

Topaz Decommissioning Project

Environmental Appraisal



RD-TOP-ZPL006
Rev 08 (Jan 2021)

FINAL

INEOS UK SNS Limited

CONTROLLED DOCUMENT

Title:

Topaz Decommissioning Project
Environmental Appraisal
FINAL

Notes:

This is a report of the Environmental Appraisal (EA) undertaken as part of the Topaz Decommissioning Project. The EA considers the potential environmental impact of decommissioning the Topaz subsea wellhead and associated pipelines.

Revision Record:							
8	22-01-21	P Jones	NH	D Scott	CEO	<i>D Scott</i>	22-01-21
7	19-11-20	P Jones	-	-	-	-	-
6	03-04-20	P Jones	-	-	-	-	-
5	19-03-20	P Jones	-	-	-	-	-
4	25-02-20	P Jones	-	-	-	-	-
3	26-11-19	R O'Sullivan	-	-	-	-	-
2	01-10-19	R O'Sullivan	-	-	-	-	-
1	26-07-19	P Jones	-	-	-	-	-
0	Mar-19	R O'Sullivan	-	-	-	-	-
Rev.	Date Prepared	Author	Chk'd	Name	Title	Signed	Date App'd
Document Origination			Check	Document Approval for use by INEOS Oil & Gas UK			
The master original of this document is held by:				SHEQ			

EXECUTIVE SUMMARY

The Topaz Field is located approximately 130km northeast of the UK coastline (Norfolk) and 42km west of the UK-Netherlands median line. It produced gas and condensate and is tied back to the DNO North Sea (ROGB) Limited Schooner platform, 15.5km to the northwest. It used a 6.6" export pipeline, a 3.6" umbilical providing control and chemical injection in order to operate. Topaz production ceased in October 2017.

The Topaz subsea wellhead is protected by a wellhead protection structure. The gas pipeline and umbilical were cleaned/flushed in 2019. The decommissioning works will take place between 2021-23, and will involve removal of the wellhead protection structure and two piles down to 3m below the seabed, removal of the tie-in spools and exposed sections of the pipeline and retrieval of mattresses where possible. A comparative assessment has been undertaken and identified that the most appropriate option is to leave the pipeline in situ.

This Environmental Appraisal reviews the potential environmental impacts that the proposed decommissioning operation (described in RD-TOP-ZPL004) could have, in line with the requirements of the OPRED guidance (2018).

Background environmental information indicates that Topaz is located within an area of sand with some areas of gravel and cobbles and undergoes high energy wave action. This physical environment impacts the species that are dominant in the area. Benthic species are used to natural seabed disturbance and are dominated by polychaetes, crustaceans and molluscs. The area is used as a nursing ground for twelve fish species and a spawning ground for ten species including cod, whiting, sandeel and mackerel. Seabirds are particularly sensitive to oil on the surface of the water in March, between June and September and in December. Species common in this part of the Southern North Sea include Common guillemot, Northern fulmars and Black-legged kittiwake. There is the potential that up to three marine mammal species (harbour porpoise, Minke whale and white-beaked dolphin) may be present in the area of Topaz, with June and July seeing the highest densities. Topaz is situated at the outermost reach of the most common excursions of harbour and grey seals coming from Donna Nook and the Wash areas. Topaz is also located approximately 28km from the Southern North Sea SAC for harbour porpoise, 28km south of the North Norfolk and Saturn Reef SAC and 33km from the Dogger Bank SAC.

Comparison of the proposed activities with the requirements of the East Offshore Marine Plan has been made. This includes consideration of other sea users, biodiversity, hazardous substance release and emissions to air. It has been concluded that this operation is in line with its principles.

The potential impacts of the proposed activities have been reviewed; each potential impact on the surrounding environment was classified as being low, medium or high. Impacts that were determined to be low have not been considered in detail. Those that may potentially have a medium or high impact were assessed and mitigation and control measures identified. These measures have reduced the anticipated impact to low levels. Other projects within the area have also been considered and the cumulative impact assessed.

It has been determined that, if the control and mitigation measures identified are put in place, there should be no significant long term or lasting impact on the surrounding environment.

Table of Contents

1	Introduction	6
1.1	Overview	6
1.2	Purpose and Scope	6
1.3	Regulatory Context	6
1.4	Stakeholder Engagement.....	6
2	Environmental Appraisal Process	7
3	Decommissioning Project Scope.....	8
3.1	Infrastructure.....	8
3.2	Pre-Decommissioning Activities	8
3.3	Proposed Decommissioning Activities.....	9
3.4	Post-Decommissioning Activities	11
3.4.1	Debris Clearance and Over-trawl Assessment.....	11
3.4.2	Monitoring and Evaluation.....	11
3.5	Waste Management.....	11
3.6	Vessel Use	12
3.7	Schedule.....	12
3.8	Environmental Management	12
4	Environmental Baseline	14
4.1	Physical Environment	14
4.1.1	Sediments.....	14
4.1.2	Oceanography and Meteorology	14
4.2	Biological Environment	14
4.2.1	Benthos	14
4.2.2	Fish and Shellfish	15
4.2.3	Seabirds	17
4.2.4	Marine Mammals	19
4.3	Socio-Economic.....	20
4.3.1	Commercial Fisheries	20
4.3.2	Shipping.....	20
4.3.3	Other Marine Users.....	20
4.3.4	Protected Areas	21
4.3.5	Marine Plans.....	22
5	Initial Assessment	24
5.1	Medium and High Significance.....	25

5.1.1	Seabed Disturbance	25
5.1.2	Unplanned Discharges.....	27
5.2	Low Significance	28
5.2.1	Atmospheric Emissions.....	28
5.2.2	Underwater Noise	29
5.2.3	Discharges to Sea	30
5.2.4	Waste Production	30
5.2.5	Light Emissions.....	30
5.2.6	Safety Risk to Other Sea Users	30
5.2.7	Socio-economic Impacts.....	31
5.2.8	Cumulative Impacts	31
5.2.9	Transboundary Impacts	33
6	Conclusions	34
7	References	35

Tables

Table 3-1	Summary of Decommissioning Activities.....	10
Table 3-2	Outline of the proposed schedule for the Topaz Decommissioning Project	12
Table 4-1	Potentially spawning and nursing fish species in the Topaz area	16
Table 4-2	Seabird Oil Sensitivity in the area around Topaz	17
Table 4-3	Marine mammal density in the Topaz area.....	19
Table 4-4	Value and weight of fish landed in 36F2 and the UK.	20
Table 4-5:	Relevant East Offshore Marine Plan Policies	22
Table 5-1	A summary of the potential impacts associated with the Topaz Decommissioning Programme prior to control and mitigation measures	24
Table 5-2	Summary of seabed area that will be affected.....	25
Table 5-3	Estimated Emissions to Air Resulting from Fuel Usage	28

Figures

Figure 3-1	Field Layout	8
Figure 4-1	Seabird sensitivity around Topaz Block 49/2.....	18
Figure 5-1	Activities occurring within the vicinity of Topaz.....	32

1 Introduction

1.1 Overview

The Topaz Field is located approximately 130km northeast of the UK coastline (Norfolk) and 42km west of the UK-Netherlands median line, with a water depth of 34 metres. It produced gas and condensate and is tied back to the DNO North Sea (ROGB) Limited Schooner platform, 15.5km to the northwest. It used a 6.6" export pipeline, a 3.6" umbilical providing control and chemical injection in order to operate. Topaz production ceased in October 2017.

1.2 Purpose and Scope

The purpose of this Environmental Appraisal (EA) is to identify potential impacts that the decommissioning of Topaz could have on the surrounding environment, and assess the significance of those impacts. Mitigation and control measures will then be determined to reduce the level of the impacts to as low as reasonably practicable (ALARP).

The EA will consider all offshore operations associated with the decommissioning of the Topaz subsea wellhead protection structure and pipelines (PL2631 and PLU2632), however it will not include impacts associated with waste management onshore as this will be considered elsewhere.

1.3 Regulatory Context

The Department for Business, Energy and Industrial Strategy (BEIS) through its Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), regulates decommissioning activity in the North Sea. The Petroleum Act 1998 requires that an approved Decommissioning Programme is in place before commencing activities; a formal environmental impact assessment is not required however according to OPRED guidance (2018) an environmental appraisal must be conducted to determine the potential impact of the proposed activities.

INEOS Oil and Gas UK has an ISO14001 certified Environmental Management System (EMS) which constitutes part of the Business Management System. The decommissioning of Topaz will be undertaken in line with the requirements of the BMS.

1.4 Stakeholder Engagement

Stakeholder engagement is an important aspect of the appraisal process; involving interested parties from the beginning of the project to the end ensures that opinions can be heard, ideas evolved and expectations managed. Informal responses received from stakeholders will be incorporated as appropriate and the formal consultation process will be undertaken on submission of the draft Decommissioning Programme. Section 5 of the Decommissioning Programme provides a summary of stakeholder comments.

2 Environmental Appraisal Process

OPRED guidance (2018) identifies that the environmental appraisal should be proportional with respect to the proposed activities, the potential environmental impacts and the sensitivities of the marine environment in the vicinity of the activities.

In order to undertake the Environmental Appraisal the activities described within the scope were reviewed to consider the potential impact on the surrounding environment; this includes biological, physical and socio-economic impacts. The surrounding environment is described in Section 4; this information was used to identify potential aspects. The potential impact on each aspect has been assessed using the matrix presented in Section 5. The extent and duration of the impact has been used to allocate a level of significance from low to high. Control and mitigation measures have then been described and the level of significance reassessed.

OPRED guidance (2018) indicates that unplanned or accidental events do not need to be assessed fully, however consideration has been given to the likelihood of the event occurring and details of the location of further information has been provided.

