* and the amphipod crustacean *Bathyporeia gracilis.*

Across the survey area as a whole there was an overlap in community structure between the different clusters. This typically occurs where gradients in sediment particle size occur, and one community merges into another.

The community structure of these clusters represented an ecological continuum from fauna recorded in sediments with a greater proportion of coarse material and low proportions of sands and fines, through fauna recorded in sediments dominated by sands but with no coarse or fines fraction, to a community found in slightly muddy sand sediments. Consequently, the BIOENV analysis (used to calculate correlations between environmental variables and the observed patterns in community structure) revealed a significant correlation between infaunal community structure and sediment particle size distribution which was not unexpected; proportions of medium sand, and medium silt contributing most to the relationship (*Fugro, 2014a*).

4.3.3 Fish Populations

Generally, there is little interaction between fish and offshore developments, although some species congregate around platforms and along pipelines. However, spawning individuals and juveniles can be sensitive to seismic and installation activities, discharges to sea and, in some cases, accidental spills. Fish are separated into pelagic (living at the surface or in the middle parts of the water column) and demersal (bottom dwelling) species:

- Pelagic species occur in shoals swimming in mid-levels of the water, typically making extensive seasonal movements or migrations between sea areas. Pelagic species include herring, mackerel, blue whiting and sprat;
- Demersal species live on or near the seabed and include haddock, cod, plaice, sandeel, sole and whiting.

4.3.3.1 Fish Spawning and Nursery Areas

Data on the spawning and nursery areas of fish on the UKCS were initially reported in 1998 by Coull *et al.* as unique polygons and then in 2012 Ellis *et al.* published data to a resolution of half an ICES rectangle. The Windermere Development lies within the ICES rectangle 36F2. For the purpose of this report, fish spawning and nursery areas within the vicinity of the Windermere Development have been identified according to whether they overlap with the boundary of ICES rectangle 36F2.

There are potential fish spawning areas (Table 4-7, Figure 4-15 and Figure 4-16) in ICES rectangle 36F2 for cod (*Gadus morhua*), herring (*Clupea harengus*), lemon sole (*Microstomus kitt*), mackerel (*Scomber scombrus*), *Nephrops*, plaice (*Pleuronectes platessa*), sandeels (Ammodytidae *marinus*), sole (*Solea solea*), sprat (*Sprattus sprattus*) and whiting (*Merlangius merlangus*) (*Coull et al., 1998; Ellis et al., 2012*).

In addition to the spawning grounds described above, the waters of ICES rectangle 36F2 also act as nursery areas for anglerfish (*Lophius piscatorius*), cod, herring, horse mackerel (*Trachurus trachurus*), lemon sole, mackerel, *Nephrops*, sandeels, sprat, spurdog (*Squalus acanthias*), tope shark (*Galeorhinus galeus*) and whiting (*Coull et al., 1998; Ellis et al., 2012*).

Table 4-7 indicates which fish species have active nursery and or spawning areas in the vicinity of the Windermere Development.

Table 4-7 Fish Spawning and Nursery Areas within ICES Rectangle 36F2 (*Coull et al., 1998 and Ellis et al., 2012*)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Anglerfish [1]			N	N	N	N	N	N				
Cod			N	N	N	N						
Herring										N	N	N
Horse Mackerel [2]					N	N	N	N	N	N		
Lemon Sole						N	N	N	N	N	N	
Mackerel							N	N	N	N		
Nephrops	N	N	N	N	N	N	N	N	N	N	N	N
Plaice												
Sandeels	N	N	N	N								
Sole												
Sprat							N	N	N	N		
Spurdog [3]	N	N	N	N	N	N	N	N	N	N	N	N
Tope Shark [3]	N	N	N	N	N	N	N	N	N	N	N	N
Whiting				N	N	N	N	N				

Key:

	Peak Spawning		Spawning		No Spawning	N	Nursery

[1] Insufficient data available on spawning grounds (*Ellis et al., 2012*)

[2] Horse mackerel appear to be widespread and with no spatially discrete nursery grounds.

[3] Viviparous species (gravid females can be found all year) (*Ellis et al., 2012*).

Figure 4-15 Fish Spawning and Nursery Areas in ICES Rectangle 36F2 (1 of 2)

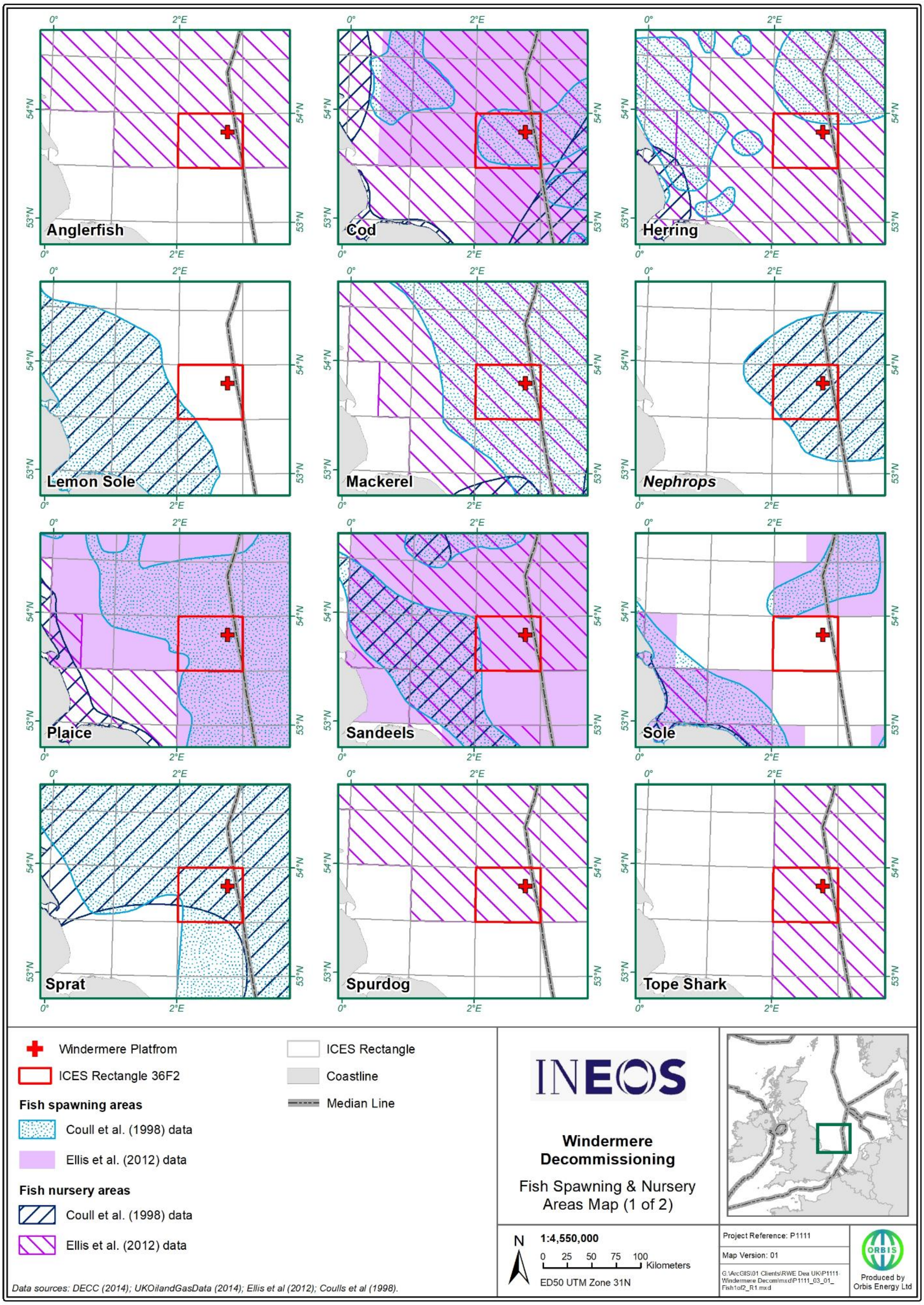
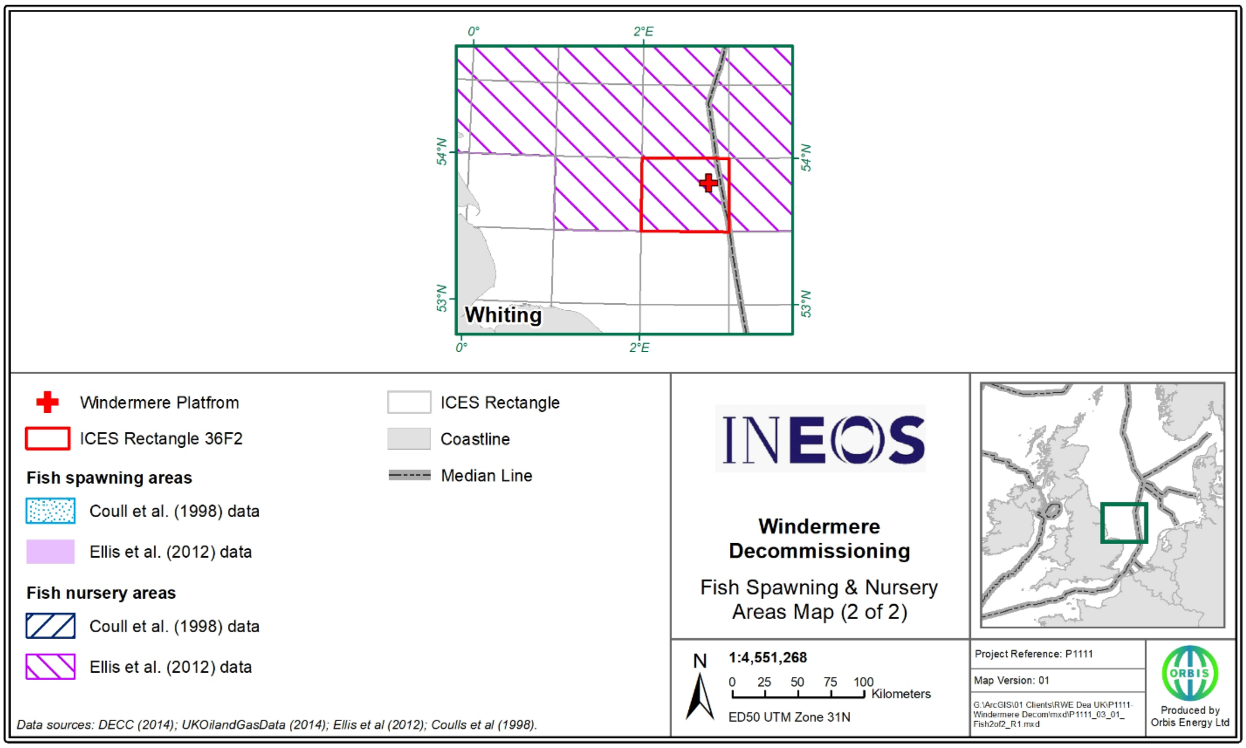


Figure 4-16 Fish Spawning and Nursery Areas in ICES Rectangle 36F2 (2 of 2)



4.3.3.2 Shellfish

The benthic fauna of the UK waters is rich and diverse (*DECC, 2009*). An important component of this benthic fauna is a collection of molluscs and crustaceans loosely referred to as shellfish, a number of which are of commercial importance. The following species may be present within the vicinity of the Windermere Development.

The Norway lobster (*Nephrops norvegicus*), commonly known as *Nephrops*, lives in burrows dug into muddy and sandy sediments, at depths between 20 to 800 m. Eggs hatch in spring or summer, the relative inactivity of females during this period, when they remain hidden in burrows, means that males are more heavily exploited in the fishery through most of the year (*DECC, 2009*). *Nephrops* is more abundant in northern UK waters, although significant populations exist on the Dogger Bank.

The brown (or edible) crab (*Cancer pagurus*) is most abundant on rocky grounds, where it hides in holes and crevices. The crab is generally found in shallow water close to shorelines, particularly along the east coast and the southwest of England, although it can be found in water as deep as 100 m (*DECC, 2009*). The species spawns between November and February, during which time the females remain in deeper waters offshore (*DECC, 2009*).

Long distance migrations are a feature of many crabs and lobsters, particularly the edible crab, European lobster, crawfish and spider crab (*Maja squinado*) (*DECC, 2009*). A number of valuable shrimp species are found around the UK. The three most important are the brown shrimp (*Crangon crangon*), the pink shrimp (*Pandalus montagui*) and the deep-water shrimp (*Pandalus borealis*). The brown shrimp generally favours areas with soft, sandy sediments, in which it can burrow, while the pink shrimp is more common over hard substrata. Eggs are carried by females over the winter months, before hatching in spring (*DECC, 2009*).

The most commercially valuable molluscs are scallops (*Pecten maximus*). Scallops are found predominantly to the south and west of the UK on sandy, muddy, shell and gravel substrata, down to depths of over 100 m. Queen Scallops (*Aequipecten opercularis*) are a smaller shellfish and are able to live on harder gravel and shell substrata although generally habitats and distributions of the two species are similar (*DECC, 2009*). Mussels (*Mytilus edulis*) are suspension feeders generally found attached to hard substrata within the inter-tidal zone, although they also attach to reefs and man-made structures in shallow waters with spawning taking place in late spring (*DECC, 2009*). The most harvested gastropod molluscs in UK waters are whelks (*Buccinum undatum*) and periwinkles (*Littorina littorea*). They spawn in November, with eggs attaching to the seabed (*DECC, 2009*). Winkles are herbivorous and spawn between January and July.

4.3.3.3 Elasmobranch Species

Skates and rays (Chondrichthyan fishes or elasmobranchs) are an important part of the North Sea ecosystem, although there is not enough known about their abundance and distribution to fully facilitate the protection they require in the marine environment. Elasmobranchs typically have a slow growth rate and low fecundity (reproduction rate), leaving them vulnerable to over-fishing pressures and pollution events and subsequent recovery of populations in response to disturbance events is low. Historically, many species have been fishery targets due to their fins and liver oils (*Kunzlik, 1988*). However, they are not often specifically targeted by commercial fisheries anymore, but are still under threat from by-catch, which continues to deplete stocks in UK waters. Work is underway to develop National Plans of Action for the conservation and management of the chondrichthyes. The species identified as being in need of immediate protection are the angel shark, common skate, long-nosed skate, Norwegian skate and white skate. It has been proposed to protect these species in UK waters in the same way as the basking shark is protected, under the Wildlife and Countryside Act (1981).

In a survey conducted by Cefas, twenty six species were identified and recorded throughout the North Sea and surrounding waters. Of these, eight may be present within the general vicinity of the Windermere Development (*Ellis et al., 2004*); these are shown in Table 4-8. Of the eight elasmobranch species, three are listed as 'Vulnerable' and one is listed as 'Near Threatened' on the IUCN Red List (*IUCN, 2018*).

Table 4-8 Distribution, Abundance and Current Status on the IUCN Red List of the Elasmobranchs Species Likely to be Found in the Area Surrounding the Windermere Development (ICES Rectangle 36F2) (*Ellis et al., 2004; IUCN, 2018*)

Species	Location	Depth range (m)	Number (individuals/hr)	Current status on IUCN Red List
Blond ray *Raja brachyura*	South and west British borders	14-146	72	Near Threatened
Cuckoo ray *Leucoraja naevus*	Irish Sea, Celtic Sea & northern North Sea	12-290	58	Least Concern
Lesser-spotted dogfish *Scyliorhinus canicula*	South and west British borders	6-308	500	Least Concern
Spotted ray *Raja montagui*	South and west British borders	8-283	88	Least Concern
Spurdog *Squalus acanthias*	widespread	15-528	-	Vulnerable
Starry ray *Amblyraja radiata*	North Sea	32-209	232	Vulnerable

Species	Location	Depth range (m)	Number (individuals/hr)	Current status on IUCN Red List
Thornback ray *Raja clavata*	South and west British borders	7-192	200	Near Threatened
Tope shark *Galeorhinus galeus*	Widespread	17-200	(regular)	Vulnerable

4.3.3.4 Basking Sharks

Basking sharks (*Cetorhinus maximus*) are thought to make extensive migrations both vertically and horizontally to locate high concentrations of plankton that will often be associated with fronts, and that they principally migrate north to south during the winter months along the continental shelf of Europe (*Sims et al., 2003; 2005*). Populations have been decreasing globally, predominantly as a consequence of historical fishing pressures and are currently listed as 'Vulnerable' on the IUCN Red List (*IUCN, 2018*).

Basking sharks appear in UK waters from April to September, with peak numbers observed in June/July and are known to occur in the North Sea in small numbers (*DTI, 2002*). Therefore, basking sharks may be present in the vicinity of the Windermere Development during the proposed decommissioning activities.

4.3.3.5 Fishing Species of Conservational Significance

The majority of fish species of conservational significance (e.g. anadromous / catadromous fish species, sea lamprey, allis shad and twaite shad), are coastal and occur in greatest abundance in relatively shallow coastal water (*DTI, 2002*). They are therefore unlikely to be present in the vicinity of the Windermere infrastructure (approximately 140 km east of the nearest UK landfall and in approximately 36 m water depth).

4.3.3.6 Survey Results

The Windermere pre-decommissioning survey reported epifauna to be sparse throughout the survey area, most likely due to the lack of suitable attachment sites as a consequence of the sediments being dominated by sands at most stations. Only a few individuals were recorded, comprising starfish, crab, shrimps, gobies and unidentified fish; tusk shells were also found on the surface (*Fugro, 2014a*).

<u>Herring Spawning Grounds</u>

North Sea herring (*Clupea harengus*) are one of the most commercially important fisheries in the North Sea (*Cefas, 2001a*) and therefore there is protection afforded to grounds which are identified as herring spawning grounds to prevent habitat degradation.

Herring spawn on gravel and similar habitats such as sand and shell, where there is a low proportion of fine sediment and well oxygenated water (*Ellis et al., 2012*). Generally, spawning takes place in shallow water (15-40 metre) (*Cefas, 2001b*).

Herring spawning potential was assessed using seabed photographic data in conjunction with geophysical (side scan sonar and bathymetry) data collected during the Windermere pre-decommissioning survey. Sediment particle size data were used to provide further information regarding sediment characterisation at grab stations.

The results of the herring spawning ground assessment are presented in Table 4-9. All stations were classified as having none or low herring spawning potential, which was consistent with a previous assessment conducted in 2014 in UKCS Block 49/5a (*Fugro, 2014a*).

Table 4-9 Herring Spawning Ground Assessment Results (*Fugro, 2014a*)

Station	Gravelly Sediment (Y/N)	<2% Fine Sediment (Y/N)	Elevated Above Seabed (Y/N)	Herring Spawning Potential
S1	N	Y	N	Low
S2	N	N	N	None
S3	N	Y	N	Low
S4	N	Y	N	Low
S5	N	Y	N	Low
S6	N	N	N	None
S7	N	N	N	None
S8	N	Y	N	Low
S9	N	N	N	None
S10	N	N	N	None
S11	N	N	N	None
S12	N	Y	N	Low
S13	N	Y	N	Low
S14	N	Y	N	Low
P1	N	Y	N	Low
P2	N	N	N	None
P3	Y	N	N	Low
P4	N	Y	N	Low
P5	N	Y	N	Low
P6	N	Y	N	None
R2	N	N	N	None
R4	N	Y	N	Low
R5	N	N	N	None

Note: Y = yes (station met criteria), N = no (station did not meet criteria).

4.3.4 Seabirds

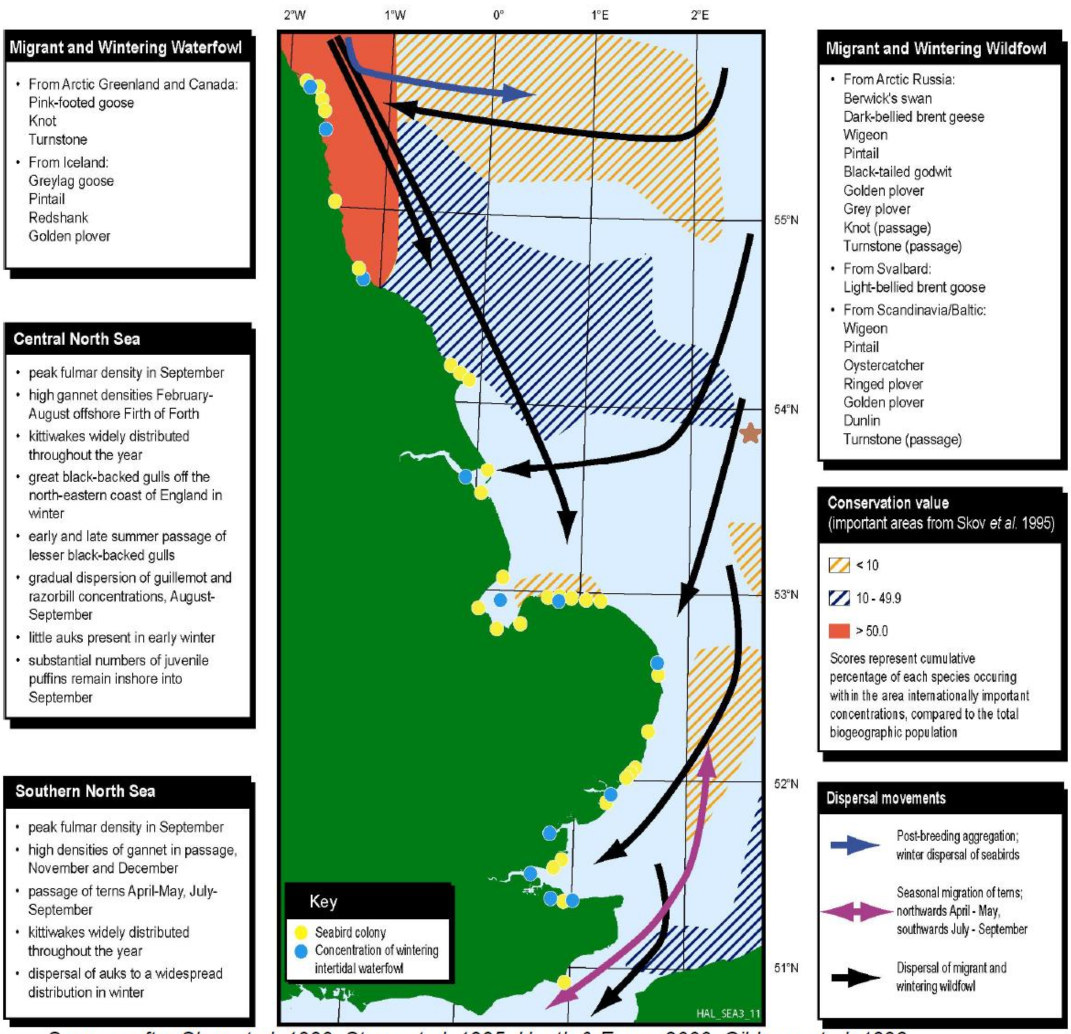
Seabirds are defined as birds which frequent coastal waters and the open ocean (*Lawrence, 2000*). The UK is globally important for seabirds, supporting breeding populations of 25 species with a further 13 regularly occurring passage or overwintering species and a number of more irregularly occurring species. With over seven million breeding seabirds, the UK has the largest populations in Europe of 15 of these species: fulmars, Manx shearwaters, gannets, Leach's petrels, shags, Arctic skuas, great skuas, lesser black-backed gulls, herring gulls, great black-backed gulls, kittiwakes, guillemots, razorbills, black guillemots and puffins (*Natural England, 2013*).

Seabird distribution and abundance in the SNS varies throughout the year, with offshore areas, in general, containing peak numbers of birds following the breeding season and throughout winter (*DECC, 2009*).

Fulmar are present in highest numbers in the SNS during the early and late breeding seasons, leading to peak densities in September. Kittiwakes are widely distributed throughout the year. Lesser black-backed gulls are mainly summer visitors, while in contrast guillemot numbers are present in greatest numbers during winter months. In addition, substantial numbers of terns migrate northwards through the offshore North Sea in April and May, with return passage from July to September (*DECC, 2009*).

Figure 4-17 shows the seasonal distribution of seabirds in the vicinity of the Windermere Development. It indicates that the Windermere Development is in an area of moderate importance for international concentrations of birds 10-49.9 percent of biogeographic population (*DTI, 2002*).

Figure 4-17 The Broadscale Seasonal Distribution and Movements of Birds in the North Sea (*DTI, 2002*)



Source: after Skov et al. 1990, Stone et al. 1995, Heath & Evans 2000, Gibbons et al. 1993

Note: the star marks approximate location of the Windermere Development

Along the adjacent UK coastline to the Windermere Development there are a number of important sites for breeding and wintering birds. These sites include:

- North Norfolk Coastline Special Protection Area (SPA) and Ramsar Site (approximately 150 km to the south-west of the Windermere platform);

- Outer Thames Estuary SPA (approximately 140 km to the south south-west of the Windermere platform);
- Wash SPA and Ramsar Site (approximately 180 km to the south-west of the Windermere platform);
- Gibralter Point SPA and Ramsar Site (approximately 180 km to the south-west of the Windermere platform);
- Humber Estuary SPA and Ramsar Site (approximately 175 km to the east of the Windermere platform); and
- Flamborough Head and Bempton Cliffs SPA (approximately 190 km to the east of the Windermere platform).

A comparison of the location of the Windermere Development with the mean-maximum foraging ranges of seabird species (from *Thaxter et al., 2012*) known to utilise SPAs and Sites of Special Scientific Interest (SSSI) along the coast of England indicates that gannet and fulmar may be present in the vicinity of the Windermere Development (*Natural England, 2012*).

An overview of the seasonal distribution of the key seabirds in the vicinity of the Windermere Development is provided in Table 4-10. It can be seen that species which are present throughout the year, albeit in varying densities, are fulmar, kittiwake and guillemot. Densities of fulmar are high (>5 individuals per square kilometre) from May to July and September to October, while densities of kittiwake are high in February, May, July, October and November. Guillemot density peaks in October to January and March to May. Other species that reach high densities are; the great black-backed gull and herring gull from November to December.

Other frequent visitors to this area (present for six months of the year or more) include gannet, great skua, lesser black-backed gull, herring gull, great black-backed gull, black tern, razorbill and puffin. The abundance of gannet and puffin peak at high (up to 4.99 individuals per square kilometre) in October – November and December, respectively. Generally, it appears that the greatest number of seabird species are present, in the vicinity of the Windermere Development, during the last quarter of the year (Table 4-10; *UKDMAP, 1998*).

Table 4-10 Seasonal Distribution of Seabird in and Around Blocks of Interest (*UKDMAP, 1998*)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Fulmar (*Fulmarus glacialis*)	High	High	Moderate	High	Very High	Very High	Very High	Moderate	Very High	Very High	High	High
Sooty shearwater (*Puffinus griseus*)										Low		
Gannet (*Morus bassanus*)	Moderate	Moderate	Moderate		Moderate	Moderate	Moderate	Moderate	Moderate	High	High	Moderate
Shag (*Phalacrocorax aristotelis*)									Low			
Pomarine skua (*Stercorarius pomarinus*)											Low	
Arctic skua (*Stercorarius parasiticus*)								Low				
Long-tailed skua (*Stercorarius longicaudus*)											Low	
Great skua (*Catharacta skua*)				Low			Low	Low	Low	Low	Low	
Black-headed gull (*Larus ridibundus*)							Low				Moderate	
Common gull (*Larus canus*)			Low				Low			Low	Low	
Lesser black-backed gull (*Larus fuscus*)			Moderate	High	Moderate	Moderate		Moderate			Moderate	
Herring gull (*Larus argentatus*)	High	High		High					Moderate	Moderate	Very High	Very High
Great black-backed gull (*Larus marinus*)	High	High	Moderate	High					High	High	Very High	Very High
Kittiwake (*Rissa tridactyla*)	High	Very High	High	High	Very High	High	Very High	Moderate	Moderate	Very High	Very High	High
Arctic tern (*Sterna paradisaea*)					Low							
Black tern (*Chlidonias niger*)				High	High	High	High	High	High	High		
Guillemot (*Uria aalge*)	Very High	High	Very High	Very High	Very High	Moderate	High	High	Moderate	Very High	Very High	Very High
Razorbill (*Alca torda*)	Moderate	Moderate	High	High	Moderate					Moderate	Moderate	High
Little auk (*Alle alle*)	Low	Low									Low	High
Puffin (*Fratercula arctica*)	Moderate	Moderate	Moderate	Moderate		Moderate				Moderate	Moderate	High

Key (Number of individuals per square kilometre)

	Very High (>5)		High (1-4.99)		Moderate (0.5-0.99)		Low (<0.49)

Seabird populations are particularly vulnerable to surface pollution. Their vulnerability varies considerably throughout the year and is dependent on a variety of factors, including time spent on the water, total biogeographical population, reliance on the marine environment and potential rate of population recovery (*DECC, 2016*).

The Seabird Oil Sensitivity Index (SOSI) (*Webb et al., 2016*) combines seabird data collected between 1995 and 2015 and individual seabird species sensitivity index values to create a single measure of seabird sensitivity to oil pollution. The SOSI score for each UKCS Block can be ranked into sensitivity categories, from 1 (extremely high sensitivity) to 5 (low sensitivity). An assessment of the median SOSI scores indicates that the sensitivity of seabirds to oil pollution within Block 49/4 are 'very high' in July and 'high' during November to January. The remainder of the year has a 'low' sensitivity. Similarly, Block 49/5 has a 'high' sensitivity recorded during November to January with the remainder of the year recorded as 'medium' to 'low' sensitivity. Block 49/9 has a 'low' sensitivity throughout the year, with the exception of February to April where no data is available (Table 4-11 and Figure 4-18).

Table 4-11 Assess In and Around the Windermere Development (UKCS Blocks 49/4, 49/5 and 49/9) (Webb et al., 2016)

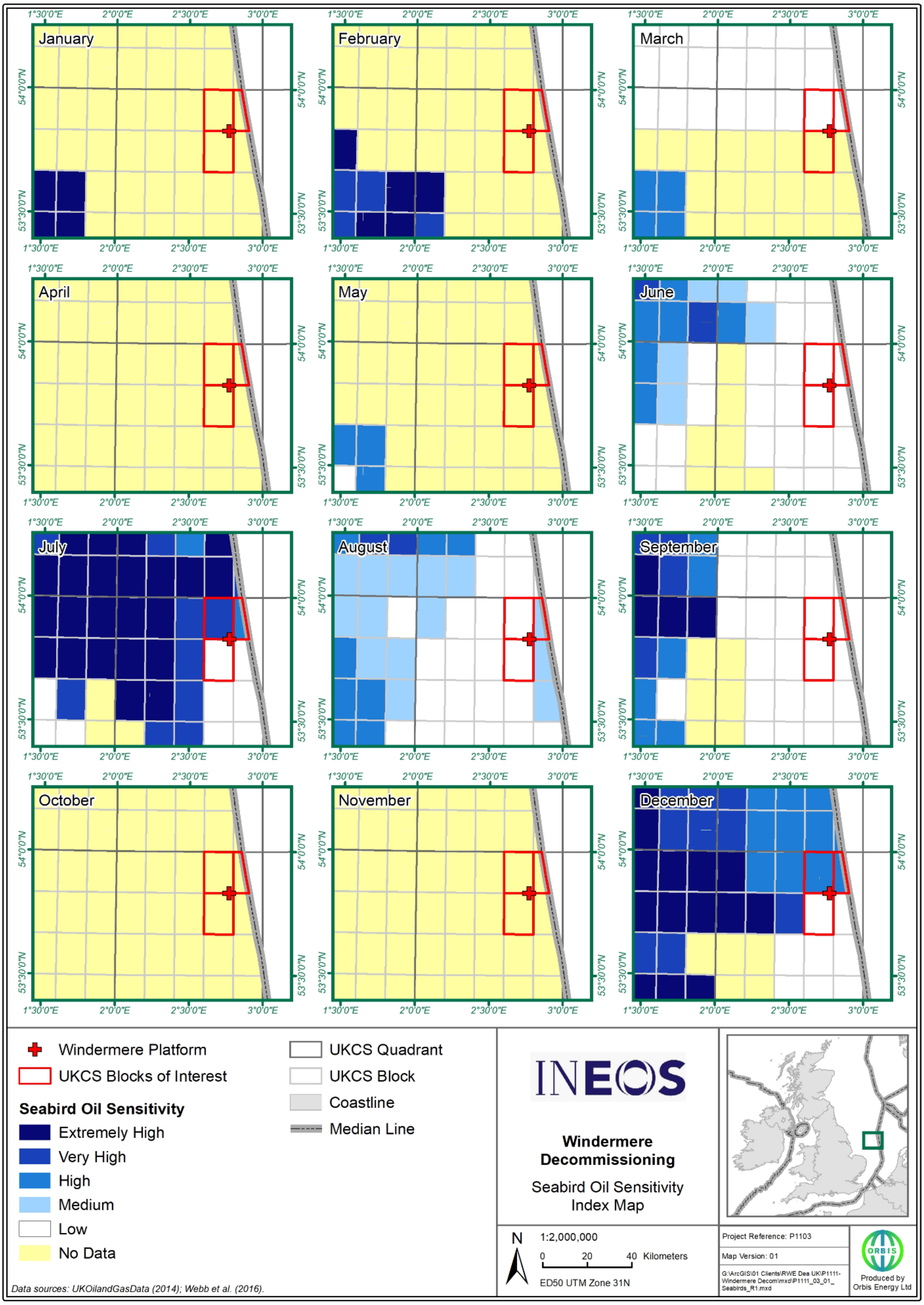
UKCS Block	J	F	M	A	M	J	J	A	S	O	N	D
44/28	3*	5*	5	5*	5*	5	1	5	5	5*	3*	3
44/29	3*	5*	5	5*	5*	5	1	5	5	5*	3*	3
44/30	3*	5*	5	5*	5*	5	2	5	5	5*	3*	3
49/3	3*	5*	5	5*	5*	5	2	5	5	5*	3*	3
49/4	3*	5*	5	5*	5*	5	2	5	5	5*	3*	3
49/5	3*	5*	5	5*	5*	5	3	4	5	5*	3*	3
49/8	2*	ND	5*	ND	5*	5	2	5	5	5*	2*	2
49/9	5*	ND	ND	ND	5*	5	5	5	5	5*	5*	5
49/10	5*	ND	ND	ND	5*	5	5	4	5	5*	5*	5
49/13	5*	ND	ND	ND	5*	5	2	5	5	5*	5*	5
49/14	5*	ND	ND	ND	5*	5	5	5	5	5*	5*	5
49/15	5*	ND	ND	ND	5*	5	5	4	5	5*	5*	5

Key

1 = Extremely High; 2 = Very High; 3 = High; 4 = Medium; 5 = Low; ND = No Data.

SOSI sensitivity category marked * indicates an indirect assessment of SOSI scores, in light of coverage gaps.

Figure 4-18 Seabird Oil Sensitivity Index (Median) Scores in the Vicinity of the Windermere Development (UKCS Blocks 49/4, 49/5 and 49/9) (*Webb et al., 2016*)



4.3.5 Marine Mammals

4.3.5.1 Cetaceans

More than twenty cetacean species have been recorded in UK waters. Of these, ten species are known to occur regularly, these are (*DECC, 2016*):

- Minke whale (*Balaenoptera acutorostrata*);
- Harbour porpoise (*Phocoena phocoena*);
- Bottlenose dolphin (*Tursiops truncatus*);
- Short-beaked common dolphin (*Delphinus delphis*);
- White-beaked dolphin (*Lagenorhynchus albirostris*);
- White-sided dolphin (*Lagenorhynchus acutus*);
- Killer whale (*Orcinus orca*);
- Risso's dolphin (*Grampus griseus*); and
- Long-finned pilot whale (*Globicephala melas*).

Species which are known to occur in the SNS sector (and therefore could be in the area of the Windermere Development) include the harbour porpoise, minke whale, white-beaked dolphin and white-sided dolphin (*Reid et al., 2003*). Cetaceans are protected under Annex IV of the Council Directive 92/43/EEC (also known as the Habitats Directive) which obliges member states to maintain or restore species of community interest to favourable conservation status as well as establish effective management and monitoring strategies to ensure that any incidental capture or killing does not have a significant negative impact on the species concerned (*Baxter et al., 2011*).

Harbour Porpoise (*Phocoena phocoena*)

Harbour porpoise is the most common cetacean in UK waters. They are widely distributed and abundant throughout the majority of UK shelf seas, both coastally and offshore, with notably fewer sightings in the far southern and south-eastern North Sea and eastern Channel (Figure 4-19) (*Reid et al., 2003*). In coastal waters, they are often encountered close to islands and headlands with strong tidal currents (*DECC, 2009*). Sightings become increasingly rare close to the continental shelf edge, with relatively few records of porpoises in deeper waters beyond the shelf edge.

White-Beaked Dolphin (*Lagenorhynchus albirostris*)

White-beaked dolphins are restricted to the North Atlantic. In the Northeast Atlantic their range extends from the British Isles to Spitsbergen. They are the second most commonly occurring cetacean in UK shelf waters, and are regularly encountered in coastal and offshore waters (Figure 4-19) (*DECC, 2009*). Their distribution is generally restricted to the northern half of UK waters, with sightings rare below 54°N in the North Sea, while they are very rare in the Channel and Irish and Celtic Seas. Analysis of summer sightings on shelf waters around the UK, from 1983-1998, showed the vast majority of white-beaked dolphins to occur in waters with a temperature of 13°C (*DECC, 2009*). While sighted throughout the year, sightings are slightly more frequent from July to October.

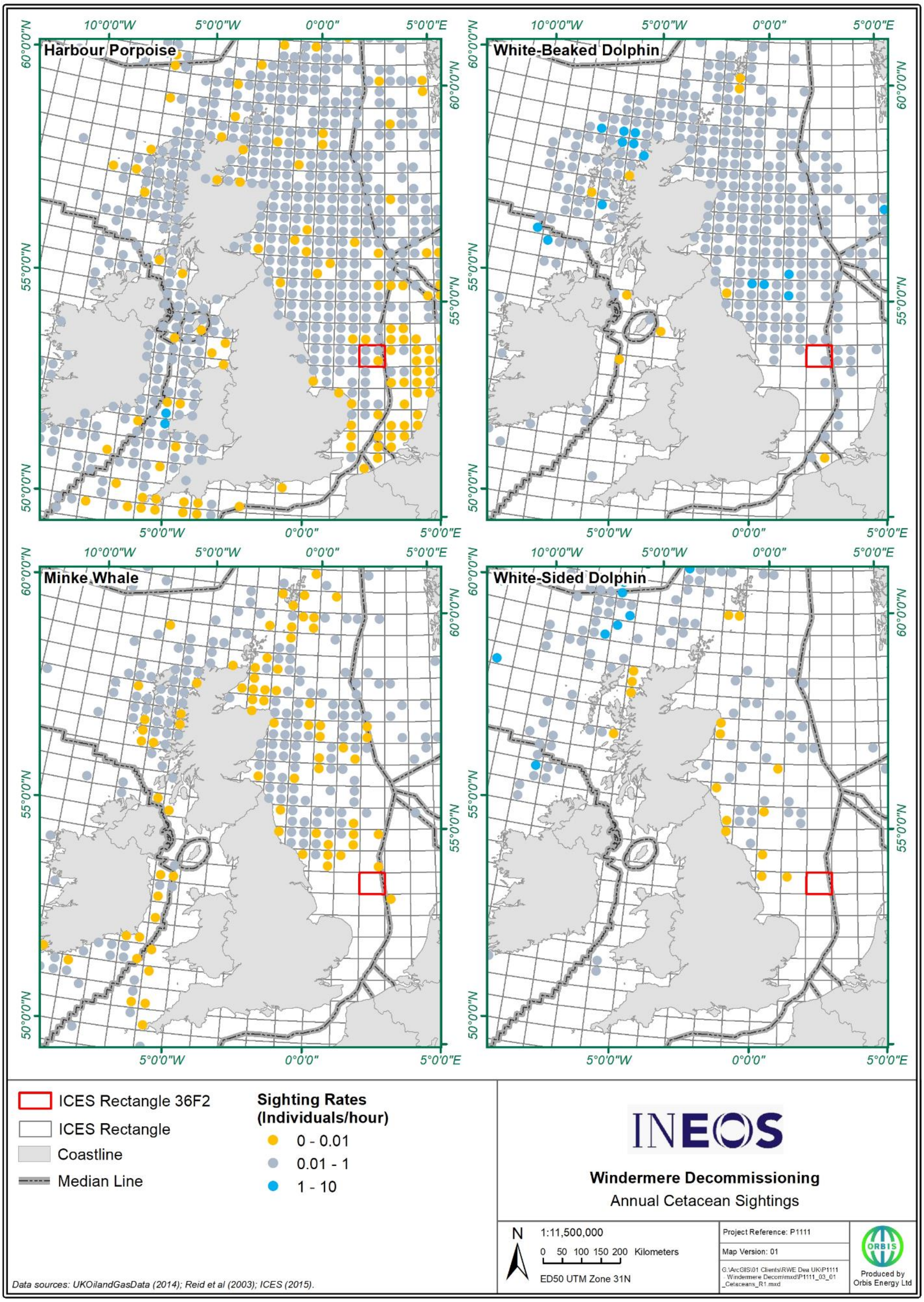
Minke Whale (*Balaenoptera acutorostrata*)

Minke whales are widely distributed in all the major oceans of the world from tropical to polar seas; they are most abundant in relatively cool waters, and on the continental shelf in waters less than 200 m (*DECC, 2009*). Within UK waters, minke whales are most frequently sighted in the western central-northern North Sea, and west of Scotland around the Hebrides. They are rare in the southernmost North Sea and eastern English Channel; North Sea sightings generally extend no further south than the Dogger Bank. Minke whales are primarily a seasonal visitor to UK waters, with whales appearing to move south into the North Sea and western Scotland at the beginning of May and remaining present until October; sightings are rare outside of this period. During these summer months, they are widely distributed throughout the region, including coastal and offshore shelf waters, and deeper waters on and beyond the shelf slope (Figure 4-19) (*DECC, 2009*).

White-Sided Dolphin (*Lagenorhynchus acutus*)

White-sided dolphins are confined to the North Atlantic (*DECC, 2009*). They share most of their range with the white-beaked dolphin, but in the Northeast Atlantic they are primarily an offshore, oceanic species. In UK waters, white-sided dolphin are concentrated in a broad zone from west of Ireland to the north and north-west of Britain (Figure 4-19). They are regularly sighted in the waters north and west of Scotland, with greatest numbers observed along the shelf break and over deeper waters further offshore, including the Faroe-Shetland Channel to the north (*Pollock et al., 2000; Weir et al., 2001*). While they have been observed throughout the year in these areas, greatest numbers are observed from May to November (*Reid et al. 2003*). They are also occasionally observed in offshore waters of the central and northern North Sea from July to September (*DECC, 2009*).

