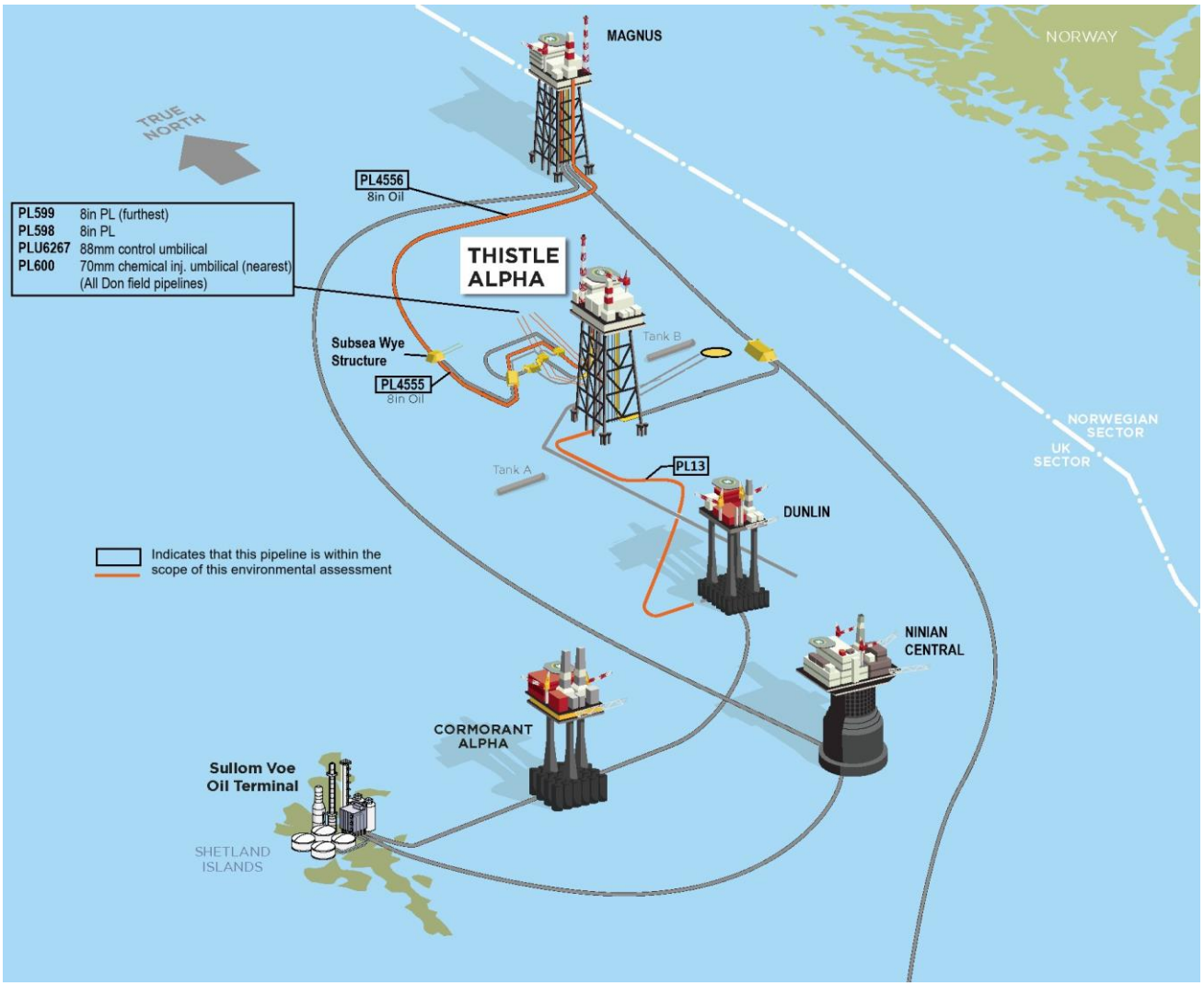
Combined Thistle & Don Pipeline Decommissioning Environmental Appraisal



FINAL VERSION

DOCUMENT CONTROL

Document ID:		M3525-XOD-THI-DN-0000-ENS-0001	
Document Classification:		Public	
Document Ownership:		Decommissioning	
Date of Document:		Signature	Date
Prepared by:	JGB		05/03/2025
Reviewed by:	AC		05/03/2025
Approved by:	AC		05/03/2025

REVISION RECORD

Revision No.	Date of Revision	Reason for Issue
A1	31/08/2023	Issued for Internal Review
A2	12/01/2024	Issued for OPRED Review
A3	12/04/2024	Updated to reflect comments from OPRED
A4	30/08/2024	Updated to reflect comments from OPRED
A5	29/10/2024	Updated to reflect comments from OPRED
C1	10/02/2025	Issued for Use
C2	24/02/2025	Updated to reflect comments from OPRED
C3	05/03/2025	Updated to reflect comments from OPRED
C4	28/04/2025	Final Version

DISTRIBUTION LIST

Company	No. of copies
Offshore Petroleum Regulator for Environment and Decommissioning	1 electronic
GMG, NFFO, NIFPO, SFF	1 electronic
Partners, etc.	1 electronic

TABLE OF CONTENTS

FIGURES AND TABLES

TABLE OF ABBREVIATIONS

Abbreviation	Meaning
3LPP	3 Layer Polypropylene
AET	Apparent Effect Threshold
AIS	Automatic Identification System
Al	Aluminium
ALARP	As Low as Reasonably Practicable
AR6	Sixth Assessment Report
Ba	Barium
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BSL	Benthic Solutions Limited
CA	Comparative Assessment
Cd	Cadmium
CCC	Committee on Climate Change
CCUS	Carbon Capture, Utilisation and Storage
CFC	Chlorofluorocarbon
CH_4	Methane
CI	Chemical Injection (used in Table 3.2.1)
CIEEM	Chartered Institute of Ecology and Environmental Management
CIP	Communication and Interface Plan
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
CoP	Cessation of Production
CPR	Continuous Plankton Reader
Cr	Chromium
CSV	Construction Support Vessel
CTEE	Coal Tar Epoxy Enamel (used in Table 3.2.1)
Cu	Copper
CWC	Concrete Weight Co (used in Table 3.2.1)
DEFRA	Department for Food & Environmental Affairs
DESNZ	Department for Energy Security and Net Zero
DP	Decommissioning Programme

Abbreviation	Meaning
DPN	Disused Pipeline Notifications (used in Table 3.2.1)
DWS	Diamond Wire Saw
EA	Environmental Appraisal
EBS	Environmental Baseline Survey
ECA	Emission Control Areas
EEZ	European Economic Zone
EMS	Environmental Management System
EEMS	Environmental and Emissions Monitoring System
EF	Emissions Factor
EIAPP	Engine International Air Pollution Prevention
EnQuest	EnQuest Heather Limited
ENVID	Environmental Impact Identification
EPDM	Ethylene Propylene Diene Monomer (used in Table 3.2.1)
EPS	European Protected Species
ERL	Effect Range Low
ERM	Effect Range Median
ESDV	Emergency Shutdown Valve
EU	European Union
EUNIS	European Nature Information System
FishSAFE	The FishSAFE database contains a host of oil & gas structures, pipelines, and potential fishing hazards. This includes information and changes as the data are reported for pipelines and cables, suspended wellheads pipeline spans, surface & subsurface structures, safety zones & pipeline gates (www.fishsafe.eu)
FOCI	Feature of Conservation Interest
GHG	Greenhouse Gas
GWP	Global Warming Potential
HAB	Habitat Assessment
HSE&A	Health, Safety, Environment and Assurance
IAPP	International Air Pollution Prevention
ICES	International Council for the Exploration of the Sea
IEMA	Institute of Environmental Management and Assessment
in	Inches
INTOG	Innovation and Targeted Oil and Gas
IPCC	Intergovernmental Panel on Climate Change

