Sean Field Decommissioning

Environmental Appraisal

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Terms and Abbreviations

Abbreviation	Text in Full
AIS	Automatic Identification System
ALARP	As Low As Reasonably Possible
BAT	Best Available Techniques
BEIS	Business, Energy and Industrial Strategy
CA	Comparative Assessment
CCUS	Carbon capture, usage and storage
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CIEEM	Chartered Institute of Ecology and Environmental Management
CO_2	Carbon dioxide
CoP	Cessation of Production
CSV	Construction Support Vessel
DECC	Department of Energy and Climate Change
°C	Degree(s) Celsius
DM1,2	Delta Platform Module
DoB	Depth of Burial
DP	Decommissioning Programme
DFPV	Drained, Flushed, Purged and Vented
DSV	Diving Support Vessel
DTI	Department of Trade and Industry
EA	Environmental Appraisal
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EMT	Environmental Management Team
ENE	East-Notheast
ENVID	Environmental Impact Identification
EPS	European Protected Species
ESE	East-Southeast
ESG	Environmental, Social and Corporate Governance
EU	European Union
EUNIS	European Nature Information System
FAO	Food and Agriculture Organisation
FCS	Favourable Conservation Status
GJ	Gigajoule

Abbreviation	Text in Full
HLV	Heavy Lift Vessel
HRA	Habitats Regulation Appraisal
HSE	Health & Safety Executive
HSEQ	Health, Safety, Environment and Quality
HSES	Health, Safety, Environment and Security
HWDT	Hebridean Whale and Dolphin Trust
ICES	International Council for the Exploration of the Seas
IEMA	Institute of Environmental Impact Assessment
IMO	International Maritime Organization
in	Inch
IoP	Institute of Petroleum
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
kg	Kilogrammes
km	Kilometre
km^2	Square kilometre
KP	Kilometre Point
LAT	Lowest Astronomical Tide
m	Metre
MAIB	Marine Accident Investigation Branch
MARPOL	International Convention for the Prevention of Pollution from Ships
MAT	Master Application Template
MCDA	Multi Criteria Decision Analysis
MCZ	Marine Conservation Zone
MFE	Mass Flow Excavation
µg/g	Micrograms per gram
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
mg/l	Milligrams per litre
MHWS	Mean High Water Spring
mm	Millimetre
MMO	Marine Management Organisation
MoD	Ministry of Defence
MPA	Marine Protected Area

Abbreviation	Text in Full
N	North
N/A	Not Applicable
NAI	Normally Attended Installation
NCMPA	Nature Conservation Marine Protected Area
NE	Northeast
NFFO	National Federation of Fishermen's Organisations
NM	Nautical miles
NNE	North-Northeast
NNW	North-Northwest
NORM	Naturally Occurring Radioactive Material
NPAI	Not Permanently Attended Installation
NtMs	Notices to Mariners
NW	Northwest
OD	Outside Diameter
ODU	Offshore Decommissioning Unit
OGA	Oil & Gas Authority
OGUK	Oil & Gas UK
ONE-Dyas	One-Dyas UK Limited
OPEP	Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
OSPAR	Oslo Paris Convention – Convention for the Protection of the Marine Environment of the North East Atlantic
P&A	Plug and Abandon (Wells)
PAH	Polycyclic aromatic hydrocarbon
PD	Sean Papa, wellhead and compression platform
PL	Pipeline
PLQ	Platform Living Quarters
PM 1,2,3	Papa Platform Module
PMF	Priority Marine Feature
PP	Sean Papa, production and accommodation platform
PVT	Papa Flare Tower
RD	Sean Romeo, a Not Permanently Attended Installation (NPAI)
RM 1,2	Romeo Platform Module
ROV	Remotely Operated Vehicle
RVT	Romeo Flare Tower

Abbreviation	Text in Full
SAC	Special Area of Conservation
SAT	Subsidiary Application Template
SCOS	Scientific Committee on Seals
SE	Southeast
SFF	Scottish Fishermens Federation
SMRU	Sea Mammal Research Unit
SNS	Southern North Sea
SOPEP	Shipboard Oil Pollution Emergency Plans
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Areas
SSE	South-Southeast
SSIV	Sub-Surface Isolation Valve
SSS	Side Scan Sonar
SSSI	Site of Special Scientific Interest
SSW	South-Southwest
Te	Tonne
THC	Total Hydrocarbon Concentration
TFSW	Trans Frontier Shipment of Waste
UK	United Kingdom
UKBAP	United Kingdom Biodiversity Plan
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VMS	Vessel Monitoring System
WMP	Waste Management Plan
WMS	Waste Management Strategy
WNW	West-Northwest
WSW	West-Southwest

EXECUTIVE SUMMARY

1 Introduction and Background

This section provides a non-technical summary of the findings for the Environmental Appraisal (EA) conducted by One-Dyas UK Limited (henceforth 'ONE-Dyas') for the proposed decommissioning activities associated with the Sean Field.

The Sean Field is comprised of the Sean North, Sean South and Sean East Fields. Collectively they will be referred to throughout, as the Sean Field. The Sean Field lies within the Southern North Sea (SNS). The Field lies approximately 94 km east of the UK coastline and 15 km from the UK / Netherlands border (Figure 1-1). The Field is comprised of 3 surface-breaking structures: Sean Papa which consists of 2 bridge-linked platforms (a wellhead and compression platform (PD) and a production and accommodation platform (PP)), and Sean Romeo (RD), a Not Permanently Attended Installation (NPAI). RD is connected to PP through a 20" infield duplex flowline (PL310). The Sean Field System produces gas from 10 wells on Sean PD and 6 wells on Sean RD. Gas from the Sean Field is transported through a 106.502 km 30" gas export pipeline to the Bacton Terminal (PL311 trunkline).

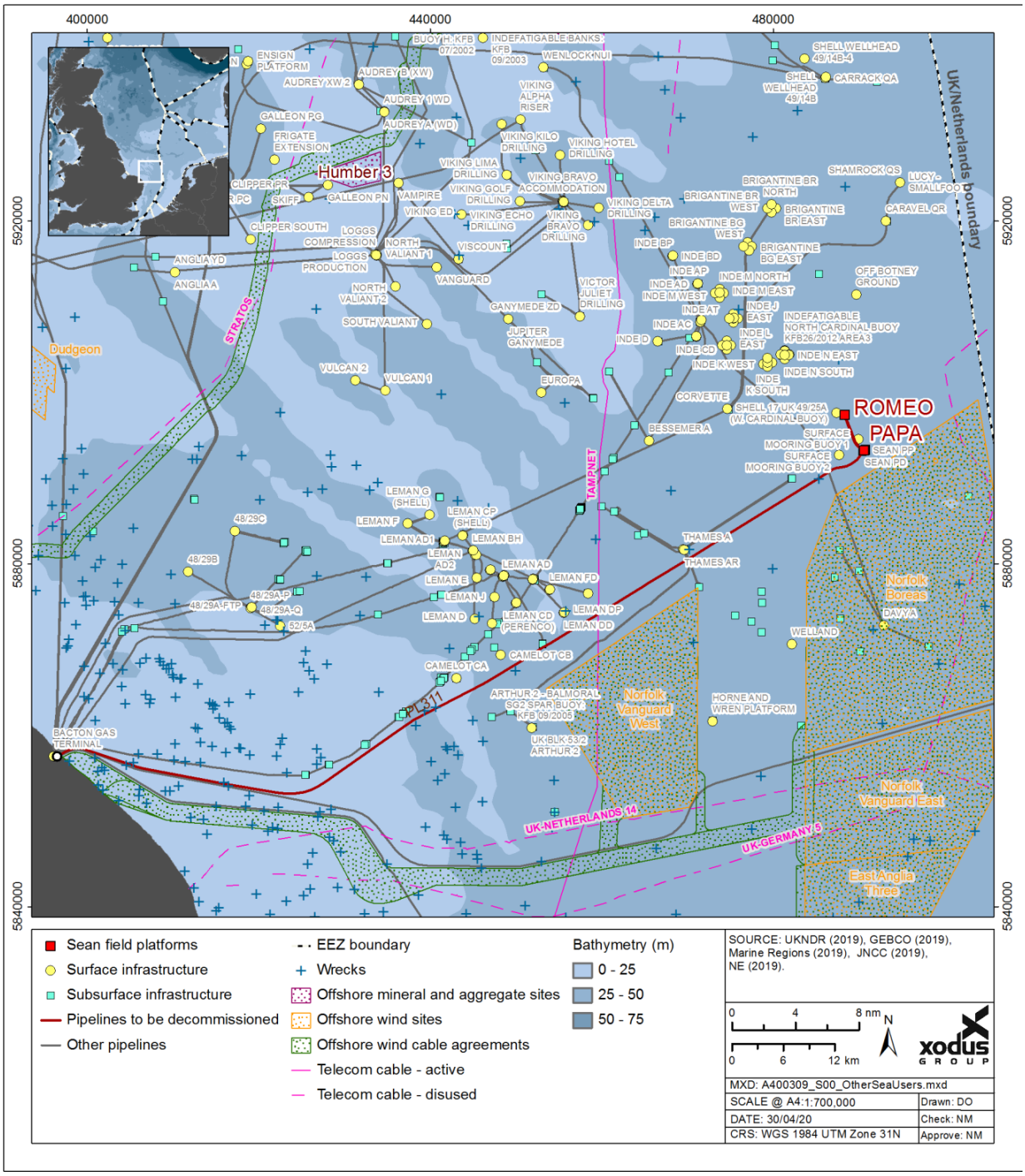


Figure 1-1 Location of the Sean Field in the context of other SNS installations

2 Decommissioning Overview

As part of the planning for decommissioning and to obtain regulatory approval for the proposed activities, a Decommissioning Programme (DP) has been prepared for the Sean Field, which is supported by this EA. The DP and EA will cover the decommissioning of all flowlines, subsea and surface infrastructure associated with the Sean Field.

This supporting EA does not cover well plugging and abandonment (P&A), or the flushing and cleaning operations that will be undertaken prior to the commencement of the decommissioning activities. These activities will be carried out as part of the preparatory work preceding decommissioning, under existing field operational permits.

The PL311 pipeline reaches landfall at Bacton Terminal, where decommissioning activities have the potential to affect coastal physical processes and recreational uses. However, onshore aspects of the decommissioning activities fall outside the scope of the Sean Decommissioning Programmes and will therefore be covered by relevant permits.

Further detail about the activities and infrastructure to be decommissioned is provided in Section 4 of this non-technical summary.

3 Proposed Schedule

The precise timing of the decommissioning activities is not yet confirmed and will be subject to market availability of cost-effective removal services and contractual agreements. The high-level Gantt chart featured in Figure 1-2 provides the overall schedule for the programme of decommissioning activities for the Sean Field.

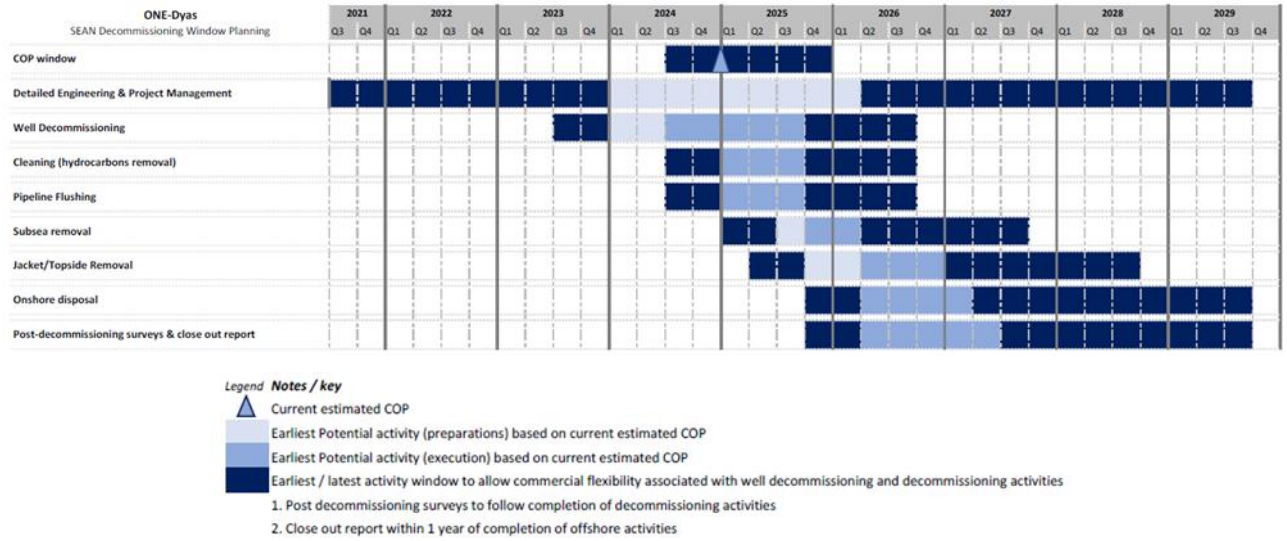


Figure 1-2 High level schedule for the Sean decommissioning project

4 Options for Decommissioning

All of the Sean Field infrastructure was assessed against the Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines (BEIS, 2018). The recommended Comparative Assessment (CA) process was applied. Equipment was initially organised into groups of items with similar characteristics, this allows for greater efficiency in dealing with the large inventory. The guidance identifies certain equipment which must be fully removed and some categories of pipelines which may be left decommissioned *in situ* subject to CA. Once the equipment groups designated for full removal were identified the remaining groups were assessed further.

All possible decommissioning options for the remaining groups were coarsely screened against the primary criteria as specified within the BEIS (2018) Guidance: Safety; Environment; Technical; Societal; and Economic. The options were scored against each criterion as either green, amber or red, pertaining to attractive, acceptable, or unattractive, respectively. This process eliminated the least favourable options from each equipment group in preparation for detailed evaluation of the remaining options. Those remaining options were then investigated in detail to develop quantitative and qualitative data for each option pertaining to the primary criteria and sub-criteria (e.g. safety data, environmental impact data, technical considerations, societal impacts and costs). Once this data was prepared in the form of published studies, a detailed evaluation was conducted to determine the final recommended decommissioning option for each item of equipment. This was

facilitated by comparing the data for each sub-criterion across the options using a pair-wise analysis to produce a relative score for each sub-criterion that would be summed to produce an overall relative score for each option and thereby identify the emerging recommendation for the group.

The decision-making process underpinning the proposed DP is described in Section 2 of the EA and the selected decommissioning options, including those carried forward to CA, are summarised in Table 1-1 below.

Table 1-2 depicts the decommissioning options reviewed in the CA Process, with the selected options in bold. The PL311 trunkline was reviewed in detail against whether potential installation burial depths and environmental conditions would drive a requirement to consider subgrouping along this pipeline. Upon review it became apparent that subgroups were not necessary and CA Groups 1 – 5 were merged and considered as a single Group 1 and have been presented thus throughout.

Table 1-1 Decommissioning of the Sean Field Installations and Infrastructure

CA Group No.	Installations/ Infrastructure	Description	Decommissioning Option
1	30" Rigid Export Pipeline	PL311: from Sean PP to Bacton, Concrete Coated, Partially Trenched (KP 1.0 to 8.0 and KP 54.0 to Sean PP) and Surface Laid in all other locations with Natural Backfill. Rock Cover, within the 500 m Zone and in 5 spot locations between KP 11.0 and 15.0 only[1].	Subject to full CA
6	20" Rigid Export Pipeline	PL310: from Sean RD to Sean PD, Concrete Coated, Trenched with gravel back fill and rock cover on trench transitions (within the 500 m Zone). The average DoB is 0.72 m.	Subject to full CA
7	1" Electrical Cable	A single power cable from Sean RD to Sean PD, Trenched & Buried. The cable is buried to an average DoB of 0.87 m.	Subject to full CA
8	Spools	All spools associated with the tie-in of pipelines to structures / risers.	Full Removal
9	Risers	Risers at platforms associated with pipelines.	Full Removal
10	Jumper / Umbilical	All jumpers / umbilical associated with the power cable and the SSIV structure.	Full Removal
11	Structures	All subsea structures (installations) – an SSIV.	Full Removal
12	Protection	All protection, support and stabilisation materials such as mattresses and grout bags.	Full Removal[2]

[1]. A full DoB profile for the PL311 is available in Appendix B.
[2] It should be noted that the default position is to fully remove all protection features in the Sean Field, this excludes any features associated with third party crossings and installations.

Table 1-2 CA Decommissioning Options Considered

CA Group No.	Subsea Infrastructure Description	Decommissioning Options Considered
1	30” Trunkline (PL311)[3]	• (Option 2A) Full removal via de-burial and cut and lift pipeline sections using a construction support vessel (CSV). • (Option 4A) Leave *in situ* and rock cover the areas of Spans/Exposure/Shallow Burial using a suitable rock dump vessel. • (Option 4C) Leave *in situ* and remove the areas of Spans/Exposure/Shallow Burial using a CSV and place rock at the cut ends. • **(Option 5) Leave *in situ*, cut and remove offshore pipeline end and remediate the pipeline end and any FishSafe spans[4] with rock.[5]**
6	20” Export Pipeline (PL310)	• (Option 2A) Full removal via de-burial of the pipeline using an MFE then cut and cut and lift the pipeline. • **(Option 5) Leave *in situ*, cut and remove pipeline ends and remediate the pipeline ends and any FishSafe spans with rock.**
7	1” Electrical Cable[6]	• **(Option 2C) Full removal, de-bury the entire line then reverse reel the cable using a suitable CSV.** • (Option 5) Leave *in situ*, cut and remove pipeline ends and remediate the cable ends with rock.

[3] Merged Groups 1 – 5 are now all considered Group 1 and have been assessed in the CA as such.
[4] FishSafe spans are defined as spans in excess of 0.8 m in height from the top of the pipeline and ≥10 m in length which therefore present a hazard to fishing activity.
[5] Offshore end of PL311 will be capped and the pipeline will be left flooded with inhibited seawater.
[6] Although Deburial has been assessed, the intent is to try and pull the cable through the sediment initially if integrity allows, reducing the environmental impact by negating full deburial.

5 Environmental and Societal Baseline

The key environmental and social sensitivities in the Sean Field and along the PL311 trunkline are summarised in Table 1-3.

Table 1-3 Key Environmental and Social Sensitivities

Environmental Receptor	Description
Benthic environment	
Seabed type	According to data by the British Geological Society, the Sean Field is situated in an area of medium and fine sands. The majority of the PL311 pipeline also passes through areas of fine sands (NMPi, 2020). The EUNIS habitat complex in the immediate area surrounding the Sean Field is classified as A5.27 'Deep circalittoral sand' (EMODnet, 2019). Very little data is available on these habitats however they are likely to be more stable than their shallower counterparts (European Environment Agency, 2019). The PL311 pipeline also passes through EUNIS habitat A5.15 'Deep circalittoral coarse sediments', A5.44 'Circalittoral mixed sediments', and small areas of either A5.25 'Circalittoral fine sands' or A5.26 'Circalittoral muddy sand' (EMODnet, 2019). Of the five stations sampled around the Sean Field platforms in the 2011 survey (Fugro, 2011), predominantly comprised of medium and fine sands, with a low proportion of fine (silt and clay) material and minimal coarse (gravel and pebble) sediment (Fugro, 2011). Additional surveys around the PL311 pipeline described the inshore sediment type at Bacton (overlapping the pipeline) as A3.1 'High energy infralittoral rock' with areas of A5.1 'Sublittoral coarse sediment' (Royal HaskoningDHV, 2018). The nearshore sediment at either side of the trunkline was reported as highly heterogeneous seabed sediment, comprising a mix of coarse sand and gravel, including pebbles and cobbles (RPS Energy, 2010; Orbis Energy Ltd, 2014; Fugro, 2016b).
Benthic Environment	The Fugro (2011) survey conducted at the Sean Field found the dominant taxa were bivalve (*Angulus fabula)*, amphipod (*Bathyporeia elegans)* and polychaete (*Spiophanes bombyx).* Additional assessments surrounding the PL311 pipeline show that other dominant fauna included amphipods and the polychaete *Nephtys cirrosa* (a species known to prefer clean, medium to fine sand with low fines content; Shell, 2015). Closer to shore calcareous worm tubes and faunal turf growing on the more stable areas of the biotope (RPS Energy, 2010). The Ross worm, *Sabellaria spinulosa*, responsible for the formation of biogenic reefs, was found in relatively high numbers in various surveyed areas around the PL311. It is reasonable to assume it is found along the PL311. The nearby proposed Norfolk Vanguard Offshore Wind Farm has an associated export cable, which when installed, will parallel the PL311 for approximately 30 km; this area was surveyed and, in addition to *S. spinulosa*, sea stars, hermit crabs, edible crabs and gobies were also observed, amongst other species. It is likely these species are found along the trunkline. The overview of benthic communities was consistent between surveys near the PL311 and corresponds with the characterised nearshore / offshore habitat types. On the homogenous sandy sediment offshore, the benthic community showed minor variation in terms of abundance, richness and species composition. Nearshore, on the more heterogenous sediment, there was a higher species diversity present (especially on patchy areas of rocky habitat in deeper waters and armouring which overlies the export pipelines from the terminals).
OSPAR (2008) List of Threatened and/or Declining Habitats and Species	

Ocean quahog	Ocean quahog are one of the longest-living animals in the world. Ocean quahog are burrowing filter feeders, therefore are reliant on suitable sediment conditions – sand and gravel substrates are their preferred habitat. The sediment type surrounding the Sean platforms have been identified as predominantly megarippled medium to fine sands with a low proportion of fine (silt and clay) material and minimal coarse (gravel and pebble) sediment (Fugro, 2011) (Figure 3-2). This is therefore likely to be a suitable habitat for ocean quahog (*A. islandica*). However, according to the findings of the 2011 surveys around the Sean Field platforms and along the PL311 pipeline route, no ocean quahog aggregations were found (Fugro, 2011; RPS Energy, 2010).
Conservation sites	
Special Areas of Conservation (SACs)	The decommissioned pipeline goes through three SACs: Southern North Sea (SNS) SAC, North Norfolk Sandbanks and Saturn Reef SAC and Haisborough, Hammond and Winterton SAC. The Sean Field borders the SNS SAC (3 km at the closest point) and the PL311 pipeline overlaps the SNS SAC. This is the largest SAC in the UK and is designated for the protection of Annex II species harbour porpoise (*Phocoena phocoena*). This site includes key winter and summer habitat for this species (JNCC, 2020a). The Sean Field is located 24 km from the North Norfolk Sandbanks and Saturn Reefs SAC and the decommissioned pipeline (PL311) runs through the south of the SAC. The SAC consists of 10 main sandbanks and a number of smaller banks (Graham *et al.*, 2001 in JNCC, 2010). The sandbanks extend from about 40 km off the northeast coast of Norfolk out to approximately 110 km (Collins *et al.,* 1995 in JNCC, 2010). The banks included are: Leman, Ower, Inner, Well, Broken, Swarte and four banks called, collectively, the Indefatigable. The banks support communities typical of sandy sediments in the southern North Sea, such as polychaete worms, isopods, crabs and brittlestars. One particular polychaete, the Ross worm (*S. spinulosa)*, is capable of creating biogenic reef structures through consolidating thousands of fragile sand-tubes to create a solid structure that rises from the seabed. The Saturn reef is such a structure (JNCC, 2009). The Sean Field is 53 km from the Haisborough, Hammond and Winterton SAC and the PL311 pipeline overlaps the SAC. This SAC is designated for two Annex I habitats: 'sandbanks which are slightly covered by sea water all the time', and 'reefs'. These sandbanks are curved, run parallel to the coast, are composed of sandy sediment and lie in full salinity water with intermediate coastal influence. Infaunal communities of the sandy bank tops are consequently of low biodiversity, characterised by mobile polychaetes and amphipods which can rapidly re-bury themselves into the dynamic sediment environments. A series of sandbanks which meet the criteria of the Annex I habitat for *S. spinulosa* reefs are located at Haisborough Tail, Haisborough Gat and between Winterton Ridge and Hewett Ridge (JNCC, 2020b). The reefs are consolidated structures of sand tubes showing seafloor coverage of between 30% to 100% of the sediment.
Marine Conservation Zone (MCZ)	The Cromer Shoal Chalk Beds MCZ is located 200 m off the North Norfolk Coast. The end of the PL311 pipeline passes through the MCZ. The MCZ is designated for a number of features including; high and moderate energy circalittoral rock, high and moderate energy infralittoral rock, North Norfolk coast (subtidal), peat and clay exposures, subtidal chalk, subtidal coarse sediments, subtidal mixed sediments and subtidal sands (Natural England, 2016a).
Special Protected Area (SPA)	The Greater Wash SPA is located 80 km from the Sean Field and is intersected by the PL311 pipeline. The SPA has been designated for the protected of the following species: red-throated diver (*Gavia stellate),* common scoter *(Melanitta nigra),* little gull *(Hydrocoloeus minutus),* sandwich tern *(Sterna sandvicensis),* common tern *(Sterna hirundo),* and little tern *(Sternula albifrons)* (Natural England, 2016b).

	The Breydon Water SPA is located 100 km southwest of the Sean Field and 24 km south of the PL311. It is designated for the following qualifying features: wintering populations of tundra swan (*Cygnus columbianus bewickii*), European golden plover (*Pluvialis apricaria*), pied avocet (*Recurvirostra avosetta*) and northern lapwing (*Vanellus vanellus*), breeding populations of common tern, and non-breeding populations of ruff (*Philomachus pugnax*) (JNCC, 2015b). The Outer Thames Estuary SPA is 72 km southwest of the Sean Field and 26 km southeast of the PL311. The SPA is designated for: breeding common tern, breeding little tern, and non-breeding populations of red-throated diver (Natural England, 2017).
Site of Special Scientific Interest (SSSI)	The Sean Field and pipelines are not located within any SSSIs. However, there are two SSSIs in the vicinity of the PL311 pipeline: Mundesley Cliffs SSSI and Paston Great Barn SSSI. Mundesley Cliffs SSSI is located 0.6 km from the trunkline. It is designated for its earth heritage. The cliffs along this stretch of coast provide some of the very best sections in the Pleistocene Cromer Forest-bed Formation, especially in Cromerian marine and freshwater deposits, and freshwater sediments of the early Anglian Cold Stage. Paston Great Barn SSSI is located 1.2 km from the pipeline. This site supports the only barbastelle bat (*Barbastella barbastellus)* maternity roost in Norfolk and one of only three sites identified in the UK (Natural England, 1999).
Annex I Habitats	Annex I Sandbanks (sandbanks which are slightly covered by sea water all the time) are located between 24 – 99 km west of the platforms. Within 40 km of each platform, Sean RD is located 23.7 km WNW of the North Norfolk Sandbanks, with Sean PP located 26.8 km WNW and Sean PD 26.9 km WNW. Fugro (2011) reported no bedforms consistent with sand banks or *S. spinulosa* reef habitat were evident from the geophysical data and no potentially sensitive habitats (e.g. potential Annex I Habitats) were identified from photographic data acquired in the Sean PP site. Annex I features have however been identified in surveys around the trunkline in the nearshore area. The proposed cable corridor of the Norfolk Vanguard Offshore Wind Farm will be 0.42 km SSE of the trunkline and will be adjacent to the first 30 km of the pipeline from Bacton. Sandbanks were present in the cable corridor and *S. spinulosa* was distributed along the cable corridor, associated with the more heterogenous substrate towards the shore (Fugro, 2016b).
Conservation Species	
Coastal and Offshore Annex II species most likely to be present in the project area	
Pinnipeds – Harbour and Grey Seals	Pinnipeds are not expected to be present in the Sean Field in significant numbers, with densities estimated at approximately 0-1 individuals per 25 km^2 for both harbour (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) (Russel *et al.*, 2017). This is due to the site being approximately 94 km offshore. However, higher numbers are expected around the pipeline as it gets closer to the shore, particularly of harbour seals (Russel *et al.*, 2017).
European Protected Species most likely to be present in the project area	
Harbour porpoise	The harbour porpoise is a small, highly mobile species of cetacean that is common in all UK waters and can be found in the vicinity of the proposed decommissioning area in very high abundance, particularly in the summer months. The density of harbour porpoise is estimated at 0.89 animals/km^2 across the project area (Hammond *et al.*, 2017), and is greatest within the Southern North Sea SAC (SNCBs, 2020).
Minke whale	Minke whale (*Balaenoptera acutorostrata*) occur in water depths of 200 m or less throughout the northern and central North Sea. They are usually sighted in pairs or in solitude; however,

	groups of up to 15 individuals can be sighted during feeding events at their annual summer feeding grounds. Sightings in relation to the project area are greatest in spring and summer months (Reid *et al.*, 2003). The density of minke whales is estimated to be 0.01 animals/km^2 in the project area (Hammond *et al.*, 2017).
White-beaked dolphin	The white-beaked dolphin (*Lagenorhynchus albirostrisis*) are found mostly in continental shelf waters with depths between 50 m and 100 m, and rarely out to the 200 m isobath (Reid *et al.*, 2003). Distribution of the species has been linked to sea surface temperature, local primary productivity and prey abundance. White-beaked dolphins are usually found in groups of around 10 individuals, although large groups of up to 500 animals have been seen. The species are estimated to have a density of 0.002 animals/km^2 near the project area (Hammond *et al.*, 2017). They are most prevalent in moderate densities in the project area from summer into the early winter months (Reid *et al.*, 2003).
Fish – spawning and nursery grounds	
Spawning grounds	The Sean Field is located within a high-density spawning ground for plaice (*Pleuronectes platessa*) and low-density spawning grounds for cod (*Gadus morhua)*, whiting (*Merlangius merlangus*), sandeel (*Ammodytidae spp.)*, mackerel (*Scomber scombrus*), sprat (*Sprattus sprattus*), and Norway lobster (*Nephrops norvegicus*). The PL311 pipeline is located within a high-density spawning ground for plaice, low-density spawning grounds for cod, sole (*Solea solea*), herring (*Clupea harengus*), sandeel, and whiting. Additionally, the pipeline is located within a spawning ground of undetermined intensity for lemon sole (*Microstomus kitt*) and sprat (Coull *et al.*, 1998; Ellis *et al.*, 2012).
Nursery grounds	The following species have nursery grounds in the Sean Field: cod, herring, mackerel, tope shark (*Galeorhinus galeus*), whiting, sprat and Norway lobster. The PL311 pipeline route passes through areas known to be nursery grounds for: cod, herring, mackerel, plaice, sandeel, sole, lemon sole, sprat, tope shark, thornback ray (*Raja clavata*) and whiting (Coull *et al.*, 1998; Ellis *et al.*, 2012).
Probability of juvenile fish aggregations	Aires *et al.* (2014) provides a predicted spatial distribution of 0-year group (i.e. juvenile) fish. The model predicted low densities for the following species in the Sean Field and along the PL311: plaice, sole, hake, anglerfish, blue whiting, Norway pout, haddock, and cod. The probability of juvenile mackerel aggregations is low-moderate. The probability of juvenile herring, horse mackerel, and sprat occurring in aggregations within the project area is moderate. Only the probability of whiting occurring in an aggregation was high within the project area (Aires *et al*., 2014).
Seabirds	
According to the density maps provided in Kober *et al.* (2010), the following species have been recorded within the area of proposed operations: northern fulmar (*Fulmarus glacialis)*, Manx shearwater (*Puffinus puffinus)*, northern gannet (*Morus bassanus)*, pomarine skua (*Stercorarius pomarinus)*, Arctic skua (*Stercorarius parasiticus)*, great skua (*Stercorarius skua)*, black-legged kittiwake (*Rissa tridactyla)*, great black-backed gull (*Larus marinus)*, lesser black-backed gull (*Larus fuscus)*, herring gull (*Larus argentatus)*, common guillemot (*Uria aalge*), razorbill (*Alca torda)*, little auk (*Alle alle)* and Atlantic puffin (*Fratercula arctica)*. In Blocks 52/4, 52/3, 52/5, 52/9, 52/10, 53/1 and 53/2 the sensitivity of seabirds to oil pollution, reflected by the SOSI (JNCC, 2015a), is high to extremely high for the majority of the Blocks over winter into spring (from October to April). It is low for the Blocks over summer between May and September, except for the month of August in many of the Blocks. The SOSI is comparatively much lower in Blocks 49/24 and 49/25: sensitivity is either low or no data is available (Webb *et al.*, 2016). In Blocks 49/27, 29/28 and 49/29, the SOSI is higher in the winter months; Blocks 49/27 and 49/28 are extremely high between November and February. Comparatively lower, though also high, Block 49/29 shows the same patter over winter (Webb *et al.*, 2016).	
Seabird Oil Sensitivity Index (SOSI)	

Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
48/29	1	1	3	3*	4	5	5	4	5	3*	3	2
48/30	1*	1	3	3*	N	5*	5	4	5	3*	3	2
49/19	5*	N	N	N	5*	5	5	5	5	5*	5*	5
49/20	5*	N	N	N	5*	5	5	5	5	5*	5*	5
49/21	1*	1	2	2*	N	N	5*	5	5*	N	1*	1
49/22	N	3*	3	3*	N	N	5*	5	3	3*	1*	1
49/23	3*	4*	4	4*	5*	5	5*	5	5	5*	3*	3
49/24	5*	5*	5	5*	5*	5	5	5	5	5*	5*	5
49/25	5*	N	N	N	5*	5	5	5	5	5*	5*	5
49/26	1*	1	4	4*	N	5*	5*	5	5	3*	3	2
49/27	N	1*	4	4*	N	5*	5*	5	5*	N	1*	1
49/28	1*	4*	4	4*	N	5*	5*	5	5*	N	1*	1
49/29	3*	4*	4	4*	5*	5	5*	5	5*	N	3*	3
49/30	3*	N	N	N	5*	5	5	5	5*	N	3*	3
50/16	5*	N	N	N	5*	5	5	5	5	5*	5*	5
50/21	5*	N	N	N	5*	5	4	5	5	5*	5*	5
50/26	5*	N	N	N	5*	5	2	5	5*	N	5*	5
52/4	2	1	2	2*	5	4	5	4	5	3*	3	2
52/3	2	2	3	3*	5	5	5	4	5	3*	3	2
52/5	1	1	3	3*	5	5	5	4	5	3*	3	2
52/9	1	1	2	2*	5	2	5	4	5	2*	2	2
52/10	1	1	2	2*	5	3	5	4	5	3*	3	2
53/1	1	2	3	3*	N	N	5*	5	5	3*	3	2
53/2	1	3	3	3*	N	N	5*	5	5*	4*	4	2
53/3	1	4	3	3*	N	N	5*	5	5*	5*	5	2
53/4	3*	4*	4	4*	N	N	5*	5	5*	N	3*	3
53/5	3*	1*	1	1*	N	N	5*	5	5*	N	3*	3
53/6	1	2	2	2*	5	3	3*	5	5	3*	3	2
53/7	1	4	2	2*	5*	3*	5*	5	5*	3*	3	3
53/8	1	4	2	2*	N	N	5*	5	5*	4*	4	2
54/1	5*	N	N	N	5*	5	3	5	5*	N	5*	5
Key	**1** = Extremely high		**2** = Very high		**3** = High		**4** = Medium		**5** = Low		**N** = No data	
	* in light of coverage gaps, an indirect assessment of SOSI has been made using the method provided by the Joint Nature Conservation Committee (JNCC) (Webb *et al.*, 2016)											

Socio-economic Receptor	Description

Commercial fishing

According to fishing data from the MMO (2020), fisheries in ICES rectangles 34F2 and 35F2 have predominantly targeted demersal species which have consistently dominated the catch by weight and value. Conversely fisheries within 34F1 have predominantly targeted shellfish species (crab, lobster, whelks). The live weight catch was noticeably lower in 2018 than previous years for all three ICES rectangles.

Fishing effort in 34F1, 34F2 and 35F2 was low year round (<50 days per annum; MMO, 2020). Amalgamated VMS data from 2007-2015 presented in Figure 3-7 shows fishing effort in this region from mobile, passive and demersal gears. Fishing intensity is generally low for all gear types around the platforms and pipeline PL310. There is no fishing data available for the southwest portion of the PL311 pipeline. Fishing effort increases to the northeast of the pipeline for demersal and mobile gears and decreases near the platforms.

Fishing Landings in ICES Rectangles 34F1, 34F2 and 35F2 (MMO, 2020)

ICES Recta-ngle	Species type	2019		2018		2017		2016		2015	
		Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)
34F1	Demersal	4	16,988	4	23,738	4	17,247	7	24,084	6	16,313
	Pelagic	16	11,424	6	4,812	15	8,776	10	6,863	16	9,750
	Shellfish	428	927,828	156	462,909	447	878,836	253	552,330	317	484,161
	Total	**488**	**956,240**	**166**	**491,459**	**466**	**904,859**	**270**	**583,277**	**339**	**510,224**
34F2	Demersal	32	80,764	35	157,425	52	229,859	142	631,858	184	801,702
	Pelagic	0	70	-	-	0	0	-	-	-	-
	Shellfish	4	6,104	4	4,804	1	1,960	1	3,336	2	3,354
	Total	**36**	**86,938**	**39**	**162,229**	**53**	**231,819**	**143**	**635,194**	**186**	**805,056**
35F2	Demersal	6	24,646	7	15,679	63	235,571	84	366,216	82	283,654
	Pelagic	-	-	-	-	0	0	-	-	-	-
	Shellfish	6	9,117	3	4,412	0	417	0	5	0	146
	Total	**12**	**33,763**	**10**	**20,091**	**63**	**235,988**	**84**	**366,221**	**82**	**283,800**

Other sea users

Shipping activity	Shipping activity is considered very high in Blocks 52/4, 52/5, 52/10 and 53/1, high in Bocks 49/24, 49/25, 49/27, 49/28, 49/29 and 53/2. Blocks 49/24, 49/25 and 49/29 are additionally located within deep water routes. There is no available data for Blocks 52/9 and 52/3 close to shore (Oil and Gas Authority, 2016).
Oil and Gas	The Sean Field and PL311 pipeline are located in the SNS in an area of extensive oil development with a number of fields located nearby, see below: *Installation* — *Installation Type* — *Operator* — *Distance and direction (from Sean PP)*

	Corvette	Platform	Shell	16.7 km WNW
	Davy A	Platform	Perenco	20.7 km SSE
	Inde CD, CP, AT, AC and AQ	Platform	Perenco	23.7 – 24.3 km WNW
	Bessemer A	Platform	Perenco	25.2 km WSW
	Caravel QR	Platform	Perenco	26.9 km NNE
	Brigantine BG and BR (north/south/east and west)	Platform	Shell	26.9 – 30.7 km NNW
	Caravel	Platform	Shell	27.0 km NNE
	Inde D, AD, AP, BD and BP	Platform	Perenco	27.3 – 31.9 NW
	Shamrock QS	Platform	Shell	31.5 km NNE
	Leman G	Platform	Perenco	36.4 km WSW
	Europa (not in use)	Platform	Chrysaor	38.4 km WNW
	Leman (DP and DD)	Platform	Perenco	39.8 km WSW
Telecommunication	The closest telecommunication cables in the vicinity of the Sean Field is the telecom UK-Germany BT cable that is now disused (11.1 km ENE of the Sean PD platform). The closest active cable is the Telecom SEA-ME-WE3 cable located 19.33 km ESE of the Sean PD platform (NMPi, 2020).			
Military activities	There are no military restrictions on Blocks 49/24, 49/25, 49/27, 49/28, 49/29, 53/1, 53/2. However, Blocks 52/4, 52/5, 52/9 and 52/10 are of concern to the MoD as they lie within a training ground (OGA, 2019). Any activities taking place within this Block will require prior notification to the MoD.			
Renewables	There are two proposed renewable energy sites within 40 km of the project area. The closest is the Norfolk Boreas proposed wind farm site which will be located approximately 2.5 km south of the Sean Field. Additionally, the Norfolk Vanguard West proposed wind farm site will be located approximately 25.3 km south of the PL311 pipeline, having recently received development consent. The proposed cable corridor of the Norfolk Vanguard Offshore Wind Farm is will be 0.42 km SSE of the trunkline and is will be adjacent to the first 30 km of the pipeline from Bacton.			
Wrecks	There are four wrecks within 20 km of the Sean Field Platforms. Three wrecks are considered dangerous wrecks, of which the closest is 6.3 km WSW of Sean PP (NMPi, 2020).			

6 Impact Assessment Process

This EA Report has been prepared in line with the BEIS (2018) *Decommissioning of Offshore Oil and Gas Installations and Pipelines Guidance Notes* and the more recent BEIS (2020) guide to *The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended).* The Decom North Sea (2017) *EA Guidelines for Offshore Oil and Gas Decommissioning* has also been considered in the formation of this EA. The BEIS (2018) Decommissioning Guidance states that an EA in support of a DP should be focused on the key issues related to the specific activities proposed; and that the impact assessment write-up should be proportionate to the scale of the project and to the environmental sensitivities of the project area.

The environmental impact assessment has been informed by a number of different processes, including identification of potential environmental issues through project engineer and marine environmental specialist review in a screening workshop, and consultation with key stakeholders (as detailed in Section 4.1).

The impact assessment screening workshop discussed the proposed decommissioning activities and any potential impacts these may pose. This discussion identified twelve potential impact areas based on the

proposed removal and decommissioning *in situ* activities. Three of the twelve potential impacts were screened in for further assessment based on the potential severity and / or likelihood of their respective environmental impact. The assessment for those impacts scoped in is detailed in Section 6, according to the methodology defined in Section 4. The twelve potential impacts are detailed in Table 1-4 below, together with justification statements for the screening decisions.

Table 1-4 Environmental Impact Screening Summary for the Decommissioning Project

Potential impact	Further assessment undertaken in Section 6	Rationale
Gaseous Emissions	No	Emissions during decommissioning activities, which comprise combustion gases associated with fuel use, will occur in the context of the CoP. As such, emissions generated by infrastructure, equipment and vessels associated with operation of the asset will be replaced by those from vessels and equipment required for decommissioning activities, as well as the recycling of any decommissioned materials. Reviewing historical EU Emissions Trading Scheme data and comparison with the likely emissions from the proposed workscope suggests that emissions relating to decommissioning will be minor relative to those generated during production. Review of available decommissioning EAs shows conclusively that atmospheric emissions in highly dispersive offshore environments do not present significant impacts and are extremely small in the context of UKCS and global emissions. Most submissions also note that emissions from short-term decommissioning activities are small compared to those previously arising from the asset over its operational life. The majority of atmospheric emissions for the Decommissioning Project relate to the vessels used for cutting, lifting, rock placement and transportation activities, the recycling of materials returned to shore and the replacement of material left *in situ*. As the decommissioning activities proposed are of short duration and will take place sequentially and across locations, gaseous emissions are not anticipated to result in any significant impacts. The estimated CO_2 emissions to be generated by the selected decommissioning options is 160,876 Te which equates to 1.2% of the total UKCS offshore emissions for the year 2018 (13,200,000 Te; OGUK, 2019). These emissions have been calculated assuming 256 days of vessel emissions across the duration of the project. This vessel time is split across eight types of vessels which will participate in a variety of activities including: surveys, structure removal and remediation. Specific vessels have not yet been contracted to undertake the decommissioning activities and thus the calculation are based off a worst-case scenario for vessel presence. Fuel use and emissions associated with vessel types are derived from the *Guidelines for the calculation of estimates of energy use and gaseous emissions in the decommissioning of offshore structures* (IoP, 2000). The total emissions estimate also includes any emissions associated with the infrastructure being removed and remaining *in*

Potential impact	Further assessment undertaken in Section 6	Rationale
		situ. In addition to this, emissions owing to onshore transportation were factored in. Appendix E provides a summary of the energy and emissions associated with the project. Overall, the total emissions generated by the decommissioning are minimal in the context of the wider region. As stated above, emissions will be small in comparison to those generated during the operational life of the asset. Considering the above, atmospheric emissions do not warrant further assessment.
Disturbance to Seabed	Yes	There is potential for decommissioning and legacy activities to generate disturbance to the seabed. These activities include those associated with pipelines decommissioned *in situ* (i.e. PL311 and PL310), the removal of the SSIV subsea structure and power cable (S0803), and the intervention of any snagging risks potentially identified in future. Seabed impacts may range in duration from short-term impacts, such as temporary sediment suspension or smothering, to permanent impacts, such as the introduction of new substrate or any consequential habitat or community level changes which may transpire. Seabed disturbance from the decommissioning activities has the potential to modify the habitat in a way which might impact upon other sea users which utilise the seabed. The power cable between the Sean PP and RD platforms may require excavation prior to being reverse reeled. The sandy substrate within the Sean Field will not readily generate berms regardless of the method of removal. The end sections of the PL310 (113 m) and the offshore end of the PL311 (20 m) will be cut and lifted. Exposed sections of these flowlines will be remediated with rock placement in line with the BEIS (2018) Guidance. The exposed ends of the pipelines will be remediated with rock to minimising any residual snag hazard. The spans along the PL311 will be similarly remediated. Non-intrusive post-decommissioning surveys will occur to ensure that the PL310 and PL311 are left in an acceptable condition. The clear seabed will be validated by an independent verification survey over the installation sites and pipeline corridors. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the SFF / NFFO, seabed clearance is likely to require conventional overtrawl survey methods. The methods used will be discussed and finalised with OPRED. Impacts to the seabed from project activities have been assessed further in Section 6.1, whilst impacts to commercial fisheries generated by seabed disturbance are assessed in Section 6.2 below.

Potential impact	Further assessment undertaken in Section 6	Rationale
Physical presence of infrastructure decommissioned *in situ*	Yes	The physical presence of infrastructure decommissioned *in situ* has the potential to impact other sea users. All subsea installations will be fully removed along with all jumpers, spool pieces and risers. The trenched umbilical will be disconnected, and reverse reeled. The power cable may require to be excavated before being reverse reeled, however attempts will be made to pull through the sediment cover. Mattresses and grout bags will be fully removed and either reused, recovered as aggregate for infrastructure projects or disposed of in landfill sites. Infrastructure to be decommissioned *in situ* include the trenched and buried rigid flowlines and any protection materials associated with third party crossings. The cut ends of the PL310 and PL311 trunkline, and exposed spans (along the PL311) are to be remediated during decommissioning. The PL311 pipeline reaches landfall at Bacton Terminal, where decommissioning activities have the potential to affect coastal physical processes and recreational uses. However, onshore aspects of the decommissioning activities fall outside the scope of this EA and will therefore be covered by relevant permits. Depth of Burial (DoB) surveys have confirmed the burial status of these flowlines (see Appendix B). PL310 is stably buried to an average depth of 0.72 m. PL311 was intentionally surface laid from the shore to KP 54.0 at the time of installation, with exception of a 7 km section between KP 1.0 and KP 8.0 which is suitably trenched and naturally buried. From KP 54.0 and to Sean PP the pipeline is also suitably trenched and naturally buried. The surface laid sections have been stable for many years; however, in 2016, five locations were identified for placement of rock remediation between KP 11.0 and 15.0. Recent survey data (DeepOcean, 2020) suggests several exposures have been generated by hydrographic sediment movement within and to the east of this previously remediated area (between KP 14.0 and 17.0). These exposures will be investigated during the pre-decommissioning survey and will be remediated following discussion and agreement from OPRED prior to decommissioning *in situ*. The addition of rock placement is investigated further in Section 6.1 as a potential surface impact to the benthic environment. It is considered that the combination of 2018 and 2020 survey data, along with the future pre-decommissioning surveys will be used as evidence of pipeline stability and to fully address the potential risk of future exposures. Future monitoring work will ensure the DoB of the buried flowlines and/or flowline segments is maintained to FishSafe depths, as defined by BEIS (2018): spans in excess of 0.8 m in height from the top of the pipeline and ≥10 m in length which therefore present a hazard to fishing activity. This monitoring work will also aim to identify any exposures or spans on

Potential impact	Further assessment undertaken in Section 6	Rationale
		the surface laid flowline sections which may need remediation under the BEIS (2018) guidance as well as add to the characterisation of trends in sediment transport across the pipeline which may aid in determination of exposure risk. The frequency of this monitoring work and any subsequent maintenance will be established in consultation with OPRED. ONE-Dyas are committed to leaving a clear seabed. The clear seabed will be validated by an independent verification survey over the installation sites and pipeline corridors. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the SFF / NFFO, seabed clearance is likely to require conventional overtrawl survey methods. The methods used will be discussed and finalised with OPRED. In spite of the above, owing to some of the infrastructure being decommissioned *in situ* and the variable fishing methods and effort along the export pipeline, further consideration of the potential for snagging hazards is required. Snagging as a risk posed to other sea users requires assessment. Considering the above, the potential risk to other sea users will be addressed in Section 6.2.
Physical presence of vessels	Yes	The presence of vessels undertaking decommissioning activities will be temporary and minor in the context of the life of the Sean Field. The majority of activity will occur using vessels similar to those currently deployed for oil and gas installation, operation and decommissioning activities and will generally be within the existing 500 m zones, with minor remedial work outside of the Sean Field, along the pipeline. The increased vessel presence from these activities, including transiting vessels, have the potential to introduce navigational impacts and impact access to fishing grounds. The proposed decommissioning of the Sean Field and associated export line are estimated to require eight different vessel types. Although the decommissioning of the Sean Field area is estimated to require various vessels depending on the selected method of removal, these would not all be on location at the same time. Vessel activities are expected to occur over approximately 256 days, most of which are attributed to tug vessels involved in the removal of the Sean Field topsides and subsea installations. There are several shipping management lanes present across the length of the export pipeline and two vessel transit routes passing Southwest and Northeast of the Sean Papa platforms. North Sea oil and gas fields typically generate high vessel traffic in the form of transit vessels routes. Decommissioning of the Sean Field assets is unlikely to generate vessel traffic which is significantly greater than was typical during their operational phase. Navigational risks shall be considered as part of the vessels'

Potential impact	Further assessment undertaken in Section 6	Rationale
		operational risk assessment and captured as a part of the permit applications for vessel activities. Other sea users will be notified in advance of planned activities through the appropriate mechanisms, meaning those stakeholders will have time to make any necessary alternative arrangements during the finite period of operations. Consultation with stakeholders will also be incorporated into logistics planning for decommissioning vessel activities. Considering the above, there remain the potential for impacts to commercial fisheries originating from the physical presence of decommissioning vessels limiting access to fishing grounds. These will be assessed fully in Section 6.2.
Discharges to Environment	No	The PL310 and PL311 pipelines will be both pigged and flushed prior to the commencement of decommissioning activities. In addition, DFPV of the topsides will occur. All flushing products will be routed into the production stream via the Sean Field infrastructure. This should remove the majority of contaminated material. Any residual traces of produced water, hydrocarbons, scale, metal oxides and other trace elements from the formation fluids are therefore expected to be low, although precise quantification is difficult to specify. It should also be noted that the pipeline has been regularly pigged during its operational life and therefore scale deposits should be minimal in the first instance. Pigging and flushing is a pre-decommissioning activity therefore will be permitted as appropriate and falls outside the scope of this EA. During the cutting of the pipeline ends there may be a small discharge of any residual material held within the pipeline. As stated, the volume of any residual material is expected to be low across the entire pipeline and will have been flushed to an acceptable level of cleanliness prior to the commencement of the decommissioning activities. As the pipeline cuts will only be at the ends, any discharge will be equal to, or less than, typical licensed produced water discharges and will dissipate before it reaches the surface with no long-term persistence expected. The potential for discharges will be fully assessed and consented in the appropriate manner. The pipeline left *in situ* will degrade overtime and contaminants contained within the pipeline material (e.g. coating) may be discharged. Discharges are expected to occur in very small quantities and over a long period of time. Furthermore, such releases will be highly localised as the pipeline will not degrade equally along its length. Given the small quantities of contaminants expected to be released and the long-term degradation of the pipeline left *in situ*, no significant impacts are anticipated. There are no cuttings piles within the Sean Field.

Potential impact	Further assessment undertaken in Section 6	Rationale
		Vessel discharges are managed through existing, International Convention for the Prevention of Pollution from Ships (MARPOL) compliant controls, including bilge management procedures and good operating practices. Post-flushing and / or water jetting, residual liquids present during the decommissioning of pipelines and substructures will be treated before being discharged to sea, such that the discharge will comprise treated water. Any residual remaining material will be in trace levels / volumes following the flushing and pigging regime and will not pose any significant risk to water quality. Therefore, no further assessment is required of this impact within this EA.
Underwater Noise	No	Vessel presence will be limited in scale and duration and, therefore, does not constitute a significant or prolonged increase in noise emissions across the project area. The Sean Field and PL311 are located in areas of moderate to very high shipping activity, therefore the contribution of the decommissioning activities to the overall noise produced by vessels in the area will be minor. All other noise generating activities associated with the decommissioning of the pipelines are considered negligible in the context of ambient noise levels and are likely to be masked by project related vessel activities. Multibeam echosounder survey equipment is likely to be used for fine-scale characterisation of pipeline exposures. At present, there is no requirement for seismic activity relating to the decommissioning activities. Should there be a requirement of seismic survey in the future, the JNCC (2017b) Guidelines will be adhered to for mitigation of noise impacts to marine mammals. The PL311 passes through the Southern North Sea SAC which is designated for the protection of harbour porpoise. This region is characterised as “one of the best areas in the United Kingdom” for habitat quality and importance to this species. None of the proposed project activities include those which have been identified as potential threats to harbour porpoise (including oil and gas extraction or exploration, abiotic marine renewable energy, fishing, marine construction, and water pollution (JNCC, 2019b)). Although decommissioning is considered reverse installation of oil and gas infrastructure (a form of ‘marine construction’), it is the seismic surveys associated with the development of oil and gas infrastructure which may have detrimental impacts on hearing sensitive marine species, such as harbour porpoise. Such surveys are not required as part of the Sean Field decommissioning. There are not anticipated to be significant levels of noise generated by any of the decommissioning activities which may have such an impact. For these reasons, the proposed decommissioning activities do not contravene the conservation objectives set out by the JNCC for the site (see Section 3.7).

Potential impact	Further assessment undertaken in Section 6	Rationale
		For these reasons, impacts from underwater noise associated with the decommissioning has been screened out from further assessment.
Artificial Light	No	Remediation activities for identified spans along the PL311 pipeline will take place between KP 14.0 and KP 17.0, a region of pipeline which falls within the Greater Wash SPA. Whilst migrating birds may become disoriented by dominant vessel lights in the offshore environment, the vessels occupying this sensitive area will only use normal vessel lighting (i.e. no floodlighting) and lighting will be directed below the horizontal plane unless it is required for technical or safety reasons. As remedial activities will be exceptionally short-term, lasting for a maximum of five days, there is considered to be no scope for significant impacts to any protected bird species either individually or as a feature of a designated site. Therefore, offshore light does not need to be assessed further.
Disturbance or Destruction of Seabird Nests	No	In recent years, there has been an increase in the number of seabirds utilising offshore installations for nesting. Opportunistic species such as Kittiwake and Herring Gull are utilising artificial nest locations and successfully rearing chicks. In some instances, colonies of several hundred birds have established and return each year. Although for most offshore platforms, the number of breeding birds remains very low. All nesting birds and nesting activities are protected from damage by conservation legislation. Under the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2017 – (OMR 17), it is an offence to: > take, damage or destroy the nest of any wild bird while that nest is in use or being built, or > take or destroy an egg of any wild bird. This legislation is relevant to installations more than 12 nautical miles from the coast, applies to all species of bird and applies irrespective of the number of nests found. i.e. there is no de-minimus. Given the decommissioning operations are not proposed to begin until 2025, ONE-Dyas will initially determine whether the platforms are supporting any nesting birds before engaging with OPRED if there is a need for mitigation measures to be introduced prior to the commencement of the decommissioning. The preferred practice is to avoid disturbance by undertaking works out with the breeding season. However, this is not always practicable. ONE-Dyas are committed to deterring birds from their installations out with the breeding season to mitigate against nesting birds on the platform. ONE-Dyas may employ a range of non-invasive / non-lethal deterrents to prevent birds nesting.

Potential impact	Further assessment undertaken in Section 6	Rationale
		These methods will continue throughout the duration of decommissioning. Should these measures not prove successful, ONE-Dyas will engage with OPRED to agree any further licensing requirements, as appropriate. This process will form part of future licensing applications for subsequent offshore applications. The proposed mitigation measures to limit the potential for disturbance or destruction of seabird nests are provided in Section 5.3 below.
Resource Use (Onshore and Offshore)	No	Generally, the main source of resource use from the proposed activities will be restricted to fuel use. Any opportunities for increasing fuel efficiency and reducing use of resources will be identified and implemented by ONE-Dyas where possible. The estimated total energy usage for the project is 1,870,638GJ. This number accounts for all operations, material recycling, and the resource loss associated with decommissioning items *in situ*. Vessels have not yet been contracted to undertake the decommissioning work therefore standards (available from the *Guidelines for the calculation of estimates of energy use and gaseous emissions in the decommissioning of offshore structures*; IoP, 2000) have been used to calculate the potential worst-case energy use. This is considered very low compared to the resources generated during the production phase of the field. Appendix E provides a summary of the energy and emissions associated with the project. Considering the above, resource use does not warrant further assessment.
Onshore Dismantling Activities	No	The BEIS (2018, 2020) Guidance states that onshore activities are not in scope of Decommissioning EAs, and this topic does not require further assessment. Despite onshore activities not being an EA requirement, the quantity of material brought to shore for dismantling will be minimal in line with the proposed decommissioning activities, with measures in place to minimise the impact associated with onshore dismantling. It should be noted that only existing disposal yards will be utilised for the material removed as a result of the decommissioning. Only licenced contractors which can demonstrate they are capable of handling and processing the material to be brought ashore will be considered for onshore activities and this will form an integral part of the commercial tendering process. The requirement of an onshore dismantling yard necessitates an environmental audit (including a site visit).