Figure 4-19 Sighting Rates of Cetaceans Around the United Kingdom (*Reid et al., 2003*)



The Small Cetacean Abundance of the North Sea (SCANS-III) aerial and ship-based surveys identified the abundance and density of cetacean species within predefined sectors of the North Sea and North-East Atlantic. The Blocks of Interest are located within the SCANS-III block 'O', which was surveyed by air (refer to Table 4-12, *Hammond et al., 2017*). The density of harbour porpoise within SCANS-III block 'O' is significantly higher (0.888 animals per square kilometre) than the total surveyed area (0.351 animals per square kilometre), suggesting that the region is important for this species.

Table 4-12 Cetacean Abundance and Density Recorded in SCANS-III Survey Block 'O' (*Hammond et al., 2017*)

Species	SCANS-III Block 'O'[1]		Total (Aerial Survey Blocks)[2]	
	Abundance[3]	Density[4]	Abundance	Density
Harbour porpoise	53,485	0.888	424,245	0.351
White-beaked dolphin	143	0.002	36,287	0.030
Minke whale	603	0.010	13,101	0.011

[1] Total area of block 'T' = 60,198 km^2;

[2] Total area of SCANS survey blocks = 1,208,744 km^2;

[3] Abundance is the total number of animals;

[4] Density is the number of animals per square kilometre.

The UK Statutory Nature Conservation Bodies (SNCBs) have also identified Management Units (MUs) to provide information on the geographical range and abundance of marine mammals, and therefore understand the potential effects of anthropogenic activities on populations (IAMMWG, 2015). The abundance of cetacean species within their respective MU is shown in Table 4-13. Harbour porpoises are the most abundant species in the North Sea compared to other species identified in Table 4-13, despite its MU being smaller in area. White-sided dolphin followed by common dolphin (*Delphinus delphis*) are the next most abundant within the UK sector of its MU.

Table 4-13 Estimates of Cetacean Abundance in the Relevant MUs (*IAMMWG, 2015*)

Species	Management Unit	Abundance in MU	Confidence Interval	Abundance in UK part of MU	Confidence Interval
Harbour porpoise	North Sea	227,298	176,360 – 292,948	110,433	80,866 – 150,811
Common dolphin	Celtic and Greater North Sea	56,556	33,014 – 96,920	13,607	8,720 – 21,234
White-beaked dolphin		15,895	9,107 – 27,743	11,694	6,578 – 20,790
White-sided dolphin		69,293	34,339 – 139,828	46,249	26,993 – 79,243
Minke whale		23,528	13,989 – 39,572	12,295	7,176 – 21,066

It should be noted, however, that the SCANS-III survey area and the IAMMWG (2015) MUs encompass relatively large geographical areas and, as such, is unlikely to accurately reflect the abundance and densities of cetaceans which may be present within the vicinity of the Blocks of Interest.

Data taken from the JNCC Atlas of Cetacean Distribution in North-West European Waters, as summarised in Table 4-14 below, has therefore been used to give a more localised indication of the seasonal distribution of cetaceans.

According to Reid *et al.* (*2003*) three species have been previously been sighted in ICES rectangle 36F2, within which the Windermere Development is located. Harbour porpoise have previously been recorded in only low numbers (0.01-1 individuals sighted per hour of effort) from February to August and in November (Table 4-14). White-beaked dolphins have been observed in the vicinity of the Windermere Development in moderate numbers (1-10 individuals sighted per hour of effort) during April and November and low numbers in June to July, October and November. Low sightings of minke whale were recorded during August.

There is a possibility of all of the three cetacean species, displayed in Table 4-14, being present in the vicinity of the Windermere Development, during decommissioning activities.

Table 4-14 Cetacean Sightings within the Vicinity of the Windermere Development (*Reid et al., 2003*)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Harbour Porpoise												
Minke Whale												
White-Beaked Dolphin												

Key (Number of individuals sighted per hour of effort)

	High (>10)		Medium (1-10)		Low (0.01-1)		V. Low (0-0.01)		No sightings (0)

4.3.5.2 Pinnipeds

Two species of pinnipeds (or seals) are found around the English coast:

- Grey seal (*Halichoerus grypus*); and
- The harbour (or common) seal (*Phoca vitulina*).

Both the harbour seal and the grey seal are listed under Annex II of the EC Habitats and Species Directive as species whose conservation requires the designation of Special Areas of Conservation (SACs). In the UK, there are currently seven SACs primarily designated for their grey seal populations and nine SACs primarily designated for their harbour seal populations (*JNCC, 2021a; JNCC, 2021b*). In addition, both harbour and grey seals are protected under the Conservation of Seals Act 1970.

<u>Grey Seals (*Halichoerus grypus*)</u>

Grey seals are large marine predators and this species is abundant in parts of the North Sea. Studies on their diet have indicated that it is highly seasonally dependent. During summer their diet is dominated by sandeels and cod.

Most of the grey seal population will be on land for several weeks from October to December during the pupping and breeding season, and again in February and March during the annual moult (*DECC, 2016*). Densities at sea are likely to be lower during this period than at other times of the year. They also haul-out and rest throughout the year between foraging trips to sea (*DECC, 2016*).

Studies have indicated that breeding females tend to faithfully return to their natal breeding colony for most of their lives (*Pomeroy et al., 2000*). Mature females give birth to a single pup which is nursed for about three weeks before it is weaned and moults into its sea-going adult coat. Some information on the distribution and movements of grey seals comes from using numbered tags attached to the flippers of pups. These indicate that young seals disperse widely in the first few months of life. Pups marked in the UK have, for example, been recaptured or recovered along the North Sea coasts of Norway, France and The Netherlands, mostly during their first year (*Wiig, 1986*).

Grey seal foraging movements are on two geographical scales: long and distant trips from one haul-out site to another; and local repeated trips to discrete offshore areas (*McConnell et al., 1999*). The large distances travelled indicate that grey seals in the North Sea are not ecologically isolated and can thus be considered as coming from a single ecological population.

Along the adjacent UK coastline to the Windermere infrastructure, a long established colony of breeding grey seals exists at Donna Nook. Other surveyed colonies are present further south at Blakeney Point on the north Norfolk coast, and also at Horsey on the east Norfolk coast. At these four main English North Sea colonies, pup production in 2014 was 6,627 compared with 4,963 in 2012 and 5,539 in 2013. There was a very considerable increase in the number of pups born at Blakeney Point (2,425 pups born in 2014 and 1,560 in 2013, an increase of 55%) which is now the biggest grey seal breeding colony in England, overtaking Donna Nook (1,799 pups in 2014) for the first time (*SCOS, 2016*).

Models of marine usage by grey seals show a generally low density of activity in the southern North Sea, with greatest activity within The Wash and off the coast of Flamborough Head (*Matthiopoulos et al., 2004*). Grey seals forage in the open sea and return regularly to haul out on land where they rest, moult and breed. Foraging trips can last anywhere between 1 and 30 days. Compared with other times of the year, grey seals in the UK spend longer hauled out during their annual moult (between December and April) and during their breeding season (between August and December). Tracking of individual seals has shown that most foraging probably occurs within 100 kilometres of a haulout site although they can feed up to several hundred kilometres offshore (*SCOS, 2016*).

Figure 4-20 shows that the at-sea distribution of grey seals in the vicinity of the Blocks of Interest has been recorded as very low (less than one individual per 25 square kilometres) (Sea mammal Research unit (SMRU) and Marine Scotland, 2017).

Given the above, low numbers of grey seals could be present in the vicinity of the Windermere Development, but would be infrequent visitors.

Harbour seals (*Phoca vitulina*)

The harbour seal (also known as common seal) is the smaller of the two species of pinniped that breed in Britain and is also an important predator in this area of the North Sea. Their diet is composed of a wide variety of prey, particularly pelagic and benthic species including whiting, saithe and a seasonal intake of sandeels. Their diet varies seasonally and from region to region depending on the abundance of schooling pelagic prey (*DECC, 2016*).

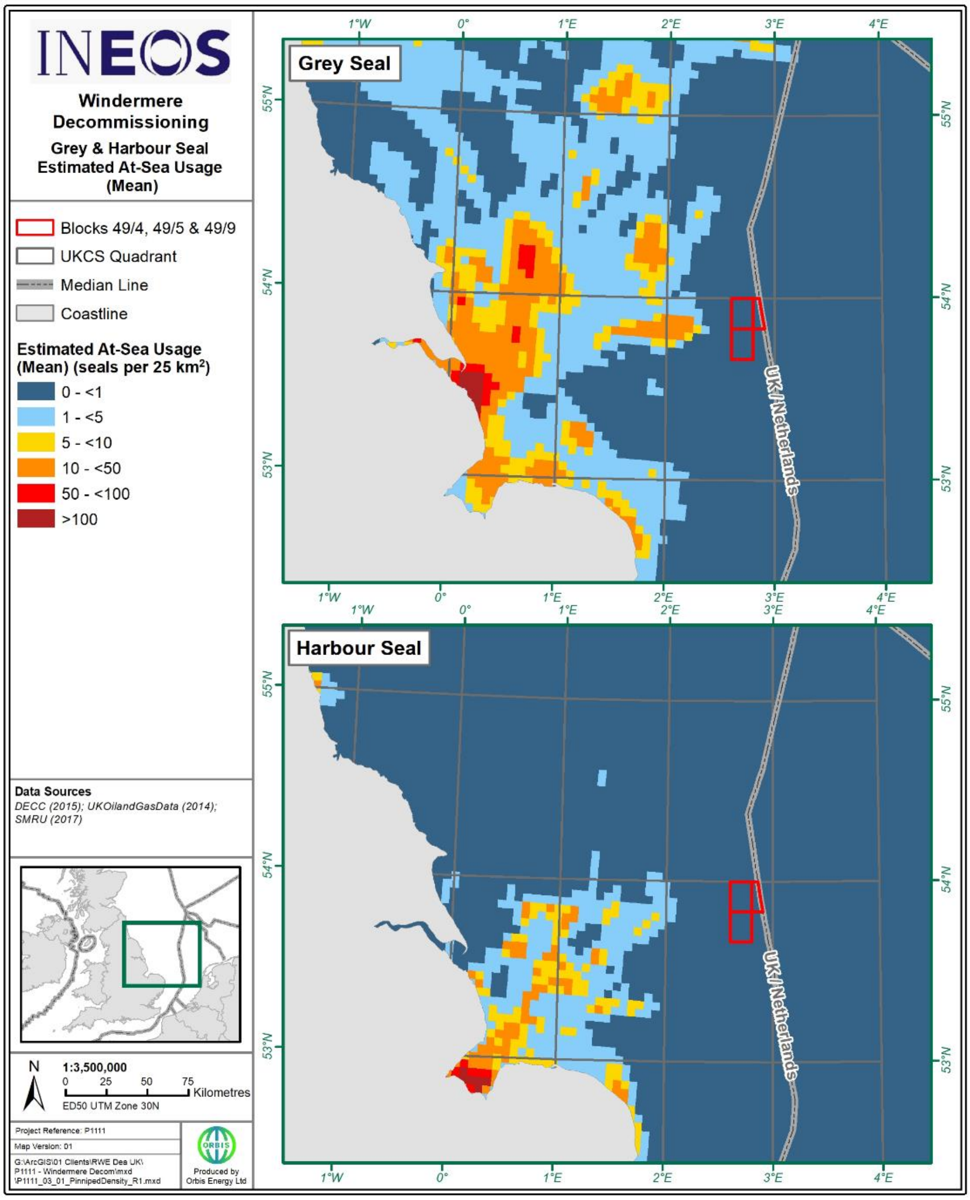
Several harbour seal colonies and haul-out sites are present on the east coast of England, with numbers estimated to be approximately 4,740 animals (*SCOS, 2016*). Approximately half of the English east coast population are recorded in The Wash, with Blakeney Point the second largest English colony, then Donna Nook (*DECC, 2016*). Colonies are also present at Scroby Sands off the east Norfolk coast and in the greater Thames area. The English east coast population has fluctuated considerably since the late 1980s in response to phocine distemper virus epidemics in 1988 and 2002, causing 50 percent and 22 percent declines in population size respectively (*DECC, 2016*).

Harbour seals haul out on tidally exposed areas of rock, sandbanks or mud. Pupping occurs on land from June to July, while the moult is centred around August and extends into September. Tagging studies of harbour seals hauling out at The Wash have shown animals to forage over a wide area at distances of up to 165 km, which is much greater than other haul-out sites in other parts of the UK (*SCOS, 2012; SCOS, 2016*).

Figure 4-20 shows that the at-sea distribution of harbour seals in the vicinity of the Blocks of Interest has been recorded as very low (less than one individual per 25 square kilometres) (*SMRU and Marine Scotland, 2017*).

It is therefore unlikely, given the above and the distance to shore of the Windermere Development (approximately 140 km), that harbour seals will be present in the vicinity of the Windermere Development.

Figure 4-20 Estimated Grey and Harbour Seal Usage of the Sea (source: *SMRU and Marine Scotland, 2017*)



4.3.5.3 Marine Reptiles

Although not indigenous to the United Kingdom, sea turtles (family *Cheloniidae*) represent the only marine reptiles to be found in UK waters (*DECC, 2016*). There are seven species of marine turtle, five of which have been recorded in UK waters. These are:

- The leatherback turtle (*Dermochelys coriacea*);
- The loggerhead turtle (*Caretta caretta*);
- Kemp's ridley turtle (*Lepidochelys kempii*);
- The green turtle (*Chelonia mydas*); and
- The hawksbill turtle (*Eretmochelys imbricata*).

Of the five species recorded in UK waters, the vast majority of records (88 percent) are of the leatherback turtle (*DECC, 2016*). This species exhibits physiological adaptations which allow it to function in temperate waters, and is the only species of marine reptile to be considered a regular member of the UK marine fauna (*DECC, 2016*). The appearance of most turtle species in UK waters is thought to be accidental, but the movement of leatherbacks is mostly regarded as a deliberate migration in response to food distribution, notably jellyfish (*Houghton et al., 2006*). This species may be at the extreme (northern) limit of its range in UK waters. Sightings of leatherback turtle in the southern North Sea are low, with the majority of sightings occurring in October and November (*Pierpoint, 2000*), in addition only eight sightings or strandings were recorded in the southern North Sea during 2001-2007 (*DECC, 2016*).

4.3.6 Marine Protected Areas

A network of well-managed Marine Protected Areas (MPAs) has been established to meet UK objectives as well as the European Marine Strategy Framework Directive (MSFD), Convention on Biological Diversity and the requirements of the OSPAR Convention to deliver an ecologically coherent MPA network in the North East Atlantic. In English waters the main types of MPAs are:

- **Special Areas of Conservation (SACs)** - designated for habitats and species listed under the EU Habitats Directive. These include three marine habitat types (shallow sandbanks, reefs and submarine structures made by leaking gases) and four marine species (grey seal, harbour seal, bottlenose dolphin and harbour porpoise) (JNCC, 2017a). In the UK there are 116 SACs with marine components covering 14% of UK waters (JNCC, 2021b);

- **Special Protection Areas (SPAs)** - designated to protect birds under the EU Wild Birds Directive. The Directive requires conservation efforts to be made across the sea and land area. In the UK 123 SPAs with marine components have been designated, covering sixty bird species (JNCC, 2021b);

- **Marine Conservation Zones (MCZs)** - designated under the Marine and Coastal Access Act (2009) to protect nationally important marine wildlife, habitats, geology and geomorphology and can be designated anywhere in English, Welsh territorial or Norther Irish offshore waters. To date there are 89 designated MCZs in English waters (JNCC, 2021b).

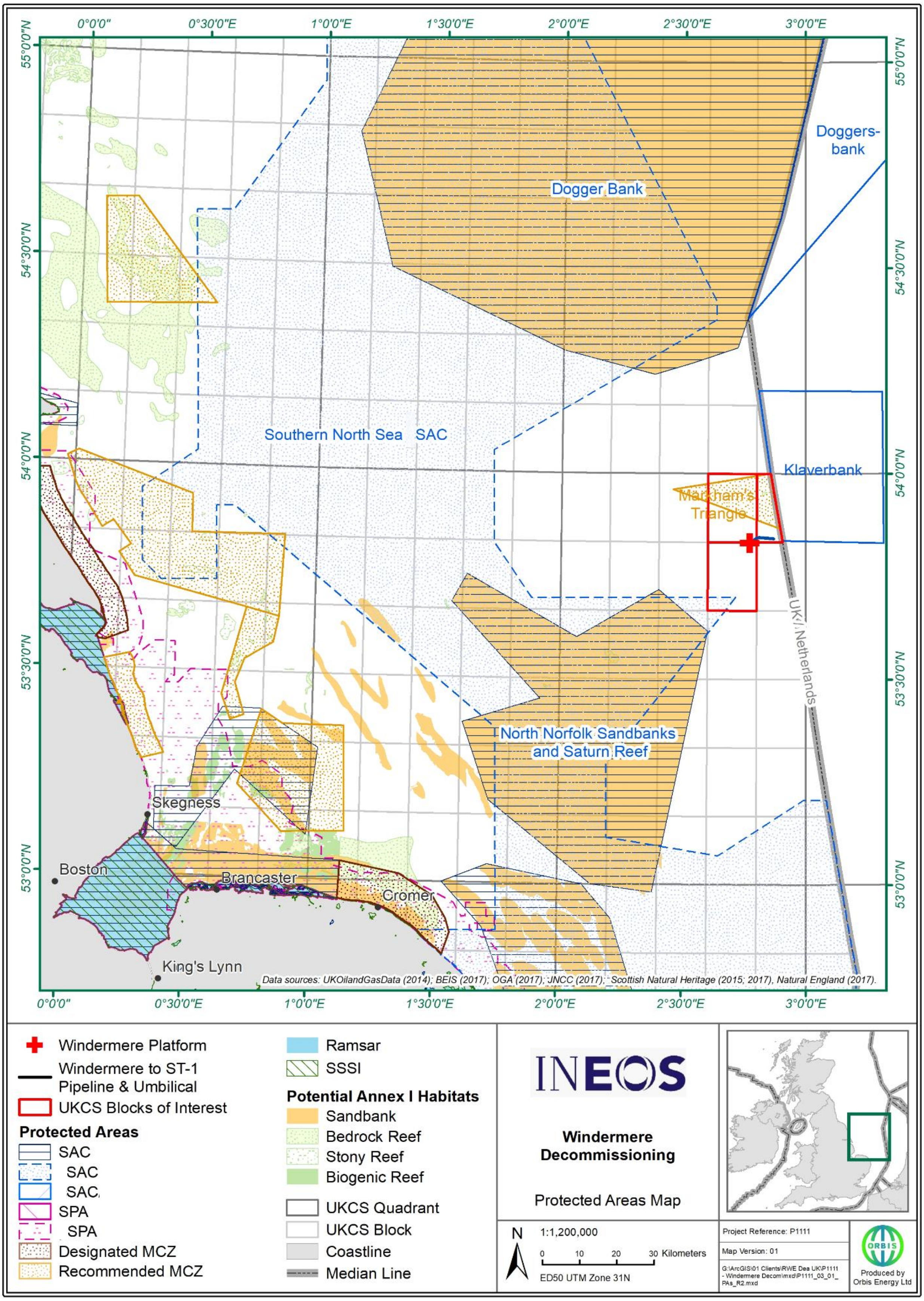
Together SACs and SPAs form the European Natura 2000 network. Other international designations such as Ramsar Wetlands of International Importance (hereafter referred to as Ramsar sites), and national designations such as Sites of Special Scientific Interest (SSSIs) also form part of the UK MPA network through their protection of marine, coastal terrestrial and geological features (JNCC, 2021b). OSPAR MPAs encompass existing MPAs designated under existing legislation and Conventions including SACs, SPAs and MCZs (JNCC, 2021b).

Table 4-15 summarises the protected areas with 40 km of the Windermere Development and shows the location of the Windermere infrastructure in relation to the protected areas around it.

Table 4-15 Marine Protected Areas within 40 Kilometres of the Windermere Development (*Net Gain, 2011; JNCC, 2017b; JNCC, 2017c; Noordzeeloket, 2014)*

Site Name	Designation	Distance From Windermere Development	Site Description
Klaverbank	SAC	2.5 km E	This site is designated for the presence of Annex I habitat 'Reefs' (1170).
Markham's Triangle	MCZ	3 km NE	This site contains broad scale habitat features such as Subtidal sand and Subtidal coarse sediments.
North Norfolk Sandbanks and Saturn Reef	SAC	25.5 km SW	This site is designated for the presence of Annex I habitats 'Sandbanks which are slightly covered by sea water all the time' (1110) and 'Reefs' (1170).
Southern North Sea	SAC	15 km SW	This site is designated for the Annex II Species 'Harbour porpoise'.

Figure 4-21 Marine and Coastal Protected Areas in the Vicinity of the Windermere Development



It can be seen from Table 4-15 and Figure 4-21 that the Windermere Development is within 40 km of four protected areas, as described below.

4.3.6.1 Klaverbank Site of Community Importance (SAC)

The Klaverbank SAC is located within the Netherlands exclusive economic zone (EEZ) approximately 2.5 km to the east of the former ST-1 platform location. The Klaverbank is an area of special ecological significance, and will be a designated Natura 2000 SCI area after the Nature and Conservation Act and the Flora and Fauna Act are extended to include the entire Dutch EEZ (*Noordzeeloket, 2014*). Currently the application of these acts is limited to the territorial sea (12 mile zone). The Klaverbank falls under the habitat type, 'Reefs' (1170). It has been designated as a MPA under the OSPAR convention. It is also designated for the protection of harbour porpoise, grey seal and harbour seal (all listed in the Annex II of the EC Habitats Directive).

The Klaverbank is the only gravel bank in the Dutch sector of the North Sea and comprises a mixture of gravel, sand and larger rocks. Although the Klaverbank is approximately 30 m to 50 m below the sea surface the clear waters promote the growth of calcareous red algae and the bank is characterised by high faunal diversity (*Lindebloom, et al., 2005; Jak, et al., 2009*). Potentially this area is important for the propagation of fish species like ray and herring which both require hard substrates. Birds and harbour porpoises are sometimes observed in large concentrations within the boundaries of the Klaverbank.

4.3.6.2 Markham's Triangle MCZ

Markham's Triangle MCZ lies approximately 3 km to the northeast of the former ST-1 platform location. This site contains two broad-scale habitats that are recommended for designation: subtidal coarse sediment and subtidal sand. The flora and fauna associated with these habitats is dependent upon the level of local environmental stress. Areas of strong tidal action have little flora, so the resident species tend to be burrowers such as polychaetes, bivalves and amphipods. This abundance of burrowing species provides ideal prey for mobile predators such as crab, seal and dolphin (the latter two are listed in Annex II of the EC Habitats Directive). Shallow sandy sediments are also an ideal habitat for sand eel, which form an important diet constituent for marine mammals and sea birds (*JNCC, 2020a*).

Markham's Triangle MCZ provides excellent connectivity between Klaverbank SAC, which provides protection of harbour porpoise, grey seal and harbour seal, and the Outer Silver Pit area, which supports communities of crustaceans, marine mammals, fish, algae and other species. It is therefore thought that these species will also be present within Markham's Triangle MCZ (*JNCC, 2020a)*

4.3.6.3 North Norfolk Sandbanks and Saturn Reef SAC

The North Norfolk Sandbanks and Saturn Reef SAC is located approximately 25.5 km south-west of the Windermere platform. The North Norfolk Sandbanks and Saturn Reef SAC site is designated due to the presence of two Annex I habitats:

i. a series of ten main sandbanks and associated fragmented smaller banks formed as a result of tidal processes ('Sandbanks which are slightly covered by sea water all the time); and
ii. areas of *Sabellaria spinulosa* biogenic reef.

The North Norfolk Sandbanks are the most extensive example of the offshore linear ridge sandbank type in UK waters (*Graham et al., 2001*). They are subject to a range of current strengths which are strongest on the banks closest to shore and which reduce offshore (*Collins et al., 1995*). The outer banks are the best example of open sea, tidal sandbanks in a moderate current strength in UK waters. Sandwaves are present, being best developed on the inner banks;

the outer banks having small or no sandwaves associated with them (*Collins et al., 1995*). The banks support communities of invertebrates which are typical of sandy sediments in the southern North Sea such as polychaete worms, isopods, crabs and starfish. Certain regions are known to be utilised as sand eel (Ammodytidae) spawning grounds (*Cefas, 2001a*), in turn providing a rich feeding ground for other wildlife such as seabirds, seals and porpoises. Gravelly sediments occur in the troughs between sandbank crests, providing hard substrate for attachment of *S. spinulosa* and optimum conditions for crust/reef development.

The Saturn *S. spinulosa* biogenic reef consists of thousands of fragile sand-tubes made by ross worms (polychaetes) which have consolidated together to create a solid structure rising above the seabed (*BMT Cordah, 2003*). Reefs formed by ross worms allow the settlement of other species not found in adjacent habitats leading to a diverse community of epifaunal and infaunal species (*JNCC, 2008a*).

4.3.6.4 Southern North Sea Special Area of Conservation (SAC)

The Southern North Sea SAC is located approximately 15 km to the south west of the Windermere platform. The Southern North Sea SAC lies along the east coast of England, predominantly in the offshore waters of the central and southern North Sea, from north of Dogger Bank to the Straits of Dover in the south. It covers an area of 36,951 square kilometres, designated for the protection of harbour porpoise. This area supports an estimated 17.5 percent of the UK North Sea Management Unit population. Approximately two thirds of the site, the northern part, is recognised as important for porpoises during the summer season, whilst the southern part support persistently higher densities during the winter (*JNCC, 2019*).

The SAC ranges in depth from Mean Low Water down to 75 metres, with the majority of the site shallower than 40 metres, and is characterised by its sandy, coarse sediments which cover much of the site. These physical characteristics are thought to be preferred by harbour porpoise, likely due to availability of prey (*JNCC, 2019*).

4.3.7 Potential Annex I Habitats

Seabed photographic data were reviewed alongside the geophysical data undertaken during the Windermere pre-decommissioning survey to determine whether potentially sensitive habitats or species of conservation significance were present within the survey area.

Sensitive habitats encountered in the southern North Sea include ‘biogenic reefs’, constructed by ross worm (*JNCC, 2008b*) and ‘sandbanks’.

The Winderemere pre-decommissioning survey did not identify evidence of biogenic reefs or sandbanks (*Fugro, 2014c*).

4.4 Socio-Economic Environment

4.4.1 Commercial Fishing

Decommissioning operations can potentially interfere with commercial fishing activities. The North Sea is one of the world’s most important fishing grounds and major UK and international fishing fleets operate in the southern North Sea, including vessels from England, Scotland, Belgium, Holland, Denmark and France (*DECC, 2016*).

UK fisheries may be broken down simply into the following sectors: demersal, pelagic and shellfish. The shellfish sector is typically the most valuable in the UK, with crabs, lobsters, *Nephrops* and scallops all of a high value. Pelagic fish are usually caught in large numbers but at low values. The average annual price per tonne (live weight) for shellfish species landed in the UK in 2013 was £1,743, compared with £1,658 for demersal species and £658 for pelagic species (*MMO, 2014c*).

The Windermere Development lies within ICES Rectangle 36F2. Specific fishing effort and landing data for this ICES Rectangle were obtained from Marine Scotland and analysed to provide an indication of commercial fishing activities in the vicinity of the Windermere Development.

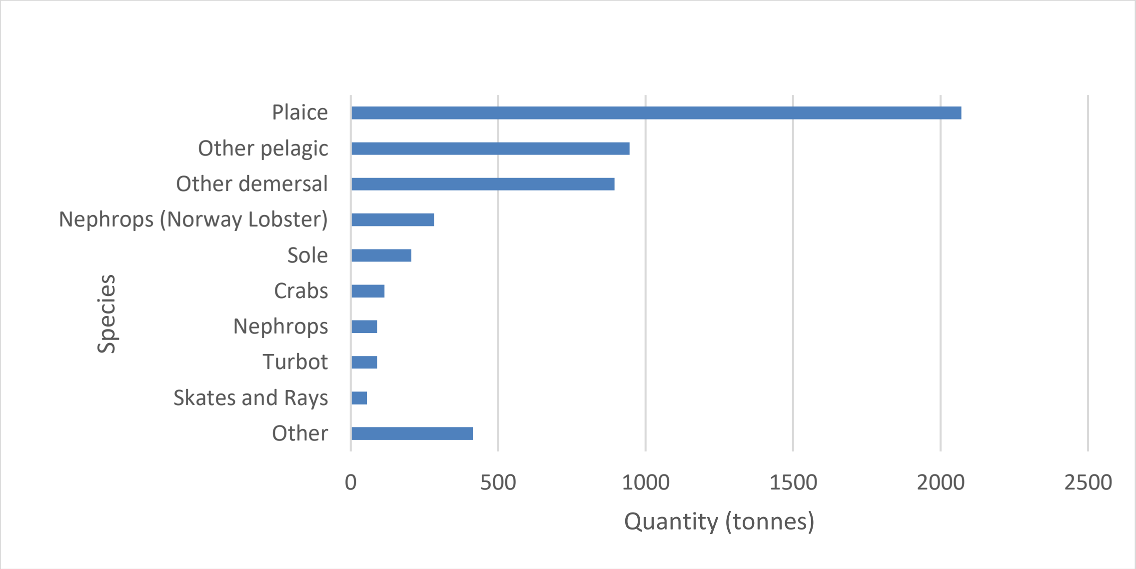
Between 2014 and 2018, the mean annual fishing effort for ICES Rectangle 36F2 was 106 days, which is low and consistent with fishing effort for large areas of the SNS. Fishing effort (days) was dominated by gear falling to the category trawls (*Marine Scotland, 2020*).

Between 2008 and 2019, the average annual landing was 430 tonnes, with the greatest quantity landed in 2011 (1,217 tonnes) and the least in 2017 (87 tonnes) (*Marine Scotland, 2020*).

~~Figure 4-22~~ **(Removed)**

The fish species landed from the commercial fishing operations in ICES Rectangle 36F2 correlate with those reported to have been landed in wide areas of the southern North Sea (*DECC, 2016*). Figure 4-23 shows the species composition of total annual catches between 2008 and 2019 in the vicinity of the Windermere Development. Demersal species made up the majority of catches (68 percent), followed by pelagic (21 percent) with the remainder shellfish (*Marine Scotland, 2020*).

Figure 4-23 Species Caught within ICES Rectangle 36F2 between 2008 to 2019 (*Marine Scotland, 2020*)



It is important to note that in addition to UK registered vessels, vessels registered to other European countries e.g. The Netherlands, may also target fisheries within the vicinity of the Windermere infrastructure.

4.4.2 Shipping and Ports

The southern North Sea is a busy sea way with ships following reasonably clearly defined shipping lanes. Major ports include, Grimsby and Immingham the UK's busiest port, London, Felixstowe and Dover with vessels mainly trading between ports on either side of the North Sea and supporting the oil and gas industry (*DECC, 2016*).

According to OGA (2016), shipping density within UKCS Blocks 49/4 and 49/5 is high and in 49/9 is low. Blocks with 'high' shipping density require a vessel traffic survey and collision risk assessment. While those with 'low' shipping density or with no data require only a vessel traffic survey unless there are routes that pass within 2 nautical miles of the site, which will lead to the requirement for a Collision Risk Assessment.

Decommissioning related vessels/jack-ups will operate within the existing 500 m safety zone around the Windermere platform and therefore no further sea area will be taken up as part of the proposal to decommission the Windermere Development. In addition, all facilities are clearly marked on up-to-date admiralty charts and navigation aids for vessels. INEOS will update the existing consent to locate for the Windermere platform to include the jack-up vessel and HLV where necessary. Should the platform be removed prior to the jack-up vessel completing its decommissioning activities, a separate consent to locate application (for the jack-up vessel) will be submitted (where required).

4.4.3 Oil and Gas Infrastructure and Submarine Cables

Figure 4-24 illustrates the existing oil and gas infrastructure within the vicinity of the Windermere Development.

The nearest surface infrastructure is the JA6 platform located 11.5 km to the east. A number of wells have been drilled within each of the Blocks of Interest; 17 wells have been drilled in Block 49/9, 19 wells in Block 49/4 and 15 wells in Block 49/5 (*UK Oil and Gas Data, 2018*).

No pipelines or cables cross the Windermere to ST-1 pipeline and umbilical. The nearest active telecommunications cable to the Windermere Development is 'NORSEA COMS', 26 km to the west. The following out of service cables pass within 20 km of the Windermere Development (*KIS-OCRA, 2018):*

- The STRATOS 2 (out of service) telecommunications cable, at its closest point, lies approximately 3.5 km to the north west and 14.4 km to the south west;
- The STRATOS 1 (out of service) telecommunications cable, at its closest point, lies approximately 17 km to the south west;
- The STRATOS 3 (out of service) telecommunications cable, at its closest point, lies approximately 17 km to the south west.

4.4.4 Military Activity

The Blocks of Interest lie within a Royal Air Force practice and exercise area (PEXA) 'Southern MDA' (D323C). Activities undertaken in this PEXA include air combat training and high energy manoeuvers (*DECC, 2016*). INEOS will contact the Ministry of Defence to make sure they are aware of the proposed decommissioning activities prior to their commencement.

4.4.5 Dredging and Dumping Activity

There are no offshore dredging sites within the Blocks of Interest. The nearest site is the aggregates application area, 'Humber 5', located 31 km to the south west of the Windermere platform (Figure 4-24) (*Crown Estate, 2017*).

4.4.6 Wind Farms

There are no active windfarms in close proximity to the Windermere Development, however the Orsted Hornsea Project Three is located within Blocks 49/4 and 49/9 (Figure 4-24) (Crown Estates, 2017). The Development Consent Order for this project was approved in 2020 (Orsted 2020).

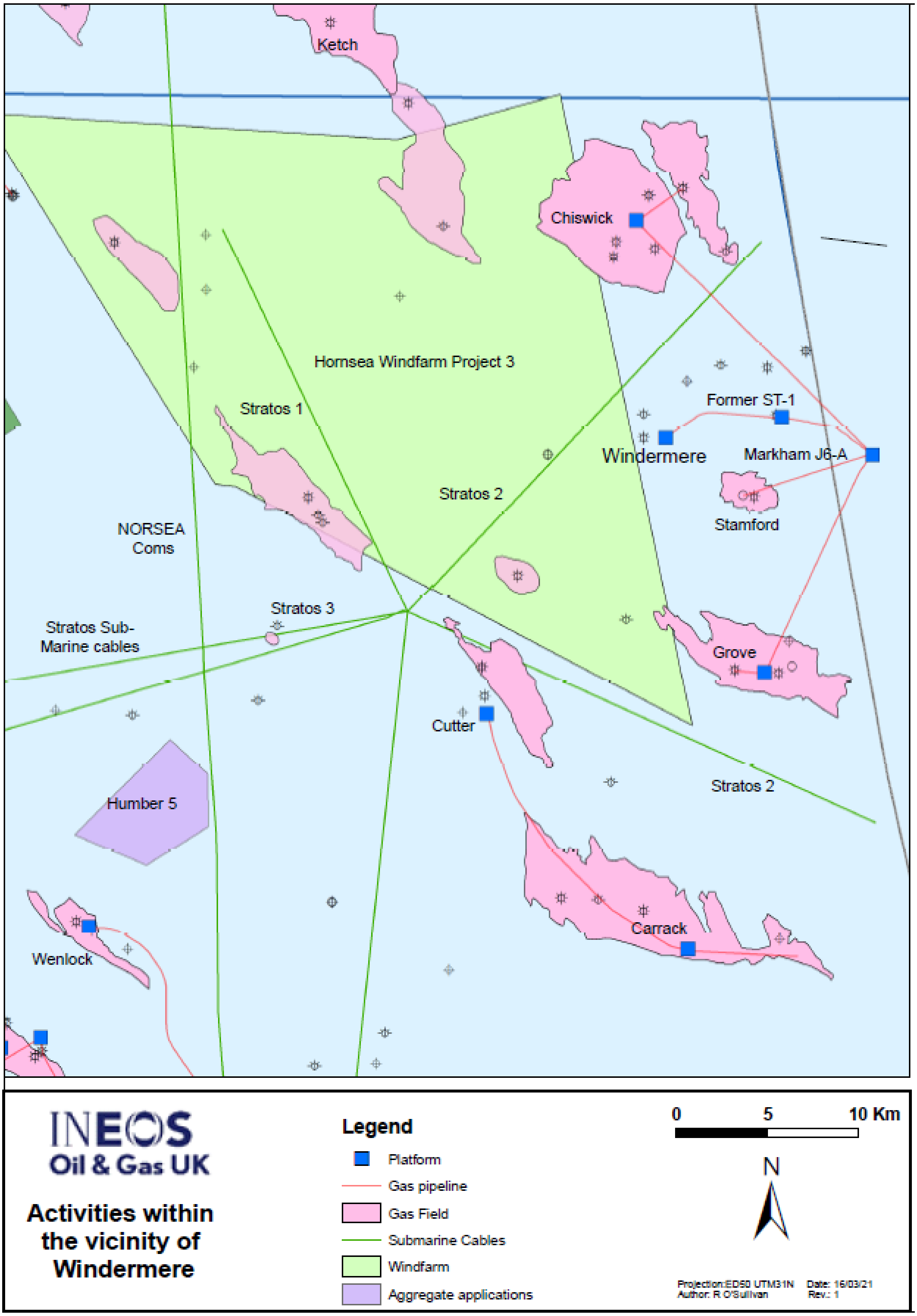
4.4.7 Archaeology

No wrecks were identified during the Windermere pre-decommissioning site survey (*Fugro, 2014a*).

4.4.8 Tourism and Leisure

Leisure based and tourist activities are fairly widespread along the east coast of England. Along the Lincolnshire Coast, Mablethorpe and Skegness are important areas for the holiday industry, but tourist facilities are also widespread between the Humber and The Wash. The north Norfolk coast is an important area for water-based activities, particularly dinghy sailing and wind-surfing. Bridlington and Great Yarmouth are both popular embarkation points for sea angling trips. The wildlife in the area is also a significant attraction and during the summer there are regular seal watching trips to Blakeney Point and the nature reserves around The Wash and North Norfolk coast attract many bird watching tourists (*Smith, 1998; DECC, 2016*).

Figure 4-24 Infrastructure in the Vicinity of the Windermere Development



4.5 Summary of Key Environmental Sensitivities

A summary of key environmental sensitivities in the vicinity of the Windermere Development include (Table 4-16):

- The Windermere Development is not situated in a protected area, the nearest marine protected areas are the Klaverbank SAC located 2.5 km to the east, the Markham's Triangle MCZ located 3 km to the north east and the North Norfolk Sandbanks, the Southern North Sea SAC 15 km to the south west and Saturn Reef SAC located 25.5 km to the south west;
- An investigation into the presence of herring spawning grounds found that the seabed in the vicinity of the Windermere Development has no to low potential (survey reference: GE030);
- Fishing effort is regarded as low. Gear type is dominated by trawls (*Marine Scotland, 2020*);
- Shipping movements in UKCS Block 49/4 and 49/5 are regarded as 'high' and 'low' in UKCS Block 49/9 (*OGA, 2016*);
- The Windermere Development lies within a Royal Air Force practice and exercise area (*DECC, 2016*);
- Previously, oil and gas activity within the Blocks of Interest has been moderate;
- The Blocks of Interest are a spawning area for cod, herring, lemon sole, mackerel, *Nephrops*, plaice¸ sandeels, sole, sprat and whiting (*Coull et al., 1998; Ellis et al., 2012*);
- The Blocks of Interest are also a fish nursery area for anglerfish, cod, herring, horse mackerel, lemon sole, mackerel, *Nephrops*, sandeels, sprat, spurdog, tope shark and whiting (*Coull et al., 1998; Ellis et al., 2012*);
- Seabird vulnerability is considered within Block 49/4 are 'very high' in July and 'high' during November to January. The remainder of the year has a 'low' sensitivity. Similarly, Block 49/5 has a 'high' sensitivity recorded during November to January with the remainder of the year recorded as 'medium' to 'low' sensitivity. Block 49/9 has a 'low' sensitivity throughout the year, with the exception of February to April where no data is available (*Webb et al., 2016*).
- Cetacean numbers overall are generally low, with the harbour porpoise, minke whale and white-beaked dolphin having been recorded in the Blocks of Interest (*Reid et al., 2003*).

Table 4-16 Seasonal Environmental Sensitivities

Activity in the Blocks of Interest, surrounding waters and adjacent coastline													
Component	**Abundance/Activity**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Plankton	Phytoplankton and zooplankton												
Benthic Fauna	Benthic faunal communities												
Fish Note 1	Anglerfish			N	N	N	N	N	N				
	Cod			N	N	N	N						
	Herring										N	N	N
	Horse mackerel					N	N	N	N	N	N		
	Lemon sole						N	N	N	N	N	N	
	Mackerel							N	N	N	N		
	Nephrops	N	N	N	N	N	N	N	N	N	N	N	N
	Plaice												
	Sandeels	N	N	N	N								
	Sole												

Activity in the Blocks of Interest, surrounding waters and adjacent coastline													
Component	**Abundance/Activity**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
	Sprat							N	N	N	N		
	Spurdog	N	N	N	N	N	N	N	N	N	N	N	N
	Tope shark	N	N	N	N	N	N	N	N	N	N	N	N
	Whiting				N	N	N	N	N				
Seabirds Note 2	Block 49/4 offshore vulnerability	3*	5*	5	5*	5*	5	2	5	5	5*	3*	3
	Block 49/5 offshore vulnerability	3*	5*	5	5*	5*	5	3	4	5	5*	3*	3
	Block 49/9 offshore vulnerability	5*	-	-	-	5*	5	5	5	5	5*	5*	5
Cetaceans	Harbour porpoise												
	Minke whale												
	White-beaked dolphin												
Resource Users	Commercial fishing (ICES rectangle 36F2)												
	Shipping and ports												
	Military activity												
	Oil and gas activity (including pipelines)												
	Telecommunications cable												
	Dredging and dumping												
	Offshore windfarms												
	Marine protected areas												
	Coastal protected sites												
	Tourism, recreation & leisure activities												

Key

	High/Peak		Medium		Low		Very Low		No Activity

Note 1: N = Nursing
Note 2: 1 = Extremely High; 2 = Very High; 3 = High; 4 = Medium; 5 = Low; - = No Data.
SOSI sensitivity category marked * indicates an indirect assessment of SOSI scores, in light of coverage gaps.

5 Environmental Impact Assessment Methodology

5.1 Introduction

This section describes the assessment methodology that has been used to identify, describe and assess the likely significant impacts of the proposed Windermere Development Decommissioning project on the environment.