Abbreviation	Meaning
IPR	Interim Pipeline Regime (used in Table 3.2.1)
ITI	Infaunal Trophic Index
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
kg	Kilogram
km	Kilometre
KPIs	Key Performance Indicators
Kt	Kilotonne(s)
LAT	Lowest Astronomical Tide
m	Metre
m^2	Square Metre
m^3	Cubic Metre
mg/kg^{-1}	Milligram per kilogram
MarLIN	The Marine Life Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multibeam Echosounder
MDAC	Methane Derived Authigenic Carbonates
MoD	Ministry of Defence
Mt	Million tonne(s)
N_2O	Nitrous Oxide
N/A	Not Applicable
NE	North-East (used in context of Don field)
NECA	Nitrogen Oxides Emissions Control Areas
NO_x	Nitrous Oxides
NOAA	National Oceanic and Atmospheric Administration
NCMPA	Nature Conservation Marine Protected Area
NLGP	Northern Leg Gas Pipeline
NMP	National Marine Plan
NMPi	National Marine Plan interactive
NNE	North-northeast
NNW	North-northwest (Used in Table 4.2.2)
NNS	Northern North Sea
NOREG	Norwegian Oil and Gas Authority (formally OLF)

Abbreviation	Meaning
NORM	Naturally Occurring Radioactive Material
NPD	Naphthalene, Anthracene and Dibenzothiophene
NSE	North-southeast (Used in Table 4.2.2)
NSTA	North Sea Transition Authority (formerly OGA)
O_3	Ozone
OEUK	Offshore Energies UK
OPEP	Offshore Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning (Branded Department within DESNZ)
OSPAR	Oslo-Paris Convention (for the Protection of the Marine Environment of the North-East Atlantic)
PAHs	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCO	Precipitated Carbonate
PETS	Portal Environmental Tracking System
PMF	Priority Marine Feature
PL600	PL600: PL600, PL600.1 through to PL600.6 as described on the relevant PWA (consent No. 17-V-25)
POC	Particulate Organic Carbon
PON2	Environmental alerts and incident reporting: Loss of deposition of materials to sea
ppm	Parts Per Million
PSA	Particle Size Analysis
PWA	Pipeline Works Authorisation (used in Table 3.2.1)
ROV	Remotely Operated Vehicle
SAC	Special Areas of Conservation
SACFOR	Abundance scale used for both littoral and sublittoral taxa (Superabundant, Abundant, Common, Frequent, Occasional, Rare)
SALB	Single Anchor Leg Base (used to be the Northern Producer export route)
SALM	Single Anchor Leg Mooring
SD	Standard Deviation
SDV	Shutdown Valve (used in Table 3.2.1)
SECA	Sulphur Oxides Emission Control Area
SEEMP	Shipboard Energy Efficiency Management Plan
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermen's Federation

Abbreviation	Meaning
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxides
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area
SSE	South-southeast (Used in Table 4.2.2)
SSIV	Subsea Isolation Valve
SSS	Side-scan Sonar
SSW	South-southwest (Used in Table 4.2.2)
SW	South-West (used in context of Don field)
Te	Tonnes
TFSW	Trans-Frontier Shipment of Waste
THC	Total Hydrocarbon Content
TOC	Total Organic Carbon
TOM	Total Organic Matter
TUTU	Topsides Umbilical Termination Unit (used in Table 3.2.1)
UK	United Kingdom
UKAPP	UK Air Pollution Prevention
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UKOOA	United Kingdom Offshore Operators Association (now OEUK)
UTM	Universal Transverse Mercator (Used in Table 3.5.1)
VMS	Vessel Monitoring System
VOC	Volatile Organic Compounds
WONS	Well Operations Notification System
WSW	West-southwest (Used in Table 4.2.2)
Zn	Zinc

1. EXECUTIVE SUMMARY

1.1 Introduction and Background

This non-technical summary provides an outline of the findings of the Environmental Appraisal ('EA') conducted by EnQuest Heather Limited ('EnQuest') for the proposed decommissioning of the Thistle pipelines, Single Anchor Leg Mooring ('SALM') base and the Don pipelines inside the Thistle 500 metre ('m') zone. The purpose of the EA is to understand and communicate the potentially significant environmental impacts associated with EnQuest's proposed decommissioning options.

The Thistle field is situated in Blocks 211/18 and 211/19 of the United Kingdom Continental Shelf ('UKCS') located ~140 kilometres ('km') to the nearest coastline and ~201 km northeast of Lerwick, in a water depth of ~162 m relative to Lowest Astronomical Tide ('LAT'). The field was discovered in 1972 and is produced over the Thistle Alpha platform (here after referred to as the Thistle platform), a fixed installation providing manned production, drilling, and utilities facilities. The Thistle platform is situated in Block 211/18 and is operated by EnQuest. The Thistle pipelines and SALM base are located in Blocks 211/12, 211/13, 211/18, 211/19, 211/23 and 211/24.

The Don North-East ('NE') and South-West ('SW') fields are located approximately 230 km northeast of the Lerwick in Block 211/18 in the United Kingdom ('UK') sector of the Northern North Sea ('NNS'), in a water depth of ~160 m. The fields were discovered in 1976 and are operated by BP. Oil was first produced in October 1989 and exported via the Thistle installation to the Sullom Voe oil terminal on Shetland.

1.2 Regulatory Context

The Petroleum Act 1998 (as amended by the Energy Act 2008) governs the decommissioning of offshore oil and gas infrastructure, including pipelines, on the UKCS. The responsibility for ensuring compliance with the Petroleum Act 1998 rests with the Department for Energy Security and Net Zero ('DESNZ'). The Petroleum Act 1998 requires the Operator of an offshore installation or pipeline to submit a draft Decommissioning Programme ('DP') for statutory and public consultation, and to obtain approval of the DP from the Secretary of State. The DP should outline in detail the infrastructure being decommissioned and the method by which the decommissioning will take place.

This EA documents the assessment of environmental impacts that may result from undertaking of activities as part of the decommissioning of the Thistle pipelines, SALM base, Don pipelines inside the Thistle 500 m zone, subsea infrastructure including umbilicals, cables and associated protection and stabilisation materials. This EA supports the Thistle pipeline DP [27] and the Don DP for pipelines inside the Thistle 500 m zone [7] submitted to Offshore Petroleum Regulator for Environment and Decommissioning ('OPRED'). The EA has been written considering the OPRED Guidance Notes [67] and the Decom North Sea EA Guidance [16] and focuses on screening out non-significant impacts to present a detailed assessment of potentially significant impacts.

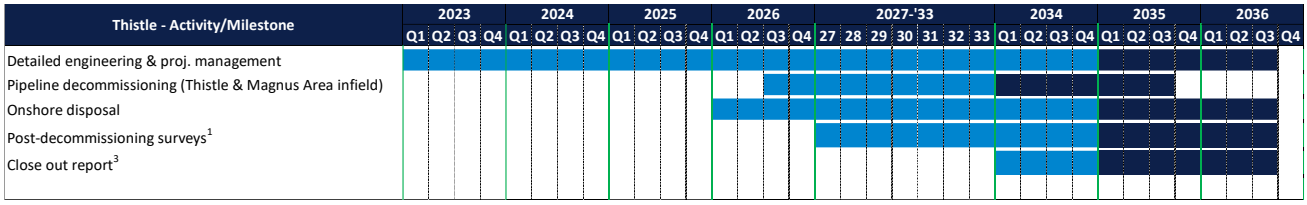
In terms of activities in the NNS, the Scottish National Marine Plan ('NMP') has been adopted by the Scottish Government to help ensure sustainable development of the marine area [75]. The NMP has been developed in line with UK, European Union ('EU') and Oslo-Paris Convention ('OSPAR') (for the Protection of the Marine Environment of the North-East Atlantic) Legislation, Directives and Guidance. The NMP states that *'where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as Carbon Capture, Utilisation and Storage ('CCUS'), decommissioning must take place in line with standard practice, and as allowed by international obligations. Re-use or removal of decommissioned assets from the*

seabed will be fully supported where practicable and adhering to relevant regulatory process' [75]. As part of the conclusions to this assessment (Section 7), EnQuest demonstrates due consideration to the NMP during project decision making and the interactions between the project and NMP.