3 Decommissioning Project Scope

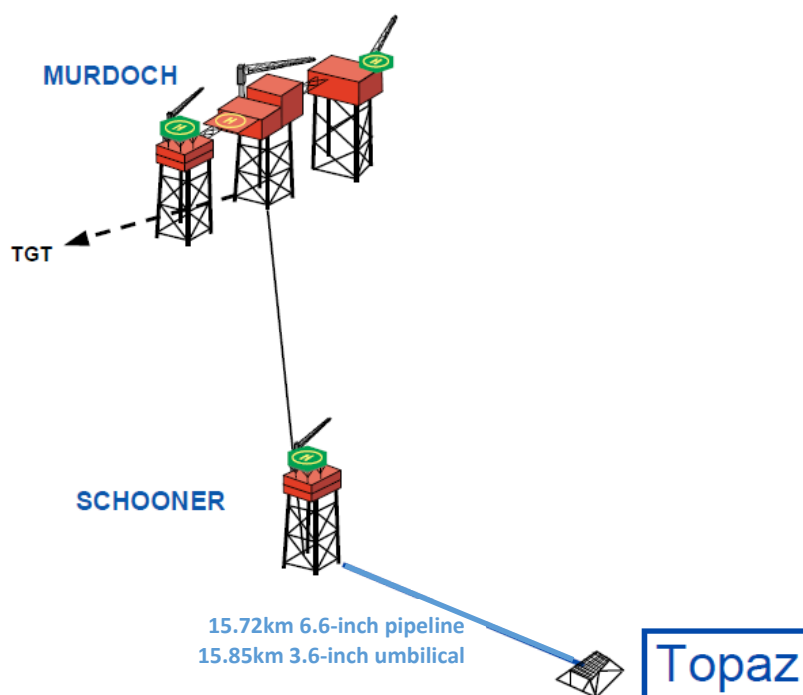
This section describes the Topaz infrastructure and the proposed decommissioning plans. Further details of the options that have been considered are provided in the Comparative Assessment (RD-TOP-ZPL005).

3.1 Infrastructure

INEOS UK SNS Limited is the installation operator of the Topaz well and gas export pipeline and umbilical. The wellhead protection structure is held in place by two piles. The gas and condensate was exported via the 6.6" diameter 15.5 km long export pipeline to DNO North Sea (ROGB) limited Schooner platform located in Block 44/26. Thereafter it was comingled and exported via a 28km 16" pipeline to Murdoch (owned and operated by ConocoPhillips) and then via the Caister Murdoch System 26-inch wet gas trunk line, to the Theddlethorpe gas terminal. Methanol supplied to Topaz via Murdoch and Schooner was provided via the existing methanol service line to Murdoch from the Theddlethorpe gas terminal.

There are no pipeline crossings on the Topaz to Schooner export pipeline. Figure 3-1 below presents the field layout.

Figure 3-1 Field Layout



3.2 Pre-Decommissioning Activities

Surveys of the pipeline have been conducted to determine depth of burial. These were conducted in 2012, 2015 and 2019. The pipeline is buried throughout its entire length (other than at either end) and the average depth of the pipeline was 1.29m in 2012 and 1.56m in 2015. The average depth of the 3.6" umbilical was 1.22m in 2012 and 1.19m in 2015. Depths of cover along the umbilical route remained similar indicating the umbilical burial is stable. Interim surveys conducted in 2019 confirmed no freespans or exposures exist on either line.

Mattresses and grout bags have been used at the wellhead and the platform end of the lines. These will be removed. Rock dump was used at 14 locations along the pipeline route in order to protect the line. These will remain *in situ*.

The survey results were used as part of the Comparative Assessment (RD-TOP-ZPL005) which concluded that leaving the pipeline *in situ* would have the least impact on the seabed.

The pipeline has been flushed and flooded to remove residual hydrocarbons. Prior to the commencement of decommissioning, the well will be plugged and abandoned to comply with Health and Safety Executive (HSE) "Offshore Installations and Wells DCR 1996" and in accordance with Oil and Gas UK (OGUK) Guidelines for the "Suspension and Abandonment of Wells" (Issue 6, June 2018) as it meets BEIS and HSE requirements. A Master Application Template (MAT) and the supporting Subsidiary Application Templates (SAT) will be submitted in support of works carried out. A PON5 will also be submitted to the Regulator for application to plug and abandon the wells.

3.3 Proposed Decommissioning Activities

The proposed decommissioning activities have been outlined in detail in the Decommissioning Programme. The proposed activities are summarised as follows.

- The subsea well abandonment will be completed using a jack-up drilling rig. The pipeline cutting and burial works shall be undertaken using specialist construction support vessel or multi support vessel.
- The mattresses and stabilisation materials will be removed using specialist ROVs. These are designed to be able to lift mattresses using a series of hooks and bring them to the surface for recycling and disposal. If the mattresses do not remain intact during the ascent, the pieces can be 'grabbed' by an additional ROV fitting ensuring that all debris is removed.
- The Topaz well will be plugged and abandoned in accordance with Oil & Gas UK guidelines;
- The wellhead protection structure will be removed and recycled or disposed onshore;
- The gas export pipeline will be partially removed. The tie-in spools will be removed and recycled or disposed onshore. The exposed sections at both ends will be removed or lowered to achieve adequate depth of coverage with best endeavours to achieve -0.6m. The existing buried sections of pipeline will be left *in situ*;
- The umbilical will be partially removed. The exposed sections adjacent to the Topaz well and Schooner platform will be removed and recycled or disposed onshore. The exposed ends will be lowered to achieve adequate depth of coverage with best endeavours to achieve -0.6m. The existing buried sections of umbilical will be left *in situ*; and

On completion of the decommissioning programmes a seabed survey will be undertaken to identify and recover debris within the platform 500m zone and a 100m wide corridor along each pipeline route.

All waste will be dealt with in accordance with the Waste Framework Directive and options for reuse and are under investigation. Section 5.2.4 provides further details.

Below is a summary of each stage of the process (adapted from RD-TOP-ZPL004 Table 1.5).

Table 3-1 Summary of Decommissioning Activities

Summary of Decommissioning Programmes		
Selected Option	Reason for Selection	Proposed Decommissioning Solution
1. Topsides		
n/a	n/a	n/a
2. Jacket		
n/a	n/a	n/a
3. Subsea Installation(s)		
The Wellhead Protection Structure will be completely removed from the seabed. The two piles which hold it in place will be cut approx. 3m below the seabed	To comply with OSPAR requirements leaving an unobstructed seabed.	Any permit applications for work associated with removal of the subsea installation (MAT) will be submitted.
4. Pipelines, Flow lines & Umbilicals		
<p>The pipeline and umbilical will be left in-situ except for short exposed sections between the end of burial and bottom of the riser/j-tube at the Schooner platform.</p> <p>Minimal local excavation will be carried out at each end, but enough to ensure safe removal of short exposed ends of the pipelines.</p> <p>Surveys indicate the pipelines will remain buried.</p> <p>Any permit applications required for work associated with pipeline pigging, flushing, cutting and removal (PLA MAT) will be submitted.</p>	<p>The pipeline was subject to a qualitative comparative assessment from which remedial pipeline end burial was selected on the basis of minimal seabed disturbance, lower energy use and reduced risk to personnel. Historical surveys indicate the pipelines are sufficiently buried and stable, posing no hazard to marine users.</p>	<p>The pipelines have been cleaned.</p> <p>The exposed sections at both platform and wellhead ends will be removed or trenched and buried to below at least 0.6m. The tie-in spools will be removed and returned to shore for recycling or disposal.</p> <p>Surveys indicate the pipeline will remain buried. Degradation will occur over a long time period within seabed sediment, and this is not expected to represent a hazard to other users of the sea. Mattresses will be removed (see item 7).</p>
5. Wells		
Plugged and abandoned in accordance with HSE "Offshore Installations and Wells DCR 1996" and Oil & Gas UK Guidelines for the Suspension and Abandonment of wells (Issue 6, June 2018).	Industry guidelines.	The well will be plugged and abandoned to comply with HSE "Offshore Installations and Wells DCR 1996" and in accordance with OGUK Guidelines for the "Suspension and Abandonment of Wells" (Issue 6, June 2018) as it meets OPRED and HSE requirements. A Master Application Template (MAT) and the supporting Subsidiary Application Templates (SAT) will be submitted in support of works carried out. A PON5 will also be submitted to the OGA for application to plug and abandon the well. The well steel that is removed to shore, which includes the velocity strings and well casings down to 3m, will be reused or recycled where possible.
6. Drill Cuttings		
Leave in place to degrade naturally	This will minimise disturbance to the seabed	The two mounds either side of the wellhead are approximately 0.5-0.8m high and either (i) emanate from the top hole section of the well which was

Summary of Decommissioning Programmes		
Selected Option	Reason for Selection	Proposed Decommissioning Solution
		drilled using non-toxic water based mud or (ii) have been formed by seabed currents around the wellhead structure. Left undisturbed the mounds are expected to disperse naturally over time.
7. Interdependencies		
<p>Flushing/cleaning of the pipeline and umbilical has already been undertaken. Liaison will be required between the Schooner owner and INEOS in order to maximise efficiency of the decommissioning effort.</p> <p>Mattresses and grout bags will be removed as part of the partial pipelines removal activities and brought to shore. These will be re-used, recycled or disposed of as appropriate. Rock dumped areas will not be removed and will remain <i>in situ</i>.</p>		

3.4 Post-Decommissioning Activities

Post-decommissioning surveys will be undertaken to determine the as-left status. These will include:

- Debris clearance
- Over-trawl assessment

3.4.1 Debris Clearance and Over-trawl Assessment

A post-decommissioning survey will be conducted covering a 500m radius of the Topaz wellhead and a 100m corridor along the pipeline route in line with the requirements of OPRED Guidance (2019). Any seabed debris related to oil and gas activities will be recovered and transported to shore for recovery or disposal as appropriate and in line with existing disposal methods. It is most likely that an ROV will be used to undertake this and reference will be made to the OPRED guidance and an application for a Marine Licence will be submitted. Consideration will be given to whether an over-trawl assessment is required to ensure the seabed has been left in an appropriate condition; this will provide independent verification of the seabed state but may not be necessary if there is not extensive debris or seabed disturbance. On completion a clear seabed certificate will be submitted to Regulators.