The impact assessment process which has been followed is illustrated in Figure 5.1.

Figure 5.1 Identification, Evaluation and Mitigation of Impacts

The key objectives of this process are to:

- Identify how the project may interact with the baseline environment in order to define, predict and evaluate the likely extent and significance of environmental impacts that may be caused by the project;
- Define mitigation measures in order to avoid, reduce, control or compensate for adverse impacts or enhance positive benefits;
- Evaluate the residual impacts of the project (i.e. the impact that is predicted to remain once mitigation measures have been designed into the intended activity);
- Develop a Register of Commitments in order that the proposed mitigation measures can be incorporated into an overall Environmental Management Plan for the project.

5.2 Impact Identification

5.2.1 Environmental Aspects and Impacts

The ISO (International Organization for Standardization) Standard for Environmental Management Systems, ISO 14001, defines an **environmental aspect** as:

'An element of an organization's activities, products, or services that can interact with the environment.'

ISO 14001 defines an **environmental impact** as:

'Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.'

An environmental impact may result from any of the identified environmental aspects and can arise from planned or unplanned events.

Environmental impacts from a planned event are those caused as a natural consequence of project decommissioning activities (e.g. platform removal, flushing of pipelines etc.) and waste disposal operations (e.g. emissions to atmosphere through waste processing etc.). They may occur continuously, intermittently or on a temporary basis.

Environmental impacts from an unplanned event are those that occur as a result of mishaps or failures (e.g. failure of equipment, procedures not being followed, unforeseen non-routine events, or process equipment not performing as per design parameters). Typical examples of impacts occurring from accidental events include (but are not limited to) spills, leaks, fires and explosions.

Impacts may be adverse (i.e. have a detrimental or negative effect to an environmental resource or receptor) or positive (i.e. have an advantageous or positive effect to an environmental resource or receptor).

To identify the potential environmental impacts associated with the proposed Windermere Decommissioning project, all activities associated with the decommissioning (as outlined in Section 3) have been considered in terms of their direct or indirect potential to interact with the baseline environment including its physical, biological and socio-economic elements (as detailed in Section 4).

Cumulative impacts (i.e. impacts that result from incremental changes caused by other past, present or reasonably foreseeable activities or projects in the local area, in combination with the proposed development) and transboundary impacts (i.e. impacts experienced in one country as a result of activities in another) have also been considered.

5.3 Evaluation of Significance

Once identified, the predicted environmental impacts are assessed to define the level of potential risk they present to the environment. If these risks are deemed significant, they should be removed or reduced through design or the adoption of operational mitigation measures.

ISO 14001 defines a **significant environmental aspect** as:

‘An environmental aspect that has or can have a significant environmental impact.’

In order to determine the significance of the predicted environmental impacts for the proposed Windermere Decommissioning project a risk assessment approach has been used, whereby:

Risk = Likelihood of Occurrence x Magnitude of Impact (Consequence)

The following sections describe the criteria which have been used to assess the significance of potential impacts.

5.3.1 Likelihood of Occurrence

For every environmental impact identified for the proposed Windermere Decommissioning project the likelihood of occurrence has been scored (from 1 to 5) based on the definitions provided in Table 5.1.

Table 5.1 Likelihood of Occurrence

Likelihood	Likelihood of Occurrence of the Impact
5	**Definite:** could be expected to occur more than once during project delivery, part of normal and expected activities
4	**Likely:** could easily be incurred and has generally occurred in similar projects
3	**Possible:** occurred in a minority of similar projects
2	**Unlikely**: known to happen, but only rarely
1	**Remote:** hasn't occurred in similar projects, but is foreseeable

5.3.2 Magnitude of Impacts

The magnitude of impact (consequence) on the environment has also been scored (from 0 to 6) based on the definitions provided in Table 5.2. A high score means the impact is of greatest severity. Where magnitude appears to fall within two different categories, the higher category is selected to provide a worst case scenario for the purposes of assessment.

Table 5.2 Definition of Consequence Categories

Consequence Category	Environmental Impact	Regulatory Compliance	Stakeholder Concern
6 Catastrophic	Catastrophic direct, indirect and/or cumulative impact on the ecosystem at an international level (major transboundary effects expected). The impact is likely to be permanent or of long-term duration and may include: Major contribution, at a global level, to a known air pollution problem; Long-term deterioration of water quality and the marine environment at an international level; Irreparable effect on the ecosystem involving change in abundance or distribution of the population, or size of genetic pool over an extensive area (> 100 km^2); Widespread and long term damage to international fisheries; Significant damage and permanent loss to archaeological, cultural or natural resources of international importance.	Major breach of regulatory requirements, which is very likely to result in prosecution	International public concerns and extensive international media interest likely, resulting in complete loss of public confidence in company.

5 Severe	Severe direct, indirect and/or cumulative impact on the ecosystem at a national. The impact is likely to be of long-term duration and may include: Major contribution, at a national level (and possible minor transboundary effects), to a known air pollution problem; Long-term deterioration of water quality and the marine environment at an national level (and possible minor transboundary effects); Change in abundance or distribution of the population, or size of genetic pool extending over a wide area (10 - 100 km^2); Widespread and long term damage to national fisheries (and possible minor transboundary effects); Significant damage and permanent loss to archaeological, cultural or natural resources of national importance.	Likely major breach of regulatory requirements resulting in potential prosecution or significant project approval delays.	National public concerns and extensive national media interest likely, resulting in major loss of public confidence in company.
4 Major	Serious direct, indirect and/or cumulative impact on the ecosystem at a regional level. The impact is likely to lead to observable and measurable medium to long-term changes and may include: Medium to long-term, regional deterioration of air quality; Medium to long-term deterioration of water quality and the marine environment at a regional level; Change in abundance or distribution of the population, or size of genetic pool extending over an area of approximately 10 km^2; Medium to long-term impact to regional fisheries; Major damage to archaeological, cultural or natural resources of regional importance.	Possible moderate to major breach of specific regulatory consent limits resulting in non-compliance.	Regional concerns at the community or broad interest group level, resulting in possible loss of public confidence in company.
3 Moderate	Moderate direct, indirect and/or cumulative impact on ecosystem on a local level, leading to observable and measurable medium-term changes. These impacts may include: Medium-term deterioration of local air quality; Medium-term deterioration of water quality and the marine environment; Change in abundance or distribution of the population extending over an area of approximately 1 km^2; Medium-term impact to local fisheries; Moderate level of damage to archaeological, cultural or natural resources.	Possible minor breach of specific regulatory consent limits resulting in non-compliance.	Local concerns at the community or broad interest group level.

2 Minor	Limited direct and/or indirect impact on ecosystem on a local level, leading to observable and measurable short-term changes. These impacts may include: Short-term deterioration of local air quality; Short-term deterioration of water quality and the marine environment; Change in abundance or distribution of the population similar in effect to small random changes in the ecosystem due to ambient environmental conditions, extending over an area of approximately 0.01 km^2; Short-term impact to local fisheries; Limited impact to archaeological, cultural or natural resources.	Very unlikely to result in a breach of regulatory or company HS&E goals.	Issues that might affect individual people or businesses or single interests at a local level.
1 Negligible	Insignificant direct or indirect impact on the ecosystem, confined within the immediate vicinity of the site, unlikely to be observable or measurable above small random changes due to ambient environmental conditions. Such impacts would have no discernible effect on the local ambient air quality, water quality, marine environment, fisheries, archaeological, cultural or natural resources.	No likelihood of breach of regulatory or company HS&E goals.	No noticeable stakeholder concern.
0 Positive	An enhancement of some ecosystem or socio-economic parameter.	N/A	Possible positive public support.

5.3.3 Impact Significance

The significance of the potential impacts is then determined by combining their likelihood and consequence scores as illustrated in the Risk Assessment Matrix below (Table 5.3).

Table 5.3 Risk Assessment Matrix

			Likelihood				
			1	**2**	**3**	**4**	**5**
			Remote	Unlikely	Possible	Likely	Certain
Consequence	**6**	Catastrophic					
	5	Severe					
	4	Major					
	3	Moderate					
	2	Minor					
	1	Negligible					
	0	Positive					

Overall Significance Definitions:	
Major	**Considered to be a significant risk:** the level of risk is unacceptable. Risk and control measures are required to move the risk figure to the lower risk categories, e.g. design out the risk, put plans and procedures in place.
Moderate	**Considered to be a significant risk:** the level of risk is tolerable, but extra control and reduction measures are required. This may be location or activity specific to minimise the risk as much as possible.
Minor	**Not considered to be a significant risk:** the level of risk is considered to be broadly acceptable and generic control and reduction measures are already part of the project design process. Continuous improvement is still a requirement.
Negligible	**No risk:** no action required.
Positive	**Positive impact:** to be encouraged.

5.4 Mitigation Measures and Residual Impacts

Where potentially significant impacts have been identified (i.e. those impacts which are considered to pose a major or moderate risk to the environment), mitigation measures have been considered in order to remove, reduce or manage the potential impacts so that they are not significant.

Once appropriate mitigation measures have been applied, the potential impacts are then reassessed to determine if the overall impact significance has been reduced. These remaining impacts are referred to as **residual impacts** (i.e. the impact that is predicted to remain once mitigation measures have been designed into the intended activity).

5.5 Results of the Assessment

The results of the environmental impact assessment for the proposed Windermere Decommissioning project are summarised in the Environmental Aspects Tables in Appendix B.

Impacts (both environmental and socio-economic) associated with the Windermere Decommissioning project have been grouped under the following headings:

- Physical Presence;
- Seabed Impacts;
- Noise;
- Atmospheric Emissions;
- Marine Discharges;

- Unplanned Releases;
- Solid Wastes.

In addition, transboundary and cumulative impacts have been discussed separately.

Those impacts given a significance ranking of minor or negligible before the application of mitigation measures are considered insignificant and have therefore been scoped out from further assessment in this ES.

Those environmental aspects which are considered to be significant (or positive) and those that are subject to control by regulation are assessed further within Sections 6 – 14 of the ES and suitable mitigation measures are determined to demonstrate that the residual impact is as low as reasonably practicable (ALARP).

All mitigation measures identified within Sections 6-14 of the ES are listed in a Register of Commitments (refer to Table 15.1 in Section 15) and will be incorporated into INEOS's overall Environmental Management Plan for the Windermere Decommissioning project to ensure that potential environmental impacts are minimised.

A summary of the residual risk assessment of the potentially significant impacts are shown in Table 5.4. All residual impacts (including transboundary and cumulative impacts) are considered to pose a residual risk that is minor or less, provided the proposed mitigation and management measures, as identified within the ES, are implemented during the Windermere Decommissioning Project. In addition, four positive impacts have been identified. These are associated with the removal of the Windermere platform and concrete mattresses, which are expected to free up sea room to other users and reduce the number of foreign objects on the seabed. As well as the onshore recycling of materials recovered from the Windermere Development during decommissioning, which is expected to result in less energy usage and atmospheric emissions than if all materials were manufactured from new.

Table 5.4 A Summary of the Residual Risk Assessment Conducted for Significant Impacts

Windermere Decommissioning Project	Residual Risk									
	Positive		Negligible		Minor		Moderate		Major	
	Planned	Unplanned	Planned	Unplanned	Planned	Unplanned	Planned	Unplanned	Planned	Unplanned
Physical Presence	2		1		3					
Disturbance of the Seabed					6					
Noise and Vibration			1		2					
Atmospheric Emissions and Energy Balance	1				1					
Marine Discharges					3					
Unplanned Hydrocarbon Release				1		3				
Solid Wastes					2					
Transboundary Impacts			1		1	1				
Cumulative Impacts					1					
Total	**3**	**0**	**3**	**1**	**19**	**4**	**0**	**0**	**0**	**0**

6 Physical Presence

6.1 Assessment of Potentially Significant Impacts

The physical presence of the jack-up vessel (either a conventional jack-up MODU rig, a (rigless) jack-up work barge or a (rigless) jack-up lift barge) and other decommissioning vessels could result in potentially significant impacts to:

- General shipping vessels (i.e. cargo and passenger ferries);
- Fishing vessels.

Note, for the purposes of this EIA, a worst case scenario of using a HLV to remove the platform has been assumed (refer to Section 3.3.2). However, the HLV will be located within an existing 500 m exclusion zone and therefore the impact on shipping and fishing vessels is not considered to be significant in this instance.

6.1.1 Regulatory Regime

The positioning of jack-up vessels and other fixed vessels / installations is covered by a Consent to Locate (CtL), which for decommissioning activities is consented under the Marine and Coastal Access Act 2009 and The Energy Act 2008.

6.1.2 Removal of the Windermere Platform

Following the removal and transportation to shore of the Windermere topsides as a complete unit, the jacket piles will be cut at approximately 3m below the seabed and the jacket will then be removed and transported to shore. A section of each pile will be left in *in situ*. Infrastructure on the seabed can pose an obstacle to fishing vessels, particularly benthic trawlers as their gears may become snagged or trapped on items left on the seabed. However, given that the jacket piles will remain *in situ* below the mudline, they should not pose an obstacle for other sea users.

The final severance methodology is yet to be defined. If explosives are required, other sea users which may be affected by this will be informed in advance and communications maintained throughout the DP.

Once the removal of the Windermere platform is complete, the existing exclusion zone around the platform will be removed. This will free up an area of approximately 0.8 square kilometres to other sea user and is expected to have a minor positive impact to shipping and other vessel as well as commercial fisheries.

6.1.2.1 Conclusions

Once the platform is safely removed, the residual impact is expected to be a positive one, as there will be more available sea room for other sea users.

Once the Windermere platform is removed, the residual impact of the physical presence on other **commercial fishing vessels** and **shipping and other vessels** is considered to be **Positive**

6.1.3 Partial removal of the Umbilical

Based on the outcome of the CA it was decided that the unburied sections of umbilical near to the platforms will be removed and the remainder of the umbilical will be left *in* situ. The remaining exposed or insufficiently buried sections of umbilical at the two platform ends will be buried. This option was selected based on minimal seabed disturbance, lower energy use and reduced risk to personnel (*INEOS, 2021b*).

INEOS will remain responsible for the umbilical section left *in situ* post-decommissioning and will therefore undertake a long-term monitoring programme (the details of which will be agreed with BEIS) of the umbilical status and take remedial actions, as required, to prevent the umbilical becoming a hazard to other activities, such as fishing.

There will be a minor impact from decommissioning vessels while the umbilical is being removed from the seabed, and then while they are in transit to and from the Windermere Development location. However, once the sections of umbilical from each platform end have been safely removed, the residual impact is expected to be a minor.

Once the remainder of the umbilical is fully buried, the residual impact of the physical presence on **commercial fishing vessels** is considered to be **Minor.**

The residual impact of pipeline survey and remediation vessels on other sea users (**commercial fishing vessels and shipping and other vessels**) is considered to be **Minor**.

6.1.4 Removal of the Stabilisation Material (Concrete Mattresses and Grout Bags)

It is proposed that, where technically feasible, an attempt to remove the exposed concrete mattresses and grout bags from the seabed will be made. If the mattress and grout bag recovery operation is considered too dangerous to personnel, due to the state of the mattresses and grout bags, a proposal will be made to BEIS to leave the mattresses and grout bags *in situ*.

As a 'worst-case' assessment, this section will assess the impact of removing all 48 of the concrete mattresses and all 300 of the grout bags at the Windermere Decommissioning area. It is proposed that the concrete mattresses and grout bags will be recovered and transported to shore for recycling or disposal.

The exact methodology for removal for the concrete mattresses and grout bags has yet to be decided / investigated (and therefore no impacts other than physical presence and sediment disturbance are assessed), however, it will likely involve the use of divers and ship-mounted cranes.

The complete removal of the concrete mattresses and grout bags will reduce the number of foreign objects on the seabed.

6.1.4.1 Conclusions

There will be a minor impact from decommissioning vessels while the concrete mattresses and grout bags are being removed, and then also while the materials are in transit from the Windermere Development location. However, once the concrete mattresses and grout bags are safely removed, the residual impact is expected to be a positive one, as it will reduce the number of foreign objects on the seabed.

Once the concrete mattresses and grout bags have been removed, the residual impact of the physical presence on **commercial fishing vessels** is considered to be **Positive**

6.1.5 Partial Removal of the Pipeline and Subsequent Monitoring and Potential Remedial Operations

Based on the outcome of the CA, it was decided that the tie-in spools and unburied sections of the pipeline near to the platforms will be removed and the remainder of the pipeline will be left *in situ*. The remaining exposed or insufficiently buried sections of the pipeline will be trenched and buried. This option was selected on the basis of minimal seabed disturbance, lower energy use and reduced risk to personnel (*INEOS, 2021a)*. Over time, it is possible that parts of the pipeline may become exposed, presenting a hazard to activities, such as fishing.

INEOS will remain responsible for the pipeline section left *in situ* post-decommissioning and will therefore undertake a long-term monitoring programme (the details of which will be agreed with BEIS) of the pipeline status and take remedial actions, as required, to prevent the pipeline becoming a hazard to other activities, such as fishing.

Remediation of pipeline exposures can be achieved by one of three methods; using rock placement in order to prevent further scouring around free spans, reburial using jetting or removal of the exposure sections. At the time of writing this ES, the exact method of remediation for any exposed parts of the pipeline is not known.

The physical presence of the vessels required for both pipeline surveying and all three of the remediation methods would provide an additional obstacle to other sea users.

However, it should be noted that, now the pipeline is flooded, it is considered unlikely that any free spans will develop going forwards and therefore it is unlikely that further remedial action would be required.

Given the above, the magnitude of the potential impact of the pipeline presenting a snagging hazard to commercial fishing vessels would be moderate and is therefore considered to be significant. And the magnitude of the potential impact of the physical presence of pipeline survey and remediation vessels on commercial fishing vessel as well as shipping and other vessels would also be moderate and is therefore considered to be significant.

Mitigation Measures

- INEOS will monitor the status of the decommissioned pipeline at appropriate intervals (agreed with BEIS) and take appropriate remedial action, as required, to ensure that it does not become a hazard to other activities, such as fishing over time;
- To mitigate the potential impact from the physical presence of vessels conducting surveys and remediation works:
    - Consultations with the Fisheries and Maritime Agencies will be undertaken, as required;
    - Vessels will all meet national and international legislation with regards to navigation aids and warning signals for other sea users;
    - Other sea users will also be informed of surveying and remediation activities, as necessary, and therefore the presence of additional vessel traffic in the area, through Notices to Mariners to enable early warning and planning of proposed activities;
    - Communications with Fisheries and Maritime agencies will be maintained, as necessary, throughout any planned activities. An FLO will be responsible for the distribution of all key information to fishermen.
    - A collision risk management plan should be developed for the surveying and remediation operations to record the pre-planning measures taken to minimise the risk of ship collision, and to define the guarding role of the ERRV whilst on location;
    - INEOS will actively seek to minimise the amount of material used for pipeline stabilisation.

6.1.5.1 Conclusions

Now that the pipeline is flooded, it is considered unlikely that any free spans will develop and therefore it is unlikely that further remedial action would be required. Going forwards there will be a minor impact from vessels conducting surveys along the pipeline length as part of the long-term monitoring programme, however the impact from the physical presence of these survey vessels on other sea users is expected to be minor.

Should remedial burial operations be required to address pipeline exposures, there will be a minor impact from vessels conducting remedial works along the pipeline length. This remediation work will reduce the risk of snagging fishing gear.

Once the remainder of the pipeline is fully buried, the residual impact of the physical presence of the pipeline on **commercial fishing vessels** is considered to be **Minor** The residual impact of pipeline survey and remediation vessels on other sea users (**commercial fishing vessels** and **shipping and other vessels**) is considered to be **Minor**

6.2 Summary of Mitigation Measures

- The jack-up vessel and the HLV will remain within the existing exclusion zone of the Windermere platform;
- Vessels will all meet national and international legislation with regards to navigation aids and warning signals for other sea users;
- Other sea users will also be informed of the decommissioning activities, as necessary, and therefore the presence of additional vessel traffic in the area, through Notices to Mariners to enable early warning and planning of proposed activities;
- Communications with Fisheries and Maritime agencies will be maintained, as necessary, throughout any planned activities. An FLO will be responsible for the distribution of all key information to fishermen;
- The crew of the ERRV attending the decommissioning operations should be experienced in traffic monitoring duties and should be briefed on the main routes of concern in the area;
- A collision risk management plan should be developed for the decommissioning operations to record the pre-planning measures taken to minimise the risk of ship collision, and to define the guarding role of the ERRV whilst on location;
- Consultations with the Fisheries and Maritime Agencies will be undertaken, as required;
- INEOS will monitor the status of the decommissioned pipeline at appropriate intervals (agreed with BEIS) and take appropriate remedial actions, as required, to ensure that it remains buried and does not become a hazard to fishing over time;
- INEOS will actively seek to minimise the amount of material required for pipeline stabilisation.

7 Disturbance of the Seabed

7.1 Assessment of Potentially Significant Impacts

During the Windermere DP, the main causes of seabed disturbance will be from:

- Removal of subsea infrastructure (jacket, platform wells, umbilical and pipeline ends);
- Removal of concrete mattresses;
- The deployment of jack-up vessel legs (spud cans);
- Jack-up vessel and pipeline stabilisation (rock placement);
- Remedial action to address pipeline exposures.

7.1.1 Regulatory Regime

The removal of subsea infrastructure, seabed disturbance and the placement of additional stabilisation / protective materials are all regulated under the Marine and Coastal Access Act 2009 (MCAA). The deployment of jack-up vessel spud cans and jack-up vessel leg stabilisation materials (rock dumping) is regulated under the MCAA and The Energy Act 2008.

7.1.2 Removal of Subsea Infrastructure

The subsea infrastructure that will need to be removed as part of the Windermere DP is summarised in Table 7.1 below (for further detail refer to Section 3.4). Note that the entire umbilical and pipeline have not been included as they will remain *in situ* and only the ends will be removed.

Table 7.1 Summary of the Subsea Structures to be removed as part of the Decommissioning Programme

Subsea Structure	Inventory
Jacket (including piles)	1 (down to 3 m below the seabed)
Platform well	2 (well casing down to 3 m below the seabed)
Umbilical	2 (sections)
Pipeline (partial)	2 (sections)
Tie-in Spools	2
Other	2 Velocity Strings

The removal of the jacket, well casings and pipeline will be undertaken by metal cutting techniques. As the platform jacket legs have been piled into the seabed, grit cutters or explosives (i.e. high energy methods) may be used to cut the piles below the seabed in order to remove them as a hazard to shipping/fishing vessels.

It is proposed that the jacket piles and well casings will be cut 3m below the seabed. Therefore, it is assumed, for the purposes of this assessment that each pile and well casing will need to be excavated to a depth of 4m with a radius of 10m to expose the cutting location. Based on these assumptions it is estimated that an approximate seabed area of 314.16m^2 and a sediment volume of 1,256.64m^3 may be disturbed to cut each structure, with a total volume of 6,283.2m^3 for all five.

It is proposed that the exposed sections of the pipeline at each platform end, along with the tie-in spools, will be removed from the seabed. The maximum total pipeline length that may be removed is estimated to be 240m. Assuming a worst case disturbance corridor of 5 m either side of the 8 inch pipeline, it is estimated that an area of around 2,448 m^2 of seabed could be disturbed as a result of the partial removal of the pipeline. In addition to this, the pipeline will need to be excavated at the identified cutting locations at a width of 1 m either side of the 8 inch pipeline and down to a depth equating to the diameter of the pipeline (approximately 0.2m) to enable cutting. Once exposed, the pipeline can be cut and recovered to the deck of the vessel. As a worst case, for the purposes of this assessment, it is assumed that all 240m of pipeline will require excavation. Therefore, in terms of volume, the removal of the pipeline could result in the disturbance of 105.6m^3 of sediment.

The umbilical is 7.0km in length and is buried to an average depth of 0.71 m (*INEOS, 2021a*). It is proposed that exposed sections of the umbilical at each platform end will be removed from the seabed. It is planned to pull the umbilical directly from the seabed, however, if this method of removal, is not possible (e.g. if the umbilical snaps), the contingency method is to expose the umbilical (using jetting) prior to pulling it to surface. As a worst case, for the purposes of this assessment, the impact of the contingency method is assessed here. The assumptions are the same as those made above for the pipeline.

It should be noted that, in addition to limiting the volume of seabed disturbance (i.e. spatial disturbance), the proposed method also limits the potential temporal disturbance of the seabed compared to methods which expose the umbilical before removing it.

Table 7.2 summarises the area of seabed and the volume of sediment that may be disturbed as a result of the removal of the subsea infrastructure. Based on the assumptions outlined above, it is estimated that the removal of all of the subsea infrastructure may result in the disturbance area of 6,467m^2 and a sediment volume of 6,494m^3. Please note, the final removal methods for the subsea infrastructure have yet to be determined and therefore the actual seabed area and sediment volume that may be disturbed is subject to change. This will be updated on the relevant Marine Licence Application before the work begins.

Table 7.2 Summary of Seabed and Sediment Disturbance as a Result of the Removal of the Seabed Infrastructure

Infrastructure	Total Potential Area of Seabed Disturbance (m^2)	Total Potential Volume of Sediment Disturbance (m^3)
Jacket Piles	(314.16[1] x 3 =) 942.48	(1,256.64[2] x 3 =) 3,769.92
Well Casings	(314.16[1] x 2 =) 628.32	(1,256.64[2] x 2 =) 2,513.27
Umbilical	2,448.00[3]	105.60[4]
Pipeline	2,448.00[3]	105.60[4]
Total	**6,467**	**6,494**

[1] Calculation of potential seabed area of disturbance for pile / well casing removal: π x (10 m x 10 m) = 314.16m^2
[2] Calculation of potential volume of disturbance for pile/well casing removal: π x (10 m x 10 m) x 4 m = 1,256.64 m^3
[3] Calculation of potential seabed area of disturbance from pipeline removal: 240 m x 10.2 m = 2,448 m^2
[4] Calculation of potential volume of disturbance from pipeline removal: 240 m x 2.2 m x 0.2 m = 105.6 m^3

The removal of the seabed infrastructure may leave indentations/scars and mounds on the seabed. Post-disturbance recovery of the seabed is dependent both on the strength of the seabed soils and the ability of the hydrological regime to rework disrupted sediments and return the seabed to its original contours. Physical disturbance as a result of removing the subsea infrastructure may cause mortality or displacement of benthic species in the impacted zone, direct loss of habitat and direct mortality of sessile seabed organisms that cannot move away from the contact area at seabed contact points. Several factors minimise these impacts:

- Biological communities are in a continual state of flux and are able to either adjust to disturbed conditions or rapidly recolonise areas that have been disturbed;
- The area has already been exposed to oil and gas exploitation of the seabed as well as being subjected to historical benthic trawling, therefore historic disturbance has already taken place;

- No sensitive species or Annex I habitats of conservation importance were identified around the Windermere Development (*Fugro, 2014a*);
- The mobile nature of the seabed sediments in the SNS area will aid the rapid recovery of the disturbed areas, although some seabed scars may persist in the medium term.

The disturbance of seabed sediments through the use of high energy methods may also lead to an increase in sedimentation, potential destabilisation of the surrounding sediments and a localised increase in turbidity. This can have an impact on water quality, plankton, fish and benthic suspension feeders. However, the impacts will be highly localised and the seabed area likely to experience disturbance is relatively small compared to similar seabed habitats present in the SNS.

Seabed sediments across the Windermere area are generally dominated by sand with a minimal proportion of gravel (*Fugro, 2014a*). Such sediments are less likely to remain re-suspended and carried over long distances, compared to fine muds and clays. It is more likely that they will resettle into the immediate vicinity following disturbance. Conversely, fine sediments would be more unstable and more likely to cause an increase in turbidity and sedimentation because of their relative ease of re-suspension.

Of particular sensitivity to localised increases in turbidity are; shellfish beds and fish spawning grounds (*OSPAR, 2008*). Several fish spawning grounds have been identified in the vicinity of the Windermere development (refer to Section 4.3.3), but of the species identified, only herring spawning grounds are of particular conservation importance. Based on the results of the pre-decommissioning site survey, seabed sediments have none or low suitability for herring spawning (*Fugro, 2014a*). No commercial shellfish beds have been identified in the proposed area of operations.

Benthic species are vulnerable to the effects of sediment loading. However, given the strong water column and seabed current regime in the area, species which are tolerant to a natural variability of sedimentation are present in the SNS in general, and are also found in the Windermere area. This was corroborated during the pre-decommissioning site survey where the benthic community was found to be dominated by the polychaete worm *Spiophanes bombyx* and the bivalves *Corbula gibba* and *Mactra stultorum* (Section 4.3.2; *Fugro, 2014a*). All of these taxa are relatively tolerant to smothering and increases in suspended sediment (*MarLIN, 2015*). In addition, no notable habitats or species of conservation importance were identified during the Windermere pre-decommissioning site survey (*Fugro, 2014a*).

Given the above the magnitude of the potential impact of the removal of the subsea infrastructure on water, seabed sediments and benthic flora and fauna is considered to be moderate and therefore the impact is considered to be significant.

Mitigation Measures

- Subsea infrastructure removal methods will be assessed prior to decommissioning operations beginning, with a view to implement the removal method with the least impact to the seabed;
- Post-decommissioning a debris survey will be undertaken to remove any objects remaining on the seabed;
- Use of dynamically positioned vessels, if possible, to avoid the impact of anchors.

7.1.2.1 Conclusions

The removal of the seabed infrastructure will pose an impact to the local water quality, seabed sediments and benthic flora and fauna, through disturbance and increased sedimentation. However, the residual impact is expected to be minor, as any water, seabed sediment and benthic flora and fauna impacts will be highly localised and temporary in nature. In addition, the areas of impact are expected to recover quickly due to the nature of the benthic community, local currents and sediment type.

The residual impact to the **water quality**, **seabed sediments** and **benthic flora and fauna** from the removal of the Windermere seabed infrastructure is considered to be **Minor**.

7.1.3 Removal of Stabilisation Material (Concrete Mattresses and Grout Bags)

It is proposed that, where technically feasible, an attempt will be made to remove all of the concrete mattresses and grout bags from the seabed. If the mattress and grout bag recovery operation is considered too dangerous to personnel, due to the state of the mattresses and grout bags, a proposal will be made to BEIS to leave the mattresses and grout bags *in situ* if alternative methods cannot be identified.

As a 'worst-case' assessment, this section will assess the impact of removing all 48 of the concrete mattresses and all 300 of the grout bags from the Windermere Development (refer to Section 3.2.4). It is proposed that the concrete mattresses and grout bags will be recovered and transported to shore for disposal or recycling.

The exact methodology for removal for the concrete mattresses and grout bags has yet to be decided / investigated, however it may involve the use of divers and shipboard cranes if alternative methods cannot be identified.

It is expected that the removal of all 48 concrete mattresses will disturb an area of seabed of approximately 1,650 m^2 (this is based on a 1m buffer being placed around each of the 5m x 2.9m mattresses). Please note this should represent a worst case as it is likely that some mattresses will be overlapping. It is assumed that all of the mattresses are over the exposed sections of the pipelines and are therefore also exposed. Consequently it is anticipated that their removal will result in a very small volume of sediment being disturbed.

The (estimated) 300 grout bags are expected to be spread between six locations on the pipelines (approximate length of footprints: 10.5m, 1m, 4m, 2m, 5m and 5m). For the purposes of this assessment, as a worst case, it is assumed that the footprint width of each grout bag area is equal to the width of a concrete mattresses (i.e. 2.9 m). Therefore, it is expected that the removal of all the 300 grout bags will disturb an area of seabed of approximately 195 m^2 (this is based on a 1 m buffer being placed around each grout bag area). It is also assumed that the majority of the grout bags are over the exposed sections of the pipelines and are therefore also exposed. Consequently it is anticipated that their removal will result in a very small volume of sediment being disturbed.

Table 7.3 summarises the predicted seabed area and sediment volume that may experience disturbance as a result of the removal of the concrete mattresses and the grout bags. It is estimated that a seabed area of 1,845 m^2 and a negligible sediment volume may be disturbed as a result of these activities. Please note, the final method of removal has yet to be determined and therefore the actual seabed area and sediment volume that may be disturbed will be subject to change. This will be updated in the relevant Marine Licence Application prior to the work commencing.

Table 7.3 Summary of the Seabed Area and Sediment Volume that may Experience Disturbance as a Result of the Removal of the Concrete Mattresses and Grout Bags

Stabilisation Material	Number	Total Area (m^2)	Total Volume (m^3)
Concrete Mattresses	48	1,650[1]	Negligible
Grout Bags	300	195[2]	Negligible
Total		1,845	Negligible

[1] Calculation for potential seabed area of disturbance for concrete mattresses: 7 m x 4.9 m = 34.3 m^2 x 48 = 1,646.4 m^2
[2] Calculation for potential seabed area of disturbance for grout bags: 4.9 m x 12.5 m = 61.25 m^2, 4.9 m x 3 m = 14.7 m^2, 4.9 m x 6 m = 29.4 m^2, 4.9 m x 4 m = 19.6 m^2, 4.9 m x 7 m = 34.3 m^2 and 4.9 m x 7 m = 34.3 m^2. Sum = 193.55 m^2.

The disturbance of seabed sediments may lead to an increase in sedimentation, potential destabilisation of the surrounding sediments and a localised increase in turbidity. This can have an impact on water quality, plankton, fish and benthic suspension feeders. However, the impacts will be highly localised and the seabed area likely to experience disturbance is relatively small compared to similar seabed habitats present in the SNS.

Seabed sediments across the Windermere area are generally dominated by sand with a minimal proportion of gravel (*Fugro, 2014a*). Such sediments are less likely to remain re-suspended and carried over long distances, compared to fine muds and clays. It is more likely that they will resettle into the immediate vicinity following disturbance.

Of particular sensitivity to localised increases in turbidity are; shellfish beds and fish spawning grounds (*OSPAR, 2008*). Several fish spawning grounds have been identified in the vicinity of Windermere (refer to Section 4.3.3), but of the species identified, only herring spawning grounds are of particular conservation importance. Based on the results of the pre-decommissioning site survey, seabed sediments in the vicinity of the Windermere Development have none or low suitability for herring spawning (*Fugro, 2014a*). In addition, no commercial shellfish beds have been identified in the area of operations.

As described in Section 7.1.2, benthic species are vulnerable to the effects of sediment loading. However, given the strong water column and seabed current regime in the area, species which are tolerant to a natural variability to sedimentation are present in the SNS in general, and are also found in the Windermere area. This was corroborated during the pre-decommissioning site survey where the benthic community was found to be dominated by the polychaete worm *Spiophanes bombyx* and the bivalves *Corbula gibba* and *Mactra stultorum* (Section 4.3.2; *Fugro, 2014a*). All of these taxa are relatively tolerant to smothering and increases in suspended sediment (*MarLIN, 2015*). In addition, no notable habitats or species of conservation importance were identified during the Windermere pre-decommissioning site survey (*Fugro, 2014a*).

Given the above, the magnitude of the potential impact of the removal of stabilisation material on water, seabed sediments and benthic flora and fauna is considered to be moderate and therefore the impact is considered to be significant.

Mitigation Measures

- Concrete mattress and grout bag removal methods will be assessed prior to decommissioning operations beginning, with a view to implement the removal methods, with the least impact to the seabed;
- Post-decommissioning a debris survey will be undertaken to identify any concrete mattresses and grout bags remaining on the seabed;
- Use of dynamically positioned vessels, if possible, to avoid the impact of anchors.

7.1.3.1 Conclusions

The removal of all of the concrete mattresses and grout bags will pose an impact to the local water quality, seabed sediments and benthic flora and fauna, through disturbance and increased sedimentation. However, the residual impact is expected to be minor, as the impact to the water column, seabed sediments and benthic flora and fauna will be highly localised and temporary in nature. In addition, the area which would be impacted is expected to recover quickly due to the nature of the benthic community, local currents and sediment type in this region of the SNS.

The residual impact to the **water quality**, **seabed sediments** and **benthic flora and fauna** from the removal of the stabilisation material is considered to be **Minor**.

7.1.4 Deployment of Jack-Up Vessel Spud Cans

As discussed in Section 3.3.3, all of the wells will be plugged and abandoned in accordance with Oil & Gas UK (OGUK) Guidelines. The decommissioning of the Windermere platform wells will be undertaken using a jack-up vessel. The final vessel selection process is yet to take place, however, for the purposes of the EIA it has been assumed that a jack-up vessel such as the Seafox 7 would be used.

Prior to well decommissioning activities starting, the jack-up vessel legs need to be jacked down onto the seabed with the hull raised on the legs above the water, providing a stable platform. Excessive penetration by the legs into a soft seabed is prevented by large round feet called spud cans, at the bottom of the legs.

As the legs are pulled out they may leave scars and / or sediment mounds. Seabed disturbance caused by the penetration of these legs into the seabed will be influenced by:

- The nature of the seabed sediments; and
- The prevailing sediment transport system in the vicinity of the well locations.

The depth of penetration of the legs will be dependent on the shear strength and load bearing capacity of the seabed soils; a firm seabed will result in less depth of penetration than a soft seabed. Post-disturbance recovery of the seabed is dependent both on the strength of the seabed soils and the ability of the hydrological regime to rework disrupted sediments and return the seabed to its original contours. Physical disturbance as a result of leg penetration can cause mortality or displacement of benthic species in the impacted zone, direct loss of habitat and direct mortality of sessile seabed organisms that cannot move away from the contact area at seabed contact points. Several factors minimise these impacts:

- Biological communities are in a continual state of flux and are able to either adjust to disturbed conditions or rapidly recolonise areas that have been disturbed;
- The area has already been exposed to oil and gas exploitation of the seabed as well as being subjected to historical benthic trawling, therefore historic disturbance has already taken place;
- No sensitive species or Annex I habitats of conservation importance were identified around the Windermere Development (*Fugro, 2014a*);
- The mobile nature of the seabed sediments in the SNS area will aid the rapid recovery of the disturbed areas, although some seabed scars may persist in the medium term.

Spud-cans typically have a diameter of 18m and therefore four spud-cans will disturb an area of seabed of approximately 1,020 m^2 to a depth of 0.5m (giving a sediment volume of 510m^3), directly below the rig. Once the rig has moved off location, it is expected that the indentations of the spud cans will naturally fill in with sediment.

Given the above, the magnitude of the potential impact of deployment of the jack-up vessel spud cans on seabed sediments is considered to be moderate and therefore the impact is considered to be significant.

Mitigation Measures

- INEOS will actively seek to position the jack-up vessel in a single location during decommissioning. This will reduce the number of instances that jack-up spud cans will be deployed on the seabed.

7.1.4.1 Conclusions

The deployment of jack-up spud cans will pose an impact to the localised seabed sediments, through disturbance and smothering. However, the residual impact is expected to be minor, as the area has already been exposed to oil and gas exploitation of the seabed; there are no sensitive species or Annex I habitats of conservation importance identified around the Windermere Development and the mobile nature of the seabed sediments in the SNS area will aid the rapid recovery of the disturbed areas.

The residual impact of the jack-up vessel spud cans on the **seabed sediments** is considered to be **Minor**

7.1.5 Jack-up Vessel Stabilisation Material (Rock Placement)

The seabed currents in the SNS have been known to cause scouring (displacement of sediments) around structures placed on the seabed (*DECC, 2009*). This sediment movement can cause destabilisation of the sediments and the structures in place. Once the jack-up vessel is on location, there may be a requirement for the legs and spud cans to be stabilised by the placement of rock to maintain the integrity of the legs in place and prevent scouring. If rock dumping is required, it is estimated that a maximum of 1,000 tonnes of rock would be needed per leg / spud can (totalling 4,000 tonnes of rock).

Once the rock is deposited, it will become an integral component of the seabed. Over time, the bare rock will be colonised with benthic organisms that favour a hard substratum. The rock dumping operations will have a localised impact on the local sediment faunal communities, potentially smothering any flora and fauna directly beneath it. Once *in situ*, the area beneath the rock would therefore become unavailable for recolonisation by soft sediment inhabiting infauna, and over time a new rocky habitat would become established. Taxa likely to colonise such a hard substratum could include tunicates, sponges, sessile tube-dwelling polychaetes (*Sabella* spp. (fanworms)) and encrusting organisms such as bryozoans.

The use of rock for scour prevention measures is considered unlikely, particularly given that there have been no reported problems with spud can penetration, seabed scour or rig movement under preload when standard jack-up MODU rigs and the Seafox 7 jack-up work barge have previously been located at the Windermere platform. However, if it is required, the amount of rock placed on the seabed will be minimised as far as practicable and it will be placed as close to the spud cans as possible to reduce the area of seabed to be impacted.

Given the above, the magnitude of the potential impact of the use of jack-up stabilisation material on seabed sediments and benthic flora and fauna is considered to be moderate and therefore the impact is considered to be significant.

Mitigation Measures

- INEOS will actively seek to minimise the amount of rock required for jack-up vessel stabilisation.

7.1.5.1 Conclusions

In conclusion, although the placement of rocks on the seabed will impact benthic organisms, any effects will be highly localised in nature and therefore the impact on the marine environment is considered to be Minor.

The residual impact of rock dumping around the jack-up vessel spud cans on the **seabed sediments** and **benthic flora and fauna** is considered to be **Minor**

7.1.6 Deployment of HLV Anchors

It is proposed that the platform topsides and jacket will be removed by HLV (Section 3.3.3). As previously mentioned, it is preferable to use dynamically positioned vessels to avoid the impact of anchors on the seabed, however, the final vessel selection process is yet to take place and therefore the EIA will assess the use of both dynamic positioning and anchoring by the HLV. For the purposes of the EIA it has been assumed that the HLV could have up to 14 anchors (with dimensions 4 m by 4 m by 4 m) each with an anchor chain of approximately 500 m.

The HLV anchoring will cause seabed disturbance from the placement and subsequent removal of each anchor and the associated anchor chain. It is estimated that 90% of the anchor chain, as a worst case, will make contact with the seabed when lines are made slack, each chain will have a total lateral movement of 4 m and could become buried (through natural processes) by up to 0.5 metres. Also for the purposes of this assessment, it is assumed that each anchor is completely buried.

Table 7.4 provides a summary of the seabed area and sediment volume that may experience disturbance as a result of anchor placement and removal. Based on the assumptions set out above, it is estimated that a total seabed area of 25,424m^2 and a total sediment volume of 13,496m^3 may experience disturbance as a result of the anchoring of the HLV. Please note, the actual area and volume will be subject to confirmation once the final anchor system has been determined.