1.3 Decommissioning Overview

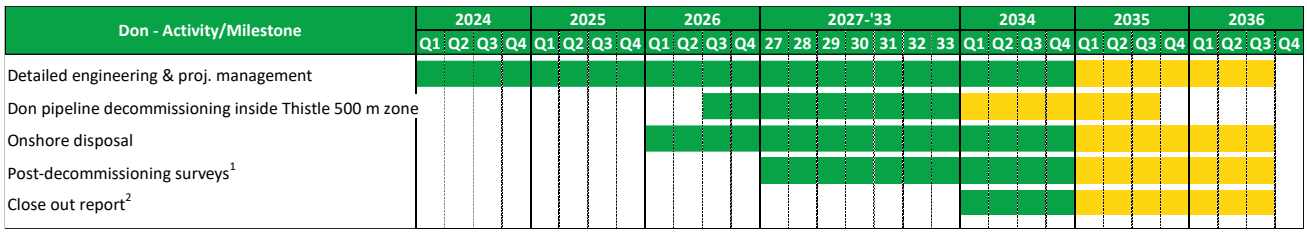
1.3.1 Proposed Schedule

The proposed schedule for the decommissioning of the Thistle pipelines and SALM base is shown in Figure 1.3.1. The proposed schedule for the sections of Don pipelines inside the Thistle 500 m zone is shown in Figure 1.3.2. The activity windows are subject to the acceptance of the DPs as presented in this document and any unavoidable constraints (e.g., vessel availability) that may be encountered while executing decommissioning activities.



Notes / Key
Earliest potential activity
Activity window extended as per NSTA strategy which aspires to combine multiple scopes in a single campaign;
Activity window to allow commercial flexibility associated with decommissioning activities;
1. Post decommissioning surveys to follow completion of decommissioning activities;
2. Decommissioning activities within the Magnus 500m zone will be addressed in a future DP for Magnus
3. Close out report within 1 year of completion of offshore activities.

Figure 1.3.1 Gantt-chart of Thistle project plan



Notes / Key
Earliest potential activity
Activity window extended as per NSTA strategy which aspires to combine multiple scopes in a single campaign
A wide activity window is proposed in order to increase the opportunity to capture cost efficiencies by decommissioning at scale (a strategic priority of the North Sea Transition Authority ('NSTA') Decommissioning Strategy) e.g. via EnQuest's commitment to explore scope aggregation opportunities as a member of the Subsea Decommissioning
1. Post decommissioning surveys to follow completion of decommissioning activities;
2. Close out report within 1 year of completion of offshore activities.

Figure 1.3.2 Gantt-chart of Don project plan

1.3.2 Selected Decommissioning Options

Options to re-use the Thistle and Don pipelines *in situ* for future hydrocarbon or alternative developments have been considered, however, to date, none have yielded a viable commercial opportunity. EnQuest exhausted all potential re-use options before facilities and infrastructure moved into the decommissioning phase and prior to Comparative Assessment ('CA'). Therefore, the re-use option has been excluded from this assessment.

Given the unlikely re-use of the Thistle and Don pipelines, there is no reason to delay decommissioning of the infrastructure (in a way that is safe, environmentally and societally acceptable). The 'do nothing' approach to the infrastructure is thus rejected.

The decommissioning options for the following Thistle and Don pipelines were compared in the CA:

Thistle pipelines:

- PL13, 16in concrete weight coated ('CWC'), surface laid on approach to the platforms, but otherwise trenched and left to backfill naturally, with multiple exposures and spans (3,645 m), ~12.69 km long.
- PL4555, 8in (and piggybacked) trenched and buried with no exposures, ~10.26 km long.
- PL4556, 8in, trenched and buried with no exposures. From the Wye structure to the pipeline end flange near the Magnus platform inside the Magnus 500m zone, ~23.39 km long.

As PL74 and PL75 (both 16in CWC, ~2.4 km long) are laid on the surface of the seabed and not trenched, they will be completely removed in accordance with mandatory requirements. Therefore, they are not subject to a CA.

Don pipelines:

- PL598, 8in, trenched and buried except for surface laid sections near Thistle, ~0.57 km (overall length, ~17.34 km).
- PL599, 8in, trenched and buried except for surface laid sections near Thistle and exposed at KP0.427 for 18 m, measured from the pipeline end flange near Thistle, ~0.57 km (~17.34 km).
- PL600 (including cores PL600, PL600.1 through to PL600.6, herein after referred to as PL600 throughout this document), 70mm umbilical, trenched and buried except for surface laid sections near Thistle, ~0.56 km (~17.73 km).
- PLU6267, 88mm umbilical, trenched and buried except for surface laid sections near Thistle, 0.54 km (~17.73 km).

The lengths in brackets are the lengths of the pipelines quoted in the original Don DP [6] and are provided for completeness and context.

The sections of PL598, PL599, PL600 and PLU6267 outside of the Thistle 500 m zone have already been decommissioned and were subject to a CA included in the original Don DP [6]. As the sections inside the Thistle 500 m zone are an extension of the wider Don field pipelines, the findings of the original CA were examined to confirm if the original approach and findings would be valid for the pipelines inside the Thistle 500 m zone.

The rest of the infrastructure is surface laid and will be removed in accordance with mandatory requirements. Associated protection and stabilisation features will be completely removed with the exception of protection structures associated with crossing points, those used to remediate pipeline spans/exposures and any third-party infrastructure. EnQuest plan to fully recover any exposed sand/grout bags and concrete mattresses. The burial status of these materials will be determined when decommissioning activities are carried out.

There are approximately 74 concrete mattresses, 29 grout mattresses, 4 concrete plinths, 2,020 grout or sandbags (25 kilogram ('kg') each) and 3,985.8 Te of deposited rock associated with the Thistle pipelines and SALM base. There are approximately 21 grout bags (25 kg each) and 1 grout bag support under mudmat associated with the Don pipelines inside the Thistle 500 m zone.

1.3.2.1 Emerging CA Decommissioning Options for Thistle Pipelines

Thistle pipelines PL13, PL4555 and PL4556 were all subject to CA. PL13 is buried with multiple exposures and spans throughout its length (3,645 m). Whereas both PL4555 and PL4556 are trenched and buried with no exposures. Therefore, the decommissioning options considered in the CA were complete removal, partial removal or remediation (PL13 only) and leave *in situ*.

Surface laid sections of PL13 on approached to the Thistle and Dunlin 'A' platform will be removed and the remaining section of the pipeline in the trench will be buried under deposited rock, resulting in ~29,300 Te of rock being deposited on the pipeline. PL4555 and PL4556 will be left *in situ* following the removal of all pipespools and associated protection and stabilisation features, surface laid sections of pipeline and associated protection and stabilisation features up to the point of burial in rock. ~15 Te of rock will be deposited on both ends of PL4555 and PL4556 resulting in a total of ~60 Te of rock. As it is proposed to leave the pipelines PL13, PL4555 and PL4556 *in situ*, they will be subject to a monitoring programme agreed between EnQuest and OPRED.

1.3.2.2 Emerging CA Decommissioning Options for Don Pipelines

Don pipelines PL598, PL599, PL600 and PLU6267 were all subject to CA. All Don pipelines are trenched and buried, except for surface laid sections near Thistle. One exposure was observed on PL599 in 2013 which measures 18 m from the pipeline end flange near Thistle. The decommissioning options considered in the CA were complete removal, partial removal or remediation (PL599 only) and leave *in situ*. The recommended outcome of the CA is that buried sections of the pipeline(s)/umbilical(s) will be left *in situ*. The surface laid sections of pipeline(s)/umbilical(s) from the bottom of riser caisson 930 to the point when the pipeline(s)/umbilical(s) is buried at end of the transition at trench depth will be removed. The exposed cut ends of the pipeline(s)/umbilical(s) will be remediated with ~15 Te of deposited rock at each pipeline end resulting in a total of ~60 Te of rock. As it is proposed to leave the pipelines *in situ*, they will be subject to a monitoring programme agreed between BP and OPRED and carried out by EnQuest.