3.4.2 Monitoring and Evaluation

The pipeline will be left *in situ* therefore a monitoring programme will be established. This will be agreed with OPRED in consultation with other relevant government departments. The form and frequency of the programme will depend on the findings of the post-decommissioning survey, which will focus on the physical disturbances of the decommissioning. Results of this survey will be available once the work is complete, with a copy forwarded to OPRED. All pipeline routes and structure sites will be the subject of surveys when decommissioning activity has concluded. After the surveys have been sent to OPRED and reviewed, the post monitoring survey regime will be discussed and agreed. This is likely to consist of a minimum of two post decommissioning environmental surveys and structural pipeline surveys. The results of these surveys will be used to determine what further action (including any additional monitoring) is required.

3.5 Waste Management

All material recovered will be returned to shore where it will be assessed for onward processing. Materials will be managed using the Waste Hierarchy: reuse, recycle, other recovery (including waste to energy) and disposal. Non-hazardous waste will include metals,

concrete and plastics. Hazardous materials will include contaminated plastics and concrete, chemicals and waste oils.

It is not anticipated that there will be any materials contaminated by Naturally Occurring Radioactive Material (NORM), however if this is encountered, it will be stored, transported, maintained and disposed of in a controlled manner. Any NORM associated with items decommissioned in situ will degrade naturally.

As much as possible of the removed materials will be recycled, depending on the capacities of the selected disposal contractor. Onshore treatment of waste has not been considered further as it will be reviewed as part of onshore activities (OPRED 2018).

3.6 Vessel Use

A number of vessels may be required to undertake the proposed activities. These could include a HLV, a Dive Support Vessel, a tug and a barge vessel. In addition a standby vessel will be present for this period and supply vessels will be visiting the location. Until such time that the method of decommissioning and exact vessel requirements are confirmed, an assessment has been based around a reasonable worst-case evaluation.

Vessels will be audited as part of selection and pre-mobilisation and work programmes will be planned to optimise vessel time in the field. Each vessel will have its own Shipboard Oil Pollution Emergency Plan (SOPEP) which it will put in to action should it be responsible for unplanned release of hydrocarbons.

Section 5 provides further information concerning emissions to atmosphere from vessels.

3.7 Schedule

It is currently envisaged that the decommissioning activities at Topaz will commence in 2020 and last for a period of up to 5 years, depending on availability of contractor vessels and equipment. The decommissioning approach will be to combine work-scopes with other INEOS assets wherever possible. Table 3-2 provides an overview of the outline project schedule for the Topaz Decommissioning Programme.

Table 3-2 Outline of the proposed schedule for the Topaz Decommissioning Project

Activity Window	2020				2021				2022				2023				2024			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Engineering / cost review																				
Subsea wellhead removal																				
Partial pipelines & umbilical removal																				
Over trawl surveys																				
Env. Survey window																				

3.8 Environmental Management

INEOS is committed to conducting its activities in a manner that protects people, property and the environment. The company seeks continued improvement in its environmental performance through the establishment of effective management systems. Potential deleterious impacts within the receiving environment are mitigated through internal programs, training and other procedures that minimise the risk of spills.

INEOS's Environmental Management System (EMS) was audited in July 2018 by Exova and recertified to ISO 14001 and OHSAS 18001.

4 Environmental Baseline

This section describes the surrounding environment which has been considered in the Environmental Appraisal. It includes the physical, biological and socio-economic environment in which the decommissioning will take place.

4.1 Physical Environment

This section will consider the physical environment in which Topaz is located.

4.1.1 Sediments

An environmental survey was conducted along the proposed pipeline route from Topaz to Schooner prior to its installation (Fugro 2008). It found that sediments were typical of the high energy environment in the area where wave action impacts the seabed. The predominant sediment types are sands with varying gravel, clay and shell content. Trawl scars were found all along the route. Areas of coarse sands, gravels and cobbles with mobile sands overlying were identified relatively close to the Topaz wellhead whereas further along the pipeline route where the seabed slopes downwards, there were found to be areas of finer sediments.

The total hydrocarbon concentrations (THC), and poly-aromatic hydrocarbon concentrations were within accepted background concentrations when sampled in 2008 (Fugro) although it was considered at the time that there was evidence of contamination with petrochemicals possibly due to low level contamination from the nearby 49/02a-5 well. There was also thought to be hydrocarbon contamination along the pipeline route from long distance transport of anthropogenic material (RWE 2008).

Concentrations of arsenic and lead exceeded the environmental assessment criteria (EAC) in the immediate vicinity of the Topaz well site. Metal concentrations beyond this area were generally close to regional background and EAC values (RWE 2008).

4.1.2 Oceanography and Meteorology

In general terms, the North Sea has a predominantly tidal current regime, supplemented periodically by storm surge currents. Residual surface circulation across the south-eastern North Sea is in a southerly direction parallel to the English Coast, but alters to a weak easterly flow in the area of Block 49/02a, with a generally counter clockwise circulation around the Dogger Bank. Non-tidal currents have been measured at speeds up to 0.05ms^{-1} at the nearby Cutter Field in Block 49/09, to the southeast of the Topaz site. The residual currents in the region are sufficient to refresh a 500m column of water in 5.6 hours. Tidal currents allow refreshment in less than 1 hour (RWE 2008).

There is considerable seasonal variation in wave height with waves in excess of 4m recorded for 15% of the time in autumn and winter, but only 2% of the time in summer (UKDMAP 1998).

Winds in the North Sea area are generally characterised by frontal depressions and anti-cyclones with the former being more prevalent in winter and bringing wind and rain from the southwest. Anti-cyclones are associated with lighter winds from the west and northwest. During the winter and early summer north-easterly and south-westerly winds are most common. However, from July to September south-westerly and westerly winds predominate (RWE 2008).

4.2 Biological Environment

4.2.1 Benthos

The benthos in the area around Topaz is typical of the SNS with population density being low. The area is dominated by polychaetes, particularly *Ophelia borealis* and *Nephtys longosetosa*,

which are characteristic of water depths between 30 and 70m and coarse mobile sands. The benthic survey undertaken for the Topaz Environmental Statement (Fugro 2008) identified 98 discrete macrofaunal taxa; of those recorded, annelids were greatest in number of taxa with crustaceans and molluscs also contributing large numbers. In terms of abundance, Echinodermata were dominant, annelids were the second most abundant, followed by crustaceans and molluscs. The most abundant taxon overall was *Amphiura filiformis* (Fugro 2008).

Multivariate analysis found two distinct communities which were characterised by water depth and sediment type. Those around Topaz in shallower water with medium sand sediments included sand burrowers and filter feeders. Further along the pipeline in deeper water where medium to very fine sand is located, species were mainly deposit feeders and carnivores. This area was more densely populated and species rich. This is likely to be due to the increased wave action in the shallower water (RWE 2008).

4.2.2 Fish and Shellfish

Over 330 species of fish have been recorded on the UK continental shelf (DECC 2016a). The majority of published information on distribution is concerned with commercial fish; however, Ellis *et al.* (2012) includes some consideration of species of conservation, rather than commercial, significance.

Fisheries sensitivity maps (Coull *et al.* 1998 and Ellis *et al.* 2012) have been used to identify the spawning grounds (location where eggs are laid) and nursery grounds (location where juveniles are common) for commercial fish species near Topaz (Table 4-1).

The following species have potential spawning and nursing grounds within the area surrounding Topaz:

- Spurdog (*Squalus acanthias*) occur throughout British waters and are a viviparous species (carry live young for 22-24 months before birth) (Ellis *et al.* 2012).
- Tope shark (*Galeorhinus galeus*) is wide-ranging with seasonal patterns of movements. They are born at a length of 30-40cm and tend to establish nursery grounds in inshore areas with slightly reduced salinity due to nearby estuaries (Ellis *et al.* 2012).
- Atlantic cod (*Gadus morhua*) are demersal (bottom dwelling) and omnivorous. They tend to spawn over coarse sand with low tidal flow (therefore are unlikely to spawn near Topaz due to the lack of appropriate sediments and high energy environments) but their larval stage remains pelagic until it is 5-7cm long (Ellis *et al.* 2012).
- Whiting (*Merlangius merlangus*) are demersal (bottom dwelling) and they mainly eat crustacean and fish (DECC 2016a). They spawn for up to three months of the year (Ellis *et al.* 2012).
- Sandeel (*Hyperoplus*) lie buried in the sand at night and feed in mid-water during daylight. They spawn on sandy sediments. Sandeel are known to be an important food source for predatory fish and seabirds (DECC 2016a).
- Atlantic mackerel (*Scomber scombrus*) are pelagic species (open water) which feed on crustacean, plankton and small fish. They spawn in open water and have a prolonged spawning period (DECC 2016a).
- Lemon sole (*Microstomus kitt*) are a flat fish that are mainly found on coarse sediments (Coull *et al.* 1998).
- Sprat (*Sprattus sprattus*) are usually found in shallow water and feed on planktonic crustaceans. Spawning mainly occurs in summer at depths of 10-20m (DECC 2016a).
- Nephrops (*Nephrops norvegicus*) lives in burrows in muddy and sandy sediments. They feed mainly on detritus, small crustaceans and worms and are most active at night (DECC 2016a).

The following species have potential spawning grounds only, in the area around Topaz:

- European plaice (*Pleuronectes platessa*) mainly live on soft sediments and have pelagic eggs; they rely on transport by current to move them from spawning grounds to nursery areas (DECC 2016a).

The following species have potential nursing grounds only near Topaz:

- Herring (*Clupea harengus*) are demersal spawners and require specific substrates to spawn.
- Anglerfish (*Lophius poscatorius*) are usually found in deep water off the continental shelf. Eggs are within a gelatinous ribbon and the post-larval stage is thought to remain within the pelagic zone for a prolonged period. Nursery grounds include the Central and some parts of the SNS (Ellis *et al.*, 2012).
- Horse mackerel (*Trachurus trachurus*) is found in two stock in UK waters. The North Sea stock spend most of the year in the central North Sea and migrates to the SNS in the summer to spawn (DECC 2016a).