Table 7.4 Summary of the Footprint Disturbance from Anchoring Activities

Infrastructure	Number	Potential Seabed Area Disturbance (m^2)	Potential Volume of Sediment Disturbance (m^3)
Anchor[1]	14	224[3]	896[4]
Anchor Chain[2]	14	25,200[5]	12,600[6]
	Total	**25,424**	**13,496**

[1] Assumes that each anchor is 4 m x 4 m x 4 m and will be completely buried.
[2] Assumes each anchor chain is 500 metres long, 90% will be in contact with the seabed, total lateral movement will be 4 metres and could be buried to 0.5 metres.
[3] Calculation for potential seabed area disturbance by anchors: 4 m x 4 m = 16 m^2 x 14 = 224 m^2
[4] Calculation for potential sediment volume disturbance by anchors: 4 m x 4 m x 4 m = 64 m^3 x 14 = 896 m^3
[5] Calculation for potential seabed area disturbance by anchor chains: 450.00 m x 4.00 m = 1,800 m^2 x 14 = 25,200 m^2
[6] Calculation for potential sediment volume disturbance by anchor chains: 450.00 m x 4.00 m x 0.50 m = 900 m^3 x 14 = 12,600 m^3

Post-disturbance recovery of the seabed is dependent both on the strength of the seabed soils and the ability of the hydrological regime to rework disrupted sediments and return the seabed to its original contours. Physical disturbance as a result of the placement and subsequent removal of the HLV anchors and anchor chains may cause mortality or displacement of benthic species in the impacted zone, direct loss of habitat and direct mortality of sessile seabed organisms that cannot move away from the contact area at seabed contact points. Several factors minimise these impacts:

- Biological communities are in a continual state of flux and are able to either adjust to disturbed conditions or rapidly recolonise areas that have been disturbed;
- The area has already been exposed to oil and gas exploitation of the seabed as well as being subjected to historical benthic trawling, therefore historic disturbance has already taken place;
- No sensitive species or Annex I habitats of conservation importance were identified around the Windermere Development (*Fugro, 2014a*);
- The mobile nature of the seabed sediments in the SNS area will aid the rapid recovery of the disturbed areas, although some seabed scars may persist in the medium term.

The disturbance of seabed sediments may also lead to an increase in sedimentation, potential destabilisation of the surrounding sediments and a localised increase in turbidity. This can have an impact on water quality, plankton, fish and benthic suspension feeders. However, the impacts will be highly localised and the seabed area likely to experience disturbance is relatively small compared to similar seabed habitats present in the SNS.

Seabed sediments across the Windermere area are generally dominated by sand with a minimal proportion of gravel (*Fugro, 2014a*). Such sediments are less likely to remain re-suspended and carried over long distances, compared to fine muds and clays. It is more likely that they will resettle into the immediate vicinity following disturbance.

Of particular sensitivity to localised increases in turbidity are; shellfish beds and fish spawning grounds (*OSPAR, 2008*). Several fish spawning grounds have been identified in the vicinity of Windermere (refer to Section 4.3.3), but of the species identified, only herring spawning grounds are of particular conservation importance. Based on the results of the pre-decommissioning site survey, seabed sediments in the vicinity of the Windermere Development have none or low suitability for herring spawning (*Fugro, 2014a*). In addition, no commercial shellfish beds have been identified in the area of operations.

As described in Section 7.1.2, benthic species are vulnerable to the effects of sediment loading. However, given the strong water column and seabed current regime in the area, species which are tolerant to a natural variability to sedimentation are present in the SNS in general, and are also found in the Windermere area. This was corroborated during the pre-decommissioning site survey where the benthic community was found to be dominated by the polychaete worm *Spiophanes bombyx* and the bivalves *Corbula gibba* and *Mactra stultorum* (Section 4.3.2; *Fugro, 2014a*). All of these taxa are relatively tolerant to smothering and increases in suspended sediment (*MarLIN, 2015*). In addition, no notable habitats or species of conservation importance were identified during the Windermere pre-decommissioning site survey (*Fugro, 2014a*).

Given the above, the magnitude of the potential impact of the HLV anchors on the water column and benthic flora and fauna is considered to be moderate and therefore the impact is considered to be significant.

Mitigation Measures

- INEOS will actively seek to position the HLV in a single location during decommissioning. This will reduce the number of instances that anchors and anchor chains will be deployed on the seabed.

7.1.6.1 Conclusions

In conclusion, although the placement of anchors and anchor chains on the seabed will impact the water column and seabed sediments, by limiting the number of locations for the HLV any effects will be highly localised in nature and therefore the impact on the marine environment is considered to be minor.

The residual impact of HLV anchoring system activities on the **water column** and **seabed sediments** is considered to be **Minor**.

7.1.7 Remedial Actions to Address Umbilical/Pipeline Exposures

Based on the outcomes of the CA workshop, it was decided that the most practical long-term, technically feasible, and the option with least environmental disturbance, would be to remove the tie-in spools and the exposed sections of the umbilical and pipeline at the platform ends and leave the remainder *in situ* with ends buried (*ODE, 2014)*. The preferred method of burial for the umbilical/pipeline ends is trench and bury. The CA concluded that rock dumping of the two pipeline ends, would only be suitable as a contingency option in the event that the trench and bury approach fails (*INEOS, 2021b*). In addition to the planned work above, it is also possible that areas of the umbilical or pipeline may require additional remediation in the future. This can be achieved by one of three methods: using rock placement in order to prevent further scouring around free spans, reburial using jetting or removal of the exposure sections. All three methods will impact the seabed to varying degrees. However, it is considered highly unlikely that any free spans will develop in flooded pipelines.

At the time of writing this ES, the exact method of remediation for any (both currently and future) exposed parts of the umbilical/pipeline is not known. If rock placement is chosen as the remedial method, the amount of stabilisation / protection materials that may be required to be deployed over the pipeline is currently unknown, however the overall footprint on the seabed is expected to be very small. Specific amounts would therefore need to be detailed in a deposit of materials on the seabed consent (DEPCON) application and a Marine Licence.

Both trench and bury and rock placement operations would result in localised sediment re-suspension and have a localised impact on sediment faunal communities, potentially smothering any flora and fauna in the immediate vicinity of the operations. However, seabed sediments across the Windermere area are generally dominated by sand with a minimal proportion of gravel (*Fugro, 2014a*). Such sediments are less likely to remain re-suspended and carried over long distances, compared to fine muds and clays. It is more likely that they will resettle into the immediate vicinity following disturbance. Conversely, fine sediments would be more unstable and more likely to cause an increase in turbidity and sedimentation because of their relative ease of re-suspension.

Of particular sensitivity to localised increases in turbidity are; shellfish beds and fish spawning grounds (*OSPAR, 2008*). Several fish spawning grounds have been identified in the vicinity of the Windermere development (refer to Section 4.3.3), but of the species identified, only herring spawning grounds are of particular conservation importance. Based on the results of the pre-decommissioning site survey, seabed sediments have none or low suitability for herring spawning (*Fugro, 2014a*). No commercial shellfish beds have been identified in the proposed area of operations.

Benthic species are vulnerable to the effects of sediment loading. However, given the strong water column and seabed current regime in the area, species which are tolerant to a natural variability to sedimentation are present in the SNS in general, and are also found in the Windermere area. This was corroborated during the pre-decommissioning site survey where the benthic community was found to be dominated by the polychaete worm *Spiophanes bombyx* and the bivalves *Corbula gibba* and *Mactra stultorum* (Section 4.3.2; *Fugro, 2014a*). All of these taxa are relatively tolerant to smothering and increases in suspended sediment (*MarLIN, 2015*). In addition, no notable habitats or species of conservation importance were identified during the Windermere pre-decommissioning site survey (*Fugro, 2014a*).

With regards to rock dumping operations, in addition to the potential impacts described above, once *in situ*, the area beneath the rock would therefore become unavailable for recolonisation by soft sediment inhabiting infauna, and over time a new rocky substrate habitat would become established. Taxa likely to colonise such a hard substrate could include tunicates, sponges, sessile tube-dwelling polychaetes (*Sabella* spp. (fanworms)) and encrusting organisms such as bryozoans.

Given the above, the magnitude of the potential impact of activities to remedy umbilical/pipeline exposures on seabed sediments and benthic flora and fauna is considered to be moderate and therefore the impact is considered to be significant.

Mitigation Measures

- INEOS will actively seek to minimise the amount of material required for pipeline stabilisation.

7.1.7.1 Conclusions

In conclusion, although the trenching and burying and the placement of rocks on the seabed will impact both seabed sediments and benthic flora and fauna, any effects will be highly localised in nature and therefore the impact on the marine environment is considered to be minor.

The residual impact of pipeline exposure remediation activities on **seabed sediments** and **benthic flora and fauna** is considered to be **Minor**

7.2 Summary of Mitigation Measures

- Subsea infrastructure removal methods (including the removal of concrete mattresses) will be assessed prior to decommissioning operations beginning, with a view to implement the removal method with the least impact to the seabed;
- Post-decommissioning a debris survey will be undertaken to identify and remove any objects remaining on the seabed;
- Use of dynamically positioned vessels, if possible, to avoid the impact of anchors;
- INEOS will actively seek to position the jack-up vessel in a single location during decommissioning. This will reduce the number of instances that jack-up spud cans will be deployed on the seabed;
- INEOS will actively seek to minimise the amount of rock required for jack-up vessel and pipeline stabilisation.
- INEOS will actively seek to position the HLV in a single location during decommissioning. This will reduce the number of instances that anchors and anchor chains will be deployed on the seabed.

8 Noise and Vibration

8.1 Assessment of Potentially Significant Impacts

Sound is used by many marine organisms to perceive information about their surrounding environment and it can play a vital part in their survival (*Richardson et al., 1995; OSPAR, 2009*).

Anthropogenic sound sources in the marine environment, such as those generated by offshore oil and gas activities, are of particular concern, especially where exposure thresholds and pressure thresholds for marine organisms are exceeded and the frequencies generated overlap within their hearing range (*OSPAR, 2009*). The potential for effects on marine fauna is dependent upon the magnitude and frequency of the generated sound. Some of the extreme affects include physical injury and hearing impairment (when marine organisms are in close proximity to the sound source), masking, and various levels of behavioural disturbance (both direct and indirect) (*LGL, 2009*). For individual animals, such effects and their secondary consequences may vary in significance from negligible to fatal (the worst outcome being documented in a small number of cases (*MMC, 2007*)).

The activities associated with the Windermere DP generate noise both above and below the sea surface. Section 4.3 identities the marine organisms likely to be present in the vicinity of the Windermere Development area and therefore these identified organisms could be impacted by the noise generated from the planned operations.

8.1.1 Regulatory Regime

8.1.1.1 Offshore Marine Regulations

Under regulation 45 of the Conservation of Offshore Marine Habitats and Species Regulations 2017 it is an offence to:

a) Deliberately capture, injure or kill any wild animal of a European Protected Species (EPS);
b) Deliberately disturb wild animals of any such species
c) Damages or destroys, or does anything to cause the deterioration of, a breeding site or resting place of such an animal, is guilty of an offence.

Disturbance includes any disturbance which is likely -

i) To impair their ability
   - to survive, to breed or reproduce, or to rear or nurture their young; or
   - in the case the case of animals of a hibernating or migratory species, to hibernate or migrate; or

ii) Affect significantly the local distribution or abundance of the species to which they belong.

JNCC guidance The Protection of Marine European Protected Species from Injury and Disturbance (*JNCC et al, 2010*) defines precautionary noise exposure thresholds for injury and behavioural responses based on the work by Southall *et al.* (*2007*).

EPS include all cetaceans, turtles and sturgeon. In UK waters turtles and sturgeon are at the limits of their global distributions (which are centred elsewhere in the west Atlantic or Europe) and only occur in extremely low numbers around the UK. It is extremely unlikely that these animals would be present, or that their local abundance or distribution could be significantly affected by marine impacts (*JNCC, 2008c*).

8.1.1.2 European Marine Strategy Framework Directive

European Marine Strategy Framework Directive (MSFD; Directive 2008/56/EC) includes measures to assess underwater sound in their qualitative descriptors for determining good environmental status (GES).

As part of the proposed requirements of this Directive, Member States may have to report on the occurrence and distribution of activities within their jurisdictions that generate 'loud, low and mid' frequency impulsive sounds that exceed levels capable of causing significant impact to marine animals. However, current EC guidance does not provide any specific levels of sound that are deemed capable of causing a 'significant impact' to marine animals, so there remains considerable flexibility in how this can be interpreted by Member States.

In the absence of any clear guidance as to the peak sound and exposure levels that are considered capable of causing significant impact to marine life, it was recommended in a study by Genesis Oil and Gas Consultants (2011) to BEIS (DECC at the time) that oil and gas activities that produced sound in excess of the levels deemed capable of inducing a Temporary Threshold Shift (TTS) in hearing of cetaceans using the Southall *et al*. (*2007*) impact exposure criteria, were likely to qualify for reporting requirements (*Genesis, 2011*).

8.1.2 Sound Transmission

In general, sound can be characterised with reference to two features, the frequency at which it is emitted, measured in hertz (Hz), and the strength or intensity of the sound, measured in decibels (dB).

Not all sounds move through the ocean in the same way, high frequency sounds generally attenuate more quickly than low frequency sounds: a 100 Hz sound may be detectable after travelling hundreds or even thousands of kilometres, whereas a 100 kilohertz (kHz) sound may travel for only a few kilometres (*Swan et al., 1994; MMC, 2007*).

The magnitude of the sound manifests itself as pressure, i.e. force acting over a given area. It is expressed in terms of 'sound pressure levels' (expressed as decibels relative to 1 micro-Pascal (dB re. 1µPa)), which use a logarithmic scale of the ratio of the measured pressure to a reference pressure. The logarithmic nature of the scale means that a reduction of 6 decibels is equivalent to the halving of the physical sound pressure received (*OSPAR, 2009*).

The spherical spreading of sound waves from a source with limited energy results in a logarithmic decline in noise due to the sound wave being distributed over a larger area at greater distances (*OSPAR, 2009*).

However, attenuation losses, resulting from physical processes in the ocean (e.g. sound absorption or scattering by organisms in the water column, reflection or scattering at the seabed and sea surface, and the effects of temperature, pressure, stratification and salinity), can distort mathematical spreading laws. This is more prevalent in shallow water (<200 m deep), where sound can be reflected by the sea floor and/or water surface, therefore sound transmission is far more complex (*OSPAR, 2009*). Consequently, actual sound transmission has considerable temporal and spatial variability that is difficult to quantify. Various models have been identified which best fit the attenuation of sound with distance from its source for different conditions Swan *et al.* (*1994*) suggest that, depending on the propagation conditions, the attenuation is between 3-6 dB per doubling of distance from the source.

A simple sound propagation model has been used to estimate the sound attenuation at the Windermere Development. The model has been generated from the following sound attenuation equation from Richardson *et al*. (*1995*):

Transmission Loss = 20Log(R/R_0) dB

Note: Spherical spreading is assumed
R_0 = the reference range, usually 1 metre, and R = the distance from the reference range.

This provides a measure of sound given to a reference distance, usually 1 m. This method provides a conservative estimate of sound propagation with distance as it struggles to extrapolate sound attenuation in the near field (within tens of metres of the noise source due to interference between sound waves and reverberation which the model does not incorporate) and therefore generally overestimates transmission of sound from the source. This is sufficient to examine a 'worst case' scenario for noise impacts on marine fauna.

8.1.3 Windermere Decommissioning Noise and Vibration Sources

Generally noise generated during decommissioning activities is likely to be localised, of lower intensity and shorter duration than that generated during installation operations (*OGUK, 2012*).

The proposed Windermere decommissioning activities will generate noise below the sea surface, as the equipment on board the jack-up vessel, HLV and decommissioning support vessels is used. This noise will be generated from vessel operations, particularly from the use of dynamic positioning systems as well as from the cutting techniques and seabed excavation works that will be required to sever the jacket from its piles in the seabed.

Noise will also be generated as equipment is removed from the seabed and as stabilisation material (rock dumping) is placed on the seabed. The noise generated from these sources is likely to be negligible compared to the noise sources assessed in the following sections (*Nedwell & Edwards, 2004*).

8.1.3.1 Noise Generated by Vessels

The jack-up vessel and the HLV will provide the greatest noise sources from the vessels used during the Windermere DP. Jack-up vessels generally produce less noise than semi-submersible vessels (*LGL, 2009*), which have their hull in constant contact with the water. Therefore, the noise generated on board the vessel from machinery, hydraulic pumps, power generation etc. is transmitted directly into the water.

Typical subsea noise levels from offshore operations and expected natural attenuation are shown in Table 8.1. To evaluate the 'worst case' noise, for the purposes of this assessment, levels accredited to a jack-up rig will be assessed for the jack-up vessel and those accredited to a large merchant vessel will be assessed for the HLV.

Table 8.1 Typical Noise Levels Associated with Offshore Operations and Their Natural Attenuation (adapted from: *Evans & Nice, 1996*; *Richardson et al, 1995*)

Activity	Frequency range (kHz)	Average source level (dB re 1µPa @ 1m)	Estimated received level at different ranges by spherical spreading (dB re 1µPa-1m)			
			0.1 km	1 km	10 km	100 km
High resolution geophysical survey; pingers, side-scan	10 to 200	<230	190	169	144	69
Low resolution geophysical seismic survey; seismic air gun	0.008 - 0.2	248	210	144	118	102
			208	187	162	87
Vertical Seismic Profiling	0.005 - 0.1	190	150	129	104	29
Production drilling	0.25	163	123	102	77	2
Jack-up drilling rig	0.005 - 1.2	85 - 127	45 - 87	24 - 66	<41	0
Semi-submersible rig	0.016 - 0.2	167 - 171	127 - 131	106 - 110	81 - 85	6 - 10
Drill ship	0.01 - 10	175 - 191	139 - 151	118 - 130	93 - 105	18 - 30
Large merchant vessel	0.005 - 0.9	160 - 190	120 - 150	99 - 129	74 - 104	<29
Super tanker	0.02 - 0.1	187 - 232	147 - 192	126 - 171	101 - 146	26 - 71

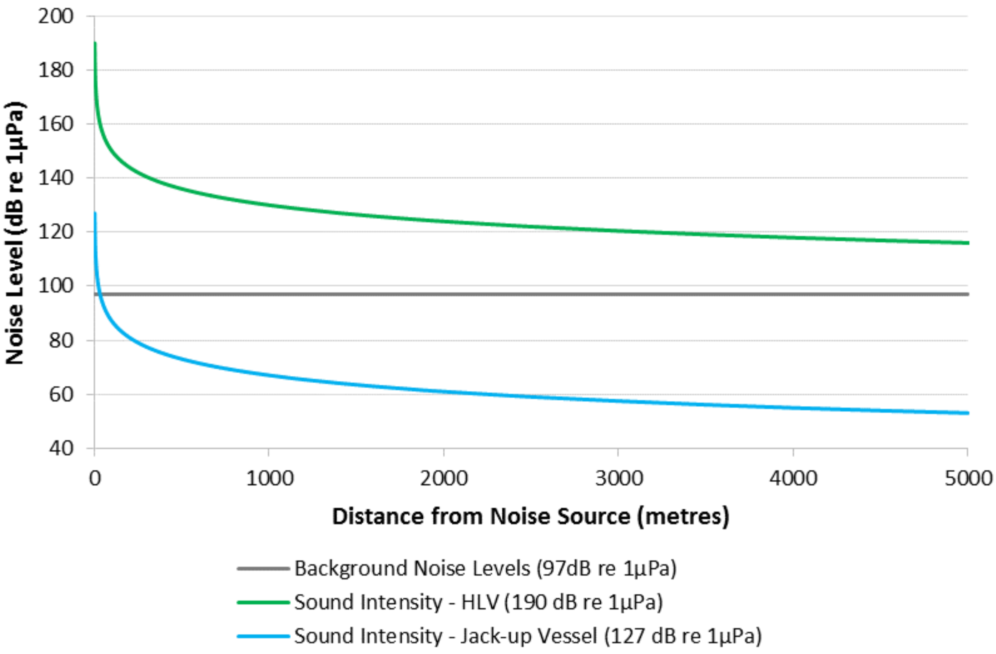
(dB) The magnitude of the sound manifests itself as a pressure wave, i.e. a force acting over a given area. It is expressed in terms of 'sound levels', which use a logarithmic scale of the ratio of the measured pressure to a reference pressure (Decibels (dB)). In this report all dB reported are re 1µPa @ 1 metre in water. Source: Richardson et al., 1995.

Average sound levels produced from a typical jack-up vessel are between 85-127 dB re. 1µPa @ 1 m (*Richardson et al., 1995*). As a 'worst case' assessment, a source noise level of 127 dB re. 1µPa was used to represent the noise energy generated from a jack-up vessel (*Richardson et al., 1995*) for sound attenuation during the Windermere decommissioning operations (Table 8.1). Ship noise is generated through; propeller cavitation (*Richardson et al., 1995*) as bubbles generated on the propeller collapse as the propeller spins (*Genesis, 2011*), vibration of machinery and engines and from other machinery. The jack-up vessel will be on location for an estimated maximum duration of 275 days.

The size of the vessel has an influence on the type of noise generated. Larger vessels require larger propulsion systems and have a greater area of the hull in contact with the surface water and therefore noise transmitted through the water column is greater compared to smaller vessels. Larger vessels also tend to emit lower frequency noises which travel further in the water column (*Genesis, 2011*). In addition, some of the vessels that will be used to support the decommissioning operations (including the HLV) will maintain their position by using thrusters when carrying out operations (known as dynamically positioned vessels), particularly when close to the platforms. Typically these vessels tend to generate more noise and of a higher frequency than a vessel's main engines (up to 170 dB). The HLV will be used to remove the Windermere jacket, topsides and other subsea structures. It is anticipated that the HLV will be on location for 18 days and may require the use of dynamic positioning thrusters throughout. Noise levels of 190 dB re 1µPa have therefore been used as an estimate of the expected noise levels from a HLV, based on the characteristics of a large merchant vessel in Table 8.1 (*Richardson et al., 1995*). This value also coincides with noise levels from vessels described by Genesis (2011) and is also greater than the levels produced by dynamically positioned vessels. It is important to note however, that these noise levels are taken for a HLV in transit, which is when the greatest noise levels are emitted. Noise levels throughout the majority of the operations are likely to be lower and more in line with those of dynamically positioned vessels. The modelling below therefore represents a 'worst case' scenario.

Modelling of the noise produced by the jack-up vessel and HLV was conducted using a simple spherical noise spreading model. The results demonstrated that at 100 m, noise levels from the jack-up vessel will be attenuated to approximately 87 dB re. 1μPa (assuming spherical spreading) and will reach background noise levels (97 dB re. 1μPa) within 30 m of the source (Figure 8.1). Noise levels from the HLV will be attenuated to approximately 150 dB re. 1μPa at 100 m but will not reach background levels within five kilometres. It is therefore evident that noise levels from the HLV have the capacity to travel long distances through the water column.

Figure 8.1 Sound Propagation in Water for a Jack-up Vessel and HLV (assuming spherical spreading)



8.1.3.2 Noise Generated by Helicopter Movements

Routine helicopter trips may be required for crew transfer on the jack-up vessel and on the HLV. However, noise from routine helicopter flights will have little impact underwater, with studies indicating that noise levels from helicopters are generally below those significant for marine mammals (*Richardson et al., 1995*).

8.1.3.3 Noise Generated by Cutting and Explosive Techniques

In order to sever the two well casings and the piles of the Windermere platform from its jacket, cutting techniques will be employed. Piles will be cut to 3 m below the seabed. The final methodology detailing the cutting techniques is yet to be defined, however there are two main severance techniques; using a cutting tool such as a grit cutter, or by the use of explosives. One or both of these methods may be employed during the Windermere decommissioning activities. Explosives are often included as a contingency in the event that other mechanical severance methods are unsuccessful as they provide a quick and reliable way to detach structures that are firmly anchored or are difficult to access (*Genesis, 2011*).

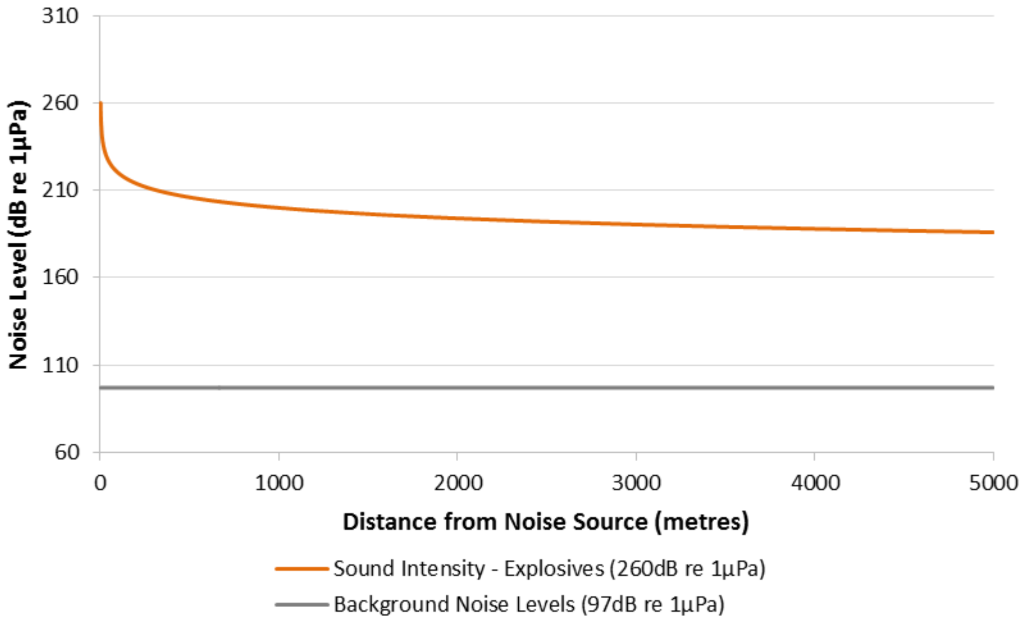
Cutting explosive charges include linear shaped charges which use high velocity energy to accelerate a v-shaped band of cutting material, usually a metal such as copper, in a high velocity jet that penetrates through the material (*Genesis, 2011*), in this case, the piles. Explosive sources produce broadband frequencies with very high peak source levels. In general, explosives are placed within or resting on the structure that is to be decommissioned and this is often below the seabed. This changes the pressure wave and therefore the way the sound is transmitted. The noise source levels from explosive detonations are some of the largest sounds generated by anthropogenic activities. Underwater explosions have the capacity to cause injury and, in extreme cases, death to marine fauna. This arises not only from the high peak pressure sound levels, but also from the initial shock wave that is emitted when charges are detonated (*Genesis, 2011*).

The decommissioning of wellheads in the North Sea has provided information on the acoustic signatures of explosives used. The highest recorded sound pressure level was 232 dB (0-peak) re 1µPa recorded at 300 m for a 45 kilogram charge detonation (*Nedwell, 2001* In *Genesis, 2011*). The low frequency energy emitted has the ability to travel considerable distances where it may continue to have an impact on marine fauna with detection ranges likely to be beyond 50 km (*Thomsen & Schack, 2013*).

Minimal information is available concerning the noise generated by cutting equipment. A study investigating the noise generated during the cutting of a conductor at 10m above the seabed by diamond wire cutting (Pangerc *et al.*, 2017) identified that the sound was not easily discernible above the background noise of the vessel and the remotely operated vehicle (ROV) and had no tonal aspects associated with its noise generation. An alternative comparison would be to a cutter suction dredger which uses a rotating cutter head to loosen material in the seabed and then uses a suction mouth to remove material from the seabed. These vessels are estimated to produce noise levels of approximately 140 dB re 1µPa at 200 m (*Genesis, 2011*). Therefore the noise emissions from explosives have been used as a 'worst case'.

Noise levels associated with the detonation of explosives have been estimated at 260 dB re. 1µPa at 1 m based on previous decommissioning activities undertaken by Perenco in 2014 at the Welland field. Based on the sound propagation method in Section 8.1.2, the noise levels will attenuate to 218 dB re. 1µPa within 100 m of the source and 204 dB re. 1µPa within 500 m from the source. Noise levels remain above 190 dB re. 1µPa within 2.3 km of the noise source (Figure 8.2). It is therefore evident that noise levels of this magnitude have the capacity to travel long distances through the water column.

Figure 8.2 Sound Propagation in Water for an Explosive Charge (assuming spherical spreading)



Note: if at a later date it is confirmed that explosives will be used during the Windermere DP, a separate Decommissioning Explosives Noise Assessment for a Marine License will be produced, which will describe the type, weight and location of the charges, the proposed timings of operations and a contain a full impact assessment for their use.

8.1.4 Potential Impacts on Fish

Fish have a lateral line (acoustico-lateralis) system which can detect sound, vibrations and other displacements of the water in the fishes' environment (*Moyle & Cech, 2004*). Fish are highly sensitive to the particle motion of the sound wave, at low frequencies (<100 Hz) this is the component that fish are most sensitive to (*Thomsen & Schack, 2013*). At higher frequencies the pressure wave colliding with the gas filled spaces, such as the swimbladder, causes an increase in the particle motion stimulating the inner ear. Therefore species with a connection between the swimbladder and the inner ear, such as clupeid fish (herring), are most sensitive to the pressure component of the noise.

Many fish use sound for communication and predator avoidance, and therefore also have the capacity to detect sounds themselves. Disruption to the noise generating and hearing organs may therefore impact species communication and survival.

Explosive activities have been linked to the death of fish during the decommissioning of oil and gas platforms, with injuries to fish documented to distances of 100 m from the blast site (*Thomsen & Schack, 2013*).

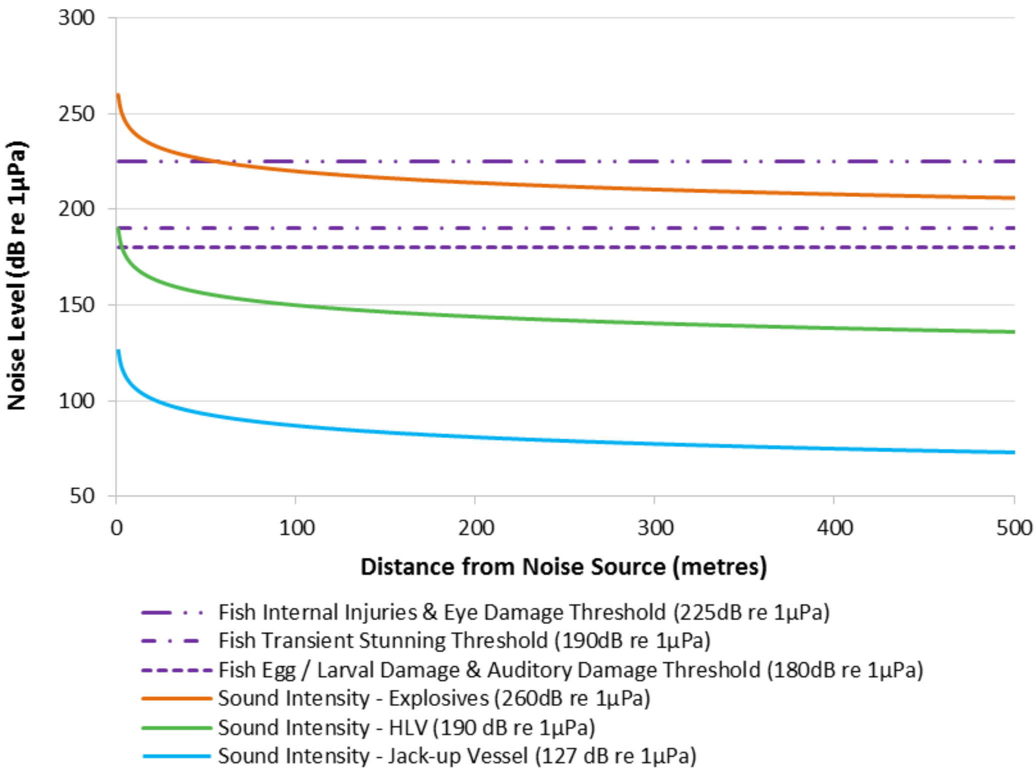
Turnpenny & Nedwell (1994) established a set of injury and behavioural thresholds for fish which are shown alongside the expected noise sources for the proposed Windermere decommissioning operations in Figure 8.3. This shows that noise levels from the explosives will exceed thresholds for internal injuries and eye damage to fish (225 dB re. 1μPa) within 47 m of the noise source. Thresholds for transient stunning (190 dB re. 1μPa) and egg/larval and auditory damage (180 dB re. 1μPa) will be exceeded out to a distance of 2.4 km and 7.5 km from the noise source respectively. Therefore the use of explosives has the potential to cause physical injury to fish and fish eggs/larvae out to a significant distance from the charge location.

Several species of fish have been identified as utilising the Windermere Development area as spawning and nursery grounds (refer to Section 4.3.3). Disturbance and injury to fish aggregations during spawning events can have an impact on the population dynamics and can lead to a loss of habitat due to the disturbance. However, the noise from explosives is a short term impact, which is usually over in a matter of seconds. Given the above, the magnitude of the potential impact from the use of explosives on fish is considered to be moderate and therefore is considered to be a significant impact.

The period of lowest spawning activity is between September and November (refer to Table 4.8). Therefore by undertaking operations which may require the use of explosives within this period, the potential impact on fish populations may be reduced.

If explosives are not used, the greatest noise source will be from the HLV. Noise levels from the HLV movements will exceed thresholds for fish egg/larval damage and auditory damage (180 dB re. 1µPa) within 3 m of the noise source. However the vessel will not be in transit during the majority of operations, therefore these noise levels represent a 'worst case scenario'. The noise may initiate a startle response from fish species, but evidence has shown that fish will habituate to this type of sound from vessels (*Westerberg, 1999*). Noise from the jack-up vessel is not expected to exceed any injury criteria for fish, even at the source (Figure 8.3). Therefore the magnitude of the potential impact from the movements of the HLV (including the use of dynamically positioned thrusters) on fish is considered to be minor and therefore is not considered to be a significant impact.

Figure 8.3 Sound Pressure Level Thresholds for the Onset of Fish Injuries from the Proposed Decommissioning Activities (after *Turnpenny & Nedwell, 1994*)



8.1.5 Potential Impacts on Marine Mammals

Marine mammals are especially sensitive to noise in the marine environment. Their extensive use of sound for communication, prey capture, predator avoidance and navigation, and the possession of large gas-filled organs, make them vulnerable to both disturbance and physiological damage from underwater noise of a sufficient magnitude. Identifying these effects, and the levels of sound which may induce them, has been the subject of considerable research; extensive reviews are provided by Richardson *et al*. (*1995*), Nowacek *et al*. (*2007*), Southall *et al*. (*2007*) and Weilgart (*2007*). Additionally, reviews of marine mammals in UK waters in contribution to previous SEA document have addressed the issue of noise (e.g. *Hammond et al*. *2006, 2008*).

Research conducted by Southall *et al*. in 2007 has produced a comprehensive review of the impacts of underwater noise on marine mammals and proposed criteria for preventing injury based on both peak sound levels and Sound Exposure Level (SEL).

The noise exposure thresholds proposed by Southall *et al.* (*2007*) are segregated according to the functional hearing capabilities of different marine mammal groups, and the different categories and features of the typical anthropogenic sounds in the ocean.

Based on current knowledge of functional hearing in marine mammals, *Southall et al*. (*2007*) defined five distinct, functional hearing categories:

1. low-frequency cetaceans (i.e., mysticetes – baleen whales);
2. mid-frequency cetaceans (i.e., most odontocetes – toothed whales);
3. high-frequency cetaceans (e,g., harbour porpoises);
4. pinnipeds in water; and
5. pinnipeds in air.

Table 8.2 categorises the cetaceans identified in Section 4.3.5, which may be present within the vicinity of the Windermere Development, into the functional hearing categories proposed by Southall *et al*. (*2007*).

Table 8.2 Functional Marine Mammal Hearing Categories of Marine Mammal Species Which May Be Present in the Vicinity of the Windermere Development (Reid et al., 2003) and their Associated Auditory Bandwidth and Group-Specific (M) Frequency-Weightings (*Southall et al., 2007*)

Functional Hearing Categories	Estimated Auditory Bandwidth[1]	Species Which May Be Present	Frequency-Weighting Network
Low-frequency cetaceans	7 Hz to 22 kHz	Minke whale	M_{lf}
Mid-frequency cetaceans	150 Hz to 160 kHz	White-beaked dolphin, White-sided dolphin	M_{mf}
High-frequency cetaceans	200 Hz to 180 kHz	Harbour porpoise	M_{hf}
Pinnipeds in water	75 Hz to 75 kHz	Grey seal, Common seal	M_{pw}
Pinnipeds in air	75 Hz to 30 kHz	Grey seal, Common seal	M_{pa}

[1] Estimated Lower to Upper Frequency Hearing Cut-Off
Note: Lf: low-frequency cetacean; mf: mid-frequency cetaceans; hf: high-frequency cetaceans; pw: pinnipeds in water; pa: pinnipeds in air

In terms of the different categories and metrics of anthropogenic sounds in the ocean, Southall *et al.,* (*2007*) identified three types of sound, single pulse, multiple pulse and non-pulse. Table 8.3 describes the acoustic characteristics of each of these sound types and also indicates the types of activities that may generate each of these sounds.

Based on the criteria set out by Southall *et al.* (2007) the noise generated by the jack-up vessel and the HLV during decommissioning activities are be classified as non-pulse noise. While, the use of explosives is categorised as single pulse or multiple pulse noise, depending on whether it is a single explosion or sequential explosions within a short period (Table 8.3).

Table 8.3 Sound Types, Acoustic Characteristics and Examples of Anthropogenic Sound Sources (*Southall et al., 2007*)

Sound Type	Acoustic characteristics (at source)	Examples
Single pulse	Single acoustic event; > 3-dB difference between received level using impulse vs equivalent continuous time constant	Single explosion; sonic boom; single airgun, watergun, pile strike, or sparker pulse; single ping of certain sonars, depth sounders, and pingers
Multiple pulses	Multiple discrete acoustic events within 24 h; > 3-dB difference between received level using impulse vs equivalent continuous time constant	Serial explosions; sequential airgun, watergun, pile strikes, or sparker pulses; certain active sonar (IMAPS); some depth sounder signals
Non-pulses	Single or multiple discrete acoustic events within 24 h; <3-dB difference between received level using impulse vs equivalent continuous time constant	Vessel/aircraft passes; offshore drilling; many construction or other industrial operations; certain sonar systems (LFA, tactical mid-frequency); acoustic harassment/deterrent devices; acoustic tomography sources (ATOC); some depth sounder signals.

8.1.6 Marine Mammals Injury Thresholds

Southall *et al.* (2007) define the minimum exposure criterion for injury as the level at which a single exposure is estimated to cause the onset of permanent hearing loss (Permanent Threshold Shift; PTS).

The injury Sound Pressure Level (SPL) threshold for all three cetacean frequency groups to the three sound types (Table 8.4) is 230 dB re. 1μPa (0-peak), however beaked whale species may require special injury criterion. While, the injury Sound Pressure Level threshold for pinnipeds in water is lower at 218 dB re. 1μPa (0-peak) (Table 8.4).

Table 8.4 Injury Criteria for Cetaceans and Pinnipeds exposed to "discrete" Noise Events (Either Single or Multiple Exposures within a 24 Hour Period) (*Southall et al., 2007*)

Marine Mammal Group	Sound Measure[1]	Sound Type		
		Single Pulse	Multiple Pulse	Non-pulse
Low-frequency cetaceans	Sound Pressure Level	230	230	230
	Sound Exposure Level	198	198	215
Mid-frequency cetaceans	Sound Pressure Level	230	230	230
	Sound Exposure Level	198	198	215
High-frequency cetaceans	Sound Pressure Level	230	230	230
	Sound Exposure Level	198	198	215
Pinnipeds (in water)	Sound Pressure Level	218	218	218
	Sound Exposure Level	186	186	203

[1] Sound Pressure Level in dB re. 1µPa (0-peak); Sound Exposure Level in dB re. 1µPa^2-s (species weighted)
Note: All criteria in the "Sound pressure level" lines are based on the peak pressure known or assumed to elicit TTS-onset, plus 6 dB. Criteria in the "Sound exposure level" lines are based on the SEL eliciting TTS-onset plus (1) 15 dB for any type of marine mammal exposed to single or multiple pulses, (2) 20 dB for cetaceans or pinnipeds in water exposed to non-pulses, or (3) 13.5 dB for pinnipeds in air exposed to non-pulses. See text for details and derivation.

8.1.7 Marine Mammals Behavioural Response Thresholds

Behavioural reactions to acoustic exposure are generally more variable, context-dependent, and less predictable than the effects of noise exposure on hearing or physiology. This is because behavioural responses to anthropogenic sound are dependent upon operational and environmental variables, and on the physiological, sensory, and psychological characteristics of exposed animals. It is important to note that the animal variables may differ (greatly in some cases) among species and even within individuals depending on various factors (e.g., sex, age, previous history of exposure, season). However, within certain similar conditions, there appears to be some relationship between the exposure Received Level and the magnitude of behavioural response. Southall *et al.* (2007) graded the severity of context-specific behavioural responses to noise exposure, as follows (Southall *et al.,* 2007 for full response descriptions):

- No observable response to a relatively minor and/or brief response, score 0-3;
- A higher potential to affect feeding, reproduction, or survival, score 4-6; and
- Considered likely to affect their life functions, with the potential to cause panic and avoidance behaviour, score 7-9.

Non-trivial disturbance, is interpreted for the purposes of this report as the sustained or chronic disruption of behaviour scoring 5 or more in the Southall *et al.* (2007) behavioural response severity scale. Table 8.5 details the sound levels which induce behavioural reactions in cetaceans that score 5 or more on the Southall *et al.* (2007) behavioural response scale.