Potential impact	Further assessment undertaken in Section 6	Rationale
Waste	No	The recycling and disposal of wastes are covered by the ONE-Dyas' Waste Management Plan (WMP), which is compliant with relevant regulations relating to the handling of waste offshore, transfer of controlled, hazardous and special waste, and TFSW. The WMP is also guided by ONE-Dyas' HSES Policy and commitments to best practice in waste management. This includes the mapping and documenting of waste management arrangements for each phase of the decommissioning activities in individual WMP and ongoing monitoring of waste procedures and performance review against national and international standards and those held within ONE-Dyas' Environmental Management Plan. Wastes will be treated using the principles of the waste hierarchy, focusing on the reuse and recycling of wastes where possible. Raw materials will be returned to shore with the expectation to recycle the majority of the returned material. There may be instances where infrastructure returned to shore is contaminated (e.g. by Naturally Occurring Radioactive Material (NORM), hazardous, and / or special wastes) and cannot be recycled. In these instances, the materials will require disposal. However, the weight and/or volume of such material is not expected to result in substantial landfill use. On this basis, no further assessment of waste is necessary.
Unplanned Events	No	The potential for unplanned interactions with other sea users, namely the risk of snagging to operational fishing gears, has been discussed in reference to the physical presence of infrastructure decommissioned *in situ* and is addressed in detail in Section 6.2. As the proposed decommissioning programme will take place post well P&A and DFPV of the topsides, the potential for a large-scale hydrocarbon release due to an unplanned event is limited to the diesel inventory of the vessels undertaking decommissioning activities. There will be eight vessel types on-site during the decommissioning process. However, the HLV is considered to have the greatest fuel inventory and therefore the greatest potential impact, should an unplanned event occur. The diesel inventory estimate of the Sean Field assets, as covered by the OPEP, is 1,000 m^3 (ONE-Dyas, 2018). A vessel's fuel inventory is likely to be split between a number of separate fuel tanks, significantly reducing the likelihood of an instantaneous release of the full inventory. The largest tank of an HLV holds 720 m^3. This has been derived from known inventories of HLV vessels analogous to that which is likely to be used during the decommissioning. Therefore, a loss of inventory from the HLV is likely to be less than the worst-case release diesel spill from the Sean topsides.

Potential impact	Further assessment undertaken in Section 6	Rationale
		Any spills from vessels in transit are covered by separate Shipboard Oil Pollution Emergency Plans (SOPEPs). ONE-Dyas will support response of any vessel-based loss of fuel containment through the vessel owner's SOPEP. Additionally, several existing controls are in place to ensure risk minimisation for any unplanned events during decommissioning activities. These are outlined in Section 5.3 below. Overall, any impact from vessel-based fuel inventory release will be less than that already assessed and mitigated against within the OPEP for the operational phase of the Sean Field assets. Dropped object procedures are industry-standard and will be employed. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. Post-decommissioning debris clearance surveys will aid in the identification of any dropped objects should they occur. In line with the mitigation measures in place, unplanned loss of materials to the sea do not require further assessment within this EA.

The initial screening identified two potential environmental and societal impacts which require further assessment within the EA against the proposed decommissioning activities: seabed impacts and impacts to commercial fisheries.

7 Environmental Management

The project has limited activity associated with it beyond the main period of preparation for decommissioning, removal of the Sean Field infrastructure, and remediation of the associated pipelines. The focus of environmental performance management for the project is therefore to ensure that the activities that will take place during the limited period of decommissioning happen in a safe, compliant and acceptable manner, in line with ONE-Dyas' ISO14001 certification and Environmental, Social and Corporate Governance (ESG) values. The primary mechanism by which this will occur is through ONE-Dyas' accredited Environmental Management System (EMS) and Health, Safety, Environment and Quality (HSEQ) Policy.

To support this, a project Health, Safety and Environment (HSE) Plan will be developed which outlines how HSE issues will be managed and how the policies will be implemented effectively throughout the project. The plan will apply to all work carried out, whether onshore or offshore. Performance will be measured to satisfy both regulatory requirements including compliance with environmental consents, as well as to identify progress on fulfilment of project objectives and commitments.

ONE-Dyas also operates a Waste Management Strategy (WMS) specific to the Sean Field and will adhered to the WMS for the duration of the decommissioning project. The WMS to detail the types of materials identified as decommissioning waste and to outline the processes and procedures necessary to support the Decommissioning Programme for the Sean Field. The WMS will detail the measures in place to ensure that the principles of the waste management hierarchy are followed during the decommissioning.

Marine Plans have been adopted by the UK Government for English to help ensure sustainable development of English inshore (out to 12 nautical miles) and offshore marine areas (12 to 200 nautical miles). In terms of activities occurring within the SNS, and particularly relevant to the Sean Field decommissioning, are the East Inshore and East Offshore Marine Plans. These Plans have been developed in line with UK, EU and OSPAR legislation, directives and guidance. As part of the conclusions to this assessment (Section 7), ONE-Dyas has

given due consideration to the Marine Plans during project decision making and the interactions between the project and Plan.

8 Conclusion

Following review of the proposed decommissioning activities and their potential to generate important impacts, impact pathways relating to seabed and commercial fisheries receptors were identified as requiring further assessment in the EA.

The Sean Field itself is not located within any protected sites; however, the PL311 trunkline passes through five protected sites as it runs from the field assets to shore. Based on the extent and character of the proposed decommissioning activities, it is considered that only three protected sites have the potential to be impacted; they are: Southern North Sea SAC; Haisborough, Hammond and Winterton SAC, and Greater Wash SPA. Rock remediation of the PL311 spans has the potential to impact the benthic habitat of these sites, one of which is designated for seabed features (biogenic reef and sandbanks). In aggregations, the Ross worm *S. spinulosa* forms biogenic reefs. The species is able to tolerate some degree of smothering and will in all likelihood re-colonise areas covered by rock placement, although it is not possible to confirm if there are areas of pipeline interacting with reef directly. Due to the active sediment systems within the SNS, sandbanks are similarly likely to recover from any disturbance. The area of potential impact is also likely to be an over-estimate as, in practice, clear seabed verification is likely to involve non-intrusive methods. As the indirect impacts will be temporary in duration and will only cover a small area benthic habitat, the impact of the decommissioning activities on the seabed, its associated features, and the protected sites, is expected to be **minor**.

The potential impacts identified to commercial fisheries were limited to the temporary loss of access to fishing grounds due to the presence of decommissioning vessels, and the potential for legacy impacts such as the snagging of fishing gears on flowlines decommissioned *in situ*. The PL310 is stably buried and where spans are located along the PL311 rock placement will take place to remediate this hazard. Fishing effort is low in the region and fishing intensity is at its lowest in areas where the spans are currently located. Seabed clearance verification surveys and continued monitoring of the infrastructure decommissioned *in situ* will take place. The temporary loss of fishing grounds during decommissioning activities is not likely to have a significant impact on the economic value of commercial fisheries operating in the area. Furthermore, the area previously lost to fisheries, comprising the 500 m zones around the Sean Field surface installations, will be reopened to fisheries post-decommissioning. The residual impacts to commercial fisheries from potential snag risk arising from the proposed decommissioning activities, and the modification of fishing grounds, is considered **negligible**.

This EA has considered the relevant Marine Plans, adopted by the UK Government to help ensure sustainable development of the marine area. ONE-Dyas considers that the proposed decommissioning activities are in alignment with its objectives and policies.

Based on the findings of this EA, including the identification and subsequent application of appropriate impact assessment methodologies, the proposed decommissioning activities do not pose any significant threat to environmental or societal receptors within the UKCS.

1 INTRODUCTION

1.1 Background

In accordance with the Petroleum Act 1998, One-Dyas UK Limited (henceforth 'ONE-Dyas'), an established United Kingdom Continental Shelf (UKCS) operator, and on behalf of the Section 29 notice holders, is applying to the Department for Business, Energy and Industrial Strategy (BEIS) to obtain approval for decommissioning the Sean Field surface and subsea infrastructure, and associated pipelines. The Sean Field is comprised of the Sean North, Sean South and Sean East Fields. Collectively they will be referred to throughout, as the Sean Field.

The Sean Field lies within the Southern North Sea (SNS) Gas Province in UK Blocks 49/25. The Field lies approximately 94 km east of the UK coastline and 15 km from the UK / Netherlands median in water depths of 28.2 - 32.2 m below LAT (Fugro, 2016a; Figure 1-2). The Field System is comprised of the Sean Papa installation which is 2 bridge-linked platforms, a wellhead and compression platform (PD) and a production and accommodation platform (PP) and Sean Romeo (RD), a Not Permanently Attended Installation (NPAI). Sean RD is connected to Sean PP through a 20" infield duplex flowline (PL310). The Sean Field System produces gas from 10 wells on Sean PD and 6 wells on Sean RD. Gas from the Sean Field is transported through a 106.502 km 30" gas export pipeline (the PL311 trunkline) to Bacton Terminal in North Norfolk (Figure 1-1).

This EA does not cover well plugging and abandonment (P&A), or the flushing and cleaning operations that will be undertaken prior to the commencement of the decommissioning activities. These activities will be carried out as part of the preparatory work preceding decommissioning, under existing field operational permits.

Sean PD currently has 10 well slots, 8 producing and Sean RD currently has 6 wells slots, 2 producing. A Cessation of Production (CoP) application was submitted to the Oil and Gas Authority (OGA) for review with confirmation subsequently received that there are no objections to ONE-Dyas UK Limited permanently ceasing production.

The Sean Field is operated by One-Dyas UK Limited who own 50% of the asset. The remaining 50% of interest in the Field is held by Rockrose UKCS15 Limited.

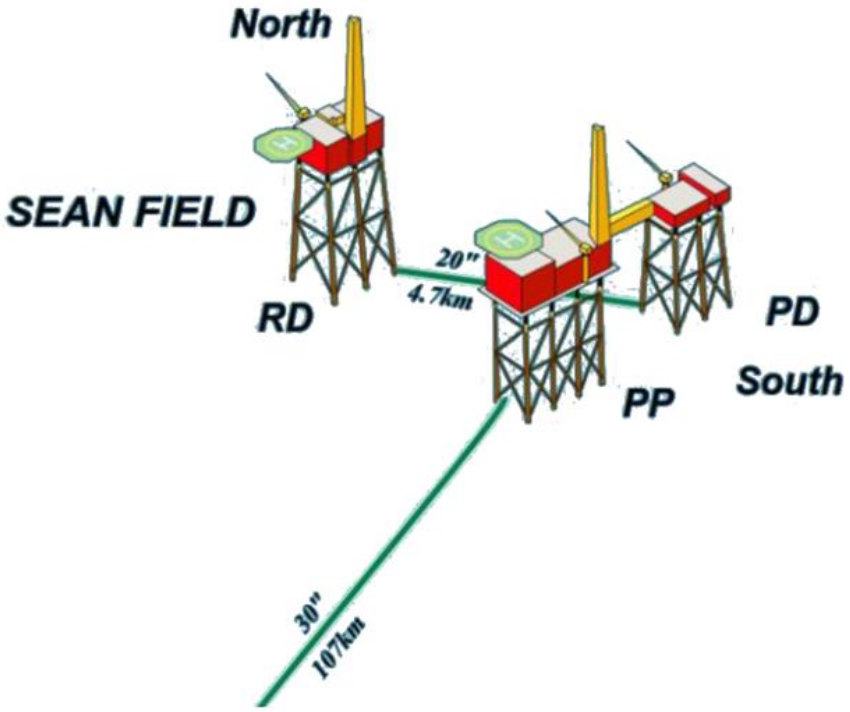


Figure 1-1 Schematic of the Sean Field platforms

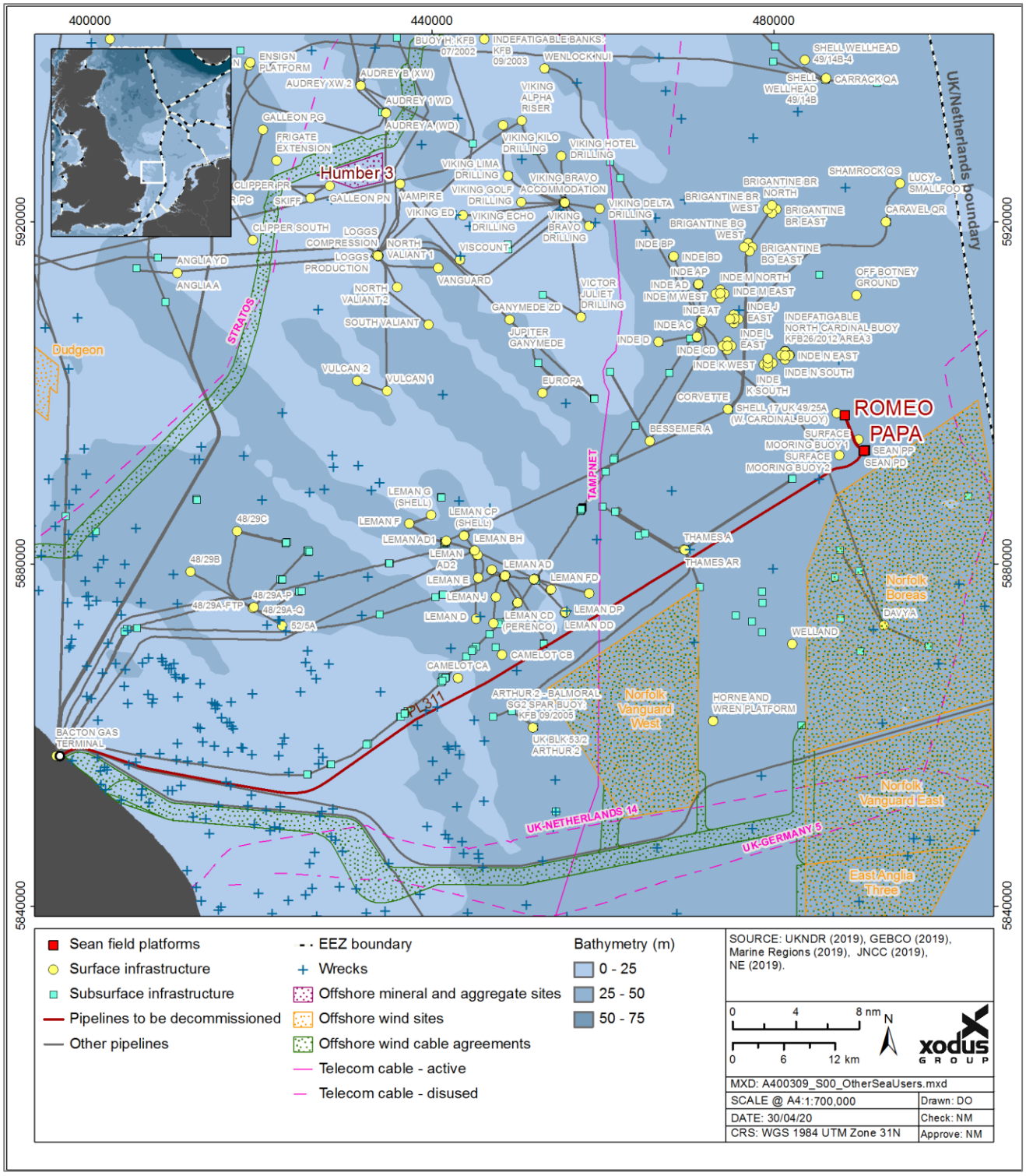


Figure 1-2 Location of the Sean Field in the context of other SNS installations

1.2 Purpose of the Environmental Appraisal Report

This EA assesses the potential environmental impacts associated with the proposed Sean Field decommissioning activities. The impact identification and assessment process considers stakeholder engagement, comparison of similar decommissioning projects undertaken in the UKCS, expert judgement, and the results of supporting studies which aim to refine the scope of the DP. This EA Report documents this process and details, in proportionate terms, the extent of any potential impacts and any necessary mitigation / control measures proposed.

1.3 Regulatory Context

The Petroleum Act 1998 (as amended) governs the decommissioning of offshore oil and gas infrastructure, including pipelines, on the UKCS. The Act requires the operator of an offshore installation or pipeline to submit a draft DP for statutory and public consultation. The DP must outline in detail the infrastructure being decommissioned and the method by which the decommissioning will take place. Responsibility for ensuring compliance with the Petroleum Act 1998 rests with Department for Business, Energy and Industrial Strategy (BEIS), formerly the Department for Energy and Climate Change (DECC) and is managed through its regulatory body the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED).

Decommissioning is also regulated under the Marine and Coastal Access Act 2009. The UK's international obligations on decommissioning are primarily governed by the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (the Oslo Paris Convention (OSPAR)). OPRED is also the Competent Authority on decommissioning in the UK for OSPAR purposes and under the Marine and Coastal Access Act 2009.

The primary guidance for offshore decommissioning from the regulator (BEIS, 2018), details the need for an EA to be submitted in support of the DP. The guidance sets out a framework for the required environmental inputs and deliverables throughout the approval process. It now describes a proportionate EA process that culminates in a streamlined EA report rather than a lengthy Environmental Statement (ES). The OPRED guidance is supported by Decom North Sea's (Decom North Sea, 2018) Environmental Appraisal Guidelines for Offshore Oil and Gas Decommissioning, which provide further definition on the requirements of the EA report.

Marine Plans have been adopted by the UK Government for English to help ensure sustainable development of English inshore (out to 12 nautical miles) and offshore marine areas (12 to 200 nautical miles). In terms of activities occurring within the SNS, and particularly relevant to the Sean Field decommissioning, are the East Inshore and East Offshore Marine Plans. These Plans have been developed in line with UK, EU and OSPAR legislation, directives and guidance. The relevant oil & gas specific sectoral policies are OG1 and OG2. With regards to decommissioning, policy OG1 states the following:

'Decommissioning and other legacy issues are...highlighted as areas that need significant attention over the period of the marine plans...It is inevitable that there will be further decommissioning activity in the East marine plan areas over the life of the marine plans, though there may be reuse of some facilities for Carbon Capture and Storage and Gas Storage and Unloading. Plan policy OG1 clarifies that, where existing oil and gas production and infrastructure are in place, the areas should be protected for the activities authorised under the production licence consent until the licence is surrendered, (including completion of any relevant decommissioning activity), or where agreement over co-located use can be negotiated. The policy will be implemented by the public authorities responsible for authorising the oil and gas activities and all other developments, including co-located activities'.

The responsibility for implementing the oil and gas specific sectorial policies within the aforementioned Marine Plans, lies with OPRED and the relevant public authorities.

The East Inshore and East Offshore Marine Plans and their policies relevant to the proposed decommissioning activities will be fully discussed within Section 3.7.4. As part of the conclusions to this assessment (Section 7), ONE-Dyas has given due consideration to the Marine Plans during project decision making and the interactions between the project and Plan.

1.4 Scope and Structure of this Environmental Appraisal

This EA report sets out to describe, in a proportionate manner, the potential environmental impacts of the proposed activities associated with decommissioning of the Sean Field and associated PL311 trunkline and to demonstrate the extent to which these can be mitigated and controlled to an acceptable level. The scope of the EA will cover the following:

- Surface installations;
- Subsea installations;
- All pipelines, flexible flowlines and umbilicals associated with the Sean Field;
- Spools and jumpers;
- Protection / stabilisation materials; and
- Remediation associated with decommissioning of the above.

This supporting EA does not cover well plugging and abandonment (P&A), or the flushing and cleaning operations that will be undertaken prior to the commencement of the decommissioning activities. These activities will be carried out as part of the preparatory work preceding decommissioning, under existing field operational permits.

The PL311 pipeline reaches landfall at Bacton Terminal, where decommissioning activities have the potential to affect coastal physical processes and recreational uses. However, onshore aspects of the decommissioning activities fall outside the scope of the Sean Decommissioning Programmes and will therefore be covered by relevant permits.

The structure of the EA is split into sections which cover:

- The process by which ONE-Dyas has arrived at the selected decommissioning strategy (Section 2);
- A description of the proposed decommissioning activities (Section 2);
- A summary of the baseline sensitivities and receptors relevant to the assessment area that supports this EA (Section 3);
- A review of the potential impacts from the proposed decommissioning activities and justification for the assessments that support this EA (Section 5);
- Assessment of key issues (Section 6); and
- Conclusions (Section 7).

This EA report has been prepared in line with ONE-Dyas' environmental assessment requirements and has given due consideration to the regulatory guidelines (BEIS, 2018) and to Decom North Sea's Environmental Appraisal Guidelines for Offshore Oil and Gas Decommissioning (Decom North Sea, 2018).

2 PROJECT SCOPE

2.1 Consideration of Alternatives and Selected Approach

2.1.1 Decision Making Context

2.1.1.1 Platforms

As a Contracting Party of the Convention for the Protection of the Marine Environment of the North-East Atlantic ('OSPAR'), the UK has agreed to implement OSPAR Decision 98/3, which prohibits leaving offshore installations wholly or partly in place. The legal requirement for Operators to comply with the OSPAR Convention is affected through the Petroleum Act 1998 (as amended by the Energy Act 2008), the Guidance Notes for which outline the expectations of the UK regulator in terms of complying with the relevant OSPAR decisions. OSPAR Decision 98/3 states that the topsides of all installations should be returned to shore and that all jackets with a weight of less than 10,000 tonnes are completely removed for reuse, recycling or final disposal on land. This applies to the Sean Field assets as each of the three platforms weigh less than 10,000 tonnes.

2.1.1.2 Subsea Installations

The latest guidance (BEIS, 2018) states that subsea installations must, where practicable, be completely removed for reuse or recycling or final disposal on land. Any piles used to secure such installations in place should be cut below natural seabed level at such a depth as to ensure that any remains are unlikely to become uncovered. Should an Operator wish to make an application to leave in place a subsea installation because of the difficulty of removing it, justification in terms of the environmental, technical or safety reasons would be required. With regards to pipelines (including flowlines and umbilicals), these should be considered on a case-by-case basis. The guidance does provide general advice regarding removal for two categories of pipelines:

- For small diameter pipelines (including flexible flowlines and umbilicals) which are neither trenched nor buried, the guidance states that they should normally be entirely removed; and
- For pipelines covered with rock protection, the guidance states that these are expected to remain in place unless there are special circumstances warranting removal.

The guidance also highlights instances where pipelines could be decommissioned *in situ*. For example, pipelines that are adequately buried or trenched or which are expected to self-bury could be considered as candidates for *in situ* decommissioning. Where an Operator is considering decommissioning pipelines *in situ*, the decision-making process must be informed by 'Comparative Assessment' of the feasible decommissioning options. This Comparative Assessment (CA) takes account of safety, environmental, technical, societal and economic factors to arrive at a preferred decommissioning solution.

Finally, the guidance states that mattresses and grout bags installed to protect pipelines should be removed for disposal onshore, if their condition allows. If the condition of the mattresses or grout bags is such that they cannot be removed safely or efficiently, any proposal to leave them in place must be supported by an appropriate Comparative Assessment of the options.

2.1.2 Alternatives to Decommissioning

Options to re-use the Sean Field infrastructure *in situ* for future hydrocarbon developments have been considered, but to date none have yielded a viable commercial opportunity. The primary reason for this is the absence of remaining hydrocarbon reserves in the vicinity of the infrastructure. No reason to delay decommissioning of the infrastructure in a way that is safe and environmentally and socially acceptable has therefore been identified.

In consideration of re-use options ONE-Dyas have also investigated the potential to use the pipeline as an interconnector between the UK and Holland via the K13 platform in the Dutch Sector. ONE-Dyas attempted to engage potential stakeholders to discuss opportunities and also to investigate the macroeconomics of this complex, cross-border project with no feedback. Due to lack of interest and response from other involved parties, ONE-Dyas decided not to pursue this further.

Additionally, Carbon Capture Use and Storage (CCUS) has been reviewed, however is not considered viable on the basis that:

- No source of CO_2 could be identified in the Norfolk area which could provide stable and long term steam;
- Licence at Sean currently not suitable for injection;
- Sean South reservoir contains many baffles, not a tank, and is therefore not suitable for injection;
- Sean North has fewer baffles, however the 'tank' may potentially leak in the northeast direction;
- Long term containment of CO_2 is not guaranteed, presenting huge risk to liabilities; and
- There is currently no clear business model for CCUS.

ONE-Dyas appreciates that the re-use of Oil and Gas infrastructure is in its infancy and as a result have committed to cap and inhibit the export pipeline contents post flushing in order to allow for the potential for re-use of this pipeline should a technology mature or a future re-use option present itself.

All of the Sean Field subsea infrastructure was assessed for decommissioning against the *Guidance Notes: Decommissioning of Offshore Oil and Gas Installations and Pipelines* (BEIS, 2018). The recommended CA process was applied. In accordance with normal practice for the Scoping phase of the CA, equipment was organised into groups of items with similar characteristics, facilitating greater efficiency in processing the latter phases of the CA. The guidance identifies certain equipment which must be fully removed and some categories of pipelines which may be left decommissioned *in situ* subject to CA. Once the equipment groups designated for full removal were identified the remaining groups were assessed further.

All possible decommissioning options for the remaining groups were coarsely screened against the primary criteria as specified within the BEIS (2018) Guidance: Safety; Environment; Technical; Societal; and Economic. The options were scored against each criterion either green, amber or red, pertaining to attractive, acceptable or unattractive respectively. This process eliminated the least favourable options from each equipment group in preparation for detailed evaluation of the remaining options. Those remaining options were then investigated in detail to develop quantitative and qualitative data for each option pertaining to the primary criteria and sub-criteria (e.g. safety data; environmental impact data; technical considerations; societal impacts; and costs). Once this data had been prepared in the form of published studies, a detailed evaluation was conducted to determine the final recommended decommissioning option for each item of equipment. This was facilitated by comparing the data for each sub-criterion across the options using a Multi Criteria Decision Analysis (MCDA) tool which employs pairwise comparisons of quantitative and qualitative data to produce a relative score for each sub-criterion that can be summed to produce an overall relative score for each option, enabling identification of the emerging recommendation for the group.

2.1.3 Subsea Comparative Assessment

Prior to the eventual recommended decommissioning options being identified, ONE-Dyas followed the CA evaluation process in which the decommissioning options are assessed against the five main criteria defined in the Guidance (BEIS, 2018), these were equally weighted.

The CA options which have been considered for decommissioning of the Sean Field are outlined in Table 2-1 below and further details are provided in the Sean Field Comparative Assessment Report. The selected options are in bold and covered in greater detail in Section 2.2. Twelve CA groups were identified during Scoping, this was consolidated prior to evaluation to eight in total and only groups 1, 6 and 7 were carried through to the Sean CA evaluation. Groups 8, 9, 10, 11 and 12, were identified for full removal. Initially Groups 1 – 5 covered different KP sections of the 30" trunkline however, these groups were consolidated into a single Group 1 and are presented thus in the following tables. Discussion over the consolidation of the five CA groups was undertaken with input from the regulator.

Table 2-1 CA Decommissioning Options Considered

CA Group No.	Subsea Infrastructure Description	Decommissioning Options Considered
1	30" Trunkline (PL311)[7]	• (Option 2A) Full removal via de-burial and cut and lift pipeline sections using a construction support vessel (CSV). • (Option 4A) Leave *in situ* and rock cover the areas of Spans/Exposure/Shallow Burial using a suitable rock dump vessel. • (Option 4C) Leave *in situ* and remove the areas of Spans/Exposure/Shallow Burial using a CSV and place rock at the cut ends. • **(Option 5)[8] Leave *in situ*, cut and remove offshore pipeline end and remediate the pipeline end and any FishSafe spans[9] with rock.**
6	20" Export Pipeline (PL310)	• (Option 2A) Full removal via de-burial of the pipeline using an MFE then cut and cut and lift the pipeline. • **(Option 5) Leave *in situ*, cut and remove pipeline ends and remediate the pipeline ends and any FishSafe spans with rock.**
7	1" Electrical Cable	• **(Option 2C) Full removal, de-bury the entire line then reverse reel the cable using a suitable CSV** • (Option 5) Leave in-situ, cut and remove pipeline ends and remediate the cable ends with rock.

2.2 Scope of Proposed Decommissioning Operations

Onshore effects are considered to be outside the regulatory control of OPRED and are thus outside of the scope of an EA (BEIS, 2018; Decom North Sea, 2018). The final 0.6 km of the PL311 is onshore therefore is not within the scope of this EA. With regards to the final 0.6 km of the PL311, ONE-Dyas has engaged with the relevant regulatory bodies (the Environment Agency and North Norfolk District Council) to inform them of the intention to decommission the PL311 *in situ*. This has been deemed the best approach considering the potentially sensitive onshore receptors and the existing coastal protection mechanisms in place along the coast at Bacton, which a more intrusive method of decommissioning could disturb. For completion, onshore receptors have been detailed further in Section 2.4.8.

2.2.1 Description of the Infrastructure being Decommissioned

The Sean Field comprises the Sean PP gas production platform, the bridge linked Sean PD wellhead platform and the Sean RD wellhead platform located in Block 49/25a of the Southern North Sea. The installations stand in 30 m of water approximately 109 km NE of Lowestoft. The Sean Papa (PD and PP) are Normally Attended

[7] The PL311 trunkline was reviewed in detail against whether potential installation burial depths and environmental conditions would drive a requirement to consider subgrouping along this pipeline. Upon review it became apparent that subgroups were not necessary and CA Groups 1 – 5 were merged and considered as a single Group 1.
[8] Offshore end of PL311 will be capped and the pipeline will be left flooded with inhibited seawater.
[9] FishSafe spans are defined as spans in excess of 0.8 m in height from the top of the pipeline and ≥10 m in length which therefore present a hazard to fishing activity.

Installations (NAI), Sean RD is a Not Permanently Attended Installation (NPAI). Sean PD includes a compression module to receive exported gas from Sean RD via a 20-in subsea pipeline. Gas is exported to Bacton Gas Terminal via a 105 km 30-in subsea pipeline from Sean PP. The 30-in export pipeline includes a seabed SSIV controlled from Sean PP. A full summary of the infrastructure to be decommissioned can be found in Appendix A.

2.2.1.1 Surface Installations

There are three surface installations in the Sean Field: the Sean PP gas production platform which is bridge-linked to the Sean PD wellhead platform, and the Sean RD wellhead platform. Table 2-2 provides the location of the platforms and other structural information.

Table 2-2 Sean Field Surface Installations

Name	Facility Type	Location (ED1950 Z31 N)	Topsides / Facilities			Jacket		
			Weight (Te)	No of modules	Weight (Te)	No of legs	No of piles	Weight of piles (Te)
Sean PP	Production Platform	53° 11' 21" N 02° 51' 42" E	6,018	6	1,374	8	8	1,832
Sean PD	Wellhead Platform	53° 11' 23" N 02° 51' 45" E	3,986	3	1,076	6	6	1,283
PP – PD	Bridge Link	-	181	1	-	-	-	-
Sean RD	Wellhead Platform	53° 13' 34" N 02° 49' 39" E	2,216	2	1,128	6	4	1,125

2.2.1.2 Subsea Infrastructure

Table 2-3 provides an overview of the subsea infrastructure within the Sean Field which has been reviewed for decommissioning options through the CA Process, described in Section 2.1.3.

Table 2-3 Summary of the Subsea Equipment to be Decommissioned in the Sean Field

CA Group No.	Infrastructure Description	Quantity within the Sean Field
1	30" Trunkline	1
6	20" Export line	1
7	1" Electrical cable	1
8	Spools	3
9	Risers	3
10	Jumper / Umbilical	1
11	Subsea structures	1 SSIV
12	Protection	20 concrete mattresses, 95 grout bags

2.2.2 Description of Proposed Decommissioning Activities

2.2.2.1 Comparatively Assessed Infrastructure (Subsea and Pipelines)

To facilitate the CA Process as efficiently as possible the infrastructure to be decommissioned was organised into groups excluding the surface infrastructure which is outside of the CA scope. Thereafter, groups of equipment required to be fully removed in accordance with current guidance were identified and the remaining groups were assessed against the required criteria (i.e. safety, environmental, technical, societal and economic criteria). Through evidence-based evaluation of those remaining groups, final decommissioning recommendations were determined and presented to statutory stakeholders.

The recommended decommissioning approach for each of the CA groups relevant to the decommissioning of the Sean Field subsea infrastructure is provided in Table 2-4 and Table 2-5.

Table 2-4 Recommended Decommissioning Options for Each CA Group Evaluated

CA Group No.	Infrastructure Description	Decommissioning Approach
1	30" Trunkline	Removal of the offshore end section using DSV or CSV.[10] Remediation of cut ends with rock, all FishSafe spans remediated using rock. Remaining pipeline decommissioned *in situ*.[11]
6	20" Export line	Removal of end sections using DSV or CSV. Remediation of cut ends with rock. Remaining pipeline decommissioned *in situ*.
7	1" Electrical cable	Full removal of the cable. The cable will be deburied prior to both ends of the cable being cut using hydraulic shears. Once disconnected at both ends a CSV vessel will reverse reel the cable.

Table 2-5 Decommissioning Approach for Infrastructure Scoped out as Full Removal

CA Group No.	Infrastructure Description	Decommissioning Approach
8	Spools	Full removal using a DSV or CSV.
9	Risers	Risers will be fully removed during the substructure removal works as part of the jackets.
10	Jumper / Umbilical	The umbilical will be fully removed by being reverse reeled using DSV or CSV.
11	Subsea structures	SSIV structure will be fully removed; rock protection shall be displaced to gain access and all piles will be cut internally (if possible) below the mudline.
12	Protection	Full removal of protection features (mattresses) using a DSV or CSV. Protection features associated with crossings to remain.

2.2.2.2 Surface Installations

Table 2-6 Surface Installation Decommissioning Approach

Item	Infrastructure Description	Decommissioning Approach
Sean PP	Sean PP Topsides	The Sean PP topsides will be removed in modules using a suitable HLV, topside modules will be transferred to a barge for transportation to a recycling / dismantling yard.
Sean PP	Sean PP Substructure	The Sean PP Substructure will be fully removed in a single lift. The jacket piles will be cut 3 m below the seabed. The jacket will

[10] The onshore section of the PL311 (from low water mark to Bacton Terminal) is out of scope for this EA and associated DP.
[11] Offshore end of PL311 will be capped and the pipeline will be left flooded with inhibited seawater.

Item	Infrastructure Description	Decommissioning Approach
		be transferred to a barge for transportation to a recycling / dismantling yard.
Sean PD	Sean PD Topsides	The PD topsides will be removed in modules using a suitable HLV, topside modules will be transferred to a barge for transportation to a recycling / dismantling yard.
Sean PD	Sean PD Substructure	The Sean PD Substructure will be fully removed in a single lift. The jacket piles will be cut 3 m below the seabed, the conductors and caissons will be removed after the removal of the topsides and prior to the removal of the jacket. The jacket will be transferred to a barge for transportation to a recycling / dismantling yard.
Sean RD	Sean RD Topsides	The RD topsides will be removed in modules using a suitable HLV, topside modules will be transferred to a barge for transportation to a recycling / dismantling yard.
Sean RD	Sean RD Substructure	The Sean RD Substructure will be fully removed in a single lift. The jacket piles will be cut 3 m below the seabed, the conductors and caissons will be removed after the removal of the topsides and prior to the removal of the jacket. The jacket will be transferred to a barge for transportation to a recycling / dismantling yard.

2.3 General Assumptions

Prior to the commencement of the proposed Sean Field decommissioning activities, preparatory activities shall be undertaken, part of Phase 1 of the full decommissioning regime for the Sean area. These preparatory activities are outwith the scope of this EA and include activities associated with the Submission of the CoP, including flushing operations, barrier testing. ONE-Dyas will acquire the necessary licensing to cover their remits, as defined in the Sean Field DP (ONE-Dyas, 2020).

Prior to the commencement of decommissioning activities, all pipework will be flushed to an acceptable level, reflecting current guidance from OPRED and the ONE-Dyas HSEQ Policy. This activity will be permitted under the appropriate licensing regime. Wells are also outwith the scope of this EA and are to be plugged and abandoned prior to the commencement of Sean Field subsea activities and covered by their own relevant licenses.

Appropriately licensed waste management companies will be identified through a selection process which ensures that the selected facility demonstrates a proven record of: (1) waste stream management throughout the deconstruction process; (2) the ability to deliver innovative re-use/recycling options; and (3) ensures the aims of the waste hierarchy are achieved. Geographic locations of potential disposal yard options may require the consideration of Trans-Frontier Shipment of Waste (TFSW), including hazardous materials. TFSWs will be reviewed by as part of due diligence. Early engagement with the relevant waste regulatory authorities will ensure that any issues with TFSW are addressed. ONE-Dyas will engage with other companies and industries to identify potential reuse opportunities. ONE-Dyas believes that such opportunities are best achieved through the tendering and selection of a waste management contractor with the expert knowledge and experience in this area.

2.4 Methodology

This section outlines the proposed decommissioning methodology, also included within this section is key information of the asset including location weight and dimensions.

2.4.1 Surface Installations

This section outlines how the surface installations in the Sean Field will be decommissioned. All surface installations will be fully removed, and a clear seabed will be achieved by severing jacket piles below the mudline. Table 2-2 above provides location details and the weight and number of installation features.

2.4.1.1 Sean PP

Prior to the removal of the Sean PP installation as much preparatory work as possible will be carried out, this includes but is not limited to NDT of joints and lift points, reinstating of lift points (where possible) and separation of topsides modules.

The first stage of platform removal is establishing access between the HLV and installation. Once established the process of topside removal can begin, the method for removing each module is similar as each module is rigged up then the module is lifted and placed on a barge where it is sea-fastened for transportation to a recycling / dismantling yard. Some lift points for the removal of PM1 can only be installed after PLQ has been removed as PLQ obscures the locations where the lift points are to be installed. The order of the Sean PP module removal is as follows:

1. PVT upper section (flare tower)
2. PVT lower section
3. PM3
4. PM2
5. PLQ
6. PM1 (MSF)

Once PM1 has been removed a work platform will be installed on the jacket to facilitate the substructure removal activities. The first step of the substructure removal is to lift the caissons out of the jacket, these are then placed on a barge and sea-fastened for transportation to a recycling / dismantling yard. The jacket piles are to be cut 3 m below the seabed using internal cutting techniques, the jacket will then be lifted and removed to shore for recycling / dismantling. The exact method of removal has not been finalised as a contractor has not been selected yet.

2.4.1.2 Sean PD

Prior to the removal of the Sean PD installation as much preparatory work as possible is carried out, this includes but is not limited to NDT of joints and lift points, reinstating of lift points (where possible) and separation of topsides modules.

The first stage of platform removal is establishing access between the HLV and installation. Once established the process of topside removal can begin, the method for removing each module is similar as each module is rigged up then the module is lifted and placed on a barge where it is sea-fastened for transportation to a recycling/dismantling yard. The DM1 lift points can only be installed after the compression module has been removed. The order of the Sean PD module removal is as follows:

1. Compression Module
2. DM1
3. DM2

After the completion of the topsides removal a work platform will be installed on the jacket to facilitate the substructure removal activities. The caissons are first removed from the jacket followed by the conductors. Both caissons and conductors are laid on a barge and sea-fastened prior to transportation to a recycling / dismantling facility. The jacket piles are then cut 3 m below the seabed using internal cutting techniques, the jacket will then be lifted and removed to shore for recycling / dismantling. As for Sean PP, the final method of removal has not been determined as a contractor has not been selected yet.

2.4.1.3 Sean RD

Prior to the removal of the Sean RD installation as much preparatory work as possible is carried out, this includes but is not limited to NDT of joints and lift points, reinstating of lift points (where possible) and separation of topsides modules.

The first stage of platform removal is establishing access between the HLV and installation. Once established the process of topside removal can begin, the method for removing each module is similar as each module is rigged up then the module is lifted and placed on a barge where it is sea-fastened for transportation to a recycling/dismantling yard. The order of the Sean RD module removal is as follows:

1. RVT upper section
2. RVT lower section
3. RM1
4. RM2

After the completion of the topsides removal a work platform will be installed on the jacket to facilitate the substructure removal activities. The caissons are first removed from the jacket followed by the conductors. Both caissons and conductors are laid on a barge and sea-fastened prior to transportation to a recycling / dismantling facility. The jacket piles are then cut 3 m below the seabed using internal cutting techniques, and the jacket will then be lifted and removed to shore for recycling / dismantling. As above, the method of removal has not been finalised as a contractor has not been selected yet.

Figure 2-1 Sean RD platform

2.4.1.4 Risers

There are risers on the jackets of the Sean platforms. The risers will be cut and plugged at the riser – spool end. Then they will be securely fastened to the jacket structure and will be removed as part of the substructure removal campaign. The risers have been accounted for in the overall jacket weight.

2.4.2 Pipelines, Umbilical and Cable

2.4.2.1 Pipelines

The 30" trunkline running from Sean PP to the Bacton Terminal (PL311) is to be decommissioned *in situ.* The pipeline was intentionally surface laid from the shore to KP 54.0 at the time of installation, with exception of a 7 km section between KP 1.0 and KP 8.0 which is suitably trenched and naturally buried. From KP 54.0 and to Sean PP the pipeline is also suitably trenched and naturally buried (DeepOcean, 2020). The offshore (Sean Field) end of the pipeline is to be cut using hydraulic shears and the end 20 m section will be recovered. The preferred vessel for carrying out these operations is a construction support vessel (CSV). Rock will be placed over the cut end and at any locations where there are FishSafe spans to remediate any residual snag risk. As was intended during installation, there are surface laid sections of pipeline along the PL311 (DoB profiles can be seen in Appendix B). These sections have remained stable over time. However, there are a number of spans along the trunkline which qualify for rock remediation. Remediation will be addressed in Section 2.4.6.

The 20" export line from Sean RD to Sean PD (PL310) is to be decommissioned *in situ*. It is buried to an average depth of 0.72 m (DeepOcean, 2020). The exposed ends of the pipeline are to be cut and removed using hydraulic shears (a total length of 113 m). Rock will be placed over the cut ends to remediate any residual snag risk. The PL310 is exposed for 38 m adjacent to Sean RD, and again for 69 m adjacent to Sean PD. There are no spans along the pipeline (refer to Appendix B for DoB data). As above, the preferred vessel for carrying out operations is a CSV. Prior to the commencement of the decommissioning activities the pipelines will be purged and flushed.

2.4.2.2 Umbilical

The umbilical running from Sean PP to the SSIV located on the 30" trunkline is to be fully removed. The SSIV umbilical is trenched and backfilled, its ends are protected with mattresses and rock. It will be disconnected at both ends prior to removal and recovered by reverse reeling onto the deck of a CSV.

2.4.2.3 Cable

The 1" power cable will be fully removed through reverse reeling. Prior to reverse reeling, there may be a requirement to deburial the cable, however attempts will be made to pull through the sediment cover where possible to minimise seabed disturbance providing cable integrity allows. The cable is buried to an average depth of 0.87 m (DeepOcean, 2020). Where deburial is required, MFE may be required, however alternative methods may be used; the method of deburial has not been finalised. The proposed decommissioning is set to commence in 2025 (see Section 2.8 for the schedule), and it is possible that new methods may become available in that time which have a lesser environmental impact compared to MFE. However, for the purposes of impact assessment, this EA has considered MFE as the worst case methodology scenario. Once disconnected at both ends a CSV vessel will reverse reel the cable. Table 2-7 provides the dimensions of the pipelines, umbilical and cable.

Table 2-7 Pipelines, Umbilical and Cable

ID	Description	OD (")	Length (km)
PL310	20-in Export Pipeline	20	4.858
PL311	30-in Export Pipeline	30	106.502
S0813	SSIV Umbilical	4	0.4
S0803	Power Cable	1	4.892

2.4.3 Spools

The surface laid spools will be fully removed using a CSV, or DSV. The final method of removal has not been determined as this will be open to the selected contractor to decide. The proposed method will be assessed at the subsequent permit application stage, however there is not anticipated to be any additional impact dependent on removal method owing to the spools being surface laid. Table 2-8 presents the spool dimensions.

Table 2-8 Spools

ID	Description	OD (“)	Length (m)
PL310	20” Riser Tie-In Spool Sean RD to 20” Gas Export Pipeline PL310	20	40
PL310	20” Riser Tie-In Spool Sean PD from 20” Gas Export Pipeline PL310	20	48
PL311	30” Riser Tie-In Spool Sean PP to 30” Gas Export Pipeline PL311	30	52.3

2.4.4 Subsea Installations

The SSIV structure is to be fully removed. The SSIV structure was originally installed in an excavated depression and covered with rock. As such, excavation will be required to uncover the structure allowing access to the SSIV piles. The method of excavation of the SSIV has not yet been determined. Once clear of the seabed, the structure will be recovered the to the deck of a CSV.

There are two concrete mooring buoy anchor weight structures in the Sean Field. These will be lifted and fully removed and will not require excavation.

Table 2-9 Subsea Installations

Description	Number	Length (m)	Width (m)	Height (m)	Weight (te)
SSIV	1	14	10	7	110
Mooring Buoys	2	4 (diameter)		2	35 (each)

2.4.5 Protection / Stabilisation

All subsea protection and stabilisation infrastructure (i.e. concrete mattresses and grout bags) will be fully recovered, unless associated with third-party crossings. There are a total of 20 known mattresses within the Sean Field and along the associated flowlines. According to recent survey data there are a total of six confirmed mattresses associated with the PL310 and PL311; five are along the PL311 and one mattress is along the PL310. Of the five along the PL311, one is associated with a third-party crossing (DeepOcean, 2020). Within the Sean Field there are a further 14 mattresses, according to the as-built information. All are associated with the SSIV (Rockwater, 1990). There are also thought to be 95 grout bags associated with the SSIV umbilical (Rockwater, 1990). The dimensions of the mattresses and grout bags are not known, so standard sizes are assumed (see Appendix A).

The intention is to fully remove all protection / stabilisation materials, with the exception of any mattresses associated with crossings. There is not anticipated to be any difficulty in achieving theremoval of existing stabilisation materials, as there is currently no evidence of access issues or of their integrity being compromised to the extent that even piece small recovery would be unachievable. However, in any instance in which one or more of the stabilisation features are identified to not have sufficient integrity to enable their safe removal during the proposed decommissioning activities, ONE-Dyas will engage with the regulator to identify the appropriate alternative options.

2.4.6 Remediation

As mentioned in Section 2.4.2.1 above, there are a number of spans requiring remediation along the PL311. There are no spans along the PL310. There are, in total 20 spans along the PL311 (Table 2-10). FishSafe spans are defined as spans in excess of 0.8 m in height from the top of the pipeline and ≥10 m in length which therefore present a potential hazard to fishing activity. Of the 20 spans along the PL311, six are of a size to be considered a fisheries hazard. These spans therefore require remediation as a priority and are considered a base-case for remediation activities. The remaining spans are optional, and their remediation may be

considered. A volume of rock has been provided in Table 2-10 which includes a contingency quota. Therefore, the rock volume presented is considered a worst case. As has been used in past Sean Field rock placement permits, an area of 9 m^2 of rock per metre of span length is anticipated to be required (ONE-Dyas, 2016). Areas of impact associated with the PL311 remediation are calculated and discussed in Section 6.1.2.4.

It should be noted that both the optional and base case span remediation activities are being accounted for in a separate rock deposition permit (PWADATE/1985-05-02, PA/3458)[12]. However, in order to present a complete picture of all decommissioning activities, the PL311 remediation has also been accounted for within this EA.

Table 2-10 Rock Placement Proposed to Address the PL311 Exposures

Span number	Span remediation status	Span length (m)	Span height (m)	Volume of rock required (m^3)
1	Optional	19	0.7	225
2	Optional	15	0.4	150
3	Optional	14	0.6	150
4	Optional	11	0.3	150
5	Optional	12	0.3	150
6	Optional	28	0.3	225
7	Base	37	0.9	525
8	Base	15	0.8	225
9	Base	19	1.3	375
10	Optional	9	0.7	150
11	Optional	13	0.1	150
12	Optional	9	0.3	150
13	Base	40	0.9	525
14	Base	21	0.9	300
15	Optional	6	0.4	75
16	Optional	14	0.5	150
17	Base	21	0.8	300
18	Optional	21	0.7	300
19	Optional	25	0.7	300
20	Optional	20	0.5	225
Total Base Case		153		2250
Total Optional		216		2550

In addition to the remediation of the PL311 spans, the pipeline ends will be cut and remediated, as described in Section 2.4.2.1. An anticipated 30 m^2 of rock is expected to be required at each of the pipeline ends – in total four ends across the PL310 and PL311.

2.4.7 Clear Seabed Verification

Following the decommissioning of the Sean Field infrastructure, it is necessary to identify any potential snagging hazards associated with any changes to the seabed. A clear seabed will be validated by an independent verification survey of all of the installation sites and pipeline corridors, as well as any 500 m exclusion zones. The aim of these clean seabed verification actions is to ensure the seabed is left clear for future fishing effort, in line with the current Decommissioning Guidance (BEIS, 2018).

Survey techniques which do not make contact with the seabed, such as Side Scan Sonar (SSS) and Remotely Operated Vehicle (ROV), will be implemented to verify the condition of the seabed during the post decommissioning survey. The survey methods will be discussed and finalised with OPRED prior to survey commencement to ensure the survey meets the requirements for clear seabed verification.

[12] Remediation of all 20 locations has now been successfully achieved as part of a June 2021 Rock Remediation Campaign

Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive, seabed clearance is likely to require conventional overtrawl survey methods. Where there is evidence of snagging hazards requiring intervention (e.g. any spans, berms, dropped objects, etc.), then overtrawling will be undertaken to ensure no residual risk of snagging remains post-decommissioning. Should overtrawling be required, it will be conducted by fishing vessel(s) using trawl gear that is appropriate for the area. It is expected that any such intervention would be limited to the 500 m zones around the Sean platforms as it is within these areas that the structures are located, where dropped objects are more likely to happen, and majority of decommissioning activity will occur.

2.4.7.1 Debris

Recent surveys of the seabed around the Sean platforms and along the associated PL310 and PL311 observed some debris items. Seven unidentifiable debris items were located within the Sean Field. A further 75 were observed along the PL311 trunkline. None of the debris items were considered hazardous to the integrity of the subsea structures they were close to or in contact with.

It is important to note that though debris may be identified in the Sean Field, it is not necessarily associated with ONE-Dyas' assets. It is likely that the majority of debris in the Sean Field and along the PL311 is associated with other industries and / or has moved into the area. Similarly, it is possible that some debris may also move in the time during and after decommissioning. However, as ONE-Dyas is committed to leaving a clear seabed following the decommissioning, the project will ensure that oil and gas related debris and debris which may pose a risk to other sea users within the project area is removed / remediated.

2.4.8 Onshore Aspects

Onshore effects are considered to be outside the regulatory control of OPRED and are thus outwith the scope of an EA (BEIS, 2018; Decom North Sea, 2018). The final 0.6 km of the PL311 is onshore therefore is not within the scope of this EA. Impacts associated within this segment of pipeline will be managed in collaboration with the relevant regulator, the Environment Agency; however, it is worth noting the proposed methodology for decommissioning and some of their notable considerations here.

The onshore section of PL311 is to be decommissioned *in situ*, along with the rest of the pipeline. Should onshore sections of the pipeline become exposed in the future, these sections will be remediated / removed as appropriate to reduce any potential risk to recreational users and other receptors. Such decisions will be made following discussion with the North Norfolk District Council and consideration will be given to all stakeholders and receptors which may be potentially impacted by such activity. The potentially important receptors which have been identified include, but are not limited to, the following:

- Sand martens which nest in the cliffs at the landfall;
- Ringed Plovers which nest on the upper beach at the landfall;
- The English Coastal Path;
- Local business, including a caravan park adjacent the landfall; and
- The Mundesley Cliffs SSSI, which has been designated for the protection of geological features.

Though not within the scope of this EA, onshore aspects which may be affected by the decommissioning activities have been discussed where relevant throughout the EA; particularly with regards to coastal processes and their interaction with the decommissioning *in situ* of the PL311, which is addressed in Section 6.1.6.

2.5 Summary of Material Inventory

This section summarises the inventory of materials associated with the subsea infrastructure to be decommissioned. Comprehensive information about the materials present within the Sean Field is provided.

The Sean Field comprises the Sean PP gas production platform, the bridge linked Sean PD wellhead platform and the Sean RD wellhead platform. Gas is exported from Sean RD to PD via a 20" pipeline, and a 30"

trunkline runs from Sean to Bacton. The 30" trunkline has an SSIV 250 m from Sean PP, the SSIV is serviced by an umbilical running from Sean PP. An electrical cable runs from Sean PP to Sean RD.

Table 2-11, Figure 2-2, Table 2-12 and Figure 2-3 summarise the total and proportional weight of each component's constituent materials for the Sean Field.

Table 2-11 Sean Field Installations Estimated Inventory

Item	Description	Weight (Te)
Metals	Ferrous (steel - all grades)	18,401
	Non-Ferrous (copper, aluminium	973
Concrete	Aggregates (concrete coating)	0
Plastic	Rubbers, polymers	261
Hazardous	Asbestos	2
	Residual fluids (hydrocarbons, chemicals)	16
	NORM scale	0
Other	Wood, GRP	568
	Marine Growth	141
	Total (Tonnes)	20,361

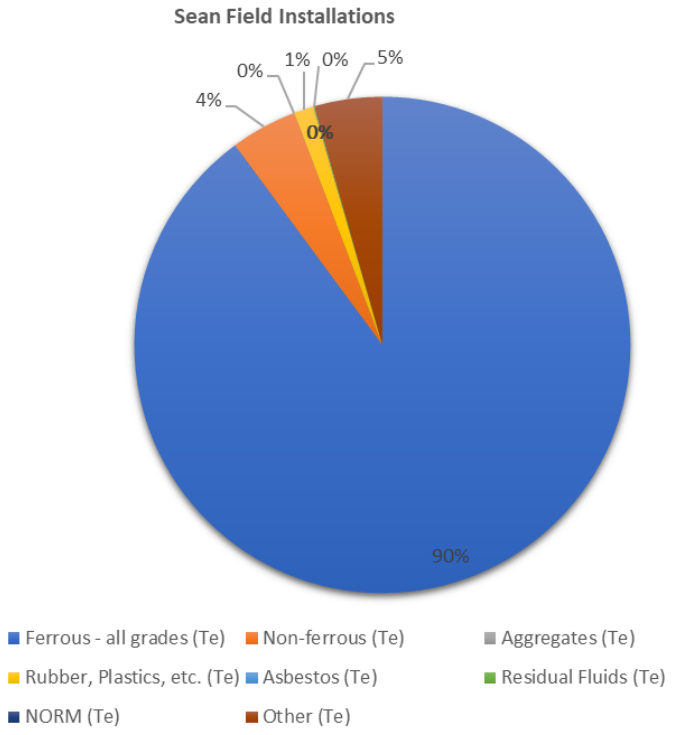


Figure 2-2 Pie chart of estimated installations inventory

Table 2-12 Sean Field Pipelines and Subsea Estimated Inventory

Item	Description	Weight (Te)
Metals	Ferrous (steel - all grades)	35,139

	Non-Ferrous (copper, aluminium	463
Concrete	Aggregates (concrete coating, mattresses, grout bags)	82,940
Plastic	Rubbers, polymers	2,110
Hazardous	Asbestos	0
	Residual fluids (hydrocarbons, chemicals)	0
	NORM scale	0
Other	Glass filament, Silica	0
	Total (Tonnes)	120,652

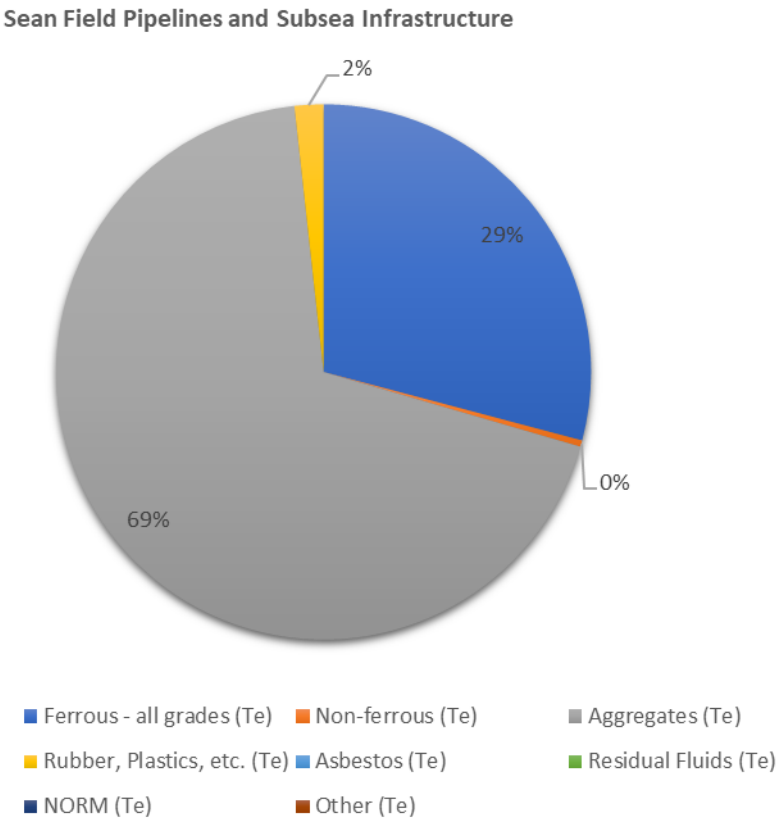


Figure 2-3 Pie chart of estimated pipelines and subsea inventory

2.6 Waste Management

The management of waste during decommissioning is a highly regulated activity, which potentially requires compliance with both national and international legislation, depending on the destinations identified for dismantling and treating any wastes generated.