Table 4-1 Potentially spawning and nursing fish species in the Topaz area

Species	J	F	M	A	M	J	J	A	S	O	N	D
Spurdog	Viviparous species: gravid females can be found all year											
Tope shark	Viviparous species: gravid females can be found all year											
Herring								N	N	N	N	N
Cod	SN	SN	SN	SN	N	N						
Whiting		SN	SN	SN	SN	SN	N	N				
Anglerfish	N	N	N	N	N	N	N	N				
Sandeel	SN	SN	N	N							SN	SN
Mackerel					SN	SN	SN	SN	N	N		
Horse mackerel					N	N	N	N	N	N		
Plaice	S	S	S									S
Lemon sole				SN	SN	SN	SN	SN	N	N		
Sprat					SN	SN	SN	SN	N	N		
<i>Nephrops</i>	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN

Source: Ellis *et al* (2012) and Coull *et al.* (1998). S= Spawning. N = Nursing

Species most likely to be affected during the proposed operations are those which are demersal in their early life stages, either egg laying, larval or juvenile stage, such as herring and sandeel. Herring are known to use nursing grounds from August to December and sandeel use the area for nursing and spawning from November to April.

Herring is one of the most important UK commercial marine species, however it is highly vulnerable to fishing pressure and influence from the oil and gas industry. They are dependent on specific substrates on which they deposit sticky eggs; gravel is considered to be the preferred spawning substrate but also boulders, rocks, small stones, coarse sand, shell fragments etc. are used. The eggs form extensive egg beds in areas of well-mixed, relatively shallow water (15 – 40m deep) with reasonably strong tidal currents (1.5 – 3 knots) (Reid *et*

al. 1995). The survey identified that the Topaz area is predominantly sand with varying gravel, clay and shell content (Fugro 2008). It is not considered likely that this would be a suitable area for herring spawning due to lack of appropriate substrate.

4.2.3 Seabirds

Distribution and abundance of seabirds in the SNS varies throughout the year and numbers of seabirds at sea are generally lower in the SNS than further north. Greatest concentrations of birds offshore usually occur outside of the breeding season. Common seabird species in this area include: Common guillemots (*Uria aalge*); Northern fulmars (*Fulmarus glacialis*); Black-legged kittiwakes (*Rissa tridactyla*); and Northern gannets (*Morus bassanus*) European herring gulls (*Larus argentatus*), great black-backed gulls (*Larus marinus*), and little auks (*Alle alle*) (DECC, 2016a).

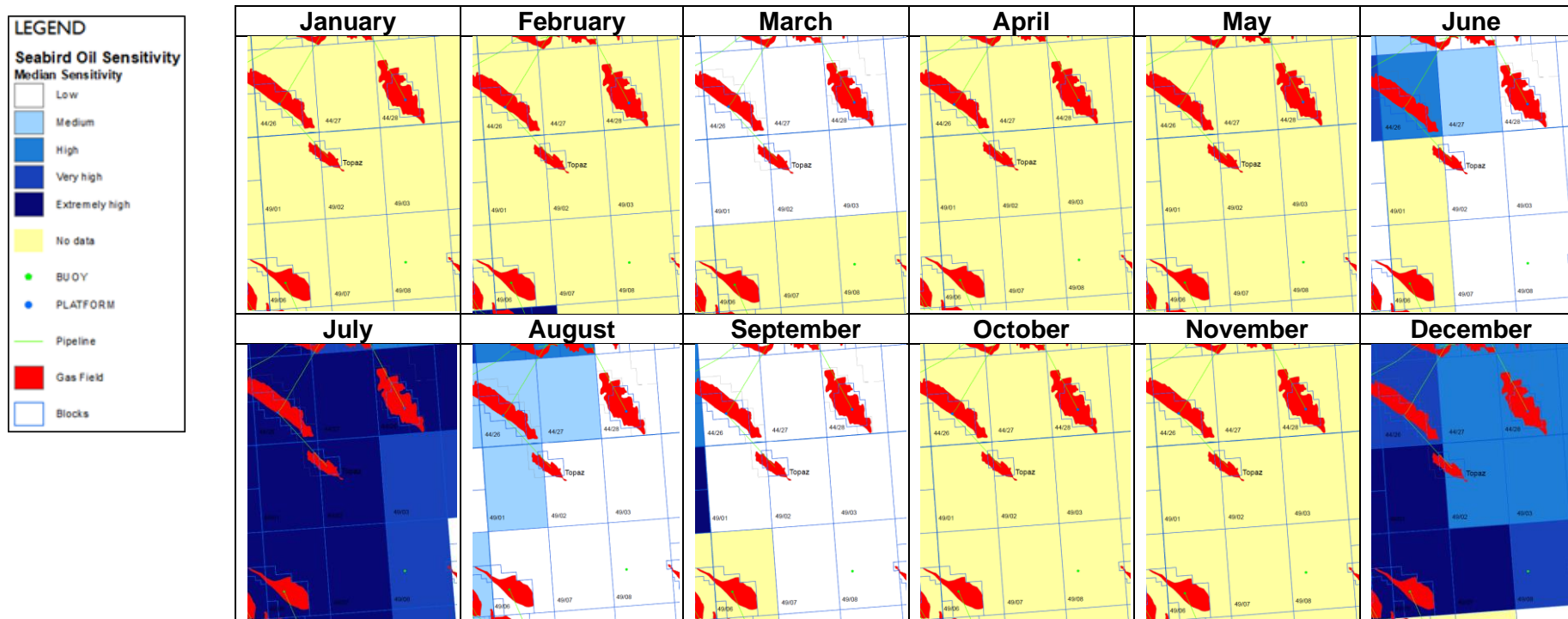
Table 4-2 and Figure 4-1 present seabird vulnerability in the vicinity of Topaz. This information is provided by the Seabird Oil Sensitivity Index (SOSI) (Webb *et al.* 2016, Certain *et al.* 2015).

It can be seen that seabird sensitivity is highest in July and December (rated extremely high), with a sensitivity of very high in September. March, June, August and September show low sensitivity within the block, although it is higher in neighbouring blocks in June and August.

Table 4-2 Seabird Oil Sensitivity in the area around Topaz

Block	J	F	M	A	M	J	J	A	S	O	N	D	
44/26	2*	5*	5	5*	3*	3	1	4	5	5*	2*	2	
44/27	3*	5*	5	5*	4*	4	1	4	5	5*	3*	3	
44/28	3*	5*	5	5*	5*	5	1	5	5	5*	3*	3	
49/01	1*	5*	5	5*	N	1*	1	4	5	5*	1*	1	
49/02	3*	5*	5	5*	5*	5	1	5	5	5*	3*	3	
49/03	3*	5*	5	5*	5*	5	2	5	5	5*	3*	3	
49/06	1*	1*	5*	N	N	1*	1	5	5*	N	1*	1	
49/07	1*	1*	5*	N	5*	5	1	5	5	5*	1*	1	
49/08	2*	N	5*	N	5*	5	2	5	5	5*	2*	2	
Key													
5	Low	4	Medium	3	High	2	Very high	1	Extremely high	N	No Data	*	Information taken from previous month or adjoining block

Figure 4-1 Seabird sensitivity around Topaz Block 49/2



4.2.4 Marine Mammals

Twenty-eight cetacean species have been recorded in UK waters from sightings and strandings, of which, eleven are known to occur regularly (DECC 2016). The SNS is considered to have relatively low densities of marine mammals compared with further north. Only white-beaked dolphin (*Lagenorhynchus albirostris*) and harbour porpoise (*Phocoena phocoena*) are considered as regularly occurring throughout most of the year and Minke whales (*Balaenoptera acutorostrata*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphi*) and white-sided dolphin (*Lagenorhynchus acutus*) are seasonal visitors (DECC 2016a).

The recent SCANS III estimates (summer 2016) for cetacean abundance in European Atlantic water shows that for the wider area surrounding Block 49/2, the species recorded in the highest densities were harbour porpoise with 0.888 individuals/km². White-beaked dolphin and Minke whale were present in lower densities of 0.002 individuals/km² and 0.010 individuals/km² respectively (Hammond *et al.* 2017).

Table 4-3 presents the density of cetaceans in the vicinity of Block 49/2. This indicates that Harbour porpoises have been recorded in low to moderate densities from February to November with Minke whale present in low densities in July and August. White-beaked dolphin were recorded in moderate densities in November, with low densities in January, March, April, July and December. (Reid *et al.* 2003).

Table 4-3 Marine mammal density in the Topaz area

Species	J	F	M	A	M	J	J	A	S	O	N	D
Harbour porpoise		3	3	3	3	2	2	3	3	3	2	
Minke whale							3	3				
White-beaked dolphin	3		3	3			3				2	3
1	High density	2	Moderate density	3	Low density	Blank				No data or not likely to be present		

Source: Reid *et al.* (2003)

Two species of seal are also commonly found in UK waters; harbour (common) seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*). The harbour seal is one of the most widespread pinniped species. Large numbers occur at haul out sites at the Wash and they are abundant in the surrounding waters. However, they tend to undertake relatively short excursions offshore, usually less than 50km and there is little evidence to suggest that they undertake seasonal migrations (DECC 2016a). Marine usage data gathered from satellite tracking of tagged individuals, reveals that Topaz is considered to be at the north eastern most reach of seals coming from The Wash. Seal density in the area of Topaz is considered to be 0.67 seals per 5km² (MMO 2018a).

Grey seals have a wide distribution across the north-western Atlantic, Baltic and north east Atlantic seas (DECC 2016a). They have breeding colonies at Donna Nook, Blackeney Point and Horsey and can undertake foraging trips of up to 100km offshore and to other haul out sites (DECC 2016a). Topaz at the north eastern most point of excursions from Donna Nook. Estimated density of grey seals at Topaz is approximately 2.5 seals per 5km² (MMO 2018a).