Table 8.5 Proposed Behavioural Response Criteria for Cetaceans and Pinnipeds Exposed to Different Sound Types (*Southall et al., 2007*)

Marine Mammal Group	Sound Measure[1]	Sound Type		
		Single Pulses	Multiple Pulses[2]	Non-pulses[2]
Low-Frequency Cetaceans	Sound Pressure Level	224	110-180 (BRS = 5-7)	90-150 (BRS = 6-7)
	Sound Exposure Level	183	n/a	n/a
Mid-Frequency Cetaceans	Sound Pressure Level	224	120-180 (BRS = 6)	90-200 (BRS = 5-8)
	Sound Exposure Level	183	n/a	n/a
High-Frequency Cetaceans	Sound Pressure Level	224	80-170 (BRS = 6)	80-170 (BRS = 6)
	Sound Exposure Level	183	n/a	n/a
Pinnipeds (in Water)	Sound Pressure Level	212	160-200 (BRS = 6)	100-110 (BRS = 6)
	Sound Exposure Level	171	n/a	n/a

[1] peak Sound Pressure Level in dB re. 1µPa (0-peak); Sound Exposure Level in dB re. 1µPa^2-s (species weighted)
[2] BRS is the Behavioural Response Score, on the Southall *et al.* (2007) behavioural response severity scale, for the given Sound Pressure Level

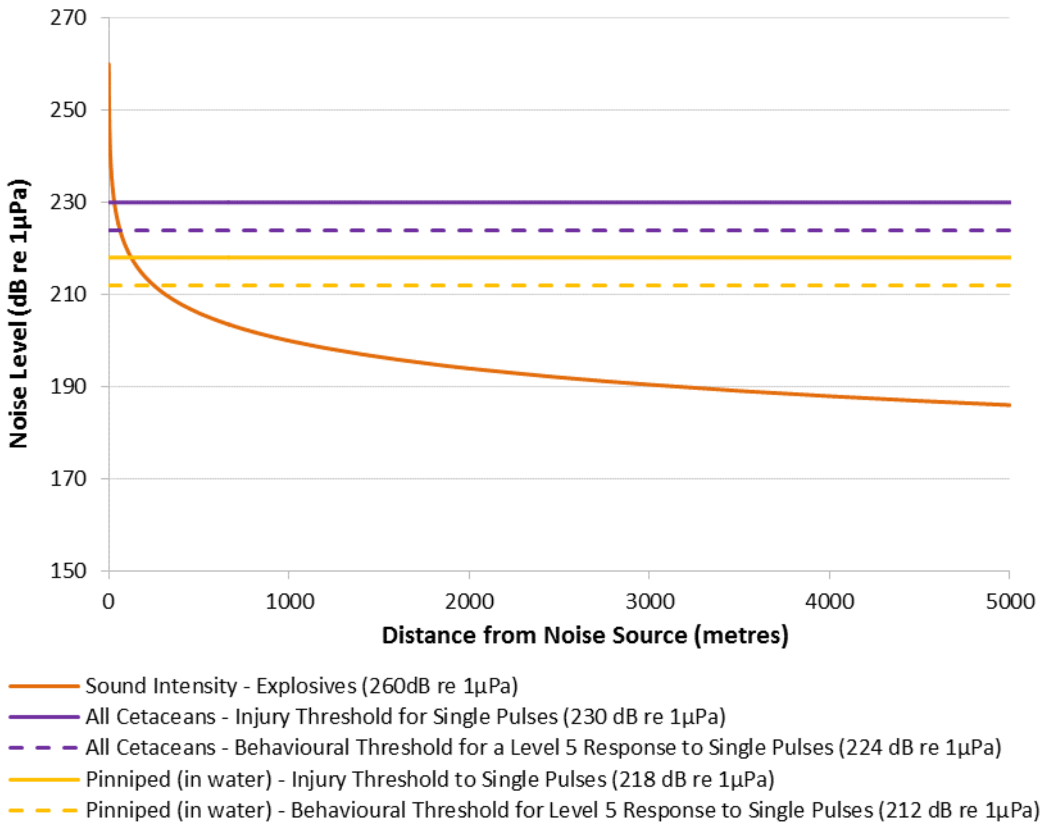
8.1.8 Marine Mammal Response to Source Level (i.e. 'Worst Case') and Received Level

If explosives are used to sever the subsea piles, these will provide the greatest noise energy from the proposed decommissioning operations, with noise levels up to 260 dB re. 1µPa at 1 m (refer to Section 8.1.4). This has therefore been considered as the 'worst case' scenario in terms of the sound that may be generated.

As the final DP is yet to be defined, explosives may not be required. In this case the greatest noise levels would arise from the movement of the HLV at around 190 dB re. 1µPa. Therefore the potential impact on marine mammals from the use of explosives, the movement of the HLV and use of the jack-up vessel, have all been assessed. As discussed in Section 8.1.4, if explosives are required for the Windermere decommissioning activities, a separate EIA will be undertaken to determine the impact of the use of explosive on the marine environment and submitted in support of a Marine Licence application.

Explosive noise will be the dominant pulsed noise source associated with the proposed decommissioning activities with noise levels of up to 260 dB at source. This will therefore exceed cetacean injury thresholds within 30 m of the noise source and injury thresholds to pinnipeds in water within 120 m of the noise source (Figure 8.4). Behavioural response to this noise may be elicited by cetaceans within 60 m of the noise source and by pinnipeds within approximately 240 m of the noise source (Figure 8.4).

Figure 8.4 Average Sound Pressure Level Thresholds for Injury and Behavioural Response Scores of 5 or more in Cetaceans Exposed to Single Pulse Noises (after *Southall et al., 2007*) and the Sound Propagation in Water (assuming spherical spreading).

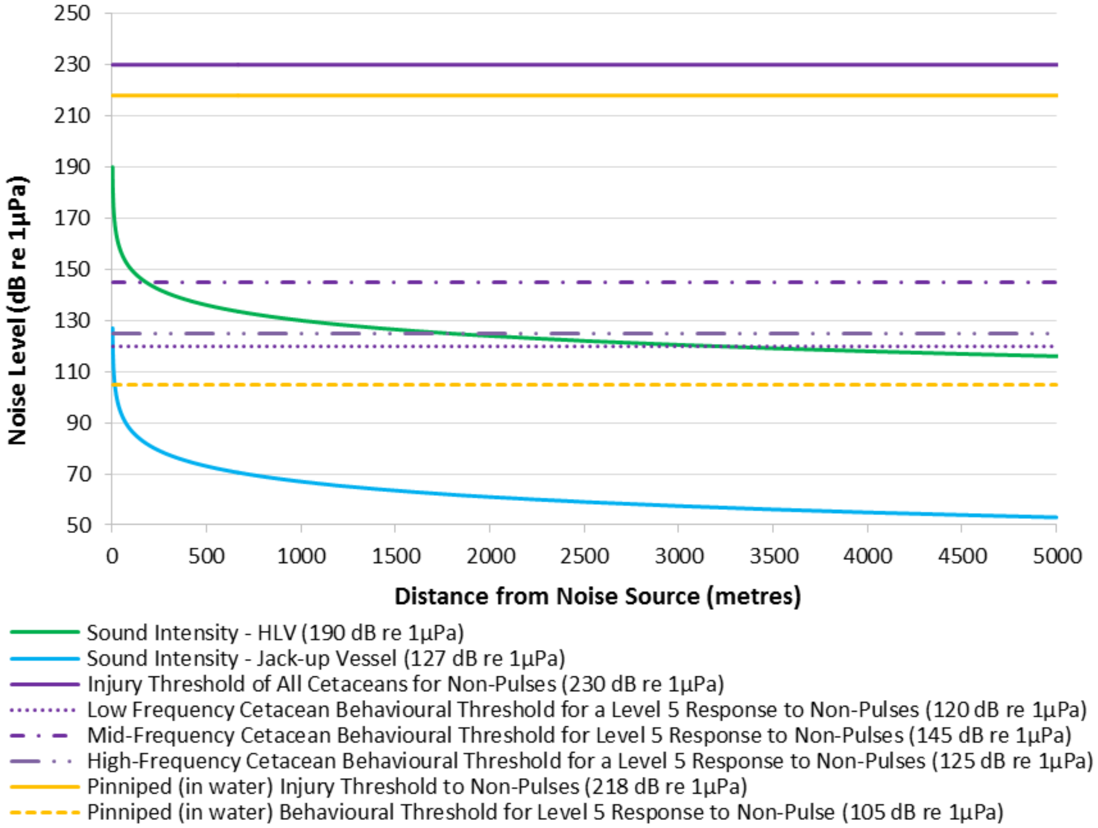


There will therefore be a danger to marine mammals within these radii from the noise source. In the event that explosives are not required, the dominant noise sources from decommissioning will be of a lower intensity and will be classified as non-pulsed.

It is anticipated that the HLV will be the dominant non-pulse sound source associated with the Windermere decommissioning operations and will generate approximately 190 dB at source (worst case noise). The jack-up vessel will also produce non-pulse sound of a lower magnitude (127 dB). In addition the noise generated by large vessels such as these, is generally of low frequency (*Nedwell & Edwards, 2004*).

As such, it is unlikely that the noise produced at source by the HLV / jack-up vessel will exceed the non-pulse injury sound pressure level threshold for cetaceans (230 dB re. 1µPa (0-peak)) or pinnipeds in water (218 dB re. 1µPa (0-peak)) (Figure 8.5).

Figure 8.5 Average Sound Pressure Level Thresholds for Injury and Behavioural Response Scores of 5 or more in Cetaceans Exposed to Non-Pulse Noise (after *Southall et al., 2007*) and the Sound Propagation in Water (assuming spherical spreading).



Note: Cetacean behavioural thresholds for a response scoring 6 on the Southall *et al.* (*2007*) severity scale are an average of the lowest Sound Pressure Level range for each sound type in Table 7.5. Therefore rough indications of the decibel level at which these thresholds occur and will vary between marine mammal groups.

It is, however, likely that noise generated from the HLV / jack-up vessel will exceed the behavioural Sound Pressure Level response thresholds for a grade 5 response for cetaceans and pinnipeds (Table 8.5). Although historic research has shown that dolphins and other odontocetes have been reported to show considerable tolerance of drilling rigs and support vessels (*Richardson et al., 1995*).

Examples of behaviour displayed by free-ranging subjects listed under a grade 5-6 response include (*Southall et al., 2007*):

- Minor or moderate individual and/or group avoidance of sound source;
- Brief or minor separation of females and dependent offspring;
- Aggressive behaviour related to noise 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;
- Brief cessation of reproductive behaviour.

In summary, Table 8.6 provides a list of which sound pressure thresholds are expected to be exceeded by the proposed Windermere decommissioning operations.

Table 8.6 Summary of Cetacean and Pinniped Sound Pressure Level Threshold Exceedance by the Noise Generated at Source by the Proposed Decommissioning Activities at Source

Marine Mammal Group	Threshold[1]	Noise Source		
		Explosives	HLV	Jack-Up Vessel
Low-Frequency Cetaceans	Behavioural (BRS 5+)	Exceeds	Exceeds	Exceeds
	Injury	Exceeds	Never exceeds	Never exceeds
Mid-Frequency Cetaceans	Behavioural (BRS 5+)	Exceeds	Exceeds	Never exceeds
	Injury	Exceeds	Never exceeds	Never exceeds
High-Frequency Cetaceans	Behavioural (BRS 5+)	Exceeds	Exceeds	Exceeds
	Injury	Exceeds	Never exceeds	Never exceeds
Pinnipeds (in Water)	Behavioural (BRS 5+)	Exceeds	Exceeds	Exceeds
	Injury	Exceeds	Never exceeds	Never exceeds

[1] 'BRS +5' = Behavioural Response Score of 5 or more, on the Southall et al. (2007) behavioural response severity scale. According to the JNCC a noise inducing a response score of 5 or more in marine mammals constitutes a 'non-trivial' disturbance.

Behavioural changes are expected to occur several kilometres from the source of explosives. However, for the other noise sources, the impacts will not be as significant. Behavioural effects may be observed in some species due to the movements of the HLV / jack-up vessel, however injury criteria are not exceeded. The noise associated with the HLV / jack-up vessel is considered to be a source of 'non-trivial' disturbance for cetaceans and pinnipeds because it is likely to induce a behavioural response scoring 5 or more, on the Southall *et al.* (*2007*) behavioural response severity scale (Table 8.6).

However, it is important to note that, source levels are measured at or calculated to 1m distance from the sound source and that due to the physics of how sound travels through water (spherical spreading assumed) and the resulting transmission losses, the area which will experience sound pressure levels above the threshold for a behavioural response scoring 5 or more in marine mammals will be relatively small and therefore very few individuals are likely to be adversely affected. This is particularly true for explosives which are often placed at or within the seabed where attenuation is likely to be greater than what is modelled.

Marine mammal abundance is generally lower within the Windermere Development area compared to other areas of the North Sea. The most abundant and frequently sighted cetacean in the North Sea is the harbour porpoise, which may spend time within the vicinity of the Windermere Development. However, Windermere is located 15km from the SNS SAC for Harbour Porpoise, therefore it is considered that there is unlikely to be any disturbance of individuals within this area, and certainly will not breach the thresholds for disturbance within the SAC as defined within JNCC guidance (JNCC, 2020b).

Currently, decommissioning activities are likely to occur between April and December (not concurrent). As discussed in Section 4.3.5.1 cetaceans likely to be present in the vicinity of the Windermere development are harbour porpoise, minke whale, white-beaked dolphin and white-sided dolphin. These species are likely to be present at various times throughout the year, but generally only in low densities.

Using the SCANS-III data Table 8.7 estimates the numbers of cetaceans which could potentially experience ‘non-trivial’ behavioural disturbance (scoring 5 or more, on the Southall *et al.* (*2007*) scale) and injury as a result of the decommissioning activities.

Table 8.7 Estimated Number of Cetaceans That Could Potentially Experience ‘Non-Trivial’ Behavioural Disturbance (Scoring 5 or more on the *Southall et al., 2007* Scale) and Injury as a Result of the Decommissioning Activities (assumes spherical spreading)

			Species		
			Harbour porpoise	Minke whale	White-beaked dolphin
Estimated Density (animals/km²)[1]			0.888	0.01	0.002
Marine Mammal Hearing Group			Hf	Lf	Mf
Potential for Non-Trivial' Behavioural Disturbance					
Noise Source	Explosives	Area with potential to disturb (km²)	0.011		
		Numbers of Animals That May Experience Behavioural Disturbance[2]	0.0098	0.00011	0.00002
	HLV	Area with potential to disturb (km²)	10.18	0.11	28.27
		Numbers of Animals That May Experience Behavioural Disturbance[2]	9.03	0.001	0.05
	Jack-up Vessel	Area with potential to disturb (km²)	0.000013	-	0.000028
		Numbers of Animals That May Experience Behavioural Disturbance[2]	1.15E-5	-	5.6E-8
Potential for Injury					
Noise Source	Explosives	Area with potential to injure (km²)	0.0028		
		Numbers of Animals That May Experience Injury[2]	0.002	0.000028	5.6E-6
	HLV	Area with potential to injure (km²)	Noise threshold not exceeded		
		Numbers of Animals That May Experience Injury[2]	-	-	-
	Jack-up Vessel	Area with potential to injure (km²)	Noise threshold not exceeded		
		Numbers of Animals That May Experience Injury[2]	-	-	-

Note: Lf: low-frequency cetacean; Mf: mid-frequency cetacean; Hf: high-frequency cetacean
[1] Source: SCANS III (*2017*) data – Survey area U – Central North Sea South.
[2] Calculation method based on Southall *et al.* (2007), as recommended by JNCC (*2010*): Area around the activity with potential to injure or disturb marine mammals multiplied by the individual species density for that area of the UKCS.

In summary, the use of explosives may have the capacity to cause injury to marine mammals and it is also likely that the use of explosives may elicit a behavioural response in marine mammals within a considerable distance from the noise source. Therefore marine mammals may experience some noise induced effects during the Windermere decommissioning activities. Given the above, the magnitude of the potential impact from noise generated by the Windermere decommissioning activities on marine mammals is considered to be moderate and therefore the impact is considered to be significant (refer to Aspects Table in Appendix B). If explosives are not used, the impacts on marine fauna are likely to be reduced and the radius of impact for all species will be lower.

As previously discussed, if explosives are required a separate EIA will be produced, once their use has been more sufficiently designed. This will help determine the time of year, the expected noise levels, the number of charges required and the locations to fully assess the impact of the use of explosives on marine organisms.

8.2 Summary of Mitigation Measures

- In order to minimise any potential impact on marine cetaceans from the proposed Windermere Decommissioning operations, INEOS will seek to conform to the JNCC protocol for minimising the risk of disturbance and injury to marine mammals from underwater noise throughout operations;
- Vessel movements and the use of dynamic positioning thrusters will be minimised where possible to reduce the potential impacts on fish and marine mammals;
- If explosives are required to be used, in addition to complying with the JNCC guidelines, INEOS will:
    - Use trained Marine Mammal Observers (MMOs) to identify if there are any vulnerable cetaceans in the vicinity of the explosive source. It is recommended that a 1 km radius mitigation zone be set up around the explosion source. If marine mammals are sighted within this area, operations should be ceased / halted until they have left the area at a safe distance;
    - Use of Passive Acoustic Monitoring (PAM), in conjunction with MMOs, to determine the presence of cetaceans in high sea states, poor visibility, during low light conditions and to identify those which may not surface regularly enough to be sighted;
    - Use the minimum amount of explosive required to achieve the task based on sound planning and engineering;
    - Implement a 'soft start' procedure whereby small amounts of explosives are used to scare fish and marine mammals from the vicinity.

8.3 Conclusions

Although there could be significant impacts from the noise generated during the Windermere decommissioning activities, it is expected that these impacts could be minimised by implementing the above mitigation measures.

In summary, it is likely that all marine mammals and fish present in the immediate vicinity of the Windermere decommissioning location (during operations) will be subject to some sound induced effects from the use of dynamic positioning thrusters and the potential use of cutting and explosives techniques, however it is unlikely that these effects will result in injury unless they are within very close proximity of the noise source.

The residual impact of noise generated from the decommissioning vessels on **marine mammals** is considered to be **Minor** The residual impact of the noise generated by the use of cutting and explosive techniques (should they be required) on **marine mammals** and **fish/shellfish** is considered to be **Minor**

9 Atmospheric Emissions and Energy Balance

9.1 Assessment of Potentially Significant Impacts

Atmospheric emissions during the decommissioning of the Windermere Development will be generated during the offshore operations and onshore waste processing.

These activities give rise to the emission of polluting gases including carbon dioxide (CO_2), oxides of nitrogen (NOx), sulphur dioxide (SO_2) and unburned hydrocarbons.

9.1.1 Regulatory Regime

Atmospheric emissions generated by decommissioning activities are regulated by the Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008 (as amended).

9.1.2 Exhaust Gas Emissions from Offshore Decommissioning Operations

The atmospheric emissions generated during offshore operations will mainly be from:

- Power generation for the jack-up vessel and associated support vessels (including helicopter trips);
- Power generation from the HLV and associated support vessels; and
- Power generation from the DSV and associated support vessels.

Table 9.1 shows the estimated atmospheric emissions generated by vessels during the Windermere decommissioning activities. Please note that all calculations have been based on the maximum period that the vessels will be on location. The duration of vessel use will continue to be optimised up to the time the decommissioning works takes place, therefore the figures below can be considered to be ‘worst case’ and the actual durations are likely to be lower.

Table 9.1 Predicted Atmospheric Emissions Generated During the Offshore Windermere Decommissioning Activities

Vessels	Rate of Fuel Use (tonnes / day)	Approx. Duration (Days)	Total Fuel Use (Tonnes)	Gas[1] (tonnes)						
				Carbon dioxide	Carbon monoxide	Oxides of nitrogen	Nitrous oxide	Sulphur dioxide	Methane	Volatile organic chemicals
Jack-up Vessel	10	275	2,750	8800.00	43.18	163.35	0.61	11.00	0.50	5.50
Guard Vessel[2] (jack-up)	4	275	1,100	3520.00	17.27	65.34	0.24	4.40	0.20	2.20
Supply Vessel[3] (jack-up)	5	275	1,375	4400.00	21.59	81.68	0.30	5.50	0.25	2.75
HLV[4]	30	18	540	1728.00	8.48	32.08	0.12	2.16	0.10	1.08
Anchor Handling Vessel[5]	5	18	90	288.00	1.41	5.35	0.02	0.36	0.02	0.18
Guard Vessel[2] (HLV)	4	18	72	230.40	1.13	4.28	0.02	0.29	0.01	0.14
Supply Vessel[3] (HLV)	5	18	90	288.00	1.41	5.35	0.02	0.36	0.02	0.18
Tug[6] (HLV)	25	18	450	1440.00	7.07	26.73	0.10	1.80	0.08	0.90
Barge[7] (HLV)	22	18	396	1267.20	6.22	23.52	0.09	1.58	0.07	0.79
DSV[8]	18	10	180	576.00	2.83	10.69	0.04	0.72	0.03	0.36
Guard Vessel[2] (DSV)	4	10	40	128.00	0.63	2.38	0.01	0.16	0.01	0.08
Supply Vessel[3] (DSV)	5	10	50	160.00	0.79	2.97	0.01	0.20	0.01	0.10
Survey Vessel[6]	18	7	126	403.20	1.98	7.48	0.03	0.50	0.02	0.25
Helicopter Trips[9]	-	275	108	345.13	0.56	1.35	0.02	0.43	0.01	0.09
		Total	**7,367**	**23,573.93**	**114.53**	**432.53**	**1.62**	**29.47**	**1.32**	**14.60**

Notes:

[1] Emission factors used from EEMS Atmospheric Emissions Calculations (*DECC, 2008*)

[2] Fuel use rate based on *IoP, 2000* (Safety vessel – working)

[3] Fuel use rate based on *IoP, 2000* (Supply vessel – working)

[4] Fuel use rate based on *IoP, 2000* (Semi-submersible crane vessel – working (100,000t))

[5] Fuel use rate based on *IoP, 2000* (Anchor Handling Vessel– working)[6] Fuel use rate based on *IoP, 2000* (Cargo barge tug – working)

[7] Fuel use rate based on *IoP, 2000* (Cargo barge – working)

[8] Fuel use rate based on *IoP, 2000* (DSV - working)

[9] Fuel use rate based on *IoP, 2000* (Helicopter Sikorsky); calculation based on 3 return flights/week, 400 km return flight, traveling at 240 km/hour.

It is anticipated that these types of emissions will disperse rapidly under most conditions to levels approaching background within a few tens of metres of their source.

9.1.2.1 Global Warming Potential of Atmospheric Emissions

Global Warming Potential (GWP) represents how much a given mass of a chemical contributes to global warming over a given time period compared to the same mass of carbon dioxide (CO_2). The GWP of CO_2 is defined as 1.0 (*USEPA, 2013*). For example, the 100 year GWP of methane (CH_4) is 21, which means that if the same mass of methane and CO_2 were introduced into the atmosphere, methane will trap 21 times more heat than the carbon dioxide over the next 100 years.

Using the GWP factors from the International Panel on Climate Change (IPCC) (*IPCC, 2007*) Table 9.2 calculates the equivalent mass of CO_2 required to achieve the same GWP as the total predicted emissions of nitrous oxide (N_2O) and CH_4 generated from the Windermere decommissioning activities. This shows that the predicted emissions of CO_2, N_2O and CH_4 from the Windermere decommissioning operational activities have a combined GWP equivalent to 24,097 tonnes of CO_2.

Table 9.2 The Global Warming Potential (GWP) for the Atmospheric Emissions Associated With the Windermere Decommissioning Operations (*IPCC, 2007*)

Gas	Total Predicted Emissions (tonnes)	GWP[1] (Relative to CO_2)	Equivalent Mass of CO_2 to Achieve the Same GWP (tonnes)
Offshore Operational Activities			
Carbon Dioxide	23,573.9	1	23,573.9
Nitrous Oxide	1.6	310	496
Methane	1.3	21	27.3
		Total	**24,097.2**

[1]Source: IPCC (2007). Please note global warming potentials are only available for CO_2, N_2O and CH_4

A quantitative comparison between the predicted CO_2 emissions during the Windermere decommissioning activities and the local, regional and UK total emissions of CO_2 has been made in Table 9.3. It can be seen from this that although there will be a short-term increase in CO_2 emissions in the vicinity of the proposed decommissioning activities, the amount of CO_2 produced is small relative to the predicted UKCS oil and gas emissions (ca. 0.17 percent) and the total UK emissions (<0.01 percent) over the proposed decommissioning activity period.

Table 9.3 The Estimated Carbon Dioxide Emissions from Windermere Decommissioning Operational Activities

Location	Estimated CO_2 Emissions Over 275 Days (tonnes)
Windermere Decommissioning Operational Activities[1]	23,573.9
UKCS Oil and Gas Atmospheric Emissions for 2018[2]	13,739,700
UK Total for 2018[3]	275,495,700

Emission factors used from EEMS Atmospheric Emissions Calculations (*DECC, 2008*)
[1] All vessels expected to consume fuel as detailed in Table 9.1, over a maximum of 275 days
[2] Based on 275 days of 2018 total UK Crude Petroleum and Natural Gas production (*BEIS, 2020*)
[3] Based on 275 days of total UK Emissions from 2018 data (*BEIS, 2020*)

Given the above, the magnitude of the potential impact from the offshore Windermere decommissioning activities on air quality and the emission of greenhouse gases, is considered to be moderate and therefore the impact is considered to be significant (refer to Aspects Table in Appendix B).

Mitigation Measures

Practical steps to limit atmospheric emissions that will be adopted during the decommissioning activities include:

- Advanced planning to ensure efficient operations;
- Emissions controlled to MARPOL Annex VI standards through the use of cleaner low emission fuels;
- Speed of vessels will be managed to minimise fuel consumption;
- Generators will be running on the minimum power for the job task to avoid unnecessary emissions;
- Well maintained and operated power generation equipment;
- Regular monitoring of fuel consumption; and
- Incorporation of decommissioning activities into INEOS 2030 Roadmap to reduce carbon emissions

9.1.2.2 Conclusions

Although there will be atmospheric emissions from the Windermere decommissioning activities the residual impact on air quality and the emission of greenhouse gases is expected to be minor.

The greenhouse gas emissions are expected to disperse within a few kilometres from source. Given the distance from shore to the decommissioning operations (approximately 140 km at the closest point) the impact of the atmospheric emissions generated by decommissioning vessels on air quality is expected to be minor.

However, given that the distance to the transboundary line, between the UK and Netherlands, is only approximately 2.5 km (at the closest point) there could be minor increases of the atmospheric greenhouse concentrations over the transboundary line. However, due to atmospheric dispersion, the concentrations are expected to be minute over a few kilometres from source and therefore the transboundary impact is expected to be minor.

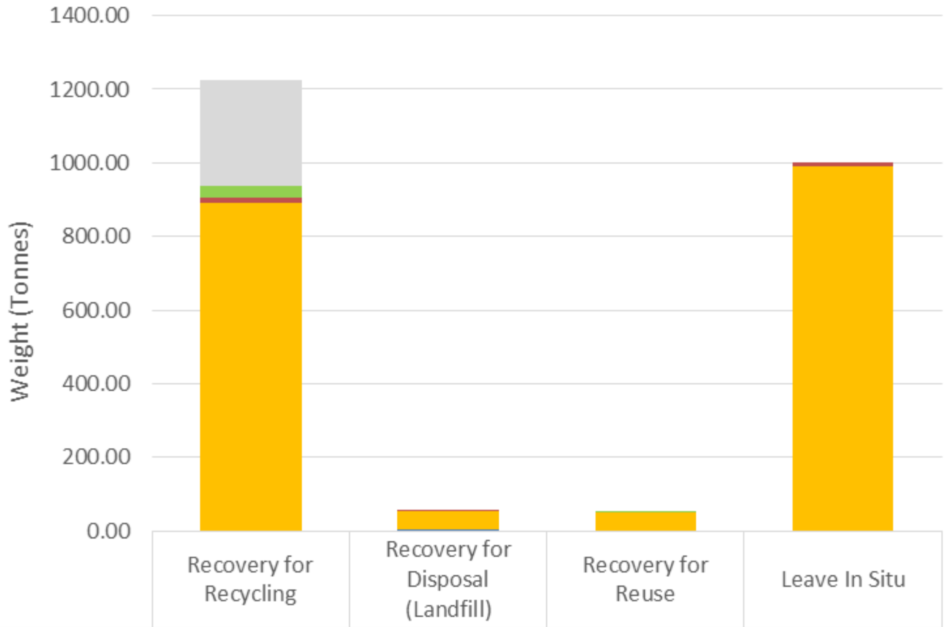
The residual impact of atmospheric emissions from the offshore Windermere decommissioning activities on **air quality and the emission of greenhouse gases** is considered to be **Minor**

9.1.3 Emissions and Energy Balance from the Onshore Processing of Materials

Power generation and energy will be required to recycle materials recovered from the Windermere Development as well as for the manufacture of materials to replace those left *in situ*.

Figure 9.1 presents the anticipated fates for the material inventory of the Windermere Development (based on Table 3.10 and Table 3.12). Please note, the amount of each material destined for each fate may be subject to change and therefore this should only be viewed as an indication. In addition, licensed waste processing contractors will be chosen for the recycling of decommissioning materials.

Figure 9.1 Proposed Fates for the Windermere Development Material Inventory (Broad Estimate)



	Recovery for Recycling	Recovery for Disposal (Landfill)	Recovery for Reuse	Leave In Situ
Concrete	287.60	0.00	0.00	0.00
Non-Ferrous Metals	31.56	0.00	1.66	0.00
Plastics / Rubber	13.85	1.63	0.81	7.89
Steel	890.22	49.46	49.46	991.55
Other	0.00	4.69	0.00	0.00

Using the Energy Institute's (formerly the Institute of Petroleum, here after referred to as the IoP) Guidelines for the Calculation of Estimates of Energy Use and Gaseous Emissions in the Decommissioning of Offshore Structures (*2000*) an estimation of the energy use required to process the steel, plastics/rubber and concrete in the Windermere Development material inventory as outlined in Figure 9.1 was calculated and is presented in Table 9.4 (hereafter referred to as Scenario 1).

Please note that for the purposes of this assessment the estimated energy use and atmospheric emissions for Scenario 1 have been calculated based on the following assumptions:

- materials left *in situ* or recovered for disposal (landfill) will be replaced (i.e. manufactured from new);
- materials recovered for reuse do not require processing and therefore, have no energy use requirement.

To put the energy use requirements of Scenario 1 into context, the energy that would be required to manufacture the same materials from new (i.e. on the assumption that none of the Windermere materials are recycled or reused) has also been estimated and presented in Table 9.4 (hereafter referred to as Scenario 2).

Table 9.4 Estimated Energy Use (GJ) Required for Scenario 1 and Scenario 2 for the Material Inventory of the Windermere Development (based on *IoP, 2000*)

Material	Process	Energy Use (GJ/ tonne)	Scenario 1 (Proposed Fates)		Scenario 2 (Manufacture all Materials from New)	
			Weight (tonnes)	Total Energy Use (GJ)	Weight (tonnes)	Total Energy Use (GJ)
Steel	Manufacture from new[1]	25	1,041.0	26,025.3	1,980.7	49,517.5
	Recover for Recycling	9	890.2	8,012.0	0	-
	Recover for Reuse	0	49.5	0.0	0	-
Plastic	Manufacture from new[1]	105	9.5	999.9	24.2	2,539.5
	Recover for Recycling	20	13.9	277.0	0	-
	Recover for Reuse	0	0.8	0.0	0	-
Concrete	Manufacture from new[1]	1	0	-	287.6	287.6
	Recover for Recycling[2]	1	287.6	287.6	0	-
	Recover for Reuse	0	0	-	0	-
	Total			**35,602**		**52,345**

[1] Includes tonnage for 'leave *in situ'* & 'recovery for disposal (landfill)' (see Figure 9.1)
[2] Concrete can be crushed and recycled into aggregates but new cement is still needed to turn this back into concrete. Cement production accounts for ca. 94% of the energy required to create concrete. Therefore, for the purposes of this assessment, it is assumed that the energy requirement and gas emissions to recycle concrete are the same as manufacturing from new (source: *BuildingGreen, 1993*).
[3] Based on a 'worst-case' impact assessment scenario of the removal of all 48 concrete mattresses and 300 grout bags.

The energy usage calculations in Table 9.4 indicate that Scenario 1 will require approximately 32% less energy than Scenario 2. Therefore by recovering materials from the Windermere Development for recycling and reuse there will, indirectly, be a lower impact on resource energy use as this will reduce the amount of material that will need to be manufactured from new to meet demand.

Table 9.5 shows the estimated gas emissions (CO_2, NO_x and SO_2) that would be generated from the proposed fates for the steel, plastics/rubber and concrete elements in the Windermere Development material inventory (Scenario 1). As above, this is presented alongside the estimated gas emissions that would be generated from the manufacture of the same materials from new (Scenario 2).

Table 9.5 Estimated Gaseous Emissions for Scenario 1 and Scenario 2 for the Fate of the Windermere Development Material Inventory

Material	Process	Gas	Gas Emissions Ratio (tonne of gas emitted / tonne of material)	Scenario 1 (Proposed Fates)		Scenario 2 (Manufacture all Materials from New)	
				Weight (tonnes)	Total Gaseous Emissions (tonnes)	Weight (tonnes)	Total Gaseous Emissions (tonnes)
Steel[1]	Manufacture from new[3]	CO_2	1.889	1,041.01	1,966.47	1,980.70	3,741.54
		NO_x	0.0035		3.64		6.93
		SO_2	0.0055		5.73		10.89
	Recover for Recycling	CO_2	0.96	890.22	854.61	0	-
		NO_x	0.0016		1.42		-
		SO_2	0.0038		3.38		-
	Recover for Reuse	n/a	n/a	49.46	-	0	-
Plastic[2]	Manufacture from new[3]	CO_2	3.179	9.52	30.26	24.19	76.90
		NO_x	-		-		-
		SO_2	-		-		-
	Recover for Recycling	CO_2	0.693	13.85	9.60	0	-
		NO_x	-		-		-
		SO_2	-		-		-
	Recover for Reuse	n/a	n/a	0.81	-	0	-
Concrete[1]	Manufacture from new[3]	CO_2	0.88	0	-	287.6	253.09
		NO_x	0.0054		-		1.55
		SO_2	0.0001		-		0.03
	Recover for Recycling[4]	CO_2	0.88	287.6[5]	253.09	0	-
		NO_x	0.0054		1.55		-
		SO_2	0.0001		0.03		-
	Recover for Reuse	n/a	n/a	0	-	0	-
				Total CO_2	**3,114.03**		**4,071.53**
				Total NO_x	**6.62**		**8.49**
				Total SO_2	**9.14**		**10.92**

[1] Source: IoP (*2000*).
[2] Source: Harvey (*2010*) & DEFRA/DECC (*2011*).
[3] Includes tonnage for 'leave *in situ*' & 'recovery for disposal (landfill)' (see Figure 9.1).
[4] Concrete can be crushed and recycled into aggregates but new cement is still needed to turn this back into concrete. Cement production accounts for ca. 94% of the energy required to create concrete. Therefore, for the purposes of this assessment, it is assumed that the energy requirement and gas emissions to recycle concrete is the same as manufacturing from new (source: *BuildingGreen, 1993*).
[5] Based on a 'worst-case' impact assessment scenario of removal of 46 concrete mattresses.
No data is represented by a dash (-).

The atmospheric calculations in Table 9.5 show that Scenario 1 will result in less gas emissions (CO_2, NO_x and SO_2) being emitted to the atmosphere than Scenario 2. Therefore by recovering materials from the Windermere Development for recycling and reuse, less new materials will need to be created to meet demand and there will be a lower impact on air quality and greenhouse gas emissions.

Given the above, the magnitude of the potential impact from the atmospheric emissions generated by the onshore processing of the Windermere Development material inventory on air quality and global warming is considered to be positive.

9.1.3.1 Conclusions

There will be a temporary increase in onshore atmospheric emissions at the waste treatment facility, where the Windermere decommissioning materials will be processed. However, these emissions would be within the 'normal' operational atmospheric emissions generated at the waste treatment facility, through normal working / treatment processes. Therefore, although INEOS recognise that the onshore processing of decommissioning materials will result in increased atmospheric emissions, the impact from these is expected to be positive as the recycling of the common materials requires less energy and produces less atmospheric emissions, when compared to producing the same weight of the new material.

The residual impact of atmospheric emissions from the processing of the Windermere Development material inventory on **air quality and the emission of greenhouse gases** is considered to be **Positive**

10 Marine Discharges

10.1 Assessment of Potentially Significant Impacts

During the Windermere DP, marine discharges will be generated by / include:

- Well abandonment and cementing activities;
- Pipeline chemical and residual hydrocarbons;
- Drainage Water, Food Waste, Sewage and Grey Water.

10.1.1 Regulatory Regime

The discharge of cementing and other offshore chemicals is covered by the Offshore Chemicals Regulations 2002 (as amended). The planned discharge of any hydrocarbons is covered under the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended).

10.1.2 Well Abandonment and Cementing Activities

Well abandonment activities were completed in 2019.

10.1.3 Pipeline Chemicals and Residual Hydrocarbons

As discussed in Section 3.2.3, the pipeline and umbilical have been flushed and now reside in a flooded condition. Residual hydrocarbons that may be retained in the umbilical and pipeline, post-flushing, will be at 30 milligrams per litre or less.

Estimates of the maximum residual hydrocarbons in the lines are shown in Table 10.1.

Table 10.1 Estimated Residual Pipeline Hydrocarbons that will be Discharged

Pipeline	Fluid Type	Estimated Volume (m^3)	Concentration of Oil in Water (ppm)
PL1273	Hydrocarbons	8.82	30 (max)
PL1273.1 to PL1273.3	Chemicals	0.55	30 (max)

On cutting the pipeline there will be a release of hydrocarbons to the environment. It is anticipated that any discharged hydrocarbons will be dispersed rapidly with the turbidity of the water and broken down through biodegradation processes. High dispersion of produced waters means that significant toxicity in the receiving waters has rarely been demonstrated (*Stagg et al., 1996*). Seabirds may be impacted by oily water on the sea surface; however this volume of condensate would be released subsurface and if residual amounts reach the surface they are not expected to persist for any significant time.

Given the above, the magnitude of the potential impact from the release of residual hydrocarbons on water quality and seabed sediments is considered to be moderate and therefore the impact is considered to be significant.

10.1.3.1 Conclusions

In conclusion, the cutting of the Windermere pipeline and umbilical will result in the discharge of residual hydrocarbons to the marine environment. However, the volumes involved are relatively small as the pipeline has already been flushed and cleaned to less than 30mg/l. Therefore the residual impact from these activities on water quality and seabed sediments is expected to be minor.

The residual impact from discharges of residual hydrocarbons, generated by umbilical / pipeline cutting, on **water quality** and **seabed sediment** contamination is considered to be **Minor**

10.1.4 Drainage Water, Food Waste, Sewage and Grey Water

Water generated from deck washdown and rainfall from the open deck areas may contain trace amounts of mud, lubricants and residual chemicals from small onboard leaks derived from activities such as re-fuelling of power packs or the laying down of dirty hoses or dope brushes etc. It should be stressed, however, that these would be relatively low volume discharges containing small residual quantities of contaminant.

INEOS will ensure that the vessels are equipped with suitable containment, treatment and monitoring systems as part of the contract specification. In addition, the INEOS Representative will also ensure good housekeeping standards are maintained onboard the vessels to minimise the amount of hydrocarbons and other contaminants entering the drainage systems.

Liquid storage areas and areas that might otherwise be contaminated with oil are generally segregated from other deck areas to ensure that any contaminated drainage water can be treated or accidental spills contained. All the drains from the vessel floor will be directed to a containment tank and the fluids processed/filtered to remove hydrocarbons (<15 parts per million hydrocarbons in water) as required under the MARPOL Convention and discharged to sea. Residual hydrocarbons will be routed to transit tanks for processing onshore. Food waste is normally macerated to increase rates of dispersion and biodegradation.

The discharge of food waste, grey water and sewage to sea will cause transient organic enrichment of the water column and an increase in biological oxygen demand (BOD). This could lead to:

- A minor increase in plankton and fish populations;
- Short term degradation of water quality;
- Potential for localised significant toxic effects;
- Mortality of individuals;
- May affect viability of plankton stocks, recruitment for fish stocks and base of food chain.

Release of drainage water or deck water from the rig may have minor localised toxicity impacts on the local fauna in the water column.

Black (sewage) and grey water (usually domestic chemicals from washing and laundry facilities on the jack-up vessel, HLV, DSV and stand-by / supply vessels) is also collected, treated to meet the requirements of the MARPOL Convention and discharged to sea.

In addition to this, each vessel will have a Garbage Management Plan in place and good housekeeping standards will be ensured. Where possible, the household products selected for use will have a low environmental impact.

Given the above, the magnitude of the potential impact from the discharge of drainage water, food waste, sewage and grey water during the Windermere decommissioning operations on water quality is considered to be moderate and therefore the impact is considered to be significant.

Mitigation Measures

- INEOS will ensure that the vessels are equipped with suitable containment, treatment and monitoring systems as part of the contract specification;
- INEOS Representative will ensure good housekeeping standards are maintained onboard the vessels;
- Each vessel will have a Garbage Management Plan in place;
- All the drains from the vessels' floor will be directed to a containment tank and the fluids processed/filtered to remove hydrocarbons;

- As part of the SHE Plan, INEOS will ensure that the contractor knows how to react to spills, that the necessary spill kits are onboard the vessel in suitable locations and personnel are trained in their use.

10.1.4.1 Conclusions

In conclusion, the residual impact from discharges of drainage, food waste, sewage and grey water during the Windermere decommissioning operations on water quality is expected to be minor.

The residual impact from discharges of food waste and sewage to sea from vessels, during the Windermere decommissioning operations, on **water quality** is considered to be **Minor** The residual impact from discharges of grey water (domestic chemicals from washing and laundry facilities on vessels), during the Windermere decommissioning operations, on **water quality** is considered to be **Minor** The residual impact from discharges of drainage water, during the Windermere decommissioning operations, on **water quality** is considered to be **Minor**

10.2 Summary of Mitigation Measures

- Any chemicals identified to be high risk will be substituted for more environmentally friendly alternatives where practicable;
- INEOS will ensure that the vessels are equipped with suitable containment, treatment and monitoring systems as part of the contract specification;
- INEOS Representative will ensure good housekeeping standards are maintained onboard the vessels;
- Each vessel (including the jack-up vessel) will have a Garbage Management Plan in place;
- All the drains from the vessels' floor will be directed to a containment tank and the fluids processed/filtered to remove hydrocarbons;
- As part of the SHE Plan, INEOS will ensure that the contractor knows how to react to spills, that the necessary spill kits are onboard the rig in suitable locations and personnel are trained in their use.

11 Unplanned Hydrocarbon Release

11.1 Assessment of Potentially Significant Impacts

It is INEOS's policy that operations will be conducted in such a manner as to minimise the risk of oil spillage and pollution. Onshore efforts in operations planning are subjected to review to identify potential risks and to ensure that they are properly controlled. These include:

- Programme review meetings (involving all contractors);
- Pre-job meetings to review the final programme in detail; and
- Hazard and risk identification to test the programme for likelihood and severity of all identified risks.

INEOS will ensure that appropriate oil spill response training is undertaken by key personnel within INEOS and relevant contractors. INEOS fully recognises that spills can and do occur and takes precautions, as outlined in the section below, to reduce the possibility of a spill occurring.