Decommissioning of the Sean Field will generate a quantity of waste. ONE-Dyas is committed to establishing and maintaining environmentally acceptable methods for managing wastes in line with the Waste Framework Directive and principles of the waste hierarchy:

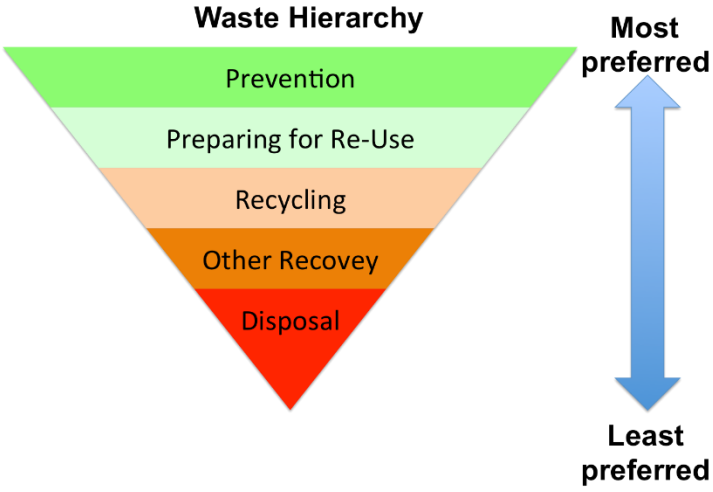


Figure 2-4 Waste hierarchy

2.7 Environmental Management Strategy

ONE-Dyas is committed to operating responsibly and will never knowingly compromise health, safety or environmental standards to meet operational objectives. ONE-Dyas will do all that is reasonably practicable to prevent major accidents, ensure the safety of everyone involved with operations and minimise environmental impacts. ONE-Dyas' HSEQ signed policy is shown in Figure 2-5.

ONE-Dyas
Health, Safety, Environmental & Quality (HSEQ) Policy

Commitment

ONE-Dyas B.V. and its subsidiaries are committed to conduct operations in a safe and sustainable way, to minimise the impact on the environment and to protect the health, safety and wellbeing of employees, contractors and the public.

All employees, consultants and/or contractors working for ONE-Dyas are responsible for achieving our HSEQ goals, through compliance with our HSEQ standards, requirements and ambitions.

Personnel is authorised and expected to take action and stop unsafe work and to report incidents, near-misses and sub-standard conditions.

Pro-active HSEQ and risk management is an integrated part of all our activities and is considered a key factor in our licence to operate.

Implementation

To implement our commitments we will:

- Maintain a systematic HSEQ Management System, developed to ensure compliance with applicable laws and regulations;
- Develop an annual HSEQ program, with tangible goals and measurable targets, to assure continuous improvement of our HSEQ performance;
- Conduct twice a year a compliance and effectiveness review of our HSEQ Management System;
- Perform risk assessments for all operated and non-operated assets and ensure effective controls and mitigations are in place, to minimise the risk of harming people, the environment, our assets and company reputation;
- Perform internal and external risk-based audit and verification activities;
- Investigate incidents in order to identify direct and indirect causes. Results of investigations will be shared openly;
- Actively co-operate with the industry and authorities, to further enhance HSEQ standards and performance.

Robert Baurdoux
CEO

17 July 2019

Figure 2-5 ONE-Dyas' HSEQ policy

2.8 Proposed Schedule

The precise timing of the decommissioning activities is not yet confirmed and will be subject to market availability of cost-effective removal services and contractual agreements. The high-level Gantt chart featured in Figure 2-6 provides the overall schedule for the programme of decommissioning activities for the Sean Field.

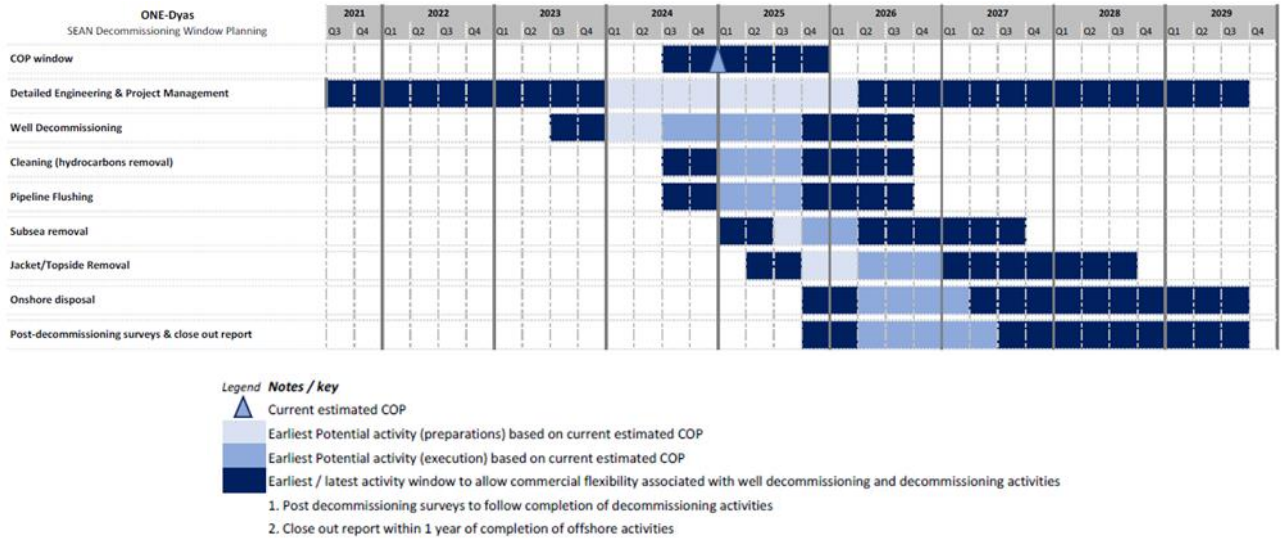


Figure 2-6 High level schedule for the Sean decommissioning project

3 ENVIRONMENTAL AND SOCIETAL BASELINE

3.1 Background

Information is provided here on the environmental baseline characteristics around the Sean Field platforms (Sean PP, Sean PD and Sean RD), connected by the PL310 pipeline, and along the associated gas export trunkline (PL311 pipeline), to help inform an assessment of the features that may be affected by the proposed decommissioning operations or may have bearing on the nature and extent of relevant impacts. The potential interactions between project activities and environmental receptors are detailed and assessed in Section 6. As the activities associated with the DP will form an ongoing presence over nearly three years, following Cessation of Production, environmental features and any relevant changes in their characteristic and sensitivities are described across as long a period of time as possible.

The project scope (Section 2) and initial screening (Section 5) suggests that the majority of potentially significant environmental impacts would be felt within relatively close proximity of the proposed development location. Therefore, environmental sensitivities are described on a local scale, with broader scale data only used where appropriate to certain ecological characteristics, such as broadscale habitat classification. Certain activities or events, such as water quality impacts, could potentially have more spatially extensive environmental impacts. In these instances, those environmental sensitivities that may be affected are described on a greater spatial scale.

In this regard, Table 3-2 provides an overview of all the environmental and societal sensitivities in the area. Details have been provided on the receptors most likely to be impacted by the proposed activities in the Sections below. This baseline characterisation describes the current conditions of the receiving environment comprising the Sean infrastructure and is considered sufficient to enable effective evaluation of the potential environmental interactions from proposed decommissioning activities at this stage.

3.2 Summary of Existing Environmental Data

The surveys presented in Table 3-1 were conducted at various locations around the Sean Papa and Sean Romeo platforms and along the associated PL311 pipeline. Figure 3-1 shows the location of the surveys in relation to the Sean Field and PL311. These surveys have been used to inform the environmental baseline of the area. The existing survey data is sufficient to broadly characterise the habitats and species located around the platforms and along the pipeline. Existing survey coverage, as will be described in the following sections, has been deemed acceptable to support the approval of a Decommissioning Environmental Appraisal.

Table 3-1 Surveys Conducted within the Sean Field and along PL311

Report Title	Survey and Reporting Year
Sean P Environmental Monitoring Survey	Fugro, 2011
Welland Field Well and Post-Decommissioning Environmental Survey	Benthic Solutions, 2016
Leman SW Well Debris Search Survey	Gardline, 2014
2016 Petrofac Subsea Inspection Campaign, Structures (OneBV) Geophysical Survey Results, Report no: 160878/003	Fugro, 2016

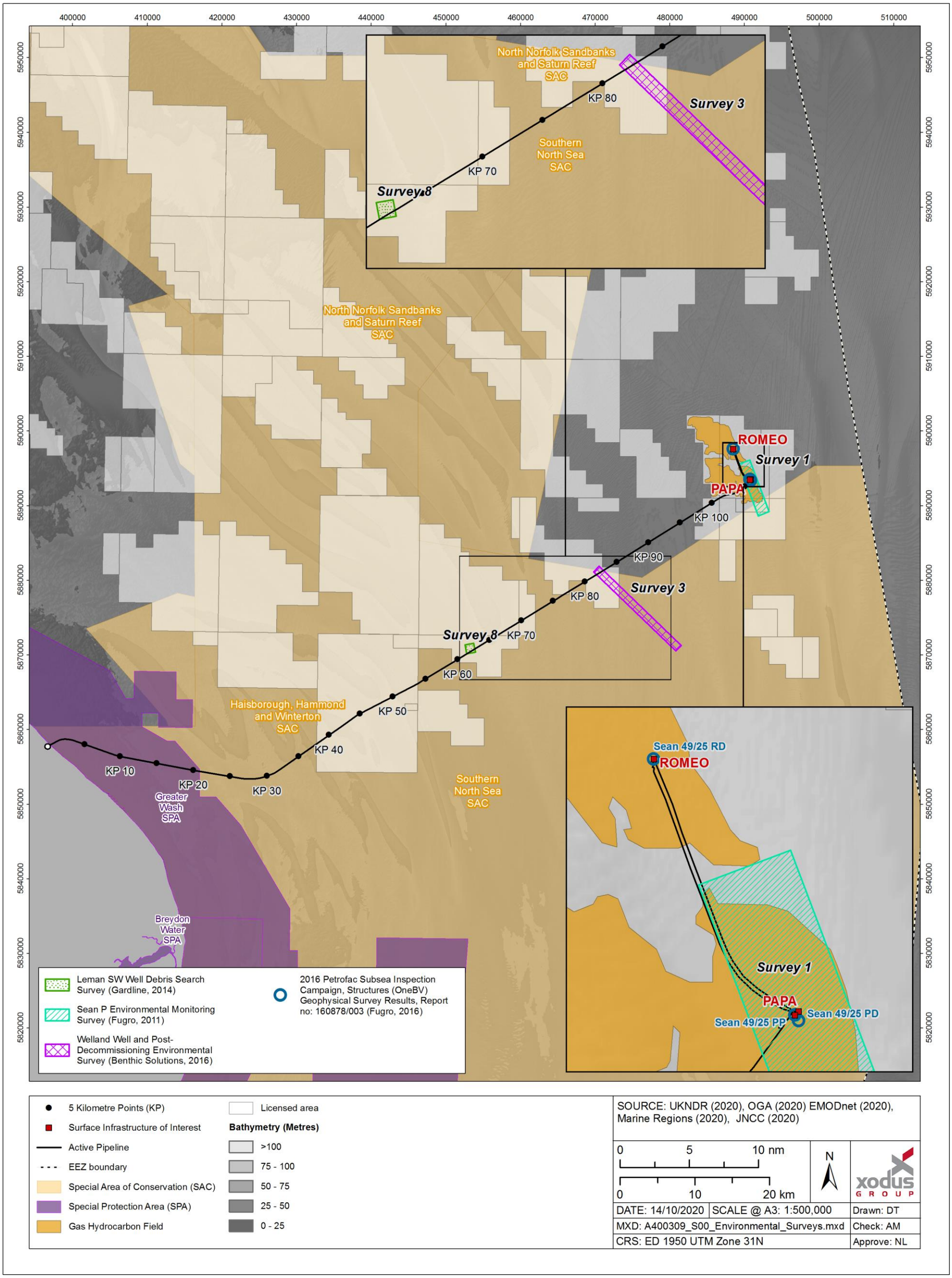


Figure 3-1 Location of the Sean Field and trunkline in relation to existing environmental surveys

3.2.1 Sean PD Environmental Monitoring Survey (Fugro, 2011)

This survey ran from 19th – 21st June 2011. Photographs and benthic samples were taken at 19 sites aligned in a cruciform arrangement centring on the Sean PD platform. The survey area corresponds to Survey 1 on Figure 3-1. Thirteen of the sites corresponded to past locations during previous 1985 and 1986 surveys, six sites were new. Samples assessed the macrofauna, organic carbon, hydrocarbons and heavy metal content.

3.2.2 Welland Field Well and Post-Decommissioning Environmental Survey (Benthic Solutions, 2016)

This survey took place from the 7th – 17th July 2016. Ground-truthing occurred at a total of 57 stations. The survey area is represented by Survey 3 on Figure 3-1. Station locations were arranged in cruciform patterns around the Welland Platform and subsea well locations, and at points along an associated pipeline. Ground-truthing was based on a combination of Day-grab samples and photography, both of which were conducted at each location.

3.2.3 Leman SW Well Debris Search Survey (Gardline, 2014)

This survey took place in February 2014 around the Leman SW well. Various methods, including camera imagery and SSS, were used to assess the seabed and identify any debris across 11 stations. Survey 8 on Figure 3-1 indicates the location of the survey.

3.2.4 Proposed Future Survey Scopes

It is considered that the combination of 2018 and 2020 survey data and data from neighbouring assets on similar sediment type, along with the future pre-decommissioning surveys will be used to determine trends and as evidence of pipeline stability and to fully address the potential risk of future exposures. Future monitoring work will ensure that any spans, longer than 10 m and higher than 0.8 m, which arise will be reported to FishSafe in the first instance. If required, OPRED will be consulted on the appropriate approach to address spans. This monitoring work will also add to the characterisation of trends in sediment transport across the pipeline which may aid in determination of exposure risk. The frequency of this monitoring work and any subsequent maintenance will be established in consultation with OPRED.

3.3 Summary of Receptors

The baseline environment in the project area is summarised in Table 3-2. For most receptors, the information provided in Table 3-2 is considered sufficient to inform the environmental assessment of potential impacts within this EA. Receptors identified during the ENVID (see Appendix C) and consultation meetings as potentially of specific interest to stakeholders included seabed habitats, benthos, other sea users and conservation sites. These receptors are discussed in more detail in Sections 3.4 to 3.7.

Table 3-2 Key Environmental and Social Sensitivities

Environmental Receptor	Description
Benthic environment	
Seabed type	According to data by the British Geological Society, the Sean Field is situated in an area of medium and fine sands. The majority of the PL311 pipeline also passes through areas of fine sands (NMPi, 2020). The EUNIS habitat complex in the immediate area surrounding the Sean Field is classified as A5.27 'Deep circalittoral sand' (EMODnet, 2019). Very little data is available on these habitats however they are likely to be more stable than their shallower counterparts (European Environment Agency, 2019). The PL311 pipeline also passes through EUNIS habitat A5.15 'Deep circalittoral coarse sediments', A5.44 'Circalittoral mixed sediments',

	and small areas of either A5.25 'Circalittoral fine sands' or A5.26 'Circalittoral muddy sand' (EMODnet, 2019). Of the five stations sampled around the Sean Field platforms in the 2011 survey (Fugro, 2011), predominantly comprised of medium and fine sands, with a low proportion of fine (silt and clay) material and minimal coarse (gravel and pebble) sediment (Fugro, 2011). Additional surveys around the PL311 pipeline described the inshore sediment type at Bacton (overlapping the pipeline) as A3.1 'High energy infralittoral rock' with areas of A5.1 'Sublittoral coarse sediment' (Royal HaskoningDHV, 2018). The nearshore sediment at either side of the trunkline was reported as highly heterogeneous seabed sediment, comprising a mix of coarse sand and gravel, including pebbles and cobbles (RPS Energy, 2010; Orbis Energy Ltd, 2014; Fugro, 2016b).
Benthic Environment	The Fugro (2011) survey conducted at the Sean Field found the dominant taxa were bivalve (*Angulus fabula)*, amphipod (*Bathyporeia elegans)* and polychaete (*Spiophanes bombyx).* Additional assessments surrounding the PL311 pipeline show that other dominant fauna included amphipods and the polychaete *Nephtys cirrosa* (a species known to prefer clean, medium to fine sand with low fines content; Shell, 2015). Closer to shore calcareous worm tubes and faunal turf growing on the more stable areas of the biotope (RPS Energy, 2010). The Ross worm, *Sabellaria spinulosa*, responsible for the formation of biogenic reefs, was found in relatively high numbers in various surveyed areas around the PL311. It is reasonable to assume it is found along the PL311. The nearby proposed Norfolk Vanguard Offshore Wind Farm has an associated export cable, which when installed, will parallel the PL311 for approximately 30 km; this area was surveyed and, in addition to *S. spinulosa*, sea stars, hermit crabs, edible crabs and gobies were also observed, amongst other species. It is likely these species are found along the trunkline. The overview of benthic communities was consistent between surveys near the PL311 and corresponds with the characterised nearshore / offshore habitat types. On the homogenous sandy sediment offshore, the benthic community showed minor variation in terms of abundance, richness and species composition. Nearshore, on the more heterogenous sediment, there was a higher species diversity present (especially on patchy areas of rocky habitat in deeper waters and armouring which overlies the export pipelines from the terminals).
OSPAR (2008) List of Threatened and/or Declining Habitats and Species	
Ocean quahog	Ocean quahog are one of the longest-living animals in the world. Ocean quahog are burrowing filter feeders, therefore are reliant on suitable sediment conditions – sand and gravel substrates are their preferred habitat. The sediment type surrounding the Sean platforms have been identified as predominantly megarippled medium to fine sands with a low proportion of fine (silt and clay) material and minimal coarse (gravel and pebble) sediment (Fugro, 2011) (Figure 3-2). This is therefore likely to be a suitable habitat for ocean quahog (*A. islandica*). However, according to the findings of the 2011 surveys around the Sean Field platforms and along the PL311 pipeline route, no ocean quahog aggregations were found (Fugro, 2011; RPS Energy, 2010).
Conservation sites	
Special Areas of Conservation (SACs)	The decommissioned pipeline goes through three SACs: Southern North Sea (SNS) SAC, North Norfolk Sandbanks and Saturn Reef SAC and Haisborough, Hammond and Winterton SAC. The Sean Field borders the SNS SAC (3 km at the closest point) and the PL311 pipeline overlaps the SNS SAC. This is the largest SAC in the UK and is designated for the protection of Annex II species harbour porpoise (*Phocoena phocoena*). This site includes key winter and summer habitat for this species (JNCC, 2020a).

	The Sean Field is located 24 km from the North Norfolk Sandbanks and Saturn Reefs SAC and the decommissioned pipeline (PL311) runs through the south of the SAC. The SAC consists of 10 main sandbanks and a number of smaller banks (Graham *et al.*, 2001 in JNCC, 2010). The sandbanks extend from about 40 km off the northeast coast of Norfolk out to approximately 110 km (Collins *et al.,* 1995 in JNCC, 2010). The banks included are: Leman, Ower, Inner, Well, Broken, Swarte and four banks called, collectively, the Indefatigable. The banks support communities typical of sandy sediments in the southern North Sea, such as polychaete worms, isopods, crabs and brittlestars. One particular polychaete, the Ross worm (*S. spinulosa)*, is capable of creating biogenic reef structures through consolidating thousands of fragile sand-tubes to create a solid structure that rises from the seabed. The Saturn reef is such a structure (JNCC, 2009). The Sean Field is 53 km from the Haisborough, Hammond and Winterton SAC and the PL311 pipeline overlaps the SAC. This SAC is designated for two Annex I habitats: 'sandbanks which are slightly covered by sea water all the time', and 'reefs'. These sandbanks are curved, run parallel to the coast, are composed of sandy sediment and lie in full salinity water with intermediate coastal influence. Infaunal communities of the sandy bank tops are consequently of low biodiversity, characterised by mobile polychaetes and amphipods which can rapidly re-bury themselves into the dynamic sediment environments. A series of sandbanks which meet the criteria of the Annex I habitat for *S. spinulosa* reefs are located at Haisborough Tail, Haisborough Gat and between Winterton Ridge and Hewett Ridge (JNCC, 2020b). The reefs are consolidated structures of sand tubes showing seafloor coverage of between 30% to 100% of the sediment.
Marine Conservation Zone (MCZ)	The Cromer Shoal Chalk Beds MCZ is located 200 m off the North Norfolk Coast. The end of the PL311 pipeline passes through the MCZ. The MCZ is designated for a number of features including; high and moderate energy circalittoral rock, high and moderate energy infralittoral rock, North Norfolk coast (subtidal), peat and clay exposures, subtidal chalk, subtidal coarse sediments, subtidal mixed sediments and subtidal sands (Natural England, 2016a).
Special Protected Area (SPA)	The Greater Wash SPA is located 80 km from the Sean Field and is intersected by the PL311 pipeline. The SPA has been designated for the protected of the following species: red-throated diver (*Gavia stellate),* common scoter *(Melanitta nigra),* little gull *(Hydrocoloeus minutus),* sandwich tern *(Sterna sandvicensis),* common tern *(Sterna hirundo),* and little tern *(Sternula albifrons)* (Natural England, 2016b). The Breydon Water SPA is located 100 km southwest of the Sean Field and 24 km south of the PL311. It is designated for the following qualifying features: wintering populations of tundra swan (*Cygnus columbianus bewickii*), European golden plover (*Pluvialis apricaria*), pied avocet (*Recurvirostra avosetta*) and northern lapwing (*Vanellus vanellus*), breeding populations of common tern, and non-breeding populations of ruff (*Philomachus pugnax*) (JNCC, 2015b). The Outer Thames Estuary SPA is 72 km southwest of the Sean Field and 26 km southeast of the PL311. The SPA is designated for: breeding common tern, breeding little tern, and non-breeding populations of red-throated diver (Natural England, 2017).
Site of Special Scientific Interest (SSSI)	The Sean Field and pipelines are not located within any SSSIs. However, there are two SSSIs in the vicinity of the PL311 pipeline: Mundesley Cliffs SSSI and Paston Great Barn SSSI. Mundesley Cliffs SSSI is located 0.6 km from the trunkline. It is designated for its earth heritage. The cliffs along this stretch of coast provide some of the very best sections in the Pleistocene Cromer Forest-bed Formation, especially in Cromerian marine and freshwater deposits, and freshwater sediments of the early Anglian Cold Stage.

	Paston Great Barn SSSI is located 1.2 km from the pipeline. This site supports the only barbastelle bat (*Barbastella barbastellus)* maternity roost in Norfolk and one of only three sites identified in the UK (Natural England, 1999).
Annex I Habitats	Annex I Sandbanks (sandbanks which are slightly covered by sea water all the time) are located between 24 – 99 km west of the platforms. Within 40 km of each platform, Sean RD is located 23.7 km WNW of the North Norfolk Sandbanks, with Sean PP located 26.8 km WNW and Sean PD 26.9 km WNW. Fugro (2011) reported no bedforms consistent with sand banks or *S. spinulosa* reef habitat were evident from the geophysical data and no potentially sensitive habitats (e.g. potential Annex I Habitats) were identified from photographic data acquired in the Sean PP site. Annex I features have however been identified in surveys around the trunkline in the nearshore area. The proposed cable corridor of the Norfolk Vanguard Offshore Wind Farm will be 0.42 km SSE of the trunkline and will be adjacent to the first 30 km of the pipeline from Bacton. Sandbanks were present in the cable corridor and *S. spinulosa* was distributed along the cable corridor, associated with the more heterogenous substrate towards the shore (Fugro, 2016b).
Conservation Species	
Coastal and Offshore Annex II species most likely to be present in the project area	
Pinnipeds – Harbour and Grey Seals	Pinnipeds are not expected to be present in the Sean Field in significant numbers, with densities estimated at approximately 0-1 individuals per 25 km^2 for both harbour (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) (Russel *et al.*, 2017). This is due to the site being approximately 94 km offshore. However, higher numbers are expected around the pipeline as it gets closer to the shore, particularly of harbour seals (Russel *et al.*, 2017).
European Protected Species most likely to be present in the project area	
Harbour porpoise	The harbour porpoise is a small, highly mobile species of cetacean that is common in all UK waters and can be found in the vicinity of the proposed decommissioning area in very high abundance, particularly in the summer months. The density of harbour porpoise is estimated at 0.89 animals/km^2 across the project area (Hammond *et al.*, 2017), and is greatest within the Southern North Sea SAC (SNCBs, 2020).
Minke whale	Minke whale (*Balaenoptera acutorostrata*) occur in water depths of 200 m or less throughout the northern and central North Sea. They are usually sighted in pairs or in solitude; however, groups of up to 15 individuals can be sighted during feeding events at their annual summer feeding grounds. Sightings in relation to the project area are greatest in spring and summer months (Reid *et al.*, 2003). The density of minke whales is estimated to be 0.01 animals/km^2 in the project area (Hammond *et al.*, 2017).
White-beaked dolphin	The white-beaked dolphin (*Lagenorhynchus albirostrisis*) are found mostly in continental shelf waters with depths between 50 m and 100 m, and rarely out to the 200 m isobath (Reid *et al.*, 2003). Distribution of the species has been linked to sea surface temperature, local primary productivity and prey abundance. White-beaked dolphins are usually found in groups of around 10 individuals, although large groups of up to 500 animals have been seen. The species are estimated to have a density of 0.002 animals/km^2 near the project area (Hammond *et al.*, 2017). They are most prevalent in moderate densities in the project area from summer into the early winter months (Reid *et al.*, 2003).
Fish – spawning and nursery grounds	
Spawning grounds	The Sean Field is located within a high-density spawning ground for plaice (*Pleuronectes platessa*) and low-density spawning grounds for cod (*Gadus morhua)*, whiting (*Merlangius merlangus*), sandeel (*Ammodytidae spp.)*, mackerel (*Scomber scombrus*), sprat (*Sprattus sprattus*), and Norway lobster (*Nephrops norvegicus*).

	The PL311 pipeline is located within a high-density spawning ground for plaice, low-density spawning grounds for cod, sole (*Solea solea*), herring (*Clupea harengus*), sandeel, and whiting. Additionally, the pipeline is located within a spawning ground of undetermined intensity for lemon sole (*Microstomus kitt*) and sprat (Coull *et al.*, 1998; Ellis *et al.*, 2012).
Nursery grounds	The following species have nursery grounds in the Sean Field: cod, herring, mackerel, tope shark (*Galeorhinus galeus*), whiting, sprat and Norway lobster. The PL311 pipeline route passes through areas known to be nursery grounds for: cod, herring, mackerel, plaice, sandeel, sole, lemon sole, sprat, tope shark, thornback ray (*Raja clavata*) and whiting (Coull *et al.*, 1998; Ellis *et al.*, 2012).
Probability of juvenile fish aggregations	Aires *et al.* (2014) provides a predicted spatial distribution of 0-year group (i.e. juvenile) fish. The model predicted low densities for the following species in the Sean Field and along the PL311: plaice, sole, hake, anglerfish, blue whiting, Norway pout, haddock, and cod. The probability of juvenile mackerel aggregations is low-moderate. The probability of juvenile herring, horse mackerel, and sprat occurring in aggregations within the project area is moderate. Only the probability of whiting occurring in an aggregation was high within the project area (Aires *et al*., 2014).

Seabirds

According to the density maps provided in Kober *et al.* (2010), the following species have been recorded within the area of proposed operations: northern fulmar (*Fulmarus glacialis)*, Manx shearwater (*Puffinus puffinus)*, northern gannet (*Morus bassanus)*, pomarine skua (*Stercorarius pomarinus)*, Arctic skua (*Stercorarius parasiticus)*, great skua (*Stercorarius skua)*, black-legged kittiwake (*Rissa tridactyla)*, great black-backed gull (*Larus marinus)*, lesser black-backed gull (*Larus fuscus)*, herring gull (*Larus argentatus)*, common guillemot (*Uria aalge*), razorbill (*Alca torda)*, little auk (*Alle alle)* and Atlantic puffin (*Fratercula arctica)*.

In Blocks 52/4, 52/3, 52/5, 52/9, 52/10, 53/1 and 53/2 the sensitivity of seabirds to oil pollution, reflected by the SOSI (JNCC, 2015a), is high to extremely high for the majority of the Blocks over winter into spring (from October to April). It is low for the Blocks over summer between May and September, except for the month of August in many of the Blocks. The SOSI is comparatively much lower in Blocks 49/24 and 49/25: sensitivity is either low or no data is available (Webb *et al.*, 2016).

In Blocks 49/27, 29/28 and 49/29, the SOSI is higher in the winter months; Blocks 49/27 and 49/28 are extremely high between November and February. Comparatively lower, though also high, Block 49/29 shows the same patter over winter (Webb *et al.*, 2016).

Seabird Oil Sensitivity Index (SOSI)

Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
48/29	1	1	3	3*	4	5	5	4	5	3*	3	2
48/30	1*	1	3	3*	N	5*	5	4	5	3*	3	2
49/19	5*	N	N	N	5*	5	5	5	5	5*	5*	5
49/20	5*	N	N	N	5*	5	5	5	5	5*	5*	5
49/21	1*	1	2	2*	N	N	5*	5	5*	N	1*	1
49/22	N	3*	3	3*	N	N	5*	5	3	3*	1*	1
49/23	3*	4*	4	4*	5*	5	5*	5	5	5*	3*	3
49/24	**5***	**5***	**5**	**5***	**5***	**5**	**5**	**5**	**5**	**5***	**5***	**5**
49/25	**5***	**N**	**N**	**N**	**5***	**5**	**5**	**5**	**5**	**5***	**5***	**5**
49/26	1*	1	4	4*	N	5*	5*	5	5	3*	3	2
49/27	**N**	**1***	**4**	**4***	**N**	**5***	**5***	**5**	**5***	**N**	**1***	**1**

49/28	**1***	**4***	**4**	**4***	**N**	**5***	**5***	**5**	**5***	**N**	**1***	**1**
49/29	**3***	**4***	**4**	**4***	**5***	**5**	**5***	**5**	**5***	**N**	**3***	**3**
49/30	3*	N	N	N	5*	5	5	5	5*	N	3*	3
50/16	5*	N	N	N	5*	5	5	5	5	5*	5*	5
50/21	5*	N	N	N	5*	5	4	5	5	5*	5*	5
50/26	5*	N	N	N	5*	5	2	5	5*	N	5*	5
52/4	**2**	**1**	**2**	**2***	**5**	**4**	**5**	**4**	**5**	**3***	**3**	**2**
52/3	**2**	**2**	**3**	**3***	**5**	**5**	**5**	**4**	**5**	**3***	**3**	**2**
52/5	**1**	**1**	**3**	**3***	**5**	**5**	**5**	**4**	**5**	**3***	**3**	**2**
52/9	**1**	**1**	**2**	**2***	**5**	**2**	**5**	**4**	**5**	**2***	**2**	**2**
52/10	**1**	**1**	**2**	**2***	**5**	**3**	**5**	**4**	**5**	**3***	**3**	**2**
53/1	**1**	**2**	**3**	**3***	**N**	**N**	**5***	**5**	**5**	**3***	**3**	**2**
53/2	**1**	**3**	**3**	**3***	**N**	**N**	**5***	**5**	**5***	**4***	**4**	**2**
53/3	1	4	3	3*	N	N	5*	5	5*	5*	5	2
53/4	3*	4*	4	4*	N	N	5*	5	5*	N	3*	3
53/5	3*	1*	1	1*	N	N	5*	5	5*	N	3*	3
53/6	1	2	2	2*	5	3	3*	5	5	3*	3	2
53/7	1	4	2	2*	5*	3*	5*	5	5*	3*	3	3
53/8	1	4	2	2*	N	N	5*	5	5*	4*	4	2
54/1	5*	N	N	N	5*	5	3	5	5*	N	5*	5
Key	**1** = Extremely high		**2** = Very high		**3** = High		**4** = Medium		**5** = Low		**N** = No data	
	* in light of coverage gaps, an indirect assessment of SOSI has been made using the method provided by the Joint Nature Conservation Committee (JNCC) (Webb *et al.*, 2016)											

Socio-economic Receptor	Description
Commercial fishing	
	According to fishing data from the MMO (2020), fisheries in ICES rectangles 34F2 and 35F2 have predominantly targeted demersal species which have consistently dominated the catch by weight and value. Conversely fisheries within 34F1 have predominantly targeted shellfish species (crab, lobster, whelks). The live weight catch was noticeably lower in 2018 than previous years for all three ICES rectangles. Fishing effort in 34F1, 34F2 and 35F2 was low year round (<50 days per annum; MMO, 2020). Amalgamated VMS data from 2007-2015 presented in Figure 3-7 shows fishing effort in this region from mobile, passive and demersal gears. Fishing intensity is generally low for all gear types around the platforms and pipeline PL310. There is no fishing data available for the southwest portion of the PL311 pipeline. Fishing effort increases to the northeast of the pipeline for demersal and mobile gears and decreases near the platforms.

Fishing Landings in ICES Rectangles 34F1, 34F2 and 35F2 (MMO, 2020)

		2019	2018	2017	2016	2015

ICES Recta-ngle	Species type	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)
34F1	Demersal	4	16,988	4	23,738	4	17,247	7	24,084	6	16,313
	Pelagic	16	11,424	6	4,812	15	8,776	10	6,863	16	9,750
	Shellfish	428	927,828	156	462,909	447	878,836	253	552,330	317	484,161
	Total	**488**	**956,240**	**166**	**491,459**	**466**	**904,859**	**270**	**583,277**	**339**	**510,224**
34F2	Demersal	32	80,764	35	157,425	52	229,859	142	631,858	184	801,702
	Pelagic	0	70	-	-	0	0	-	-	-	-
	Shellfish	4	6,104	4	4,804	1	1,960	1	3,336	2	3,354
	Total	**36**	**86,938**	**39**	**162,229**	**53**	**231,819**	**143**	**635,194**	**186**	**805,056**
35F2	Demersal	6	24,646	7	15,679	63	235,571	84	366,216	82	283,654
	Pelagic	-	-	-	-	0	0	-	-	-	-
	Shellfish	6	9,117	3	4,412	0	417	0	5	0	146
	Total	**12**	**33,763**	**10**	**20,091**	**63**	**235,988**	**84**	**366,221**	**82**	**283,800**

Other sea users

Shipping activity	Shipping activity is considered very high in Blocks 52/4, 52/5, 52/10 and 53/1, high in Bocks 49/24, 49/25, 49/27, 49/28, 49/29 and 53/2. Blocks 49/24, 49/25 and 49/29 are additionally located within deep water routes. There is no available data for Blocks 52/9 and 52/3 close to shore (Oil and Gas Authority, 2016).
Oil and Gas	The Sean Field and PL311 pipeline are located in the SNS in an area of extensive oil development with a number of fields located nearby, see below:

Installation	*Installation Type*	*Operator*	*Distance and direction (from Sean PP)*
Corvette	Platform	Shell	16.7 km WNW
Davy A	Platform	Perenco	20.7 km SSE
Inde CD, CP, AT, AC and AQ	Platform	Perenco	23.7 – 24.3 km WNW
Bessemer A	Platform	Perenco	25.2 km WSW
Caravel QR	Platform	Perenco	26.9 km NNE
Brigantine BG and BR (north/south/east and west)	Platform	Shell	26.9 – 30.7 km NNW
Caravel	Platform	Shell	27.0 km NNE
Inde D, AD, AP, BD and BP	Platform	Perenco	27.3 – 31.9 NW
Shamrock QS	Platform	Shell	31.5 km NNE
Leman G	Platform	Perenco	36.4 km WSW
Europa (not in use)	Platform	Chrysaor	38.4 km WNW

	Leman (DP and DD) Platform Perenco 39.8 km WSW
Telecommunication	The closest telecommunication cables in the vicinity of the Sean Field is the telecom UK-Germany BT cable that is now disused (11.1 km ENE of the Sean PD platform). The closest active cable is the Telecom SEA-ME-WE3 cable located 19.33 km ESE of the Sean PD platform (NMPi, 2020).
Military activities	There are no military restrictions on Blocks 49/24, 49/25, 49/27, 49/28, 49/29, 53/1, 53/2. However, Blocks 52/4, 52/5, 52/9 and 52/10 are of concern to the MoD as they lie within a training ground (OGA, 2019). Any activities taking place within this Block will require prior notification to the MoD.
Renewables	There are two proposed renewable energy sites within 40 km of the project area. The closest is the Norfolk Boreas proposed wind farm site which will be located approximately 2.5 km south of the Sean Field. Additionally, the Norfolk Vanguard West proposed wind farm site will be located approximately 25.3 km south of the PL311 pipeline, having recently received development consent. The proposed cable corridor of the Norfolk Vanguard Offshore Wind Farm will be 0.42 km SSE of the trunkline and will be adjacent to the first 30 km of the pipeline from Bacton.
Wrecks	There are four wrecks within 20 km of the Sean Field Platforms. Three wrecks are considered dangerous wrecks, of which the closest is 6.3 km WSW of Sean PP (NMPi, 2020).

3.4 Seabed Habitats and Benthos

3.4.1 Sediment type

According to data by the British Geological Society, the Sean Field is situated in an area of medium and fine sands (NMPi, 2020) and the EUNIS seabed benthic habitat type surrounding the Sean Field platforms is classed as A5.27 'Deep Circalittoral Sand', shown in Figure 3-2. This corresponds well to the sediment type observed at the Sean platforms in 2011, reported as relatively homogeneous, predominantly comprising medium to fine sand with low proportions of fine material and varying amounts of shell fragments (Fugro, 2011).

The PL311 pipeline predominantly runs though A5.27 "Deep circalittoral sand", A5.15 'Deep circalittoral coarse sediments', A5.44 'Circalittoral mixed sediments' and smaller areas of either A5.25 'Circalittoral fine sand' or A5.26 'Circalittoral muddy sand' (NMPi, 2020). Few data are available on the EUNIS habitat complex A5.27 'Deep circalittoral sand'. However, such habitats are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms (European Environment Agency, 2019).

At the end of the PL311 closest to the Sean PP platform, there was evidence of sand waves (Fugro, 2011). An environmental survey at the Welland Field Well, conducted across a narrow transect which overlapped PL311 at approximately KP 85.0, reported a baseline homogenous seabed of megarippled sand. There were small quantities of shell material associated with the survey. Fines comprised <10%, and gravel accounted for <1% of the sediment composition (Benthic Solutions, 2016). This is consistent with the benthic habitat described within the Sean Field (Fugro, 2011). Generally, within the SNS, sediments are very mobile and sediment transportation is particularly active.

Further along the PL311 (at approximately KP 65.0) seabed imagery at the pipeline, identified sediments comprising loose to dense medium megarippled silty sand with shells and shell fragments (Gardline, 2014). North of the PL311, surveys of the Leman Field complex identified sediment consistent with EUNIS A5.25 'Circalittoral fine sand', A5.44 'Circalittoral mixed sediment' and A5.6 'Sublittoral polychaete worm reefs on sediment' (Shell, 2015). The predominant sediment type within the surveyed Leman Field complex, approximately 9 km north of the PL311, is consistently reported as sand with minimal fines and complex topography (Gardline, 2014; Shell, 2015).

At the coast, the Bacton to Walcott Coastal Management Scheme defined the inshore sediment as A3.1 'High energy infralittoral rock' with areas of A5.1 'Sublittoral coarse sediment' (Royal HaskoningDHV, 2018). Surveys conducted at the coastline on either side of the PL311 found the sediment to be highly heterogenous seabed sediment composed of a mixture of coarse sand and gravel, including pebbles and cobbles (RPS Energy, 2010; Orbis Energy Ltd, 2014; Fugro, 2016b). This sediment is unstable due to the strong tidal currents and wave action present along the coastline. A variety of other reports identify the inshore sediment near the PL311 to be coarse, smaller areas of 'rock or reef' are also typical of this section of the trunkline (RPS Energy, 2010; Fugro, 2016b; Royal HaskoningDHV, 2018).

The PL311 passes through the North Norfolk Sandbanks and Saturn Reef SAC and the Haisborough, Hammond and Winterton SAC. Both of these SACs are protected for the presence of Annex I reef and sandbank habitats. The sediment along with the pipeline is consistent with the type of sediment associated with sandbanks. In places, Annex I sandbanks were detected along the PL311 pipeline (Perenco, 2014; Fugro, 2016b). Conservation areas will be addressed fully within Section 3.7.

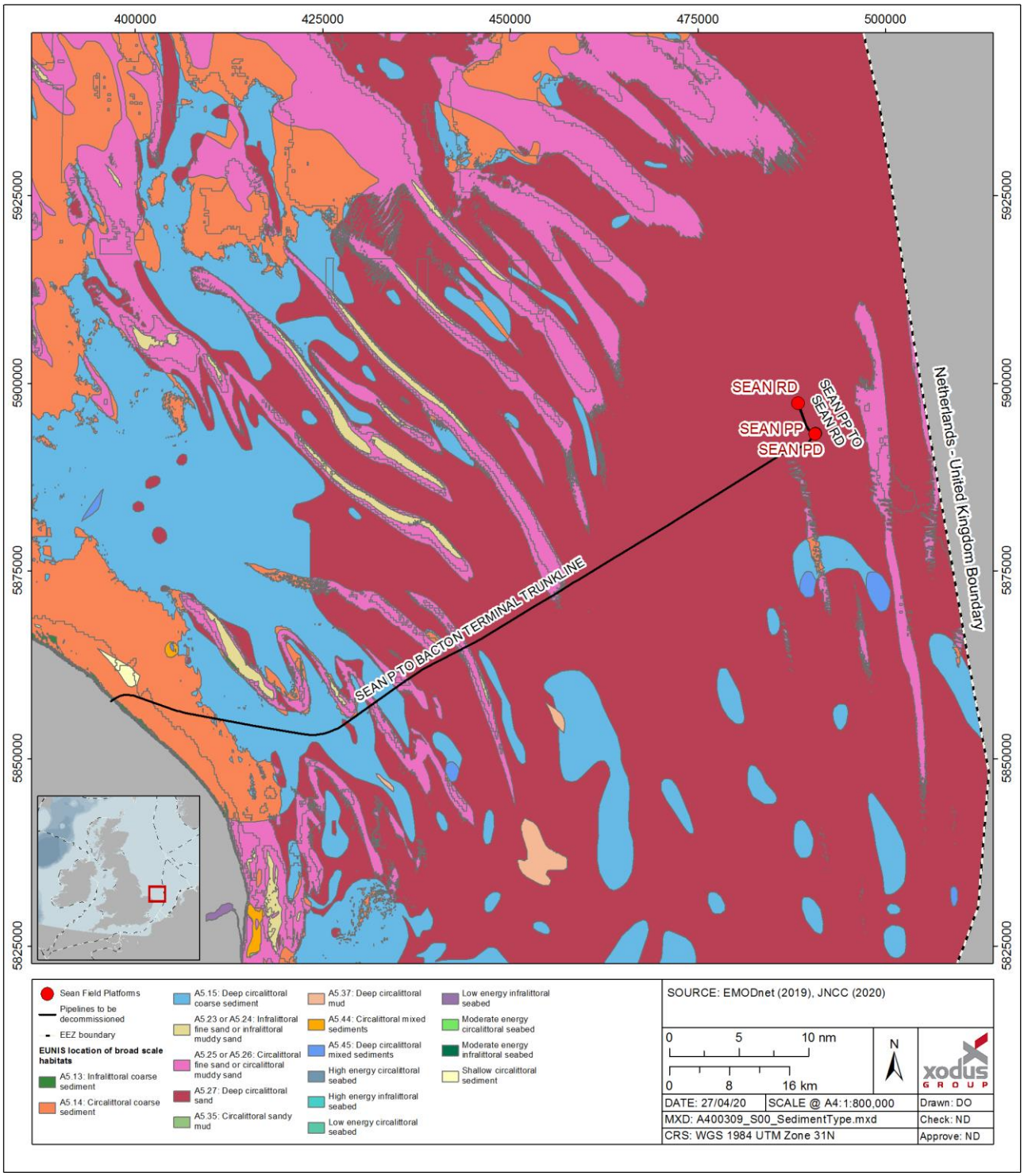


Figure 3-2 EUNIS seabed habitats in the vicinity of the Sean Field and the PL311 pipeline

3.4.2 Epifauna and meiofauna

The dominant taxa recorded at the Sean Field platforms were the bivalve (*Angulus fabula*), amphipod (*Bathyporeia elegans*) and polychaete (*Spiophanes bombyx*). Of the taxa recorded ~50% were annelid, ~30% were crustacean, ~13% were molluscan and ~3% were echinoderm (Fugro, 2011). Epifaunal diversity across the survey area was low. Brittlestars (*Ophiuroidea)* and the common sea star (*Asterias rubens)* were noted on the seabed photographs and the sea potato urchin (*Echinocardium cordatum*), crabs (*Malacostraca*) and a flatfish (*Pleuronectidae*) were recovered in grab samples. Occasional crustacean burrows were also observed. No ocean quahog (*Arctica islandica*) was identified in the Sean Field survey (Fugro, 2011); however, the sediment within the Field is consistent with that which would be suitable to sustain the species.

The Sean Field is located approximately 25 km from the North Norfolk Sandbanks and Saturn Reef Special Area of Conservation (SAC) boundary, which has been designated to protect the largest areas of linear sandbanks in UK waters and biogenic reefs formed by the Ross worm *Sabellaria spinulosa*. Within the Sean Field, no bedforms consistent with sandbanks or *S. spinulosa* reef habitat were evident from the geophysical data and no potentially sensitive habitats (e.g. potential Annex I Habitats) were identified from photographic data acquired in the Sean Papa site (Fugro, 2011).

Further along the PL311, the pipeline intersects the southern corner of the North Norfolk Sandbanks and Saturn Reef SAC. Surveys within the Leman Field Complex to the north of the PL311 (approximately 9 km away) recorded presence of *S. spinulosa* (Shell, 2015). To the south of the PL311 a large area was assessed as part of the 'Norfolk Vanguard Offshore Wind Farm Environmental Statement'. The area was reported to be predominantly populated with *S. spinulosa*; the species made up nearly 72% of the annelid abundance (Fugro, 2016b). The proposed cable corridor of the Norfolk Vanguard Offshore Wind Farm will be 0.42 km SSE of the trunkline and will be adjacent to the first 30 km of the pipeline from Bacton. *S. spinulosa* was distributed along the proposed cable corridor (Fugro, 2016b). Considering the presence of *S. spinulosa* to the north and south of the PL311, and its documented presence within an adjacent cable corridor route, it is reasonable to assume that *S. spinulosa* are also found along the PL311 trunkline. However, the the presence of *S. spinulosa* is not necessarily indicative of an aggregation or a biogenic reef. Additionally, one survey which covered an area along the PL311 at KP 62.0 identified and confirmed the presence of biogenic reef (Gardline, 2014). An assessment of the status and quality of the patches of reef identified 0.4 km SSE of the pipeline were described as having low 'reefiness' with moderate 'reefiness' observed along the pipeline route (Fugro, 2016b). Another assessment within the vicinity of Leman B (~8 km north of the PL311) showed local patches of biogenic reef with 'low' to 'medium' elevantion and were considered to have 'medium' reefiness (Shell, 2015). Protected species associated with the habitat available within the Sean Field and associated PL311 trunkline will be addressed within Section 3.7.3.

In addition to *S. spinulosa*, the most common species observed within the Norfolk Vanguard Offshore Windfarm area, near the PL311 trunkline were: sea stars (*Asterias rubens*), hermit crabs (*Pagurus spp.*), edible crab (*Cancer pagurus*), gobies (*Gobiidae*), dragonet (*Callionymus sp*.), pogge (*Agonus cataphractus*), plumose anemone (*Metridium senile*) and athecate hydoids (Fugro, 2016b). Given the proximity of this survey site, it is reasonable to assume a similarity in benthos. Just to the north of the PL311, within the Leman Fields, dominant taxa included amphipods (*Bathyporeia elegans*, *Urothoe brevicornis* and *Bathyporeia guilliamsoniana*), and the polychaete *Nephtys cirrosa*; all species which are known to prefer clean, medium to fine sand with low fines content (Shell, 2015).

A report for the 'Baird Gas Storage Project' includes an area which overlaps the trunkline for a total of 25 km and runs north of the PL311 the rest of the route to shore. The faunal community was reported to be fairly homogenous and diverse, with low abundances across the site, and was dominated by the high proportion of the crustacean *B. elegans*. The following visible fauna were identified along the pipeline route to Bacton: Annelida (*Pomatoceros sp.*, *S. spinulosa*), Crustacea (barnacles: *Balanidae sp.*, crabs *Necora puber*, *Cancer pagurus* and shrimp: *Pandalus montagui*), mollusca (gastropods, mussels: *Mytilus edulis* and *Calliostoma zizyphinum*), pisces (*Myococephalus scorpius*), cnidaria (anemones), echinoderms (brittle stars: *Ophiura albida* and starfish: *Asterias rubens*), bryozoans (hornwrack: *Glustra folicea*) and porifera (sponges). The occurrence of the *S. spinulosa* was confirmed at a number of stations in varying abundance, and numerous *Mytilus edulis* mussels were found to be present at the nearshore end of the PL311 route. This suggests that both these species will be present in the nearshore/inshore area of the trunkline (RPS Energy, 2010).

The inshore/nearshore habitats of heterogenous gravelly sediment are typically characterised by robust fauna, especially on patchy areas of rocky habitat in deeper waters and armouring which overlies the export pipelines from the terminals (including Bacton). The Norfolk Vanguard Offshore Windfarm area assessed the benthic habitat and associated fauna to the coast, immediately due south of the PL311 as it terminates at Bacton. This area of coarser sediments comprised a rich and diverse epibenthic community, which included a variety of sessile epifauna. Characteristic epibenthic species included crustaceans, such as *Pagurus bernhardus, Necora puber* and species of *Liocarcinus*, together with echinoderms such as *Ophiura ophiura* and *Ophiura albida, Asterias rubens and Crossaster papposus*. Sessile colonial epifauna comprised bryozoans, notably, *Flustra foliacea* together with the sea anemone of the genus *Urticina* (Fugro, 2016b). Given the proximity of this described area to the PL311, it is likely that this characterisation of benthos is applicable along the final nearshore length of the trunkline.

3.4.3 Sediment contamination

Total hydrocarbon concentrations (THC) were found to vary across the Sean Field. Concentrations ranged from 0.7 µg/g to 7.1 µg/g, with a singular particularly high concentration of 15.1 µg/g recorded 200 m northeast of the platform. This exceeded the 95th percentile concentration for background stations in the Southern North Sea (11.4 µg.g-1) but did not exceed the predicted no effects concentration (PNEC) at which adverse biological effects are expected (50 µg.g-1; Fugro, 2011). Distinctly higher levels were apparent at three of the four stations located 200 m from the Sean PD Platform whereas stations located beyond 200 m of the Sean PD Platform displayed fairly low levels ranging between 0.7 µg.g-1 and 2.4 µg.g-1; below UKOOA (Cefas, 2001) background levels for the Southern North Sea (4.3 µg.g-1). Comparison of these data with those collected during surveys undertaken in 1985 and 1986 suggest a marked reduction in THC over the period between the surveys, with mean concentrations for the stations shown reduced by 95%.

To the south of the PL311, within the Arthur Field (approximately 1 km away in line with KP 50.0), the organic content of sediments was also low, ranging from 0.5% to 1.5%, with no discernible trend across the survey area. The low levels are likely to be as a result of the very low levels of fines (Perenco, 2015a).

Within the Leman C Field (~6 km north of the PL311), survey data showed that contaminant concentrations for hydrocarbons and metals were generally below background concentrations (or slightly above in the case of some metals) for the SNS as determined by UKOOA (Cefas, 2001). In 2012, Leman C THC values ranged from 0.5 µg/g to 4.1 µg/g. THC values in the Leman A Field in 2008 were in the similar range of 1.0-4.3 µg/g, with an exception of a single station located 100 m from the Leman A platform with higher THC of 7 µg/g (Shell, 2015).

The Thames Area contains the Arthur and Gawain Fields. The Gawain Field overlaps the PL311 (at KP 97.0) and, as above, the Arthur Field is located ~1 km from the PL311. Across the whole Thames Area, of all the metal contaminants, only arsenic was present above Level 1 thresholds (Cefas L1 threshold is 20 ppm) at most sampled stations. However, elevated levels of arsenic can occur following geological inputs and / or industrial discharge (Perenco, 2014, 2015a, 2015b). Cadmium was the only other metal found at concentration above its respective Cefas Level 1 threshold; it was sampled at a level of 0.4 ppm. Barium was detectable at all stations sampled with levels of between 6 and 36 ppm across the sites but there was no evidence of any 'hotspots' of barium concentration (Perenco, 2014a, 2014b, 2015). Considering the area covered by the Thames complex these levels are suggestive that, along the PL311 trunkline, metal contaminants are mostly found below established thresholds.

3.5 Maritime Activities

The North Sea contains some of the world's busiest shipping routes, with significant traffic generated by vessels trading between ports at either side of the North Sea and the Baltic. North Sea oil and gas fields also generate high vessel traffic in the form of transit vessels routes. Figure 3-3 is a composite of Automatic Identification System (AIS) vessel tracks, illustrating the relative vessel activity surrounding the Sean Field and along the PL310 and PL311 pipeline routes. There are two high intensity transiting vessel routes that pass southwest to north-northeast of the Sean Field platforms.

The PL310 and PL311 pipelines are located in UKCS Blocks 49/25, 49/24, 49/27, 49/28, 49/29, 52/3, 52/4, 52/5, 52/9, 52/10, 53/1 and 53/2 where shipping activity has been assessed to vary between moderate and

very high (Oil and Gas Authority, 2016). Vessel activity is greatest along the southwest section of the PL311 pipeline (between the shore and KP 30.0), as shown in Figure 3-3. Other shipping routes of relative high density cross the PL311 between KP 40.0 – 50.0, and closer to the Sean Field between KP 90.0 – 100.0. Vessel activity reduces along the PL311 pipeline between these busier routes. There are still multiple lower intensity transit routes crossing the pipeline along its length (Figure 3-3).

Blocks 52/4, 52/5, 52/9 and 52/10 are noted as being of concern to the Ministry of Defence (MoD) (Oil and Gas Authority, 2019). It is recommended that operators contact the MoD about proposed activities and their timings prior to commencement of works.

Two proposed renewable energy sites will sit within 40 km of the Sean Field and the PL310 and PL311 pipelines. The closest is the Norfolk Boreas proposed wind farm which will be located approximately 2.5 km south of the Sean Field. Additionally, the Norfolk Vanguard offshore windfarm proposed site will be located within 5 km south of the PL311 pipeline, at the closest point. The planned cable route associated with this windfarm will parallel the PL311 to Bacton from KP 30.0 at a similar distance. The Norfolk Vanguard windfarm consents are currently under review. Neither of the proposed windfarms have a timeline of construction at present. Figure 3-4 shows the Sean Field and PL311 in relation to other sea users, including the future location of the two aforementioned proposed wind farm sites, and other offshore infrastructures.

Of the oil and gas installations near the Sean Field, the closest is the Shell operated Corvette, 16.7 km northwest. All other platforms are located over 20 km away from Sean. The PL311 passes close to an additional number of third-party installations (Figure 3-4), the closest being the Camelot platform (operated by Energy Resource Technology), the Leman Complex (operated by Shell) and the Hewett Field (operated by Eni Hewett). Infrastructure associated with the Thames (operated by Perenco), Camelot and Leman Fields are located ~3 km from the PL311. Of these developments, the wider Thames Decommissioning Project concluded in 2018 (Perenco, 2015) and the decommissioning of the Camelot installation ended in 2016, with close out reports having been issued (Energy Resource Technology, 2012).