1.4 Environmental and Societal Sensitivities

The key environmental and societal sensitivities associated with the Thistle pipelines, SALM base and Don pipelines (Blocks 211/12, 211/13, 211/18211/19, 211/23 and 211/24); here after referred to as the 'project area') have been summarised in Table 1.4.1 below.

Table 1.4.1 Environmental and Societal sensitivities

Physical Environment
The water depth across the Thistle survey area from 151.8 m LAT in the southeast to 169.0 m LAT in the northwest with a natural slope of 0.06°[31]. The mean residual current through the project area is approximately 0.05 to 0.15 m/s [82]. Wave energy at the seabed is 'moderate' (between 0.21-1.2 N/m^2) within the area [54]. The annual mean wave height within the area ranges from 2.71 -3.00 m and the annual mean wave power is 36.1-42.0 kW/m [2] [54].
Conservation Interests
Survey imagery showed evidence of "lebensspuren" features and the presence of sea pen species (*Virgularia mirabilis* and *Pennatula phosphorea*). However, no faunal burrows were observed, and the density of sea pens was unknown. Consequently, it can be concluded that the OSPAR-protected 'Sea pen and burrowing megafauna communities' habitat was not present within the surveyed area [31]. Cobbles and boulders were recorded along two transects within the survey area and were assessed for the potential to be 'Annex I Stony Reef'. The results of the stony reef assessment categorised both transects as 'Not a Reef' due to their limited expanse of >25m^2, however contained patches with significant elevation and composition to be defined as 'Low' in terms of reef structure [31]. Several seabed depressions were observed on the geophysical and photographic data across the Thistle survey area that resembled unit pockmarks. However, no Annex I habitat 'Submarine structures made by leaking gases' were identified in the depressions ground-truthed [31].

Table 1.4.1 Environmental and Societal sensitivities
Conservation Sites
The closest protected area to the Thistle field is the Pobie Bank Reef Special Area of Conservation ('SAC'), located approximately 103 km to the southwest. It is protected for bedrock and stony reefs which provide a habitat to an extensive community of encrusting and robust sponges and bryozoans (*Ectoprocta*) [59]. The northeast Faroe-Shetland Channel Nature Conservation Marine Protected Area ('NCMPA') is located approximately 109 km and the Hermaness Saxa, Vord and Valla Field Special Protection Area (SPA') is located approximately 140 km from the Thistle platform.
Conservation Species
Harbour porpoise (*Phocoena phocoena*), white-beaked dolphin (*Lagenorhynchus albirostris*) and minke whale (*Balaenoptera acutorostrata)* are all likely to be present in the project area [33]. All of which are Scottish Priority Marine Features ('PMF's), European Protected Species ('EPS') and are covered by the UK Biodiversity Action Plan ('BAP'). Grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina)* densities are expected to be very low. This is confirmed by the grey and harbour seal density maps published on Ntional Marine Plan interatctive ('NMPi'), where the mean percentage at-sea population for grey seals and harbours seals in the area is >0 to <=0.001% per 25 km [10] [62]. Both seal species are PMFs and Habitats Directive Annex II protected species.
Benthic Environment
The seabed within the project area is considered to be EUNIS ('European Nature Information System') habitat MD52: Atlantic offshore circalittoral sand. Side-scan sonar ('SSS') indicated medium reflectivity across most of the sampling area relating to the ambient muddy sand sediment. Areas of higher reflectively were typically associated with areas close to the platform which corresponded to the mixed sediment present consisting of cohesive silt intermixed with coarse sediment and *Mytilus shells*. Particle size analysis ('PSA') indicated a mixed sediment type composed primarily of sedimentary sands with varying smaller contributions of fines and gravels at all stations that fall outside the physical cuttings pile limit [31]. Nematoda were the most abundant taxa recovered and totalled 82.3% of the total individuals recorded. These pollutant tolerant taxa often reflect high levels of hydrocarbon and heavy metal contamination. with [31]. Benthic fauna observed in the seabed imagery was highly variable, with most stations sampled near or within the physical extent of the cuttings pile showing a reduced species richness and an increase in abundance of opportunistic phyla [31]. Variation in the macrofauna community composition was significantly correlated to sediment particle size composition, hydrocarbons, and heavy metal concentrations. Sea pen species *Virgularia mirabilis* and *Pennatula phosphorea* were observed at Station EBS_250_NE. Evidence of "lebensspuren" features were also observed in the Thistle survey area [31]
Fish
The project area is located within the spawning grounds of cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), Norway pout (*Trisopterus esmarkii*), saithe (*Pollachius virens*) and whiting (*Merlangius merlangus*) [14][22]. Additionally, the project area is located in a high nursery intensity area for blue whiting (*Micromesistius poutassou*). The following species have nursery grounds near the project area: European hake (*Merluccius merluccius*); haddock; herring (*Clupea harengus*); ling (*Molva molva*); mackerel (*Scomber scombrus*);

Table 1.4.1 Environmental and Societal sensitivities
Norway pout; spurdog (*Squalus acanthias*) and whiting [14] [22]. Aires *et al.* provides modelled spatial representations of the predicted distribution of juvenile fish (less than one year old) [1]. The probability of juvenile aggregations of anglerfish, European hake, haddock, herring, mackerel, horse mackerel (*Trachurus trachurus*), Norway pout, plaice (*Pleuronectes platessa*), sprat (*Sprattus sprattus*), and whiting occurring is very low, and for hake and blue whiting the probability is up to medium [1]. Cod, saithe, herring, ling, Norway pout, and whiting are PMF species in offshore waters.
Seabirds
The following species could be found within the project area: northern fulmar (*Fulmarus glacialis*), razorbill (*Alca torda*), lesser black-backed gull (*Larus fuscus*), European storm-petrel (*Hydrobates pelagicus*), northern gannet (*Morus bassanus*), great skua (*Stercorarius skua),* black-legged kittiwake (*Rissa tridactyla*), great black-backed gull (*Larus marinus*), herring gull (*Larus argentatus*), glaucuous gull (*Larus hyperboreus*), common guillemot (*Uria aalge*), little auk (*Alle alle*) and Atlantic puffin (*Fratercula arctica*) [50]. The Seabird Oil Sensitivity Index ('SOSI') identifies areas at sea where seabirds are likely to be most sensitive to surface pollution [81]. Seabird sensitivity in the project area is considered 'low' throughout most of the year for Blocks 211/12, 211/13/, 211/18, 211/19, 211/23 and 211/24, except for November-January where it is considered 'high'. March in Block 211/12 is considered 'medium' [81].
Societal Receptors
Commercial Fisheries
Vessel Monitoring System ('VMS') data from 2010-2020 indicates that fishing intensity within the project area is low for dredges. Bottom trawl fishing is lowest in Block 211/18 and highest in Blocks 211/13 and 211/19 [47]. In 2022, fishing effort in International Council for the Exploration of the Sea ('ICES') Rectangle 51F1 was highest in March, accounting for 17% of the total number of days fished, followed by May contributing to 12% of fishing effort. The highest fishing effort in ICES Rectangle 52F1 was recorded in September, accounting for 14% of the total number of days fished. Trawls were the most utilised gear in Rectangles 51F1 and 52F1, accounting for 86% and 91% of the total number of days fished in 2022, respectively. Other gear types utilised include hooks and lines, seine nets and gill nets and entangling nets [53]. The five top landed species in Rectangle 51F1 in 2022 in terms of weight included haddock, whiting, saithe, hake and cod. Saithe, hake, haddock, ling and whiting were the five top landed species in Rectangle 52F1 [53]
Other Sea Users
Shipping activity is assessed to be low in Blocks 211/12, 211/18, 211/23 and very low in Blocks 211/13, 211/19, 211/24 [34][63]. There are twelve third-party surface installations within 40 km of the project area; the closest being the Dunlin Alpha structure, located approximately 9.9 km to the southeast of the Thistle platform, which is operated by Fairfield and is currently undergoing decommissioning. The nearest active cable is located 58 km northeast of the Thistle platform. There are some historic cables in the vicinity of the project area – though disused, sections of these cables may remain on the seabed. Blocks 211/12, 211/13, 211/18, 211/19, 211/23 and 211/24 are all in an area of concern to the Ministry of Defence ('MoD') as they lie within training ranges.