It is noted that spills of diesel are the most frequent type of spill on the UKCS, comprising 14.5 percent of UKCS spills by number and 3.5 percent of the total amount of oil spilt. Gas condensate spills are the least frequent, comprising 1.9 percent of the number of spills on the UKCS and 0.3 percent of the total amount of oil spilt (OGUK, 2011).

During the Windermere DP, the most frequently expected type of spill would be a small (< 1 cubic metre (m^3)) spill of diesel or chemical from the decommissioning vessels during bulk transfer to/from the vessels, leakage, or during use or storage. However, the release of such small volumes (up to 1m^3) would create a sheen around the platform/decommissioning vessels but would quickly disperse under normal conditions. Modelling such a small quantities would not lead to any difference in response procedures or tactics, therefore modelling for these scenarios was not undertaken.

The pipelines between Windermere and ST-1 have been flooded with seawater and therefore no longer contain hydrocarbons or any associated chemicals. The Windermere platform topside equipment has been cleaned and mothballed and no hydrocarbons are present. The wells have been plugged and abandoned and therefore there is no longer a possibility of a well blowout. Therefore, the main spill risks during the decommissioning activities will be from:

- The instantaneous loss of the entire inventory of the HLV (e.g. Saipem S7000) – 2,000m^3, caused, for example by a vessel collision;
- The instantaneous loss of the entire inventory of the jack-up vessel (e.g. Seafox 5) – 1,320m^3, caused, for example by a vessel collision;
- The instantaneous loss of the entire inventory of the DSV (e.g. Seven Discovery) – 1,495m^3, caused, for example by a vessel collision;

Based on the size of the vessel inventories (fuel capacity), the worst case spill scenario in these DP activities would be the entire loss of fuel inventory from the HLV, estimated to be 2,000m^3 of diesel.

At the time of writing this ES, INEOS had yet to finalise competitive tenders for the decommissioning work and therefore the final selection of decommissioning vessels may vary depending on the contractor selected. While a 2,000 m^3 spill is considered the worst case scenario at this time, if the contracted vessels have a fuel inventory significantly larger than 2,000 m^3 INEOS commit to re-run the oil spill modelling.

11.1.1 Regulatory Regime

Prior to decommissioning activities commencing on the Windermere Development, an update to the existing Windermere Hydrocarbon Safe Mode Oil Pollution Emergency Plan (OPEP) (RD-WIN-SPL005) will be in undertaken. This will be approved under the Merchant Shipping (Oil Pollution Preparedness, Response and Cooperation Convention) Regulations 1998 and The Offshore Installation (Emergency Pollution and Control) Regulations 2002.

11.1.2 Release of 'Worst Case' Diesel Scenario

Based on the potential worst case spill scenario associated with the Windermere DP stochastic and trajectory oil spill modelling has been run using the OILMAP model (version 6.10.3.3, developed by ASA) in order to illustrate the fate and movement of hydrocarbons in the marine environment during all four seasons; winter (December to February), spring (March to May), summer (June – August) and autumn (September to November).

11.1.2.1 Model Input Parameters

The parameters entered into the OILMAP model are detailed in Table 11.1.

Table 11.1 Oil Spill Modelling Parameters

<table>
<tr><th colspan="9">Inventory Loss Parameters</th></tr>
<tr><td colspan="2">Loss from Well / FPSO / Rig (please specify)</td><td colspan="2">Heavy Lift Vessel (HLV)</td><td colspan="2">Instantaneous Loss?</td><td colspan="3">Yes</td></tr>
<tr><td colspan="2">Worst-case volume</td><td colspan="2">2,000 m^3</td><td colspan="2" rowspan="2">Will the well self kill?
If yes, when</td><td colspan="3" rowspan="2">N/A</td></tr>
<tr><td colspan="2">Flow rate</td><td colspan="2">2,000 m^3 instantaneously</td></tr>
<tr><td colspan="2">Justification for predicted worst-case volume</td><td colspan="7">This is the maximum diesel inventory on the HLV used during the decommissioning operations</td></tr>
<tr><th colspan="9">Location</th></tr>
<tr><td colspan="2">Spill Source point Latitude (N/S)</td><td colspan="2">53° 49' 56.41" N</td><td colspan="2">Spill source point Longitude (E/W)</td><td colspan="3">02° 46' 21.61" E</td></tr>
<tr><td colspan="2">Installation / Facility Name</td><td colspan="2">Windermere Platform</td><td colspan="2">Quad / Block</td><td colspan="3">49 / 9</td></tr>
<tr><th colspan="9">Hydrocarbon Properties</th></tr>
<tr><td colspan="2">Hydrocarbon name</td><td colspan="7">Marine diesel</td></tr>
<tr><td colspan="2">Assay available</td><td colspan="2">No</td><td colspan="2">Was an analogue used for spill modelling?</td><td colspan="3">Yes</td></tr>
<tr><td></td><td>Name</td><td>ITOPF Category</td><td>Specific Gravity</td><td>API</td><td>Viscosity (temp)</td><td>Pour Point (°C)</td><td>Wax Content (%)</td><td>Asphaltene Content (%)</td></tr>
<tr><td>Analogue</td><td>Diesel 2002</td><td>Group 2</td><td>0.83</td><td>38.8°</td><td>2.76 cP @ 25°C</td><td>-55</td><td>1.7</td><td>0</td></tr>
<tr><th colspan="9">Metocean Parameters</th></tr>
<tr><td colspan="2">Air Temperature</td><td colspan="2">15°C (all seasons)</td><td colspan="2">Sea Surface Temperature</td><td colspan="3">Winter (Dec – Feb): 6°C
Spring (Mar – May): 9°C
Summer (Jun – Aug): 15°C</td></tr>
</table>

			Autumn (Sep –Nov): 11°C
Wind	**Data period**	2008 – 2013	
	Data reference	NOGAPS (US Navy Operational Global Atmospheric Prediction System)	
Current	**Data period**	2008 – 2013	
	Data reference	HYCOM (HYbrid Coordinate Ocean Model) general ocean circulation model, and TPXO8 tidal harmonics	
Modelled Release Parameters			
Surface or Subsurface	Surface	**Depth**	0 metres
Release duration	0 Days	**Instantaneous?**	Yes
Persistence duration	10 Days	**Release rate**	n/a
Total simulation time	10 Days	**Total release**	2,000 m^3
Oil Spill Modelling Software			
Name	OILMAP	**Version**	6.10.3.3

11.1.2.2 Model Output

Table 11.2 summarises the output for the spill scenario modelled. While Figure 11.1 presents the minimal arrival time of surface oil, exceeding a thickness of 0.04 µm, during each season and Figure 11.2 presents the probability (as a percentage) of surface oil exceeding a thickness of 0.04 µm during each season.

Table 11.2 Oil Spill Modelling Summary by Season

Oil Spill Modelling Summary								
Spill Scenario / Descriptor	Total loss of the marine diesel fuel inventory of the HLV in **winter**		Total loss of the marine diesel fuel inventory of the HLV in **spring**		Total loss of the marine diesel fuel inventory of the HLV in **summer**		Total loss of the marine diesel fuel inventory of the HLV in **autumn**	
Spill Dimensions from a worst case trajectory run (Length and Area)	45 km	520 km^2	38 km	480 km^2	34 km	440 km^2	36 km	500 km^2
Did the spill cross a median line in any of the trajectory runs? [1]	Yes		No		No		Yes	
Which median line(s)?	UK / Netherlands		N/A		N/A		UK /Netherlands	
Minimum time until oil crosses median line(s)	5 hours		N/A		N/A		3 hours	
Landfall								
Minimum time until beaching	N/A		N/A		N/A		N/A	
Volume beached in scenario eliciting earliest beaching	0 m^3		0 m^3		0 m^3		0 m^3	
Predicted locations	**December - February**		**March – May**		**June - August**		**September - November**	
N/A	% N/A		% N/A		% N/A		% N/A	
Key Sensitivities at Risk								
Sensitivities / sites of concern	Sensitivity of seabirds to oil pollution within Block 49/4 are 'very high' in July and 'high' during November to January. The remainder of the year has a 'low' sensitivity. Block 49/5 has a 'high' sensitivity recorded during November to January with the remainder of the year recorded as 'medium' to 'low' sensitivity. Block 49/9 has a 'low' sensitivity throughout the year, with the exception of February to April where no data is available (Webb *et al*, 2016).							

[1] Information taken from the earliest simulation within the stochastic model run to cross the median line. Note that the trajectory which has a worst-case extent (length and area) may not necessarily be the same trajectory which crosses the median line first.

Figure 11.1 Seasonal Arrival Time Plot

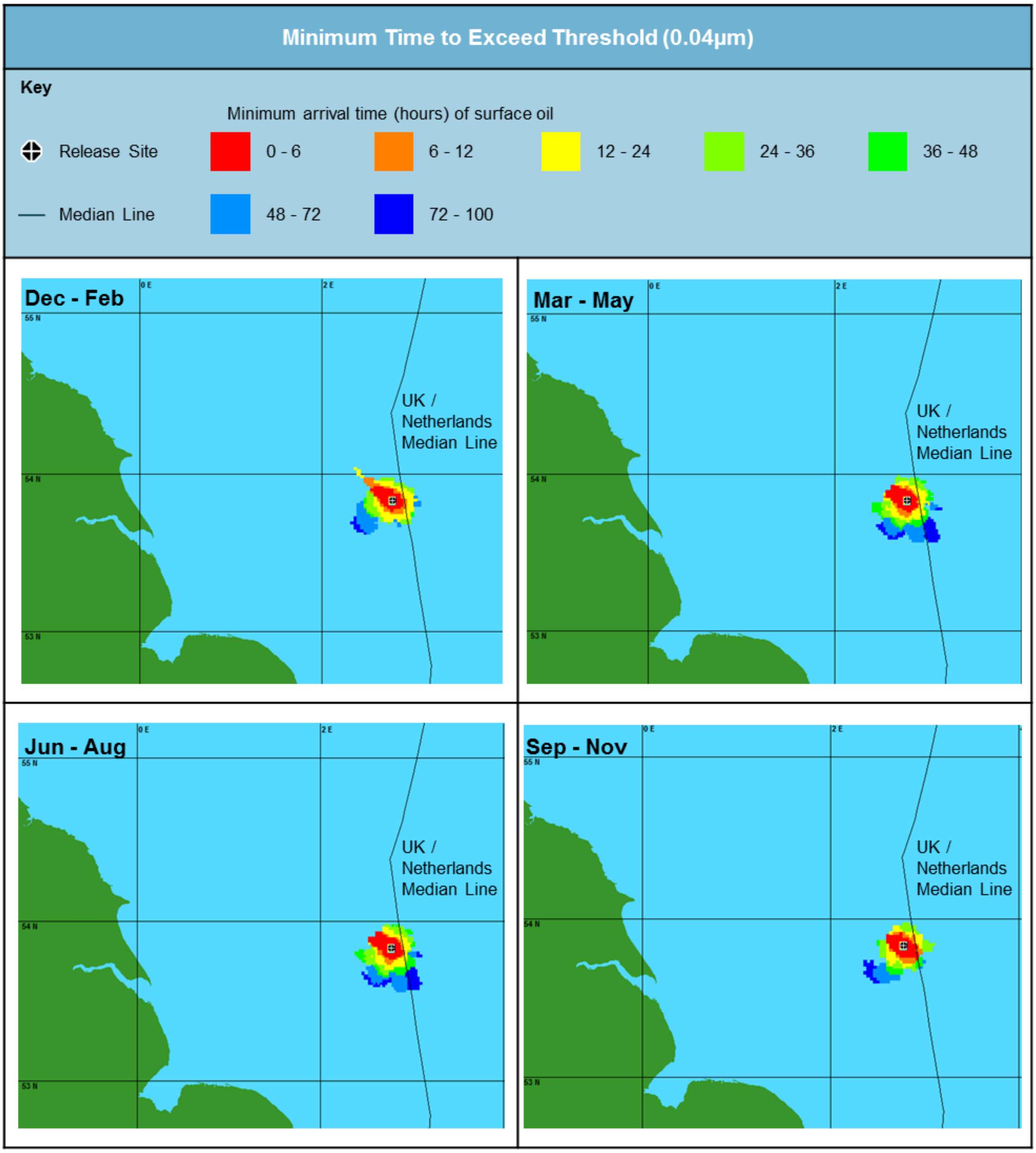
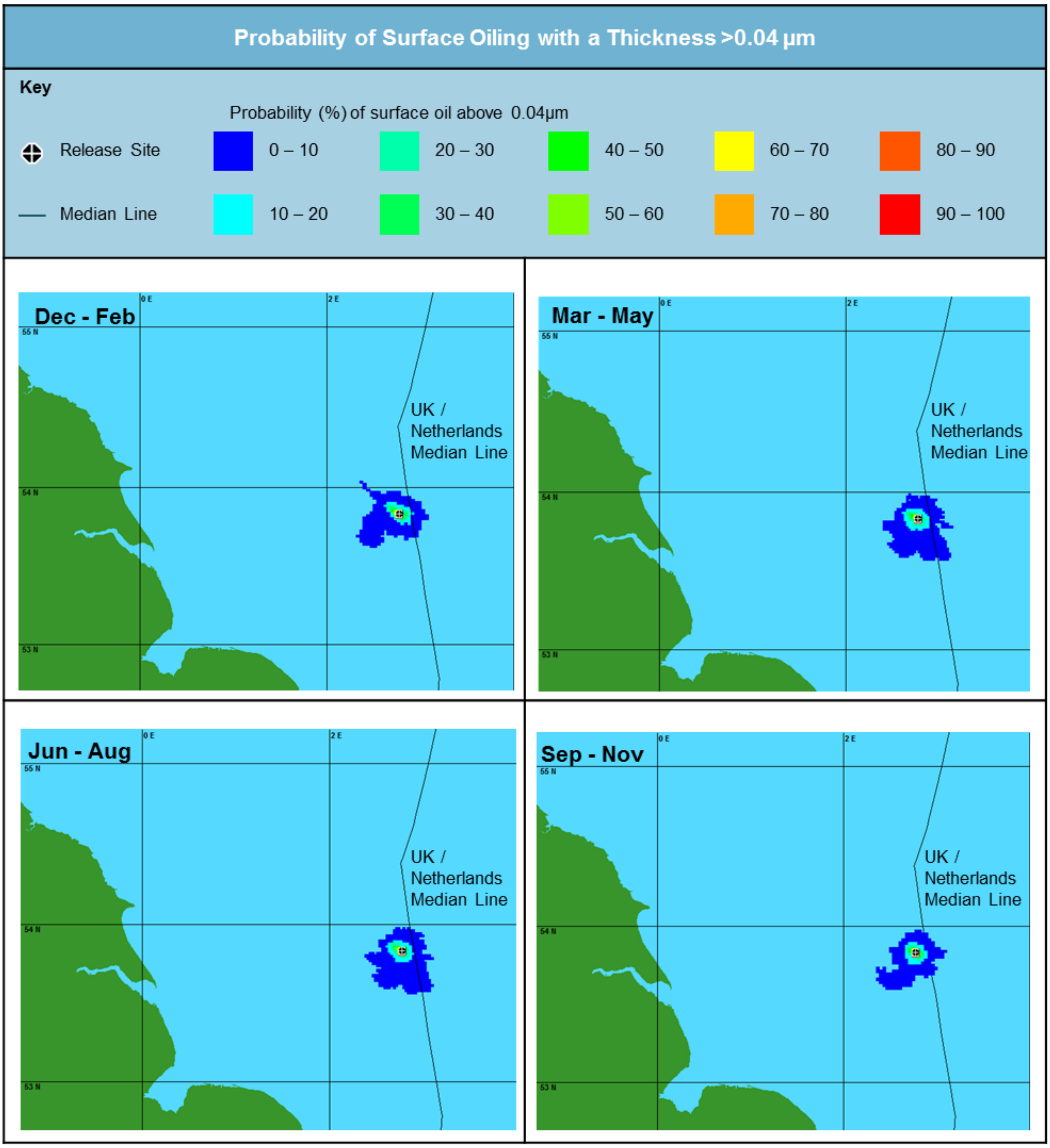


Figure 11.2 Seasonal Probability of Oil Beaching and Crossing Transboundary Lines



11.1.2.3 Discussion of Results

The stochastic modelling of an instantaneous release of 2,000m^3 of marine diesel to the sea surface from the Windermere platform location, under 'typical' conditions for each season, shows that during autumn and winter the hydrocarbon slick is pushed slightly to the southwest of the release location while in spring and summer the slick is pushed to the south and southeast.

The released diesel did not beach during any season, however, it did cross the UK/Netherlands transboundary line during autumn and winter. An examination of the individual trajectory runs for each of these seasons revealed that the minimum time it took for surface oil, with a minimum thickness of 0.04 µm, to cross the UK/Netherlands transboundary line was 3 hours during autumn and 5 hours during winter. For both seasons the probability of surface oil, with a minimum thickness of 0.04 µm, crossing the UK/Netherlands transboundary line was less than 10 percent.

With regards to marine protected areas, the model output indicates that the diesel slick resulting from the worst case spill scenario would enter the MCZ, Markham's Triangle under 'typical' (stochastic) conditions for all four seasons, with a probability of between 10 and 20 percent. In addition, the oil slick would also enter the Klaverbank (in the Netherlands EEZ) under 'typical' (stochastic) conditions for autumn and winter, with a probability of less than 10 percent.

Modelling has demonstrated that the majority of the diesel has a propensity to disperse within the water column or evaporate.

The Windermere Development is located in an area of the North Sea that has an active hydrological regime which will assist in the natural dispersion and dilution of pollutants. Although the area surrounding the Windermere Development is sensitive for both fish spawning and cetaceans, the main sensitivity from a spill is to seabirds, with very high sensitivity occurring in Blocks 49/4 in July and high sensitivity in Blocks49/4, and 49/45 between November and January.

Seabirds could be affected by a diesel release as the hydrocarbons could affect the bird's plumage, causing feathers to mat and separate, impairing waterproofing and exposing the animal's sensitive skin to extremes in temperature. In cases with heavy crude oils, this can result in hypothermia, meaning the birds can become cold, or hyperthermia, which results in overheating. Instinctively, the bird tries to get the oil off its feathers by preening, which results in the animal ingesting the oil and causing severe damage to its internal organs. However, as diesel is a light oil, the impact on seabirds is reduced when compared to crude oil spills (*bird-rescue.org, 2013*). In addition, diesel does not persist in the marine environment for any great time.

Given the above, the magnitude of the potential impact from the unplanned release of hydrocarbons during the Windermere decommissioning operations on the marine environment is considered to be Minor. However, INEOS is committed to ensuring that the risk of an oil spill event occurring during operations is minimised as far as possible, therefore the below mitigation measures would be implemented.

Mitigation Measures

Mitigations measures to reduce the risk of an oil spill during the Windermere DP include:

1. Loss of Fuel Inventory

An incident, such as a collision, could potentially cause the entire inventory of hydrocarbons stored on a decommissioning vessel to be released to the sea. For Mobile Offshore Drilling Units (MODU) in the North Sea between 1980 and 1997 a total loss accident frequency of 3.75 occurrences per 1,000 unit years has been recorded (Worldwide Offshore Accident Databook – Statistical Report 1998, DET NORSKE VERITAS). In practice it is most likely that any release of oil would occur over a period of time. An immediate release could, however, occur in the unlikely event that all compartment/tanks containing oil were instantaneously fractured in some way.

The stand-by vessel will monitor approaching shipping by radar and patrol the 500m safety exclusion zone around the HLV, jack-up vessel and other vessels to warn off approaching vessels prior to them entering the safety exclusion zone. Notification of the decommissioning programme will be made to all the relevant maritime authorities in advance of the commencement of operations.

2. Fuel Transfer

Small spills of hydrocarbons (< 1 m^3) can occur during re-fuelling of the rig (bunkering).

Before commencing operations, if practicable, INEOS will try to ensure the decommissioning vessels are fully bunkered prior to moving onto location. When fuel transfer is required the following precautions will be taken, whenever possible:

- Supervision or operations on both supply boat and decommissioning vessels;
- Transfers to take place during daylight hours and only in calm sea and weather conditions, whenever possible;
- Use of non-return valves on bulk transfer hoses;
- Transfer hoses are regularly maintained and inspected and a close visual inspection of them carried out prior to transfer to or from a supply vessel;
- Use of flotation collars on hoses;
- There is bunding around each of the loading stations and around the main fuel oil tank vents on the main deck.

INEOS will ensure that the crews onboard the decommissioning vessels have been trained and regularly hold exercises to contain and clean up deck spills and safely store contaminated material until its ultimate disposal on shore. Training records will be held on board.

3. Deck Spills

- The areas onboard vessels holding potential sources of pollution have plate decks and are protected by bunds. Bunds are fitted at all times except during heavy rain or washdown. Drainage within these areas is to the closed drain system and all water is treated by the water treatment system prior to release to the sea. Locations where inventories of utility oils and chemicals are stored are covered with bunded areas and drip tray/save-alls below spring loaded valves on fuel oil tanks.
- Special training is given to personnel with the responsibility for the operation of valves, particularly dump valves, to make them aware of the importance to the environment of preventing accidental oil spills in general and in the correct identification and utilisation of valves prior to their use.
- Clean-up equipment is available for deck spills and two containers of specialised equipment are sited on the main deck. Training is given in the control and clean-up of oil spills.

4. General

INEOS will also ensure that operations staff are fully aware of their responsibilities under the Oil Pollution Emergency Plan (OPEP), are trained in the appropriate response techniques and are involved in at least one response exercise per shift, per year, to ensure that the Plan can be implemented effectively.

All personnel, both offshore and onshore, who are involved in the Windermere DP, will be fully briefed as to the sensitivities in the area. This will be covered in the well programmes, pre-spud meetings and toolbox talks and in the Health, Safety, Environmental Management System (HSE MS).

11.1.2.4 Conclusions

The Windermere Development is located in an area of the North Sea that has an active hydrological regime which will assist in the natural dispersion and dilution of pollutants. The main sensitivity from a spill is to seabirds. However, as diesel is a light oil, the impact on seabirds is reduced when compared to crude oil spills (*bird-rescue.org, 2013*). In addition, the diesel does not persist in the marine environment for any great time.

The modelling carried out for the planned operations allows the following conclusions to be drawn:

- Diesel spills are more likely to affect the environment within the vicinity of the decommissioning vessels. While the diesel spill did not beach in any season, there is less than a 10 percent probability of the worst case instantaneous diesel spill crossing the UK/Netherlands transboundary line during autumn and winter. The surface oil did not cross a transboundary line when modelled during spring or summer.
- With regards to marine protected areas, the model output indicates that under 'typical' (stochastic) conditions for all four seasons there is less than a 20 percent probability of the oil slick entering the MCZ. There is also less than a 10 percent probability of it entering the SAC, Klaverbank but only under 'typical' conditions for autumn and winter.

The residual impact on the marine environment from the accidental spillage of diesel resulting from a collision between vessels on **water quality** and **seabirds** is considered to be **Minor**

12 Solid Wastes

12.1 Assessment of Potentially Significant Impacts

The Windermere decommissioning operations will generate solid wastes that will require onshore disposal. These are:

- Operational waste;
- Decommissioning materials.

12.1.1 Regulatory Regime

The management and disposal of solid waste will be covered by The Environment Protection Act 1990 (EPA 90), the Control of Pollution (Amendment) Act 1989 (as amended), the Mercury Export and Data (Enforcement) Regulations 2010, the Environmental Permitting (England and Wales) Regulations (as amended) and The Radioactive Substances Act (1993).

12.1.2 Operational Waste Management

Careful consideration is given to minimising the amount of waste generated and controlling its eventual disposal. Furthermore, there will be a waste management plan in place for the HLV, DSV and jack-up vessel, which covers the entire DP.

Typically, up to 8 tonnes of waste per month is generated from a Jack-up or HLV. Bulk wastes (e.g. garbage, scrap metals etc.) generated on the jack-up vessel will be segregated by type and back loaded to shore where they can be recycled or disposed of in a controlled manner. INEOS will ensure that an effective waste management programme is implemented to minimise the amounts generated and to ensure material such as scrap metal, waste oil and surplus chemicals are sent for recycling or re-use as far as practicable. Other waste will be sent to authorised landfills or incineration facilities, depending on its precise nature.

Given the above, the magnitude of the potential impact from the onshore disposal of operational waste on land use is considered to be moderate and therefore the impact is considered to be significant.

Mitigation Measures

- INEOS will ensure that an effective waste management plan is put in place prior to decommissioning activities commencing.

12.1.2.1 Conclusions

Providing the INEOS waste management plan is adhered to, there should be no significant impacts resulting from the generation and disposal of operational solid waste, during the Windermere decommissioning operations. Therefore, the residual impact on the environment from the onshore disposal of operational solid waste is expected to be minor.

The residual impact on the environment from operational solid waste on **land use** is considered to be **Minor**

12.1.3 Decommissioning Materials Management

The Windermere decommissioning activities will generate materials that will need to be recovered to shore for appropriative processing and disposal (see Section 3.6 for the expected material inventory). The materials are defined as ‘controlled waste’ in Section 75(4) of the Environmental Protection Act 1990 as ‘household, industrial and commercial waste or any such waste’.

Any waste that arises from the decommissioning of the Windermere Development will be treated and disposed of in accordance with all relevant legislation and company policy. Wastes will be categorised and handled in a manner that will minimise the threat to personnel and the environment. In order to maximise the reuse and recycle rate of decommissioning wastes, INEOS will minimise the volume of materials destined for incineration/landfall. Where practicable, recovered materials will be segregated for ease of handling and to reduce the energy used when transporting different materials to their respective recycling, reuse or disposal facilities. Each waste stream will be assessed individually in order to implement the most favourable option. The waste stream management methods are detailed in the DP.

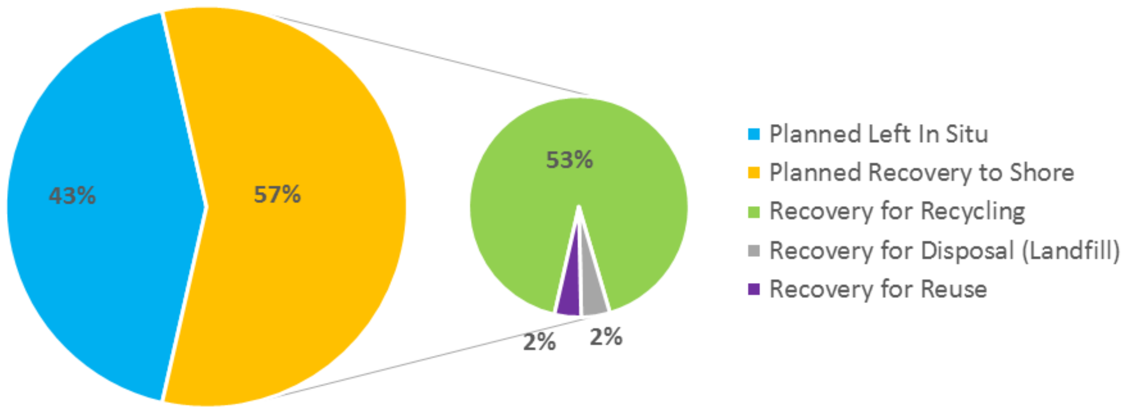
Any non-hazardous waste (i.e. steel, copper, plastics etc), which have not been contaminated with special waste (i.e. chemicals, NORM etc) will be removed and recovered for reuse, recycling or disposal in landfill. Any special waste (i.e. NORM, oil and chemicals) will require additional treatment from specialised waste contractors.

Prior to decommissioning activities commencing, INEOS will also compile a detailed waste management plan for dealing with the expected material inventory. It is expected that those recovered materials that can be recycled / re-used (i.e. steel) will be subject to processing and / or recycling. Materials that cannot be recycled / re-used (i.e., cement) will be treated, cleaned and then transported to appropriate disposal in landfill.

Any NORM-contaminated material returned to shore will be treated, recycled or disposed of as appropriate, in line with the Radioactive Substances Act 1993. The selected NORM contractor will have the experience and management procedures in place to handle and dispose of the NORM in a responsible way and in accordance with the Radioactive Substances Act 1993. Procedures for NORM LSA scale and radioactive components will be in accordance with company procedures and in line with the requirements of the Windermere NORM permit (EPR/XB3298DK).

Figure 12.1 presents the percentage of the total expected Windermere Development material inventory (2,863 tonnes) proposed for each fate. Approximately 43 percent of all materials will remain *in situ* (this is mainly attributed to the pipeline and jacket pile ends 3 m below the seabed), while 57 percent will be recovered to shore. Once onshore, the recovered materials will either be recycled, reused or be disposed of (i.e. go to landfill).

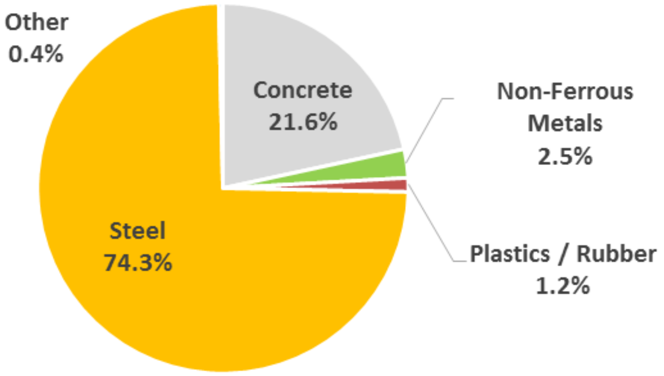
Figure 12.1 Proposed Fates for the Expected Windermere Development Material Inventory as a Percentage of the Total Tonnage (approximately 2,330 tonnes).



As Figure 12.1 indicates, of the four possible fates (leave *in situ*, recover for recycling, recover for reuse and dispose of in landfill), the majority of the material inventory is expected to be left *in situ* or recycled.

Figure 12.2 presents the percentage of each material that is expected to be recovered to shore (includes for recycling, reuse and disposal in landfill). Of the materials proposed for recovery, the majority is steel (74 percent), of which over 90 percent is expected to be recycled. The next major material, by weight, will be concrete (22 percent), which is expected to be cleaned, crushed and recycled (note Figure 12.2 assumes that all of the concrete mattresses and grout bags are recovered).

Figure 12.2 The Composition of the Materials Expected to be Recovered to Shore



Overall, of the total material expected to be recovered to shore, approximately 92 percent is expected to be recycled, 4 percent is expected to be reused and 4 percent is expected to go to landfill.

12.1.3.1 Marine Growth

During the decommissioning of offshore structures, marine growth constitutes a waste that has to be managed within the environmental legislative framework and the capabilities, and capacity of the decommissioning supply chain (*BMT Cordah, 2011*). In the UK, marine growth is defined as a 'controlled waste' under Environmental Protection Act 1990. While under the EU Waste Framework Directive (WFD) (2006/12/EC) marine growth is defined as 'directive waste'.

The removal of marine growth from offshore structures commonly takes place:

- Onshore at a licenced disposal yard;
- Offshore with the structure still *in situ*; and/or
- At an intermediate location (e.g. a fjord, sea loch or inshore waters), where the structure would be wholly or partly onboard a vessel.

At the time of writing this ES, a contractor for waste management had yet to be selected and therefore the fate of marine growth is unknown at this time. Oil & Gas (UK) Ltd commissioned BMT Cordah Limited to conduct a high level comparative assessment of the options for the removal of marine growth from decommissioned offshore structures. The removal of marine growth onshore at a disposal yard attained the highest overall score (*BMT Cordah, 2011*).

For the purposes of this assessment, it is assumed that the removal of marine growth will take place onshore at a licenced disposal yard.

As discussed in Section 3.4.4, some of the marine growth adhered to the Windermere platform jacket may be removed or become dislodged during the jacket cutting, lifting and transportation. The detached marine growth will fall to the seabed or be dispersed by currents and decompose naturally. A bulk release of marine growth to sea could potentially cause the water quality in the vicinity of the release to deteriorate (initiated by the breakdown products of the dead marine growth leading to localised eutrophication). If this were to happen, however, the effect is likely to be localised and transient given the dispersive environment that exists offshore (*BMT Cordah, 2011*).

The remaining marine growth will be removed from the Windermere platform jacket onshore at a licenced disposal yard and processed appropriately. Following its removal, marine growth is commonly sent to landfill, composted, used for land-spreading or, in some cases, it may be dried onshore and then sent (still attached) to a recycling facility for steel smelting (*BMT Cordah, 2011*).

Given the above, the magnitude of the potential impact from the onshore disposal of decommissioning materials on land use is considered to be moderate and therefore the impact is considered to be significant.

Mitigation Measures

- INEOS will ensure that an effective waste management plan is put in place prior to decommissioning activities commencing;
- INEOS will ensure all waste contractors are audited and meet relevant legislation;
- INEOS will actively seek to reduce the amount of recovered materials that are sent to landfill.

12.1.3.2 Conclusions

Providing the INEOS waste management plan is adhered to, there should be no significant impacts resulting from the generation and disposal of expected materials inventory of the Windermere Development. Therefore, the residual impact from the onshore disposal of decommissioning materials on land use is expected to be minor.

The residual impact from the onshore disposal of decommissioning materials on **land use** is considered to be **Minor**

12.2 Summary of Mitigation Measures

- INEOS will ensure that an effective waste management plan is put in place prior to decommissioning activities commencing;
- INEOS will ensure all waste contractors are audited and meet relevant legislation;
- INEOS will actively seek to reduce the amount of recovered materials that are sent to landfill.

13 Transboundary Impacts

13.1 Assessment of Potentially Significant Impacts

13.1.1 Unplanned Hydrocarbon Releases

At its closest point, the Windermere Development is located approximately 2.5 km to the west of the UK / Netherlands transboundary line.

Modelling the worst case spill scenario under 'typical' (stochastic) conditions for autumn and winter the diesel slick crossed the UK/Netherlands transboundary line after 3 hours and 5 hours, respectively. The probability of the diesel slick crossing the transboundary line was small (less than 10 percent) for both of these seasons. The diesel slick did not cross a transboundary line when modelled during 'typical' conditions for spring and summer.

If a diesel spill did cross the transboundary line, then the Bonn agreement would be activated. In accordance with the Bonn Agreement for Co-operation in dealing with Pollution of the North Sea by Oil & Other Harmful Substances, 1983, all states bordering the North Sea notify each other of marine pollution or the threat of marine pollution and assist one another in dealing with incidents. Reporting of any incidents will be made to the UK authorities (which is detailed in the Windermere OPEP) who will, if appropriate, advise authorities in other jurisdictions.

Mitigation Measures

- INEOS will ensure that the Bonn agreement is fully detailed in the Windermere OPEP.

13.1.1.1 Conclusions

Given the distance from the transboundary line to the Windermere Development it is possible that should a spill occur the UK/Netherlands transboundary line could crossed and foreign waters impacted. However, the modelling of the worst case spill scenario (the instantaneous release of 2,000m^3 of diesel oil from the HLV) indicates that the resulting diesel slick has a small (less than 10 percent) probability of crossing the UK/Netherlands transboundary line under 'typical' seasonal conditions for autumn and winter. In addition, in the event of a spill the diesel would not persist on the surface of the sea for a significant time. Therefore, the residual impact to transboundary areas from hydrocarbon releases would be minor.

The residual impact from potential unplanned hydrocarbon releases on **transboundary areas** is considered to be **Minor**

13.1.2 Atmospheric Emissions

Due to the distance of the Windermere Development to the UK/Netherlands transboundary line (approximately 2.5 km) there could be minor increases of the atmospheric greenhouse gas concentrations over the transboundary line. However, due to atmospheric dispersion, the concentrations are expected to be minute over a few kilometres from the source. In addition, the operations will be temporary in nature and with the implementation of the mitigation measures, as outlined in Section 9.1.2, the transboundary impact from atmospheric emissions is expected to be minor.

The residual impact from atmospheric emissions on **transboundary areas** is considered to be **Minor**

13.1.3 Chemical and Planned Hydrocarbon Discharges

Due to the planned volumes of chemicals and hydrocarbons to be discharged (refer to Section 10.1.3), and distances from the discharge locations to the transboundary line (approximately 2.5 km at the closest point), negligible transboundary impacts are expected.

The residual impact from planned chemical and hydrocarbon discharges on **transboundary areas** is considered to be **Negligible**

13.2 Summary of Mitigation Measures

- INEOS will ensure that the Bonn agreement is referenced appropriately in the Windermere OPEP.

14 Cumulative Impacts

14.1 Assessment of Potentially Significant Impacts

Cumulative impacts (i.e. impacts that result from incremental changes caused by other past, present or reasonably foreseeable activities or projects in the local area, in combination with the proposed development) are discussed below.

Given the distance to other offshore activities in the vicinity of the Windermere Development, it is possible that cumulative impacts may arise. Known projects that could result in a cumulative impact with the Windermere DP include:

- The Hornsea Project Three windfarm
- Ketch Decommissioning

The windfarm project has only recently had its Development Consent Order approved and its construction schedules are not yet available. It is assumed that the Windermere DP will be completed prior to any pre-construction/construction offshore activities commencing on the wind farm (although it is noted that site investigations were carried out in Q4 2014 (*4C Offshore, 2015*)). As such no cumulative impacts are anticipated.

The Ketch platform, located 30km north west of Windermere and owned by DNO North Sea (ROGB) Limited, is currently in the process of being decommissioned. The proposed project schedule published in the Decommissioning Programme (DNO, 2019) indicates platform removal operations will commence in early 2021 with the potential for operations to be delayed up until the end of 2024. Although the platform removal schedules are similar (both indicate removal between 2021 and 2024), it is unlikely that major decommissioning events, such as topsides removal, will occur at the same time.

INEOS is always keen to maximise efficiency and may explore the potential to work with other operators who are decommissioning in the area to determine whether energy and efficiency gains can be made by working together. These are likely to have a positive, rather than negative environmental impact.

Should it be the case that the decommissioning activities at Ketch will occur at a similar timeframe to the Windermere Decommissioning, there is the potential for cumulative impacts of noise and vibration. No other aspects are considered to be significant.

14.1.1 Noise and Vibration

The calculation of noise disturbance from explosives is presented in Section 8. The Schooner and Ketch Decommissioning Environmental Appraisal (2018) identifies that noise from an explosion to sever the platform piles will cause disturbance to high frequency cetaceans at up to 4.9km from the source. Noise from all sources at the Ketch decommissioning has the potential to cause mild disturbance at up to 16.3km. Based on these calculations and those presented in Section 8, it is considered unlikely that noise from both sources will combine to cause cumulative noise.

However noise which excludes individuals from two areas at once, will reduce the area available to cetaceans, potentially affecting foraging behaviour. Although Windermere is not located within the SNS SAC, the JNCC Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (2020) can be used to provide a benchmark. It defines significant disturbance as exclusion from more than 20% of the relevant area on any given day or an average of 10% of the area over a season. The SNS SAC is 36,951km^2, therefore the combined area affected by noise from both Ketch and Windermere decommissioning is below this threshold.

A more detailed environmental impact assessment will be undertaken as part of permitting the operations, where details of the planned operations will be described. At this time, there will be greater certainty in schedules and a full assessment of the potential cumulative impact of noise can be undertaken if there is any overlap.

Mitigation Measures put in place will be the same as those described in Section 8, with the addition of the below:

- INEOS will ensure that prior to confirming timelines, consultation will be made with DNO North Sea so that activities can be coordinated to minimise the potential for noise generation at the same time.
- INEOS will undertake a further impact assessment as part of permitting requirements in order to determine the cumulative impact of noise should schedule with Ketch operations overlap.

The residual cumulative impact of noise generated during decommissioning on **marine mammals** and **fish/shellfish** is considered to be **Minor**

15 Environmental Management

15.1 Overview

INEOS operates under an integrated Safety, Health & Environmental Management System (SH&EMS) which is a component of INEOS's overall Business Management System (BMS).

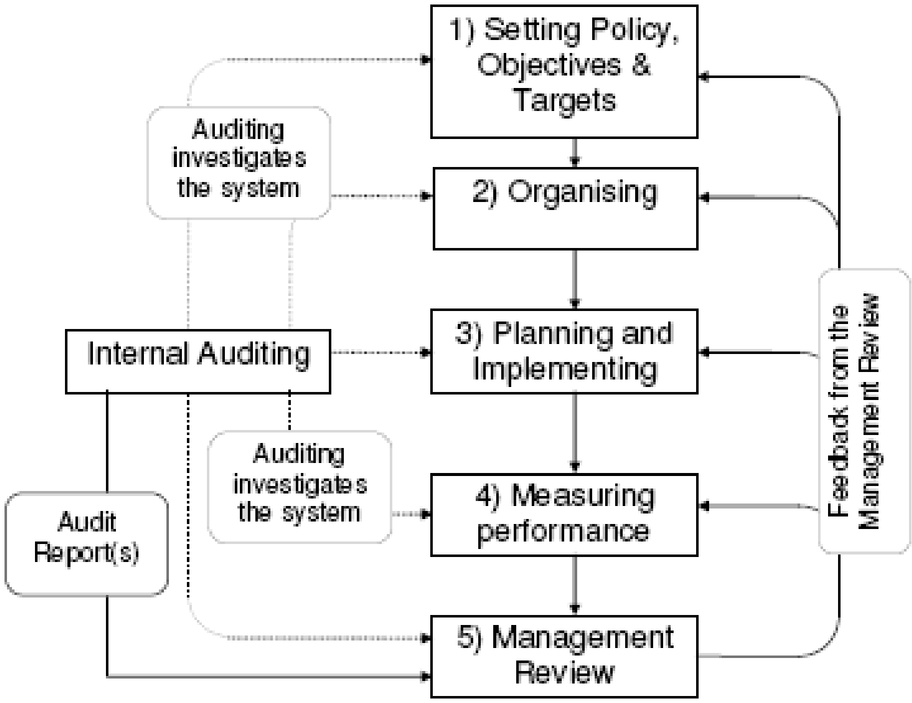
The HS&EMS governs how INEOS's staff and directly employed consultants/contracted personnel working within INEOS will conduct their activities. It applies at all levels within the INEOS UK SNS Limited organisation, including all subsidiary companies, and applies to all INEOS UK SNS Limited business activities.

The content and structure of the SH&EMS have been based on:

- Principles in the Health and Safety Executive publication HS(G)65 'Successful Health and Safety Management';
- OHSAS 18001 'Occupational Health & Safety Management Systems – Specification';
- ISO 45001 'Occupational Health and Safety';
- BS EN ISO 14001 standard for Environmental Management Systems.

The system comprises of five key elements, which together provide the framework of a "Plan – Do – Check – Act" approach to SHE management. These five key principles underlying the system are shown in Figure 15.1 below.

Figure 15.1 Principle Elements of the SH&EMS



A copy of the INEOS SHE Policy Statement, which sets out the Company's expectations and commitments to SHE performance and drives the implementation of the SH&EMS, is provided in Figure 15.2.