All cetaceans are listed in Annex IV of the EC Habitats Directive and are European Protected Species (EPS). Animals are protected regardless of their location. It is an offence to deliberately disturb or physically injure any EPS.

4.3 Socio-Economic

The following sections consider the socio-economic situation found within the area of Topaz.

4.3.1 Commercial Fisheries

Topaz is located within International Council for the Exploration of the Seas (ICES) rectangle 36F2. Approximately 35 species are caught within this ICES rectangle; the most commonly caught are plaice, *Nephrops* and sole. Turbot, lemon sole and brill are all species of value that are also caught in the area. Landing between 2008 and 2017 averaged 475 tonnes (landed weight) per year with an average value of £755,982 per year. This accounts for approximately 0.08% of the landed weight of fish in the UK and 0.11% of the value of all fish caught in the UK (MMO 2018b).

Table 4-4 Value and weight of fish landed in 36F2 and the UK.

Year	ICES Rectangle 36F2		UK Records	
	Landed weight (tonnes)	Value (£)	Landed weight (tonnes)	Value (£)
2008	217.6	461,885	521,751	599,744,695
2009	426.1	946,986	541,129	679,561,141
2010	454.8	1,115,373	566,976	720,189,630
2011	1217.5	1,085,163	557,912	831,568,874
2012	936.2	407,943	590,797	770,346,990
2013	448.3	1,405,095	640,932	762,033,113
2014	235.2	431,653	604,181	664,262,466
2015	291.5	562,101	547,066	573,918,965
2016	431.2	935,890	564,064	728,851,976
2017	87.6	207,735	554,317	694,277,570
Total	4,745.9	7,559,826	5,689,124	7,024,755,420
Average	474.6	755,982	568,912	702,475,542

4.3.2 Shipping

In 2014, approximately 503 million tonnes of freight traffic was handled by UK ports. Grimsby, located south west of Topaz, was the UK busiest port, handling 12% of the UK's shipping traffic in 2014 (DECC 2016a).

Vessel traffic within Block 49/2 is considered to be moderate (BEIS 2016). There are approximately 3 shipping routes that cross the Topaz to Schooner pipeline and 3 that pass within 5km of the pipeline with an average use of approximately 1100 ships per year (RDUK 2008).

The east coast of England is a popular tourist destination, with widespread tourist facilities between the Humber and The Wash. North Norfolk and Great Yarmouth are also popular for water sports and sea angling trips (RDUK 2008), however Topaz is over 130km from the nearest coastline, therefore it is unlikely that recreational vessels will be found in the vicinity.

4.3.3 Other Marine Users

The nearest platform to Topaz is Schooner which is located 15.5 km to the North West. Ketch is located 20.5km north east.

Topaz is tied-back to Schooner, which is in turn tied-back to the Murdoch platform. This is operated by ConocoPhillips and is located 36km north of Topaz.

There are no pipeline crossings on the export pipeline between Topaz and Schooner.

The Humber 7 Aggregate area is located 18.5km south of Topaz and Humber 4 Aggregate area is located 20km to the south west. These are extended option areas and the rights are currently under license to DEME Building Materials Ltd (MMO 2018a).

The Hornsea windfarm developments are situated to the east and west of Topaz. There are three project areas which are owned by Orsted. Project 1 is furthest from Topaz (7km) and is currently under construction. It will be completed in 2020 and will have 1.2GW capacity covering an area of approximately 407km². Hornsea Project 2 is to the north of Project 1 and was granted government consent in 2016. It is 6.5km from Topaz. Contracts have now been awarded however a construction commencement date has not yet been confirmed. Hornsea Project 3 is located to the east of the others and Topaz and its closest boundary is 1.2 km from Topaz. It is still in the development phase (Orsted, 2019).

4.3.4 Protected Areas

Topaz is located within 26km of the boundary of the Southern North Sea Special Area of Conservation (SAC) for harbour porpoises. This has an area of 36,951km² which covers important winter and summer habitats and is within the top 10% of locations with persistently high densities of harbour porpoise (JNCC 2017). This SAC is part of a network of five areas that are intended to protect harbour porpoises. The SNS area is considerably larger than the other areas and covers from north of the Dogger Bank to the Strait of Dover. It crosses the boundary of four other SACs which are all classified for their sandbanks. There was not enough satisfactory information regarding prey distribution for this to be used to determine the extent of the boundary of the SAC, therefore habitat variables such as water depth, temperature and seabed sediments were used as a proxy (JNCC 2016). It is not considered that any activities required during decommissioning will affect the objective of the SAC to maintain a Favourable Conservation Status of the harbour porpoise. Further information regarding noise is provided below.

North Norfolk Sandbanks and Saturn Reef SAC (28km south of Topaz) consists of 10 main sandbanks and a number of smaller banks, which collectively form the most extensive example of offshore linear ridge sandbanks in UK waters. The banks are home to invertebrate communities typical of sandy sediments, such as polychaete worms, crabs and brittlestars (JNCC 2016).

Dogger Bank SAC is located 33km north of Topaz. The Bank has been selected under the EC Habitats Directive as it consists of sandbanks which are slightly covered by sea water all the time. It also has three non-qualifying interest features:

- Harbour porpoise
- Grey seal
- Common seal

The SAC boundary encompasses 12,331 km² and includes the largest single continuous expanse of shallow sandbank in UK waters. A large part of the southern area of the bank is covered by water seldom deeper than 20m with other areas within the boundary reaching 40m deep. The Dogger Bank is considered to be a unique ecological region. Its exposed location in open waters means it is subjected to substantial wave energy, which prevents flora colonising the fine sandy sediments on the top of the bank (JNCC 2016).

There are also a number of recommended Marine Conservation Zones (MCZ) in the SNS; Markham's Triangle (15km to the east) was designated in May 2019 for its subtidal coarse sediment, subtidal mixed sediments, subtidal mud and subtidal sands (DEFRA, 2019)

No species or habitats of conservation significance under the UK's Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010, UKBAP (2001) or OSPAR (2008) were observed during the Fugro survey (2008).

4.3.5 Marine Plans

Topaz is located within the boundary of the East Offshore Marine Plan. This was published in 2014 and lays out an approach to managing the resources, activities and interactions within and between each of the Plan areas. The Plan defines 17 policy areas for activities undertaken within the boundary (DEFRA 2014). Of these, the most relevant are presented in the table below with a summary of how the proposed operation complies with the requirements of the policy (or refers to where this has already been covered).

Table 4-5: Relevant East Offshore Marine Plan Policies

Policy Area	Policy Reference	Policy Description	Comments
Environment	ECO1	Cumulative impacts affecting the ecosystem of the East marine plans and adjacent areas (marine, terrestrial) should be addressed in decision making and plan implementation	Cumulative impacts have been considered in Section 5.2.8.
	ECO2	The risk of release of hazardous substances as a secondary effect due to any increased collision risk should be taken account of in proposals that require an authorisation.	Section 5.1.2 considers the potential for unplanned events and the mitigation measures in place to minimise this.
	BIO1	Appropriate weight should be attached to biodiversity, reflecting the need to protect biodiversity as a whole, taking account of the best available evidence including on habitats and species that are protected or of conservation concern.	Section 4 describes the existing biodiversity. The Comparative Assessment determined that the proposal to leave the pipeline <i>in situ</i> would be the least damaging to biodiversity.
	MPA1	Any impacts on the overall Marine Protected Area 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.	The potential impacts on Marine Protected Areas are considered in Section 5.
	CC2	Proposals for development should minimise emissions of greenhouse gases as far as is appropriate. Mitigation measures will also be encouraged where emissions remain following minimising steps. Consideration should also be given to	Emissions of greenhouse gases and potential impacts on air quality are considered in Section 5.2.1.

Policy Area	Policy Reference	Policy Description	Comments
		emissions from other activities or users affected by the proposal	
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.	It is considered that this activity is compatible with the oil and gas activity that is occurring within the area.
Fisheries	FISH1	Within areas of fishing activity, proposals should demonstrate that they will not prevent fishing activities on, or access to fishing grounds or how, if there are significant adverse impacts on the ability to undertake fishing activities or access to fishing grounds, they will minimise them.	There will be a temporary exclusion zone during the operation however once the operation is complete the area will be returned to normal. In addition, if it is considered necessary, over-trawl assessments will be undertaken to ensure the pipeline is safe for fishing activities.
	FISH2	Proposals should demonstrate that they will not have an adverse impact upon spawning and nursery areas and any associated habitat	Section 4.2.2 considers fish spawning and nursing in the area and determines that there will not be a significant impact.

5 Initial Assessment

An initial assessment was undertaken to identify the potential changes to the existing environmental and socio-economic aspects that may occur as a result of the proposed activities. The assessment was completed on 21st January 2019 where participants in a meeting considered the proposed activity and the potential for unplanned events. Each activity was reviewed to identify the potential level of impact that each aspect could suffer in terms of site specific, transboundary and cumulative effects¹. Table 5-1 presents a summary of the findings of this review. The risk levels assigned are the unmitigated and uncontrolled risks.

Mitigation and control measures that will be used to avoid, reduce, remediate or compensate each impact have been taken in to consideration and are described in Sections 5.1 and 5.2. These mitigation and control measures have reduced all potential impacts that are considered medium in Table 5-1, to low.

Table 5-1 A summary of the potential impacts associated with the Topaz Decommissioning Programme prior to control and mitigation measures

Activity / Aspect	Seabed disturbance	Atmospheric emissions	Underwater noise	Discharges to sea	Waste management	Light emissions	Safety risk to other sea users	Socio-econom. impacts	Unplanned discharges	Cumulative impacts	Transboundary impacts
Vessel presence	M	L	L	L		L	L	P	M	L	
Vessel transfers		L	L	L		L	L	P	M	L	
On-seabed cutting	M		L	L						L	
Lifting											
Dropped objects	L			L			L			L	
Excavation	M		L							L	
Temporary deposits	L						L			L	
Pipeline flushing				L						L	
Mattress removal	L										
Removal of seabed infrastructure	M										
Pipeline remaining in situ							L			L	
Over-trawl assessment	L										
Use of side-scan sonar			L							L	
Waste production		L			L			P		L	L
L	Low – no risk or not considered to be significant: 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.										
M	Medium- 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.										
H	High – considered to be a significant risk: the level of risk is unacceptable. Risk and control measures are required to move the risk figure to a lower risk category, e.g. design out the risk, put plans and procedures in place.										
P	Positive – to be encouraged.										