Table 1.4.1 Environmental and Societal sensitivities
There are no operational renewable energy sites within 100 km of the project area. The Thistle area lies approximately 124km of the NE1 ScotWind area. The project area is close to areas identified under the Innovation and Targeted Oil and Gas ('INTOG') scheme. The project area is located within INTOG area NE-b and INTOG area NE-a is located approximately 42 km northwest of the Thistle platform. The nearest wreck is located approximately 0.3 km northeast of the Thistle platform and is classified as 'unknown' [64]. There are several foul grounds near the project area, however there are no dangerous wrecks.

1.5 Impact Assessment

This EA has been prepared in line with the OPRED Guidance Notes [67] and with Decom North Sea's EA Guidelines for Offshore Oil and Gas Decommissioning [16]. The OPRED 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 [16].

The EA has been informed by several different processes, including the identification of potential environmental issues through Project Engineer and marine Environmental Specialist review in an Environmental Identification ('ENVID') screening workshop and consultation with key stakeholders.

The impact assessment screening identified nine potential impact areas based on the proposed Thistle subsea decommissioning activities:

- Atmospheric emissions;
- Seabed disturbance;
- Physical presence of vessels in relation to other sea users;
- Physical presence of infrastructure decommissioned *in situ*;
- Discharges to sea;
- Underwater noise;
- Resource use;
- Waste; and
- Accidental events.

Of these, three aspects were screened in and taken forward for assessment based on the potential severity and/or likelihood of their respective environmental impact and stakeholder concern: atmospheric emissions, seabed disturbance and physical presence of infrastructure decommissioned *in situ*. These aspects, a summary of the impact assessment process and any relevant mitigation measures are presented in Table 1.5.1.

Table 1.5.1 Key potential impacts assessed				
Aspect	**ENVID impact**	**Impact Assessment overview**	**Key mitigation**	**Residual Impact**
Atmospheric emissions were investigated further due to increasing scientific, public and stakeholder concern regarding anthropogenic climate change and the potential contribution of these emissions to global warming.	**'Low'**	Emissions during decommissioning activities will be produced from offshore vessels, onshore transport, recycling and theoretically, from the embodied carbon of the infrastructure decommissioned *in situ*. The atmospheric emissions from the Thistle pipelines, SALM base and Don pipelines decommissioning activities will be temporary and limited in nature. It is not expected that atmospheric emissions will negatively impact local air quality or represent a significant contribution to climate change. The Thistle pipelines, SALM base and Don pipelines decommissioning activities will add a small (0.17%) contribution to the overall offshore emissions in the UK (based on 2018 reported values) and the release of Greenhouse Gas ('GHG') into the environment [66]. The contribution to global warming will be negligible in relation to those from the wider offshore industry and outputs at a national or international level. EnQuest is aware of the impact of cumulative emissions, including those which may be an indirect result of concurrent decommissioning operations, and these will be further assessed.	• Streamlining of activities through planning to reduce vessel time. • Shipboard Energy Efficiency Management Plan ('SEEMP') on board each vessel. • Vessel equipment maintained according to manufacturer's recommendations. • Use of low sulphur diesel. • Green dynamic positioning or economical speeds when operationally appropriate. • EnQuest Third Party Contractor Assurance process / procedure.	**'Low'** (Not significant)
Seabed disturbance was investigated further for potential impacts due to the nature of the proposed activities and their interaction with the seabed	**'Medium'**	The proposed decommissioning activities of the Thistle pipelines, SALM base and Don pipelines may impact a temporary (direct and indirect) area of 0.25 km^2 of seabed habitat, with an additional area of 0.043 km^2 of permanent impact associated with rock remediation and an area of 0.226 km^2 permanent impact associated with infrastructure decommissioned *in situ*. While the activities may result in the mortality of some individuals, many of the taxa within the project area are relatively resilient; sandy communities are comparatively quick to recover from disturbance. No decommissioning activity will be taking place in a protected area; therefore, it is highly unlikely that habitat or species of	• Cutting and lifting operations controlled by ROV and conducted around high tide and slack water to minimise distribution of mobilised sediments. • Requirements for excavation minimised to provide access only where necessary. • Dynamic positioning rather than	**'Low'** (Not significant)

Table 1.5.1 Key potential impacts assessed				
Aspect	**ENVID impact**	**Impact Assessment overview**	**Key mitigation**	**Residual Impact**
		conservation interest will be directly or indirectly affected. With regards to the sediment and benthic features within area, the Thistle decommissioning activities are unlikely to affect the natural physical processes of the area. Two distinct drill cuttings piles are present at the north and southwestern legs of the Thistle platform which merge in the centre [31][32]. However, visual evidence and burial profiles of the pipelines to be decommissioned confirm that the pipelines are not buried under drill cuttings on approach to the risers [19]. Therefore, the cuttings piles will be left undisturbed and is not considered in the further assessment of seabed disturbance. The Thistle pipelines PL13, PL4555, PL4556 and Don pipelines PL599, PL598, PL600, PLU6267 being decommissioned *in situ* are also unlikely to have an impact on these processes and their gradual degradation over time will have a negligible impact on the surrounding sediments.	anchoring. • Careful placement of rock mass within planned footprint. • Data reviewed for potential sensitive seabed habitats prior to the commencement of operations. • Post-decommissioning surveys and monitoring carried out using non-intrusive methodologies.	
Physical presence of infrastructure decommissioned *in situ* was investigated as a potential impact on commercial fisheries and the risk that infrastructure decommissioned *in situ* may pose as a gear	**'Medium'**	Fishing effort in the project area (ICES Rectangle 51F1 and 52F1) is low. In 2022, there were 212 days of effort in 51F1 and 58 days in 52F1 [53]. The value of commercial fisheries is also considered 'low' when comparing the financial value and contribution of the catch within the wider regional context. The CA outcome has determined that Thistle pipeline PL13, which is trenched, will be decommissioned *in situ* following the removal of surface laid sections on approaches to the Thistle and Dunlin 'A' platform; and the remaining section of the pipeline inside the trench being buried using ~29,300 Te of rock. The buried sections of pipelines PL4555 and PL4556 will be decommissioned *in situ*, removing surface laid sections up to the point of burial in rock. Cut pipeline ends will be protected	• Notifications to Mariners • UK Hydrographic Office, FishSAFE and Kingfisher updates. • 500 m safety exclusion zone to remain in operation during decommissioning activities. • Ongoing consultation with fisheries representatives. • Post-decommissioning, a clear seabed verification. • Post-decommissioning	**'Low'** (Not significant)

Table 1.5.1 Key potential impacts assessed				
Aspect	**ENVID impact**	**Impact Assessment overview**	**Key mitigation**	**Residual Impact**
snagging risk.		with ~15 Te of deposited rock, totally quantity ~60 Te [26]. Historical survey data has revealed that approximately one-third of PL13 remains exposed, with 150 exposures (an overall exposed length of 3,645 m) and 66 spans (5 of which are reportable) recorded [19]. Approximately 29,300 Te of rock will be deposited to bury the remaining section of pipeline in the trench to allow fishing gear to trawl across it without snagging. PL598 and PL599 were trenched and the trench actively backfilled when installed. PL598 suffered from a number of spans but these were remediated by 1994. The most recent survey (2013) of PL599 found a partly (50% - top half) exposed section ~18 m long, which contained a span (2.5 m long x 0.1 m high span). This was not reportable, and it is unknown whether the exposure or span still exists as no other recent survey data has been found. PL600 suffers from one span at the Thistle tie-in location, however this will be removed along with the surface paid infrastructure. PLU6267 is reported to have experienced a consistent burial profile, with the level of exposure in the field being low except for the surface laid section on the approaches at Thistle (which will be removed as part of the decommissioning of pipeline sections in the Thistle 500 m zone) [6]. Historical survey data would indicate that if PL598, PL599, PL600 and PLU6267 remain buried they would not pose a snagging hazard [26]. EnQuest will also engage in a monitoring schedule with the assumption that should any further spans or potential snagging points emerge, these will be remediated.	monitoring campaign.	