The SH&EMS was awarded ISO 14001 and OHSAS 18001 certification by DNV in November 2010. The environmental component of the SH&EMS (i.e. the Environmental Management System) was verified to ISO 14001 standards by DNV in October 2014 and was re-certified to ISO14001 by Exova (now BMTrada) in November 2016 and at appropriate intervals since.

An additional site at the INEOS Norwich office (Drilling) was added to the certification in January 2018.

A formal review of SHE performance is also conducted annually. This is an essential step required to assess the effectiveness of the SH&EMS in achieving the aims of INEOS's policy and objectives and to achieve continuous improvement in the control system.

15.2 Environmental Policy

The Environmental Management System (EMS) is a tool for identifying and managing the impact INEOS's business has on the environment. The EMS works to reduce this impact by controlling the quantity of materials and energy used and the amount of waste produced. As well as facilitating the management of environmental impacts in a credible way, the EMS provides a practical tool to help evaluate and improve performance in a verifiable way.

The following guiding principles and methodologies are integrated, as appropriate, into INEOS's EMS:

- The precautionary principle;
- The polluter pays principle;
- Best available techniques and best environmental practice, including, where appropriate, clean technology;
- Sustainable development;
- The application of an integrated ecosystem approach; and
- The waste management hierarchy of avoidance, reduction, re-use, recycling, recovery, and residue disposal.

Implementation of the EMS, for all INEOS's activities and projects (including the Windermere Decommissioning Project), ensure that the company:

- Complies, as a minimum, with all environmental legislation applicable in the UK, applying best industry practice and undertaking steps to improve environmental protection levels where appropriate;
- Plans for the management of environmental issues, identifying performance standards, procedures for control and monitoring, and resources to be applied;
- Systematically identifies hazards, assesses the risk of harm and incorporates measures to control risks (this is central to the design, construction and operation of facilities);
- Selects competent contractors and provide them with all necessary information, including definition of INEOS's SHE requirements;
- Monitors and audits contractors to ensure that they operate in compliance with the principles of INEOS's Policy and meet the standards required; and
- Maintains emergency and contingency plans.

For the Windermere DP, INEOS shall require each of its contractors and suppliers to:

- Operate an effective EMS relevant to their scope of work/supply; and
- Comply with INEOS's environmental requirements including appropriate planning, hazard identification, risk control, performance monitoring and reporting.

In addition, INEOS will develop an EMP for the Windermere DP to ensure compliance with the INEOS Environmental Policy and EMS, as well as with statutory requirements. The EMS will incorporate all the mitigation measures which INEOS has committed to implement, as identified during the EIA process (refer to Section 15.3), and will outline the processes INEOS will follow in order to monitor compliance.

Figure 15.2 INEOS UK SNS Limited SHEQ Policy Statement

Policy Statement for
SHEQ (Safety, Health, Environmental & Quality) Management

INEOS Oil & Gas UK seeks to conduct its business activities to maximise commercial value, in full compliance with statutory requirements, and so that quality and efficiency are assured at all times. INEOS Oil & Gas UK also recognises its moral and legal obligations to conduct all its activities in a manner that promotes the health and safety of its employees and others affected, prevents work-related injury and illness and protects the natural environment with the prevention of pollution.

INEOS Oil & Gas UK is committed to integrated business management, including SHE (safety, health & environmental) management, in accordance with recognised quality management principles. Thus, the Company operates and maintains a Business Management System (BMS) compliant with standards ISO 9001, ISO14001 and ISO45001.

Accordingly, **INEOS Oil & Gas UK will:**

- annually set SHEQ objectives, seeking to achieve continual improvement;
- ensure that a competent workforce is established and receives all necessary information, instruction and training and that all personnel have a clear understanding of their roles and responsibilities;
- provide all personnel with opportunities for participation in SHE decisions, risk assessments and aspects of SHE management as well as undertaking consultation and communication regarding SHE issues;
- monitor and record SHEQ performance and assess compliance through internal audits;
- annually conduct management review of performance against objectives, including review and development of the Policy and BMS and communicate the results of this review with the workforce;
- ensure that sufficient resources are provided to achieve its objectives.

For all business activities and projects undertaken, **INEOS Oil & Gas UK will:**

- comply, as a minimum, with all SHE legislation applicable in the UK, to discharge its Duty of Care, applying best industry practice and undertaking steps to improve safety or environmental protection levels where appropriate;
- ensure that systematic hazard identification, assessment of risk and incorporation of measures to minimise and control risks are central to all our activities;
- apply all necessary control measures in the design, construction and operation of offshore facilities to prevent the occurrence of major accident events;
- select competent contractors with regard to their SHEQ management capability and provide them with all necessary information, including definition of INEOS Oil & Gas UK's SHEQ requirements;
- monitor and audit contractors as necessary to ensure satisfactory quality assurance and SHE performance; and
- maintain emergency and contingency plans.

INEOS Oil & Gas UK requires each of its **contractors and suppliers** to:

- operate effective SHEQ management systems; and
- comply with INEOS Oil & Gas UK's SHEQ requirements including appropriate SHEQ planning, hazard identification, risk control, performance monitoring and reporting.

SHEQ leadership and management is a responsibility for all **INEOS Oil & Gas UK personnel. The prime responsibility resides with the line management** from the most senior executive to supervisory level.

All INEOS Oil & Gas UK personnel are required to comply with procedures forming the Company's BMS and to act responsibly at all times so as to protect their own safety, the safety of others and protection of the environment.

Signed on behalf of INEOS Oil & Gas UK:
Dougie Scott (Chief Executive Officer)

Date: 9th December 2020

15.3 Windermere Decommissioning Environmental Statement Commitments

INEOS has made a number of commitments within this ES in order to reduce the potential environmental and socio-economic impacts from the proposed Windermere DP, as far as practicable. These commitments, along with the INEOS personnel responsible for ensuring that they are implemented, are summarised in Table 15.1. INEOS will monitor implementation of these commitments as the project progresses and tracked close-out.

Table 15.1 Key Commitments in the Windermere Decommissioning Environmental Statement

Ref No.	Commitment	Details	ES Section	Responsibility
1	Communications with fisheries and maritime agencies and other sea users	• Consultations with the Fisheries and Maritime Agencies will be held by either INEOS or their representatives to try and address any potential conflicts and optimise the schedule. • Communications with these agencies will be maintained, as necessary, throughout the DP. • INEOS will appoint a Fisheries Liaison Officer (FLO) if required, who will be responsible for the distribution of all key information to fishermen. • Other sea users will also be informed of the decommissioning activities, and therefore the presence of additional vessel traffic in the area, through Notices to Mariners to enable early warning and planning of proposed activities. • If explosives are required to sever the platform, other sea users which may be affected by this will be informed in advance and communications maintained throughout the DP.	6.2	INEOS or their representative
2	Collision risk management	• Decommissioning vessels will meet national and international legislation with regards to navigation aids and warning signals for other sea users. • A collision risk management plan should be developed for the decommissioning operations to record the pre-planning measures taken to minimise the risk of ship collision, and to define the guarding role of the ERRV whilst on location.	6.2	INEOS or their representative
3	Jack-up Vessel	• INEOS will actively seek to position the jack-up vessel in a single location during decommissioning. This will reduce the number of instances that jack-up spud cans will be deployed on the seabed.	7.1.4	INEOS or their representative
4	HLV	• INEOS will actively seek to position the HLV in a single location during decommissioning. This will reduce the number of instances that anchors and anchor chains will be deployed on the seabed.	7.1.6	INEOS or their representative
5	On-going monitoring of the pipeline	• INEOS will monitor the decommissioned pipeline at appropriate intervals (agreed with BEIS), to ensure that it remains buried and does not become a hazard to fishing over time.	6.1.8	INEOS or their representative
6	Stabilisation material for pipeline	• INEOS will actively seek to minimise the amount of material required for pipeline stabilisation.	6.1.8 & 7.1.7	INEOS or their representative
7	Removal of stabilisation material (concrete mattress and grout bags)	• Where technically feasible, an attempt to remove the exposed concrete mattresses and grout bags from the seabed will be made. If the mattress and grout bag recovery operation is considered too dangerous to personnel, due to the state of the mattresses, a proposal will be made to DECC to leave the mattresses and grout bags *in situ*.	6.1.7 & 7.1.3	INEOS or their representative

Ref No.	Commitment	Details	ES Section	Responsibility
8	Removal of Subsea Structures	• Subsea infrastructure removal methods will be assessed prior to decommissioning operations beginning, with a view to implement the removal method, with the least impact to the seabed.	7.1.2	INEOS or their representative
9	Post-decommissioning Survey	• Post-decommissioning a debris survey will be undertaken to remove any objects remaining on the seabed and identify any mattresses remaining on the seabed.	7.2	INEOS or their representative
10	Stabilisation material for jack-up vessel	• If it is required, the amount of rock placed on the seabed for rig stabilisation will be minimised as far as practicable and it will be placed as close to the spud cans as possible to reduce the area of seabed to be impacted. • If rock dumping is required for the jack-up vessel, it is estimated that a maximum of 1,000 tonnes of rock would be needed per leg / spud can (totalling 4,000 tonnes of rock).	7.1.5	INEOS or their representative

11	Noise from decommissioning activities	• In order to minimise any potential impact on marine cetaceans from the proposed Windermere Decommissioning operations, INEOS will seek to conform to the JNCC protocol for minimising the risk of disturbance and injury to marine mammals from underwater noise throughout operations;
		• Vessel movements and the use of dynamic positioning thrusters will be minimised where possible to reduce the potential impacts on fish and marine mammals;
		• At the time of writing this ES the use of explosives during decommissioning had not be confirmed. If the use of explosives is confirmed, INEOS will produce a separate Decommissioning Explosives Noise Assessment for a Marine License, which will describe the type, weight and location of the charges, the proposed timings of operations and a contain a full impact assessment for their use;
		• If explosives are required to be used, in addition to complying with the JNCC guidelines, INEOS will:
		  • Use of trained Marine Mammal Observers (MMOs) to identify if there are any vulnerable cetaceans in the vicinity of the explosive source. It is recommended that a 1 km radius mitigation zone be set up around the explosion source. If marine mammals are sighted within this area, operations should be ceased / halted until they have left the area at a safe distance;
		  • Use of Passive Acoustic Monitoring (PAM), in conjunction with MMOs, to determine the presence of cetaceans in high sea states, poor visibility, during low light conditions and to identify those which may not surface regularly enough to be sighted;
		  • Use the minimum amount of explosive required to achieve the task based on sound planning and engineering;
			8.2 & 14.1.4	INEOS or their representative

Ref No.	Commitment	Details	ES Section	Responsibility
		• Implement a 'soft start' procedure whereby small amounts of explosives are used to scare fish and marine mammals from the vicinity; • INEOS will consult with BEIS as to whether other operations using explosives are being undertaken at a similar time and location.		
12	Atmospheric Emissions	Commitments to limit atmospheric emissions that will be adopted during the decommissioning programme include: • Advanced planning to ensure efficient operations; • Emissions controlled to MARPOL Annex VI standards through the use of cleaner low emission fuels; • Speed of vessels will be managed to minimise fuel consumption; • Generators will be running on the minimum power for the job task to avoid unnecessary emissions; • Well maintained and operated power generation equipment; and • Regular monitoring of fuel consumption; • Licensed waste processing contractors will be chosen for the recycling of decommissioning materials.	9.2 & 13.1.3	INEOS or their representative
13	Drainage water, Food waste and grey water	• INEOS will ensure that the vessels are equipped with suitable containment, treatment and monitoring systems as part of the contract specification; • INEOS Representative will ensure good housekeeping standards are maintained onboard the vessels; • Each vessel will have a Garbage Management Plan in place; • All the drains from the vessels' floor will be directed to a containment tank and the fluids processed/filtered to remove hydrocarbons; • As part of the SHE Plan, INEOS will ensure that the contractor knows how to react to spills, that the necessary spill kits are onboard the vessel in suitable locations and personnel are trained in their use.	10.1.4	INEOS or their representative
14	Unplanned Hydrocarbon Release	• INEOS will ensure that appropriate oil spill response training is undertaken by key personnel within INEOS and relevant contractors.	11.1.2.3	INEOS or their representative

Ref No.	Commitment	Details	ES Section	Responsibility

		• While a 2,000 cubic metre spill is considered the worst case scenario at the time of writing this ES, if the contracted vessels have a fuel inventory significantly larger than 2,000 cubic metres INEOS commit to re-run the oil spill modelling.
		• Before commencing operations, if practicable, INEOS will try to ensure the decommissioning vessels are fully bunkered prior to moving onto location. When fuel transfer is required the following precautions will be taken, whenever possible:
		  • Supervision or operations on both supply boat and decommissioning vessels;
		  • Transfers to take place during daylight hours and only in calm sea and weather conditions, whenever possible;
		  • Use of non-return valves on bulk transfer hoses;
		  • Transfer hoses are regularly maintained and inspected and a close visual inspection of them carried out prior to transfer to or from a supply vessel;
		  • Use of flotation collars on hoses;
		  • There is bunding around each of the loading stations and around the main fuel oil tank vents on the main deck.
		• INEOS will ensure that the crews onboard the decommissioning vessels have been trained and regularly hold exercises to contain and clean up deck spills and safely store contaminated material until its ultimate disposal on shore. Training records will be held on board.
		• INEOS will also ensure that operations staff are fully aware of their responsibilities under the OPEP, are trained in the appropriate response techniques and are involved in at least one response exercise per shift, per year, to ensure that the Plan can be implemented effectively.
		• All personnel, both offshore and onshore, who are involved in the Windermere DP, will be fully briefed as to the sensitivities in the area. This will be covered in the well programmes, pre-spud meetings and toolbox talks and in the SHE Management Plan.		

15	Waste	• INEOS will ensure that an effective waste management plan is put in place prior to decommissioning activities commencing. • Wastes will be categorised and handled in a manner that will minimise the threat to personnel and the environment; • INEOS will actively seek to reduce the amount of recovered materials that are sent to landfill. • INEOS will ensure all waste contractors are audited and meet relevant legislation.	12.2 & 12.1.3	INEOS and their contractors
16	Transboundary Impacts	• INEOS will ensure that the Bonn agreement is referenced appropriately in the Windermere OPEP.	13.2	INEOS

Ref No.	Commitment	Details	ES Section	Responsibility
17	Cumulative Impacts	• INEOS will ensure that prior to confirming timelines, consultation will be made with DNO North Sea so that activities can be coordinated to minimise the potential for noise generation at the same time. • INEOS will undertake a further impact assessment as part of permitting requirements in order to determine the cumulative impact of noise should schedule with Ketch operations overlap.	14	INEOS

16 Conclusions

Thirty environmental aspects were initially identified to have potentially significant impacts (see Aspects Table in Appendix B). With the application of mitigation and management measures, as identified within this ES, it is considered that the residual risk for all of these environmental aspects can be removed, reduced or managed so that they do not have residual impacts that are potentially significant (see Aspects Table in Appendix B and Sections 6-14). Table 16.1 provides a summary of the residual risk assessment conducted for significant impacts.

Table 16.1 A Summary of the Residual Risk Assessment Conducted for Significant Impacts

Windermere Decommissioning Project	Residual Risk									
	Positive		Negligible		Minor		Moderate		Major	
	Planned	Unplanned	Planned	Unplanned	Planned	Unplanned	Planned	Unplanned	Planned	Unplanned
Physical Presence	2		1		3					
Disturbance of the Seabed					6					
Noise and Vibration			1		2					
Atmospheric Emissions and Energy Balance	1				1					
Marine Discharges					3					
Unplanned Hydrocarbon Release				1		3				
Solid Wastes					2					
Transboundary Impacts			1		1	1				
Cumulative Impacts					1					
Total	**3**	**0**	**3**	**1**	**19**	**4**	**0**	**0**	**0**	**0**

In conclusion, all residual impacts (including transboundary and cumulative impacts) are considered to pose a risk to the environment that is minor or less (and in some instances positive) and therefore are not considered significant, provided the proposed mitigation and management measures, as identified within the ES, are implemented during the Windermere Decommissioning Project (refer to Table 16.1, Sections 6-14 and Appendix B).

17 References

Barne, J.H., Robson, C.F., Kaznowska, S.S. & Doody, J.P., (1995). Coasts and Seas of the United Kingdom. Region 6. Eastern England: Flamborough Head to Great Yarmouth.

Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H.,Miller, B., Moffat, C.F., (Eds) (2011). Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. pp. 191, website: http://www.gov.scot/Topics/marine/science/atlas (accessed March 2015).

BEIS (2018). Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines. November 2018.

BEIS (2020). Final UK greenhouse gas emissions national statistics: 1990-2018, website: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2018.

Bluestream (2010). Windermere Inspection Final Report, prepared by Bluestream on behalf of Centrica Energy Upstream, Project no. P9-155 part II, Document ref: B-PRJ-RPT-001.

BMT CORDAH (2003). Ross-worm non-technical report. Report to Subsea 7 as part of contract for ConocoPhillips. 8 pp.

BMT Cordah (2011). The Management of Marine Growth during Decommissioning, BMT Cordah Limited, commissioned by Oil & Gas UK Ltd. Report ref: A.CON.093.

Buchman, M. F. (2008). NOAA Screening Quick reference Tables, NOAA OR&R Report 08-1 Seattle, WA: Office of Responce and Restoration Division, National Oceanic and Atmospheric Administration.

BuildingGreen (1993). Cement and Concrete: Environmental Considerations from EBN Volume 2, No. 2 – March/April 1993, on the Cement Sustainability Initiative page of the World Business Council for Sustainable Development website, website: http://www.wbcsdcement.org/pdf/tf2/cementconc.pdf (accessed March 2015).

Cefas (2001a). Contaminant status of the North Sea, Technical report produced for Strategic Environmental Assessment – SEA-2, Technical Report TR_004, Produced by Cefas, website: https://www.gov.uk/government/publications/strategic-environmental-assessment-2-supporting-documents.

Cefas (2001b). North Sea Fish and Fisheries, Technical report produced for Strategic Environmental Assessment – SEA-2, Technical Report TR_003, Produced by Cefas, website: https://www.gov.uk/government/publications/strategic-environmental-assessment-2-supporting-documents.

Collins, M.B., Shimwell, S.J., Gao, S., Powell, H., Hewitson, C. & Taylor, J.A. (1995). Water and sediment movement in the vicinity of linear sandbanks: the Norfolk Banks, southern North Sea. Marine Geology, 123, 125-142.

Comber, S.D.W., Franklin, G., Gardner, M.J., Watts, C.D., Boxall, A.B.A., Howcroft, J., (2002). Partitioning of marine antifoulants in the marine environment. The Science of the Total Environment 286, 61-71.

Coull, K. A., Johnstone, R., and S.I. Rogers (1998). Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd.

Crown Estate Scotland (2017) Offshore Renewables and Cables & Pipelines Activity (25/09/2017), website: http://www.crownestatescotland.com/maps-and-publications#jump-Marine-Offshore wind

DECC (2008). EEMS Atmospherics Emissions Calculations, issue 1.10a, Department of Energy and Climate Change, Document reference: EEMS/ATMS/CALC/002, website: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/136461/atmos-calcs.pdf.

DECC (2009). Offshore Energy SEA Environmental Report: Future Leasing for Offshore Wind Farms and Licensing for Offshore Oil & Gas and Gas Storage, Department of Energy and Climate Change (DECC), website: https://www.gov.uk/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process.

DECC (2011). Guidance Notes – Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998.

DECC (2014b). Annual Statement of Emissions for 2012, Department of Energy and Climate Change, website: https://www.gov.uk/government/statistics/annual-statement-of-emissions-for-2012.

DECC (2016) UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3). Aberdeen: Department of Energy and Climate Change (DECC), website: https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-3-oesea3.

Defra (2011). Guidance on Applying the Waste Hierarchy, Department for Environment, Food and Rural Affairs, website: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69403/pb13530-waste-hierarchy-guidance.pdf.

DEFRA / DECC (2011). Guidelines for DERFA/DECC's Greenhouse Gas Conversion factors for Company Reporting. Produced by AEA for the Department of Energy and Climate Change (DECC) and the Department for Environment, Food and Rural Affairs (DEFRA).

DNO (2019). Ketch Decommissioning Programmes. Final. July 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/826988/Ketch_Decommissioning_Programme_BEIS_Final_July_2019.pdf

Dobson, M. & Frid, C. (1998). Ecology of Aquatic Systems, Addison Wesley Longman Ltd.

DTI (2002). Strategic Environmental Assessment of Parts of the Central & Southern North Sea - SEA 3. Report to the Department of Trade and Industry.

Earle, R. L. and Earle, M. D. (2004). Unit Operations in Food Processing, Web Edition 2004, published by The New Zealand Institute of Food Science & Technology (Inc.), website: http://www.nzifst.org.nz/unitoperations/contents.htm.

Ellis, J.R., Cruz-Martínez, A., Rackham, B.D. and Roger, S.I. (2004). The Distribution of Chondrichthyan Fishes Around the British Isles and Implications for Conservation, Journal of Northwest Atlantic Fishery Science, Volume 25: 195-213.

Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. & Brown, M.J. (2012). Spawning and nursery grounds of selected fish species in UK waters, CEFAS, Science Series, Technical Report no. 147, website: http://www.cefas.defra.gov.uk/publications/techrep/TechRep147.pdf.

EMODnet (European Marine Observation and Data Network) (2015). EMODnet Bathymetry portal, website: http://www.emodnet-bathymetry.eu.

Evans, P.G.H. and Nice, H. (1996). Review of the effects of underwater sound generated by seismic surveys on cetaceans, Sea Watch Foundation, Report for UKOOA.

Finding Sanctuary, Irish Seas Conservation Zones, Net Gain and Balanced Seas. (2012). Impact Assessment materials in support of the Regional Marine Conservation Zone Projects' Recommendations.

Fugro (2007). Report No. 9032V2.1: Pipeline route survey UKCS Block 49/4 to DCS Block J6-A, s.l.: s.n, Fugro Survey Limited.

Fugro (2010). Report No. GH031-02: Report of the Annual Offshore Pipelines and Platform Survey 2010 – Dutch and UK Continental Shelf, North Sea, Block J & Block 49, Prepared on behalf of Centrica Energy by Fugro Survey B.V, Survey Period: April 2010.

Fugro (2014a). Report No. GE030-R3: Windermere Decommissioning Environmental Survey UKCS (Block 49/09B), North Sea - Environmental Survey Results, Fugro Survey B.V.

Fugro (2014b). Report No. GE030-R2: Windermere Decommissioning Environmental Survey UKCS (Block 49/09B), North Sea – Geophysical Survey Results, Fugro Survey B.V.

Fugro (2014c). Supplement to Report No. GE030-R3: Windermere Decommissioning Environmental Survey UKCS (BLOCK 49/9B), North Sea – Statement confirming absence of Annex I habitats, Fugro Survey B.V.

Fugro (2014d). Report No.130019.1V1.2. ST-1 Decommissioning Survey UKCS Block 49/5a, Volume 1 of 2: Environmental Habitat Assessment with Herring Spawning Ground Assessment, s.l.: s.n, Fugro Survey Limited.

Fugro (2014e). FSLTD Report No: 131229.1BV3.1. Grove NE Infill Rig Site and Pipeline Route Surveys UKCS Block 49/10a, 49/10c and NLCS Block J6, s.l.: s.n, Fugro Survey Limited.

Fugro (2014f). Report No. 131229.4V2.2. Stamford Well and Stamford to J6A 6" Gas Pipeline and 5" Umbilical Pre-decommissioning Survey, s.l.: s.n, Fugro Survey Limited.

Gardline (2013). Forewind LTD, Dogger Bank Offshore Wind Farm – Tranche B and Teeside Cable Corridor Benthic Survey, Environmental Characterisation Report, prepared by Gardline Environmental Limited on behalf of Forewind LTD, Project Ref: 9180-1, website: http://www.forewind.co.uk/uploads/files/Teesside/Phase2_Consultation/Chapter_12_Appendix_A_Tranche_B_and_Export_Cable_Corridor_Benthic_Survey_Report.pdf.

Genesis (2011). Review and Assessment of Underwater Sound Produced from Oil and Gas Sound Activities and Potential Reporting Requirements under the Marine Strategy Framework Directive. 2011. Genesis Oil and Gas Consultants report for the Department of Energy and Climate Change.

GESAMP (1993). Impact of oil and related chemicals and wastes on the marine environment, Reports and Studies GESAMP 50, International Maritime Organization, London, U.K. 180p.

Graham, C., Campbell, E., Cavill, J., Gillespie, E. & Williams, R. (2001). JNCC Marine Habitats GIS Version 3: its structure and content. British Geological Survey Commissioned Report, CR/01/238. UK: British Geological Survey

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Vingada, J., Øien, N. (2017) Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys, May 2017, website: https://synergy.st-andrews.ac.uk/scans3/2017/05/01/first-results-are-in/.

Harvey, L. (2010). Energy Efficiency and Demand for Energy Services. Energy and the New Reality 1. Earthscan Ltd. Cromwell Press, London, UK. ISBN: 978-1- 84971-912-5.

Houghton, J.D.R., Doyle, T.K., Wilson, M.W., Davenport, J. & Hays, G.C. (2006). Developing a simple rapid method for identifying and monitoring jellyfish aggregations from the air. Mar. Ecol. Prog. Ser. 314: 159-170.

Hydrographer of the Navy (2008). International Chart Series No. 2182A, Hydrographer of the Navy.

IAMMWG (2015) Management Units for Cetaceans in UK Waters (January 2015). Peterborough: Inter-Agency Marine Mammal Working Group, Joint Nature Conservation Committee. Report No. 547.

INEOS (2021a). Windermere Decommissioning Programmes, Document Number: RD-WIN-ZPL001.

INEOS (2021b). Windermere Decommissioning Project: Comparative Assessment Report, Document Number: RD-WIN-ZPL002.

IoP (2000). Guidelines for the calculation of estimates of energy use and gaseous emissions in the decommissioning of offshore structures, Institute of Petroleum, February 2000.

IPCC (2007). IPCC Fourth Assessment Report, Working Group I Report, Chapter 2, 2007. Intergovernmental Panel on Climate Change (IPCC), 2007.

IUCN (2018) The IUCN Red List of Threatened Species. Website: http://www.iucnredlist.org/.

Jak, R., Bos, O., Witbaard, R. & Lindeboom, H. (2009). Conservation objectives for Natura 2000 sites (SACa and SPAs) in the Dutch sector of the North Sea. Department of Knowledge,Ministry of Agriculture, Nature and Food Quality on behalf of the Marine Ecological Network and Natura 2000 theme, p. Report No. C065/09.

JNCC (1999). Seabird Vulnerability in UK Waters: Block Specific Vulnerability, 1999. Joint Nature Conservation Committee, Aberdeen.

JNCC (2008a). Onshore Special Area of Conservation: North Norfolk Sandbanks and Saturn Reef. SAC Selection Assessment. Version 4.0 July 2008, Joint Nature Conservation Committee.

JNCC (2008b). UK Biodiversity Action Plan Priority Habitat Descriptions – Sabellaria spinulosa reef. Joint Nature Conservation Committee, website: http://jncc.defra.gov.uk/page-5706.

JNCC (2008c). The deliberate disturbance of marine European Protected Species Guidance for English and Welsh territorial waters and the UK offshore marine area, Joint Nature Conservation Committee.

JNCC (2010). Special Areas of Conservation (SAC): North Norfolk Sandbanks and Saturn Reef. Conservation Objectives and Advice on Operations V6.0, Joint Nature Conservation Committee website:

http://jncc.defra.gov.uk/pdf/NNSandbanksandSaturnReef_ConservationObjectives_AdviceonOperations_6.0.pdf (accessed January 2015).

JNCC (2011). Habitat account – Marine, coastal and halophytic habitats: 1110 Sandbanks which are slightly covered by seawater all of the time, Joint Nature Conservation Committee, website: http://jncc.defra.gov.uk/ProtectedSites/SAC selection/habitat.asp?FeatureIntCode=H1110.

JNCC (2017b) North Norfolk Sandbanks and Saturn Reef MPA, website: http://jncc.defra.gov.uk/page-6537.

JNCC (2019). Southern North Sea MPA. Website https://jncc.gov.uk/our-work/southern-north-sea-mpa/

JNCC (2020a). Markham's Triangle MPA, website https://jncc.gov.uk/our-work/markhams-triangle-mpa/#summary. Updated July 2020.

JNCC (2020b). Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs. May 2020. https://data.jncc.gov.uk/data/2e60a9a0-4366-4971-9327-2bc409e09784/JNCC-Report-654-FINAL-WEB.pdf

JNCC (2020c) SACs with Marine Components. https://jncc.gov.uk/our-work/sacs-with-marine-components/

JNCC (2021a). Annex II Species Account: 1365 Common seal, Joint Nature Conservation Committee, website: https://sac.jncc.gov.uk/species/S1365/.

JNCC (2021b). Annex II Species Account: 1364 Grey seal, Joint Nature Conservation Committee, website: https://sac.jncc.gov.uk/species/S1364/

JNCC, Natural England, CCW (2010). JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys (DRAFT), Joint Nature Conservation Committee, Natural England and Countryside Council for Wales.

KIS-OCRA (2018). Kingfisher Information Systems – Offshore Cable and Renewables Awareness: Online Map, website: http://www.kis-orca.eu/map#.WmHFwbp2v4h.

Korevaar, C.G. (1990). North Sea Climate based on observations from ships and light vessels. Kluwer Academic Publishers.

Künitzer, A., Basford, D., Craeymeersch, J. A., Dewarumez, J. M., Dörjes, J., Duineveld, G. C. A., Eleftheriou, A., Heip, C., Herman, P., Kingston, P., Niermann, U., Rachor, E., Rumohr, H. and de Wilde, P. A. J (1992). The Benthic Infauna of the North Sea: Species Distribution and Assemblages, ICES Journal of Marine Science, 49: 127 – 143.

Kunzlik, P.A. (1988). The Basking Shark. Scottish Fisheries Information Pamphlet Number 14, 1988.

Law, R.J. and Fileman, T.W. (1985). The distribution of hydrocarbons in surficial sediments of the central North Sea. Mar. Pollut. Bull., 16: 335 – 337.

Lawrence (2000). Hederson's Dictionary of Biological Terms. Prince Hall.

Leterme S.C., Seuront L. & Edwards M. (2006). Differential contribution of diatoms and dinoflagellates to phytoplankton biomass in the NE Atlantic and the North Sea, Mar. Ecol.-Prog. Ser. 312: 57–65.

LGL (2009). Cetacean Stock Assessment in Relation to Exploration and Production Industry Sound, LGL Limited, prepared on behalf of Joint Industry Programme by LGL Limited environmental research associates and LGL Alaska Research Associates Inc., LGL Report TA4582-1, Canada.

Lindebloom, H., Geurts van Kessel, J. & Birkenbosch, L. (2005). Areas with special ecological values on the Dutch Continental Shelf. Ministerie van Verkeer en Waterstaat, p. Report RIKZ/2005.008. Alterra Report nr. 1203.

Marine Scotland (2020) Fishing Effort and Quantity and Value of Landings by ICES Rectangle. website: http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/RectangleData.

MarLIN (2015) Biodiversity and Conservation, The Marine Life Information Network, website: http://www.marlin.ac.uk/bacs.php.

Matthiopoulos J, McConnell B, Duck C, Fedack M (2004). Using satellite telemetry and aerial counts to estimate space use by grey seals around the British Isles. Journal of Applied Ecology 41: 476-491.

McConnell BJ, Fedak MA, Lovell P, Hammond PS (1999). Movements and foraging areas of grey seals in the North Sea. Journal of Applied Ecology 36, 573-590.

MMC (2007). Marine Mammals and Noise: A Sound Approach to Research And Management, A Report to Congress from the Marine Mammal Commission.

MMO (2014a). Seascape character area assessment East Inshore and East Offshore marine plan areas, website: http://www.marinemanagement.org.uk/marineplanning/areas/documents/east_seascape.pdf.

MMO (2014b). Guidance for marine licensing staff to support the implementation of marine planning policies for socio-economics, tourism and seascape (MMO 1078), Marine Management Organisation, website: https://www.gov.uk/government/publications/guidance-on-socio-economic-tourism-and-recreation-impact-assessment-and-seascape-character-assessment-to-support-marine-planning-mmo-1078.

MMO (2014c). UK Sea Fisheries Statistics 2013 – Chapter 3: Landings, Table 3.17: Average price of fish landed by UK vessels into the UK: 1938 to 2013, Marine Management Organisation, website: https://www.gov.uk/government/statistical-data-sets/uk-sea-fisheries-annual-statistics-report-2013.

Moyle, P.B. & Cech, J.J. (2004). Fishes: An introduction to Ichthyology. Pearson Prentice Hall.

Natural England (2012). Seascape characterisation around the English Coast (Marine Plan areas 3 and 4 and part of area 6 pilot study). Report NECR106. October 2012.

Natural England (2013). MCZ Factsheets – November 2013. http://publications.naturalengland.org.uk/category/1721481.

Nedwell, J.R. & Edwards, B. (2004). A review of the measurement of underwater man made noise carried out by Subacoustech Ltd. Subacoustech Ltd. 2004.

Net Gain (2011). Final recommendations – Submission to Natural England and JNCC. 31 August 2011. Version 1.2.

Noordzeeloket (2014). North Sea Natura 2000: Cleaver Bank, Government of the Netherlands, website: http://www.noordzeeloket.nl/en/projects/north-sea-natura-2000/sites/cleaver-bank/ (accessed January 2015).

Nowacek, D.P., Thorne, L.H., Johnston, D.W. & Tyack, P.L. (2007). Responses of cetaceans to anthropogenic noise. Mammal Review. 37 (2): 81-115

NSTF (1993). North Sea Quality Status Report 1993 - London (Oslo and Paris Commissions) & Fredensborg, North Sea Task Force, Denmark (Olsen & Olsen).

ODE (2014). Windermere Decommissioning Define Phase: Topsides and Jacket Offshore Surveys Instructions and Findings, prepared by ODE (Offshore Design Engineering) for RWE Dea UK, Document Number: 277802-TEM-0002 Rev 1, Client Reference: RD - WINR - ODE - PM - RT – 92011, Issue date: 15th October 2014.

ODE (2015a). Windermere Decommissioning: Marine Growth Weight Estimate, prepared by ODE for RWE Dea UK, reference 277802.

ODE (2015b). RWE - Windermere Decommissioning: Answer to Orbis queries, Rev A, prepared by ODE for RWE Dea UK, reference 277802.

OGA (2016) 29th Licensing Round Information – Levels of Shipping Activity, August 2016.

OGP (2008). Guidelines for the management of Naturally Occurring Radioactive Material (NORM) in the oil and gas industry. Report No. 412. September 2008.

OGUK (2009) Environmental Emissions: Chemical Discharges, Oil & Gas UK, online: http://www.oilandgasuk.co.uk/knowledgecentre/chemical_discharges.cfm.

OGUK (2012). The Decommissioning of Steel Piled Jackets in the North Sea Region, Oil & Gas UK, website: http://www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/OP074.pdf.

Orsted (2020). About the Project. https://hornseaproject3.co.uk/about-the-project#project-timeline-december-2020

OSPAR (2008). OSPAR guidance on environmental considerations for offshore wind farm development. Reference: 2008-3.

OSPAR (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment, Biodiversity Series, The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention"), website: http://www.ospar.org/ documents/dbase/publications/p00441_noise%20background%20document.pdf.

OSPAR (2012). CEMP Assessment 2012: Levels and Trends in Marine Contaminants and their Biological Effects, s.l.: OSPAR Commission.

OSPAR Commission (2000). Quality Status Report 2000, Region II - Greater North Sea. OSPAR Commission, London, 136 +xiii pp.

Pierpoint, C. (2000). Bycatch of marine turtles in UK and Irish waters, JNCC Report No 310, website: http://jncc.defra.gov.uk/pdf/jncc_310.pdf.

Pollock, C. M., Mavor, R., Weir, C. R., Reid, A., White, R. W., Tasker, M. L., Webb, A. and Reid, J. B. (2000). The Distribution of Seabirds and Marine Mammals in the Atlantic Frontier, North and West of Scotland, Joint Nature Conservation Committee, Aberdeen.

Pomeroy, P.P., Twiss, S.D. & Duck, C.D., (2000). Expansion of a grey seal (Halichoerus grypus) breeding colony: changes in pupping site use at the Isle of May, Scotland. Journal of Zoology, London, 250, 1-12.

RDUK (2007). Environmental Report 2006, RWE Dea UK, Document number: RD-COR-SRT009-1.

RDUK (2012). Windermere Production Oil Pollution Emergency Plan, RWE Dea UK, document number RD-WIN-SPL002-4.

RDUK (2014). Environmental Report 2013, RWE Dea UK, Document number: RD-COR-SRT034-1.

Rees, H.L., Eggleton, J.D., Rachor, E., Vanden Berghe, E. (Ed.) (2007). Structure and Dynamic of the North Sea Benthos, ICES Cooperative Research Report, No 288, International Council for the Exploration of the Sea, Copenhagen, website: http://www.ices.dk/sites/pub/Publication%20Reports/Cooperative%20Research%20Report%20(CRR)/crr288/CRR%20288.pdf.

Reid, J., Evans, P.G.H. and Northridge, S. (Eds) (2003). An atlas of cetacean distribution on the Northwest European continental shelf. Joint Nature Conservation Committee, Peterborough.

Richardson, W.J., Greene, C.R. Jr., Malme, C.I. & Thomson, D.H. (1995). Marine mammals and noise. Academic Press, San Diego.

SCOS (2012). Scientific Advice on Matters Related to the Management of Seal Populations: 2012, SCOS Main Advice 2012, website: http://www.smru.st-andrews.ac.uk/documents/1199.pdf.

SCOS (2016) Scientific advice on matters related to the management of seal populations: 2016. St. Andrews: Special Committee on Seals (SCOS), website: http://www.smru.st-andrews.ac.uk/files/2017/04/SCOS-2016.pdf.

Sims, D.W., Southall, E.J., Metcalfe, J.D. and Pawson, M.G. (2005). Basking shark population assessment, Final report for Global wildlife Division of Defra Tender CR0247.

Sims, D.W., Southall, E.J., Richardson, A.J., Reid, P.C. & Metcalf, J.D. (2003). Seasonal movements and behaviour of basking sharks from archival tagging; no evidence of winter hibernation, Marine Ecology Progress Series 248: 187-196.

Smith, J. (1998). UKCS 18th Round Environmental Screening Report: Area IV Southern North Sea. Report to UKOOA. CORDAH, Neyland, Pembrokeshire. Report No. OPRU/6/98 65 pp. plus figures.

SMRU and Marine Scotland (2017) Estimated at-sea Distribution of Grey and Harbour Seals – updated maps 2017. doi: 10.7489/2029-1. website: https://data.marine.gov.scot/dataset/estimated-sea-distribution-grey-and-harbour-seals-updated-maps-2017.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr., C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. & Tyack, P.L.

(2007). Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals 33, 411–521.

SPD (2013). Windermere Wells Decommissioning Concept Select Study, prepared by SPD on behalf of RWE Dea UK.

Swan, J., Neff, J. & Young, P. (1994). Environmental implications of offshore oil and gas development in Australia: The findings of an independent scientific review, Australian Petroleum Exploration Association, Sydney.

Thaxter, C. B., Lascelles, B., Sugar, K., Cook, A. S. C. P., Roos, S., Bolton, M., Langston, R. H. W. and Burton, N. H. K. (2012). Seabird Foraging Ranges as a Preliminary Tool for Identifying Candidate Marine Protected Areas, Biological Conservation, 156: 53 – 61.

Thomsen, F. & Schack, H.B. (2013). Danish sustainable offshore decommissioning: Decommissioning of an oil rig in the Ekofisk oil field – A risk assessment. Offshore Centre Danmark. 31 pp.

Turnpenny, A.W.H. & Nedwell, J.R. (1994). The effects on marine fish, diving mammals and birds of underwater sound generated by seismic surveys. FARL Report Reference: FCR 089/94, October 1994.

Tvedten (2001). EIA of disposal of marine growth from Maureen at Aker Stord. Øyvind F. Tvedten, RF – Rogaland Research. 2001.

UK Oil and Gas Data (2018) Data Registry for UK Offshore Oil and Gas, Website: www.ukoilandgasdata.com.

UKDMAP (1998). United Kingdom Digital Marine Atlas, Third Edition, July 1998, National Environmental Research Council.

UKOOA (2001). An analysis of UK Offshore oil and gas environmental surveys 1975 – 1995, Aberdeen: Heriot-Watt University, UKOOA.

Webb, A., Elgie, M., Irwin, C., Pollock, C. and Barton, C. (2016) Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK. website: http://jncc.defra.gov.uk/page-7373.

Weilgart, L.S. (2007). The impacts of anthropogenic ocean noise on cetaceans and implications for management, Canada Journal of Zoology. 85: 1091 – 1116.

Weir, C.R., Pollock, C., Cronin, C. and Taylor, S., (2001). Cetaceans of the Atlantic Frontier, north and west of Scotland. Continental Shelf Research, 21, 1047–1071.

Westerberg, H. (1999). Impact Studies of Sea-Based Windpower in Sweden. "Technische Eingriffe in marine Lebensraume". In: Vella, G. 2002. Offshore Wind: The Environmental Implications, website: http://www.utilitiesproject.com/documents.asp?grID=117&d_ID=880.

Wiig, Ø. (1986). The status of the grey seal Halichoerus grypus in Norway. Biol. Conserv. 38: 339-349.

Appendices

18 Legislation and Marine Policy

18.1 Key International and National Legislation

Table 18.1 shows some of the key national and international legislation which is applicable to the Windermere Decommissioning Programme.