¹ Those present at the meeting included Head of SHEQ, Head of Operations, Decommissioning Team Leader and SHEQ Advisor.

5.1 Medium and High Significance

No impacts were assessed as having a high level of significance. The following aspects have been identified as medium significance prior to the use of mitigation and control measures.

5.1.1 Seabed Disturbance

5.1.1.1 Introduction

The proposed activities that will potentially affect the seabed and the associated flora and fauna are:

- Removal of seabed infrastructure (wellhead protection structure, tie-in spools, umbilical and pipeline ends)
- Mattress removal
- Locating of the HLV²
- Jack-up vessel spud cans
- Remedial action to address remaining exposures

The majority of these activities will involve temporary disturbance. The table below presents the reasonable worst case area that will be disturbed.

Table 5-2 Summary of seabed area that will be affected

Activity	Assumptions	Area	Volume
Anchoring HLV	14 anchors each 4x4x4m. 500m long chains 90% in contact with seabed, buried to 0.5m with 4m lateral movement ³	25,424m ²	13,496m ³
Location of Jack-up vessel spud cans	4x18m diameter spud cans to a depth of 0.5m	1,020m ²	510m ³
Pipeline section and umbilical removal	Assume all pipeline sections underneath the mattresses will be removed. 109 mattresses at 5m long each gives 545m of pipeline to be removed. Assume 3m wide corridor of disturbance and up to 0.5m deep (on average).	1,635m ²	817.5m ³
Wellhead protection structure removal including two piles	Piles will be cut 3m below the surface. Assume 4m ² area of disturbance at each location.	8m ²	24m ³
Wellhead removal	Cut of well tubing allowing 4m deep with radius of 2m	2m ²	8m ³
Mattress removal	109 mattresses at 5m x 3m each. Impact up to 0.5m deep for recovery of mattresses	1,635m ²	817.5m ³
Total		29,724m²	15,673m³
Pipeline remaining in situ		-	-
Drill cuttings piles leaving in place	Two mounds either side of the wellhead aprx. 0.5-0.8m high. Will disperse naturally with time.	-	-

² Although it is considered likely that the HLV will be a DP vessel, vendor selection has not yet occurred therefore the worst case scenario must be assumed. In this case, the HLV would be secured in place by anchors.

³ 4m x 4m = 16m² area of disturbance for each anchor x 14 = 224m² for all anchors. Assuming buried 4m deep = 896m³. Each of the 14 anchor chains is 500m long but only 90% in contact with the seabed = 450m² per anchor. Assuming lateral movement of 4m = 1800m² so 25,200m² for all anchors. With 0.5m burial this is a total volume of 12,600m³. Adding the anchors and chains together = 25,424m² and a volume of 13,496m³.

5.1.1.2 Potential Impacts

The Comparative Assessment considered the potential for removing the pipeline, however it was determined that the amount of seabed disturbance associated with this was too great in comparison with the potential impacts of leaving the covered areas in situ.

The removal of the exposed items will cause movement of the sediment resulting in smothering or direct mortality of some benthic species. The species identified in the area are typical of the region. The most vulnerable species are expected to be those that are immobile and therefore incapable of moving away from the disturbance (immobile epifauna and infauna). This may potentially affect species further up the food chain that rely on these species as food supply. However, the number of individuals affected is likely to be relatively small due to the minimal area that will be disturbed.

The mobilisation and re-suspension of sediments are most likely to affect suspension / filter / deposit feeders by interfering with food uptake, potentially affecting the growth and condition of these animals (Nicholls *et al.* 2003). However, sediments in the area are naturally mobile and benthic species that are present are unlikely to be sensitive to this sort of disturbance.

The sediment in the Topaz area is sand with some areas of gravels and cobbles. When the Topaz wellhead was commissioned, the hard, and immobile, surfaces of the protection structure became an alternative substrate providing habitat for species that otherwise may not thrive in this area. The removal of the protection structure, exposed pipework and other hard substrates such as mattresses will result in the removal of that alternative substrate. This may affect species that have become established in the area, but will return it to its natural state.

The removal of the seabed infrastructure including mattresses will cause disturbance of the seabed, however this will be temporary and will remove a number of hard features which are not in keeping with the character of the surrounding environment. The relatively shallow water, prevailing current and wave action result in regular natural disturbance of the seabed and the species living in this area are dominant as their life cycles thrive on this disturbance.

5.1.1.3 Control and Mitigation Measures

The following control and mitigation measures will be put in place to reduce the level of seabed disturbance to 'as low as reasonably practicable' (ALARP).

- All activities which may lead to seabed disturbance will be planned, managed and implemented in such a way that disturbance is minimised. This has already included selection of leaving the pipeline in situ. Prior to undertaking these works planning meetings are held with the designated contractors to determine the most appropriate methodologies for completing the work. These reviews consider the potential health and safety, environmental (including seabed disturbance), cost, time and resource impacts. Based on these assessments the most appropriate methodology is agreed. This will then be described in the Environmental Impact Assessment Justification Document which is submitted to EMT for approval prior to commencement of the operation. Once approval is received all documents associated with the permits are provided to the contractors. Contractors are made aware of the area of disturbance that has been included within the permits and are instructed to ensure this is not exceeded.
- A debris survey will be undertaken on completion of the activities to identify any remaining debris from the project. This will be recovered where possible.
- Consideration will be given to the method of debris clearance (preference will be given to ROV removal) and whether an over-trawl assessment is necessary. Minimisation of

any area affected will be ensured through discussion with the relevant fishing organisations and regulators.

The species and habitats near Topaz are reasonably widespread and the surrounding environment is relatively active. Suspension and re-suspension of sediments is commonplace and species are equipped to manage to a certain extent. The proposed activities will be localised and relatively short duration, therefore, with the control measures in place are considered to have reduced the risk significance to low.

5.1.2 Unplanned Discharges

5.1.2.1 Sources

The potential for unplanned discharges of hydrocarbon to sea is considered in the Oil Pollution Emergency Plan (OPEP) and the vessels' Shipboard OPEP (SOPEP). The current version of the OPEP does not incorporate the presence of any vessels or Jack-up facilities, however a new version will be submitted and approved prior to commencing operations.

The largest inventory of hydrocarbons is likely to be associated with the Heavy Lift Vessel. Although vendors have not yet been selected a worst case scenario of 2000m³ of diesel has been assumed to be the full capacity of the diesel fuel tanks. An unplanned release could occur due to a loss of structural integrity of the storage tanks. This may be caused by corrosion or mechanical failure or following a collision with another vessel or fixed installation. This would result in the instantaneous loss of marine diesel to sea. The OPEP and SOPEPs will present the modelled results of the worst case release scenario. In the instance that a spill may approach the median line, the appropriate transboundary agreement will be activated via BEIS.

Should any reservoir hydrocarbons break containment, they will be natural gas and condensate. Topaz has not generated much gas in recent years and the well has been shut in. Work will already have been completed to flush the pipeline, therefore there should not be significant quantities of condensate that could cause an unplanned discharge during the proposed operation.

5.1.2.2 Impacts

Topaz is located within 26km to 33km of three SACs, however the Topaz OPEP notes that the most sensitive feature is likely to be seabirds. The highest sensitivities are March, June to September and December. If a raft of seabirds are present during a hydrocarbon spill there is the potential for them to become oiled. This is particularly significant if they are flightless due to moulting.

Marine diesel is a light end hydrocarbon which does not persist in the marine environment. The active nature of the sea in this area is likely to break up any spill in a short period. The response to a spill of this nature, in line with OPRED guidance, is to undertake monitoring while allowing natural dispersion. If the spill is approaching a sensitive feature such as a raft of seabirds, or the median line, further advice from OPRED and Oil Spill Response Limited will be sought.

5.1.2.3 Control and Mitigation Measures

Any unplanned release will be managed using the requirements of the OPEP or the SOPEP. This will include live modelling using the specific environmental conditions at the time of the event in order that an appropriate response can be planned. All vessel activities will be

planned, managed and implemented to limit the time required in the field. All vessels will be contracted and monitored in line with contractor assurance procedures. It is considered that, with these control and mitigation measures in place, the risk significance is low.

5.2 Low Significance

Aspects where the potential impact of the activities is considered to be of low significance before control and mitigation measures are in place are described below.

5.2.1 Atmospheric Emissions

Sources of emissions to air from the proposed activities will come from the vessels used to undertake the work. Estimated emissions to air resulting from fuel usage by the vessels are given below and include carbon dioxide (CO₂), carbon monoxide (CO), oxides of nitrogen (NO_x), sulphur dioxide (SO₂) and volatile organic compounds (VOCs). This is based on undertaking operations for 128 days and includes transit to the worksite and back.