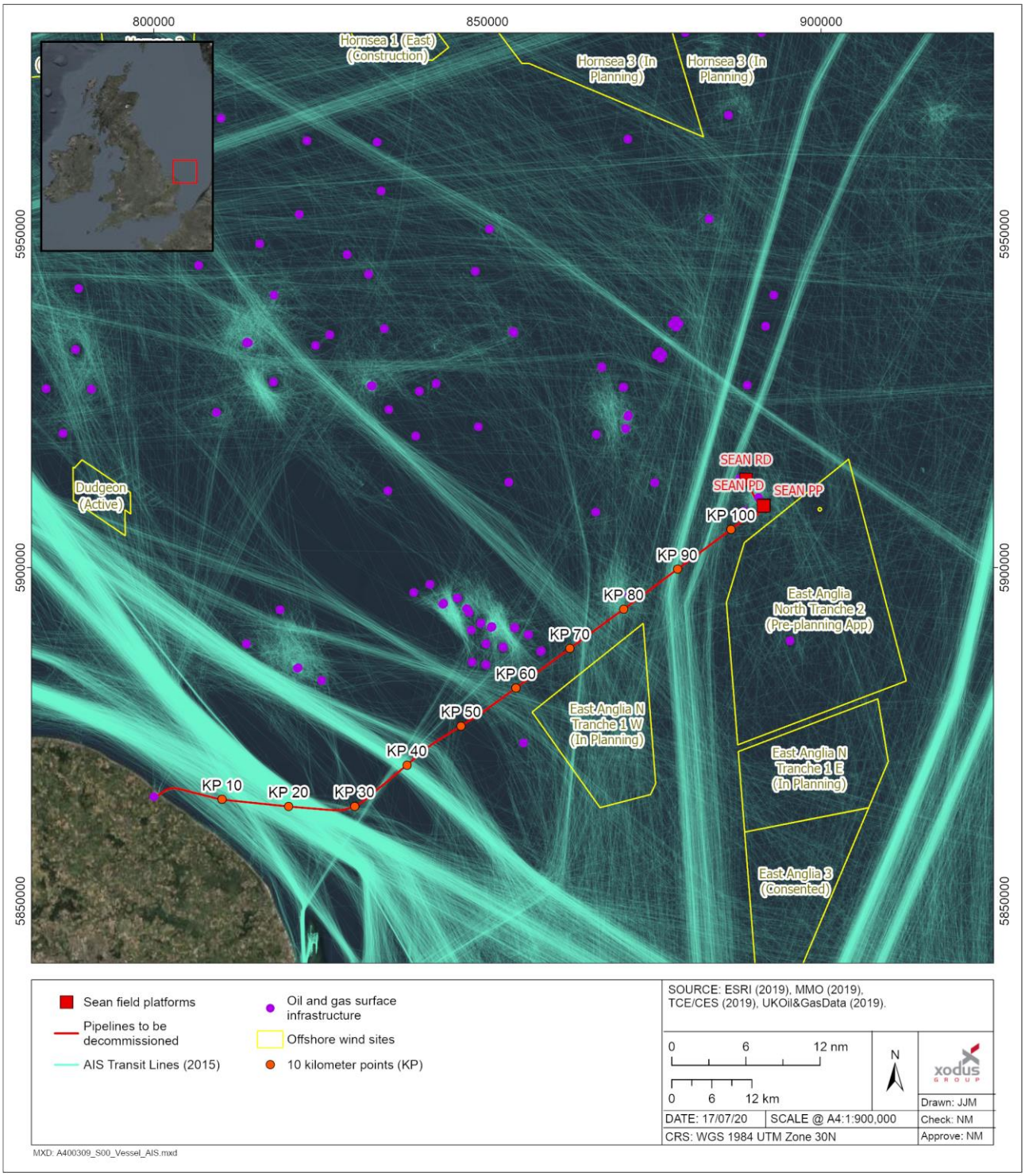


Figure 3-3 Vessel activity around the Sean Field and the PL310 and PL311 pipelines

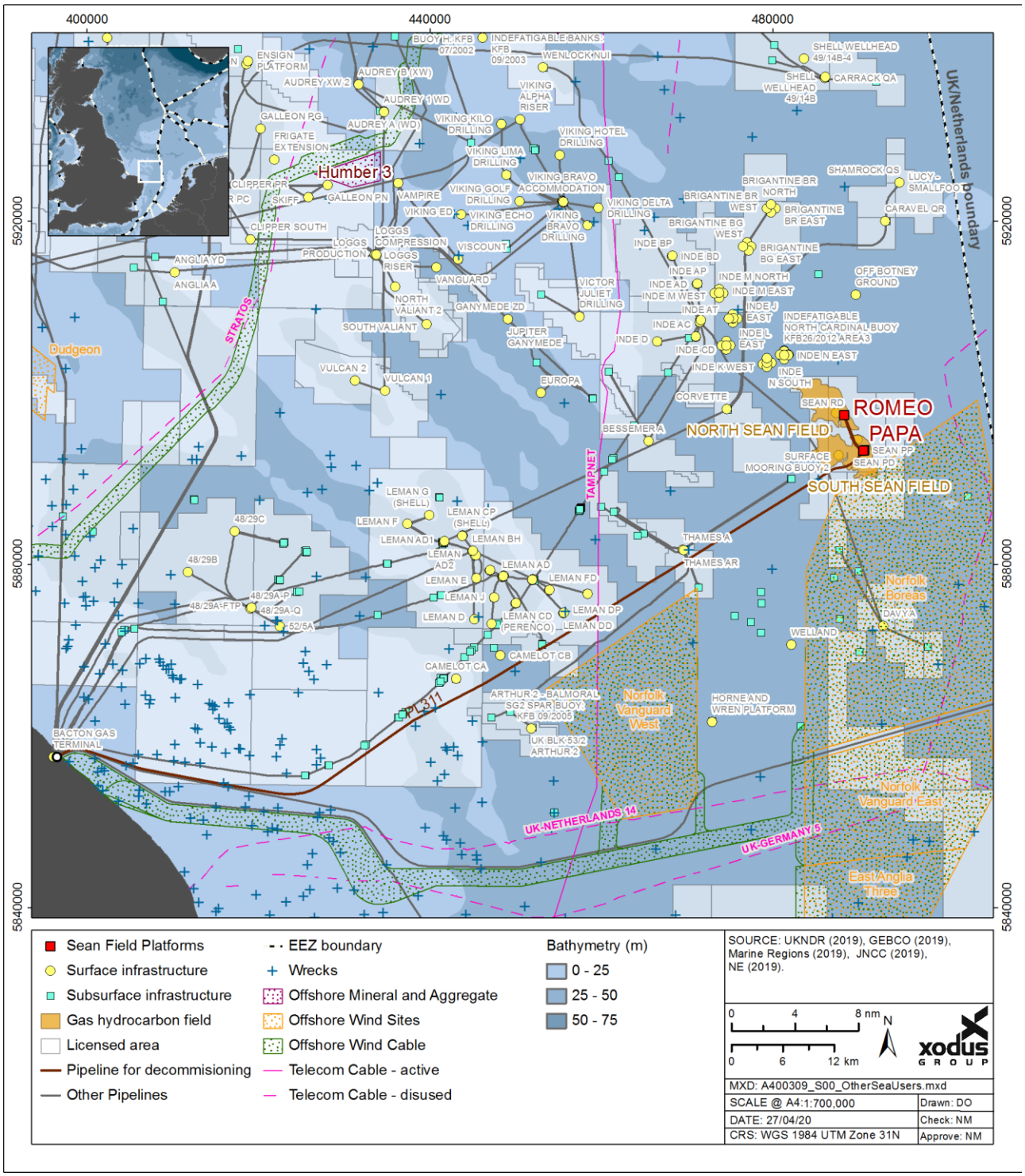


Figure 3-4 Other sea users in the vicinity of the Sean Field and associated pipelines

3.6 Commercial Fisheries

The Sean Field and PL310 and PL311 pipelines sit within ICES rectangles 34F1, 34F2 and 35F2. The associated landings tonnages and values for 34F1, 34F2 and 35F2 have been provided for the most recent fishing years (2014-2018 inclusive; Table 3-3; MMO, 2020).

According to fishing data from the MMO (2020), fisheries in ICES rectangles 34F2 and 35F2 have predominantly targeted demersal species which have consistently dominated the catch by weight and value. Conversely fisheries within 34F1 have predominantly targeted shellfish species, including lobster, crab and whelk.

The live weight catch was noticeably lower in 2019 than previous years within rectangles 34F2 and 35F2. After a lower catch year in 2018, the live weight returned to the level seen in 2017 for rectangle 34F1. The total annual landings for rectangles 34F1, 34F2 and 35F2 in 2019 was 0.03% of the UK total of 622,000 tonnes. The value of catch across all three rectangles was 0.07% of the 2019 UK catch value of £987,000,000 (Table 3-3). The annual value of catch in the wider region is variable, ranging between approximately £40,000 – £500,000. This is roughly consistent with that of rectangles 34F1, 34F2 and 35F2 (Table 3-3; MMO, 2020). Only where the whelk fishery to the north dominates is there a sharp increase in landings value with catch from the area worth just under £1M.

Bass dominated the demersal landings and value in 2019, accounting for 34% of the live weight and 85% of the value of demersal landings in ICES rectangle 34F1. In the shellfish category, whelk dominated the landings, accounting for 51% of the live weight but only 32% of the value. Conversely, lobsters accounted for 38% of the value but only 7% of the live weight for the rectangle. The pelagic catch mainly comprised of herring. In ICES rectangle 34F2, sole and plaice accounted for 40% and 28% of the demersal live weight respectively, and 71% and 13% of the value respectively in 2019. In ICES rectangle 35F2, within which the Sean Field is located, plaice and sole were the primary contributing demersal species again; making up 46% and 32% of the live weight respectively. Whelks were responsible for almost all the shellfish catch in rectangle 35F2 and 95% of the value (MMO, 2020).

Average annual fishing effort, as a measure of total fishing days per annum, was low across the project area, with a region of moderate to high effort restricted to an area north of ICES rectangle 35F2 (Figure 3-5). Data on the gear types utilised within the three corresponding ICES rectangles is not available.

AIS recordings of fishing vessel movements from 2015 indicate vessel movement is dominated by transiting vessels closer to shore with the majority of higher intensity fishing areas located to the south of the pipeline (Figure 3-6). Fishing vessel activity is generally low within the decommissioning project area. However, higher levels of fishing activity take place to the south of the Sean Field within the East Anglia North Tranche 2 pre-planning application area and to east of the Sean Field. Towards the centre of the PL311 pipeline to the northwest of the East Anglia N Tranche 1 W area, the clusters of back and forth vessel movement are indicative of trawl fishing (Figure 3-6).

Amalgamated VMS data from 2007-2015, presented in Figure 3-7, shows that the UK fishing fleet effort in the vicinity of the project is low, with activity dominated by demersal mobile gear types. There is no data available for the southwest portion of the PL311 pipeline. Fishing effort averaged across all gear types increases to the northeast and southwest of the pipeline and decreases towards the Sean Field (Figure 3-5).

An analysis of relative fishing activity along the pipeline reveals that the highest number of instances of gears crossing the pipeline is located in the centre section of the trunkline, between KPs 60.0 and 90.0 (Figure 3-8). This corresponds with the VMS data presented in Figure 3-7 for mobile and demersal fishing gears. Between 2007 and 2015, gears crossed the pipeline over a maximum of 13-20 hours (per year) at that section of pipeline. AIS tracks of fishing vessels show a straight line pattern back and forth over the PL311 at this point. This is usually indicative of trawling. Similar activity can be seen approximately 15 km south of the PL311 and approximately 10 km east of Sean PD (Figure 3-6). Fishing intensity by the UK fleet along the PL310 pipeline is highest closest to the Sean RD platform and decreases towards the Sean PP platform. Within the wider regional context this is relatively low.

Dutch vessels are responsible for the majority of international fishing in the Sean Field. Beam trawl fishing is the prevalent method utilised by Dutch vessels. The proposed Norfolk Boreas windfarm which will be located just south of the Sean Field found that Dutch beam trawl fishing effort within the region equated to 50 - 100

days of effort on average between 2013 and 2017. This is somewhat higher than the UK vessel effort though still of moderate intensity. The use of seine nets by Dutch fishing vessels was lower still; no more than five days of effort per annum (Vattenfall, 2019). Dutch vessels are not permitted to fish within the UK 12 NM limit therefore the prevalence of Dutch fishing along the PL311 trunkline decreases with proximity to shore (Vattenfall, 2019).

Table 3-3 Live Weight and Value for Species Types Landed in ICES Rectangles 34F1, 34F2 and 35F2 (MMO, 2020)

ICES Rectangle	Species type	2019		2018		2017		2016		2015	
		Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)	Live weight (Te)	Value (£)
34F1	Demersal	4	16,988	4	23,738	4	17,247	7	24,084	6	16,313
	Pelagic	16	11,424	6	4,812	15	8,776	10	6,863	16	9,750
	Shellfish	428	927,828	156	462,909	447	878,836	253	552,330	317	484,161
	Total	**448**	**956,240**	**166**	**491,459**	**466**	**904,859**	**270**	**583,277**	**339**	**510,224**
34F2	Demersal	32	80,764	35	157,425	52	229,859	142	631,858	184	801,702
	Pelagic	0	70	-	-	0	0	-	-	-	-
	Shellfish	4	6,104	4	4,804	1	1,960	1	3,336	2	3,354
	Total	**36**	**86,938**	**39**	**162,229**	**53**	**231,819**	**143**	**635,194**	**186**	**805,056**
35F2	Demersal	6	24,646	7	15,679	63	235,571	84	366,216	82	283,654
	Pelagic	-	-	-	-	0	0	-	-	-	-
	Shellfish	6	9,117	3	4,412	0	417	0	5	0	146
	Total	**12**	**33,763**	**10**	**20,091**	**63**	**235,988**	**84**	**366,221**	**82**	**283,800**

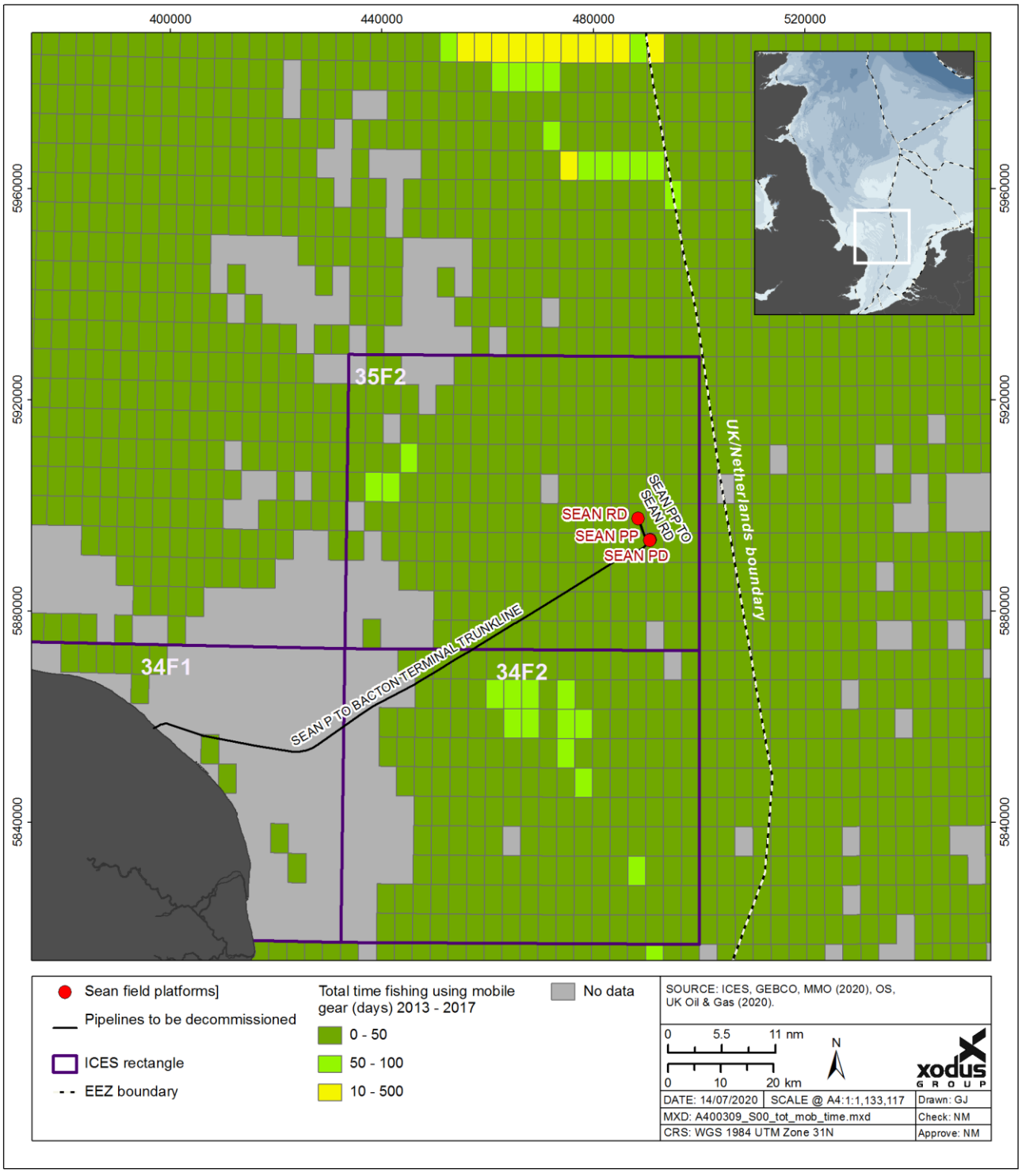


Figure 3-5 Fishing effort data

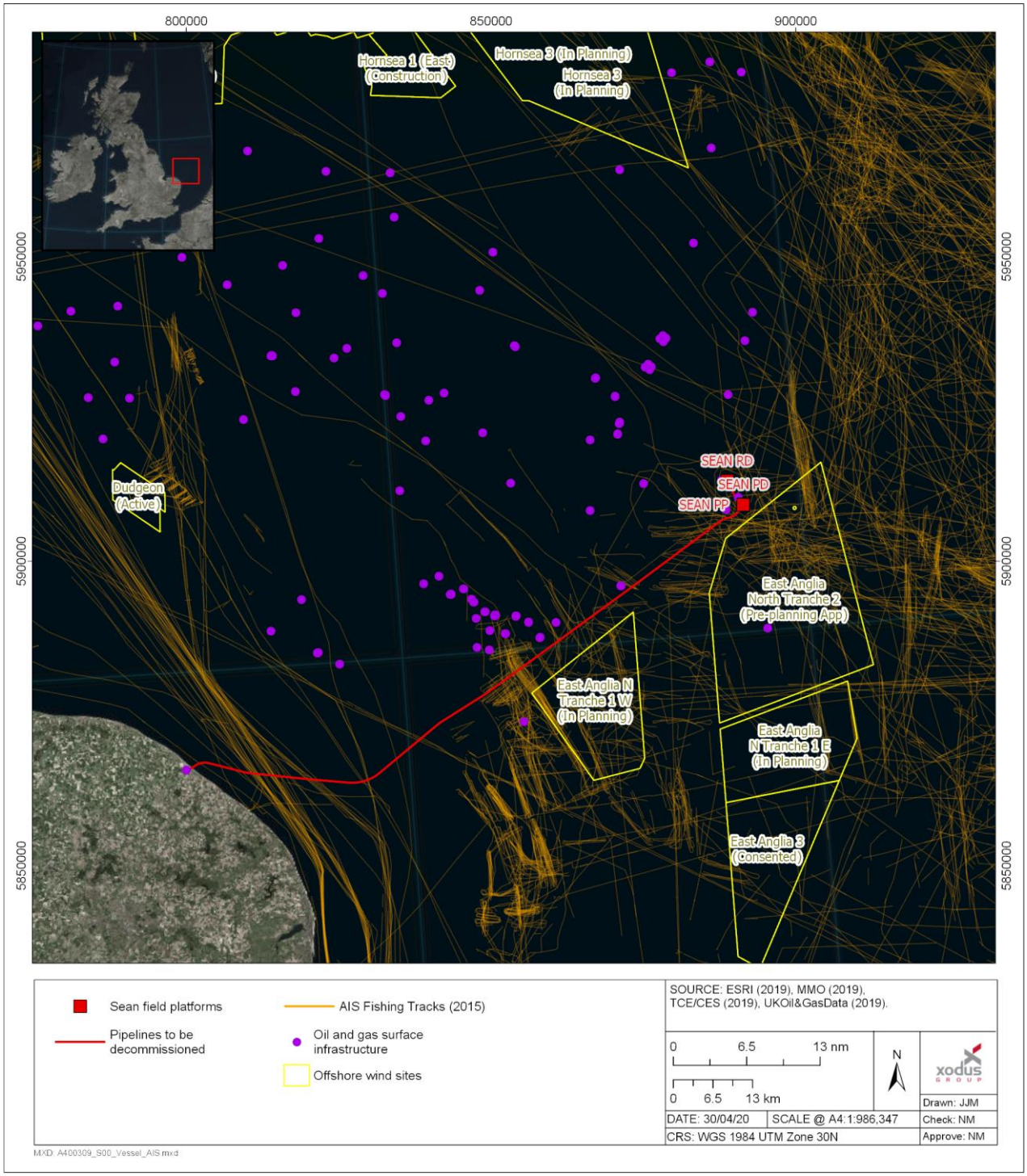


Figure 3-6 AIS data from commercial fishing vessels for the year 2015 (MMO, 2016)

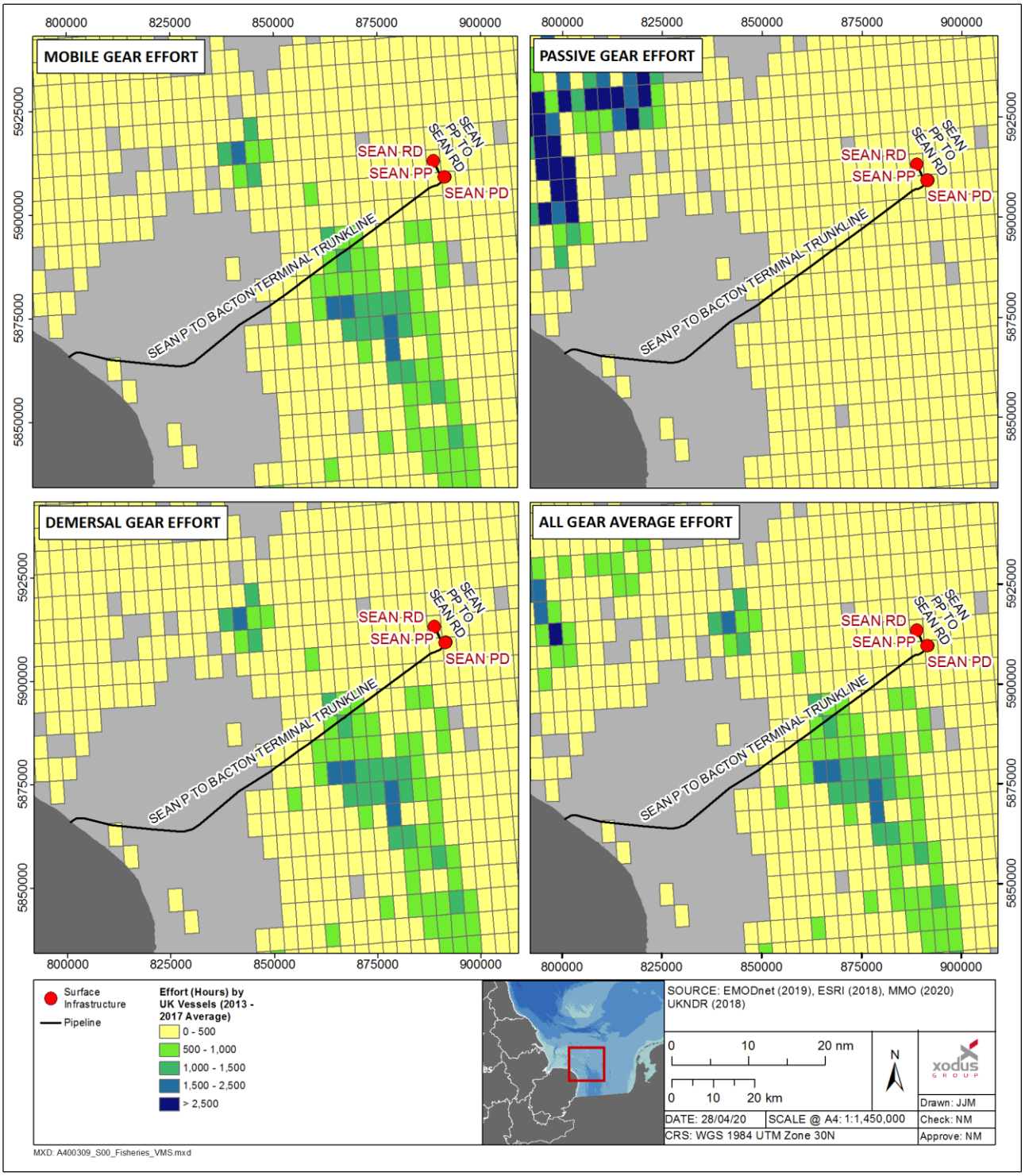


Figure 3-7 VMS intensity for mobile, demersal and passive fishing gears in ICES rectangles 34F1, 34F2 and 35F2

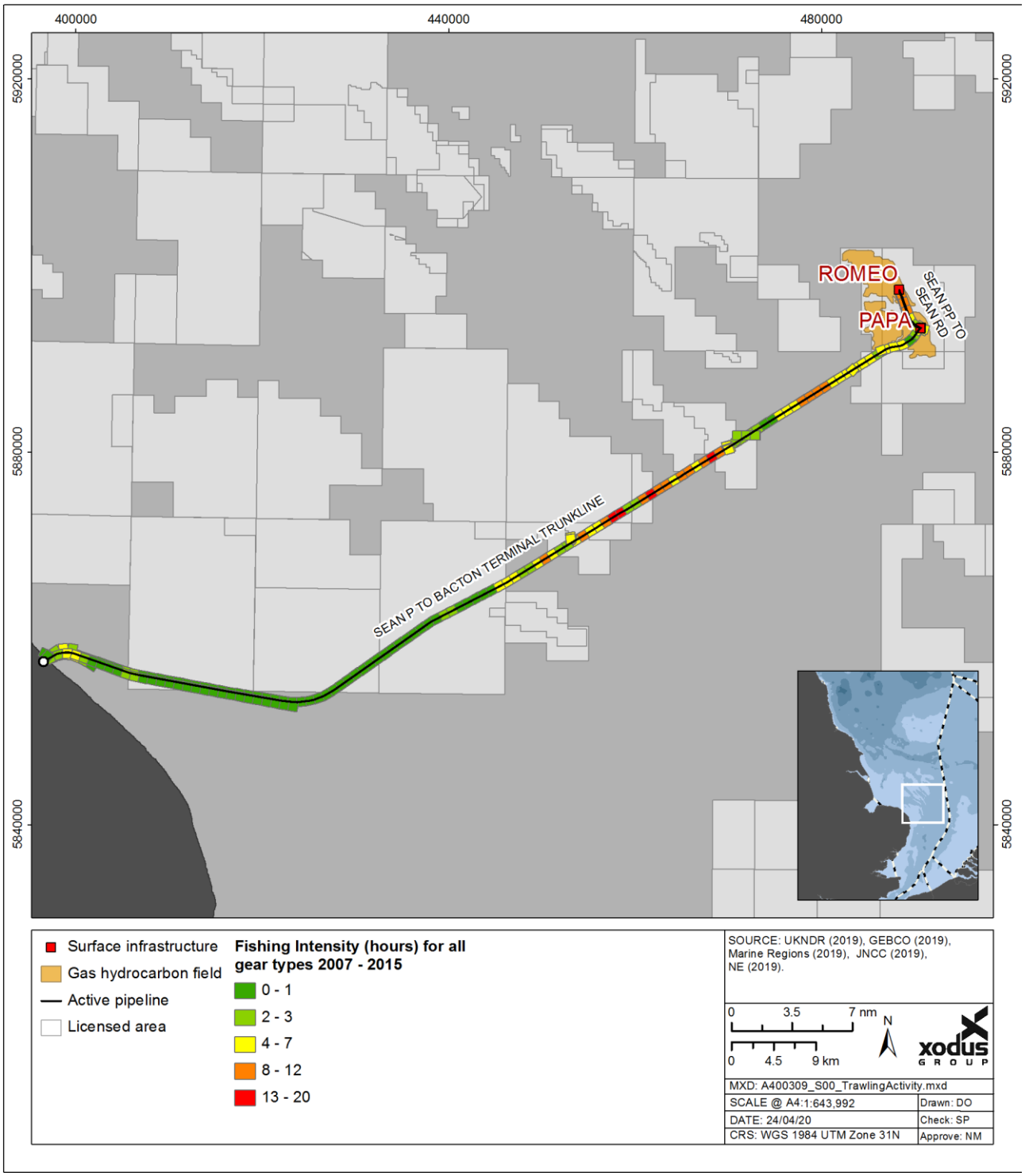


Figure 3-8 Relative fishing intensity associated with the PL310 and PL311 pipelines

3.7 Conservation Sites and Species

3.7.1 Offshore Conservation

The North Sea hosts a number of habitats and species of conservation interest, and numerous sites have been designated to protect these interests. Figure 3-9 shows the closest conservation areas to the project.

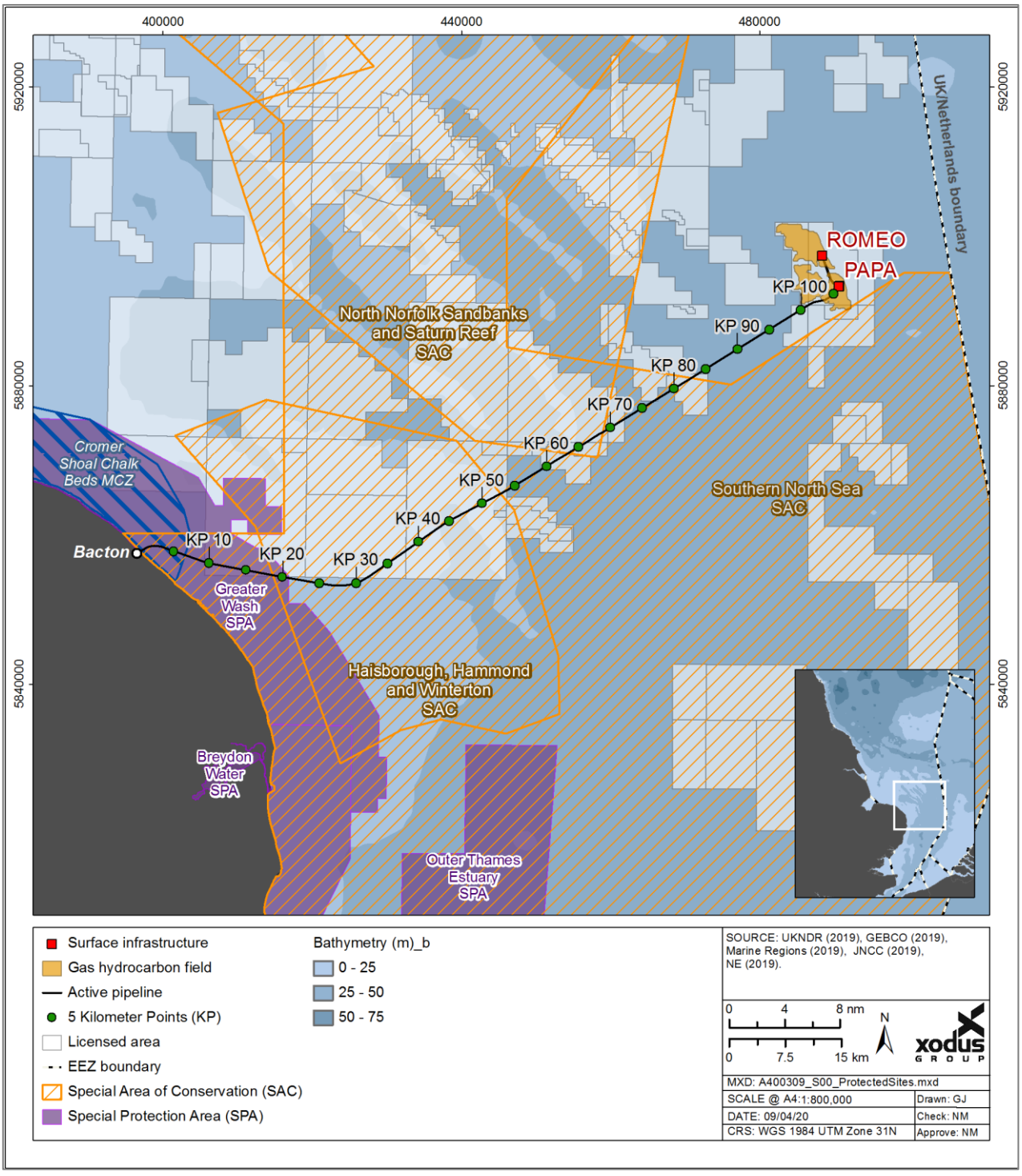


Figure 3-9 Conservation areas proximal to the Sean Field, PL310 and PL311 pipelines

PL311 passes through five protected areas, including three SACs, one SPA and one MCZ (Figure 3-9). The only other site within 40 km of the PL311 is the Outer Thames Estuary SPA. The sites are detailed in Table 3-4 below. For designated sites which overlap with the decommissioning infrastructure and activities, the conservation objectives of the site have been provided.

Table 3-4 Offshore Conservation Areas Proximal to the Sean Field, PL310 and PL 311 Pipelines

Offshore sites which overlap with the decommissioning activities			
Site	**Designating features**	**Conservation Objectives**	**Distance and direction**
Southern North Sea SAC	The SNS SAC is SAC is designated for the protection of Annex II species harbour porpoise. This site includes key winter and summer habitat for this species and covers an area over three times the size of Yorkshire, making it the largest SAC in UK and European waters at the point of designation in 2017.	The Conservation Objectives of the site are to ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters. In the context of natural change, this will be achieved by ensuring that: > Harbour porpoise is a viable component of the site; > There is no significant disturbance of the species; and > The condition of supporting habitats and processes, and the availability of prey is maintained (JNCC, 2019a).	Intersected by pipeline PL311, borders the Sean Field
North Norfolk Sandbanks and Saturn Reef SAC	The North Norfolk Sandbanks and Saturn Reef SAC is protected for the Annex I features 'Sandbanks which are slightly covered by sea water all the time' and 'Reefs'. The area consists of 10 main sandbanks and a number of smaller banks (Graham *et al.*, 2001 in JNCC, 2010). The sandbanks extend from about 40 km off the northeast coast of Norfolk out to approximately 110 km (Collins *et al.*, 1995 in JNCC, 2010). The banks included are: Leman, Ower, Inner, Well, Broken, Swarte and four banks called, collectively, the Indefatigable. The banks support communities typical of sandy sediments in the SNS, such as polychaete worms, isopods, crabs and brittlestars. One particular polychaete, the Ross worm (*S. spinulosa*), is capable of creating biogenic reef structures through consolidating thousands of fragile sand-tubes to create a solid structure that rises from the seabed. The Saturn Reef is such a structure (JNCC, 2009).	The Conservation Objectives for the North Norfolk Sandbanks and Saturn Reef SAC are for the features to be in favourable condition, thus ensuring site integrity in the long term and contribution to FCS of Sandbanks and Reefs. This contribution would be achieved by maintaining or restoring, subject to natural change: > The extent and distribution of the qualifying habitats in the site; > The structure and function of the qualifying habitats in the site; and > The supporting processes on which the qualifying habitats rely (JNCC, 2017a).	Intersected by pipeline PL311, 24 km west of the Sean Field
Haisborough, Hammond and Winterton SAC	The Haisborough, Hammond and Winterton SAC is designated for two Annex I habitats: 'Sandbanks which are slightly covered by sea water all the time', and 'Reefs'. A series of sandbanks which meet the criteria of the Annex I habitat description are distributed throughout the SAC. *S. spinulosa* reefs are located at Haisborough Tail, Haisborough Gat and between Winterton Ridge and Hewett Ridge (JNCC, 2020b).	The objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the FCS of its qualifying features, by maintaining or restoring: > The extent and distribution of qualifying natural habitats and habitats of the qualifying species; > The structure and function (including typical species) of qualifying natural habitats; > The structure and function of the habitats of the qualifying species; > The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely; > The populations of each of the qualifying species; and > The distribution of qualifying species within the site (Natural England, 2018).	Intersected by pipeline PL311, 53 km southwest of the Sean Field

Site	Designating features	Conservation Objectives	Distance and direction
Greater Wash SPA	The Greater Wash SPA has been designated for the protected of the following species: red-throated diver (*Gavia stellate),* common scoter *(Melanitta nigra),* little gull *(Hydrocoloeus minutus),* sandwich tern *(Sterna sandvicensis),* common tern *(Sterna hirundo),* and little tern *(Sternula albifrons)* (Natural England, 2016b).	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; > The extent and distribution of the habitats of the qualifying features > The structure and function of the habitats of the qualifying features > The supporting processes on which the habitats of the qualifying features rely > The population of each of the qualifying features, and, > The distribution of the qualifying features within the site (Natural England, 2016b).	Intersected by pipeline PL311, 80 km southwest of the Sean Field
Cromer Shoal Chalk Beds MCZ	The Cromer Shoal Chalk Beds MCZ is designated for a number of features including high and moderate energy circalittoral rock, high and moderate energy infralittoral rock, North Norfolk coast (subtidal), peat and clay exposures, subtidal chalk, subtidal coarse sediments, subtidal mixed sediments and subtidal sands (Natural England, 2016a).	The conservation objective of each of the zones is that the protected habitats: 1. Are maintained in favourable condition if they are already in favourable condition; and 2. Be brought into favourable condition if they are not already in favourable condition. For each protected feature, favourable condition means that, within a zone: 1. Its extent is stable or increasing; and 2. Its structure and functions, its quality, and the composition of its characteristic biological communities (including diversity and abundance of species forming part or inhabiting the habitat) are sufficient to ensure that its condition remains healthy and does not deteriorate. For the feature of geological interest, favourable condition means that, within a zone: 1. Its extent, component elements and integrity are maintained; 2. Its structure and functioning are unimpaired; and 3. Its surface remains sufficiently unobscured for the purposes of determining whether the conditions in paragraphs (1) and (2) are satisfied. Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery (Natural England, 2016a).	Intersected by pipeline PL311, 88 km southwest of Sean Field
Other offshore sites within 100 km of the decommissioning activities			
Site	**Designating features**		**Distance and direction**
Breydon Water SPA	The Breydon Water SPA is designated for the following qualifying features: wintering populations of tundra swan (*Cygnus columbianus bewickii*), European golden plover (*Pluvialis apricaria*), pied avocet (*Recurvirostra avosetta*) and northern lapwing (*Vanellus vanellus*), breeding populations of common tern, and non-breeding populations of ruff (*Philomachus pugnax*) (JNCC, 2015b).		24 km south of PL311, 100 km southwest of Sean Field
Outer Thames Estuary SPA	The Outer Thames Estuary SPA is designated for the following qualifying features: breeding common tern, breeding little tern, and non-breeding red-throated diver (Natural England, 2017).		26 km southeast of PL311, 72 km southwest of Sean Field

3.7.2 Onshore Conservation

The Sean Field is located 94 km from the shoreline and the PL311 pipeline intersects the English coastline (Figure 3-10). The protected sites in the vicinity of the pipeline is listed in Table 3-5 below.

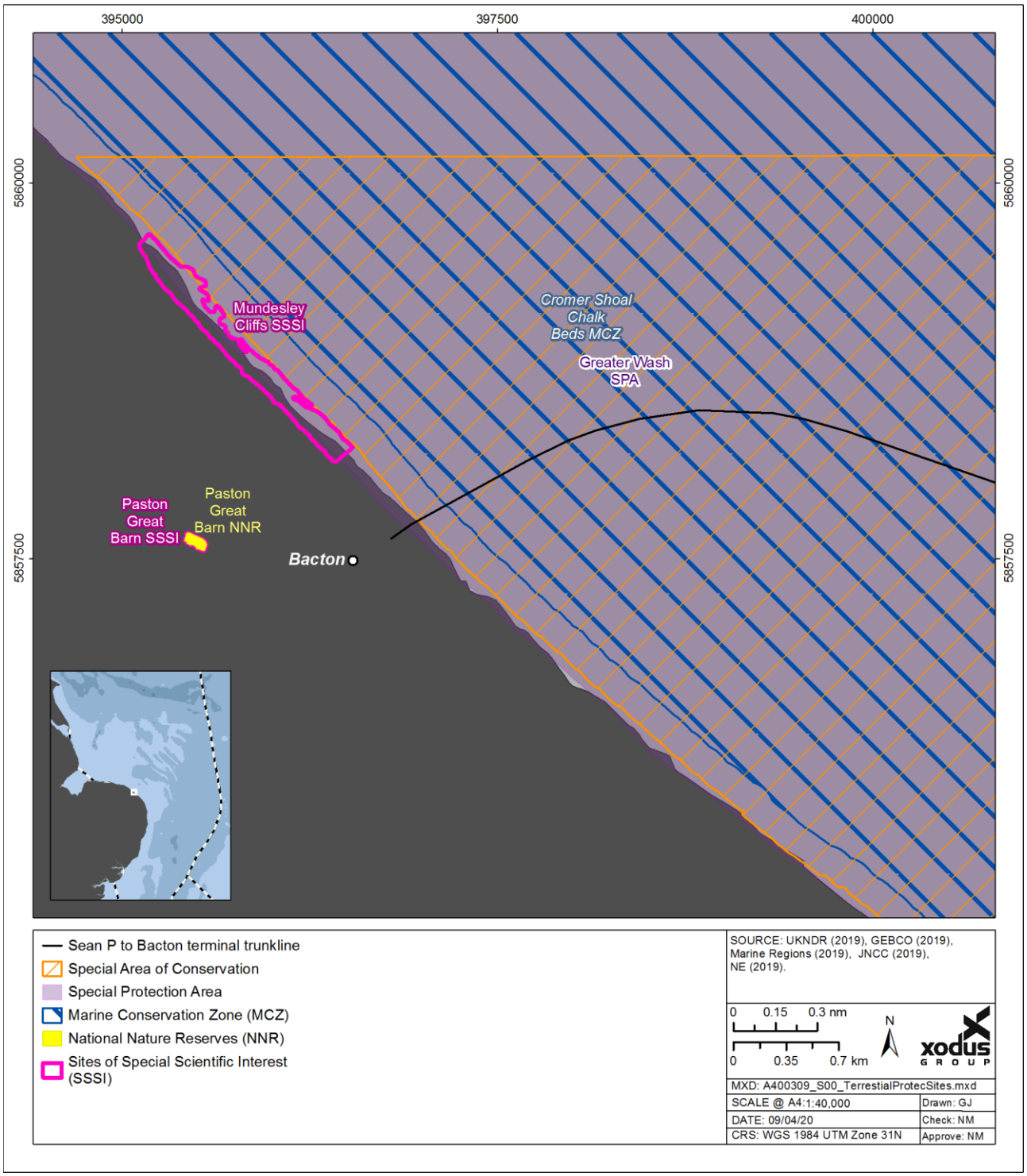


Figure 3-10 Onshore Conservation areas proximal to the landfall of the PL311 pipeline

Table 3-5 Onshore Conservation Areas Proximal to the PL311 Pipeline

Site	Designating features	Distance and direction
Mundesley Cliffs SSSI	Mundesley Cliffs SSSI is designated for its earth heritage. The cliffs along this stretch of coast provide some of the very best sections in the Pleistocene Cromer Forest-bed Formation, especially in Cromerian marine and freshwater deposits, and freshwater sediments of the early Anglian Cold Stage. At both Mundesley, and Paston the type locality, marine and rarer freshwater deposits of Pastonian age are particularly well-developed. It is a nationally important site for its extensive Pleistocene sequence (Natural England,1984).	0.6 km north of PL311
Paston Great Barn NNR and SSSI	Paston Great Barn SSSI is designated for its built-up areas and gardens. This site supports the only barbastelle bat (*Barbastella barbastellus)* maternity roost in Norfolk and is one of only three known in the UK. The barbastelle bat is listed as a rare and threatened species in the European and British Red Data Books of rare and endangered animal species (Natural England, 1999).	1.2 km south of PL311
Happisburgh Cliffs SSSI	The Happisburgh Cliffs SSSI is designated for Earth Heritage. This locality is important both for the cliff exposures which uniquely show three glacial deposits, the Cromer Tills (of Anglian age) with intercalated waterlain sediments, and for the underlying Cromer Forest-bed Formation, exposed in the foreshore, with excellent development of pre-Pastonion and Pastonian sediments. It is an important site for dating the Pleistocene succession of East Anglia with a range of sediments from marine to freshwater and glacial, spanning five stages, from the pre-Pastonian to the Anglian (Natural England, 1985).	3.5 km south of PL311
Sidestrand and Trimingham Cliffs SSSI	The Sidestrand and Trimingham Cliffs SSSI is designated for Earth Heritage and supralittoral rock. This stretch of cliffs between Overstrand and Mundesley on the northeast coast of Norfolk provides a fine series of geological exposures in unconsolidated Pleistocene sediments and in the underlying chalk. These cliffs, which extend for a distance of 6.5 km and are up to 60 m high, are subject to frequent cliff falls and slumping. This mobility creates a mosaic of habitats from bare clay and sand to ruderal communities and semi-stabilised grassland with occasional seepage lines which support an outstanding assemblage of invertebrates. Four aspects of the geology of the site are of special interest; the chalk, the Pleistocene sediments, fossil vertebrates and mass movement (Natural England, 1993).	4 km south of PL311

3.7.3 Protected Species

3.7.3.1 European Protected Species

Marine mammals are afforded varying levels of protection under different international and national legislation depending upon their genus. Within English waters, cetaceans (whales, dolphins and porpoises) are protected through the listing of European Protected Species (EPS) under Annex IV of the Habitats Directive. Under the Habitats Directive, it is an offence to:

- Deliberately capture, injure or kill any wild animal of an EPS; or
- Deliberately disturb wild animals of an EPS in such a way as to:
    - Impair their ability to migrate, hibernate, survive, breed, or rear or nurture their young; or
    - Significantly affect the local distribution or abundance of the species to which they belong.

Bottlenose dolphin, harbour porpoise, grey and harbour seals gain additional protections through Annex II of the Habitats Directive, which requires their consideration in the designation of SACs. Priority species were identified as being the most threatened and requiring conservation action under the UK Biodiversity Action Plan (UK BAP). The following UK BAP marine mammal species have been recorded within the area: harbour porpoise, harbour seal, minke whale and white-beaked dolphin (JNCC, 2007). In addition, harbour porpoise are listed as an OSPAR (2008) 'threatened and/or declining' species.

Compared to the central and northern North Sea, the SNS generally has a relatively low density of marine mammals, with the likely exception of harbour porpoise (*Phocoena phocoena*). While over ten species of cetacean have been recorded in the SNS, only harbour porpoise and white-beaked dolphin (*Lagenorhynchus albirostris*) can be considered as regularly occurring throughout most of the year, and minke whale (*Balaenoptera acutorostrata*) can be considered a frequent seasonal visitor. Bottlenose dolphin (*Tursiops truncatus*) and Atlantic white-sided dolphin (*Lagenorhynchus acutus*) can be considered uncommon visitors (DECC, 2016).

The following species are most likely to be present within the decommissioning area:

- **Harbour porpoise** are a small, highly mobile species of cetacean that is common to all UK waters. As such the harbour porpoise can also be found in the vicinity of the proposed decommissioning area in abundance. Based on observational data, higher numbers are present in January and July (Reid *et al.*, 2003). The density of harbour porpoise is estimated at 0.89 animals/km^2 across the project area (Hammond *et al.*, 2017).
- **Minke whales** are the smallest, most prevalent baleen whale to be sighted in UK waters (HWDT, 2018). They occur in water depths of 200 m or less throughout the northern North Sea and central North Sea. They are usually sighted in pairs or in solitude; however, groups of up to 15 individuals can be sighted feeding. It appears that animals return to the same seasonal feeding grounds. Sightings in relation to the project area are mainly, and greatest numbers, in spring and the summer months (Reid *et al.*, 2003). The density of minke whales is estimated at 0.01 animals/km^2 in the project area (Hammond *et al.*, 2017).
- **White-beaked dolphins** are found mostly in continental shelf waters with depths between 50 m and 100 m, and rarely out to the 200 m isobath (Reid *et al.*, 2003). Distribution of the species has been linked to sea surface temperature, local primary productivity and prey abundance. White-beaked dolphins are usually found in groups of around 10 individuals, although large groups of up to 500 animals have been seen. The species are estimated to have a density of 0.002 animals/km^2 near the project area (Hammond *et al.*, 2017). They are most prevalent in moderate numbers in the project area from summer into the early winter months (Reid *et al.*, 2003).

3.7.3.2 Other Protected Species

UK BAP priority species have been identified as being the most threatened and requiring conservation action under the UK Biodiversity Action Plan (UK BAP). The following UK BAP species have been recorded in the area: cod, herring, mackerel, sandeel, and whiting, as well as harbour seals (JNCC, 2007). OSPAR (2008) 'threatened and/or declining' species that are likely to be present within the decommissioning area are cod, black-legged kittiwake, and lesser black-backed gull.

The seabed habitat along the trunkline could support sandeel populations. Sandeels are restricted to sandy sediments (Holland *et al.*, 2005; DECC, 2016). According to Mazik, *et al.* (2015), sandeels are likely to avoid areas with greater than 10% of silt/clay or very fine sand. Surveys conducted close to the trunkline, state that fine content is minimal; therefore, it is likely that the area is be suitable for supporting sandeel. Sandeel are important not only to commercial fisheries but also are also of ecological significance as they are a vital food source for marine birds and predatory fish (DECC, 2016). The presence of suitable sandeel habitat could be important in sustaining marine populations associated with the various designated protected sites in the vicinity of the decommissioning activities.

In addition to sandeels, the sandy sediment type within the Sean Field could be a suitable habitat for ocean quahog, an OSPAR listed species. However, according to the findings of the 2011 surveys around the Sean platforms, no aggregations were found to be present. Additional surveys conducted at locations around the PL311 pipeline and in other nearby Fields also did not report the presence of ocean quahog (Perenco, 2015b; Benthic Solutions, 2016; RPS Energy, 2010).

S. spinulosa are another benthic species which, through survey evidence, are known to occur in locations near the PL311 (Shell, 2015; Fugro, 2016b). When these polychaetes come together in aggregations, they form reef structures which as a habitat, in addition to being nationally protected, are OSPAR listed. Figure 3-11 shows the known location of biogenic reef and sandbanks in the SNS in relation to the Sean Field and PL311 trunkline against the backdrop of SACs and MCZs in the region.

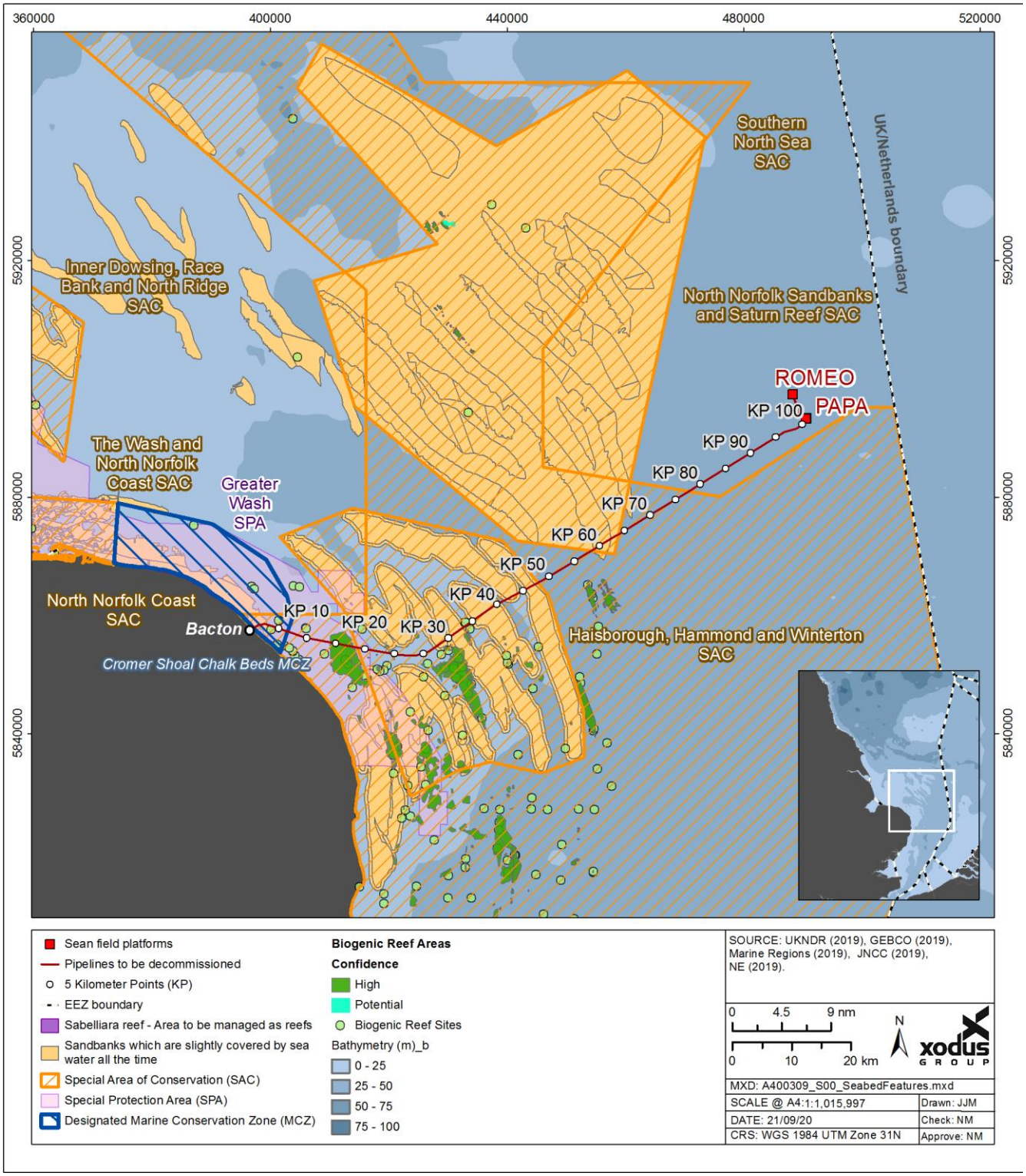


Figure 3-11 The Sean Field and PL311 in relation to areas of *S. spinulosa* biogenic reef

Two species of pinniped regularly occur in the North Sea: grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*). Of these, harbour seals are classed as a UK BAP species. Both species forage in coastal and offshore waters, depending on the seasonal distribution of their prey. However, both species tend to be concentrated close to shore, particularly during the pupping seasons which occur from May to July for harbour

seals and September to December for grey seals (Marine Scotland, 2014). Grey seals have larger foraging ranges than harbour seals, often travelling hundreds of kilometres, whereas harbour seals will generally forage within 50 km of their selected haul out sites (SCOS, 2018; Thompson *et al.*, 1996). Harbour and grey seals are not expected in significant numbers around the Sean Field, however higher numbers are expected near to the pipeline near to shore.

Harbour seals use The Wash and North Norfolk coast for breeding and hauling-out, north of Bacton Terminal. However, due to the relative proximity of this region to the terminal, it is expected that harbour seals will be found in moderate densities along the inshore stretch of the PL311; they may be found in densities of 10-50 animals per 25 km^2 (Russel *et al.*, 2017) (Figure 3-12). Grey seals are not so prevalent in the Sean Field but along the PL311 closest to the coast, they may be observed in densities of 10-50 individuals per 25 km^2 (Russel *et al.*, 2017) (Figure 3-13).

Harbour seals use extensive tidal flats of The Wash and North Norfolk Coast SAC for breeding and hauling-out, the SAC is thought to accommodate 7% of the total UK population (JNCC, 2020c). Blakeney Point (approximately 26 km NW from Bacton Terminal, along the coast) is considered the largest pupping site in England for grey seal. Horsey Beach (16.5 km SW of Bacton Terminal) is also considered a seal hotspot with 2,000 pups born in 2018 / 19 (Norfolk Wildlife Trust, 2020). Seals and their haul-out sites are protected under the following legislation:

- Conservation of Offshore Marine Habitats and Species Regulations 2017 regulation 47 (protects all species from 12 to 200 nautical miles);
- Conservation of Habitats and Species Regulations 2017 regulation 45 (protects multiple seal species including, grey and harbour, from 0 to 12 nautical miles);
- Wildlife and Countryside Act 1981 section 11 (protects any wild animal from 0 to 12 nautical miles);
- Conservation of Seals Act 1970 section 1 (protects all seals from 0 to 12 nautical miles); and
- In the county of Norfolk, under the Conservation of Seals (England) Order 1999.