Table 18.1 Key Environmental Legislation of Relevance to the Proposed Windermere Decommissioning Programme

Legislation	Overview of Objectives	Relevance to the Windermere Decommissioning Programme
The Petroleum Act 1998 (as amended by the Energy Act 2008).	This Act sets out the requirements for undertaking the decommissioning of offshore installations and pipelines including preparation and submission of a Decommissioning Programme (DP). It also requires that decommissioning proposals for pipelines should be contained within a separate DP from that of installations unless within the same field.	DPs will be submitted for approval alongside the ES.
The Energy Act 2008	Part 3 – Sets out provisions for the abandonment of wells including financial security provisions and enables the BEIS Secretary of State (SoS) to make all relevant parties liable for the decommissioning of an installation or pipeline powers to protect the fund for decommissioning in case of insolvency of the owner parties. A written consent is required from the SoS if a relevant operation will result, or is likely to result, in an obstruction or danger to navigation (during or subsequent to the operation). The relevant operations will include the construction, alteration, maintenance, improvement, dismantling or abandonment of any works; and the deposit or removal of any substance or article.	Consent to locate will be applied for prior to applicable offshore activities commencing.
Marine and Coastal Access Act 2009 (MCAA)	Introduced a marine licensing system to cover those offshore energy activities that are the responsibility of BEIS, and which are not excluded from the MCAA licensing provisions. The licensable activities are principally related to decommissioning and include: • Seabed disturbance (i.e. to access platform legs or relocate cuttings piles or carry out trenching work that is not covered by a Pipeline Works Authorisation (PWA)); • Temporary deposits during abandonment; • Deposits or removal of certain cables (not covered by PWA); • Deposits (including setting the provisions for marking objects on the seabed) or removal of objects e.g. rock dumping, mattress placement or burial operations not covered by a PWA, or to remove platforms or other structures from the seabed;	Marine Licenses will be applied for, as applicable, to cover all of the proposed activities relevant to the Decommissioning Programme.

Legislation	Overview of Objectives	Relevance to the Windermere Decommissioning Programme
	• Deposit and use of explosives to remove structures. The legislation also makes provision for the designation of Marine Conservation Zones (MCZs) and the establishment of the Marine Management Organisation (MMO) who deal with aspects of licensing marine activities through the implementation of Marine Plans and Policy.	
The Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2011	Requires environmental assessments to be carried out for offshore oil and gas decommissioning activities. A Decommissioning Programme must be supported by an EIA through the production of an ES. A Comparative Assessment will also be required in the case of OSPAR derogation cases where some (if not all) infrastructure is to be left in place, in this all of the disposal options must be assessed.	An EIA has been undertaken along with a Comparative Assessment for the decommissioning of the pipeline, umbilical and stabilisation materials.
The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended)	Applies the Habitats Directive and the Wild Birds Directive in relation to oil and gas plans or projects wholly or partly on the United Kingdom's Continental Shelf and superjacent waters outside territorial waters ('the UKCS').	A pre-decommissioning site survey has been conducted. No potential Annex I habitats were identified.
The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended)	Ensures that certain activities that have an effect on important species and habitats in the offshore marine environment, can be managed. The 2010 amendment makes it an offence to deliberately disturb wild animals of a European Protected Species (EPS) in such a way as to be likely (a) to impair their ability (i) to survive, breed, or rear or nurture their young; or (ii) in the case of animals of a hibernating or migratory species, to hibernate or migrate or b) to affect significantly the local distribution or abundance of that species. If explosives are used for abandonment, consultation must be undertaken with BEIS and JNCC. Consideration must be given to the impact on offshore habitats and species.	The ES has considered the use of explosives in a 'worst case scenario'. Other potential impacts have been assessed in the ES. A separate Noise Assessment will be produced, as required A Wildlife (or EPS Disturbance) License will be obtained, if required.
Offshore Chemicals Regulations 2002 (as amended)	All activities, which use and/or discharge chemicals to the marine environment during well suspension/abandonment and used during decommissioning must be detailed on a Chemical Permit. These permits require details of all the chemicals to be used and discharged and an assessment of their likely effects on the environment.	Chemical permit applications will be in place prior to offshore activities commencing if chemicals are used/discharged.
Merchant Shipping (Oil Pollution Preparedness, Response and Cooperation	Implements The Oil Pollution Preparedness, Response and Cooperation Convention (OPRC Convention) in the UK, which aims to facilitate international co-operation and mutual assistance in preparing for and responding to a major oil pollution incident and to encourage states to develop and maintain an adequate capability to deal with oil pollution emergencies. All offshore production installations must have an Oil Pollution Emergency Response Plan (OPEP) in place.	The Windermere installation has an approved OPEP in place. However, it will be reviewed and updated as required, prior to

Legislation	Overview of Objectives	Relevance to the Windermere Decommissioning Programme
Convention) Regulations 1998 (as amended)	The existing OPEP covers activities relating to decommissioning and should be revised to include such activities or a separate decommissioning OPEP should be submitted. The 2015 Amendment Regulations implement the European Union Directive 2013/30/EU on the safety of offshore oil and gas operations.	decommissioning activities commencing.
The Offshore Installation (Emergency Pollution and Control) Regulations 2002	The Offshore Installations (Emergency Pollution Control) Regulations 2002 give the government powers to intervene in the event of an incident or accident involving an offshore installation where: • There is, or may be a risk of, significant pollution; • An operator is failing or has failed to implement effective control and preventative operations. BEIS's role is to monitor, and if necessary intervene, to protect the environment in the event of a threatened or actual pollution incident in connection with an offshore installation.	The Windermere installation has an approved OPEP in place. However, it will be reviewed and updated as required, prior to decommissioning activities commencing.
Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended)	Prohibits the discharge of oil to sea other than in accordance with the terms and conditions of a permit. Operators of offshore installations must identify all planned oil discharges to relevant waters and apply for the appropriate OPPC permits.	May be required for the discharge of residual hydrocarbons in the pipelines – INEOS will apply for OPPC applications, if applicable.
The Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2001	Transpose the relevant provisions of the Industrial Emissions Directive 2010/75/EU in respect to specific atmospheric pollutants from combustion installations (with a thermal capacity rating ≥ 50 MW) on offshore platforms. Such permits would have been granted prior to decommissioning, if the power generation is below this threshold during the course of the decommissioning, the operator will be required to surrender the permit.	No action required – Windermere doesn't have power generation facilities.
The Greenhouse Gas Emissions Trading Scheme (ETS) Regulations 2005 (as amended)	A permit would have been granted to cover the emission of greenhouse gases for facilities which have an aggregated thermal capacity from combustion equipment >20 MW(th) prior to decommissioning. Therefore when the thermal capacity falls below this threshold the permit must be surrendered. The installation(s) will be deemed closed and will fall out of the ETS.	No action required – Windermere doesn't have power generation facilities.
The Merchant Shipping (Prevention of Air Pollution from Ships)	Implements International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 Convention in the UK.	INEOS will ensure all vessels associated with the DP will comply with this regulation.

Legislation	Overview of Objectives	Relevance to the Windermere Decommissioning Programme
Regulations 2008 (as amended)		
The Environment Protection Act 1990 (EPA 90)	Part 2 of the EPA 90 introduces the Operators Duty of Care, which obliges waste producers to manage their wastes responsibly	A Waste Management Plan will be in place for all waste streams which will place emphasis on the waste hierarchy principles.
Control of Pollution (Amendment) Act 1989 (as amended)	This is the principle legislation which requires all carriers of controlled waste (which includes waste arising from domestic, industrial and commercial premises as well as special/hazardous waste for which there are additional regulations) to be registered.	A Waste Management Plan will be in place with approved waste handing/disposal contractors used.
Mercury Export and Data (Enforcement) Regulations 2010	Puts in place the provisions for UK enforcement and management of directly applicable obligations under the EU Mercury Regulation, which implements the objectives of the Community Strategy Concerning Mercury (adopted in 2005), namely to reduce the supply of, and demand for, mercury in order to protect human health and the environment.	INEOS will ensure that any mercury waste is sent to shore in-line with existing legislation for the containment/shipment of hazardous waste.
The Radioactive Substances Act (1993) and Environmental Permitting (England and Wales Regulations 2010 (as amended)	This Act prohibits the disposal and accumulation of radioactive waste except as authorised by the Environment Agency (EA). Registration for accumulation of radioactive substances is required under this Act, this includes LSA and NORM. Some accumulation and deposits are exempt from licensing due to the low levels of activity.	Windermere has a permit for storage and handling of NORM.
OSPAR Decision 98/3 on the disposal of Disused Offshore Installations	This decision prohibits the dumping and leaving wholly or partially in place of disused offshore installations with some exceptions for large structures (derogation cases).	The platforms will be wholly removed with the exception of the piles which will be cut below the seabed
OSPAR Recommendation 2003/5 to Promote the Use and Implementation of Environmental	All operators controlling the operation of offshore installations on the UKCS are required to have in place an independently verified Environmental Management System (EMS) designed to achieve: the environmental goals of the prevention and elimination of pollution from offshore sources and of the protection and conservation of the maritime area against other adverse effects of offshore activities and to demonstrate continual improvement in environmental performance. OSPAR recognises the ISO 14001: 2015 & EMAS International standards as	INEOS operate under an integrated SH&EMS which is certified to ISO 14001.

Legislation	Overview of Objectives	Relevance to the Windermere Decommissioning Programme
Management Systems by the Offshore Industry	containing the necessary elements to fulfil these requirements. All operators are also required to provide a public statement of their environmental performance on an annual basis.	
OSPAR Recommendation 2006/5 on a management scheme for Offshore cuttings piles	This outlines the approach for the management of cuttings piles left on the seabed.	No action necessary – There are no expected drill cuttings associated with the project. It is likely that cuttings will have been widely dispersed given the hydrodynamic regime in the area.

18.2 National Marine Policy – The Marine and Coastal Access Act (MCAA) 2009

Table 18.2 identifies the objectives of the East Inshore and East Offshore Marine Plans that are relevant to the Windermere Decommissioning Programme, along with their (directly) associated and contributing (i.e. indirectly associated) plan policies. Table 18.3 lists the plan policies, identified in Table 18.2, by sector and explains their relevance to the Windermere Decommissioning Programme.

Table 18.2 East Inshore and East Offshore Marine Plans – Objectives and Their Associated and Contributing Plan Policies that are Relevant to the Windermere Decommissioning Programme

Objectives	Plan Policy	
	Associated Policy	Contributing Policy
Objective 1: To promote the sustainable development of economically productive activities, while taking account of spatial requirements of other activities of importance to the East marine plan areas.	**-**	GOV3; OG1; WIND1; PS1 PS2; FISH1; FISH2; TR1
Objective 2: To support activities that create employment at all skill levels, taking account of the spatial and other requirements of activities in the East marine plan areas.	**EC2**	BIO1; MPA1; DEF1; OG1; WIND1; PS1; PS2; FISH1; FISH2; TR1
Objective 5: To conserve heritage assets and ensure that decisions consider the character of the local area.	**SOC2; SOC3**	FISH1
Objective 6: To have a healthy, resilient and adaptable marine ecosystem in the East marine plan areas.	**ECO1; ECO2**	BIO1; MPA1; FISH2
Objective 7: To protect, conserve and, where appropriate, recover biodiversity that is in or dependent upon the East marine plan areas.	**BIO1**	ECO1; ECO2; MPA1; GOV3 FISH2
Objective 8: To support the objectives of MPAs (and other designated sites around the coast that overlap, or are adjacent to the East marine plan areas), individually and as part of an ecologically coherent network.	**MPA1**	ECO1; ECO2; BIO1; GOV1; FISH2
Objective 9: To facilitate action on climate change adaptation and mitigation in the East marine plan	**-**	WIND1
Objective 10: To ensure integration with other plans and regulations and management of key activities and issues in the East marine plan, and adjacent areas	**GOV3**	-

Table 18.3 East Inshore and East Offshore Marine Plans - Objectives and Policies of Relevance to the Windermere Decommissioning Programme

Sector	Policy	Relevance to the Windermere Decommissioning Programme
(BIO) Biodiversity	**BIO1:** Appropriate weight should be attached to biodiversity, taking account of the best available evidence including on habitats and species that are protected or of conservation concern in the East marine plan areas.	Refer to Section 4.3 of the ES.
(CC) Climate Change	**CC2:** Proposals for development should minimise as far as practicable emissions of greenhouse gases. Mitigation measures will also be encouraged. Consideration should also be given to: Emissions from other activities or users affected by the proposal; The impact upon mitigation measures that may be in place related to other activities.	Mitigation measures will be put in place to minimise greenhouse gas emissions. Refer to Section 9 of the ES.
(DEF) Defence	**DEF1:** Proposals in or affecting MoD danger and exercise areas should not be authorised without agreement from the MoD.	Blocks of Interest lie within PEXA. INEOS will liaise with the MoD prior to an the commencement of decommissioning activities (Refer to Section 4.4.4)
(EC) Economic	**EC2:** Proposals that provide additional sustainable employment benefits should be supported, particularly where these benefits have the potential to meet employment needs in localities close to the marine plan areas.	Project will create employment for contractors offshore as well as sites handling the decommissioned material onshore.
(ECO) Ecosystem	**ECO1:** Cumulative impacts affecting the ecosystem of the East marine plans and adjacent areas (marine, terrestrial) should be taken into account in decision-making and plan implementation.	No significant cumulative impacts have been identified. Refer to Section 14 of the ES.
	ECO2: The risk of release of hazardous substances as a result of any increased collision risk should be taken account of in proposals that require an authorisation.	Oil spill modelling has been undertaken for the project. Refer to Section 11 of the ES.
(FISH) Fisheries	**FISH1:** Within areas of fishing activity, proposals should demonstrate in order of preference: That they will not prevent fishing activities on, or access to, fishing grounds; How, if there are impacts on the ability to undertake fishing activities and access to fishing grounds, they will minimise or mitigate these;	There will be a temporary loss of access to fishing grounds during the decommissioning operations, particularly during the removal of the platform. However, following removal, there will be no restrictions on fishing that were in place around the platforms. INEOS will inform fishermen who use the area in advance of offshore activities commencing allowing fishing vessels

Sector	Policy	Relevance to the Windermere Decommissioning Programme
	The case for proceeding with their proposal if it is not possible to minimise or mitigate the impacts.	to plan alternative deployment. Refer to Section 6.1 of the ES.
	FISH2: Within and adjacent to spawning and nursery areas and their associated habitat, applications for proposals should demonstrate, in order of preference: That they will not have an impact upon spawning and nursery areas and the associated habitat; How, if there are impacts upon the spawning and nursery areas and the associated habitat, they will minimise or mitigate these; The case for proceeding with their proposals if it is not possible to minimise or mitigate the impacts.	Some seabed disturbance may occur from the removal of seabed infrastructure, however the effects are likely to be temporary (Refer to Section 7 of the ES).
(GOV) Governance	**GOV3:** Proposals should demonstrate in order of preference: That they will avoid displacement of other existing or authorised but yet to be implemented activities; How, if there are impacts resulting in displacement by the proposed activity, they will minimise or mitigate these impacts; The case for proceeding with the proposal if it is not possible to minimise or mitigate the impacts of displacement.	The impact of displacement of shipping and commercial fishing is discussed in Section 6.
(MPAs) Marine Protected Areas	**MPA1:** Any impacts on the overall MPA network must be taken account of in strategic level measures and assessments, with due regard given to any current agreed advice on an ecologically coherent network.	While the Windermere Development does not lie within a MPA, it is located 2.5 km from an MCZ and within 26 km of two SACs (refer to Section 4.3.6). However, the integrity of these sites is not expected to be significantly impacted by the proposed operations.
(OG) Oil and Gas	**OG1:** Proposals within areas with existing oil and gas production should not be authorised except where compatibility with oil and gas production and infrastructure can be satisfactorily demonstrated.	The project is compatible with oil and gas production and infrastructure.
(PS) Ports and Shipping	**PS1:** Proposals that require static, sea surface infrastructure or that significantly reduce under-keel clearance will not be authorised in International Maritime Organisation (IMO) designated routes.	Static infrastructure will not be required. All decommissioning operations will be temporary.

Sector	Policy	Relevance to the Windermere Decommissioning Programme
	PS2: Proposals that require static, sea surface infrastructure which encroaches upon important navigation routes should not be authorised unless there are exceptional circumstances. Proposals should: Be compatible with the need to maintain space for safe navigation, avoiding adverse economic impact; Anticipate and provide for future safe navigational requirements where evidence and / or stakeholder input allows; Account for cumulative impacts upon navigation resulting from the proposal and other existing (and known proposed) activities as well as known proposed developments.	Some of the UKCS Blocks are located are ranked as having 'high' or 'very high' shipping activity. Consultations prior to and communications during decommissioning will be maintained.
(SOC) Social and Cultural	**SOC2:** Proposals that may affect heritage assets should demonstrate, in order of preference: That they will not compromise the heritage asset; How, if there are impacts on a heritage asset, they will minimise or mitigate these; The case for proceeding with the proposal if it is not possible to minimise or mitigate the impact.	The project will not impact on any heritage assets (Refer to Section 4.4.7 of the ES).
	SOC3: Proposals should consider the potential impacts on the terrestrial and marine character of an area, taking into account any proposed mitigation measures.	While the Windermere Development does not lie within a MPA, it is located 2.5 km from an MCZ and within 26 km of two SACs (refer to Section 4.3.6). However, the integrity of these sites is not expected to be significantly impacted by the proposed operations.
(TR) Tourism and Recreation	**TR1:** Proposals for development should demonstrate that during construction, in order of preference: They will not disrupt or disturb tourism and recreation activities; How, if there are impacts on tourism and recreation activities they will minimise or mitigate the impacts; The case for proceeding with the proposal if it is not possible to minimise or mitigate the impacts.	Given the distance from shore, it is not anticipated that decommissioning activities will disrupt or disturb tourism and recreation activities. Vessels may be seen from the shore, particularly in transit between the Windermere Development and onshore yards, but the duration of this will be minimal.

Sector	Policy	Relevance to the Windermere Decommissioning Programme
(WIND) Offshore Wind Renewable Energy	**WIND1:** Proposals for other development or activities that require authorisation, which are in or could affect sites held under a lease or an agreement for lease that has been granted by The Crown Estate for development of an OWF, should not be authorised unless: They can clearly demonstrate that they will not compromise the construction, operation, maintenance, or decommissioning of the OWF; The lease/agreement for lease has been surrendered back to The Crown Estate and not been re-tendered; The lease/agreement for lease has been terminated by the Secretary of State; In other exceptional circumstances.	There are no active wind farms in close proximity to the Windermere Development, however the Hornsea Project Three has recently had its DCO approved and is within 3 km (Refer to Section 4.4.6).

19 Environmental Aspects Table

19.1 Decommissioning Activities

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.1 Physical Presence												
DC.1.1	P	Presence of a HLV / jack- up vessel (within existing 500 m exclusion zone)	Commercial Fishing	Potential for navigation hazard and emergency situation due to increased risk of collision.	1	3		N	• The vessels will only be positioned within existing 500 m exclusion zones at Windermere. • The vessels will meet national and international legislation with regards to navigation aids and warning signals for other sea users. • Sea users will be notified of the presence of intended movements of decommissioning vessels via Notices to Mariners, Navtex and NAVAREA warnings, as well as to the appropriate MRCC. • Communications with Fisheries and Maritime agencies will be maintained, as necessary, throughout the DP. • A guard vessel will be onsite for the duration of the decommissioning activities. • A collision risk management plan will be in place for the decommissioning activities.	1	3	
DC.1.2	P		Shipping and other vessels		1	3		N		1	3	
DC.1.3	P		Commercial Fishing	Interference with commercial fishing activities.	1	2		N	• A FLO will be responsible for the distribution of all key information to fishermen. The FLO will inform fishermen who use the area in advance of offshore activities commencing allowing fishing vessels to plan alternative deployment.	1	2	
DC.1.4	P		Marine Mammals	Collision between marine mammals and vessels	1	2		N	• Vessel movements and speed will be minimised.	1	2	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation: Likelihood	Impact Before Mitigation: Consequence	Impact Before Mitigation: Risk	Impact Before Mitigation: Significant Aspect (Y/N)	Mitigation Measures	Residual Impact: Likelihood	Residual Impact: Consequence	Residual Impact: Residual Risk
				causing injury or mortality to individuals.								
DC.1.5	P	Presence of other decommissioning vessels	Commercial Fishing	Potential for navigation hazard and emergency situation due to increased risk of collision.	2	2		N	• Consultations with fisheries and maritime agencies will be undertaken. • Communications with Fisheries and Maritime agencies will be maintained, as necessary, throughout the DP. • Vessels will all meet national and international legislation with regards to navigation aids and warning signals for other sea users. • Sea users will be notified of the presence of intended movements of decommissioning vessels via Notices to Mariners, Navtex and NAVAREA warnings, as well as to the appropriate MRCC. • A guard vessel will be onsite for the duration of the decommissioning activities. • A collision risk management plan will be in place for the decommissioning activities.	1	2	
DC.1.6	P		Shipping and other vessels		2	2		N		1	2	
DC.1.7	P		Commercial Fishing	Interference with commercial fishing activities.	1	2		N	• A FLO will be responsible for the distribution of all key information to fishermen. The FLO will inform fishermen who use the area in advance of offshore activities commencing allowing fishing vessels to plan alternative deployment.	1	2	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.1.8	P		Marine Mammals	Collision between marine mammals and vessels causing injury or mortality to individuals.	1	2		N	• Vessel movements and speed will be minimised.	1	2	
DC.1.9	P	Removal of the Windermere Platform	Shipping and other vessels	Removal will free up sea room, as the 500 m exclusion zone will be removed	5	0		Y	• None Required.	5	0	
DC.1.10	P		Commercial Fishing		5	0		Y		5	0	
DC.1.11	P	Partial Removal of Umbilical and subsequent monitoring and potential remedial operations	Commercial Fishing	Risk of snagging fishing gear.	3	3		Y	• INEOS will monitor the status of the decommissioned umbilical at appropriate intervals (agreed with BEIS) and take remedial actions, as required, to ensure that it does not become a hazard to other activities, such as fishing over time.	2	3	
DC.1.12			Commercial Fishing	Potential for navigation hazard and emergency situation due to increased risk of collision from vessels conduction survey and remediation operations.	3	3		Y	• Consultations with the Fisheries and Maritime Agencies will be undertaken, as required; • Vessels will all meet national and international legislation with regards to navigation aids and warning signals for other sea users; • Other sea users will also be informed of surveying and remediation activities, as necessary, and therefore the presence of additional vessel traffic in the area, through Notices to Mariners to enable early warning and planning of proposed activities; • Communications with Fisheries and Maritime agencies will be maintained, as necessary, throughout any	2	3	
DC.1.13			Shipping and other vessels							2	3	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation: Likelihood	Impact Before Mitigation: Consequence	Impact Before Mitigation: Risk	Impact Before Mitigation: Significant Aspect (Y/N)	Mitigation Measures	Residual Impact: Likelihood	Residual Impact: Consequence	Residual Impact: Residual Risk
									planned activities. An FLO will be responsible for the distribution of all key information to fishermen. • A collision risk management plan should be developed for the surveying and remediation operations to record the pre-planning measures taken to minimise the risk of ship collision, and to define the guarding role of the ERRV whilst on location; • INEOS will actively seek to minimise the amount of material used for pipeline stabilisation. •			
DC.1.14	P	Removal of stabilisation material (concrete mattresses and grout bags)	Commercial Fishing	Removal will eliminate risk of snagging fishing gear	5	0		Y	• None Required.	5	0	
DC.1.15	P	Partial removal of the pipeline and subsequent monitoring and potential	Commercial Fishing	Risk of snagging fishing gear.	3	3		Y	• INEOS will monitor the status of the decommissioned pipeline at appropriate intervals (agreed with BEIS) and take remedial actions, as required, to ensure that it does not become a hazard to other activities, such as fishing over time.	2	3	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.1.16	P	remedial operations	Commercial Fishing	Potential for navigation hazard and emergency situation due to increased risk of collision from vessels conduction survey and remediation operations.	3	3		Y	• Consultations with the Fisheries and Maritime Agencies will be undertaken, as required; • Vessels will all meet national and international legislation with regards to navigation aids and warning signals for other sea users; • Other sea users will also be informed of surveying and remediation activities, as necessary, and therefore the presence of additional vessel traffic in the area, through Notices to Mariners to enable early warning and planning of proposed activities; • Communications with Fisheries and Maritime agencies will be maintained, as necessary, throughout any planned activities. An FLO will be responsible for the distribution of all key information to fishermen. • A collision risk management plan should be developed for the surveying and remediation operations to record the pre-planning measures taken to minimise the risk of ship collision, and to define the guarding role of the ERRV whilst on location; • INEOS will actively seek to minimise the amount of material used for pipeline stabilisation.	2	3	
DC.1.17	P		Shipping and other vessels		3	3		Y		2	3	
DC.2 Seabed Disturbance												
DC.2.1	P	Removal of subsea infrastructure	Water Quality	Disturbance to sediments, increasing turbidity and decreasing water quality and potential for debris to remain on the seabed.	5	3		Y	• Subsea infrastructure removal methods will be assessed prior to decommissioning operations beginning, with a view to implement the removal method, with the least impact to the seabed.	5	2	
DC.2.2	P		Seabed Sediments		5	3		Y		5	2	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.2.3	P		Benthic Flora and Fauna	Mortality and smothering of benthic organisms in decommissioning footprint.	5	3		Y	• Post-decommissioning a debris survey will be undertaken to remove any objects remaining on the seabed. • Use of dynamically positioned vessels, if possible, to avoid the impact of anchors.	5	2	
DC.2.4	P	Removal of stabilisation material (concrete mattresses and grout bags)	Water Quality	Disturbance to sediments, increasing turbidity and decreasing water quality and potential for debris to remain on the seabed.	5	3		Y	• Concrete mattress and grout bag removal methods will be assessed prior to decommissioning operations beginning, with a view to implement the removal method, with the least impact to the seabed. • Post-decommissioning a debris survey will be undertaken to remove any concrete mattresses and grout bags remaining on the seabed. • Use of dynamically positioned vessels, if possible, to avoid the impact of anchors.	5	2	
DC.2.5	P		Seabed Sediments		5	3		Y		5	2	
DC.2.6	P		Benthic Flora and Fauna	Mortality and smothering of benthic organisms in decommissioning footprint.	5	3		Y		5	2	
DC.2.7	P	Deployment of jack-up vessel spud cans	Seabed Sediments	Possible seabed scour as a result of the spud cans being placed on the seabed.	3	3		Y	• INEOS will actively seek to position the jack-up vessel in as few separate locations as is possible during decommissioning. This will reduce the number of instances that jack-up spud cans will be deployed on the seabed.	3	2	
DC.2.8	P		Benthic Flora and Fauna	Direct impact of jack-up legs on seabed leading to mortality of benthic species	4	2		N		4	2	
DC.2.9	P	Jack-up vessel stabilisation material (rock placement)	Seabed Sediments	Physical disturbance to seabed. Raised seabed profile.	3	3		Y	• INEOS will actively seek to minimise the amount of rock required for jack-up vessel stabilisation.	3	2	
DC.2.10	P		Benthic Flora and Fauna	Smothering of sessile species. Change to seabed composition.	3	3		Y		3	2	
DC.2.11	P		Fish / Shellfish	Loss of spawning grounds.	3	2		N		3	2	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.2.12	P	Deployment of HLV anchors	Water Quality	Physical disturbance to seabed, increasing turbidity and decreasing water quality. Localised and temporary change to seabed profile.	3	3		Y	• INEOS will actively seek to position the HLV in as few separate locations as is possible during decommissioning. This will reduce the number of instances that anchors and anchor chains will be deployed on the seabed.	3	2	
DC.2.13	P		Seabed Sediments		3	3		Y		3	2	
DC.2.14	P		Benthic Flora and Fauna	Smothering of sessile species. Temporary change to seabed composition.	4	2		N		4	2	
DC.2.15	P	Remedial actions to address pipeline exposures	Seabed Sediments	Physical disturbance to seabed. Raised seabed profile.	3	3		Y	• INEOS will actively seek to minimise the amount of mattresses and grout bags required for pipeline stabilisation.	3	2	
DC.2.16	P		Benthic Flora and Fauna	Smothering of sessile species. Change to seabed composition.	3	3		Y		3	2	
DC.2.17	P		Fish / Shellfish	Loss of spawning grounds.	3	2		N		3	2	
DC.3 Noise												
DC.3.1	P	Noise generated by decommissioning activities (vessel)	Marine Mammals	Possible behavioural impacts in response to elevated noise levels.	3	3		Y	• Vessel movements and the use of dynamic positioning thrusters will be minimised where possible to reduce the potential impacts on marine mammals. • Vessel movements will be minimised.	3	2	
DC.3.2	P		Fish / Shellfish		3	2		N		3	2	
DC.3.3	P	Noise generated by	Marine Mammals		3	1		N		3	1	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.3.4	P	decommissioning activities (helicopter movements)	Fish / Shellfish	Possible behavioural impacts in response to elevated noise levels.	3	1		N	• Ensure good pre-planning to minimise the number of helicopter trips necessary to and from the jack-up vessel / HLV.	3	1	
DC.3.5	P	Noise generated by the use of cutting or explosive techniques	Marine Mammals	Possible behavioural and injury impacts in response to elevated noise levels.	3	4		Y	• In order to minimise any potential impact on marine cetaceans from the proposed Windermere Decommissioning operations, INEOS will seek to conform to the JNCC protocol for minimising the risk of disturbance and injury to marine mammals from underwater noise throughout operations. • Vessel movements and the use of dynamic positioning thrusters will be minimised where possible to reduce the potential impacts on fish and marine mammals. • If explosives are required to be used, in addition to complying with the JNCC guidelines, INEOS will: • Use of trained Marine Mammal Observers (MMOs) to identify if there are any vulnerable cetaceans in the vicinity of the explosive source. It is recommended that a 1 km radius mitigation zone be set up around the explosion source. If marine mammals are sighted within this area, operations should be ceased / halted until they have left the area at a safe distance; • Use of Passive Acoustic Monitoring (PAM), in conjunction with MMOs, to determine the presence of cetaceans in high sea states, poor visibility, during low light conditions and to identify those	3	2	
DC.3.6	P		Fish / Shellfish		3	3		Y		3	2	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.3.7	P		Plankton		5	2		N	which may not surface regularly enough to be sighted; • Use the minimum amount of explosive required to achieve the task based on sound planning and engineering; • Implement a 'soft start' procedure whereby small amounts of explosives are used to scare fish and marine mammals from the vicinity.	5	2	
DC.4 Atmospheric Emissions												

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.4.1	P	Exhaust gas emissions from offshore decommissioning operations (vessels)	Air	Emissions to atmosphere may contribute to global warming (CH_4, CO_2), acid effects (SOx, NOx). Potential for localised smog formation (VOC, NOx).	5	3		Y	• Advanced planning to ensure efficient operations. • Emissions controlled to MARPOL Annex VI standards through the use of cleaner low emission fuels. • Speed of vessels will be managed to minimise fuel consumption. • Generators will be running on the minimum power for the job task to avoid unnecessary emissions. • Well maintained and operated power generation equipment. • Regular monitoring of fuel consumption.	5	2	
DC.4.2	P	Emissions and energy balance from processing materials	Air	Emissions to atmosphere may contribute to global warming (CH_4, CO_2), acid effects (SOx, NOx). Potential for localised smog formation (VOC, NOx).	5	0		Y	• None Required	5	0	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation: Likelihood	Impact Before Mitigation: Consequence	Impact Before Mitigation: Risk	Impact Before Mitigation: Significant Aspect (Y/N)	Mitigation Measures	Residual Impact: Likelihood	Residual Impact: Consequence	Residual Impact: Residual Risk
DC.5 Marine Discharge												
DC.5.15	P	Discharge of food waste and sewage to sea from vessels	Water Quality	Will cause transient organic enrichment of the water column and an increase in biological oxygen demand (BOD). Could lead to a minor increase in plankton and fish populations.	5	3		Y	• INEOS will ensure that the vessels are equipped with suitable containment, treatment and monitoring systems as part of the contract specification; • INEOS representative will ensure good housekeeping standards are maintained onboard the vessels. • Each vessel will have a Garbage Management Plan in place. • As part of the SHE Plan, INEOS will ensure that the vessel contractor knows how to react to spills, that the necessary spill kits are onboard the vessels in suitable locations and personnel are trained in their use.	5	2	
DC.5.16	P	Discharge of food waste and sewage to sea from vessels	Plankton	Will cause transient organic enrichment of the water column and an increase in biological oxygen demand (BOD). Could lead to a minor increase in plankton and fish populations.	5	2		N	As above	5	2	
DC.5.17	P	Discharge of food waste and sewage to sea from vessels	Benthic Flora and Fauna	Will cause transient organic enrichment of the water column and an increase in biological oxygen demand (BOD). Could lead to a minor increase in plankton and fish populations.	5	2		N	As above	5	2	
DC.5.18	P	Discharge of food waste and sewage to sea from vessels	Fish / Shellfish	Will cause transient organic enrichment of the water column and an increase in biological oxygen demand (BOD). Could lead to a minor increase in plankton and fish populations.	5	2		N	As above	5	2	
DC.5.19	P	Discharge of food waste and sewage to sea from vessels	Seabirds	Will cause transient organic enrichment of the water column and an increase in biological oxygen demand (BOD). Could lead to a minor increase in plankton and fish populations.	5	2		N	As above	5	2	
DC.5.20	P	Discharge of food waste and sewage to sea from vessels	Marine Mammals	Will cause transient organic enrichment of the water column and an increase in biological oxygen demand (BOD). Could lead to a minor increase in plankton and fish populations.	5	2		N	As above	5	2	
DC.5.21	P	Discharge of grey water (domestic chemicals from washing and laundry facilities on vessels)	Water Quality	Short term degradation of water quality. Potential for localised significant toxic effects. Mortality of individuals. May affect viability of plankton stocks, recruitment for fish stocks and base of food chain.	5	3		Y	• INEOS will ensure that the vessels are equipped with suitable containment, treatment and monitoring systems as part of the contract specification; • INEOS representative will ensure good housekeeping standards are maintained onboard the vessels. • All the drains from the vessel floor will be directed to a containment tank and the fluids processed/filtered to remove hydrocarbons. • As part of the SHE Plan, INEOS will ensure that the vessel contractor knows how to react to spills, that the necessary spill kits are onboard the vessels in suitable locations and personnel are trained in their use.	5	2	
DC.5.22	P	Discharge of grey water (domestic chemicals from washing and laundry facilities on vessels)	Plankton	Short term degradation of water quality. Potential for localised significant toxic effects. Mortality of individuals. May affect viability of plankton stocks, recruitment for fish stocks and base of food chain.	5	2		N	As above	5	2	
DC.5.23	P	Discharge of grey water (domestic chemicals from washing and laundry facilities on vessels)	Benthic Flora and Fauna	Short term degradation of water quality. Potential for localised significant toxic effects. Mortality of individuals. May affect viability of plankton stocks, recruitment for fish stocks and base of food chain.	5	2		N	As above	5	2	
DC.5.24	P	Discharge of grey water (domestic chemicals from washing and laundry facilities on vessels)	Fish / Shellfish	Short term degradation of water quality. Potential for localised significant toxic effects. Mortality of individuals. May affect viability of plankton stocks, recruitment for fish stocks and base of food chain.	5	2		N	As above	5	2	
DC.5.25	P	Discharge of grey water (domestic chemicals from washing and laundry facilities on vessels)	Seabirds	Short term degradation of water quality. Potential for localised significant toxic effects. Mortality of individuals. May affect viability of plankton stocks, recruitment for fish stocks and base of food chain.	5	2		N	As above	5	2	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation: Likelihood	Impact Before Mitigation: Consequence	Impact Before Mitigation: Risk	Impact Before Mitigation: Significant Aspect (Y/N)	Mitigation Measures	Residual Impact: Likelihood	Residual Impact: Consequence	Residual Impact: Residual Risk
DC.5.26	P		Marine Mammals		5	2		N		5	2	
DC.5.27	P	Drainage water	Water Quality	Release of drainage water or deck water from decommissioning vessels may be discharged. May have minor localised toxicity impacts on the local fauna in the water column.	5	3		Y	• INEOS will ensure that the vessels are equipped with suitable containment, treatment and monitoring systems as part of the contract specification; • INEOS representative will ensure good housekeeping standards are maintained onboard the vessels. • All the drains from the vessel floor will be directed to a containment tank and the fluids processed/filtered to remove hydrocarbons. • As part of the SHE Plan, INEOS will ensure that the vessel contractor knows how to react to spills, that the necessary spill kits are onboard the vessels in suitable locations and personnel are trained in their use.	5	2	
DC.5.28	P		Plankton		5	2		N		5	2	
DC.5.29	P		Fish / Shellfish		5	2		N		5	2	
DC.6 Accidental Events												
DC.6.11	U	Spillage of diesel or other oils during bunkering operations and storage	Water Quality	Degradation of water quality.	4	2		N	• Accidental spills will be kept to a minimum through training, good housekeeping and through storage/handling procedures. • Re-fuelling will only be undertaken during periods of good visibility and in good weather conditions.	3	2	
DC.6.12	U		Seabed Sediments	Contamination of sediments.	4	2		N		3	2	
DC.6.13	U		Plankton		4	2		N		3	2	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.6.14	U		Benthic Flora & Fauna	Degradation in water quality may affect viability of plankton stocks, recruitment for fish stocks, and base of food chain. Smothering, physical contamination and toxic effects on benthic organisms.	4	2		N	• Non-return valves will be installed on fuel transfer hoses, and operations will be supervised at all times. • Oil Pollution Emergency Plan is in place, alongside other Emergency Response documents • Regular inspections will be undertaken to ensure all equipment in good working order.	3	2	
DC.6.15	U		Fish / Shellfish		4	2		N		3	2	
DC.6.16	U		Protected areas		4	2		N		3	2	
DC.6.17	U		Seabirds	Toxic effects on individuals.	4	2		N		3	2	
DC.6.18	U		Marine Mammals		4	2		N		3	2	
DC.6.19	U	Spillage of diesel resulting from a collision between vessels	Water Quality	Degradation of water quality.	2	3		Y	• Co-ordination of all support/standby vessel movements. • Notices to Mariners, NAVTEX and NAVAREA warnings. • Use of Radar system. • Ship Oil Pollution Emergency Plan will be in place, alongside other Emergency Response documents.	1	3	
DC.6.20	U		Seabed Sediments	Contamination of sediments.	2	3		N		1	3	
DC.6.21	U		Plankton	Degradation in water quality may affect viability of plankton stocks, recruitment for fish stocks, and base of food chain. Smothering, physical contamination and toxic effects on benthic organisms.	2	3		N		1	3	
DC.6.22	U		Benthic Flora & Fauna		2	3		N		1	3	
DC.6.23	U		Fish / Shellfish		2	3		N		1	3	
DC.6.24	U		Protected Areas		2	3		N		1	3	
DC.6.25	U		Seabirds	Oiling of a birds plumage destroys its integrity as insulation and may cause the animal to die of hypothermia or by drowning.	2	3		Y		1	3	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.6.26	U		Marine Mammals	Toxic effects on individuals.	2	3		N		1	3	
DC.6.27	U		Commercial Fishing	Decrease in catch and landing value.	2	3		N		1	3	
DC.6.28	U	Overboard spill of chemicals during decommissioning activities	Water Quality	Toxic potential of chemical releases could degrade water quality.	3	2		N	• Chemicals with improved environmental performance preferentially chosen. • Accidental spills will be kept to a minimum through training, good housekeeping and through storage/handling procedures. • Regular inspections to ensure all equipment in good working order. • A location specific oil pollution emergency plan and emergency procedures will be in place to minimise any spill.	3	2	
DC.6.29	U		Plankton	Degradation in water quality may affect viability of plankton stocks, recruitment for fish stocks, and base of food chain.	3	2		N		3	2	
DC.6.30	U		Benthic Flora & Fauna		3	2		N		3	2	
DC.6.31	U		Fish / Shellfish		3	2		N		3	2	
DC.6.32	U		Seabirds		3	2		N		3	2	
DC.6.33	U		Marine Mammals		3	2		N		3	2	
DC.6.34	U	Loss of debris and dropped objects	Commercial Fishing	Debris and dropped objects might fall on the seabed and constitute an uncharted obstacle to fishing gear.	3	1		N	• Prohibition of discarding of debris on the seabed. Audit of all equipment brought onto, and off, the site by all contractors. Retrieval of dropped objects and debris identified during post work surveys.	3	1	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation				Mitigation Measures	Residual Impact		
					Likelihood	Consequence	Risk	Significant Aspect (Y/N)		Likelihood	Consequence	Residual Risk
DC.7 Solid Waste												
DC.7.1	P	Onshore disposal of operational waste	Land Use	Effects associated with onshore disposal are dependent on the nature of the site or process. Landfills: land take, nuisance, emissions (methane), possible leachate, and limitations on future land use. Treatment plants: nuisance, atmospheric emissions, potential for contamination of site.	5	3		Y	• Waste management in place which will ensure: • Minimisation of the amounts generated; • Segregation of waste by type; • Storage in covered skips to prevent emissions and leaks; • Recycling or re-use prioritised where possible, in particular for scrap metal, waste oil and surplus chemicals; • Waste sent to authorised landfills or incineration facilities, depending on its precise nature, when no other option is possible; • Use of authorised waste contractors. • Auditing of waste management contractors to ensure compliance.	5	2	
DC.7.2	P		Air	Atmospheric emissions from the processing and recycling of some materials	5	2		N		5	2	
DC.7.3	P	Onshore disposal of decommissioning materials	Land Use	Effects associated with onshore disposal are dependent on the nature of the site or process. Landfills: land take, nuisance, emissions (methane), possible leachate, and limitations on future land use. Treatment plants: nuisance, atmospheric emissions,	5	3		Y	• INEOS will ensure that an effective waste management plan is put in place prior to decommissioning activities commencing. • INEOS will ensure all waste contractors are audited and meet relevant legislation. • INEOS will actively seek to reduce the amount of recovered materials that are sent to landfill.	5	2	

Ref	Event Type	Environmental Aspect	Environmental Receptor	Description of Potential Impact	Impact Before Mitigation: Likelihood	Consequence	Risk	Significant Aspect (Y/N)	Mitigation Measures	Residual Impact: Likelihood	Consequence	Residual Risk
				potential for contamination of site								
DC.8 Transboundary Impacts												
DC.8.1	U	Hydrocarbon spill crosses the transboundary line	Water	Degradation of water quality in international territorial waters	5	3		Y	• INEOS will ensure that the Bonn agreement is fully detailed in the Windermere OPEP.	5	2	
DC.8.2	P	Atmospheric Emissions	Air	Atmospheric emissions from offshore decommissioning activities crossing the transboundary line	5	3		Y	• Refer to DC.4.1 for mitigation measures.	5	2	
DC.8.2	P	Chemical and hydrocarbon discharges	Water	Degradation of water quality in international territorial waters	3	1		N	• None required.	3	1	
DC. 9 Cumulative Impacts												
DC.9.1	P	Noise generated by decommissioning activities (cumulative)	Marine Mammals	Possible behavioural impacts in response to elevated noise levels from Windermere and Ketch decommissioning.	3	3		Y	• As per DC.3 • Consultation with DNO North Sea to determined whether activities will coincide and coordinate to minimise potential for concurrent noise generation • Undertake further impact assessment during permitting to consider cumulative noise impacts if they will occur.	3	2	
			Fish / Shellfish		3	2		N		3	2	