Table 5-3 Estimated Emissions to Air Resulting from Fuel Usage

Operation	Days	Fuel use (tonnes)	Total emissions (tonnes)						
			CO ₂	CO	NO _x	N ₂ O	CH ₄	VOC	SO _x
Jack up vessel	100	2,400	7,680	37.7	143	0.53	0.43	4.80	9.60
HLV	18	540	1,728	8.5	32	0.12	0.10	1.08	2.16
Barge	18	396	1,267	6.2	24	0.09	0.07	0.79	1.58
Tug	18	450	1,440	7.1	27	0.10	0.08	0.90	1.80
Anchor handling vessel	18	90	288	1.4	5	0.02	0.02	0.18	0.36
DSV	10	180	576	2.8	11	0.04	0.03	0.36	0.72
Guard vessels	128	512	1,638	8.0	30	0.11	0.09	1.02	2.05
Supply vessels	128	640	2,048	10.0	38	0.14	0.12	1.28	2.56
Helicopters ⁴	128	41	130	0.6	2	0.01	0.01	0.08	0.16
Total	566	5,249	16,795	82.3	312	1.16	0.95	10.49	20.99

It is estimated that offshore fuel consumption for the planned activities be approximately 5,249 tonnes which will release approximately 3,686 tonnes of CO₂. UK oil and gas exploration, production, transportation, venting and flaring produced 3.9 million tonnes of CO₂ during 2016 and shipping produced 5.8 million tonnes of CO₂ in the same year (National Statistics, 2018). The estimated CO₂ emissions from the planned activities will therefore account for some 0.04% of the 2016 equivalent emissions.

Emissions to air from vessels are expected to disperse rapidly under most conditions to levels approaching background within a few tens of metres of the source. Although all such

⁴ Based on 3 return flights per week at 0.55 t/hr for 1.35hrs per trip.

emissions will contribute in a small way to greenhouse gases in the atmosphere, local environmental effects will be negligible.

5.2.2 Underwater Noise

Underwater noise will be generated during the following proposed activities:

- Vessel use including DP engines
- Cutting
- Excavation
- Lifting
- Side scan sonar

The presence of oil and gas activities within the area indicates that vessel traffic in the vicinity is common place and the noise of the additional vessels will not be a significant change. DP thrusters will be used to maintain location during operations and are a common occurrence in the SNS. DP thrusters typically create continuous noise characterised by low levels of sound spread over a longer period. The amplitude of the sound may vary throughout the duration, but the amplitude does not fall to zero for any significant time. The vessels presence will also be relatively short term so the impact from vessels is considered to be low.

Minimal information is available concerning the noise generated underwater during decommissioning activities. A study investigating the noise generated 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. Although the exact methods have not yet been defined it is more likely that shears will be used and it is considered that this will be a quieter process than diamond wire cutting.

There is a limited amount of information concerning other underwater tools, however research has been completed using hand held diver tools including drills, wrenches, grinders, high-pressure water jet lance, chainsaw, grinder and oxy-arc cutter (Nedwell and Howell, 2004 and Anthony *et al* 2009). Although reported source levels are relatively low compared to those generated by vessels, there is no information available regarding reactions of marine mammals.

The noise generated during excavation varies significantly depending on the substrate involved. Soft sediments which include high concentrations of water, such as those at Topaz, will require less effort to remove and will generate less sound whilst moving than harder sediments (CEDA 2011).

Noise disturbance studies have a high degree of variation in their results and even when information on equipment specifications is known, it is still difficult to predict the level of disturbance to marine mammals accurately (Weilgart 2013). The level of background noise is likely to mask much of the sound produced by the vessels, due to the level of shipping, trawling and tidal activity within the region.

It is anticipated that noise emissions associated with the proposed operations will be transient and temporary and will make only a very minor contribution to the typical noise levels found in the vicinity of Topaz. The number of cuts undertaken will be minimised and the duration of the operation will be as short as possible, which will limit disturbance to marine mammals. It is considered that the impact on marine mammals is likely to be low.

5.2.3 Discharges to Sea

The pipeline and umbilical have both been cleaned and flushed, which resulted in discharges to sea. These activities were consented under the Offshore Petroleum Activities (Oil Pollution Prevent and Control) (OPPC) Regulations 2005.

Unplanned events such as a loss of diesel fuel from a vessel, are considered in Section 5.1.2.

5.2.4 Waste Production

The proposed activities will generate hazardous and non-hazardous waste. This will include steel, concrete, plastics and non-ferrous metals as well as hydrocarbon contaminated materials. Waste will be handled offshore in line with Waste Management Plans and transferred onshore for disposal via a licenced waste management contractor. This contractor will ensure that all sites and waste carriers have appropriate environmental and operating licences and will be managed in line with INEOS Oil and Gas UK contractor assurance processes. Efforts will be made to reuse or recycle as much waste as possible. Transfers for further treatment or disposal abroad will have the appropriate trans-frontier shipment licences.

It is not anticipated that the activities will identify any NORM contamination however, should this be the case, Environment Agency guidance and approval for disposal will be sought.

It is considered that the significance of waste production for the offshore marine environment will be low.

5.2.5 Light Emissions

OSPAR Agreement 2015-18 (2015) notes that there is the potential that migrating birds and seabirds may be attracted to lights from offshore installation and vessels, which in some cases can be fatal. Although there is not sufficient evidence to determine whether there is a significant effect at the population level, the precautionary principle should be applied and OSPAR recommend that BAT is used to avoid or minimise the impacts of conventional lighting on birds crossing or using the North Sea.

The decommissioning activities will involve additional lighting to be present, however the planned period of activity is limited and work will be undertaken when daylight hours are relatively long, minimising the time when artificial light is required. The activities will also not be significantly different to general vessel movements and other oil and gas activities that usually occur in the area. Lights will be directed below the horizontal plane where possible. It is considered that the potential impact will be low.

5.2.6 Safety Risk to Other Sea Users

The increased presence of vessels in the area increases the risk to other sea users, however a standby vessel or guard vessels will be used during appropriate activities and other sea users will be requested to remain outside of the 500m exclusion zone.

Sub-sea equipment will be removed or made safe. Consideration will be given to whether an over-trawl assessment is required to ensure that the risk to other vessels in the future is ALARP; this will be avoided if it is not necessary.

Measures will be taken to minimise the likelihood of dropped objects including preparation of lifting plans, training and awareness of the potential for dropped objects and all lifting equipment will be tested and certified. Any items dropped during the operations will be recorded and any significant objects recovered where possible. If recovery is not an option, further action will be agreed with OPRED to minimise risk to other sea users.

It is considered that the safety risk to other sea users is low.

5.2.7 Socio-economic Impacts

There are a number of socio-economic impacts associated with the proposed activities. Topaz has already ceased production, therefore there is limited employment associated with it. The number of personnel required to plan and undertake the proposed activities and the associated contractors and sub-contractors, increases employment, albeit on a temporary basis. A further positive impact is the increase in commercial activity of both companies operating offshore and waste handling companies onshore, along with the benefits that this brings to local communities.

The work will be undertaken inside a 500m exclusion zone, which will prevent the presence of fishing and other vessels, however this is not a large area and is a short term requirement therefore it is not considered that temporary exclusion will have an impact on livelihoods.

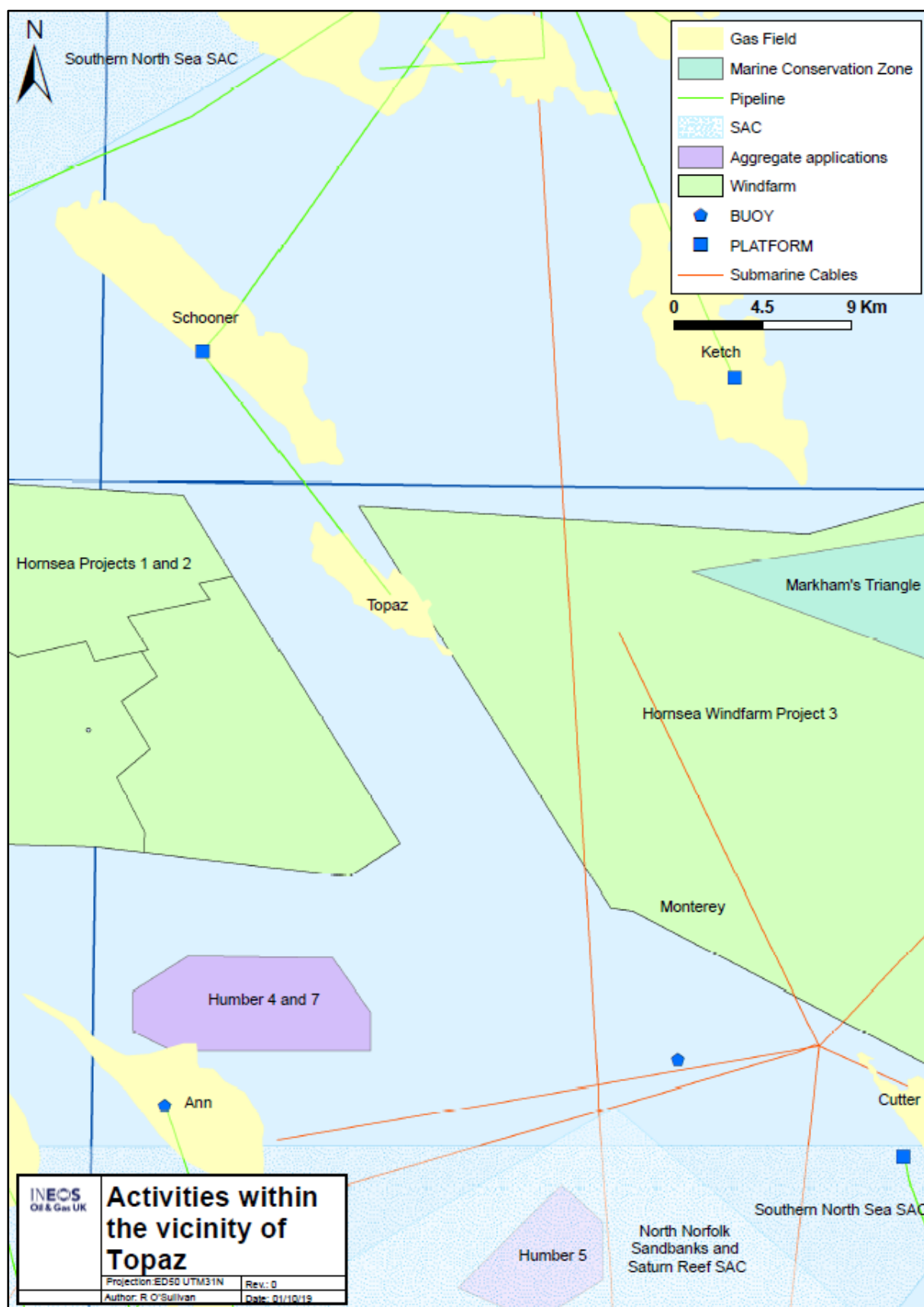
It is considered that the impact on socio-economic factors will be either positive or low.