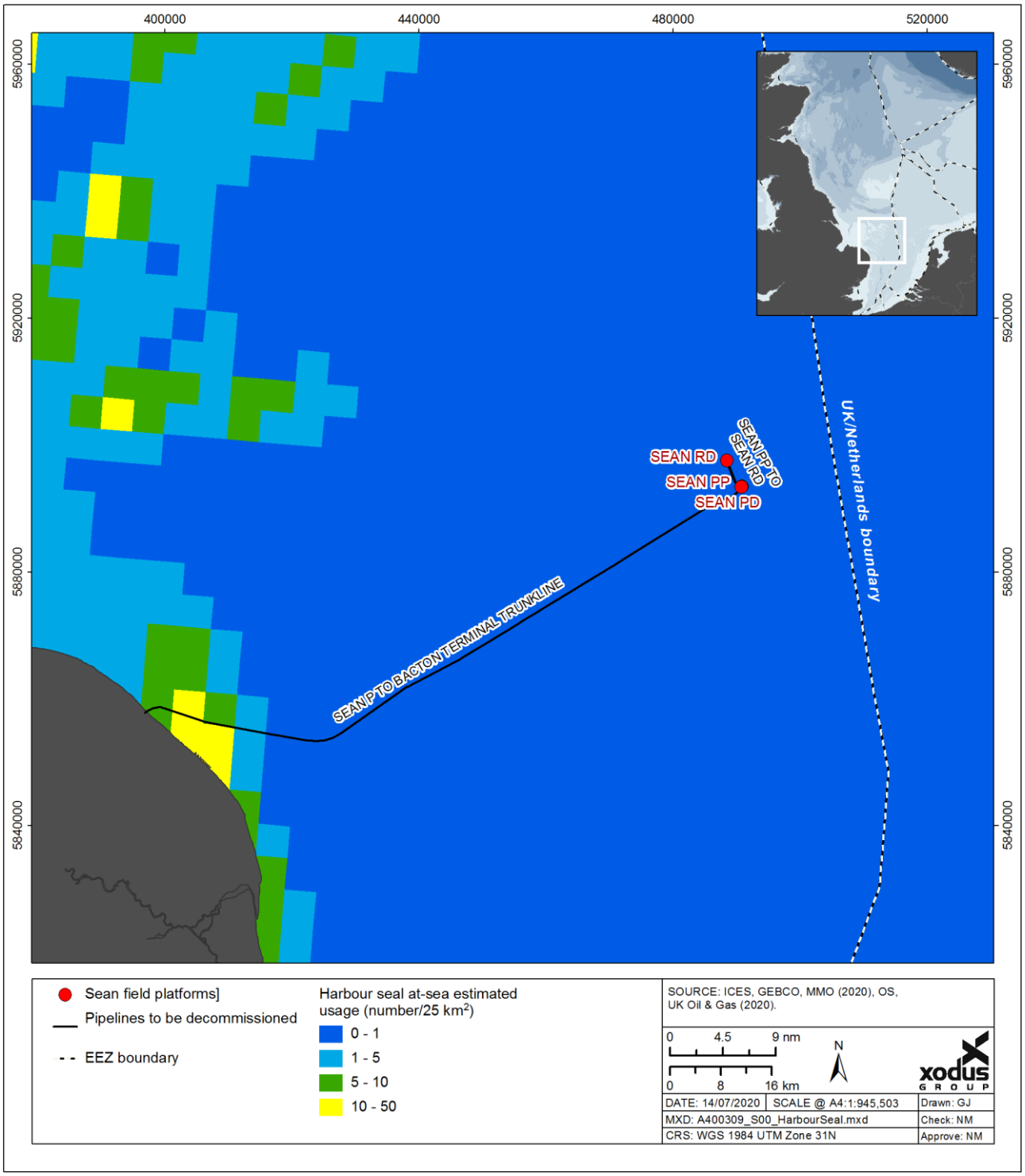


Figure 3-12 Harbour seal density in the vicinity of the Sean Field and along the PL311

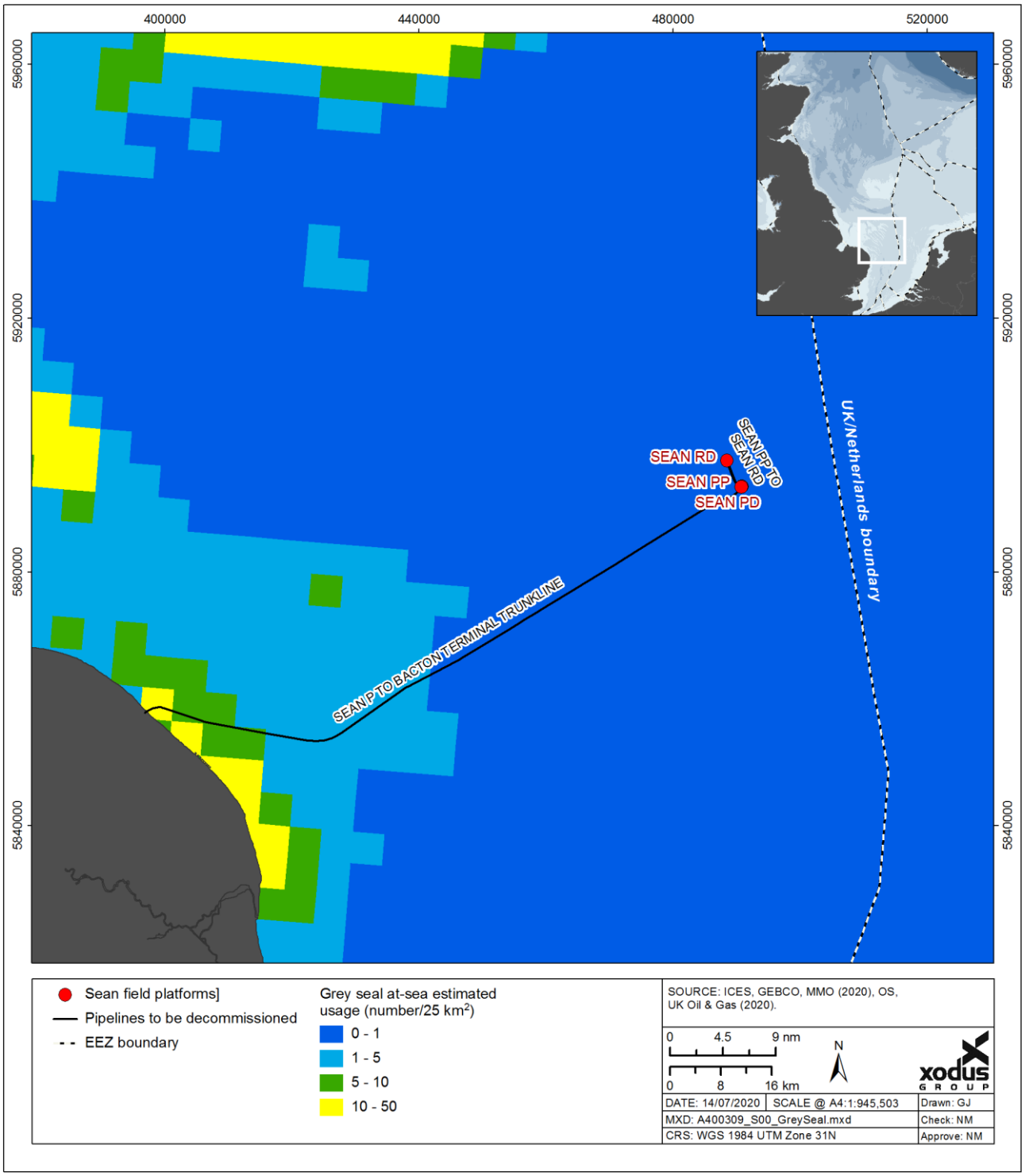


Figure 3-13 Grey seal density in the vicinity of the Sean Field and along the PL311

3.7.4 East Inshore and East Offshore Marine Plans

The East Inshore and East Offshore Marine Plans are the first plans adopted for English seas and came into force in April 2014. The aim of the Marine Plans is to help ensure the sustainable development of the marine area through informing and guiding regulation, management, use and protection of the marine plan areas. The responsibility for implementing the oil and gas specific sectorial policies OG1 and OG2 lies with OPRED and the relevant public authorities. The decommissioning operations at the Sean Field platforms and associated PL311 trunkline have been assessed against the Marine Plan objectives and sectoral and cross-sectoral policies. Where relevant they have been discussed in this Section, specifically ECO1, ECO2, BIO1, OG1, MPA1, CC2, GOV2, FISH1 and FISH2. Assessment of compliance against relevant policies has been achieved through this impact assessment. The decommissioning operations do not contradict any of the Marine Plan objectives and policies. ONE-Dyas will ensure they comply with all the policies that have been introduced; with particular attention being made to the following policies:

3.7.4.1 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. ONE-Dyas will ensure that any potential impacts associated with the Sean Field and associated trunkline decommissioning operations will be kept to a minimum as discussed in Sections 5.1 and 6.1.

3.7.4.2 ECO2

The risk of release of hazardous substances as a secondary effect due to any increased collision risks should be taken into account in proposals that need an authorisation. Any potential release of hazardous substances has been assessed and discussed in Section 5.1.

3.7.4.3 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 in the East Marine Plans and adjacent areas (marine, terrestrial). This is discussed throughout Sections 5.1 and 6.1 and ONE-Dyas will ensure that any potential impacts are kept to a minimum.

3.7.4.4 OG1MPA1

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[121] on an ecologically coherent network.

ONE-Dyas ensures that potential impacts to the MPA network during decommissioning operations are kept to a minimum. This is discussed in Section 6.1.

3.7.4.5 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 from other activities or users affected by the proposal.

ONE-Dyas ensures that emissions of greenhouse gases during decommissioning operations are kept to a minimum. This is discussed in Section 5.1.

3.7.4.6 GOV2

Opportunities for co-existence should be maximised wherever possible. ONE-Dyas will ensure that all opportunities for co-existence during the decommissioning will be taken. Co-existence between the proposed decommissioning activities and other sea users will be discussed in Sections 5.1 and 6.2.

3.7.4.7 FISH1

Within areas of fishing activity, proposals should demonstrate in order of preference:

1. That they will not prevent fishing activities on, or access to, fishing grounds;

2. How, if there are adverse impacts on the ability to undertake fishing activities or access to fishing grounds, these will be minimised;
3. How, if the adverse impacts cannot be minimised, they will be mitigated; and
4. The case for proceeding with their proposal if it is not possible to minimise or mitigate the adverse impacts.

ONE-Dyas ensures that potential impacts to fishing activity during decommissioning operations are kept to a minimum. This is discussed in Section 6.2.

3.7.4.8 FISH2

Proposals should demonstrate, in order of preference:

1. That they will not have an adverse impact upon spawning and nursery areas and any associated habitat;
2. How, if there are adverse impacts upon the spawning and nursery areas and any associated habitat, they will minimise them;
3. How, if the adverse impacts cannot be minimised, they will be mitigated; and
4. The case for proceeding with their proposals if it is not possible to minimise or mitigate the adverse impacts.

ONE-Dyas ensures that potential impacts to fishing activity during decommissioning operations are kept to a minimum. This is discussed in Section 6.2.

4 EA METHODOLOGY

The Impact assessment is designed to: (1) identify potential impacts to environmental and societal receptors from the proposed decommissioning activities; (2) evaluate the potential significance of any identified impacts in terms of the threat that they pose to these receptors; and (3) assign measures to manage the risks in line with industry best practice; and address concerns or issues raised by stakeholders through consolation.

The impact assessment was undertaken using the following approach:

1. The potential environmental issues arising from decommissioning activities were identified through a combination of the expert judgement of project engineers and marine environmental specialists in a screening workshop, and consultation with key stakeholders (Section 4.1; ENVID summary in Appendix C). The potential environmental issues which have been scoped in for consideration include the following key receptor risk groups:
    - Gaseous emissions;
    - Disturbance to seabed;
    - Physical presence of infrastructure decommissioned *in situ*;
    - Physical presence of vessels;
    - Discharges to environment;
    - Underwater noise;
    - Offshore light;
    - Resource use;
    - Onshore dismantling activities;
    - Waste; and
    - Unplanned events.
2. Undertake initial screening based on a high-level consideration of these aspects against the evaluation criteria. Screening aspects in or out of further detailed assessment. Justification statements will be compiled detailing the rationale for screening out any aspects from further assessment (Section 5.1):
    - For aspects which are considered potentially significant, evaluate significance of potential impacts against impact criteria definitions (Section 6); and
    - For any potentially significant impact, capture any potential mitigation and/or control measures to be used to further reduce any impact to ‘as low as reasonably practicable’ (ALARP).

4.1 Stakeholder Engagement

Informal consultation regarding the decommissioning of the Sean Field and associated trunkline has focused on sharing project expectations, approach and specific considerations with the following key stakeholders:

- Marine Management Organisation (MMO)
- Natural England
- North Norfolk District Council
- Crown Estate
- National Federation of Fishermen’s Organisations (NFFO)
- Joint Nature Conservation Committee (JNCC)
- OPRED
- Environment Agency
- Health and Safety Executive (HSE)

The results of the consultations are summarised in Appendix D and full details of the consultation to date are provided in Section 5 of the DP (ONE-Dyas, 2020).

4.2 EA Process

4.2.1 Overview

The decision process related to defining whether or not a project is likely to significantly impact on the environment is the core principle of the environmental impact assessment process; the methods used for identifying and assessing potential impacts should be transparent and verifiable.

The method presented here has been developed by reference to the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines for marine impact assessment (CIEEM, 2018), the Marine Life Information Network (MarLIN) species and ecosystem sensitivities guidelines (Tyler-Walters *et al.*, 2004) and by The Institute of Environmental Management and Assessment (IEMA) in their *Guidelines for Environmental Impact Assessment* (IEMA, 2015; 2016). Decommissioning specific guidance from the *Decommissioning of Offshore Oil and Gas Installations and Pipelines Guidance Notes* (BEIS, 2018) and the more recent guide *to The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended)* (BEIS, 2020), in addition to the Decom North Sea (2018) guidance, has also been used to inform the considerations of the EA assessment process.

Environmental impact assessment provides an assessment of the environmental and societal effects that may result from a project's impact on the receiving environment. The terms impact and effect have different definitions in environmental impact assessment, and one drives the other. Impacts are defined as the changes resulting from an action, and effects are defined as the consequences of those impacts.

In general, impacts are specific, measurable changes in the receiving environment (volume, time and / or area); for example, were a number of marine mammals to be disturbed following exposure to vessel noise emissions. Effects (the consequences of those impacts) consider the response of a receptor to an impact; for example, the effect of the marine mammal / noise impact example given above might be exclusion from an area caused by disturbance, leading to a population decline. The relationship between impacts and effects is not always so straightforward; for example, a secondary effect may result in both a direct and indirect impact on a single receptor. There may also be circumstances where a receptor is not sensitive to a particular impact and thus there will be no significant effects / consequences.

For each impact, the assessment identifies a receptor's sensitivity and vulnerability to that effect and implements a systematic approach to understand the level of impact. The process considers the following:

- Assessment of the consequence/extent of the impact, defined by the nature and type of impact, and the spatial extent of the impact on the receptor;
- Identification of the duration and frequency of the effect of the receptor;
- Definition of magnitude of impact, based on the magnitude of the shift from baseline conditions;
- Definition of the probability of impacts; and
- Ranking of impact significance, considering the probability that it will occur, the spatial and temporal extent and the magnitude of the impact and any residual effects after mitigations are applied.

Each of these variables are expanded upon in the following Sections to provide consistent definitions across all EA topics. In each impact assessment, these terms are used in the assessment summary table to summarise the impact and are enlarged upon as necessary in any supporting text. It should be noted that all impacts discussed in this EA report are adverse unless explicitly stated otherwise.

Once the consequence of a potential impact has been assessed it is possible to identify measures that can be taken to mitigate impacts through engineering decisions or execution of the project. This process also identifies aspects of the project that may require monitoring, such as a post-decommissioning survey at the completion of the works to inform inspection reports.

For some impacts significance criteria are standard or numerically based. For others, for which no applicable limits, standards or guideline values exist, a more qualitative approach is required. This involves assessing significance using professional judgement.

Despite the assessment of impact significance being a subjective process, a defined methodology has been used to make the assessment as objective as possible and consistent across different topics. The assessment process is summarised below. The terms and criteria associated with the impact assessment process are described and defined; details on how these are combined to assess consequence and impact significance are then provided.

4.2.2 Baseline Characterisation

In order to make an assessment of potential impacts on the environment it was necessary to firstly characterise the different aspects of the environment that could potentially be affected (the baseline environment). The baseline environment has been described in Section 3 and is based on desk studies combined with additional site-specific studies such as surveys and modelling where required. Information obtained through consultation with key stakeholders was also used to help characterise specific aspects of the environment in more detail.

The EA process requires identification of potential receptors which could be affected by the Decommissioning Project (e.g. commercial fisheries, water quality, and seabed impacts). Important receptors are identified within the impact assessments (Section 6).

4.2.3 Impact Definition

4.2.3.1 Impact Consequence / Extent

The impact consequence is based on the geographical extent, as described in Table 4-1.

Table 4-1 Impact Consequence Criteria

Ranking	Consequence	Criteria
High	**Major**	Extent of change: Impact occurs over a large scale or spatial geographical extent.
Medium	**Moderate**	Extent of change: Impact occurs over a local to medium scale/spatial extent and/or has a prolonged duration.
Medium	**Minor**	Extent of change: Impact occurs on-site or is localised in scale/spatial extent.
Low	**Negligible**	Extent of change: Impact is highly localised.

4.2.3.2 Duration/Frequency of Effect

Duration of effect is key to determining the final ranking of impact significance. This criterion takes account of:

> Duration over which the impact is likely to occur e.g. days, weeks; and

> Frequency and/or intensity of impact, i.e. how often the impact is expected to occur.

These variables are defined in Table 4-2 and Table 4-3, and the overall ranking methodology of duration of effects is provided in Table 4-4.

Table 4-2 Definition of Duration Criteria

Duration	Definition
Short-term	Impacts that are predicted to last for a short duration (e.g. less than one year).
Temporary	Impacts that are predicted to last a limited period (e.g. a few years). For example, impacts that occur during the decommissioning activities and which do not extend beyond the main activity period for the works or which, due to the timescale for mitigation, reinstatement or natural recovery, continue for only a limited time beyond completion of the anticipated activity.
Prolonged	Impacts that may, although not necessarily, commence during the main phase of the decommissioning activity and which continue through the monitoring and maintenance, but which will eventually cease.
Permanent	Impacts that are predicted to cause a permanent, irreversible change.

Table 4-3 Definition of Frequency Criteria

Frequency	Description
Continuous	Impacts that occur continuously or frequently.
Intermittent	Impacts that are occasional or occur only under a specific set of circumstances that occurs several times during the course of the Decommissioning Project. This definition also covers such impacts that occur on a planned or unplanned basis and those that may be described as 'periodic' impacts.

Table 4-4 Overall Duration / Frequency Ranking Criteria

Ranking	Duration	Criteria
High	**Major**	Frequency/intensity of impact: high frequency (occurring repeatedly or continuously for a long period of time) and/or at high intensity.
Medium	**Moderate**	Frequency/intensity of impact: medium to high frequency (occurring repeatedly or continuously for a moderate length of time) and/or at moderate intensity or occurring occasionally/intermittently for short periods of time but at a moderate to high intensity.
Medium	**Minor**	Frequency/intensity of impact: low frequency (occurring occasionally/intermittently for short periods of time) and/or at low intensity.
Low	**Negligible**	Impact is very short-term in nature (e.g. days/few weeks).

4.2.3.3 Impact Magnitude

The impact magnitude requires an understanding of how far the receptor will deviate from its baseline condition as a result of the impact. The resulting effect on the receptor is considered under vulnerability and is an evaluation based on scientific judgement. Table 4-5 defines the criteria for impact magnitude.

Table 4-5 Impact Magnitude Criteria

Ranking	Magnitude	Criteria
High	**Major**	Total loss or major alteration to key elements / features of the baseline conditions.
Medium	**Moderate**	Partial loss or alteration to one or more key elements/features of the baseline conditions.
Medium	**Minor**	Minor shift from the baseline conditions. Impact is localised and temporary / short-term with minor detectable change to site characteristics or a minor change to a small proportion of the receptor population. Low frequency impact occurring occasionally or intermittently.
Low	**Negligible**	Very slight change from baseline conditions. Impact is highly localised and short-term resulting in very slight or imperceptible changes to site characteristics.

4.2.3.4 Impact Probability

The probability of an impact is another factor that is considered in this impact assessment. This captures the probability that the impact will occur and also the probability that the receptor will be present and is based on knowledge of the receptor and experienced professional judgement. Table 4-6 provides definitions of the different levels of probability of impact that are used in the Decommissioning Project impact assessment.

Table 4-6 Impact Probability Criteria

Ranking	Probability	Criteria
High	**Major**	The impact is likely to occur.
Medium	**Moderate**	The impact is moderately likely to occur.
Medium	**Minor**	The impact is possible.
Low	**Negligible**	The impact is unlikely to highly unlikely.

4.2.4 Receptor Definition

As part of the assessment of impact significance it is necessary to differentiate between receptor sensitivity, vulnerability and value. The sensitivity of a receptor is defined as 'the degree to which a receptor is affected by an impact' and is a generic assessment based on factual information whereas an assessment of vulnerability, which is defined as 'the degree to which a receptor can or cannot cope with an adverse impact' is based on professional judgement taking into account an number of factors, including the previously assigned receptor sensitivity and impact magnitude, as well as other factors such as known population status or condition, distribution and abundance.

4.2.4.1 Receptor Sensitivity

Receptor sensitivity to potential impact activities ranges from negligible to very high. Definitions for assessing the sensitivity of a receptor are provided in Table 4-7.

Table 4-7 Criteria for Assessment of Sensitivity of Receptor

Receptor Sensitivity	Definition
Very high	Receptor with no capacity to accommodate a particular effect and no ability to recover or adapt.
High	Receptor with very low capacity to accommodate a particular effect with low ability to recover or adapt.
Medium	Receptor with low capacity to accommodate a particular effect with low ability to recover or adapt.
Low	Receptor has some tolerance to accommodate a particular effect or will be able to recover or adapt.
Negligible	Receptor is generally tolerant and can accommodate a particular effect without the need to recover or adapt.

4.2.4.2 Receptor Vulnerability

Information on both impact magnitude and receptor sensitivity is required to determine receptor vulnerability. These criteria described in Table 4-5 and Table 4-7 are used to define receptor vulnerability as per Table 4-8.

Table 4-8 Criteria for Assessment of Vulnerability of Receptor

Receptor Vulnerability	Definition
Very high	The impact will have a permanent effect on the behaviour or condition on a receptor such that the character, composition or attributes of the baseline, receptor population or functioning of a system will be permanently changed.
High	The impact will have a prolonged or extensive temporary effect on the behaviour or condition on a receptor resulting in long term or prolonged alteration in the character, composition or attributes of the baseline, receptor population or functioning of a system.
Medium	The impact will have a short-term effect on the behaviour or condition on a receptor such that the character, composition, or attributes of the baseline, receptor population or functioning of a system will either be partially changed post development or experience extensive temporary change.
Low	Impact is not likely to affect long term function of system or status of population. There will be no noticeable long-term effects above the level of natural variation experience in the area.
Negligible	Changes to baseline conditions or receptor population of functioning of a system will be imperceptible.

It is important to note that the above approach to assessing sensitivity/vulnerability is not appropriate in all circumstances and in some instances professional judgement has been used to determine receptor sensitivity. In some instances, it has also been necessary to take a precautionary approach where stakeholder concern exists regarding a particular receptor. Where this is the case, this is detailed in the relevant impact assessment in Section 6.

4.2.4.3 Receptor Value

The value, or importance, of a receptor is based on a pre-defined judgement established in legislative requirements, guidance or policy. Where these may be absent, it is necessary to make an informed judgement on receptor value based on perceived views of key stakeholders and specialists. Examples of receptor value definitions are provided in Table 4-9.

Table 4-9 Criteria for Assessment of Value of Receptor

Receptor Value	Definition
Very high	Receptor of international importance (e.g. United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site). Receptor of very high importance or rarity, such as those designated under international legislation (e.g. EU Habitats Directive) or those that are internationally recognised as globally threatened (e.g. International Union for Conservation of Nature (IUCN) red list). Receptor has little flexibility or capability to utilise alternative area. Best known or only example and / or significant potential to contribute to knowledge and understanding and/or outreach.
High	Receptor of national importance (e.g. Nature Conservation Marine Protected Area (NCMPA), Marine Conservation Zone (MCZ)). Receptor of high importance or rarity, such as those which are designated under national legislation, and / or ecological receptors such as United Kingdom Biodiversity Action Plan (UKBAP) priority species with nationally important populations in the study area, and species that are near-threatened or vulnerable on the IUCN red list. Receptor provides the majority of income from the Decommissioning Project area. Above average example and / or high potential to contribute to knowledge and understanding and / or outreach.
Medium	Receptor of regional importance. Receptor of moderate value or regional importance, and / or ecological receptors listed as of least concern on the IUCN red list, but which form qualifying interests on internationally designated sites, or which are present in internationally important numbers. Any receptor which is active in the Decommissioning Project area and utilises it for up to half of its annual income/activities. Average example and/or moderate potential to contribute to knowledge and understanding and/or outreach.
Low	Receptor of local importance. Receptor of low local importance and / or ecological receptors such as species which contribute to a national site, are present in regionally. Any receptor which is active in the Decommissioning Project area and reliant upon it for some income/activities. Below average example and / or low potential to contribute to knowledge and understanding and / or outreach.
Negligible	Receptor of very low importance, no specific value or concern. Receptor of very low importance, such as those which are generally abundant around the UK with no specific value or conservation concern. Receptor of very low importance and activity generally abundant in other areas/ not typically present in the Decommissioning Project area. Poor example and / or little or no potential to contribute to knowledge and understanding and / or outreach.

4.2.5 Impact Significance Ranking

The initial ranking of impact significance is based on the criteria described in Sections 4.2.3 and 4.2.4. It involves:

> Determination of the extent of impact, the duration/frequency, the impact magnitude and its probability;

> Consideration of sensitivity, vulnerability and value of the receptor; and

> Existing controls which can be industry standards, legislation requirements or prescriptive.

The sensitivity, vulnerability and value of receptor are combined with the impact magnitude (and probability, where appropriate) using informed judgement to arrive at a significance assessment for each impact, as described in Table 4-10. The assessment of significance considers mitigation measures that are embedded within the proposed activities.

Table 4-10 Criteria for Assessment of Significance

Ranking	Significance	Criteria
High	**Major**	Impacts are likely to be highly noticeable and have long term effects, or permanently alter the character of the baseline, and are likely to disrupt the function and status / value of the receptor population. They may have broader systemic consequences (e.g. to the wider ecosystem/industry). These impacts are a mitigation priority to avoid or reduce the anticipated effects of the impact.
Medium	**Moderate**	Impacts are likely to be noticeable and result in prolonged changes to the character of the baseline and may cause hardship to, or degradation of, the receptor population, although the overall function and value of the baseline / receptor population is not disrupted. Such impacts are a priority for mitigation in order to avoid or reduce the anticipated effects of the impact.
Medium	**Minor**	Impacts are expected to comprise noticeable changes to baseline conditions, beyond natural variation, but are not expected to cause long term degradation, hardship, or impair the function and value of the receptor. However, such impacts may be of interest to stakeholders and / or represent a contentious issue during the decision-making process and should therefore be avoided or mitigated as far as reasonably practicable.
Low	**Negligible**	Impacts are expected to be either indistinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not anticipated to be a stakeholder concern and / or a potentially contentious issue in the decision-making process.

4.2.6 Cumulative Impact Assessment

While the scope of this impact assessment is restricted to the Project decommissioning activities, there will be other marine activities which have the potential to interact with the activities completed under the decommissioning work scope. The impact assessments presented in the following Sections consider the potential for significant cumulative impacts to occur as a result of overlapping activities.

4.2.7 Transboundary Impact Assessment

For most potential impacts from decommissioning, the likelihood of transboundary impact is low. However, where impacts on mobile receptors are of concern, the likelihood of a transboundary impact is higher. The impact assessments presented in the following Sections have identified the potential for transboundary impacts and the potential for transboundary impact is considered within the definition of significance.

4.2.8 Mitigation

Where potentially significant impacts (i.e. those ranked as ‘moderate’ or ‘major’ in Table 4-10) are identified, mitigation measures must be considered. The intention is that mitigations should remove, reduce or manage potential impacts to a point where the resulting residual significance is at an acceptable or insignificant level. Mitigation is also proposed in some instances to maintain the significance levels of impacts defined as ‘not significant’. The impact assessment conclusions define the residual impact significance after mitigations are applied.

5 INITIAL ASSESSMENT SCREENING AND JUSTIFICATION

An impact assessment screening workshop was undertaken to discuss the proposed decommissioning activities and any potential impacts these may pose. This discussion identified twelve potential impacts based on the proposed removal methods identified in Section 2. Three of these potential impacts could not be screened out of further assessment based on the significance or likelihood of the impact occurring. The twelve potential impacts and their screening rationales are detailed in Section 5.1, and those impacts carried forward for further assessment are defined in Section 5.2.

5.1 Assessment of Potential Impacts

The screening of potential environmental impacts from the Decommissioning Project for further assessment is provided in Table 5-1, including summarised rationales for the screening outcomes.

Table 5-1 Environmental Impact Screening Summary for the Decommissioning Project

Potential impact	Further assessment undertaken in Section 6	Rationale
Gaseous Emissions	No	Emissions during decommissioning activities, which comprise combustion gases associated with fuel use, will occur in the context of the CoP. As such, emissions generated by infrastructure, equipment and vessels associated with operation of the asset will be replaced by those from vessels and equipment required for decommissioning activities, as well as the recycling of any decommissioned materials. Reviewing historical EU Emissions Trading Scheme data and comparison with the likely emissions from the proposed workscope suggests that emissions relating to decommissioning will be minor relative to those generated during production. Review of available decommissioning EAs shows conclusively that atmospheric emissions in highly dispersive offshore environments do not present significant impacts and are extremely small in the context of UKCS and global emissions. Most submissions also note that emissions from short-term decommissioning activities are small compared to those previously arising from the asset over its operational life. The majority of atmospheric emissions for the Decommissioning Project relate to the vessels used for cutting, lifting, rock placement and transportation activities. As the decommissioning activities proposed are of short duration and will take place sequentially and across locations, gaseous emissions are not anticipated to result in any significant impacts. The estimated CO_2 emissions to be generated by the selected decommissioning options is 160,876 Te which equates to 1.2% of the total UKCS offshore emissions for the year 2018 (13,200,000 Te; OGUK, 2019). These emissions have been calculated assuming 256 days of vessel emissions across the duration of the project. This vessel time is split across eight types of vessels which will participate in a variety of activities including: surveys, structure removal and remediation. Specific vessels have not yet been contracted to undertake the decommissioning activities and thus the calculation are based off a worst-case scenario for vessel

Potential impact	Further assessment undertaken in Section 6	Rationale
		presence. Fuel use and emissions associated with vessel types are derived from the *Guidelines for the calculation of estimates of energy use and gaseous emissions in the decommissioning of offshore structures* (IoP, 2000). The total emissions estimate also includes any emissions associated with the infrastructure being removed and remaining *in situ*. In addition to this, emissions owing to onshore transportation were factored in. Appendix E provides a summary of the energy and emissions associated with the project. Overall, the total emissions generated by the decommissioning are minimal in the context of the wider region. As stated above, emissions will be small in comparison to those generated during the operational life of the asset. Considering the above, atmospheric emissions do not warrant further assessment.
Disturbance to Seabed	Yes	There is potential for decommissioning and legacy activities to generate disturbance to the seabed. These activities include those associated with pipelines decommissioned *in situ* (i.e. PL311 and PL310), the removal of the SSIV subsea structure and power cable (S0803), and the intervention of any snagging risks potentially identified in future. Seabed impacts may range in duration from short-term impacts, such as temporary sediment suspension or smothering, to permanent impacts, such as the introduction of new substrate or any consequential habitat or community level changes which may transpire. Seabed disturbance from the decommissioning activities has the potential to modify the habitat in a way which might impact upon other sea users which utilise the seabed. The power cable between the Sean PP and RD platforms may require excavation prior to being reverse reeled. The sandy substrate within the Sean Field will not readily generate berms regardless of the method of removal. The end sections of the PL310 (113 m) and the offshore end of the PL311 (20 m) will be cut and lifted. Exposed sections of these flowlines will be remediated with rock placement in line with the BEIS (2018) Guidance. The exposed ends of the pipelines will be remediated with rock to minimising any residual snag hazard. The spans along the PL311 will be similarly remediated. Non-intrusive post-decommissioning surveys will occur to ensure that the PL310 and PL311 are left in an acceptable condition. The clear seabed will be validated by an independent verification survey over the installation sites and pipeline corridors. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the SFF / NFFO, seabed clearance is likely to require conventional overtrawl

Potential impact	Further assessment undertaken in Section 6	Rationale
		survey methods. The methods used will be discussed and finalised with OPRED. Impacts to the seabed from project activities have been assessed further in Section 6.1, whilst impacts to commercial fisheries generated by seabed disturbance are assessed in Section 6.2 below.
Physical presence of infrastructure decommissioned *in situ*	Yes	The physical presence of infrastructure decommissioned *in situ* has the potential to impact other sea users. All subsea installations will be fully removed along with all jumpers, spool pieces and risers. The trenched umbilical will be disconnected, and reverse reeled. The power cable may require to be excavated before being reverse reeled, however attempts will be made to pull through the sediment cover. Mattresses and grout bags will be fully removed and either reused, recovered as aggregate for infrastructure projects or disposed of in landfill sites. Infrastructure to be decommissioned *in situ* include the trenched and buried rigid flowlines and any protection materials associated with third party crossings. The cut ends of the PL310 and PL311 trunkline, and exposed spans (along the PL311) are to be remediated during decommissioning. The PL311 pipeline reaches landfall at Bacton Terminal, where decommissioning activities have the potential to affect coastal physical processes and recreational uses. However, onshore aspects of the decommissioning activities fall outside the scope of this EA and will therefore be covered by relevant permits. Depth of Burial (DoB) surveys have confirmed the burial status of these flowlines (see Appendix B). PL310 is stably buried to an average depth of 0.72 m. PL311 was intentionally surface laid from the shore to KP 54.0 at the time of installation, with exception of a 7 km section between KP 1.0 and KP 8.0 which is suitably trenched and naturally buried. From KP 54.0 and to Sean PP the pipeline is also suitably trenched and naturally buried. The surface laid sections have been stable for many years; however, in 2016, five locations were identified for placement of rock remediation between KP 11.0 and 15.0. Recent survey data (DeepOcean, 2020) suggests several exposures have been generated by hydrographic sediment movement within and to the east of this previously remediated area (between KP 14.0 and 17.0). These exposures will be investigated during the pre-decommissioning survey and will be remediated following discussion and agreement from OPRED prior to decommissioning *in situ*. The addition of rock placement is investigated further in Section 6.1 as a potential surface impact to the benthic environment. It is considered that the combination of 2018 and 2020 survey data, along with the future pre-decommissioning surveys will be used as

Potential impact	Further assessment undertaken in Section 6	Rationale
		evidence of pipeline stability and to fully address the potential risk of future exposures. Future monitoring work will ensure the DoB of the buried flowlines and/or flowline segments is maintained to FishSafe depths, as defined by BEIS (2018): spans in excess of 0.8 m in height from the top of the pipeline and ≥10 m in length which therefore present a hazard to fishing activity. This monitoring work will also aim to identify any exposures or spans on the surface laid flowline sections which may need remediation under the BEIS (2018) guidance as well as add to the characterisation of trends in sediment transport across the pipeline which may aid in determination of exposure risk. The frequency of this monitoring work and any subsequent maintenance will be established in consultation with OPRED. ONE-Dyas are committed to leaving a clear seabed. The clear seabed will be validated by an independent verification survey over the installation sites and pipeline corridors. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the SFF / NFFO, seabed clearance is likely to require conventional overtrawl survey methods. The methods used will be discussed and finalised with OPRED. In spite of the above, owing to some of the infrastructure being decommissioned *in situ* and the variable fishing methods and effort along the export pipeline, further consideration of the potential for snagging hazards is required. Snagging as a risk posed to other sea users requires assessment. Considering the above, the potential risk to other sea users will be addressed in Section 6.2.
Physical presence of vessels	Yes	The presence of vessels undertaking decommissioning activities will be temporary and minor in the context of the life of the Sean Field. The majority of activity will occur using vessels similar to those currently deployed for oil and gas installation, operation and decommissioning activities and will generally be within the existing 500 m zones, with minor remedial work outside of the Sean Field, along the pipeline. The increased vessel presence from these activities, including transiting vessels, have the potential to introduce navigational impacts and impact access to fishing grounds. The proposed decommissioning of the Sean Field and associated export line are estimated to require eight different vessel types. Although the decommissioning of the Sean Field area is estimated to require various vessels depending on the selected method of removal, these would not all be on location at the same time. Vessel activities are expected to occur over approximately 256 days, most of which are attributed to tug vessels involved in the removal of the Sean Field topsides and subsea installations.

Potential impact	Further assessment undertaken in Section 6	Rationale
		There are several shipping management lanes present across the length of the export pipeline and two vessel transit routes passing Southwest and Northeast of the Sean Papa platforms. North Sea oil and gas fields typically generate high vessel traffic in the form of transit vessels routes. Decommissioning of the Sean Field assets is unlikely to generate vessel traffic which is significantly greater than was typical during their operational phase. Navigational risks shall be considered as part of the vessels' operational risk assessment and captured as a part of the permit applications for vessel activities. Other sea users will be notified in advance of planned activities through the appropriate mechanisms, meaning those stakeholders will have time to make any necessary alternative arrangements during the finite period of operations. Consultation with stakeholders will also be incorporated into logistics planning for decommissioning vessel activities. Considering the above, there remain the potential for impacts to commercial fisheries originating from the physical presence of decommissioning vessels limiting access to fishing grounds. These will be assessed fully in Section 6.2.
Discharges to Environment	No	The PL310 and PL311 pipelines will be both pigged and flushed prior to the commencement of decommissioning activities. In addition, DFPV of the topsides will occur. All flushing products will be routed into the production stream via the Sean Field infrastructure. This should remove the majority of contaminated material. Any residual traces of produced water, hydrocarbons, scale, metal oxides and other trace elements from the formation fluids are therefore expected to be low, although precise quantification is difficult to specify. It should also be noted that the pipeline has been regularly pigged during its operational life and therefore scale deposits should be minimal in the first instance. Pigging and flushing is a pre-decommissioning activity therefore will be permitted as appropriate and falls outside the scope of this EA. During the cutting of the pipeline ends there may be a small discharge of any residual material held within the pipeline. As stated, the volume of any residual material is expected to be low across the entire pipeline and will have been flushed to an acceptable level of cleanliness prior to the commencement of the decommissioning activities. As the pipeline cuts will only be at the ends, any discharge will be equal to, or less than, typical licensed produced water discharges and will dissipate before it reaches the surface with no long-term persistence expected. The potential for discharges will be fully assessed and consented in the appropriate manner. The pipeline left *in situ* will degrade overtime and contaminants contained within the pipeline material (e.g. coating) may be

Potential impact	Further assessment undertaken in Section 6	Rationale
		discharged. Discharges are expected to occur in very small quantities and over a long period of time. Furthermore, such releases will be highly localised as the pipeline will not degrade equally along its length. Given the small quantities of contaminants expected to be released and the long-term degradation of the pipeline left *in situ*, no significant impacts are anticipated. There are no cuttings piles within the Sean Field. Vessel discharges are managed through existing, International Convention for the Prevention of Pollution from Ships (MARPOL) compliant controls, including bilge management procedures and good operating practices. Post-flushing and / or water jetting, residual liquids present during the decommissioning of pipelines and substructures will be treated before being discharged to sea, such that the discharge will comprise treated water. Any residual remaining material will be in trace levels / volumes following the flushing and pigging regime and will not pose any significant risk to water quality. Therefore, no further assessment is required of this impact within this EA.
Underwater Noise	No	Vessel presence will be limited in scale and duration and, therefore, does not constitute a significant or prolonged increase in noise emissions across the project area. The Sean Field and PL311 are located in areas of moderate to very high shipping activity, therefore the contribution of the decommissioning activities to the overall noise produced by vessels in the area will be minor. All other noise generating activities associated with the decommissioning of the pipelines are considered negligible in the context of ambient noise levels and are likely to be masked by project related vessel activities. Multibeam echosounder survey equipment is likely to be used for fine-scale characterisation of pipeline exposures. At present, there is no requirement for seismic activity relating to the decommissioning activities. Should there be a requirement of seismic survey in the future, the JNCC (2017b) Guidelines will be adhered to for mitigation of noise impacts to marine mammals. The PL311 passes through the Southern North Sea SAC which is designated for the protection of harbour porpoise. This region is characterised as “one of the best areas in the United Kingdom” for habitat quality and importance to this species. None of the proposed project activities include those which have been identified as potential threats to harbour porpoise (including oil and gas extraction or exploration, abiotic marine renewable energy, fishing, marine construction, and water pollution (JNCC, 2019b)). Although decommissioning is considered reverse installation of oil and gas infrastructure (a form of ‘marine construction’), it is the seismic surveys associated with the development of oil and gas infrastructure which may have detrimental impacts on hearing

Potential impact	Further assessment undertaken in Section 6	Rationale
		sensitive marine species, such as harbour porpoise. Such surveys are not required as part of the Sean Field decommissioning. There are not anticipated to be significant levels of noise generated by any of the decommissioning activities which may have such an impact. For these reasons, the proposed decommissioning activities do not contravene the conservation objectives set out by the JNCC for the site (see Section 3.7). For these reasons, impacts from underwater noise associated with the decommissioning has been screened out from further assessment.
Artificial Light	No	Remediation activities for identified spans along the PL311 pipeline will take place between KP 14.0 and KP 17.0, a region of pipeline which falls within the Greater Wash SPA. Whilst migrating birds may become disoriented by dominant vessel lights in the offshore environment, the vessels occupying this sensitive area will only use normal vessel lighting (i.e. no floodlighting) and lighting will be directed below the horizontal plane unless it is required for technical or safety reasons. As remedial activities will be exceptionally short-term, lasting for a maximum of five days, there is considered to be no scope for significant impacts to any protected bird species either individually or as a feature of a designated site. Therefore, offshore light does not need to be assessed further.
Disturbance or Destruction of Seabird Nests	No	In recent years there has been an increase in the number of seabirds utilising offshore installations for nesting. Opportunistic species such as Kittiwake and Herring Gull are utilising artificial nest locations and successfully rearing chicks. In some instances, colonies of several hundred birds have established and return each year. Although for most offshore platforms, the number of breeding birds remains very low. All nesting birds and nesting activities are protected from damage by conservation legislation. Under the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2017 – (OMR 17), it is an offence to: > take, damage or destroy the nest of any wild bird while that nest is in use or being built, or > take or destroy an egg of any wild bird. This legislation is relevant to installations more than 12 nautical miles from the coast, applies to all species of bird and applies irrespective of the number of nests found. i.e. there is no de-minimus. Given the decommissioning operations are not proposed to begin until 2025, ONE-Dyas will initially determine whether the platforms are supporting any nesting birds before engaging with OPRED if

Potential impact	Further assessment undertaken in Section 6	Rationale
		there is a need for mitigation measures to be introduced prior to the commencement of the decommissioning. The preferred practice is to avoid disturbance by undertaking works out with the breeding season. However, this is not always practicable. ONE-Dyas are committed to deterring birds from their installations out with the breeding season to mitigate against nesting birds on the platform. ONE-Dyas may employ a range of non-invasive / non-lethal deterrents to prevent birds nesting. These methods will continue throughout the duration of decommissioning. Should these measures not prove successful, ONE-Dyas will engage with OPRED to agree any further licensing requirements, as appropriate. This process will form part of future licensing applications for subsequent offshore applications. The proposed mitigation measures to limit the potential for disturbance or destruction of seabird nests are provided in Section 5.3 below.
Resource Use (Onshore and Offshore)	No	Generally, the main source of resource use from the proposed activities will be restricted to fuel use. Any opportunities for increasing fuel efficiency and reducing use of resources will be identified and implemented by ONE-Dyas where possible. The estimated total energy usage for the project is 1,870,638GJ. This number accounts for all operations, material recycling, and the resource loss associated with decommissioning items *in situ*. Vessels have not yet been contracted to undertake the decommissioning work therefore standards (available from the *Guidelines for the calculation of estimates of energy use and gaseous emissions in the decommissioning of offshore structures*; IoP, 2000) have been used to calculate the potential worst-case energy use. This is considered very low compared to the resources generated during the production phase of the field. Appendix E provides a summary of the energy and emissions associated with the project. Considering the above, resource use does not warrant further assessment.
Onshore Dismantling Activities	No	The BEIS (2018, 2020) Guidance states that onshore activities are not in scope of Decommissioning EAs, and this topic does not require further assessment. Despite onshore activities not being an EA requirement, the quantity of material brought to shore for dismantling will be minimal in line with the proposed decommissioning activities, with measures in place to minimise the impact associated with onshore dismantling.

Potential impact	Further assessment undertaken in Section 6	Rationale
		It should be noted that only existing disposal yards will be utilised for the material removed as a result of the decommissioning. Only licenced contractors which can demonstrate they are capable of handling and processing the material to be brought ashore will be considered for onshore activities and this will form an integral part of the commercial tendering process. The requirement of an onshore dismantling yard necessitates an environmental audit (including a site visit).
Waste	No	The recycling and disposal of wastes are covered by the ONE-Dyas' Waste Management Plan (WMP), which is compliant with relevant regulations relating to the handling of waste offshore, transfer of controlled, hazardous and special waste, and TFSW. The WMP is also guided by ONE-Dyas' HSES Policy and commitments to best practice in waste management. This includes the mapping and documenting of waste management arrangements for each phase of the decommissioning activities in individual WMP and ongoing monitoring of waste procedures and performance review against national and international standards and those held within ONE-Dyas' Environmental Management Plan. Wastes will be treated using the principles of the waste hierarchy, focusing on the reuse and recycling of wastes where possible. Raw materials will be returned to shore with the expectation to recycle the majority of the returned material. There may be instances where infrastructure returned to shore is contaminated (e.g. by Naturally Occurring Radioactive Material (NORM), hazardous, and / or special wastes) and cannot be recycled. In these instances, the materials will require disposal. However, the weight and/or volume of such material is not expected to result in substantial landfill use. On this basis, no further assessment of waste is necessary.
Unplanned Events	No	The potential for unplanned interactions with other sea users, namely the risk of snagging to operational fishing gears, has been discussed in reference to the physical presence of infrastructure decommissioned *in situ* and is addressed in detail in Section 6.2. As the proposed decommissioning programme will take place post well P&A and DFPV of the topsides, the potential for a large-scale hydrocarbon release due to an unplanned event is limited to the diesel inventory of the vessels undertaking decommissioning activities. There will be eight vessel types on-site during the decommissioning process. However, the HLV is considered to have the greatest fuel inventory and therefore the greatest potential impact, should an unplanned event occur. The diesel inventory estimate of the Sean Field assets, as covered by the OPEP, is 1,000 m^3 (ONE-Dyas, 2018). A vessel's fuel inventory is likely to be split between a number of separate fuel

Potential impact	Further assessment undertaken in Section 6	Rationale
		tanks, significantly reducing the likelihood of an instantaneous release of the full inventory. The largest tank of an HLV holds 720 m^3. This has been derived from known inventories of HLV vessels analogous to that which is likely to be used during the decommissioning. Therefore, a loss of inventory from the HLV is likely to be less than the worst-case release diesel spill from the Sean topsides. Any spills from vessels in transit are covered by separate Shipboard Oil Pollution Emergency Plans (SOPEPs). ONE-Dyas will support response of any vessel-based loss of fuel containment through the vessel owner's SOPEP. Additionally, several existing controls are in place to ensure risk minimisation for any unplanned events during decommissioning activities. These are outlined in Section 5.3 below. Overall, any impact from vessel-based fuel inventory release will be less than that already assessed and mitigated against within the OPEP for the operational phase of the Sean Field assets. Dropped object procedures are industry-standard and will be employed. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. Post-decommissioning debris clearance surveys will aid in the identification of any dropped objects should they occur. In line with the mitigation measures in place, unplanned loss of materials to the sea do not require further assessment within this EA.

5.2 Aspects taken forward for Further Assessment

Based on the initial screening provided in Section 5.1, the following potential environmental and societal impacts have been identified as requiring further assessment within the EA:

- Disturbance to seabed;
- Physical presence of infrastructure decommissioned *in situ*; and
- Physical presence of vessels;

These potential impacts are addressed in detail within Section 6.

5.3 Proposed Mitigations and Existing Controls

To ensure that impacts remain as described above, ONE-Dyas will follow routine environmental management activities, for example appropriate project planning, contractor management, vessel audits, activity permitting and legal requirements to report discharges and emissions, such that the environmental and societal impact of the decommissioning activities will be minimised. With the application of appropriate mitigation and control measures, the impact of decommissioning activities on environmental and societal receptors should be reduced. A summary of the proposed control and mitigation measures is shown in Table 5-2.

Table 5-2 Proposed Mitigation and Control Measures

General and Existing

• Lessons learnt from previous decommissioning scopes will be reviewed and implemented as appropriate;
• Vessels will be managed in accordance with ONE-Dyas' existing marine procedures, including:
  ○ The vessels' work programme will be optimised to minimise vessel use where possible;
  ○ All pipeline will be pigged and flushed, these activities will be assessed and permitted under existing operational permits prior to decommissioning, to ensure minimal residual contaminants are present in the infrastructure before decommissioning operations commence;
  ○ Ballast water will be managed in compliance with IMO / MARPOL standards and ONE-Dyas' marine assurance standards;
  ○ The OPEP is one of the controls included in a comprehensive management and operational control plan developed to minimise the likelihood of large hydrocarbon releases and to mitigate their impacts should they occur;
  ○ All vessels undertaking decommissioning activities will have a MARPOL-approved SOPEP;
  ○ Existing processes will be used for contractor management to assure and manage environmental and social impacts and risks;
  ○ ONE-Dyas' management of change process will be followed should changes of scope be required;
  ○ Careful planning, selection of equipment, subsequent management and implementation of activities; and
  ○ Dynamic positioning will be used where possible. Inshore, if required, alternative anchoring methods will aim to minimise impact footprint.
• A pre-decommissioning environmental seabed survey, centred along the export pipeline route, will be carried out. This survey will be limited to sections of the pipeline where remediation is proposed. The survey will focus on visual data collection, with limited chemical and sediment analysis, as such data has been recently gathered. Results of this survey will be available once the work is complete, with a copy forwarded to OPRED.
• Procedures will be in place to reduce the potential of dropped objects, including lift planning and training and awareness. All equipment will be tested and certified. The location of any dropped objects will be recorded and, where possible, the object will be retrieved.
• The pipeline route will be the subject to an as-left seabed clearance verification survey (non-intrusive) when decommissioning activity has concluded, and if deemed necessary, an oilfield debris clearance survey. A DROPS survey will also be conducted post-topside removal.
• The main risk from infrastructure remaining *in situ* is the potential for interaction with other users of the sea, specifically from fishing related activities. Where the pipeline is trenched or trenched and buried below seabed level, the effect of interaction with other users of the sea is considered to be negligible. Only areas deemed as posing risk (FishSafe reportable spans) shall be remediated. Remediation shall be agreed with OPRED
• The infrastructure is currently shown on Admiralty Charts and the FishSafe system. When the decommissioning activity has been competed, information will be made available to update any Admiralty Charts and the FishSafe system.
• The licence holders recognise their commitment to undertake post-decommissioning monitoring of infrastructure left *in situ*. After the post-decommissioning survey reports have been submitted to OPRED and reviewed, a post-decommissioning monitoring survey regime, scope and frequency, will be agreed with OPRED.

- Any snagging risk to other sea users will be minimised at the point of decommissioning. Any infrastructure decommissioned *in situ* will be monitored for the identification of future exposures or spans. Any potential for remediation will be agreed with OPRED.
- Environmental risk will be assessed as appropriate through the MATs / SATs system, any discharges to sea will be applied for via the appropriate channels.
- Use of materials will be minimised and reuse of existing materials will be employed where possible. In instances where this will not be achievable, efforts will be made to recycle as much as possible.

Gaseous Emissions

- Fuel use will be monitored and low sulphur diesel will be used during decommissioning operations.
- Where practicable and possible, vessel sharing (across the ONE-Dyas portfolio) will occur to minimise use. Scheduling will optimise resource use efficiency.
- Additionally, ONE-Dyas will use the SNS vessel pool: where practicable and possible vessel trips may be shared with Dutch sector platforms and other operators.

Large-Scale Releases to Sea

Decommissioning activities are due to take place post well P&A and topsides DFPV, however, several additional measures have been identified to ensure the risk of unplanned events resulting in a large-scale release is considered negligible:

- Post-flushing water will be routed into the production lines via Sean Papa so there will be no discharge of fluids.
- All solid waste will be skipped and shipped to shore for disposal, rather than being discharged at sea.
- Risk of full inventory loss from a vessel is very low given that the majority of vessels have multiple, separated fuel tanks, making full contaminant loss highly unlikely and the distance from shore would prevent any significant volume of diesel reaching any shoreline. Any potential diesel fuel spillages resulting from unplanned collisions will be minimised by approved OPEP / SOPEP, in which risks associated with the decommissioning activities have been appropriately assessed and planned for.

Waste Management

- All waste will be managed in accordance with the Waste Management Plan, including any marine growth waste, or NORM identified during flushing, cleaning or decommissioning of the pipeline.
- The Active Waste Management Plan will involve the use of a waste inventory, and all residual wastes being shipped to shore for processing and tracking. The Plan will prioritise reuse and recycling (<3% of the material generated for disposal should go to landfill).
- An appropriate waste handling contractor will be tasked with waste produced during the decommissioning activities. The contractor will maintain a waste audit trail.
- An existing disposal yard will be selected and an environmental audit of the chosen dismantling yard (including a site visit) will be required.
- Jetting of removed infrastructure to clean off marine growth may occur offshore to minimise onshore impacts.

Nesting Seabird Management Strategy
Regulatory guidance on the responsibilities of operators are currently under development. ONE-Dyas are cognisant of the legislative requirements and in line with discussion held with OPRED on their expectations, we will endeavour to undertake the following actions: • ONE-Dyas will develop a Seabird Management Plan based on the presence of birds utilising the installation for nesting. • Assess the schedule of works and prioritise where possible decommissioning operations that fall out with the nesting period. • Undertake an independent pre-decommissioning breeding bird survey/monitoring programme and initial status assessment. • If birds are found to be nesting then, remedial dissuasion works based on BAT (Best Available Techniques), will be undertaken prior to the next years breeding season. These may include aspects of the following: o Passive disturbance strategies i.e. Scarecrows, predator decoys and bio-acoustic deterrent; o Active disturbance strategies i.e. Physical disturbance by offshore workers (prior to nesting activity), motion activated sprinklers or lasers; and o Physical deterrents i.e. netting, deterrence gels and anti-nesting spikes. • ONE-Dyas will undertake an Ornithological assessment prior to works commencing. Data will be obtained as soon as possible to ascertain if the bird deterrent measures are effective. • Should the deterrent strategies prove ineffective then ONE-Dyas will seek engagement with OPRED to agree any further licensing requirements. • Following approval of a license ONE-Dyas will ensure that an independent Ornithologist is on scene during works and that all nest removal or disturbance activities are “under strictly supervised conditions and removal on a selective basis”.

6 IMPACT ASSESSMENT

The following receptors have been identified as requiring further assessment against potential impacts from the proposed decommissioning activities:

- Seabed disturbance (Section 6.1) from decommissioning operations relating to installations within the Sean Field, and the PL310 and PL311 pipelines, deposition of rock protection on cut ends and spans and potential overtrawl surveys. These activities may present a temporary or permanent disturbance, and may influence regional coastal processes; and,
- Physical presence (Section 6.2), both in terms of the infrastructures decommissioned *in situ* and the presence of vessels engaging in decommissioning activities, presents a risk to other users. Increased vessel operations during decommissioning incurs potential increased risk of collision. Additionally, there is a residual risk of snagging of fisheries vessels from facilities decommissioned *in situ*. Equally, there are risks to onshore receptors associated with infrastructure decommissioned *in situ*.

6.1 Disturbance to Seabed

6.1.1 Approach

Activities expected to cause seabed disturbance during the Decommissioning Project will include: cutting, lifting and removal of subsea infrastructure, and material placement and remediation. A non-intrusive survey will be employed firstly to establish the post-decommissioning status of the PL310 and PL311 trunkline and establish if any further remediation is required. Further consultation with OPRED will be undertaken once post-decommissioning survey results have been obtained.

There are two impact mechanisms associated with the decommissioning operations. The first is direct physical disturbance of seabed sediments and habitats. Physical disturbance is the main impact mechanism associated with the proposed decommissioning operation. This will occur due to removal of infrastructure from the seabed, and remediation of snagging hazards from the placement of material (rock) on the seabed. The total area of seabed expected to be impacted by direct physical disturbance has been calculated by adding together the individual areas of disturbance estimated for each activity. All dimensions used in calculating the disturbance area of each decommissioning activity are available in Appendix A.

The second impact mechanism is indirect disturbance. This occurs outside of the direct disturbance footprint due to re-suspension and settlement of natural seabed sediments. The scale of indirect disturbance due to re-suspension and settlement of natural sediment has been estimated based on the expected area of direct disturbance. Seabed disturbance may be classified in the following sections as: short-term, temporary, prolonged, or permanent. These terms are defined in Table 4-2.