1.6 Conclusion

This EA has considered the relevant Marine Plans, adopted by the UK and Scottish Governments to help ensure sustainable development of the marine area. EnQuest consider that the proposed decommissioning activities are in alignment with its objectives and policies.

Having reviewed the project activities within the wider regional context and taking into consideration the mitigation measures to limit any potential impacts, the findings of this EA conclude that the activities do not pose any significant threat to environmental or societal receptors within the UKCS.

2. INTRODUCTION

2.1 Background

The Thistle field was discovered in 1972 and is situated in Blocks 211/18 and 211/19 of the Northern North Sea ('NNS') sector of the United Kingdom Continental Shelf ('UKCS'). The Thistle platform (Block 211/18a) is located approximately 140 kilometres ('km') north-northeast ('NNE') of the nearest coastline (Figure 2.1.2) and ~201 km northeast of Lerwick and operated by EnQuest Heather Limited ('EnQuest'). The Thistle pipelines and Single Anchor Leg Mooring ('SALM') base are in Blocks 211/12, 211/13, 211/18, 211/19, 211/23 and 211/24. The water depth in the area is ~ 162 metres ('m') relative to Lowest Astronomical Tide ('LAT').

The Don North-East ('NE') and South-West ('SW') field comprises four operating licences, Don NE (P104, P236 and P296) and Don SW (P236). The fields were operated by BP and are located approximately 230 km northeast of Lerwick in Block 211/18 in the United Kingdom ('UK') sector of the NNS, in a water depth of ~160 m. The fields were discovered in 1976. Oil was first produced in October 1989 and exported via the Thistle installation to the Sullom Voe oil terminal on Shetland. The original combined Don fields (Don NE and SW) fields are illustrated in Figure 2.1.1.