5.2.8 Cumulative Impacts

Consideration has been given to the potential cumulative impacts of the proposed activities and other activities that have occurred historically, are ongoing or are planned to be undertaken in this area. It is likely that many of the other activities will impact the same receptors therefore the cumulative impact may be greater than assessed here.

Figure 5-1 presents a map of the other activities occurring in the area. Information in relation to proposed surveys and other project information is not generally available so far in advance of the operation therefore this may not include all the potential activity.

Figure 5-1 Activities occurring within the vicinity of Topaz



As previously stated, construction is already underway at the Hornsea Project 1 windfarm and should be completed by 2020. No confirmation is available when construction will commence at Project 2.

There are no Environmental Statements currently submitted with activities that will take place within 40km of Topaz (BEIS 2019).

5.2.9 Transboundary Impacts

The proposed activities will be undertaken 42km from the transboundary line with The Netherlands. Vessel activities within the area will increase during the activity and there is the potential for a hydrocarbon release to sea. Further details are provided in Section 5.1.2. All spills to sea will be managed under the requirements of the OPEP or the vessel SOPEPs.

Any trans-frontier shipment of waste will be completed within the requirements of the appropriate licences.

6 Conclusions

The Topaz subsea wellhead is protected by a wellhead protection structure, located in block 49/2. It ceased production of natural gas and condensate in October 2017; decommissioning will involve the cleaning and flushing of the 6" pipeline and umbilical, removal of the wellhead protection structure and two piles down to 3m below the seabed, removal of the tie-in spools and exposed sections of the pipeline and retrieval of mattresses where possible. A comparative assessment has been undertaken and identified that the most appropriate option is to leave the pipeline in situ.

Background environmental information has been provided. Topaz is located within an area of sand with some areas of gravel and cobbles and undergoes high energy wave action. The benthic species in this area are used to natural seabed disturbance. The area is used as a nursing ground for twelve fish species and a spawning ground for ten species. Seabirds are particularly sensitive to oil on the surface of the water between March, June and September and in December. There is the potential that up to three marine mammal species may be present in the area of Topaz, with June and July seeing the highest densities. Topaz is located within 26km to 33km of three SACs (Southern North Sea, North Norfolk Sands and Saturn Reef and Dogger Bank). Comparison of the proposed activities with the requirements of the East Offshore Marine Plan has been made and it has been concluded that this operation is in line with its principles.

This Environmental Appraisal has been completed following a meeting to identify the potential impacts of the proposed activities. Each potential impact on the surrounding environment was classified as being low, medium or high. Impacts that were determined to be low have not been considered in detail. Those that may potentially have a medium or high impact were assessed and mitigation and control measures identified. These measures have reduced the anticipated impact to low levels. Other projects within the area have also been considered and the cumulative impact assessed.

It has been determined that, if the control and mitigation measures identified are put in place, there should be no significant long term or lasting impact on the surrounding environment. Although some disturbance will occur when the well protection structure, spools and mattresses are removed, this will be minimal and short term. The pipeline shall remain in situ and will be monitored as agreed with the relevant Regulators. The removed materials will be transported to shore where they will be reused / recycled / disposed of appropriately in line with the Waste Management Plan.

The decommissioning will take place within the requirements of the INEOS HS&E Management System which has been certified by external bodies to ISO14001 and OHSAS 18001.

7 References

- Anthony, T. G, N. A. Wright and M.A. Evans (2009). Review of Diver Noise Exposure. Health and Safety Executive RR735. Available at <http://www.hse.gov.uk/research/rrpdf/rr735.pdf>
- BEIS (2016). 29 Round Shipping Density Table. Department of Business, Energy and Industrial Strategy.
- BEIS (2019). Oil and gas: environmental submissions and determinations. Available at <https://www.gov.uk/guidance/oil-and-gas-environmental-data>. Updated 20 Feb 2019.
- CEDA (2011). CEDA Position Paper: Underwater Sound in Relation to Dredging. CEDA Environment Commission Working Group. Available at <https://www.iadc-dredging.com/ul/cms/terraetagua/document/3/0/5/305/305/1/article-ceda-position-paper-underwater-sound-in-relation-to-dredging-terra-et-aqua-125-4.pdf>. Accessed January 2019.
- Coull, K.A., Johnstone, R. and Rogers, S.I. (1998). Fisheries Sensitivity Maps for British Waters. Published and distributed by UKOOA.
- DECC (2016a). UK Offshore Energy Strategic Environmental Assessment. OESEA Environmental Report and Appendices. March 2016. <https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-3-oesea3>
- DEFRA (2014). East Inshore and East Offshore Marine Plans. HM Government. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/312496/east-plan.pdf. Accessed December 2018.
- DEFRA (2019). Markham's Triangle Marine Conservation Zone. 31 May 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/805490/mcz-markhams-triangle-2019.pdf. Accessed October 2019.
- Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2012). Spawning and nursery grounds of selected fish species in UK waters. Science Series Technical Report No. 147. CEFAS, Lowestoft.
- Fugro Survey Limited (2008). Rig Site and Pipeline Route Survey, Topaz Rig Site and Pipeline Route, UKCS Block 49/02a Report Number: 9577V1.0. Volume 1 of 2: Habitat Investigation.
- Hammond, PS., C Lacey, A. Gilles, S Viquerat, P. Borjesson, H. Herr, K. Macleod, V. Ridoux, M.B. Santos, M. Scheidat, J. Teilmann, J. Vingada and N. Øien (2017). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. May 2017. <https://synergy.st-andrews.ac.uk/scans3/files/2017/05/SCANS-III-design-based-estimates-2017-05-12-final-revised.pdf>
- JNCC (1999). Seabird vulnerability in UK waters: block specific vulnerability. JNCC. Joint Nature Conservation Committee and Natural England. Available at <http://jncc.defra.gov.uk/pdf/SouthernNorthSeaConservationObjectivesAndAdviceOnActivities.pdf>. Accessed December 2018.
- JNCC (2016). Harbour Porpoise (*Phocoena phocoena*) possible Special Area of Conservation Southern North Sea. Draft Conservation Objectives and Advice on Activities.
- JNCC (2017). Inshore and Offshore Special Area of Conservation: Southern North Sea. SAC Selection Assessment Document. Joint Nature Conservation Committee and Natural England. Available at <http://jncc.defra.gov.uk/PDF/SouthernNorthSeaSelectionAssessmentDocument.pdf>. Accessed December 2018.

Marine Management Organisation (2015). Modelled mapping of continuous underwater noise generated by activities. A report produced for the Marine Management Organisation, pp 50. MMO Project No: 1097. ISBN: 978-1-909452-87-9.

MMO (2018a). Marine Management Organisation Marine Planning Evidence. Available at <http://defra.maps.arcgis.com/apps/webappviewer/index.html?id=2c2f6e66c0464fa99d99fd6d8822ddef>. Accessed December 2018.

MMO (2018b). Fishing Effort and Quantity and Value of Landings by ICES Rectangle. <https://www2.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/RectangleData>. Accessed January 2019.

National Statistics (2018). Final UK Greenhouse Gas Emissions National Statistics 1990-2016. Available at <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2016>.

Nedwell, J and D. Howell (2004). A review of offshore windfarm related underwater noise sources. *COWRIE*. Accessed December 2018.

OPRED (2018). Decommissioning of offshore oil and gas installations and pipelines. Guidance Notes. Department for Business, Energy and Industrial Strategy. November 2018. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/760560/Decom_Guidance_Notes_November_2018.pdf. Accessed December 2018.

OPRED (2019). Environmental Management Team Policy for Decommissioning Debris Surveys and Recovery and Over-Trawl Verification.

Orsted (2019). Our Wind Farms. Available at <https://orsted.co.uk/en/Generating-energy/Offshore-wind/Our-wind-farms>. Accessed February 2019.

OSPAR (2005). Agreement on background concentrations for contaminants in seawater, biota and sediment. OSPAR agreement 2005-6.

OSPAR (2015) Guidelines to reduce the impact of offshore installations lighting on birds in the OSPAR maritime area. OSPAR Agreement 2015-08). OIC 15/15/1, Annex 5. Available at www.ospar.org/documents?d=33046. Accessed December 2018.

Nicholls, P., Hewitt, J. and Halliday, J. (2003) Effects of suspended sediment concentrations on suspension and deposit feeding marine macrofauna. National Institute of Water and Atmospheric Research Ltd. Auckland, New Zealand.

Pangerc, T., S. Robinson, P. Theobald and L Galley (2017). Underwater sound measurement data during diamond wire cutting: First description of radiated noise. *Presented at Fourth International Conference on the Effects of Noise on Aquatic Life, Dublin Ireland, 10-16th July 2016. Published in Acoustical Society of America. 27.*

RDUK (2008). Topaz Environmental Statement. July 2008. RWE Dea UK RD-TOP-SRT001. Rev 1.

Reid, J.B, P.G.H Evans, S. P. Northridge (2003). Atlas of Cetacean distribution in north-west European waters. JNCC, Peterborough, UK.

UKDMAP (1998). Third edition. British Oceanographic Data Centre UK.

Webb, A., M Elgie, C. Irwin, C. Pollock and C. Barton (2016). Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK. HiDef Aerial Surveying Limited and Oil and Gas UK. Document Number HP00061 701.

Weilgart, L. (2013) A review of the impacts of seismic airgun surveys on marine life. Submitted to the CBD Expert Workshop on Underwater Noise and its Impacts on Marine and Coastal Biodiversity, 25-27 February 2014, London, UK. Available at: <http://www.cbd.int/doc/?meeting=MCBEM-2014-01>.