6.1.2 Sources of Potential Impact

6.1.2.1 Overview

The following activities have been identified as sources of potential seabed disturbance:

- Pipeline, spools, flowline and umbilical decommissioning:
  - Full removal of spools;
  - Cut and lift ends followed by *in situ* decommissioning of PL310 and PL311;
  - Full removal of umbilical and electrical cable; and
  - Remediation associated with the pipeline ends and spans.
- Infrastructure decommissioning:
  - Removal of jacket substructures (Sean PP, PD, RD);
  - Anchor and mooring line footprint for the HLV responsible for removing the topsides; and

- Full removal of subsea installations.

> Stabilisation materials:

- Removal of mattresses not related to any third party crossing / installation.

Below, seabed disturbance is characterised for each of these activities, followed by discussions on potential impacts to sensitive receptors and protected sites.

A seabed clearance verification survey is required following all decommissioning projects to ensure the seabed is left unobstructed for future fishing effort, in line with the current Decommissioning Guidance (BEIS, 2018). Seabed clearance verification includes a non-intrusive survey of the decommissioned area (e.g. using ROV, SSS, etc. techniques) and third party review by the NFFO to achieve certification.

6.1.2.2 Pipeline, Spools, Flowline and Umbilical Decommissioning

As described in Section 2.4, PL310 and PL311 trunkline will be decommissioned *in situ*. All other flexible flowlines and spools will be fully removed, including the electrical cable.

The area of seabed disturbed by recovery of each individual line to the surface has been estimated by multiplying the length of each section which will be removed, by the outer diameter. The areas disturbed by recovery of each individual line have then been summed to give an overall area of disturbance affected. The spools are surface laid therefore will not require de-burial and reverse reeling. The umbilical is trenched and backfilled with ends protected with rock and concrete mattresses. The umbilical will be reverse reeled. The electric cable is buried and may require excavation prior to being reeled in. While the specific method of deburial has not yet been determined, in the interest of calculating the likely worst-case seabed impact area scenario, MFE has been used as the method of choice in the calculations.

In addition to the calculated direct disturbance from pipeline decommissioning, an estimate has been made of the possible indirect disturbance due to re-suspension and settlement of sediment. Most re-suspended sediment will settle within the initial disturbance area, but it has been assumed that some will land beyond that area. As a conservative estimate, the area of indirect disturbance has been assumed to be double the area of direct disturbance. None of the proposed activities will be taking place within a designated site, nor will the activities be occurring close enough to a designated site as to have an impact on it.

The direct and indirect disturbance areas associated with these proposed operations are summarised in Table 6-1. A full inventory of infrastructure dimensions is available in Appendix A. Both of these disturbance levels are temporary and will only last as long as activities are occurring. Disturbance due to placement of rock armour to protect exposed ends of flowlines decommissioned *in situ* and to remediate spans is assessed separately in Section 6.1.2.4.

Table 6-1 Area of Seabed Impact Associated with Pipeline, Spools, Flowline and Umbilical Decommissioning

Activity	Quantity and dimensions	Expected duration of disturbance	Direct disturbance area (km^2)	Indirect disturbance area (km^2)
Cutting and removal of both PL310 ends	113 m removed across both ends	Temporary	0.000074	0.00015
Cutting and removal of PL311 offshore end	20 m removed from offshore end	Temporary	0.000020	0.000039
(Unconfirmed) MFE to uncover the power cable and subsequent removal	4,892 m long cable with 5 m width accounting for MFE	Temporary	0.024	0.049
Full removal of SSIV umbilical	300 m long umbilical	Temporary	0.000031	0.000061

Activity	Quantity and dimensions	Expected duration of disturbance	Direct disturbance area (km^2)	Indirect disturbance area (km^2)
Full removal of PL310 associated spools	2 spools (one 40 m, the other 48 m in length)	Temporary	0.000045	0.000089
Full removal of PL311 associated spool	Single spool 52.3 m long	Temporary	0.000040	0.000080
		Total	**0.025 km^2**	**0.049 km^2**

As both the PL310 and PL311 pipelines will be decommissioned *in situ* there are legacy residual impacts associated with this. Table 6-2 provides the footprints associated with decommissioning the pipelines *in situ*. To calculate the footprint, the length of pipeline has been used and a width dimension has been assumed as a 10 m corridor centred on the pipeline. This is a highly conservative worst-case estimate which will account for any stabilisation features along the pipelines (mattresses and grout bags), and any spread of historic rock placement. Due to overlap between some protected sites, the areas of impact per site will not correspond to the cumulative total area of the trunkline alone (Table 6-2).

The footprint of the PL311 has also been broken down to show the area within each protected site. Comprehensive discussion on the impacts of the decommissioning on protected sites is available in Section 6.1.5.

Table 6-2 Area of Seabed Associated with the Legacy Impact of Decommissioning the PL310 and PL311 *in situ*

Pipeline	Dimensions	Area (km^2)	Remaining infrastructure split by protected site[13]				
			Area within Southern North Sea SAC (km^2)	Area within North Norfolk Sandbanks and Saturn Reef SAC (km^2)	Area within Haisborough, Hammond and Winterton SAC (km^2)	Area within Greater Wash SPA (km^2)	Area within Cromer Shoal Chalk Beds MCZ (km^2)
PL310	4.858 km, 10 m corridor buffer	0.049	-	-	-	-	-
PL311	106.502 km, 10 m corridor buffer	1.061	0.82	0.054	0.34	0.206	0.06
Total		**1.11**	**0.82**	**0.054**	**0.34**	**0.206**	**0.06**

[13] These totals represent the area within each specific designated site, however a number of the sites overlap each other thus the area of impact within each site will not align with the cumulative total area of impact.

6.1.2.3 Seabed Infrastructure Decommissioning

As described in Section 2.4, the subsea structures, comprised of a single SSIV and two anchor weights, will be fully removed. The three Sean Field platforms will also be fully removed, including the subsurface components of the installations.

The area of seabed disturbed by recovery of each individual item has been estimated by multiplying the item length by the width. The areas disturbed by each individual item have then been summed to give the overall area of seabed disturbed. An additional 0.5 m has been added to the pile diameter to account for the internal cutting procedure which may generate some additional impact. The SSIV structure currently sits in a rock covered depression. In order to remove the structure (as described in Section 2.4.4), some level of excavation may be required. In light of this, the area of impact has been determined based on the dimensions of the original excavation, which include the dimensions of the SSIV.

As a worst-case scenario it has been assumed that the HLV chosen for the removal of the topsides will have anchors. A known HLV capable of topside removal has eight anchors each of which sits for approximately 1 km on the seabed. To account for movement of the chain on the seafloor and the action of reeling the anchors in / out, a 10 m buffer width has been assumed along the entire length of the chain on the seabed. This has been assumed as a worst-case vessel scenario; as yet a specific vessel has not been chosen for the topsides removal. None of the proposed activities will be taking place within a designated site, nor will the activities be occurring close enough to a designated site as to have an impact on it.

As with flowlines, indirect disturbance has been estimated as double the area of direct disturbance. The direct and indirect disturbance areas associated with the proposed operations are summarised in Table 6-3 (for full inventory refer to Appendix A).

Table 6-3 Area of Seabed Impact Associated with Seabed Infrastructure Decommissioning

Activity	Quantity and dimensions	Expected duration of disturbance	Direct disturbance area (km^2)	Indirect disturbance area (km^2)
Internal cutting and subsequent removal of Sean PP jacket substructure	8 piles of diameter 1,372 mm, plus an additional 0.5 m buffer	Temporary	0.000035	0.000071
Internal cutting and subsequent removal of Sean PD jacket substructure	6 piles of diameter 1,372 mm, plus an additional 0.5 m buffer	Temporary	0.000027	0.000053
Internal cutting and subsequent removal of Sean RD jacket substructure	6 piles of diameter 1,372 mm, plus an additional 0.5 m buffer	Temporary	0.000027	0.000053
Anchors of HLV responsible for removal of topsides	8 mooring lines and associated anchors which lie on the seabed for 1 km each, with a 10 m buffer	Temporary	0.080	0.16
Removal of mooring buoy anchor weights	2 mooring buoy anchor weights of 4 x 4 m	Temporary	0.000032	0.000064
Excavation and subsequent removal of SSIV	1 SSIV of 14 x 10 m, plus area accounting for excavation	Temporary	0.00054	0.0011

Total	**0.081 km²**	**0.16 km²**

6.1.2.4 Stabilisation Materials Decommissioning and Pipeline Remediation

As noted in Section 2.4, the intention is that all concrete mattresses and grout bags will be recovered. Any protection / stabilisation associated with third party crossings will be left undisturbed. New deposits of rock will also be required in order to protect the newly cut ends of trenched and buried rigid pipelines due to be decommissioned *in situ*. An estimated 30 m² of rock will be required per cut end, as a worst case assumption to account for an overtrawlable rock berm with a 3:1 slope. The area associated with the remediation of the pipeline cut ends has been calculated and is shown in Table 6-5.

Rock remediation will also be required for the spans along the PL311. There are 20 spans[14], of which six require remediation due to their size and length (Section 2.4.6). These six spans are considered part of the base case for remediation and together total 153 m in length (Table 6-4). All these spans fall between KP 14 and KP 17. In the interest of preventing further expansion of these spans, rock cover will be placed on an area double the length of the spanned areas (306 m). As determined during past rock remediation activities along the PL311, an estimated 9 m² of rock will be placed per metre to cover this length (ONE-Dyas, 2016). The area of impact associated with the remediation of the six base case PL311 spans is shown in Table 6-4. All of these spans are located within the Southern North Sea SAC and the Greater Wash SPA (see Table 6-4).

In addition to these base case remediation spans, there are an additional 14 spans which may be remediated (Table 6-4). Cumulatively, they have a length of 216 m. These spans are not considered a hazard therefore their remediation is considered optional. However, in the interest of presenting a worst case scenario with regards to the area of seabed impact, these optional areas have also been included in Table 6-4. As for the base case span remediation, the length of the spans has been doubled to prevent future expansion of the spans (432 m). An estimated 9 m² of rock will be placed per metre to cover this length (ONE-Dyas, 2016). All of these spans are located within the Southern North Sea SAC however some spans are also located within the Greater Wash SPA or the Haisborough, Hammond and Winterton SAC. Please note that due to the overlap between sites, the same area of rock has occasionally been presented more than once within the column for each designated site in Table 6-4.

Table 6-4 PL311 Spans and Associated Area of Rock Remediation within Designated Sites

Span number	Span remediation status	Span length (m)	Volume of rock required (m³)	Southern North Sea SAC		Haisborough, Hammond and Winterton SAC		Greater Wash SPA	
				Within site?	Area (km²)	Within site?	Area (km²)	Within site?	Area (km²)
1	Optional	19	225	Y	0.0003	N	-	N	-
2	Optional	15	150	Y	0.0003	Y	0.0003	N	-
3	Optional	14	150	Y	0.0003	Y	0.0003	N	-
4	Optional	11	150	Y	0.0002	Y	0.0002	N	-
5	Optional	12	150	Y	0.0002	Y	0.0002	N	-
6	Optional	28	225	Y	0.0005	Y	0.0005	N	-
7	Base	37	525	Y	0.0007	N	-	Y	0.0007
8	Base	15	225	Y	0.0003	N	-	Y	0.0003
9	Base	19	375	Y	0.0003	N	-	Y	0.0003
10	Optional	9	150	Y	0.0002	N	-	Y	0.0002
11	Optional	13	150	Y	0.0002	N	-	Y	0.0002
12	Optional	9	150	Y	0.0002	N	-	Y	0.0002
13	Base	40	525	Y	0.0007	N	-	Y	0.0007
14	Base	21	300	Y	0.0004	N	-	Y	0.0004

[14] Remediation of all 20 locations has now been successfully achieved as part of a June 2021 Rock Remediation Campaign.

15	Optional	6	75	Y	0.0001	N	-	Y	0.0001
16	Optional	14	150	Y	0.0003	N	-	Y	0.0003
17	Base	21	300	Y	0.0004	N	-	Y	0.0004
18	Optional	21	300	Y	0.0004	N	-	Y	0.0004
19	Optional	25	300	Y	0.0005	N	-	Y	0.0005
20	Optional	20	225	Y	0.0004	N	-	Y	0.0004
				Total	**0.0069**	**-**	**0.0015**	**-**	**0.0051**

Rock placement is considered a source of permanent disturbance. It also has an associated temporary indirect disturbance area due to the sediment suspension that rock placement will cause. As previously, this is considered twice the area of direct impact.

According to the most recent pipeline survey data, there are four mattresses along the PL310 and PL311 combined (excluding those which are associated with third-party crossings and therefore will be left *in situ*; DeepOcean, 2020). There are a further 14 mattresses within the Sean Field associated with the SSIV structure (Rockwater, 1990). In total 19 mattresses are being considered for removal during the decommissioning. The mattresses dimensions are not known therefore a standard size has been assumed.

There are an estimated 95 grout bags in the Sean Field, associated with the SSIV umbilical (Rockwater, 1990). Grout bags are used in conjunction with different subsurface installations to provide protection or stability. As such, they are usually stacked or piled on top of one another or on top of other installations / mattresses. Although unlikely, the worst-case scenario has been defined as all 95 bags spread in a single layer on the seabed. A standard grout bag size has been used to estimate the area cover in the Sean Field. Converse to rock placement, the removal of mattresses and grout bags will only generate a temporary disturbance and has been treated thus below.

The direct and indirect seabed disturbance areas associated with the stabilisation materials and remediation are summarised in Table 6-5. All indirect disturbance is temporary, hence only one total is presented below. The areas shown by protected site in Table 6-4 are summed to present a single total according to base case vs optional remediation in Table 6-5 below.

Table 6-5 Area of Seabed Impact Associated with Decommissioning of Stabilisation Materials and Pipeline Remediation

Activity	Quantity and dimensions	Expected duration of disturbance	Direct disturbance area (km^2)	Indirect disturbance area (km^2)
Remediation of PL310 ends	An estimated 30 m^2 per cut end	Permanent	0.00006	0.00012
Remediation of PL311 offshore end	An estimated 30 m^2 of rock placement at the offshore cut end	Permanent	0.00003	0.00006
Remediation of base case PL311 spans	Rock to cover 306 m of spans (9 m^2 of rock per metre of length)	Permanent	0.0028	0.0056
Remediation of optional PL311 spans	Rock to cover 432 m of spans (9 m^2 of rock per metre of length)	Permanent	0.0039	0.0078
Removal of mattresses and grout bags	19 mattresses and 95 grout bags (of standard dimensions 0.6 m x 0.3 m)	Temporary	0.00034	0.00068
		Total (Permanent)	**0.0067 km^2**	**-**

Total (Temporary)	**0.00036 km^2**	**0.014 km^2**

The base case span remediation activity which is proposed along the PL311 will occur entirely within the Southern North Sea SAC and Greater Wash SPA (between KP 14.0 and 17.0). Therefore, the direct and indirect areas of impact quoted in Table 6-5 above apply as the area of impact within both the protected sites. The optional remediation, if it is deemed necessary, will affect the Southern North Sea SAC, Haisborough, Hammond and Winterton SAC and Greater Wash SPA. Further discussion on the impact of the proposed decommissioning activities within each protected site is provided in Section 6.1.5. The offshore end of the PL311 which will also be remediated is not located within any protected area. No other proposed decommissioning activities will be taking place within a designated site, nor will the activities be occurring close enough to a designated site as to have an impact on it.

6.1.2.5 Clear Seabed Verification

As previously discussed, a seabed clearance verification is required following all decommissioning projects to ensure there is no residual risk to other sea users, particularly commercial fisheries. Where non-intrusive survey techniques are not considered sufficient more traditional forms of seabed clearance will be employed, namely overtrawling.

Although an important activity for limiting the potential for safety hazards, the use of overtrawling constitutes a substantial potential temporary impact to the benthic environment from decommissioning activities. Proposed overtrawling remediation has therefore been limited to infrastructure where intervention is considered to be required. As a worst-case, it is assumed that overtrawling may be required for each of the 500 m safety zones around the Sean Field surface structures. Considering the majority of activities will be occurring on and within the seabed of the 500 m zones, the increased potential for dropped objects within the safety zone, and the lack of precision involved in overtrawling, a worst-case scenario has been determined as the whole of the safety zone. There are three 500 m safety zones within the Sean Field. The Sean PP and RD platforms are connected by a bridge and so there is some overlap between the two safety zones. This has been accounted for in the calculations.

In addition to the calculated direct disturbance from overtrawling, an estimate has been made of the possible indirect disturbance due to re-suspension and re-settlement of sediment. The area exposed to indirect disturbance was assumed to be twice the area of direct disturbance.

The area predicted to be disturbed in the worst-case overtrawling scenario is presented in Table 6-6. None of the proposed overtrawling activity is within any protected or designated site.

Table 6-6 Area of Seabed Impact Associated with Clear Seabed Verification

Activity	Quantity and dimensions	Expected duration of disturbance	Direct disturbance area (km^2)	Indirect disturbance area (km^2)
Overtrawling	3 x 500 m safety zones (2 overlapping)	Temporary	2.32	4.64
		Total	**2.32 km^2**	**4.64 km^2**

6.1.2.6 Summary of Seabed Impacts

Seabed disturbance from the decommissioning activities discussed throughout this Section is summarised in Table 6-7. This illustrates a worst-case scenario for seabed disturbance, in which the majority of the seabed impact is from the worst-case overtrawling estimate.

In all instances, it has been assumed that the area of indirect disturbance will affect twice the area of direct disturbance. The placement of stabilisation materials may occur within the potential overtrawl area; however, it is considered independently as an area of permanent disturbance.

Table 6-7 Total Potential Seabed Disturbance from the Decommissioning Activities

Activity	Temporary direct disturbance (km^2)	Temporary indirect disturbance (km^2)	Permanent disturbance (km^2)
Decommissioning of pipelines, flowlines and umbilical	0.025	0.049	0
Decommissioning of seabed infrastructure	0.081	0.16	0
Decommissioning of stabilisation materials and remediation activities	0.00036	0.014	0.0067
Totals without overtrawl	**0.11 km^2**	**0.22 km^2**	**0.0067 km^2**
Overtrawl	2.32	4.64	0
Totals with overtrawl	**2.43 km^2**	**4.86 km^2**	**0.0067 km^2**

Of the total permanent disturbance area, attributed to rock remediation, almost all of it will occur within the Greater Wash SPA and Southern North Sea SAC (0.0067 km^2), as discussed in Section 6.1.2.4. No other activities or sources of temporary direct or permanent disturbance will be occurring in designated sites at any other point during the decommissioning. Temporary indirect disturbance associated with the decommissioning of stabilisation materials and remediation activities will cover an area of 0.014 km^2 (Table 6-7), of which the majority will be generated by the rock remediation activity.

6.1.3 Effects on Sensitive Receptors

6.1.3.1 Direct Disturbance

Decommissioning activities are expected to lead to two types of direct physical disturbance. The first is temporary disturbance, which will result from the removal of pipelines and infrastructure from the seabed, and the placement of protective material. The sediment will be disturbed by the action of retrieving equipment from the seabed and rock placement, but once decommissioning is complete, the affected areas will be free of anthropogenic material. However, in the case of rock placement, temporary disturbance will only apply to the wider area impacted by suspended sediments, not the area covered by rock. Temporary disturbance should allow recovery in line with natural processes such as sediment re-suspension and deposition, movement of animals into the disturbed area from the surrounding habitat, and recruitment of new individuals from the plankton.

The second type of direct disturbance will be permanent disturbance caused by the deposition of additional rock armour on the seabed to protect infrastructure decommissioned *in situ*. This type of disturbance will effectively change the seabed type in the affected areas from the naturally occurring sand (as described in Section 3.4.1) to a hard substrate. These materials will be permanently left on the seabed and ultimately will become fully buried by the deposition of new natural sediment. While the seabed will eventually recover and the substrate will return to pre-disturbance conditions, the time frame over which this occurs is so long-term that the disturbance is considered permanent.

The temporary and permanent seabed effects associated with direct disturbance are discussed in the subsections below.

6.1.3.1.1 Temporary Direct Disturbance

As noted in Table 6-7, approximately 0.11 km^2 of seabed would be affected by temporary direct disturbance, when not accounting for overtrawl. Including overtrawl, the total becomes 2.43 km^2. The scale of the disturbance is very small when compared to other forms of disturbance that occur in the area, such as commercial trawling. A commercial trawler with a 12 m wide beam trawl trawling at its slowest rate of approximately 4.7 km/h would cover an area of roughly 0.06 km^2 per hour so would therefore take approximately 41 hours to cover the anticipated direct disturbance area (FAO, 2019). As stated in Section 3.6, fishing effort in ICES rectangles 34F1, 34F2 and 35F2, within which the PL311 is located, is low and has never

surpassed 50 days per annum (1,200 hours). Despite fishing activity being low, in this context, the limited scale of the disturbance associated with the decommissioning activities is clear.

Decommissioning disturbance will cause mortality, due to injuries arising from the crushing of benthic and epibenthic fauna which are sedentary or unable to move quickly. Mobile fauna will likely also be disturbed. The sediment structure, including the burrows of any animals present, will be affected. Past surveys of the region have identified the most common taxa. Benthic fauna communities around the Sean Field and along the PL311 were dominated by the bivalve (*A. fabula*), amphipod (*B. elegans*) and polychaete (*S. bombyx*) (Fugro, 2011). Occasional crustacean burrows were also observed within the Sean Field though no burrowing megafauna habitat has been confirmed in the Field (Fugro, 2011). While the sediment of the area does appear to be suitable for ocean quahog, surveys found no evidence of the species around the Sean Field platforms or along the trunkline.

A species of conservation concern which was observed in relatively high numbers was the Ross worm, *S. spinulosa*. This species forms biogenic reefs which support diverse communities. The species has been recorded in multiple surveys along the PL311 (see Section 3 for full discussion). The North Norfolk Sandbanks and Saturn Reef SAC, through which the PL311 briefly passes, is partly protected for the presence of biogenic reefs (see Table 3-4). *S. spinulosa* are very sensitive to physical pressures. The Marine Life Information Network (MarLIN) provides a detailed breakdown of the species' sensitivities. They are considered to have a 'medium' sensitivity to abrasion according to the MarLIN classification (Tillin *et al.*, 2020). Physical disturbance to the species, including abrasion, may occur during the decommissioning, this will be considered in Section 6.1.3.1.2 below. While *S. spinulosa* are not sensitive to light smothering, their sensitivity is considered 'medium' when smothering is heavy (Tillin *et al.*, 2020).

The seabed disturbance in relation to those protected sites which may overlap with the activities is detailed in the sections below. In particular, Section 6.1.5.1 will discuss the seabed impact of the decommissioning on the Hainborough, Hammond and Winterton SAC, and consequently will address *S. spinulosa* further. No other species of conservation concern, or those which are sensitive to disturbance, have been identified within the Sean Field or along the trunkline.

EUNIS habitats A5.27 'Deep circalittoral sand', A5.15 'Deep circalittoral coarse sediments', A5.44 'Circalittoral mixed sediments' and, to a lesser extent, A5.25 'Circalittoral fine sand' / A5.26 'Circalittoral muddy sand' are representative of the decommissioning area (NMPi, 2020). In particular, habitat A5.27 'Deep circalittoral sand', within which the Sean Field and approximately 60 km of the PL311 are located, is one of the most prevalent seabed habitats in the North Sea, covering an approximate area of 150,506 km^2 throughout UK waters. As such, temporary disturbance of a small area of seabed (approximately 0.0016% of the total habitat) is expected to have a negligible effect in the context of the regional environment.

6.1.3.1.2 Permanent Direct Disturbance

Permanent direct disturbance will occur due to leaving hard substrate on the seabed in perpetuity. This encompasses the introduction of new rock armour to protect exposed sections of flowlines that will be decommissioned *in situ*. Approximately 0.0067 km^2 of seabed will be subject to permanent direct disturbance due to the introduction of hard substrate, of which 0.0078 km^2 is associated with the optional unconfirmed remediation.

The immediate effect of the introduction of new hard substrate will be mortality and injury of benthic and epibenthic fauna that cannot move away from the activities, as well as disturbance of motile fauna. Following the introduction of the material, the ongoing effect will be the change of an area of softer habitat to a hard substrate, and a related change in the types of organisms that can use the habitat. Organisms such as sea pens and burrowing bivalves, anemones and crustaceans will no longer be able to use the area affected, while new habitat will be created for other groups such as encrusting sponges and other species of anemone. *S. spinulosa* have no resistance as individuals to a change in substrate type, as occurs with rock placement, or a change in their habitat structure (Tillin *et al.*, 2020).

Remediation with rock will be the only decommissioning activity to occur along the PL311 trunkline therefore this will be the only activity to potentially interact with *S. spinulosa*. Mapped areas of known biogenic reef do overlap with current areas of spans which are to be remediated during the decommissioning (see Figure 3-11). The six spans which will be remediated as part of the base case remediation activities are all located between

KP 14.0 and 17.0. Within these 3 km, high confidence biogenic reef is known to be present. The extent of the reef is shown in Figure 3-11. The environmental pre-decommissioning survey undertaken prior to the commencement of any activity would confirm if the pipeline sections to be remediated overlap with the distribution of any *S. spinulosa* reef. ONE-Dyas intend to undertake a sighting survey of the pipeline just prior to decommissioning activities commencing. This will include a visual survey from an ROV equipped with a pipe tracker system which will provide a visual record of habitat along / beside the pipeline. This would assist in informing the placement of rock as remediation. As noted above, in Section 6.1.3.1.1, the species is considered sensitive to abrasion; therefore, should rock placement coincide with a section of reef, it could impact the species at a highly localised scale. However, owing to their preference to colonise harder substrates, including cobbles and boulders, and their sometimes gregarious nature (Tillin *et al.*, 2020), it is likely that in the wake of any change in substrate caused by the decommissioning activities, *S. spinulosa* will recolonise the new substrate. Additionally, their larval dispersal potential can cover distances of over 10 km (Tillin *et al.*, 2020). Therefore, despite the potential for impacts on the biogenic reef due to the decommissioning, it is likely that re-colonisation of the impacted area will occur.

While the introduction of hard substrate clearly results in a change in the habitat type and associated fauna present, the scale of the impact is negligible considering the very large extent of sandy seabed available in the SNS. Recovery of the affected areas is expected to take many years but will eventually occur as the deposited rock material is gradually buried by natural sediment deposition (however the time period is such that this is still considered a permanent disturbance). Therefore, the community is expected to recover and revert to pre-disturbance composition with time, including *S. spinulosa*.

6.1.3.2 Indirect Disturbance

Indirect disturbance to the seabed is expected to be caused by the re-suspension and re-settlement of seabed material disturbed during decommissioning operations.

Increased suspended sediment load in the water column, and the subsequent settling can negatively affect seabed habitats and species. The effect mechanisms are interference with feeding due to an individual's inability to keep their feeding apparatus clear of sediment, and physical burial of individuals that are unable to recover to the surface through layers of newly deposited sediment (Gubbay, 2003; Rogers, 1990). The potential area of indirect impact amounts to 4.86 km^2 of seabed indirectly impacted by sediment settlement. There are no recorded sensitive filter feeders (such as ocean quahog) in the Sean Field or along the trunkline. As discussed above, *S. spinulosa* are more sensitive to physical disturbance and are able to cope with moderate levels of sedimentation. However, as indicated in Figure 3-11 and discussed above, there is the potential for overlap between span remediation efforts and the known location of biogenic reef. This remediation incurs an associated indirect disturbance caused by the re-suspension of sediment. *S. spinulosa* being of 'medium' sensitivity when smothering is heavy (Tillin *et al.*, 2020), they are potentially at risk of being impacted by the decommissioning. However, it is not possible to establish the exact location of the reef in relation to the PL311 pipeline as there is no survey imagery to confirm either the presence or absence of the species at the location of the spans to be remediated. As stated above, ONE-Dyas intend to conduct a pipeline survey which will provide a visual record of any habitats in proximity to the pipeline. While imagery alone would not confirm if any observed reef structure was alive, it would nevertheless inform the placement of rock. The use of a fall pipe during rock placement enables a more accurate placement of rock remediation and therefore should also minimise indirect disturbance to a degree. Unless in particularly close proximity to an area of *S. spinulosa*, the impact of increased sedimentation should be minimal as smothering caused by rock bag placement is unlikely to be considered any higher than 'medium'.

Overall, effects due to increased sediment suspension are not likely to significantly impact the benthos of the decommissioning area, as such indirect disturbance is temporary in nature and highly localised. With regards to *S. spinulosa*, they are able to resist smothering to an extent.

6.1.3.3 Impact of Pipelines Decommissioned in situ

The decommissioning of items *in situ* has attached legacy impacts. This arises from the gradual breakdown of materials left *in situ*. In this instance, the PL310 and PL311 will undergo long-term structural degradation caused by corrosion, leading to the eventual collapse of the pipelines under their own weight and that of overlying pipeline coating material, scale and sediment. During this process, degradation products derived

from the exterior and interior of the pipe will breakdown and potentially become bioavailable to benthic fauna in the immediate vicinity.

The primary degradation products will originate from the following pipeline components:

- Pipeline scale;
- Steel;
- Sacrificial anodes;
- Asphalt enamel coating;
- Concrete coating; and
- Plastic coating.

As pipelines will be purged and flushed prior to the commencement of decommissioning, the pipeline contents will be limited to treated seawater and so is not discussed further herein.

Heavy Metals

Metals with a relatively high density or a high relative atomic weight are referred to as heavy metals. It is expected that these metals will be released into the sediments and water column during the breakdown of the components of the pipeline scale, steel and sacrificial anodes.

The toxicity of a given metal varies between marine organisms for several reasons, including their ability to take up, store, remove or detoxify these metals (Kennish, 1997). Concentrations of the metals are not expected to exceed acute toxicity levels at any time owing to the decommissioning. However, chronic toxicity levels may be reached for short periods within the interstitial spaces of the sediments or in close proximity to the pipelines. At these levels, heavy metals act as enzyme inhibitors, adversely affect cell membranes, and can damage reproductive and nervous systems. Changes in feeding behaviour, digestive efficiency and respiratory metabolism can also occur. Growth inhibition may also occur in crustaceans, molluscs, echinoderms, hydroids, protozoans and algae (Kennish, 1997). It is expected that any toxic impacts will be short lived and localised with minimal potential to impact populations of marine species. The potential for uptake and concentration of metals would also be limited to the local fauna and due to the slow release of these chemicals not likely to result in a significant transfer of metals into the food chain.

With regards to species of concern found in the project area, some practitioners consider *S. spinulosa* relatively insensitive to metal or chemical contaminants (Holt *et al*., 1998), although direct evidence is limited. Studies of the response of *S. spinulosa* to an outfall from a bromide extraction works containing free halogens (Hoare and Hiscock, 1974) suggest that it is generally tolerant of changes in water quality (UK Biodiversity Group, 1999). A further study by Walker and Rees (1980) recorded that down-tide of a sewage discharge in Dublin Bay *S. spinulosa* was present in greater densities and diversities than elsewhere in the bay, indicating a level of tolerance for environmental change. As described in sections above, they are known to have life history strategies which enable them to exist in variable or unpredictable environments, responding to suitable conditions with a high rate of reproduction and rapid development (Tillin *et al*., 2020).

The slow release of the metals associated with the pipeline steel and steel associated with the concrete coating and mattress protection is expected to have a negligible impact on the local environment. It is anticipated that failure of the pipelines due to through-wall degradation would only begin to occur after many decades (of the order of 60 to 100 years) (HSE, 1997).

Along buried pipeline corridors there may be accumulations of heavy metals in the sediments. Where present, the finer fraction of these sediments (silts and clays) are likely to form bonds with these metals, making them less bioavailable to marine organisms. The sandy (coarser fraction) of the sediments surrounding the pipelines are less likely to retain metals (MPE, 1999). The seabed surrounding the PL310 and PL311 is largely composed of sand and will therefore release any metals to the surrounding seawater, making them bioavailable, but also diluting them into the wider environment.

The PL311 only covers 1.11 km^2 within the context of the wider SNS. Degradation is unlikely to occur at a constant rate and across the entire length of the pipeline. Therefore, due to the highly localised nature of any degradation products and the low concentrations of contaminants being released over an elongated period it is highly unlikely that these products will be detectable above current background conditions. Further discussion on the impact of heavy metals on protected sites is available in Section 6.1.5.

PAHs

The base material of some of the concrete coated pipelines is asphalt. Asphalt largely displaced the use of coal tar in pipeline coatings owing to its being less hazardous. However, considering the hydrocarbon composition of asphalt, though largely inert, there may be some opportunity for PAHs to be released during the natural course of degradation.

The asphalt enamel coating degrades when the internal pipeline steel corrodes or if the concrete coat is damaged. There are no known records of concrete durability, but it is expected that the concrete will decay at a very slow rate. It is presumed that PAH will be released once the asphalt layer is open to the seawater, and over time will be released into the surrounding environment, though generally asphalt is very inert. PAHs in marine sediments will have a low biodegradation potential due to low oxygen and low temperatures (Cerniglia, 1992). PAHs are almost insoluble and only become available to marine organisms through ingestion of particulate matter (MPE, 1999, Cox and Gerrard, 2001).

Two factors, lipid and organic carbon, control to a large extent the partitioning behaviour of PAHs between sediment, water, and tissue. Accumulation of PAHs occurs in all marine organisms; however, there is a wide range in tissue concentrations from variable environmental concentrations, level and time of exposure, and a species' ability to metabolize these compounds. There are many variables, such as chemical hydrophobicity, uptake efficiency, feeding rate, and ventilatory volume, which may affect the outcome. The route of uptake may be an important issue for short-term events; however, under long-term exposure and equilibrium conditions between water, prey, and sediment, the route of uptake may be immaterial because the same tissue burdens will be achieved regardless of uptake routes (Meador *et al*., 1995). Due to their poor solubility in water these substances will partition in organic material including plankton and marine snow (cell water release) and marine sediments (cell water and sediment release). All substances in this group are persistent with a half-time in the marine environment ranging from weeks (water column) to several years (sediments). Evidence of carcinogenicity, mutagenicity or teratogenicity attributable to PAHs in the marine environment is very limited and the amounts concerned are not thought to pose a threat to marine organisms (MPE, 1999). Given that PAHs are expected to be released in very low concentrations during the deterioration of the coating over time, it is unlikely that marine organisms will accumulate them to a significant extent.

Due to the highly localised nature of any degradation products and the low concentrations of contaminants being released over an elongated period it is highly unlikely that these products will be detectable above current background conditions in the area. Further discussion on the impact of PAHs on protected sites is available in Section 6.1.5.

Plastics

There are plastic components within the composition of the PL310 and PL311. However, as no micro-organisms have evolved to utilise chemically resistant polymer chains as a carbon source, these plastics can be expected to persist in the environment for centuries (OGUK, 2013). As the rate of biodegradability in the marine environment is also low, it can be assumed that the environmental effect of leaving these plastics in place is insignificant (MPE, 1999).

Due to the highly localised nature of any degradation products and the low concentrations of contaminants being released over an elongated period it is highly unlikely that these products will be detectable above current background conditions in the area. Further discussion on the impact of plastics on protected sites is available in Section 6.1.5.

6.1.4 Cumulative and Transboundary Impacts

The Sean Field decommissioning activities will be occurring in close proximity to the proposed locations of the Norfolk Boreas and Norfolk Vanguard offshore windfarms. The cable corridor associated with both developments will be located within 5 km of the PL311. However, the proposed timelines for the decommissioning activities and the construction of the windfarms are unlikely to coincide. Offshore works are expected to commence in the mid to late 2020s (Vattenfall, 2020) and should not overlap with the decommissioning timeline anticipated for the Sean Field decommissioning project, due to start in 2025 (see Section 2.8). Of the oil and gas installations in the area, the closest is the Corvette platform (operated by Shell) which is still in operation. All other facilities are >20 km from the Sean Field.

The PL311 pipeline to shore passes close to a number of oil and gas installations, the closest being the the Leman Complex (operated by Shell) and the Hewett Field (operated by Eni Hewett). These installations can be seen on Figure 3-4. All of these facilities are located within the Southern North Sea SAC. Additionally, the Hewett Field is located partly within the Haisborough, Hammond and Winterton SAC, and the Leman Complex is located mostly within the North Norfolk Sandbanks and Saturn Reef SAC. Owing to the potential for cumulative impacts between activities associated with these third party installations and the proposed decommissioning activities, cumulative impacts within certain designated sites have been addressed in Section 6.1.5.

Within the context of the SNS as a whole, the proposed Sean activities are unlikely to act cumulatively with any other activities in the area. Amongst the oil and gas developments listed above, a number have been or will be subject to decommissioning in the future. In the case of OWFs, a number of developments are under consideration in the SNS (including the two proposed Vattenfall sites). With regards to temporary impacts generated by the proposed Sean Field decommissioning and those generated by third party activities, there is limited opportunity for a cumulative effect owing to the timing of activities. Temporary impacts will be short lived and recovery possible. It is unlikely that all such activities in the SNS would occur in tandem; it is more probable that activities will be staggered temporally, meaning that temporary impacts will not act cumulatively between developments.

In addition, though well developed, the installations throughout the SNS are far enough apart to minimise the potential for spatial overlap between activities. The footprint of activities such as cable laying or in association with wind turbine installation, is highly localised to the immediate surroundings of the affected area. Such activities would be unlikely to overlap spatially or temporally with the proposed Sean decommissioning.

The only permanent impacts to the seabed associated with the Sean decommissioning are in relation to the placement of rock for the remediation of pipeline ends and spans. Only similar activities would result in a permanent impact to the seabed. In the case of other oil and gas developments in the SNS, it is expected that the relevant guidance for decommissioning activities within the UKCS will be suitably followed. Based on the current guidance (BEIS, 2018), this involves the *in situ* decommissioning of pipelines to ensure seabed impacts are minimised. In following the guidance and as a result of the highly mobile seabed of the SNS, it is likely that rock placement will be required for remediation across a number of current and future decommissioning projects. Ultimately, this methodology aims to reduce the overall impact of activities to the seabed and minimise risk to other sea users. Using the impact assessment methodology in determining the magnitude of an impact (Table 4-5), total loss of the SNS habitat and alteration of baseline conditions would be required for an impacts magnitude to be considered major. Given the area of the SNS and the anticipated localised nature of rock placement activities, the cumulative quantity of rock remediation would have to be extensive to impact the natural morphodynamic systems and habitats of the sandy SNS habitat. The potential for the placement of rock to generate a cumulative impact within protected sites in the SNS in addressed fully in Section 6.1.5.

The Sean Field is 15 km from the UK / Netherlands median line. The area of indirect temporary disturbance is 4.86 km^2 and so the potential for sediment to travel beyond the immediate vicinity of the decommissioning area and into neighbouring territorial waters is minimal. Given this, the potential for seabed transboundary impacts is highly unlikely.

6.1.5 Potential Impacts to Protected Sites

Along its length, the PL311 passes through five protected sites:

- Southern North Sea SAC;
- North Norfolk Sandbanks and Saturn Reef SAC;
- Haisborough, Hammond and Winterton SAC;
- Greater Wash SPA; and
- Cromer Shoal Chalk Beds MCZ.

Common to all sites is the potential impact of the long-term degradation of the PL311 *in situ*. The area of pipeline which will remain *in situ* within each protected area is quantified in Table 6-2 above. Due to the highly localised nature of any degradation products and the exceptionally low concentrations of contaminants which may be discharged over the lifetime of the degrading pipeline, the leave *in situ* decommissioning of the existing PL311 pipeline is not considered to form a material change to the background conditions within these sites. As a result, there will not be any likely significant effects attributed to the long-term degradation of the pipeline within any of the above protected sites through which the PL311 travels.

There is the potential for the addition of rock placement to modify existing baseline conditions within several of these sites in such a manner that requires further assessment. Figure 6-1 shows the locations of rock remediation required as a base case (in red), as well as optional remediations (in yellow), for existing spans along PL311 in the context of the protected sites it transects. All locations of planned or base case span remediation will occur between KP 14.0 and 17.0, within the Greater Wash SPA. There are a further five optional remediation locations between KP 25.0 and 30.0: four within the Southern North Sea SAC and Haisborough Hammond and Winterton SAC; and another single location within the Southern North Sea SAC (approximately at KP 60.0). Table 6-4 lists all the spans according to their location within the protected sites.

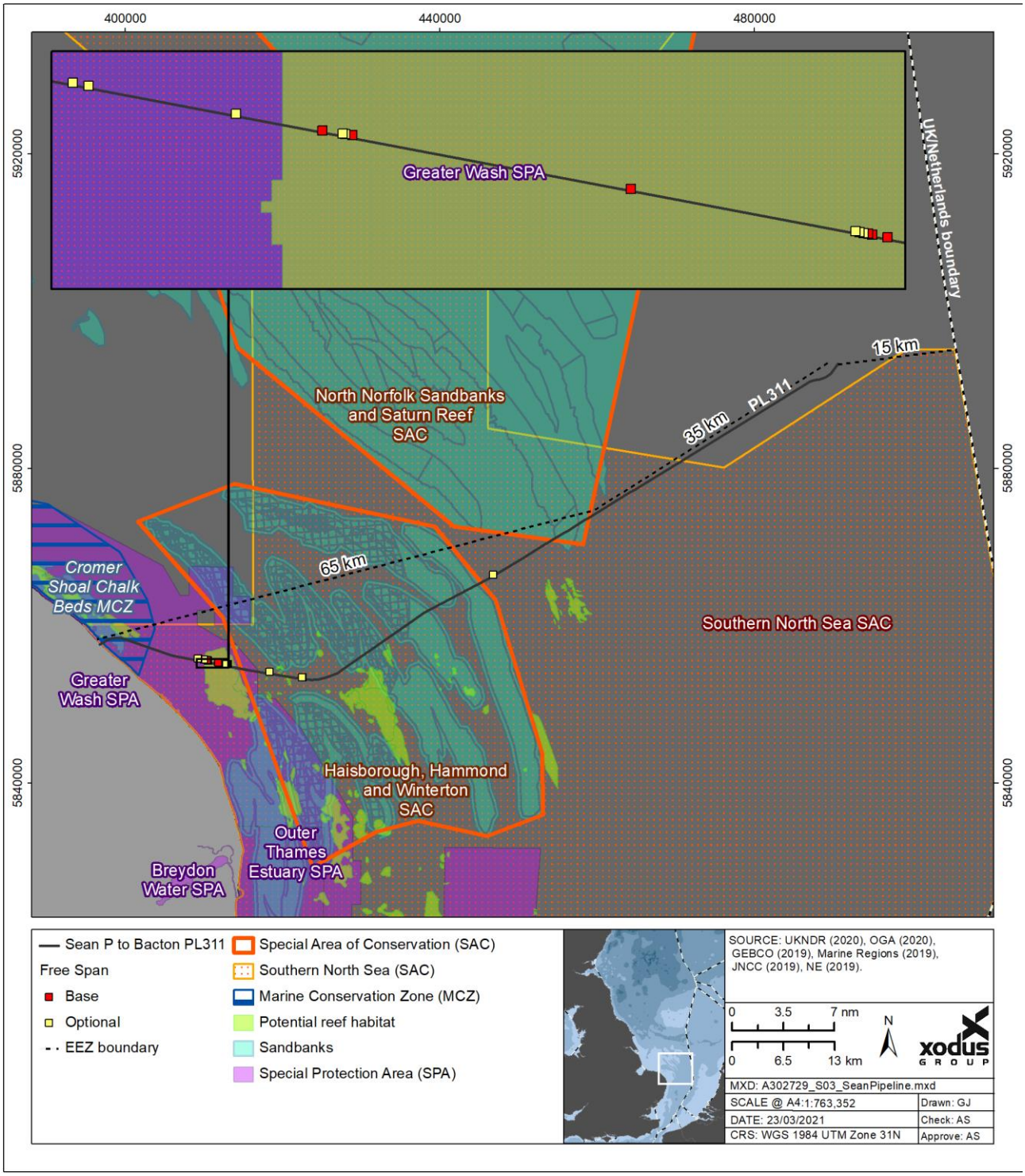


Figure 6-1 Locations of base case and optional rock remediation along the PL311

With regards to sites protected for seabed features, the Haisborough, Hammond and Winterton SAC is the only such site which overlaps the possible area of impact associated with optional rock placement. However, it is also important to address impacts to sites with features which rely on the benthos for supporting functions (e.g. as prey habitat or through the provision of supporting processes). Therefore, secondary impacts to the conservation objectives of any sites in which rock placement is planned or optional has been considered below.

The following sites are taken forward for further assessment within the context of a Habitats Regulation Appraisal (HRA):

- Haisborough, Hammond and Winterton SAC;
- Southern North Sea SAC; and
- Greater Wash SPA.

These sites are the only sites likely to be impacted by the proposed decommissioning activities. Each site will be addressed in the following subsections.

6.1.5.1 Haisborough, Hammond and Winterton SAC

This SAC covers an area of 146,759 ha (1467.59 km^2) and is protected for sandbanks and biogenic *S. spinulosa* reef. The area of reef and sandbanks respectively are 88.06 ha (0.88 km^2) and 66,892.75 ha (66.89 km^2; JNCC, 2017d). As above, the spans requiring remediation as part of the base case activities are located between KP 14.0 and 17.0, just outside the western boundary of the SAC. Five optional remediation points are located within the site (Table 6-4). Figure 6-1 shows the location of the pipeline and proposed remediation in relation to areas of known biogenic reef and sandbanks in the SNS.

As described above, *S. spinulosa* have no resistance to a change in substrate type, as would occur with rock placement, or a change in their habitat structure (Tillin *et al.*, 2020). While areas of rock deposition outwith the boundaries of the SAC will coincide with mapped areas of known biogenic reef, within the SAC the optional remediation locations do not overlap with areas of high confidence reef (see Figure 6-1). Therefore, within the SAC there may be limited opportunity for the optional rock remediation activities to affect *S. spinulosa*. Prior to the commencement of the decommissioning activities, an environmental pre-decommissioning survey will be undertaken with the intention of identifying any areas of overlap between the distribution of any *S. spinulosa* reef and potential remediation. ONE-Dyas intend to undertake a sighting survey of the pipeline just prior to decommissioning activities commencing. This will include a visual survey from an ROV equipped with a pipe tracker system which will provide a visual record of habitat along / beside the pipeline. *S. Spinulosa* is considered, by its nature, an ephemeral species (Jackson and Hiscock, 2008) and it would be hard to identify from video footage the living status of a reef. Regardless, this pre-decommissioning survey would advise the placement of rock in order to minimise the potential for impact on the reef habitat, alive or otherwise.

Ultimately, rock placement could impact the species at a highly localised scale. However, owing to their preference to colonise harder substrates, including cobbles and boulders (Tillin *et al.*, 2020), it is likely that in the wake of any change in substrate caused by rock placement, *S. spinulosa* will recolonise the new substrate. Additionally, their larval dispersal potential can cover distances of over 10 km and, in reproductive terms, they are 'r'-strategists: meaning they have a high rate of reproduction therefore are well adapted to live in frequently disturbed environments (Jackson and Hiscock, 2008; Tillin *et al.*, 2020). Therefore, despite the potential for impacts on the biogenic reef due to the decommissioning, it is likely that re-colonisation of the impacted area will occur. The area of direct permanent disturbance predicted to be generated by the (optional) remediation activity within the SAC is 0.0015 km^2. This only constitutes 0.0001% of the SAC. If the rock placement was to occur on or near S. spinulosa reef, the area would only constitute 0.17% of the reef habitat within the SAC as a whole.

The natural development of a sandbank in terms of shifts in location and / or shape may be altered by the addition of materials or constructions. This could also affect sandbank recovery through changes in the local hydrographic regime, and thus activities occurring outside the SAC may impact features within it. Sensitivity to obstruction of sandbanks is therefore considered high. However, the physical presence of structures on sandbanks have been shown to not cause morphological impacts on sandbanks over anything but a localised area (Cefas, 2006). Moreover, the sandbanks are likely to recover (Hill *et al.*, 2011), particularly considering the hydrologically active environment of the SNS. Existing pipelines are not predicted to affect sandbank features, with surface features being uninterrupted by their presence and leaving them *in situ* is not predicted to increase the current extent of possible habitat loss or physical impact to the site. The communities and typical species across the SAC are predicted to remain the same with recovery occurring in areas of disturbance shortly after activities cease.

With respect to cumulative impacts on the SAC, a DP was put forward for the Eni Hewett Field facilities in 2020. Of the installations to be decommissioned, four are located within the Haisborough, Hammond and Winterton SAC: the 48/29A Complex (comprised of three platforms) and the 52/5A platform. Table 6-8 compares the area of impact associated with the PL311 remediation within the SAC to similar rock placement activities associated with the decommissioning of the Hewett Field platforms which are also within the SAC. Cumulatively, the impact of such activities would result in a permanent area of impact equating to 0.019 km^2 (0.0013% of the SAC area), the majority of which is attributed to the Hewett Field decommissioning. It is likely that this is also an overestimate of area as the Hewett Field EA does not differentiate between rock placement-related permanent impact and other temporary impacts (Eni Hewett, 2020).

At time of writing, ONE-Dyas are not aware of any other similar projects involving rock placement occurring nearby, there are no other oil and gas installations within the SAC therefore there is limited opportunity for other sources of impact to act cumulatively with the remediation along the PL311.

Table 6-8 Decommissioning Area Impact within the Haisborough, Hammond and Winterton SAC

Project	Activity	Impact duration	Area within the Haisborough, Hammond and Winterton SAC (km^2)	Source
Sean Field decommissioning	Remediation of the PL311	Permanent	0.0015	Table 6-4
Hewett Field decommissioning	Removal of stabilisation materials and addition of new rock along pipelines (624 m^2 for all 6 Hewett Field platforms)	Permanent	0.00042	Hewett Platforms Decommissioning EA (Eni Hewett, 2020)
Hewett Field decommissioning	Spud can and stabilisation rock deposit associated with an HLV DP2 jack-up vessel (25,140 m^2 for all 6 Hewett Field platforms)	Permanent	0.017	Hewett Platforms Decommissioning EA (Eni Hewett, 2020)
		Total	**0.019 km^2**	

Though the intended base case remediation is outside the boundary of the site, there is the potential for some impact with the site. While the rock placement may not directly impact the seabed of the SAC, suspended sediment may reach the site. However, increased sedimentation is unlikely to be generated in such quantities as to pose a significant impact on the sites' quality. Furthermore, *S. spinulosa* are resilient to light sedimentation (Tillin *et al.*, 2020).

Overall, to reach a level of significant impact in the SAC, a substantial quantity of rock would need to be placed. As in Table 6-8, the total area of impact attributed to all (known) planned activities within the SAC equates to 0.0013% site. Furthermore, the rock placement within the Haisborough, Hammond and Winterton SAC is considered optional therefore is not confirmed and may not take place at all thereby eliminating all potential for impact on the Haisborough, Hammond and Winterton SAC.

To conclude, it is unlikely that the seabed features of the SAC will be compromised, should there even be any interaction between the proposed decommissioning activities and the designated area. Consequently, the Conservation Objectives to maintain and restore the sites' habitats (as in Table 3-4), will not be contravened.

6.1.5.2 Southern North Sea SAC

All the PL311 spans to be remediated (either as base case activities or optional) are located within the Southern North Sea SAC, this will be the only decommissioning activity to occur in the site. Due to the location of the remediation activities, there is potential for a localised effect on the supporting habitats and prey of harbour porpoise. In this instance, the physically impacted seabed will undergo a change in substrate, from sand to

rock. While this disturbance is considered permanent, the area of impact within the SAC will be very small. The SAC is the largest in UK waters and covers an area of 3,695,054.0 ha (369,50.54 km^2; JNCC, 2019b). Proportionately, the area of rock placed will constitute 0.00001% of the whole SAC. Therefore, only a minimal area of seabed will be impacted and lost to the prey of harbour porpoise. When looking at the area of sandy seabed lost in the context of the North Sea as a whole, this becomes <0.00001% of the overall habitat lost (150,506 km^2 of sandy seabed). The physically impacted seabed is predicted to recover over a period of time depending on the local environment.

Harbour porpoise predominantly feed on high-calorie shoaling fish species within the mid-water column, such as herring and mackerel. These fish species are unlikely to be directly affected by changes to benthic habitat, however, may be susceptible to community-level changes which modify the availability of their own prey species During decommissioning, it is possible that fish may temporarily leave the area immediate to localised rock placement activities. However, harbour porpoise, which are highly mobile due to their targeting of patchy prey, will be able to capitalise on prey patches elsewhere within the protected site and wider region. Moreover, fish are expected to return to the area of impact once rock placement activities cease.

The SNS has a long history of development with respect to the oil and gas industry, with ample active and abandoned infrastructure present throughout. Surrounding the PL311 pipeline within the SNS SAC are numerous developments: the Leman A, B and C complexes, and the additional Leman D, E, F, and G platforms (operated by Shell); the Hewett Field (operated by Eni Hewett); the Thames Area (which includes the installations in the Arthur and Horne and Wren Fields), and the Welland Field (the latter two groups of assets being operated by Perenco). Many of these developments have put forward DPs or have been approved for decommissioning at the time of writing, so it is possible that the proposed decommissioning will coincide with other decommissioning or operations and maintenance activities in the area. Furthermore, there is likely to be a high level of decommissioning activity across the wider region in the coming years and decades. However, in all such instances, it is expected that the relevant guidance for decommissioning activities within the UKCS will be suitably followed. Based on the current guidance (BEIS, 2018), this involves the *in situ* decommissioning of pipelines to ensure seabed impacts are minimised. Decommissioning of pipelines in this manner within a highly mobile environment such as the SNS SAC may require remediation to ensure the safety of other sea users, however operators and regulators will collectively be seeking to minimise seabed impacts wherever possible (e.g. through localised remediation) to align with the conservation objectives of this site. Given the size of the SNS SAC and the anticipated localised nature of activities which may modify the existing substrate, the cumulative quantity of rock remediation would have to be extensive to the point that prey availability was substantially reduced. As such, collective impacts with the future decommissioning of surrounding developments and across the wider region will not generate dramatic changes to the baseline habitat which supports the harbour porpoise features of the site.

Similarly, future development of the SNS SAC for offshore wind projects (e.g. Norfolk Vanguard and Boreas, East Anglia Three, Hornsea Three and Four, etc.) will not introduce the potential of significant cumulative impacts to the supporting seabed habitat of this site due to their collectively small footprint. Offshore wind farms have relatively small seabed footprints compared to other industries, as the only infrastructure which makes contact with the seabed are wind turbine generator foundations (or mooring foundations, if floating wind), and temporarily placed, often surface-laid cables. For these reasons, the collective seabed footprint of the optional localised rock placement on PL311 with offshore wind energy projects within the SNS SAC is anticipated to remain relatively small, localised and not form a significant departure from the existing habitat supporting harbour porpoise across the large region encompassed by this site.

As the primary designated feature of the SNS SAC is harbour porpoise, the deposition of rock is unlikely to generate secondary impacts to this species through changes in prey availability nor introduce significant impacts to the habitat which supports those prey in such a manner which could adversely impact the integrity of the site. For these reasons, the proposed decommissioning activities will not significantly impact the site's qualifying features, nor will they undermine the ability for the site's Conservation Objectives (detailed in Table 3-4) to be met. In conclusion, the integrity of the SNS SAC will not be compromised and no likely significant effects will occur due to the proposed activities.

6.1.5.3 Greater Wash SPA

The PL311 span remediation activities will occur within the SPA. The site is designated for multiple bird species and subsequently, their supporting habitat. Therefore, the six base case remediation locations between KP 14.0 and 17.0 have the potential to impact the supporting habitat and prey availability of the sites qualifying features. In addition to these areas, a further eight span locations may undergo optional remediation. The SPA covers 353,577.86 ha (3535.78 km^2) and covers a long section of coastline, from East Yorkshire to Norfolk (JNCC, 2018). The proposed decommissioning remediation activities occurring within the site will cover 0.0051 km^2; this area includes the base case and optional proposed remediation areas as a worst case impact scenario. These activities will only affect 0.0001% of the SPA. This is minimal in comparison to the overall area of habitat available to birds. Furthermore, as stated within Section 6.1.5.2, in the wake of the decommissioning activities any prey which have moved are likely to return.

In addition, of all the bird species for which the site is designated, only the red-throated diver and common scoter (Natural England, 2016b) are, behaviourally, likely to spend any time close to the seabed. Common scoter feed on molluscs (RSPB, 2021) and therefore may be most affected by the placement of rock and loss of habitat. However, the seabed within which the PL311 currently lies is unlikely to be productive habitat for the species at present. Therefore, the addition of rock over such a comparatively small area of the site (0.0001%), is unlikely to impact this species or any other to a significant degree.

The impact of light generated during the decommissioning programme on birds has been scoped out (see Section 5.1 and the ENVID in Appendix C). In the interest of ONE-Dyas' commitment to minimise the potential for impacts on seabirds, during the remediation activities planned within the SPA efforts will be made to use only vessel lighting and avoid the use of floodlights. This, and other mitigation measures have been addressed in Section 5.3.

Cumulative impacts are unlikely to occur as there are no other oil and gas installations within the site (Figure 3-4), nor are there any other known activities occurring within the site.