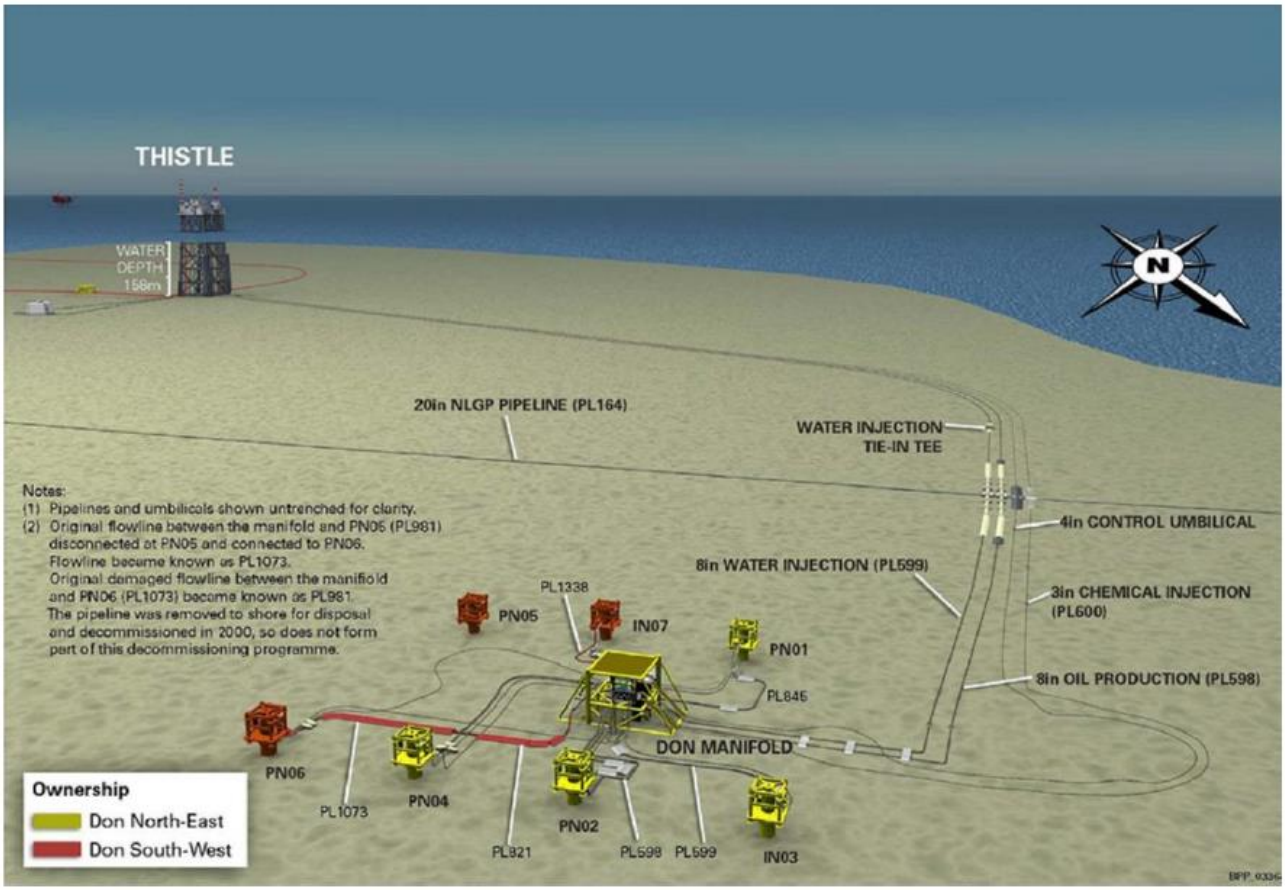


Figure 2.1.1 The Don field assets and infrastructure

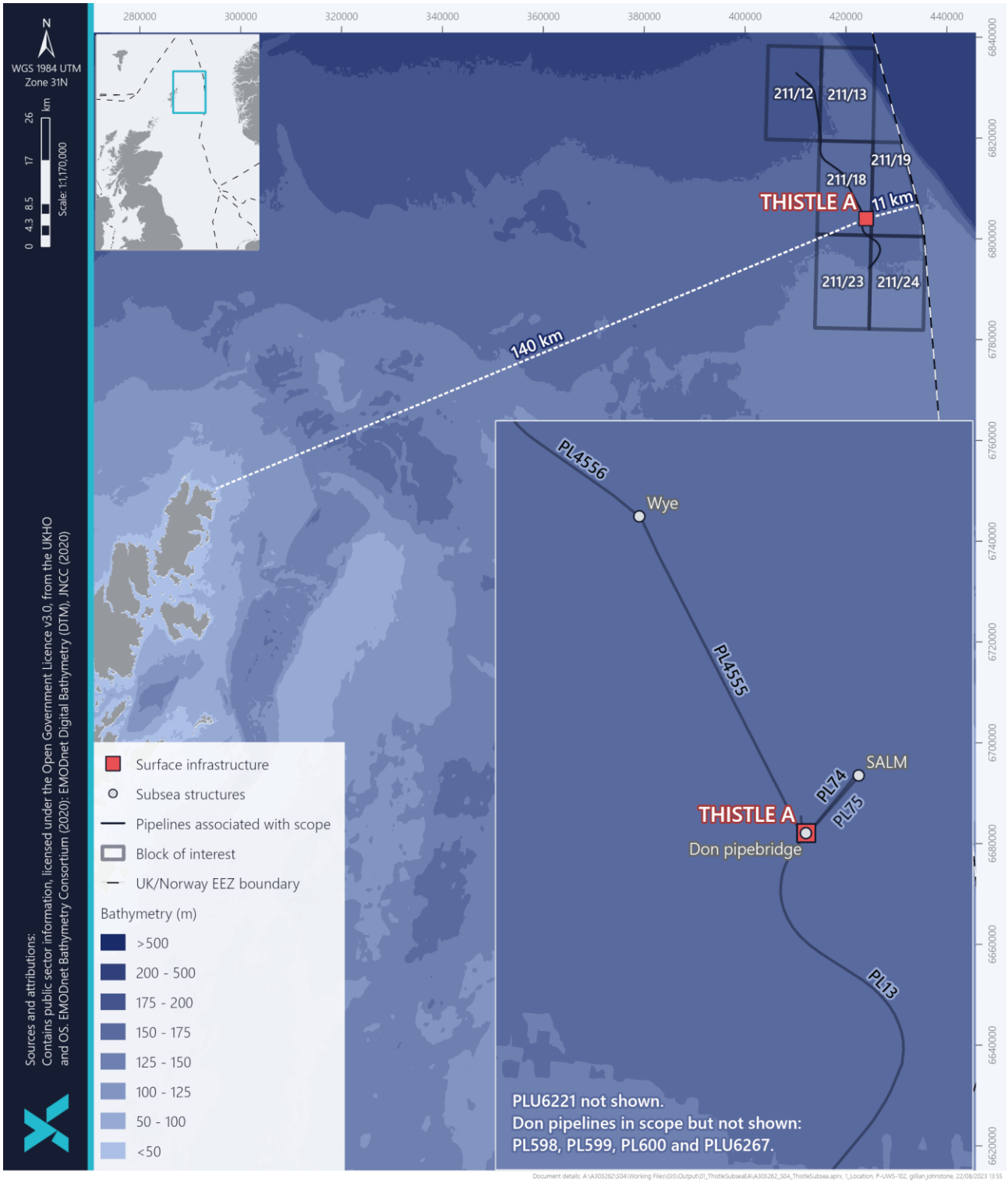


Figure 2.1.2 Location of infrastructure relevant to the Thistle pipelines and SALM base

2.2 Overview of the Infrastructure

The following sections and Figure 2.2.1, Figure 2.2.2, Figure 2.2.3, and Figure 2.2.4 provide an overview of the infrastructure relevant to the Thistle pipelines, SALM base and Don pipelines.

Thistle Installations:

- SALM base.

Thistle Pipelines:

- PL13 16in oil export pipeline to Dunlin.12.7 km long;
- PL74 16in seawater pipeline to SALM base, 2.4 km long;
- PL75 16in oil export pipeline to SALM base, 2.4 km long;
- PL166 (NLGP) riser attached to the Thistle jacket, 0.2 km long;
- PL4555 8in oil export pipeline to Wye structure, 10.26 km long;
- PL4556 8in oil export pipeline from the Wye structure to the pipeline end flange near the Magnus platform inside the Magnus 500m zone, 23.39 km long.
- PLU6221 (NLGP) riser, for umbilical that serves PL166 SSIV, 0.17 km long; and
- Wye structure.

Don Pipelines:

- PL598, 8in oil production pipeline inside Thistle 500 m zone, 567 m long,
- PL599 8in water injection pipeline inside Thistle 500 m zone, 570 m long;
- PL600 70mm chemical injection umbilical inside Thistle 500 m zone, 560 m long;
- PLU6267 88mm control & monitoring umbilical inside Thistle 500 m zone, 539 m long; and
- Don pipebridge connected to riser caisson 930 on the Thistle platform.

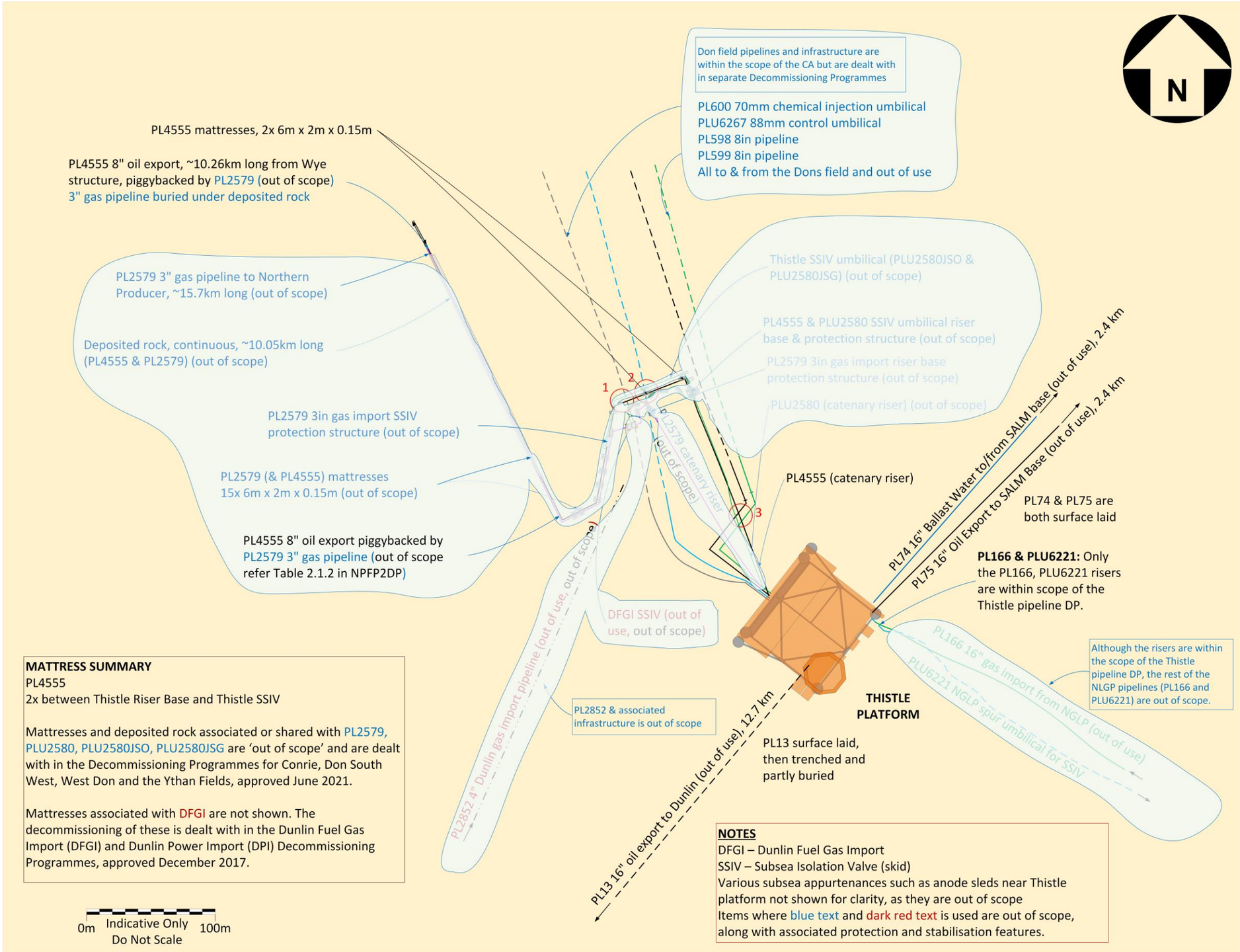


Figure 2.2.1 Thistle approaches (PL13, PL74, PL75, PL4555 & PLU6221)