As such, neither the multiple bird species for which the site is designated, nor their prey, will be significantly impacted through the proposed decommissioning activities. Therefore, the proposed decommissioning activities are not thought to contravene the site's Conservation Objectives (as detailed in Table 3-4), and the integrity of the site will not be compromised.

6.1.6 Coastal Processes

Although onshore impacts are outwith the scope of this EA, the dynamic foreshore environment which the PL311 trunkline transects should be considered up to the Mean High Water Spring (MHWS) tide mark. There are low, unconsolidated cliffs (5-10 m high) along the stretch of coastline where the Bacton Terminal, which the trunkline feeds, is situated. These cliffs are made of soft deposits, mainly sand and soft clay which are highly vulnerable to erosion (Royal HaskoningDHV, 2018). At present, is has been found that the terminal could ultimately inhibit the movement of sediment along the coast thus leading to enhanced erosion in the wake of the terminal (North Norfolk District Council, 2012).

Though the terminal at Bacton is not within the scope of this EA, should natural erosional process cause the PL311 decommissioned *in situ* to be exposed below MHWS, this could in turn further prevent the replenishment of the coastline. Exposure of the pipeline in the nearshore and onshore area could compromise the movement of sediment along the coastline and affect the energy distribution from wave and tidal activity. Due to the nature of bedload transport moving in a southerly direction down the North Norfolk coast, and suspended matter moving in an offshore direction from the Norfolk coast (HR Wallingford, 2002); following pipeline exposure, sediment would build up on the north side of the pipeline thereby inhibiting coastal processes. The mobile sediment transported along the coast supplies the local region, including multiple onshore coastal protected sites (see Table 3-5). Blocking of sediment transport could negatively affect these areas which are both known and designated for their Earth Heritage and coastal landscape features.

However, this section of coastline was recently subject to a large sandscaping project, the first of its kind in the UK. The Bacton to Walcott Coastal Management Scheme, also known as the Bacton Sandscaping Scheme, aimed to provide protection to the Bacton Gas Terminal and to increase the level of coastal protection to the villages of Bacton and Wallcot which lie downdrift of the terminal. This was achieved through the

placement of ~1 million cubic metres of sand placed at the terminal (Royal HaskoningDHV, 2018) which may have an influence below the tideline thereby providing protection to the PL311.

Given the recent conclusion of the Bacton Sandscaping Scheme, the impact of potential future pipeline exposures on coastal processes is not expected to be likely or significant.

6.1.7 Mitigation Measures

The following measures will be adopted to ensure that seabed disturbance and its impacts are minimised to a level that is as low as reasonably practicable:

- All activities which may lead to seabed disturbance will be planned, managed and implemented in such a way that disturbance is minimised;
- Careful planning, selection of equipment, and management and implementation of activities;
- Rock armour will be placed by a fall pipe vessel equipped with an underwater camera on the fall pipe to ensure accurate placement of the rock armour, a minimised footprint, and that the minimum safe quantity of rock is used.
- A debris survey will be undertaken at the completion of the decommissioning activities. Any debris identified as resulting from oil and gas activities will be recovered from the seabed where possible; and
- Clear seabed verification will ensure there is no residual risk to other sea users. Non-intrusive verification techniques will be considered in the first instance, but if deemed necessary, seabed clearance may require conventional overtrawl survey methods, in agreement with OPRED and fishing bodies.

6.1.8 Conclusion

Receptor	Impact Magnitude	Receptor Sensitivity	Receptor Vulnerability	Receptor Value
Seabed Habitat	Low	Low	Medium	Low
Benthic fauna	Low	Medium	Low	Medium
Protected Sites	Low	Medium	Medium	Very high

Justification

Decommissioning activities in the Sean Field and along associated flowlines will result in temporary direct disturbance to the seabed amounting to 2.43 km^2. When accounting for temporary indirect disturbance occurring as a secondary pathway from this direct disturbance via sediment suspension and resettlement, the total area impacted is anticipated to double to 4.86 km^2. Permanent disturbance caused by rock placement will affect approximately 0.0067 km^2 of seabed within the project area. The Sean Field is situated within an area of sand habitat which is characterised by submerged sandbanks.

The direct impact of the proposed activities may potentially affect <0.0001 % of the 150,506 km^2 of sandy seabed available in the North Sea, when not including overtrawl. Therefore, the magnitude of impact on the seabed habitat is considered **low**. Additionally, the widespread occurrence of the habitat results in the seabed receptor value being considered **low**. Any direct impacts will be short term and subsequently the habitat will recover rapidly and as such, the receptor sensitivity is considered to be **low**. Given the potential for permanent impacts associated with rock dump in a small region of strictly sandy habitat, the seabed will experience partial change, resulting in a **medium** level of vulnerability.

The benthic taxa of the Sean Field is typical of the SNS and predominantly the benthic communities in the area are not sensitive. However, the Ross worm (*S. spinulosa*) is found in the project area along the PL311 in areas where the only potential impact to the species would be through the span remediation activities. Though it is sensitive to physical abrasion, *S. spinulosa* is able to withstand light smothering and has moderate sensitivity to heavy smothering. As such, the species does have some resilience towards impacts which may be generated by the proposed decommissioning activities. For this assessment, the sensitivity and value of this regionally-important, ubiquitous reef-building species are both considered **medium**. Furthermore, it is not known if there are regions along the PL311 which do interact with areas of known biogenic reef, particularly between KPs 14.0 and 17.0 where confirmed span remediation will occur. Additional visual inspection of this area of pipeline will confirm the presence of any biogenic reef structures prior to rock placement. Should remediation directly impact such reef structures, the area of habitat lost would be minute compared to the wider available habitat colonised by this species, and recovery of lost reef formations are likely to occur rapidly, given the nature of *S. spinulosa* (Tillin *et al,* 2018). The residual impact associated with the decommissioning *in situ* of the Sean pipelines will also result in highly localised degradation. For these reasons, the impact magnitude on the benthos is considered **low**. *S. spinulosa* prefer colonisation of hard substrate and therefore it is probable that areas of reef impacted by rock placement, should there be any, will recover. Research has shown *S. spinulosa* to have some degree of tolerance to such changes in environment (Walker and Rees, 1980). As such the vulnerability of benthos is considered **low** to impacts from the decommissioning, including the degradation and discharge of pipeline constituents into the environment.

The PL311 trunkline transects five protected sites and the decommissioning activities will occur within three of them: the Southern North Sea SAC; Haisborough, Hammond and Winterton SAC; and Greater Wash SPA. SACs are sites of European importance which contribute to an international network of protected sites. Considering this, the receptor value of protected sites is considered **very high**. Again, based on the scale of potential impacts, impact magnitude has been deemed **low**. The sensitivity of these sites has been

considered **medium** which primarily reflects the presence of *S. spinulosa* in the Haisborough, Hammond and Winterton SAC. As the other two sites are not designated for seabed / benthic features, the sensitivity would be lower as the designated features are not at risk of being directly impacted, and their supporting habitat remains substantially unaffected by the decommissioning activities. The vulnerability of each site is considered **medium** as the impacts will be mostly temporary in duration and highly localised, therefore the sites are expected to recover from any potential impacts associated with the decommissioning activities. Based on the assessment above, the overall residual impact significance for impacts associated with seabed disturbance is considered to be **minor**.	
Residual Impact Significance	**Minor**

6.2 Physical Presence

6.2.1 Sources of Risks to Other Users

The Sean decommissioning activities have the potential to impact upon other users of the offshore environment, namely commercial fisheries receptors. Potential risk may arise during decommissioning activities or from legacy impacts of infrastructure decommissioned *in situ*. The following impact pathways are considered to have the potential for significant impacts to commercial fisheries:

- Physical presence of subsea infrastructure decommissioned *in situ* posing a potential snagging risk; and
- Physical presence of decommissioning vessels temporarily modifying access to fishing grounds.

These impacts are assessed against their corresponding receptors in Section 6.2.2.

6.2.1.1 Physical presence of subsea infrastructure decommissioned in situ posing a potential snagging risk

The long-term presence of subsea infrastructure decommissioned *in situ* has the potential to interfere with other sea users that may use the area. In particular, exposures or even free-spans associated with infrastructure decommissioned *in situ* which may arise during initial decommissioning and long-term degradation, introduce a snagging risk to some fisheries. In addition to the physical presence of the pipelines / umbilicals decommissioned *in situ*, seabed depressions, local rock placement, mattresses and grout bags also increase the potential for interaction with fishing gear. Demersal fishing gears which interact with the seabed are vulnerable to snagging. Snagging may lead to the loss or damage of catch or fishing gear and may result in vessel destabilisation in extreme circumstances. There have been of 15 fishing vessels sinkings due to snagged gear between 1989 and 2014 which resulted in 26 fatalities (MAIB, 2020). Generally, the patterns in interactions between oil and gas infrastructure and fishing gear are spatially concentrated in the muddy Northern North Sea (NNS) where demersal fisheries are generally concentrated. There are limited instances of such incidents occurring in the SNS (Rouse, Hayes and Wilding, 2018).

The PL310 between Sean Papa and Sean Romeo, and the PL311 trunkline will be decommissioned *in situ* with areas of exposure remediated. Over time the pipeline could become exposed due to natural sediment processes, thereby introducing the potential for snagging.

6.2.1.2 Physical presence of decommissioning vessels temporarily modifying access to fishing grounds

Fishing techniques vary across project area, from demersal trawl fisheries targeting offshore areas to shellfish fisheries closer to shore. Overall fishing effort is relatively low in the Sean Field and along the PL311. Fishing intensity is higher along the PL310 between the Sean platforms than at other points along the pipelines, though still low in relative regional terms (8-12 hours of fishing closest to Sean Romeo, Figure 3-8; MMO, 2020).

Vessel activities associated with the decommissioning will predominantly take place within the 500 m safety zones associated with the Sean platforms, which are exclusionary to fisheries. Decommissioning vessel activities may affect the aforementioned moderately higher intensity fishing in that area closest to Sean RD. However, the decommissioning activities and associated vessel presence will occur over a limited time period. Once the Sean platform topsides and supporting jacket structures have been removed, no remediation is planned along the PL310. Therefore, topside and jacket removal are the only activities with the potential to disrupt fisheries in the area. Extensive remedial works are not anticipated along most of the PL311 trunkline. Therefore, there is not likely to be such decommissioning vessel presence as to modify fishing ground availability in other regions of the project area. Ultimately, the physical presence of decommissioning vessels temporarily modifying access to fishing grounds will be constrained to the 500 m zones which will eventually be removed.

6.2.2 Effects on Sensitive Receptors

The risks generated by the physical presence of infrastructure decommissioned *in situ* and the presence of vessels in relation to project are assessed against their respective offshore and onshore receptors below.

6.2.2.1 Commercial Fisheries

Annual fishing effort in the Project area (ICES rectangles 34F1, 34F2 and 35F2) was low (0-50 days, Figure 3-5). Demersal catch was dominant in all but 43F1, where shellfish contributed the most to fisheries. Demersal catch includes trawl gears which interact with the seabed. Shellfish fisheries are associated with a more passive gear effort.

On review of demersal trawling activity in the North Sea, Rouse *et al.* (2017) found that a low percentage (0.93%) of demersal trawling trips specifically targeted oil and gas pipelines compared with surrounding areas. The PL310 experiences some increased fishing compared to the surrounding areas (Figure 3-8), but fishing effort is still relatively low (Figure 3-7, 0 – 500 hours on average per annum). The PL310 at the point closest to Sean Romeo (where it experiences higher fishing intensity), is buried to an average depth of 1 m. Along its entire length, the PL310 is buried to an average depth of 0.72 m (DeepOcean, 2020; Appendix B). The PL310 is considered suitably buried along its length, therefore it does not encourage use as artificial fisheries aggregation features, nor is it they likely to become exposed over time and present a snagging risk.

The available VMS data for trawling activity along pipelines indicates that fishing intensity across the PL311 is predominantly very low. Effort relating to mobile demersal gears (including trawling) was highest at the mid-point of the PL311 pipeline between KPs 60.0 and 90.0 (up to 1,500 hours annually, Figure 3-7 and Figure 3-8). The pipeline is trenched and buried to an average depth of 0.75 m along this section. Therefore, the area of trunkline which is exposed to the highest fishing intensity, albeit still low in the regional context, is presently stably buried to a depth considered safe for fisheries.

From the shore up until approximately KP 54.0, the PL311 was intentionally untrenched when installed. Past this point, the pipeline was trenched and buried. This change is visible in the DoB profiles of the pipeline (available in Appendix B). The average DoB for the entire length of the PL311 is 0.18 m (DeepOcean, 2020). This is largely owing to the presence of spans within this intentionally untrenched extent of pipeline. This section is also the part of the pipeline which experiences the lowest fishing intensity (Figure 3-7 and Figure 3-8), so much so that fishing effort in this location largely does not register (Figure 3-5). This could be due in part to the presence of multiple high density shipping routes between the shore and KP 50.0 (shown in Figure 3-3). Regardless of the areas use by commercial fisheries, the spans occurring within the area require remediation in order to minimise the potential for snagging events.

The spans along the PL311 which require remediation (as part of the base case activities) to be made FishSafe are between KP 14.0 and 17.0. At these locations, appropriate remediation in the form of rock placement will occur. The spans cover a length of 153 m but so as to ensure they do not grow over the coming years, rock will be placed along an area double the length of the existent spans (306 m). Rouse, Hayes and Wilding (2018) suggest that in dynamic regions such as the SNS, re-exposure and development of spans is continuous thus highlighting the importance of monitoring in such an environment. The same method has been applied to the optional span remediation locations; the span lengths total 216 m, but rock will be placed along 432 m. Any potential changes in burial status of either pipeline resulting in legacy impacts to commercial fisheries due to its degradation over time will be managed through continued monitoring and communication with relevant users of the sea, as detailed in Section 6.2.4 below.

Overall, the region experiences low fishing activity and effort. In the areas along the PL310 and PL311 where fishing intensity is slightly higher, the pipelines are stably buried to suitable depths. In the section of PL311 closest to the shore where the pipeline was intentionally laid untrenched, there are some spans which require remediation. This coincides with an area little used by commercial fisheries. Rock remediation over these spans will be overestimated in order to ensure that, in the future, the spans will not grow. Therefore, the decommissioning activities will only reduce the potential for snagging events to occur along a section of pipeline which attracts little commercial activity regardless. Therefore, snagging risks associated with the decommissioning of the pipelines *in situ* is minimal.

226 vessel days are associated with the proposed decommissioning activities. Given the relatively low fishing activity across the Sean Field relative to the wider UKCS and surrounding region in the SNS, the temporary loss of access to fishing grounds during decommissioning activities are not likely to have significant impacts on economic value of commercial fisheries operating within this region. Moreover, following decommissioning of the Sean Field platforms (as described above in Section 6.2.1.2), access to fishing grounds previously lost to the 500 m exclusion zones associated with the surface infrastructure will be restored. Existing controls on

decommissioning vessel movements across the project area, and the promulgation of Notices to Mariners (NtMs) assist with reducing the severity of such impacts to a minor disturbance of localised fishing operations. For these reasons, potential impacts associated with decommissioning vessel presence are considered negligible.

6.2.3 Cumulative and Transboundary Impacts

The Sean Field is located approximately 15 km from the UK / Netherlands border. As such, this region experiences higher levels of fishing by foreign vessels compared to other regions of the UKCS. Activity by fishing fleets of several non-UK nationalities may be recorded throughout the waters surrounding the Sean Field; the most common of which being Belgian and Dutch vessels which predominantly operate demersal gears (Vattenfall, 2019; MMO, 2020). Dutch vessels operating beam trawls are particularly prominent in the Sean Field equating to 50 – 100 days of effort per year, on average (Vattenfall, 2019). However, this is still moderate intensity overall considering the regional context.

In the wake of the decommissioning activities the seabed will be left in an overtrawlable condition, so no cumulative impacts to any UK and / or foreign fishing fleets, demersal or otherwise, are expected to result from the proposed activities. As mentioned previously, the removal of the 500 m safety zones around the Sean Field surface installations will be removed thereby increasing the available fishing grounds for commercial fishing fleets of all nationalities which have been granted access to fishing in the UKCS.

Due to the proximity of the proposed offshore windfarms, Norfolk Vanguard (25.3 km south of the PL311) and Norfolk Boreas (2.5 km from the Sean Field), there is potential for the shipping routes in the area to be constrained further. However, as the consenting process for the Vanguard windfarm is currently under review, offshore construction of the Vanguard windfarm is highly unlikely to coincide with the proposed Sean Field decommissioning activities.

Other oil and gas developments in the area may be undergoing decommissioning at the same time as the Sean Field. Regular vessel activities in relation to operations and maintenance are also likely to be ongoing over the duration of the proposed decommissioning activities. However, in all circumstances, these vessel activities are relatively short-term. An anticipated 256 days of vessel time, split across eight vessels, are likely to be required for the Sean decommissioning. More than one vessel is likely to be on site at any given time, and the vessel activities are not likely to differ from regular operation and maintenance vessel presence. Most of the vessel activity will be constrained to the Sean Field, from which the closest third party installation is 16.7 km. Therefore, vessel presence within the Sean Field does not present an additional impact on the availability of surrounding fishing and navigational area.

The nearest installations to the PL311 are as follows: the Leman D Complex and Camelot installations (all within ~3 km of the pipeline; Figure 3-4). Along the pipeline, the only activity will be in relation to the placement of rock. Of the other devlopments in the area, the wider Thames Decommissioning Project concluded in 2018 (Perenco, 2015) and the decommissioning of the Camelot installation ended in 2016, with close out reports having been issued (Energy Resource Technology, 2012). As these operations have concluded, there is very little opportunity for vessel presence due to the Sean decommissioning to act cumulatively with any other oil and gas vessel activity. Furthermore, as in Figure 6-1, the majority of the rock placement is close to shore and not in the vicinity of any other installations so there is little opportunity for spatial overlap between different project activities. Vessel presence due to project activities will be temporary, localised and not form a material change to existing vessel traffic levels in the vicinity of the project therefore there is no risk of cumulative impacts associated with the project.

6.2.4 Mitigation Measures

A number of mitigation measures will be employed to reduce the impact on other sea users:

> The Sean Field subsea infrastructure is currently shown on Admiralty Charts and the FishSafe system. Once decommissioning activities are complete, updated information (i.e. which infrastructure remains *in situ* and which has been removed) will be made available to allow the Admiralty Charts and the FishSafe system to be updated;

- Any exposed / cut flowline ends will undergo rock placement to ensure they are overtrawlable to active fishing gears;
- Any objects dropped during decommissioning activities will be removed from the seabed where appropriate;
- Clear seabed verification will ensure there is no residual risk to other sea users. Non-intrusive verification techniques will be considered in the first instance, but if deemed necessary, seabed clearance may require conventional overtrawl survey methods. Where there is evidence of residual snagging hazards (e.g. any spans, berms, dropped objects, etc.), then intervention in the form of overtrawling to re-level the seabed or the addition of rock placement will be implemented;
- The post-decommissioning survey will confirm the depth to which the *in situ* decommissioned infrastructure is buried below the seabed; and
- ONE-Dyas recognises its commitment to monitor any infrastructure decommissioned *in situ* and therefore intends to set up arrangements to undertake post-decommissioning monitoring. The frequency of the monitoring that will be required will be agreed with OPRED and future monitoring will be determined through a risk-based approach based on the findings from each subsequent survey. During the period over which monitoring is required, the status of the infrastructure decommissioned *in situ* would be reviewed and any necessary remedial action undertaken to ensure it does not pose a risk to other sea users.

6.2.5 Conclusion

Receptor	Impact Magnitude	Receptor Sensitivity	Receptor Vulnerability	Receptor Value
Commercial Fisheries	Low	Low	Negligible	Low
Justification				
The decommissioning of pipelines *in situ* should not pose an increased risk of snagging. The PL310 is considered suitably buried along its length. The PL311 spans occurring between KPs 14.0 and 17.0 will be remediated. These spans coincide with a section of pipeline closest to shore where fishing effort and intensity are lowest. There are no spans requiring remediation to be made FishSafe at other locations along the trunkline. Therefore, in areas where snagging has the greatest potential to occur there is little chance of interaction with fishing gear. Furthermore, any identified spans will be remediated appropriately during decommissioning, thereby reducing the potential for future snagging events. The proposed decommissioning activities will occur over a temporary time period, limiting vessel-related impacts across the project area. Furthermore, the activities will be mostly constrained to the 500 m safety zones surrounding the surface infrastructure. These zones are in place to provide safety to other sea users by limiting the possibility of collisions or interactions with surface infrastructure and include the exclusion of operational fishing vessels. Therefore, the ongoing presence of vessels during the decommissioning programme should have little additional impact on the area available to commercial fisheries. Once the decommissioning of the surface infrastructure is complete and activities have ceased, the 500 m zones associated with the Sean Field surface installations will be removed – this will return an area previously unavailable to commercial fisheries, both of UK and international origin. This positive outcome of decommissioning, in combination with the minimal snagging risk posed by the decommissioning of pipelines *in situ*, warrants the impact magnitude being ranked as **low**. Commercial fisheries are considered to be able to adapt or accommodate localised exclusions in the short-term, signifying **low** sensitivity to the proposed activities. While vessels carrying demersal gears are sensitive to snagging, the potential for such an event to occur following the decommissioning activities and legacy management and monitoring is minute, making the vulnerability of the receptor **negligible**. Finally, it is important to consider the value of the receptor in the context of the wider region. The waters in which the Sean Field and associated pipelines are located experience low to no UK demersal fishing effort, based on available fishing data. Landings value remains very low across the project area as well. While fishing effort and value of landings is higher when accounting for the Dutch fleet, in the wider regional context this is still moderate. Overall, the value of the area to commercial fisheries is considered **low**. Considering the above, the residual impact significance associated with the physical presence of infrastructure and vessels is considered to be **negligible**.				
Residual Impact Significance	Negligible			

7 CONCLUSION

7.1 Summary

The Sean Field is located in the SNS, approximately 94 km offshore. The Sean Field System consists of the Sean Papa installation formed of 2 bridge-linked platforms, a wellhead and compression platform (PD) and a production and accommodation platform (PP) and Sean Romeo (RD), an NPAI. Sean PP and RD are connected by the PL310 production flowline. The larger PL311 trunkline travels from Sean PP to the coast, ending at Bacton Terminal, North Norfolk.

A CA was completed to determine the decommissioning methods for all the items associated with the asset. The DP proposes to remove all installations (surface and subsea) within the Sean Field and decommission the PL310 and PL311 *in situ*, with rock remediation where required.

Following detailed review of the proposed decommissioning activities, the environmental sensitivities characteristic of the Sean Field area, industry experience with decommissioning activities, and consideration of stakeholder concerns, it was determined that potential project-related impacts to the seabed and commercial fisheries required further consideration. As the approach for the decommissioning of the Sean Field and associated infrastructure varies, the worst-case aspects from each method were considered and assessed in line with a tried and tested EA Methodology described in Section 4. The results are detailed in Section 6 and summarised below.

The Sean Field itself is not located within any protected sites and is remote from coastal sensitivities owing to its location 15 km from the Dutch border. The PL311 passes through five protected sites before reaching Bacton Terminal: Southern North Sea SAC; North Norfolk Sandbanks and Saturn Reef SAC; Haisborough, Hammond and Winterton SAC; Greater Wash SPA, and Cromer Shoal Chalk Beds MCZ (Figure 3-9). However, the proposed decommissioning activities only stand to potentially impact the Southern North Sea SAC, Haisborough, Hammond and Winterton SAC, and Greater Wash SPA, based on their inclusion of conservation features including or relating to benthic receptors. Rock remediation of the PL311 spans has the potential to directly, or indirectly impact the benthic habitat of the three conservation sites, of which the Haisborough, Hammond and Winterton SAC is designated for the seabed features (biogenic reef and sandbanks). *S. spinulosa*, which is able to generate the biogenic reefs associate with this site, is an ephemeral species and it is difficult to predict where their complex reef structures will be formed with any precision. Visual inspection of any rock remediation locations will make it possible to confirm if there are areas of pipeline which have the potential to interact with these biogenic reef formations directly. The species has moderate sensitivity to heavy smothering and abrasion and is considered likely to tolerate some loss of substrate as a result of localised rock placement. Due to the active sediment systems within the SNS, sandbanks are similarly likely to recover from any disturbance. The majority of the area of potential seabed impact calculated can be attributed to overtrawl. In practice, non-intrusive methods of clear seabed verification will be used in the first instance to determine the condition of the seabed post-decommissioning. Thus, the total area of direct and indirect impact reflected in this assessment forms a worst-case estimate and is likely an overestimate of the actual area of impact, following seabed clearance verification survey work. Despite this, the indirect impacts will be temporary in duration and will only cover a small area of biogenic reef and sandbanks, and an even smaller area of sandy substrate. In light of this, the impact of the decommissioning activities on the seabed, its associated features, and the protected sites, is expected to be **minor**.

The potential impacts identified to commercial fisheries were limited to the temporary loss of access to fishing grounds due to the presence of decommissioning vessels, and the potential for legacy impacts such as the snagging of fishing gears on flowlines decommissioned *in situ*. The PL310 is stably buried and where spans are located along the PL311 rock placement will take place to remediate this hazard. Fishing effort in the area is generally low. In areas where the PL311 spans are located, fishing effort and intensity is the lowest compared to any other point within the decommissioning area. Post-decommissioning, seabed clearance verification surveys and continued monitoring of the infrastructure decommissioned *in situ* will take place.

Existing mitigations and controls will ensure that the temporary decommissioning activities are limited both spatially and temporally. The activities will take place mostly within the 500 m safety zones. As such, the presence of vessels engaged in the decommissioning activities should present little additional impact with regards to fishing ground availability. Based on these observations, the temporary loss of fishing grounds

during decommissioning activities are not likely to have any significant impacts on the economic value of commercial fisheries operating in the area. The residual impacts to commercial fisheries from potential snag risk arising from the proposed decommissioning activities, and the modification of fishing grounds, is considered **negligible**.

In order to ensure that the environmental and societal impact of the decommissioning activities remains as low as reasonably practicable, ONE-Dyas will adhere to their in-house management procedures, including but not limited to contractor management, vessel inspections and audits and the legal obligation to report any accidental discharges and emissions which may occur. As the impact assessment in this report details, the decommissioning of the Sean Field and associated pipelines is unlikely to have a significant impact on the environment of other users (both offshore and onshore) if the control and mitigation measures are applied effectively (as listed in Section 5.3).

7.2 Final Remarks

This EA has considered the objectives and marine planning policies of the East Inshore and East Offshore Marine Plans across the range of relevant policy topics. ONE-Dyas considers that the proposed decommissioning activities are in alignment with such objectives and policies.

Based on the findings of this EA, including the identification and subsequent application of appropriate mitigation measures and Project management according to ONE-Dyas' HSEQ Policy and EMS, it is considered that the proposed decommissioning activities do not pose any threat of significant impact to environmental or societal receptors within the UKCS or internationally.

8 REFERENCES

Aires, C., González-Irusta, J.M., Watret, R. (2014) Updating Fisheries Sensitivity Maps in British Waters. Scottish Marine and Freshwater Science Vol 5 No 10. Edinburgh: Scottish Government, 88pp. DOI: 10.7489/1555-1.

BEIS (2018). Decommissioning of Offshore Oil and Gas Installations and Pipelines. Available online at: https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines [Accessed on 23/09/2020].

BEIS (2019). 2017 UK Greenhouse Gas Emissions, Final Figures. Statistical Release: National Statistics. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/776085/2017_Final_emissions_statistics_-_report.pdf [Accessed on 23/09/2020].

BEIS (2020). The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended) – A Guide. May 2020 – Revision 6

Benthic Solutions (2016). Welland Post-Decommissioning Environmental Survey, Volume 4 - Full Environmental Baseline Report, Bibby HydroMap Project No. 2016-033, Perenco UK Ltd.

Cefas (2001). Contaminant Status of the North Sea: Strategic Environmental Assessment – SEA2 (Department of Trade and Industry, DTI). Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/197352/TR_SEA2_Contamination.pdf [Accessed 10/09/2020]

Cefas (2006). Scroby Sands Offshore Wind Farm – Coastal Processes Monitoring. Client: Department of Trade and Industry. Contract AE0262.

Cerniglia, C. E. (1992). Biodegradation of polycyclic aromatic hydrocarbons. Biodegradation, 3, 351–368.

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester

Coull, K., Johnstone, R. & Rogers, S. (1998). Fisheries Sensitivity Maps in British Waters, Published and distributed by UKOOA Ltd. Available online at https://www.cefas.co.uk/media/52612/sensi_maps.pdf

Cox, P. and Gerrard, S. (2001). The Environmental Assessment of Southern North Sea Pipeline Decommissioning. Centre for Environmental Risk Report, August, 2001.

DECC (2016). UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3). Available online at: https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-3-oesea3 [Accessed on 23/09/2020].

Decom North Sea (2018). Environmental Appraisal Guidelines: Offshore Oil and Gas Decommissioning. Available at: https://decomnorthsea.com/about-dns/projects-update/environmental-appraisal-guidelines [Accessed on 23/09/2020].

DeepOcean (2020). ONE-Dyas Pipeline Inspection 2020: Volume 1 Pipeline Inspection Report. Doc no NO.E11272-SUR-REP-001)

Ellis, J.R., Milligan, S., Readdy, L., South, A., Taylor, N. & Brown, M. (2012). Mapping the spawning and nursery grounds of selected fish for spatial planning. Report to the Department of Environment, Food and Rural Affairs from Cefas. Defra Contract No. MB5301, Available online at https://www.cefas.co.uk/publications/techrep/TechRep147.pdf

EMODnet (2019). Seabed Habitats. Available online at: https://www.emodnet-seabedhabitats.eu/ [Accessed 28.01.2020]

Energy Resource Technology (2012). Camelot CA Platform, Camelot CA Pipelines, Camelot CB Pipelines Decommissioning Programmes. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/255075/Camelot_dp.pdf

Eni Hewett (2020). Hewett Platforms Decommissioning Environmental Appraisal. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/899051/ENIUK_805479_Environmental_Appraisal_Platforms_Hewett_Consultation_Final.._.pdf [Accessed 29.03.2021]

European Environment Agency (2019). Factsheet: Deep circalittoral sand. Available online: https://eunis.eea.europa.eu/habitats/2731 [Accessed 23.09.2020]

FAO (2019). Fishing gear types – beam trawls. Available at http://www.seafish.org/geardb/gear/beamtrawl/ [Accessed 19/09/2020].

Fugro (2011). Environmental Monitoring Survey Sean P UKCS Blocks 49/25a, FSLTD Report No: 00646.2V1.2, Shell UK Ltd.

Fugro (2016). Petrofac Subsea Inspection Campaign, Structures (OneBV) Geophysical Survey Results, Report No: 160878/003.

Gardline (2014). UKCS Block 53/02 Leman SW, Debris Search Survey, Project Number: 10001, Client Reference: PUK/06/1236, Perenco UK Ltd.

Gubbay, S. (2003). Marine aggregate extraction and biodiversity. Information, issues and gaps in understanding. Report to the Joint Marine Programme of the Wildlife Trusts and WWF-UK.

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. and Øien, N. (2017). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Available online at: https://synergy.st-andrews.ac.uk/scans3/files/2017/05/SCANS-III-design-based-estimates-2017-05-12-final-revised.pdf

Hebridean Whale and Dolphin Trust (HWDT) (2018). Hebridean Marine Mammal Atlas. Part 1: Silurian, 15 years of marine mammal monitoring in the Hebrides. A Hebrideam Whale and Dolphin Trust Report, Scotland, UK. 60pp.

Hill, J. M., Marzialetti, S. and Pearce, B. (2011). Recovery of Seabed Resources Following Marine Aggregate Extraction. Marine ALSF Science Monograph Series No. 2. MEPF 10/P148. (Edited by R.C. Newell & J. Measures). 44pp. ISBN: 978 0 907545 45 3

Hoare, R. and Hiscock, K. (1974). An ecological survey of the rocky coast adjacent to a bromine extraction works. Estuarine and Coastal Marine Science, 2(4): 329-336.

Holland, G. J., Greenstreet, S. P. R., Gibb, I. M., Fraser, H. M. & Robertson, M. R. (2005). Identifying sandeel Ammodytes marinus sediment habitat preferences in the marine environment. Marine Ecology Progress Series, 303: 269–282.

Holt, T.J., Rees, E.I., Hawkins, S.J. and Seed, R. (1998). Biogenic Reefs (volume IX). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project), 170 pp.

HR Wallingford (2002). Southern North Sea Sediment Transport Study – Phase 2. Sediment Transport Report. Prepared for Great Yarmouth Borough Council by HR Wallingford in association with CEFAS/UEA, Posford Haskoning and Dr B D'Olier. Report EX4526, HR Wallingford, August 2002.

HSE (Health and Safety Executive) (1997). The abandonment of offshore pipelines: Methods and procedures for abandonment. Offshore technology report. HSE Books, Norwich. ISBN -7176-1421-2.

IEMA (2015) Environmental Impact Assessment Guide to: Shaping Quality Development. Available online at: https://www.iaia.org/pdf/wab/IEMA%20Guidance%20Documents%20EIA%20Guide%20to%20Shaping%20Quality%20Development%20V6.pdf

IEMA (2016). Environmental Impact Assessment Guide to: Delivering Quality Development. Available online at: https://www.iema.net/assets/newbuild/documents/Delivering%20Quality%20Development.pdf

Institute of Petroleum (IoP) (2000). Guidelines for the calculation of estimates of energy use and gaseous emissions in the decommissioning of offshore structures. Institute of Petroleum, 2000.

Jackson, A. and Hiscock, K. (2008). *Sabellaria spinulosa* Ross worm. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 29-03-2021]. Available from: https://www.marlin.ac.uk/species/detail/1133

JNCC (2009). Designated Offshore SACs and Candidate SACs. Available online at http://www.jncc.gov.uk/page-4534.

JNCC (2010). Offshore Special Area of Conservation: North Norfolk Sandbanks and Saturn Reef SAC Selection Assessment . Version 4.0 (Aug-2010). Available online: http://jncc.defra.gov.uk/pdf/NNSandbanksAndSaturnReef_SAC_SAD_5.0.pdf. [Accessed 27/04/2020].

JNCC (2015a). Seabird Oil Sensitivity Index. Available online at: http://archive.jncc.gov.uk/default.aspx?page=7373

JNCC (2015a). Natura 2000 – Standard Data Form: Breydon Water SPA. Available online at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9009181.pdf [Accessed 27/04/2020]

JNCC (2017a). Conservation objectives for North Norfolk Sandbanks and Saturn Reef Special Area of Conservation. Available online at: http://data.jncc.gov.uk/data/d4c43bd4-a38d-439e-a93f-95d29636cb17/NNSSR-2-Conservation-Objectives-v1.0.pdf [Accessed on 28.09.2020]

JNCC (2017b). JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys. Available online at: http://data.jncc.gov.uk/data/e2a46de5-43d4-43f0-b296-c62134397ce4/jncc-guidelines-seismicsurvey-aug2017-web.pdf [Accessed on 06/09/2020].

JNCC (2017c). Natura 2000 – Standard Data From: North Norfolk Sandbanks and Saturn Reef SAC. Available online at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030358.pdf [Accessed 28.09.2020]

JNCC (2017d). Natura 2000 – Standard Data From: Haisborough, Hammond and Winterton SAC. Available online at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030369.pdf [Accessed 28.09.2020]

JNCC (2018). Natura 2000 – Standard Data From: Greater Wash SPA. Available online at: https://jncc.gov.uk/jncc-assets/SPA-N2K/UK9020329.pdf [Accessed 29.09.2020]

JNCC (2019a). Harbour Porpoise (*Phocoena phocoena*) Special Area of Conservation: Southern North Sea Conservation Objectives and Advice on Operations. Avalilable online: http://data.jncc.gov.uk/data/206f2222-5c2b-4312-99ba-d59dfd1dec1d/SouthernNorthSea-conservation-advice.pdf [Accessed 28.09.2020]

JNCC (2019b). Natura 2000 – Standard Data From: Southern North Sea SAC. Available online at: https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030395.pdf [Accessed 28.09.2020]

JNCC (2020a). Southern North Sea SAC. Available online at https://sac.jncc.gov.uk/site/UK0030395

JNCC (2020b). Haisborough, Hammond and Winterton SAC. Available online at https://sac.jncc.gov.uk/site/UK0030369

JNCC (2020c). The Wash and North Norfolk Coast SAC. Available online at: https://sac.jncc.gov.uk/site/UK0017075 [Accessed 08.10.2020]

Kennish, M. J. (1997). Pollution Impacts on Marine Biotic Communities. CRC Press LLC, USA, ISBN 0-8493-8428-1.

Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, J. L., Ried, B. J., (2010). An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs. ISSN; 0963-8091. JNCC report No.431

MAIB. (2020). Marine Accident Investigation Branch (MAIB). Available online at: https://www.gov.uk/government/organisations/marine-accident-investigation-branch [Accessed 22.09.2020]

Mazik, K., Strong, J., Little, S., Bhatia, N., Mander, L., Barnard, S. & Elliott, M. (2015). A review of the recovery potential and influencing factors of relevance to the management of habitats and species within Marine Protected Areas around Scotland. Scottish Natural Heritage Commissioned Report No. 771. Available online at http://www.snh.org.uk/pdfs/publications/commissioned_reports/771.pd

Meador, J.P, Stein, J.E, Reichert, W.L, and Varanasi, U. (1995). Bioaccumulation of polycyclic aromatic hydrocarbons by marine organisms. Rev. Environ. Contam. Toxicol., 143, 79-165.

MMO (2020). UK sea fisheries annual statistics report 2019. Available online at https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2019 [Accessed 28/09/2020].

MPE (Ministry of Petroleum and Energy) (1999). The Final Disposal of Disused Pipelines and Cables. Summary of the Findings of a Norwegian Assessment Programme. Oslo, December, 1999.

Natural England (1984). Mundesley Cliffs SSSI. Available online at https://designatedsites.naturalengland.org.uk/sitedetail.aspx?SiteCode=S1003572&SiteName=&countyCode=&responsiblePerson=&unitId=&SeaArea=&IFCAArea=. [Accessed 27/04/2020].

Natural England (1985). https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S1001304&SiteName=burgh&countyCode=&responsiblePerson=. [Accessed 27/04/2020].

Natural England (1993). Sidestrand and Trimingham Cliffs SSSI. Available online at https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S1003919&SiteName=stra&countyCode=&responsiblePerson=. . [Accessed 27/04/2020].

Natural England (1999). Paston Great Barn SSSI. Available online at https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S2000408&SiteName=&countyCode=29&responsiblePerson=&SeaArea=&IFCAArea=. [Accessed 27/04/2020].

Natural England (2016a). Natural England Conservation advice for Marine Protected Areas Cromer Shoal Chalk Beds MCZ. Available online at: https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UKMCZ0031&SiteName=cromer&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&HasCA=1&NumMarineSeasonality=0&SiteNameDisplay=Cromer%20Shoal%20Chalk%20Beds%20MCZ. [Accessed 27/04/2020].

Natural England (2016b). European Site Conservation Objective for Greater Wash SPA Available online at http://publications.naturalengland.org.uk/publication/4597871528116224 [Accessed 27/04/2020].

Natural England (2017) Outer Thames Estuary SPA. Available online at: https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK9020309&HasCA=1&NumMarineSeasonality=3&SiteNameDisplay=Outer%20Thames%20Estuary%20SPA [Accessed 27/04/2020].

NMPI (2020). National Marine Plan Interactive. Available at: http://www.gov.scot/Topics/marine/seamanagement/nmpihome [Accessed 23/09/2020].

Norfolk Wildlife Trust (2020). Wildlife in Norfolk: Grey Seal. Available online at: https://www.norfolkwildlifetrust.org.uk/wildlife-in-norfolk/species-explorer/mammals/grey-seal [Accessed 08.10.2020]

North Norfolk District Council (2012). Shoreline Management Plan 6: 6.10 Bacton Terminal. Available online: http://www2.north-norfolk.gov.uk/smp6/files/SMP6_Individual/SMP6%20%20-%20Chapter%205%20-%20Policy%20Unit%20-%206.10%20Bacton%20Gas%20Terminal.pdf [Accessed 23.09.2020]

OGUK (2013). Long term Degradation of Offshore Structures and Pipelines Decommissioned and left in Situ, Oil and Gas UK. February 2013.

Oil and Gas Authority (2016). Information of levels of shipping activity. 29th Offshore Licensing Round information and resources. Available online at https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/offshore-licensing-rounds/#tabs [Accessed 27/04/2020].

Oil and Gas Authority (2019). 32nd Offshore Licensing Round – Other Regulatory Issues. Available online at: https://www.ogauthority.co.uk/media/6047/other-regulatory-issues_sept-05-2019.pdf [Accessed 27/04/2020].

ONE-Dyas (2016). Sean Freespan Rock Dump Campaign: EIA Justification. Oranje Nassau Energie B.V. (Doc no. A-301834-S00-PERM-001)

ONE-Dyas (2018). Sean Field System Oil Pollution Emergency Plan (OPEP). Doc no. ONE_UK-25-1-PG-00083-0-01

ONE-Dyas (2020). Sean Field Decommissioning Programme. Report No. A400309-S00-REPT-004, October 2020.

Orbis Energy Ltd (2014). Thames Energy Decommissioning Environmental Impact Assessment, Doc Ref: PER-SNS-DECOM-THA-005, Perenco UK Ltd and Tullow Oil SK Limited.

Perenco (2015). Thames Complex Decommissioning Programmes. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/473068/Thames_Area__Thames_Complex_DP.pdf

Reid, J., Evans, P. & Northridge, S., (2003). An atlas of cetacean distribution on the northwest European Continental Shelf, Joint Nature Conservation Committee: Peterborough.

Rockwater (1990). As-Built Report: Sean PP – SSV Assembley Data Book Part 1, Volume 3. Doc no. RW/SSV/GPR/024

Rogers, C.S. (1990). Reponses of coral reefs and reef organisms to sedimentation. Marine Ecology Progress Series, 62, 185 – 202.

Rouse, S., Kafas, A., Catarino, R., and Hayes, P. (2017). Commercial fisheries interactions with oil and gas pipelines in the North Sea: considerations for decommissioning, ICES Journal of Marine Science, 75(1): 79–286.

Rouse, S., Hayes, P. and Wilding, T. (2018). Commercial fisheries losses arising from interactions with offshore pipelines and other oil and gas infrastructure and activities. ICES Journal of Marine Science, 77(3), pp.1148-1156.

Royal HaskoningDHV (2018). Bacton to Walcott Coastal Management Scheme, Environmental Statement Non-Techincal Summary, North Norfolk District Council, Shell U.K. Ltd.

RPS Energy (2010). Bacton Storage Company Limited Baird Gas Storage Project, Offshore Environmental Statement – Non-Technical Summary (BSCL Document Ref No.: BD-017-EV-RPT-003, DECC Ref No.: D/3979/2008)

RSPB (2021). Common scoter: Key Information. Available online: https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/common-scoter/ [Accessed 30.03.2021]

Russell, D. F., Jones, E. L., Morris, C. D. (2017). Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals, Scottish Marine and Freshwater Science Report Vol 8 No 25. Available at: https://data.marine.gov.scot/dataset/updated-seal-usage-maps-estimated-sea-distribution-grey-and-harbour-seals [Accessed 01.09.2020]

Scientific Committee on Seals (SCOS) (2018). Scientific Advice on Matters Related to the Management of Seal Populations: 2018. Available online: http://www.smru.st-andrews.ac.uk/files/2019/05/SCOS-2018.pdf [Accessed 23.09.20]

Shell (2015). Leman BH Decommissioning Project: Environmental Impact Assessment. (Doc no. Shell: LBT-SH-HX-0702-00003-001.)

SMRU (Sea Mammal Research Unit) (2011). Utilisation of space by grey and harbour seals in the Pentland Firth and Orkney waters, Scottish Natural Heritage Commissioned Report No. 441.

Statutory Nature Conservation Bodies (SNCBs) (2020). Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wales & Northern Ireland). Report by JNCC, Natural England and DAERA. June, 2020.

Thompson, P., Mcconnell, B., Tollit, D., Mackay, A., Hunter, C. and Racey, P. (1996). Comparative Distribution, Movements and Diet of Harbour and Grey Seals from Moray Firth, N. E. Scotland. The Journal of Applied Ecology, 33(6), p.1572.

Tillin, H.M., Marshall, C. & Gibb, N. (2018). [Sabellaria spinulosa], didemnids and other small ascidians on tide-swept moderately wave-exposed circalittoral rock. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: https://www.marlin.ac.uk/habitat/detail/348 [Accessed 23.09.2020]

Tyler-Walters H. and Hiscock K. (2004) (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom.

UK Biodiversity Group (1999). UK Biodiversity Group Tranche 2 Action Plans - Volume V: Maritime species and habitats. English Nature, Peterborough, 211 pp.

Vattenfall (2019). Norfolk Boreas Offshore Wind Farm Environmental Statement, Chaper 14: Commerical Fisheries. Available online: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000400-6.1.14%20Environmental%20Statement%20Chapter%2014%20Commercial%20Fisheries.pdf [Accessed 30.10.20]

Vattenfall (2020). Vattenfall in Norfolk, Norfolk Vanguard and Norfolk Boreas Indicative Timeline. Available online: https://group.vattenfall.com/uk/what-we-do/our-projects/vattenfallinnorfolk/norfolk-vanguard [Accessed 28.09.2020]

Walker, A. J. M. and Rees, E. I. S. (1980). Benthic ecology of Dublin Bay in relation to sludge dumping: fauna.

Webb, A., Elgie, M., Irwin, C., Pollock, C. & Barton, C. (2016). Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK. Document No HP00061701. Available online at http://jncc.defra.gov.uk/page-7373

APPENDIX A INFRASTRUCTURE INVENTORY

Sean Field Inventory

Surface Installations:

The Sean platforms have associated risers. They will be removed as one item along with the jacket. Their weights have been accounted for in the following table.

Name	Facility Type	Location (ED1950 Z31 N)	Topsides / Facilities			Jacket		
			Weight (Te)	No. of modules	Weight (Te)	No. of legs	No. of piles	Weight of piles (Te)
Sean PP	Production Platform	53° 11' 21" N 02° 51' 42" E	6,018	6	1,374	8	8	1,832
Sean PD	Wellhead Platform	53° 11' 23" N 02° 51' 45" E	3,986	3	1,076	6	6	1,283
PP – PD	Bridge Link	-	181	1	-	-	-	-
Sean RD	Wellhead Platform	53° 13' 34" N 02° 49' 39" E	2,216	2	1,128	6	4	1,125

Pipelines, Umbilical and Cable:

ID	Description	OD (")	Length (km)
PL310	20-in Export Pipeline	20	4.858
PL311	30-in Export Pipeline	30	106.502
S0813	SSIV Umbilical	4	0.4
S0803	Power Cable	1	4.89

Spools:

ID	Description	OD (")	Length (m)
PL310	20" Riser Tie-In Spool Sean RD to 20" Gas Export Pipeline PL310	20	40
PL310	20" Riser Tie-In Spool Sean PD from 20" Gas Export Pipeline PL310	20	48
PL311	30" Riser Tie-In Spool Sean PP to 30" Gas Export Pipeline PL311	30	52.3

Subsea Installations:

Description	Number	Length (m)	Width (m)	Height (m)	Weight (te)
SSIV	1	14	10	7	110
Mooring Buoys	2	4 (diameter)		2	35 (each)

Protection / Stabilisation

20 concrete mattresses in the Sean Field:

- 14 in the Sean Field (associated with the SSIV);
- 6 mattresses along the PL310 and PL311;
- 1 known mattress associated with third-party crossings along the PL311 which will be decommissioned *in situ*; and
- Assumed standard dimensions: 6 m x 3 m (4.716 Te in air).

95 grout bags in the Sean Field:

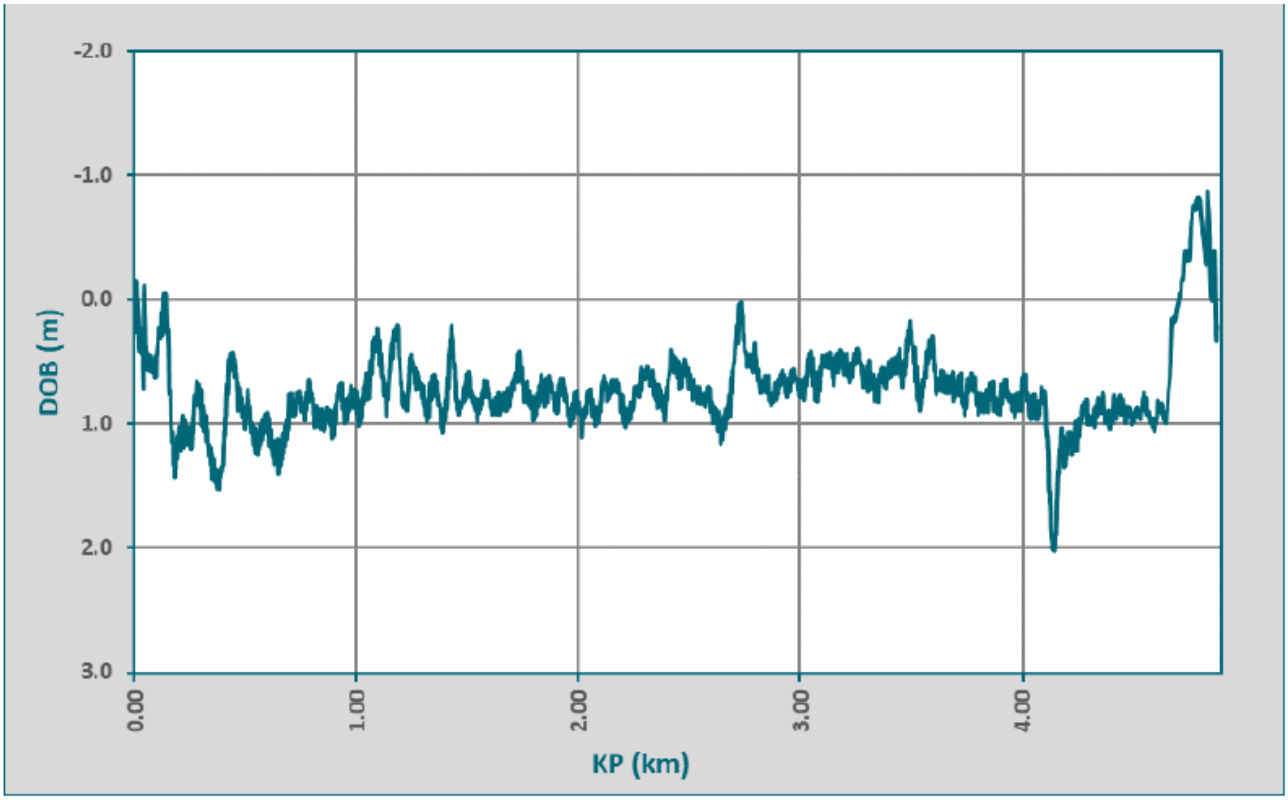
- All associated with the SSIV umbilical; and
- Assumed standard dimensions: 0.6 m x 0.3 m (25 kg in air).

APPENDIX B DEPTH OF BURIAL SUMMARY

Sean RD to Sean PD (PL310) DoB (from DeepOcean, 2020)

The following DoB profile has been taken from the DeepOcean (2020) pipeline inspection report. PL310 is stably buried to an average depth of 0.72 m. The pipeline was exposed for 38m adjacent to Sean RD Platform and the pipeline/spool exposed for 69m adjacent to Sean PD Platform. The exposed sections are proposed to be recovered as part of the tie-in spool recovery. The pipeline/spool were found to be well supported on the seabed and no freespans were observed.

PL 311 Burial Events Summary					
Category	Number of events	Min. Length (m)	Max. Length (m)	Total Length (m)	Percentage of Survey Length
Free Spans	73	1	40	779	0.7
Exposures	971	1	1110	30263	28.9
Depth of Burial	N/A	-3.85	3.37	N/A	N/A



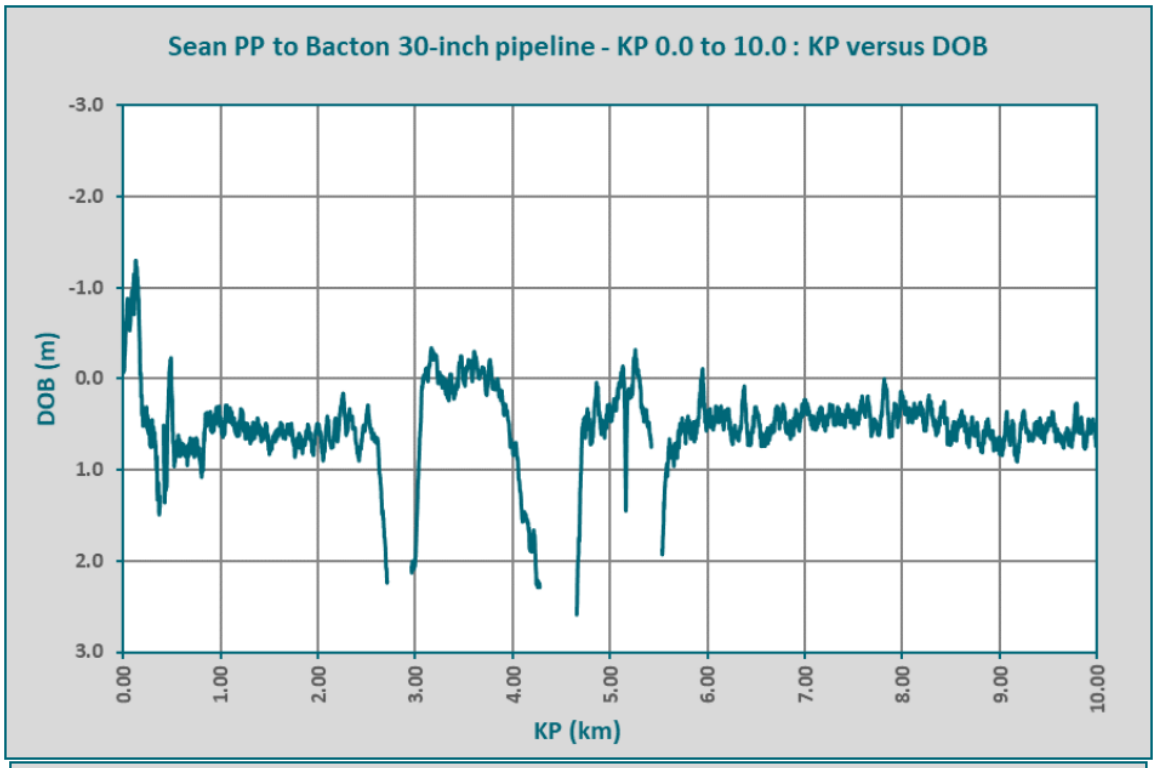
Sean PP to Bacton Terminal Trunkline (PL311) DoB (from DeepOcean, 2020)

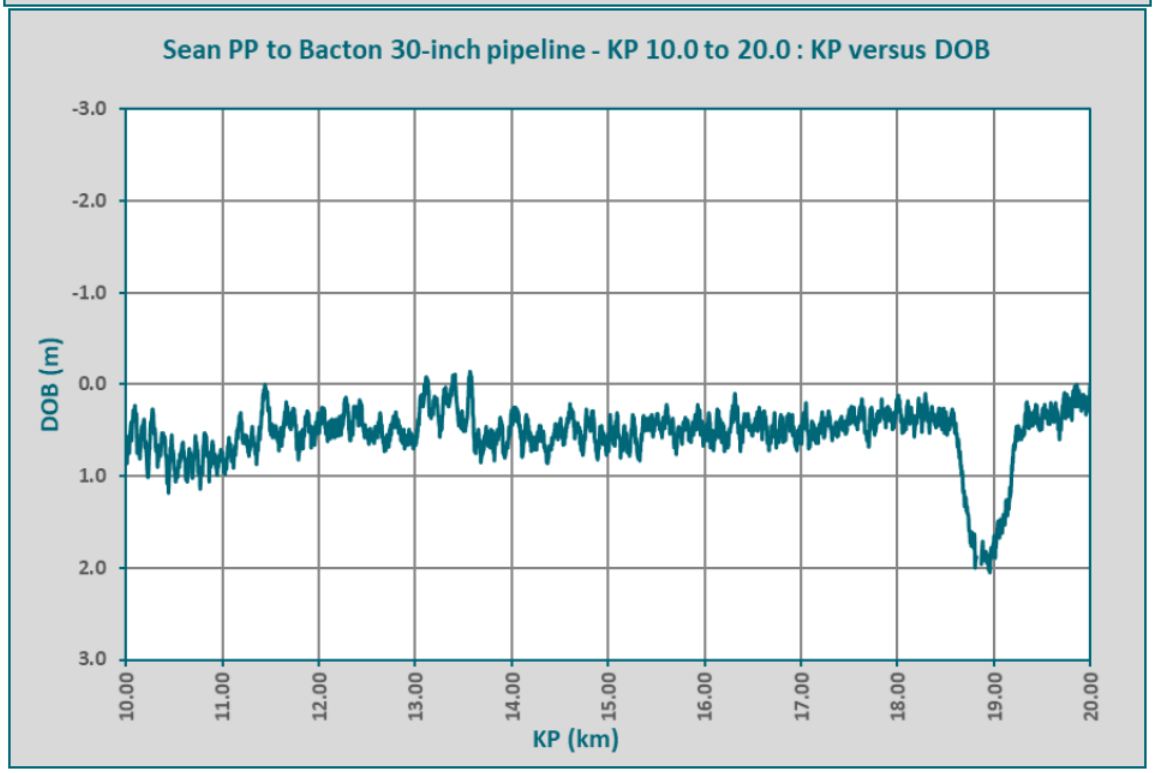
The following DoB profiles have been taken from the DeepOcean (2020) pipeline inspection report. The KP points in the following figures are ordered from KP 0.0 at the Sean PP platform, increasing to shore. This is in contrast to the figures discussed throughout this EA (which treat the shore as KP 0.0) and align with historical installation schematics. A DoB profile is presented for every 10 km stretch of the PL311, starting at the Sean PP platform:

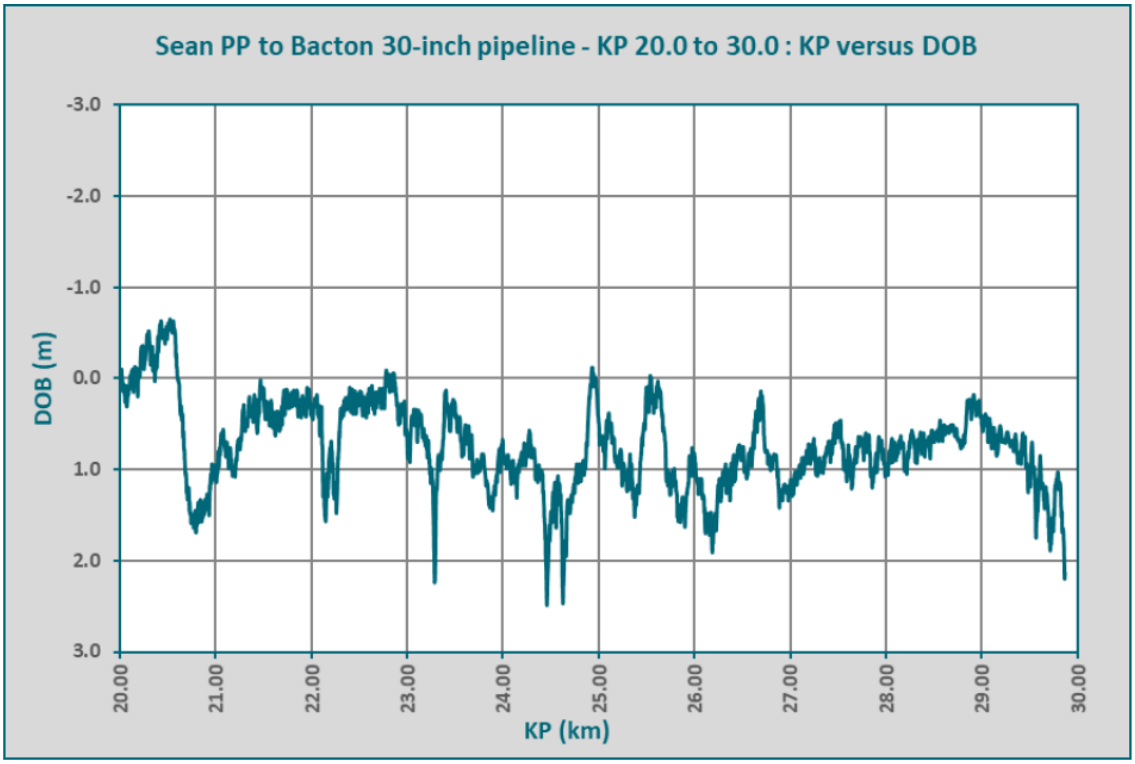
PL 311 Burial Events Summary					
Category	Number of events	Min. Length (m)	Max. Length (m)	Total Length (m)	Percentage of Survey Length
Free Spans	73	1	40	779	0.7
Exposures	971	1	1110	30263	28.9
Depth of Burial	N/A	-3.85	3.37	N/A	N/A

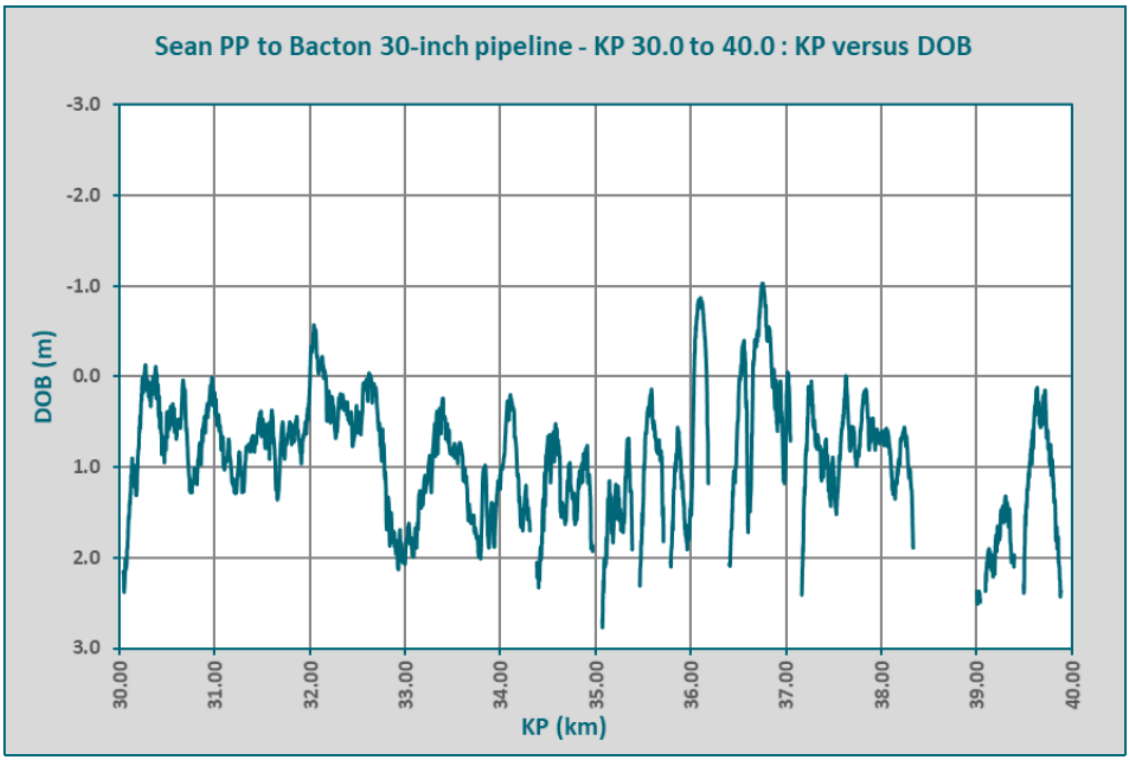
PL311 was intentionally surface laid from the shore to KP 54.0 at the time of installation, with exception of a 7 km section between KP 1.0 and KP 8.0 which is suitably trenched and naturally buried. From KP 54.0 and to Sean PP the pipeline is also suitably trenched and naturally buried. The surface laid sections have been stable for many years; however, in 2016, five locations were identified for placement of rock remediation between KP11.0 and 15.0. Recent survey data (DeepOcean, 2020) suggests further exposures have been generated by hydrographic sediment movement within and to the east of this previously remediated area (between KP14.0 and 17.0). A remediation scope of work and deposit consent request has been prepared to remediate 20 spans along PL311 [Note 1], of these six are of a size considered to be in exceedance of FishSafe[Note 2]criteria and shall be remediated as a priority. Presence of further spans or exposures will be investigated during the pre-decommissioning survey and will be remediated following discussion and agreement from OPRED prior to decommissioning.

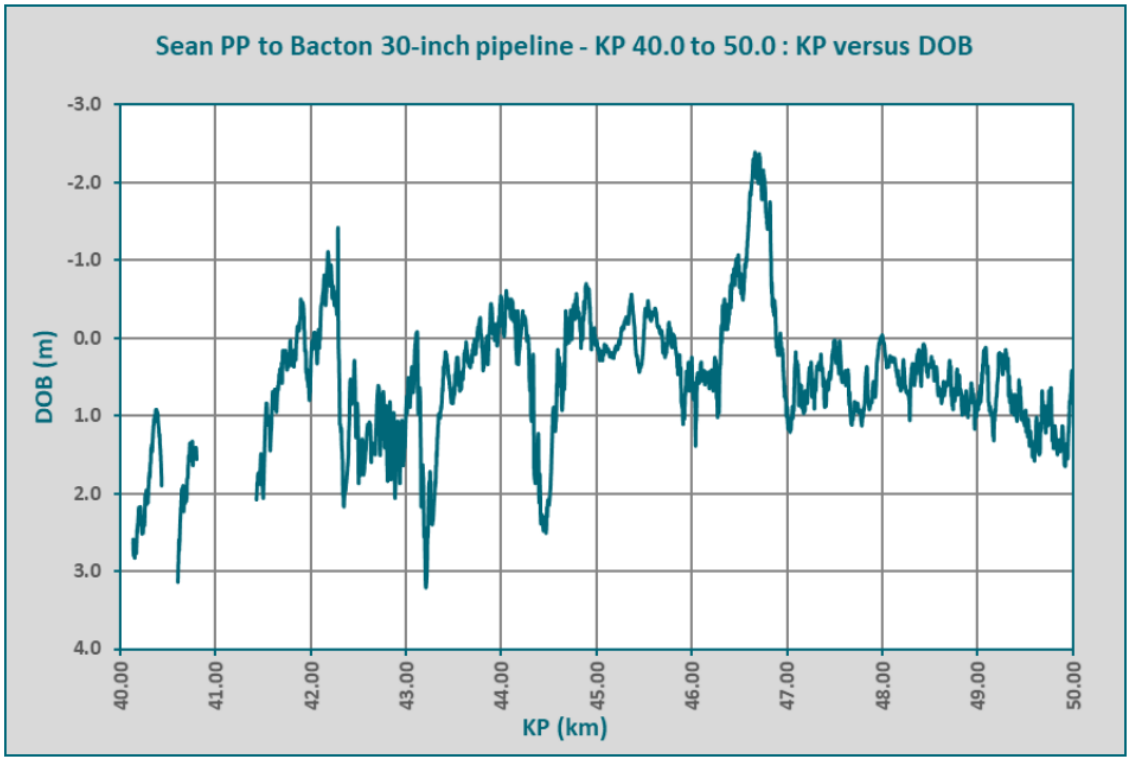
Note 1: Remediation of all 20 locations has now been successfully achieved as part of a June 2021 Rock Remediation Campaign
Note 2: FishSafe spans are defined as spans in excess of 0.8 m in height from the top of the pipeline and ≥10 m in length which therefore present a potential hazard to fishing activity.

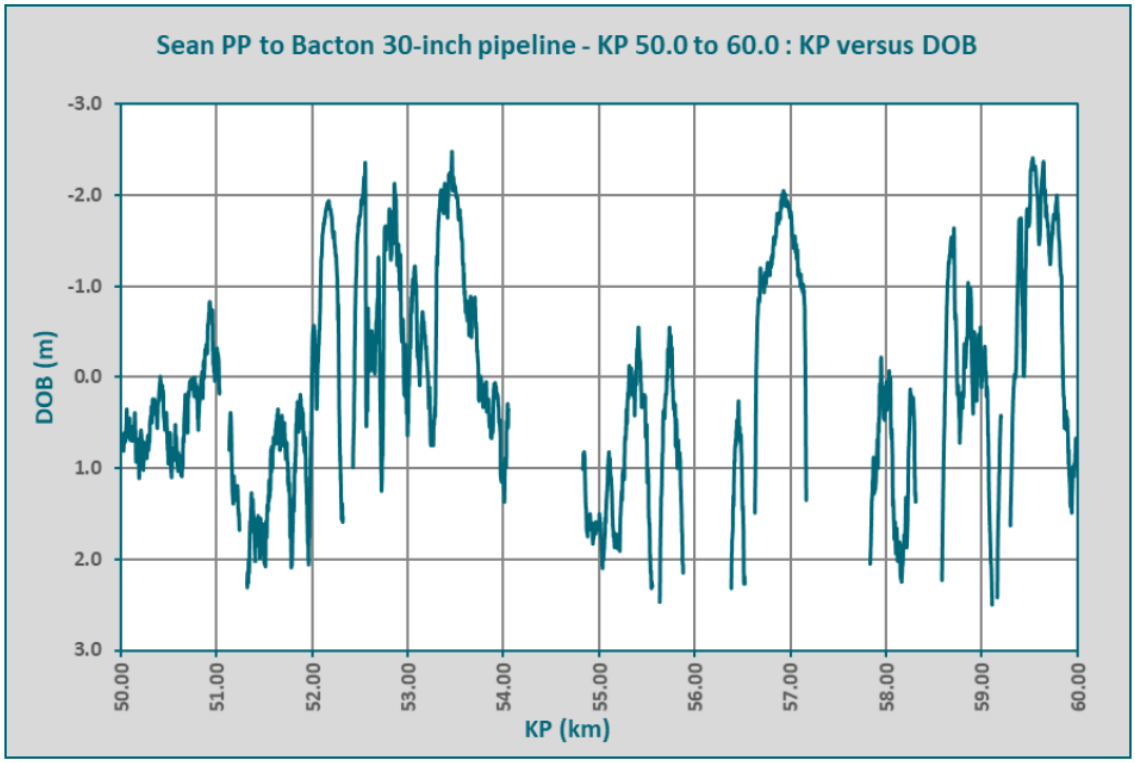

Sean PP to Bacton 30-inch pipeline - KP 0.0 to 10.0 : KP versus DOB
DOB (m)
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
KP (km)

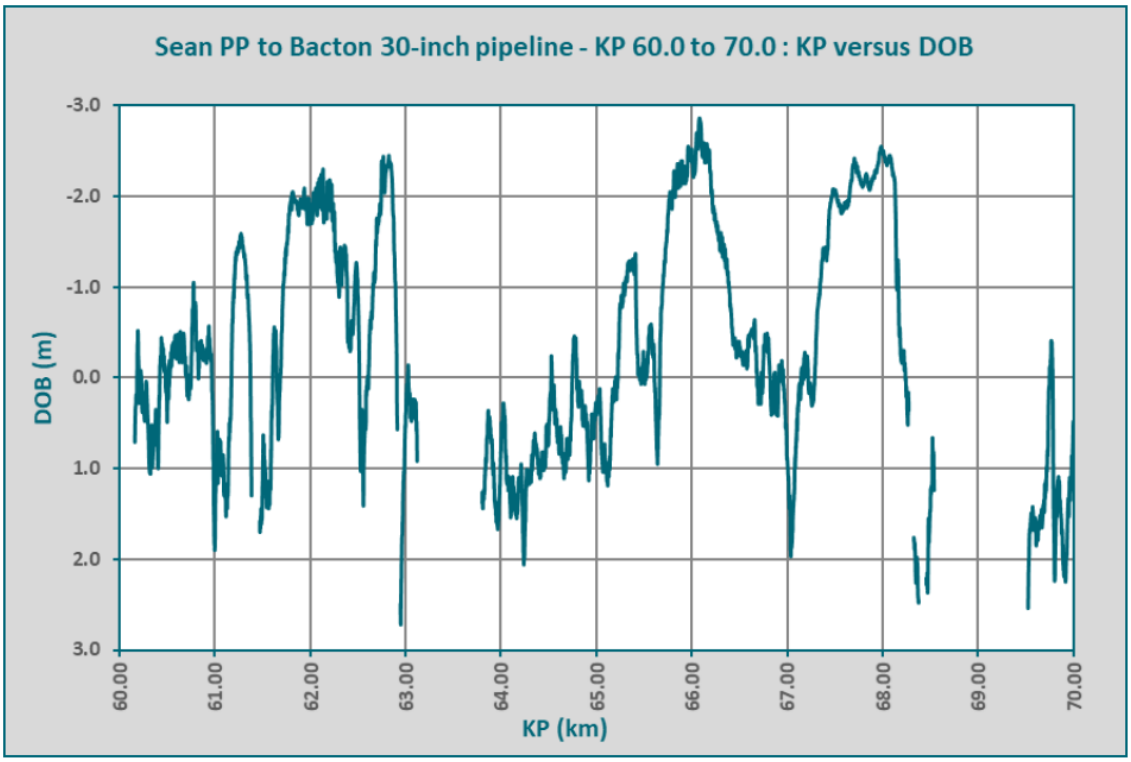

Sean PP to Bacton 30-inch pipeline - KP 10.0 to 20.0 : KP versus DOB
DOB (m)
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
10.00
11.00
12.00
13.00
14.00
15.00
16.00
17.00
18.00
19.00
20.00
KP (km)

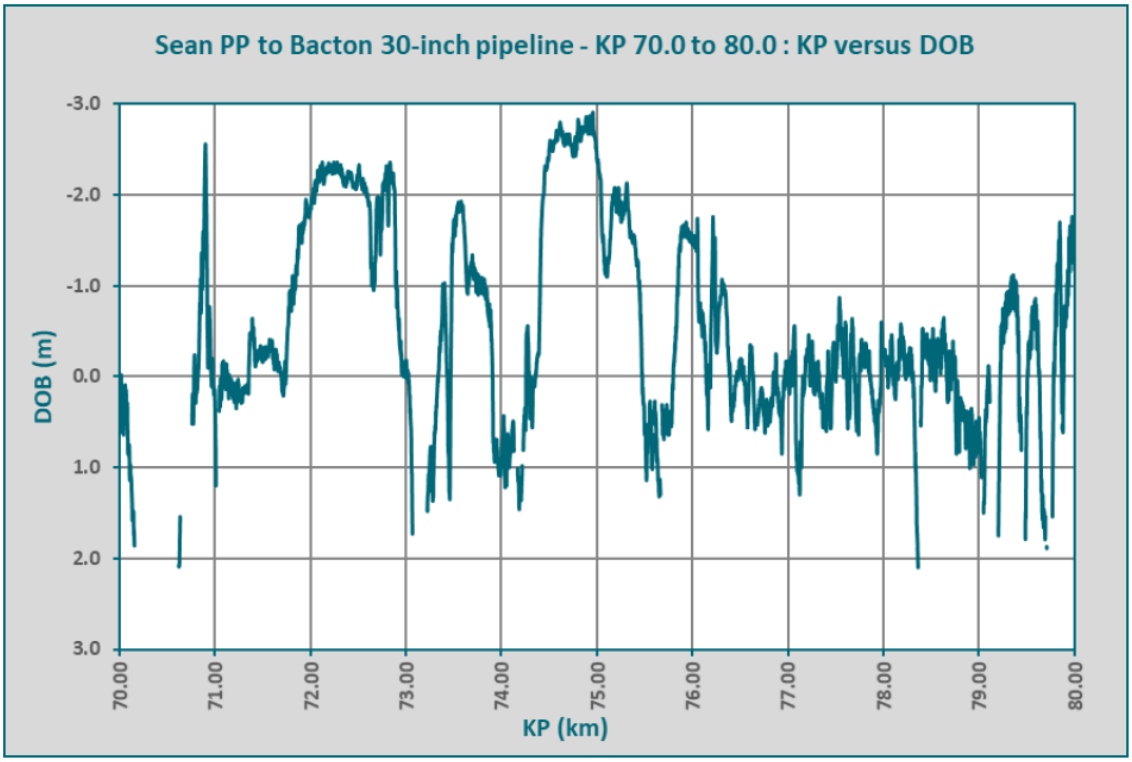

Sean PP to Bacton 30-inch pipeline - KP 20.0 to 30.0 : KP versus DOB
DOB (m)
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
20.00
21.00
22.00
23.00
24.00
25.00
26.00
27.00
28.00
29.00
30.00
KP (km)

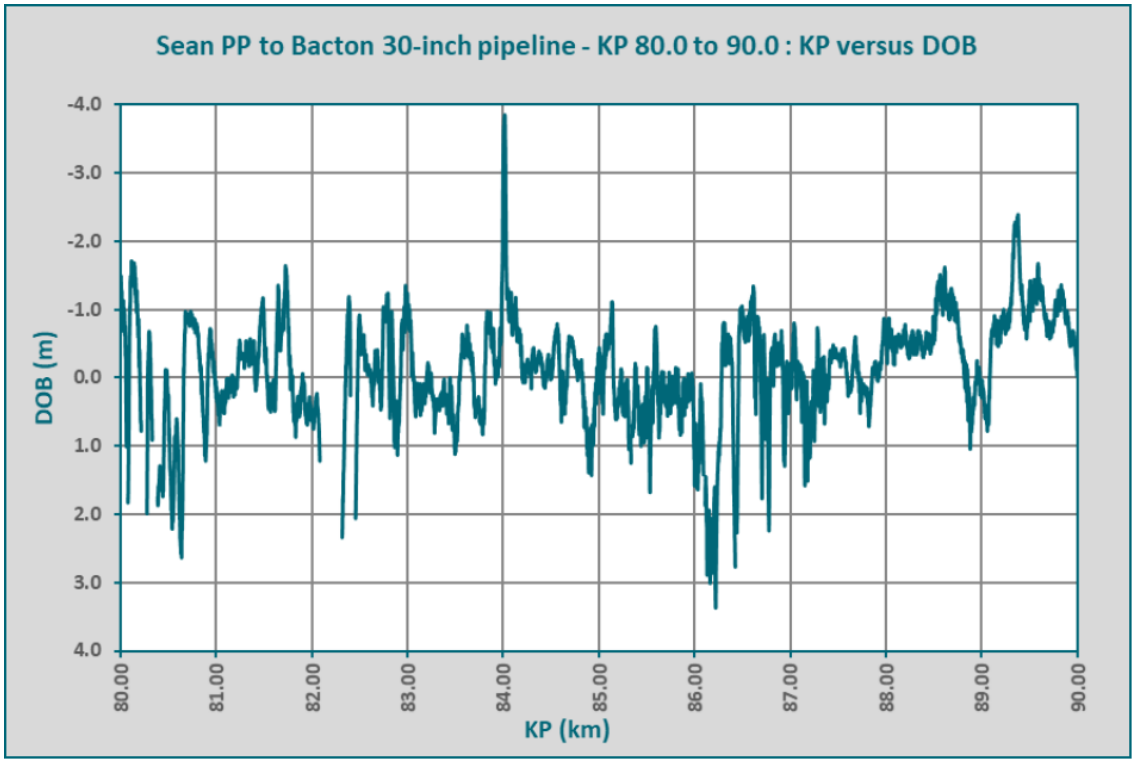

Sean PP to Bacton 30-inch pipeline - KP 30.0 to 40.0 : KP versus DOB
DOB (m)
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
30.00
31.00
32.00
33.00
34.00
35.00
36.00
37.00
38.00
39.00
40.00
KP (km)

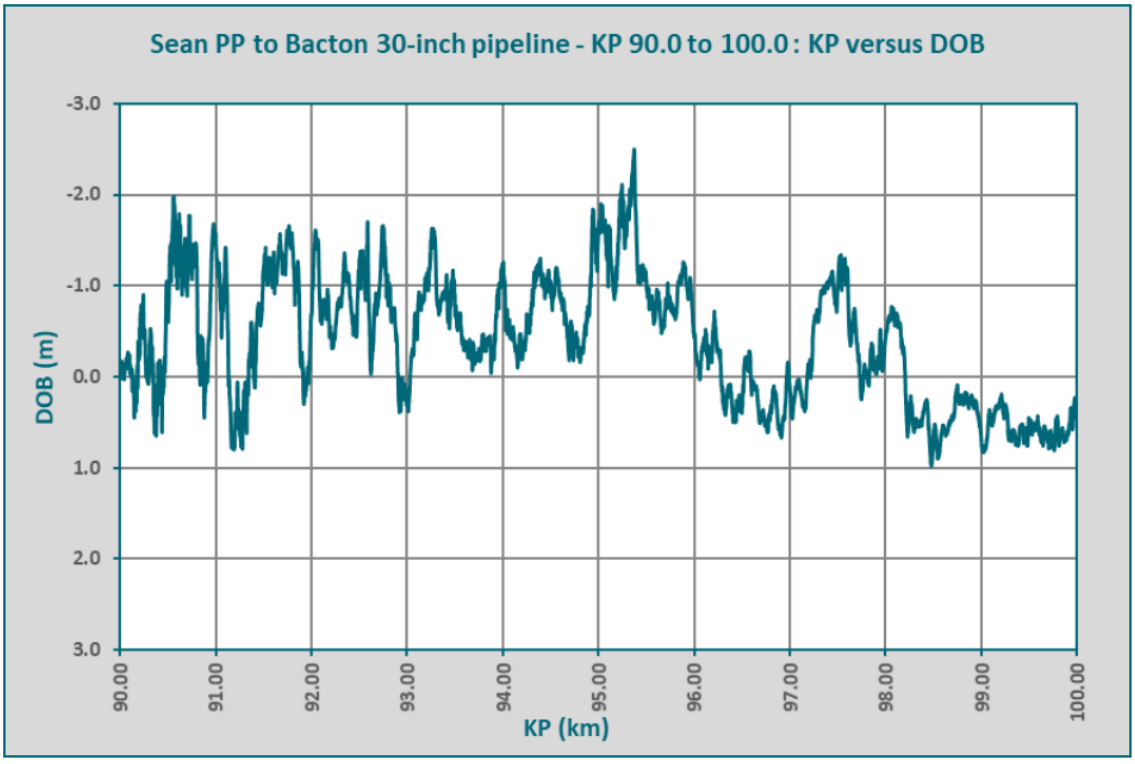

Sean PP to Bacton 30-inch pipeline - KP 40.0 to 50.0 : KP versus DOB
DOB (m)
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
40.00
41.00
42.00
43.00
44.00
45.00
46.00
47.00
48.00
49.00
50.00
KP (km)

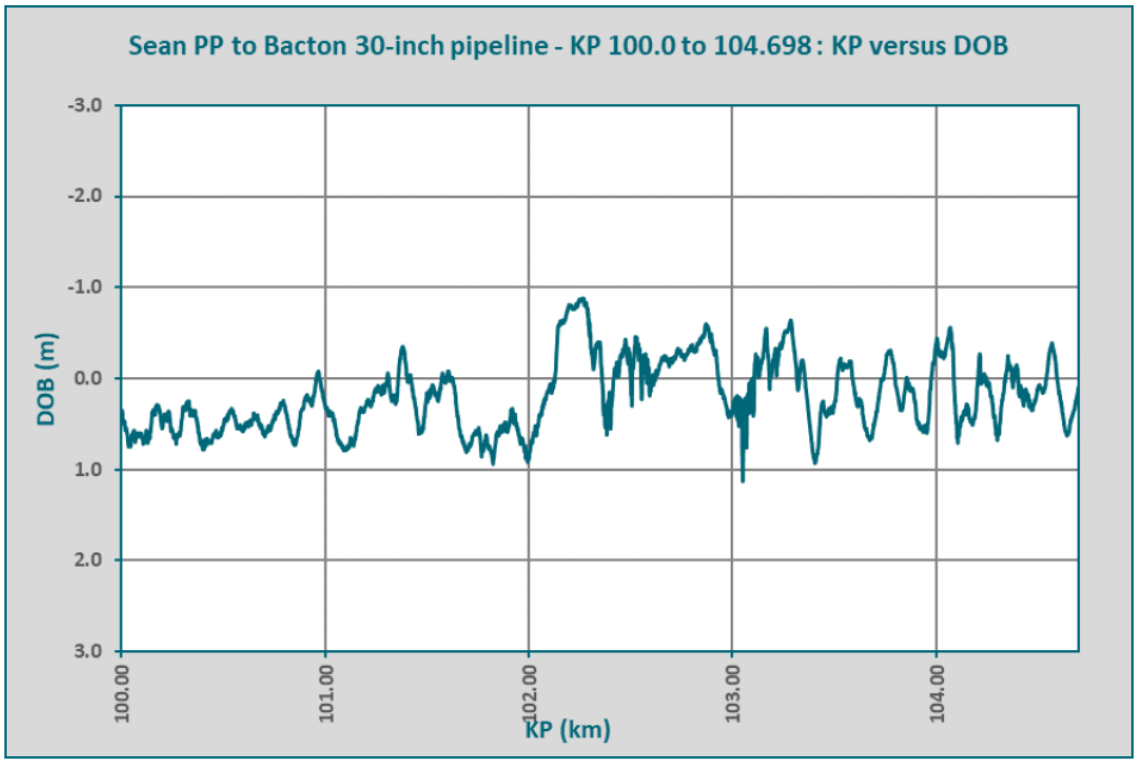

Sean PP to Bacton 30-inch pipeline - KP 50.0 to 60.0 : KP versus DOB
DOB (m)
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
50.00
51.00
52.00
53.00
54.00
55.00
56.00
57.00
58.00
59.00
60.00
KP (km)


Sean PP to Bacton 30-inch pipeline - KP 60.0 to 70.0 : KP versus DOB
DOB (m)
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
60.00
61.00
62.00
63.00
64.00
65.00
66.00
67.00
68.00
69.00
70.00
KP (km)


Sean PP to Bacton 30-inch pipeline - KP 70.0 to 80.0 : KP versus DOB
DOB (m)
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
70.00
71.00
72.00
73.00
74.00
75.00
76.00
77.00
78.00
79.00
80.00
KP (km)


Sean PP to Bacton 30-inch pipeline - KP 80.0 to 90.0 : KP versus DOB
DOB (m)
-4.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
80.00
81.00
82.00
83.00
84.00
85.00
86.00
87.00
88.00
89.00
90.00
KP (km)


Sean PP to Bacton 30-inch pipeline - KP 90.0 to 100.0 : KP versus DOB
DOB (m)
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
90.00
91.00
92.00
93.00
94.00
95.00
96.00
97.00
98.00
99.00
100.00
KP (km)


Sean PP to Bacton 30-inch pipeline - KP 100.0 to 104.698 : KP versus DOB
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
DOB (m)
100.00
101.00
102.00
103.00
104.00
KP (km)

APPENDIX C ENVID SUMMARY

Aspect	Reverse construction / prep work topsides / jacket	Subsea structure, pipeline / umbilical and spools removal / prep for leave *in situ*	Nearshore pipeline removal / prep for leave *in situ*	Remove platform topsides and transfer to shore	Remove jackets and transfer to shore	Nearshore jacket transfer/ dismantling	Onshore dismantling	Debris clearance and overtrawl trials	Legacy	Planned / Unplanned	Summary of Environmental Impact	Mitigation	Impact ranking	Impact Significane	Consider in the EA?	Actions/Comments
Energy Use and Emissions to Air																
- Vessels and transport to shore	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	P	An increase in vessel movement in relation to the decommissioning will generate increased atmospheric emissions. As will any onshore transport associated with disposal/movement of decommissioned material. This will contribute towards global emissions and climate change. However, this will not be a significant increase in emissions beyond background levels normally generated by vessels/transport. Furthermore, on a global scale the emissions associated with the decommissioning will be minimal.	- Low sulphur diesel. - Contractor selection - maintenance programme. - MARPOL compliance. - Campaign, logistics, sharing vessels (across ONE-Dyas portfolio) optimising vessels to minimise use - Energy and emissions assessment to be carried out (inputs to EA and CA evaluation). -Waste duty of care. - ONE Dyas use SNS pool for vessels - ie shared trips with Dutch sector platforms and other operators.	Low	Negligible	No	Vessel use will be limited, with only a small number of vessels to be deployed for transport and transits will be made following direct routes to minimise energy usage and emissions to air.
- Material recycling and replacement	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	P	The process associated with recycling material removed during decommissioning will generate emissions. Where recycling of materials is not possible there will be a requirement for new materials/structure to be made for future projects. Therefore emissions are associated with this novel production which will be required as a result of the decommissioning. Emissions associated with recycling are less than new replacement production and there will be emphasis on recycling where possible. Furthermore, these emissions are minor in comparison to those produced during the operational phase.	Covered by recycling site PPC.	Low	Negligible	No	Majority of emissions will be due to recycling or remanufacture depending on decommissioning option. However, energy use is not expected to exceed the operational phase of the assets.

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Disturbance to seabed																
- Disturbance to the seabed within a protected site and/or to features of conservation importance due to decommissioning activities.	No	Yes	Yes	No	Yes	Yes	No	Yes	No	P	The removal of infrasturcture and associated mitigation measures will cause disturbance to the seabed. This may be temporary (sediment suspension), longer term or even permanent. Permanent disturbance will be caused by the placement of rock (where required). This represents a change in seabed type to a hard substrate which will affect the associated benthos. Considering the project location within protected sites, there will be some disturbance to the site. Disturbance to cuttings piles (should there be any) will also	- Quantify footprints for options. - Limit the footprint of the activities. - Investigate Internal Cutting Opportunities. - Minimise disturbance of cuttings pile, if any. - Modelling study for cuttings disturbance, if required. - Optimise rock placement (e.g. use of FFPV, bags, grade etc.) - Review of survey data for distribution of sensitivities, especially Sandbanks and Sabellaria Reef. - Aim to use DP vessel where possible. However, this might not be possible in shallower inshore areas. In this instance use of jack-up barge or anchor plans would be recommended. - Stakeholder consultation.	Medium	Moderate	Yes	- Environmental survey in preparation. - Survey GAP study underway. - Overtrawlability trials footprint information required (i.e. areas to be rock dumped and/or areas of shallow burial). - Assumption is that all vessels offshore will be DP, however, anchoring may take place inshore. - Legacy - assumed that seabed sampling does not constitute significant disturbance. - Debris clearance as per regulatory requirements.
Risks to Other Users																
- Physical presence of nearshore pipeline	No	No	Yes	No	No	No	No	Yes	Yes	P	Potential degradation or sibsidence of the pipeline over time may present a hazard to nearshore/onshore activities, namely recreational users of the area. The pipeline could be a physical hazard to individuals.	Continued monitoring for an agreed period, modelling of risk of exposure, including if current coastal defences are removed. Remediation will be undertaken if required.	Medium	Minor	No	The nearshore and coastal environment have been identified to have many environmental and societal sensitivities, including the potential for adverse impacts due to coastal erosion, subsidence of ground level over time, impacts to coastal recreational users and others. For these reasons, the leave *in situ* method of decommissioning the nearshore pipeline has been identified as the best option to limit impacts to these sensitive receptors. For this reason, impacts to nearshore receptors will not be covered in the EA. ONE is aware of the existing sensitivities, however, and is committed to remedial works, including removal of the nearshore pipeline segment, should they be required. Legacy monitoring of *in situ* infrastructure will ensure any exposures (e.g. due to weather or coastal processes) are identified and dealt with in a timely manner. Such remediation and the potential environmental impacts they may generate will be covered in the necessary permits, as and when required.
- Physical presence of vessels and rigs in relation to other sea users	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	P	The physical presence of vessel activities associated with the decommissioning may introduce navigational risks or limit access to fishing grounds.	- Campaign, logistics, sharing vessels (across One-Dyas portfolio) optimising vessels to minimise use. Consent to Locate permit appliaction - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings. - Stakeholder consultation. - Logistics planning which considers stakeholder input. - Fisheries Liaison officer. - For previous surveys etc ONE Dyas has contacted vessel owners that use the routes directly too. - 500 m safety exclusion zone will remain in place for the duration of decommissioning activities.	Medium	Moderate	Yes	-Vessel activities will be largely constrained to the 500 m safety zone surrounding the Sean main complex platform (Sean-Papa platforms). There may be some remedial works required along the length of the pipeline, however, such activities will be of exceptionally short duration (i.e. several hours to days) compared to works undertaken within the platform area. - Several shipping management lanes are present across the length of the export pipeline. Shipping likely to get funnelled further by development of the Norfolk Boreas and Norfolk Vanguard West OWFs. However, all navigational risks will be mitigated using the proposed mitigations, including stateholder engagement. - Fishing techniques change across project area, from large commercial trawling offshore to lobster potting inshore. Whilst fishing effort is moderate to high at Sean Field and on approaches to the landfall, vessel activities will predominantly take place within the 500 m fishing exclusion zones for a temporary period - after which commercial fishing vessels should regain access to the fishing grounds within the exclusion zone. Remedial works are not anticipated in the very nearshore environment.

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Discharges to Environment																
- Routine vessel (e.g. greywater, blackwater, ballast) and/or facilities discharges.	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	P	Routine vessel discharges (eg ballast) may generate a harmful environmental impact. Ballast water can be a source for spreading invasive species. Other routine discharges may result in localised pollution. However, due to the routine nature of these discharges and the mitigation measures in place to minimise the scale of potential impact, this is not though to cause a significantly harmful environmental impact.	- IMO Ballast Water Management Convention, including Ballast water plan and log book. - Treatment to IMO/MARPOL standards. - Compliance with One-Dyas marine assurance standards.	Low	Negligible	No	All contracted vessels will operate in line with IMO and MARPOL regulations and all discharges will be permitted under applicable UK legislation.
Degradation of pipeline material onshore	No	No	Yes	No	No	NO	No	No	Yes	P	The degradation of pipeline material once onshore may result in the release of residues from the material into the environment. This degredation will not be uniform therefore will be highly localised to sepcific areas and is unlikely to cause a negative environmental impact.	Monitoring and ultimately remedial action if required. E.g., removal, recover, rebury The pipeline will have been flushed / cleaned in accordance with regulatory / permitary requirements.	Low	Negligible	No	Material of construction degrading and becoming exposed to sediment Potential bio/chemical degradation 'Monitoring and debris removal Internal pipeline residuals can be expected to degrade before pipeline Any residuals remaining in the pipeline or umbilical will be exposed over a long duration. Not an instantaneous release.
Degradation of pipeline material offshore	No	Yes	No	No	No	NO	No	No	Yes	P	The degradation of any pipeline left in situ may result in the isolated release of residual matter to the environment. The pipeline will not degrate along its length equally therefore these releases will be localised. Furthermore, the limited release into a comparatively large open body of water will not cause any significant impact.	Monitoring and ultimately remedial action if required. The pipeline will have been flushed / cleaned in accordance with regulatory / permitary requirements.	Low	Negligible	No	Material of construction degrading and becoming exposed to marine sediment/environment Potential bio/chemical degradation Monitoring and remediation Internal pipeline residuals can be expected to degrade before pipeline Any residuals remaining in the pipeline or umbilical will be exposed over a long duration. Not an instantaneous release.
- Chemicals/hydrocarbon/NORM/Mercury discharges.	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	P	Chemicals may be released over time through degradation of the infrastructure. This may have an adverse impact on and offshore to the habitat and associated fauna due to material toxicity. However, due to the localised nature of the release and the comparatively wide-scale habitat the discharges are being released into, it is expected that the environment will be able to absorb the impact without significant detriment to the environment.	- Selection of chemicals with less potential for environmental impact. - Environmental risk assessment through the MATs/SATs system. - Decom yard management plans, selection, auditing. - Predefined cleanliness achieved through hydrocarbon freeing (Drain Flush Purge Vent DFPV). '- Limit the footprint of the activities in cutting piles (if, present). - One-Dyas HSE management system.	Low	Negligible	No	Any discharges to sea will be applied for via the PETS portal.
-Drill cuttings discharges.	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	P	Drill cuttings, should the pile be disturbed, could release potentially hazardous rediual material into the environment, thereby impacting both species and habitats.	- Limit the footprint of the activities in cutting piles (if present).	Low	Negligible	No	Releases due to cuttings disturbance (if present) - including offshore debris clearance and overtrawl - will be below the OSPAR Threshold values. - Legacy issues relate to disturbances to cuttings (if present) due to fishing after decommissioning will also be below the OSPAR Threshold values.

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Underwater Noise																
- Underwater noise from vessels (significant disturbance to marine species)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	P	Noise associated with vessels may cause some temporary disturbance to marine species. However, this level of noise is likely to be in line with general background noise levels therefore is not expected to have an impact on marine species.	- Campaign, logistics, sharing vessels (across One-Dyas portfolio) optimising vessels to minimise use. - Main potential impact likely to be from disturbance rather than injury. - Contractor selection.	Low	Negligible	No	- Decommissioning vessel use unlikely to be dramatically greater than levels already utilised during normal operations at Sean Field (stand by / resupply, etc.). It will constitute a small number of vessels remaining within the immediate proximity of the Sean-Papa platforms for a limited time. - Due to very high levels of shipping activity in the surrounding region, it is unlikely that the addition of a few localised vessels will constitute an important noise source. Underwater ambient noise levels in this region regularly fall above the 120 dB threshold for disturbance (see Farcas *et al.* , 2020) without significant impacts to marine mammal populations, and as such, ongoing vessel activity has the potential to 'drown out' noise emissions from decommissioning activities, particularly by small vessels.
- Underwater noise from cutting / dredging / rock placement (significant disturbance to marine species)	No	Yes	Yes	No	Yes	Yes	No	Yes	No	P	Noise generated during decommissioning operations can cause disturbance or injury to marine mammals, particularly given the proximity of the activities to the Southern North Sea SAC. However, activities which generate noise will be limited, based on the chose CA options. Therefore the levels of noise associated with the project are not likely to cause any significant impact on marine mammals.	- Suitable technology for cutting will be selected to ensure the effectiveness of the cutting, minimising the duration, disturbance and risk of requiring the activity to be repeated. - No explosives expected to be used. - Stakeholder engagement (JNCC/NE).	Medium	Minor	No	- Sean Field located approximately 4km north of Southern North Sea SAC. Majority of export pipeline length within Southern North Sea SAC. - Cutting by hydraulic shears is base case for removal of installations - this constitues the greatest noise source. However, as internal cutting will be used for the removal of the jackets and platforms, any noise generated by the cutting tool will experience elevated transmission loss due to the sound being enclosed by the structures being cut. For these reasons, noise emissions associated with the decommissioning of the Sean Field infrastructure is not considered further in the EA.
Offshore Surficial Impacts																
- Impacts from artificial light in the offshore environment (particularly seabirds)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	P	The generation of light can be disruptive to seabirds and their colonies. Activities close to shore will be limited therefore the generation of light in proximity to densely populated/utilised seabird areas will be minimal.	- Lighting directed below the horizontal plane unless required for technical or safety reasons.	Medium	Minor	No	- Nearshore elements of the project may be located within the Greater Wash SPA. However, normal vessel lighting will be used and any nearshore activities will be constrained to a few locations for several days of work at each location, in the worst case.
- Disturbance or destruction of seabird nests on offshore structures	Yes	No	No	Yes	Yes	No	No	No	No	P	In recent years there has been an increase in the number of seabirds utilising offshore installations for nesting. Opportunistic species such as Kittiwake and Herring Gull are utilising artificial nest locations and successfully rearing chicks. In some instances, colonies of several hundred birds have established and return each year. Although for most offshore platforms, the number of breeding birds remains very low. All nesting birds and nesting activities are protected from damage by conservation legislation.	- ONE-Dyas will develop a Seabird Management Plan based on the presence of birds utilising the installation for nesting. - Assess the schedule of works and prioritise where possible decommissioning operations that fall out with the nesting period. - Undertake an independent pre-decommissioning breeding bird survey/monitoring programme and initial status assessment. - If birds are found to be nesting then, remedial dissuasion works based on BAT (Best Available Techniques), will be undertaken prior to the next years breeding season. - ONE Dyas will undertake an Ornithological assessment prior to works commencing. Data will be obtained as soon as possible to ascertain if the bird deterrent measures are effective. - Should the deterrent strategies prove ineffective then there will be a requirement to apply for a “License to Disturb” to OPRED through our DCA MAT through the PETS system at the Marine Licensing stage after DP approval. - Following approval of a license ONE DYAs will ensure that an independent Ornithologist is on scene during works and that all nest removal or disturbance activities are “under strictly supervised conditions and removal on a selective basis”.	Medium	Minor	No	The preferred practice is to avoid disturbance by undertaking works out with the breeding season. However, this is not always practicable. ONE Dyas are committed to deterring birds from their installations out with the breeding season to reduce nesting bird disturbance to ALARP (as low as reasonably practicable). We may employ a range of non-invasive/ non-lethal deterrents to prevent birds nesting.

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Resource Use (offshore and onshore)																
'- Use of raw materials and additives (including chemicals, rock cover and steel)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	P	There is an impact associated with the production of raw materials (eg rock for rock placement). However, this is going to be minimal in the wider context of resource use throughout the oil and gas industry offshore. Furthermore, the resource use associated with decommissioning will be vastly reduced in comparison to resource use associated with the initial project construction.	- Planning of activities will minimise use of materials (there is also a financial driver for this). - Recycling as much as possible. - Investigate reuse of existing subsea protection materials i.e. mattresses and grout bags. (to minimise the use of rock placement). - Stakeholder consultation.	Low	Negligible	No	- Main concern with rock placement activities will be seabed habitat alteration, rather than resource use per se, especially within MPA designated for benthic features. - Implications for legacy use of rock placement associated with potential future spanning.
- Energy consumption (fuel use and power consumption by offshore and onshore plant/equipment)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	P	Energy consumption associated with the decommissioning will be mainly attributed to fuel use. There are mitigation measures in place to monitor and minimise this. Furthermore, the energy consumption associated with decommissioning will be minor in comparison to the enegry produced during the operational phase of the Sean Field.	- Monitor fuel use. - Energy and emissions assessment could be carried out. - Scheduling/design to optimise opportunities to use resources more efficiently (e.g. at same time).	Low	Negligible	No	- Fuel/energy use will be noted as part of the emissions to air assessment but not specifically assessed within the EA Report (other than for resulting emissions to atmosphere).
Onshore Dismantling Activities																
- Airborne noise, including traffic movements at onshore sites	No	No	No	Yes	Yes	Yes	Yes	No	No	P	Airbone noise associated with the decommissioning operations will be mainly generated by traffic associated with material disposal. This is unlikely to be significant above general background levels.	- Utilise existing disposal yard. - Limit the duration of the noise emitting activities - Environmental audit of dismantling yard (including site visit). - Contractor management / selection. - Yard to engage with local communities. - Review records of engagement with communities and close out of issues. - Contract award should include recognition of social issues including noise.	Low	Negligible	No	- NOTE: Consider noise impact to coastal communities
- Odour (onshore) (e.g. from marine growth)	No	No	No	No	No	Yes	Yes	No	No	P	Marine growth on infrastructures when exposed to air can generate odour. Disposal will be limited in duration and scope based on the chosen CA options.	- Utilise existing disposal yard. - Environmental audit of dismantling yard. - Selection of a yard that has procedures in place to dispose of marine growth in a manner that will avoid odour nuisance. - Marine growth management plan or waste management plan.	Low	Negligible	No	- Welding emits a gaseous smell - Offshore odour is out of scope as it is considered an HSE issue rather than a societal one for the EA. - NOTE: Consideration of invasive species and potential transport to other countries if waste shipped internationally.
- Light - onshore	No	No	Yes	Yes	Yes	Yes	Yes	No	No	P	Onshore activities will be limited to disposal-related activities and are unlikely to generate light significantly above background or typical levels. Furthermore, disposal will be limited in duration and scope based on the chosen CA options.	- Utilise existing disposal yard. - Environmental audit of dismantling yard. - Yard to engage with local communities. - Review records of engagement with communities and close out of issues. - Stakeholder engagement.	Low	Negligible	No	Onshore elements of the project are scoped out from further investigation, following the BEIS (2018) Guidance.
- Dust	No	No	No	No	No	No	Yes	No	No	P	Onshore activities will be disposal-related therefore limited in duration and are unlikely to generate significant quantities of dust. Furthermore, disposal will be limited in duration and scope based on the chosen CA options.	- Utilise existing disposal yard. - Environmental audit of dismantling yard. - Yard to engage with local communities. - Review records of engagement with communities and close out of issues. - Bid evaluation for onshore activities should consider economic, environment and social issues - Environmental management plan.	Low	Negligible	No	- Scope of EA excludes mining of rock (wrt rock placement activities). - Action: For consistency of documents, the EA Report is to make use of the terms 'rock placement' for the activity and 'rock cover' to describe the material.
- Visual aesthetics - Onshore	No	No	Yes	Yes	Yes	Yes	Yes	No	No	P	Onshore activities will be disposal-related therefore limited in duration aso will not impact visual aesethics. Furthermore, disposal will be limited in duration and scope based on the chosen CA options.	- Utilise existing disposal yard. - Environmental audit of dismantling yard. - Yard to engage with local communities. - Review records of engagement with communities and close out of issues. - selection using FPAL performance	Low	Negligible	No	- Could be an attraction; potential for visitors should the jacket be brought nearshore for dismantling. - Nearshore and shoreline work may also result in attraction of visitors.

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Waste																
- Non-hazardous waste	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	P	Non-hazardous waste generated will be dealt with through standard procedures and the ONE-Dyas waste management strategy.	- One-Dyas Waste management strategy. - Project waste management plan, use of licensed waste contractors/sites, waste transfer notes. - Develop WMP prioritising reuse and recycling. - Contractor to maintain a waste audit trail through to recycling or disposal facility. - Contractor to report waste inventories. - Audit of yard's/contractors waste management systems. - selection using FPAL performance	Low	Negligible	No	- Development of detailed subsea materials inventory.
- Hazardous waste (including F-gases)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	P	Hazardous waste generated will be dealt with through standard procedures and the ONE-Dyas waste management strategy.	- One-Dyas Waste management strategy - Project waste management plan, use of licensed waste contractors/sites, waste transfer notes. - Develop WMP prioritising reuse and recycling. - Contractor to maintain a waste audit trail through to recycling or disposal facility. - Contractor to report waste inventories. - Audit of yard's/contractors waste management systems.	Low	Negligible	No	'- Development of detailed subsea materials inventory. - Note: Potential for low/trace levels of Mercury to also be present in export pipeline/infrastructure.
- NORM waste	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	P	NORM waste generated will be dealt with through standard procedures and the ONE-Dyas waste management strategy.	- One-Dyas Waste management strategy - Project waste management plan, use of licensed waste contractors/sites, waste transfer notes. - Develop WMP prioritising reuse and recycling. - Contractor to maintain a waste audit trail through to recycling or disposal facility. - Contractor to report waste inventories - Audit of yard's/contractors waste management systems. - Licensed facility capable of taking contaminated material under appropriate licence and disposing appropriately (e.g. incineration). - Company procedures during preparation to return radioactive material to shore.	Low	Negligible	No	- Dealt with under its own permitting. - Undertake NORM survey to identify locations and provide locations and estimate of quantity and activity to be added to inventory.
- Marine growth	No	Yes	Yes	No	Yes	Yes	Yes	No	No	P	Marine growth can be removed prior to disposal to avoid the visual impact and associated potential for odour generation.	- Project waste management plan, use of licensed waste contractors/sites, waste transfer notes. - Develop WMP. - Contractor to maintain a waste audit trail through to recycling or disposal facility. - Audit of yard's waste management. - Consider jetting offshore. - Marine growth management plan.	Low	Negligible	No	- Primarily an issue for the jacket, but there is some growth on other metal structures and on mattresses. - May jet off material whilst structures are being brought to shore. - Experience that marine growth falls off during transit to shore but dries off and may emit odour for in excess of one month.
- Use of landfill space	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	P	This will be dependent on the quanitity of material to be disposed of. Reuse and recycling of material will be prioritised and disposal should be minimised.	- Maximise recycling opportunities. - One-Dyas Environmental Management System. - Follow One-Dyas waste management strategy and project management plan. Approximately 97% of material recovered will be recycled. A target of less than 3% to go to landfill.	Medium	Moderate	No	- - Per the BEIS (2018) Guidance, issues associated with onshore activities, including the treatment of wastes returned to shore, are considered outwith the scope of the EA for marine environmental impacts. - NOTE: Discussions on whether majority of non-recyclable waste i.e. concrete would be processed rather than entered into landfill.'

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Unplanned Events																
- Accidental chemical/hydrocarbon release (inc. vessels, both offshore and nearshore)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	UP		- SOPEP, including modelling and appropriate response planning (for vessels over 400 gross register tonnage i.e. HLV). - Maintenance procedures. - SIMOPs. - Bulk handling procedures and personnel training. - Vessels will be selected which comply with IMO/MCA codes for prevention of oil pollution. - Preferred operational procedures to be in place onboard Vessels including use of drip trays under valves, use of pumps to decant lubricating oils, use of lockable valves on storage tanks and drums. - Chemical storage areas contained to prevent accidental release of chemicals. - Maintenance procedures. - Pre-mobilisation audits will be carried out including a comprehensive review of spill prevention procedures - Arrangements in place to track spills. - Third party management/engagement for pipeline crossings, adjacent work sites and associated decommissioning work. - Wells P&A'd and topsides DFPV and isolated.	Medium	Moderate	No	- Rupture of a hydrocarbon line (gas or oil) causing major environmental spill. - Managed as part of risk management processes considering low probability high consequence events. - OPEP / CIP for Sean Field - All vessel activities close to shore are covered by standard operating procedures, including SOPEPs. - The worst-case scenario, therefore, would be an HLV spill close to the platform - 1,065 m3 - which is nearly identical to the surface diesel inventory on the Sean Papa platform. No additional modelling should be required, as the worst-case scenario has been disseminated through studies of the platform's accidental surface inventory release scenario.
- Physical presence of infrastructure decommissioned in situ in relation to other sea users (snagging offshore and nearshore)	No	Yes	Yes	No	No	No	No	No	Yes	UP	The presence of infrastructure decommissioned in situ can result in an impact to other sea users. Commercial fisheries may be exposed to snagging risk. Inshore there may be impacts on recreational users associated with the degradation of the pipeline in time.	- Stakeholder consultation, especially discussion of issues with NFFO, IFCAs and MOD. - Notifications and notice to mariners. - for previous surveys etc ONE Dyas has contacted vessel owners that use the routes directly too. '- Overtrawlability trials following activities - Stakeholder consultation - Remediation activities (spanning)	Medium	Moderate	Yes	- Potential for snagging of fishing gear '- Where rock is required to cover cut ends, or to bury exposed pipelines berm design should be overtrawlable.
- Dropped objects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	UP	Dropped objects are covered under standard industry procedure. Dropped object potential will be limited as far as possible due to the nature of activities and the mitigation measures in place to address the issue.	- One-Dyas Environmental Management System - Procedures will be in place to reduce the potential for dropped objects. - Subsea structures will not be removed until after the flowlines and pipelines have been flushed and cleaned. - Training and awareness of contractors will be required. - Lift planning will be undertaken to manage risks during lifting activities, including the consideration of prevailing environmental conditions and the use of specialist equipment where appropriate. - All lifting equipment will be tested and certified. - Procedures will be put in place to make sure that the location of any lost material is recorded and that significant objects are recovered where practicable. - Debris clearance surveys will be carried out. - DROPS survey to be carried out (dropped object and make safe survey) (topside only).	Medium	Minor	No	A clear seabed verification survey will aim to retrieve and remediate any potential snagging risks or seabed hazards generated by dropped objects. There are no cuttings piles which could be disturbed should a dropped object fall in the vicinity of the wellheads. Majority of works will fall within the 500 m safety exclusion zone, which will be fully swept via overtrawl post decommissioning.

APPENDIX D STAKEHOLDER SUMMARY

The following table provides a summary of the stakeholder consultation comments.

Relevant Party	Comments / Concerns Raised	Response & EA Section where addressed
Informal Consultations		
OPRED	The use of rock placement in certain areas is likely to be opposed therefore it may prudent to take a closer look at the proposed remediation in specific areas.	Indicative locations of proposed remediation have been established from recently acquired 2020 pipeline survey data. The potential impact of remediation at these locations has been assessed within Section 6.1.
	The trunkline had been identified by OPRED as a potential candidate for the development of carbon capture, usage and storage (CCUS). What re-use options have been considered for the 30" Export Pipeline?	Re-use options were considered and discounted for a number of reasons (see Section 2.1.2).
JNCC	The review should consider the specific impact of each option on site specific locations i.e. per Marine Protected Area (MPA).	The impacts of the chosen CA options were scoped in / out in Section 5.1. For impacts on specific receptors which were scoped in, the potential impact on protected areas was assessed where relevant (Section 6.1.5).
MMO	The features of each MPA are considered for each flowline and options under consideration.	The impacts of the chosen CA options were scoped in / out in Section 5.1. For impacts on specific receptors which were scoped in, the potential impact on protected areas was assessed where relevant (Section 6.1.5).

APPENDIX E ENERGY AND EMISSIONS SUMMARY

Appendix E.1 Energy and Emissions by Project Activity

Planned activity	Operations energy (GJ)	Operations CO_2 (Te)
Onshore transportation of materials	668,101.2	174.5
Onshore deconstruction	19,769.4	632.6
Onshore recycling of materials	159,205.3	16,202.1
Offshore transport (vessels)	444,392.4	32,761.0
New manufacture to replace material left *in situ*	1,023,562	143,867
Total	**2,315,030.3**	**193,637.2**

Appendix E.2 Offshore Transport Energy and Emissions

Vessel type	Total Duration (days)	Operations energy (GJ)	Operations CO_2 (Te)
CSV	46.13	444,392.4	32,761.0
DSV	14.9		
HLV	29.81		
Barge	64.5		
Tugs	80.2		
Survey Vessel	12.4		
Trawler	3.28		
Rock Dump FPV	4.61		