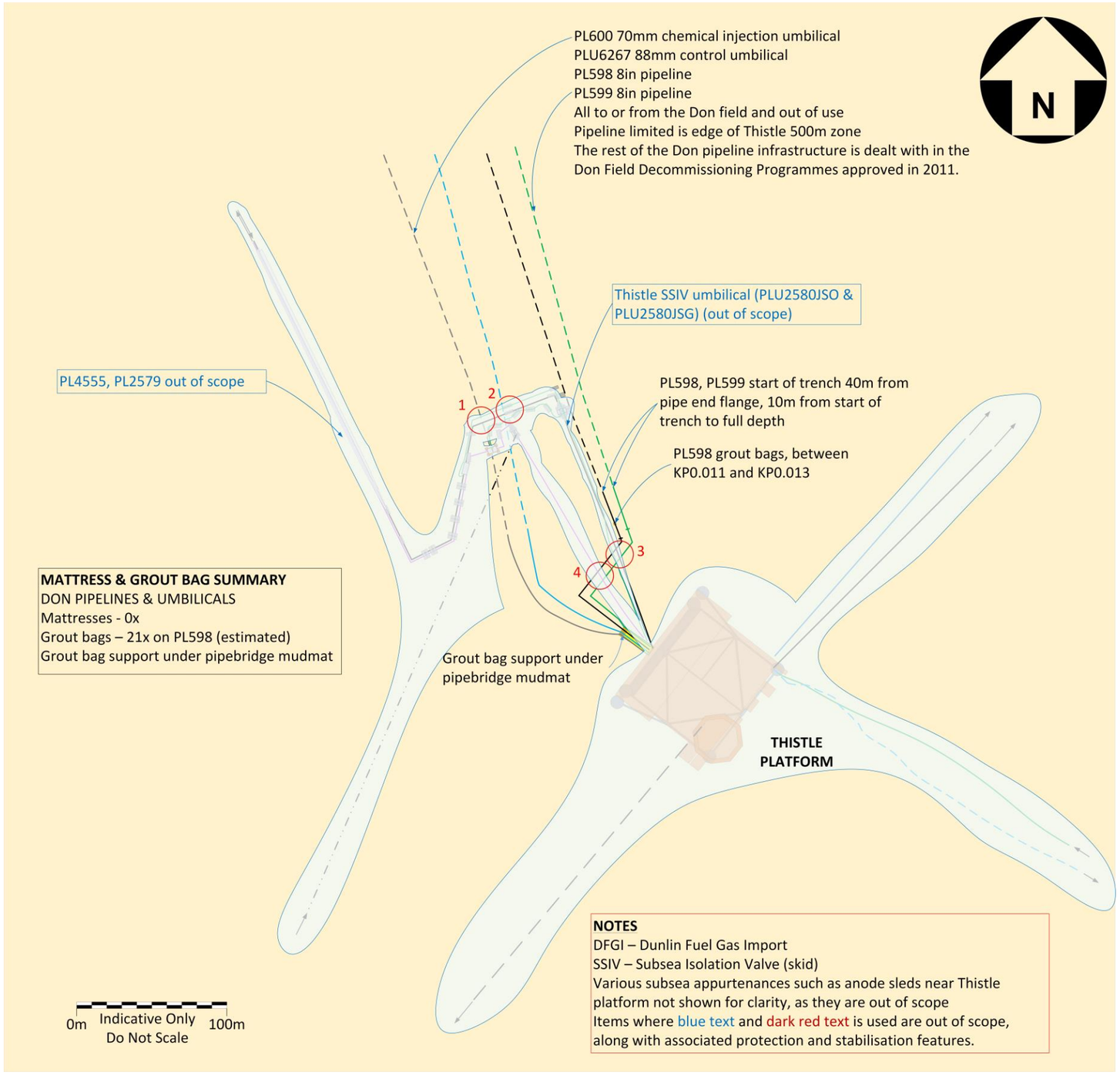


Figure 2.2.2 Don pipelines at Thistle platform approaches (PL598, PPL599, PL600, PLU6267)

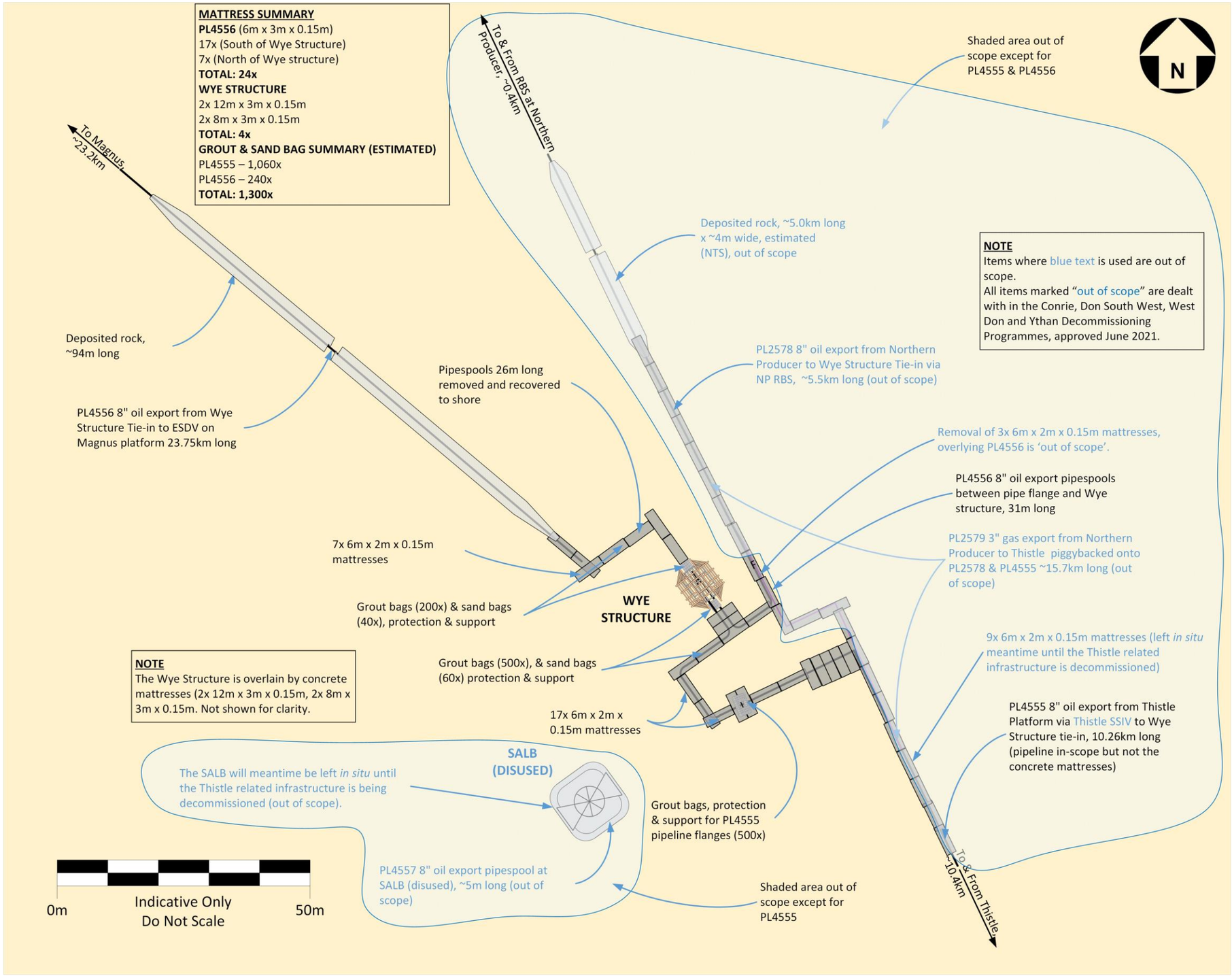


Figure 2.2.3 Wye structure & SALB approaches

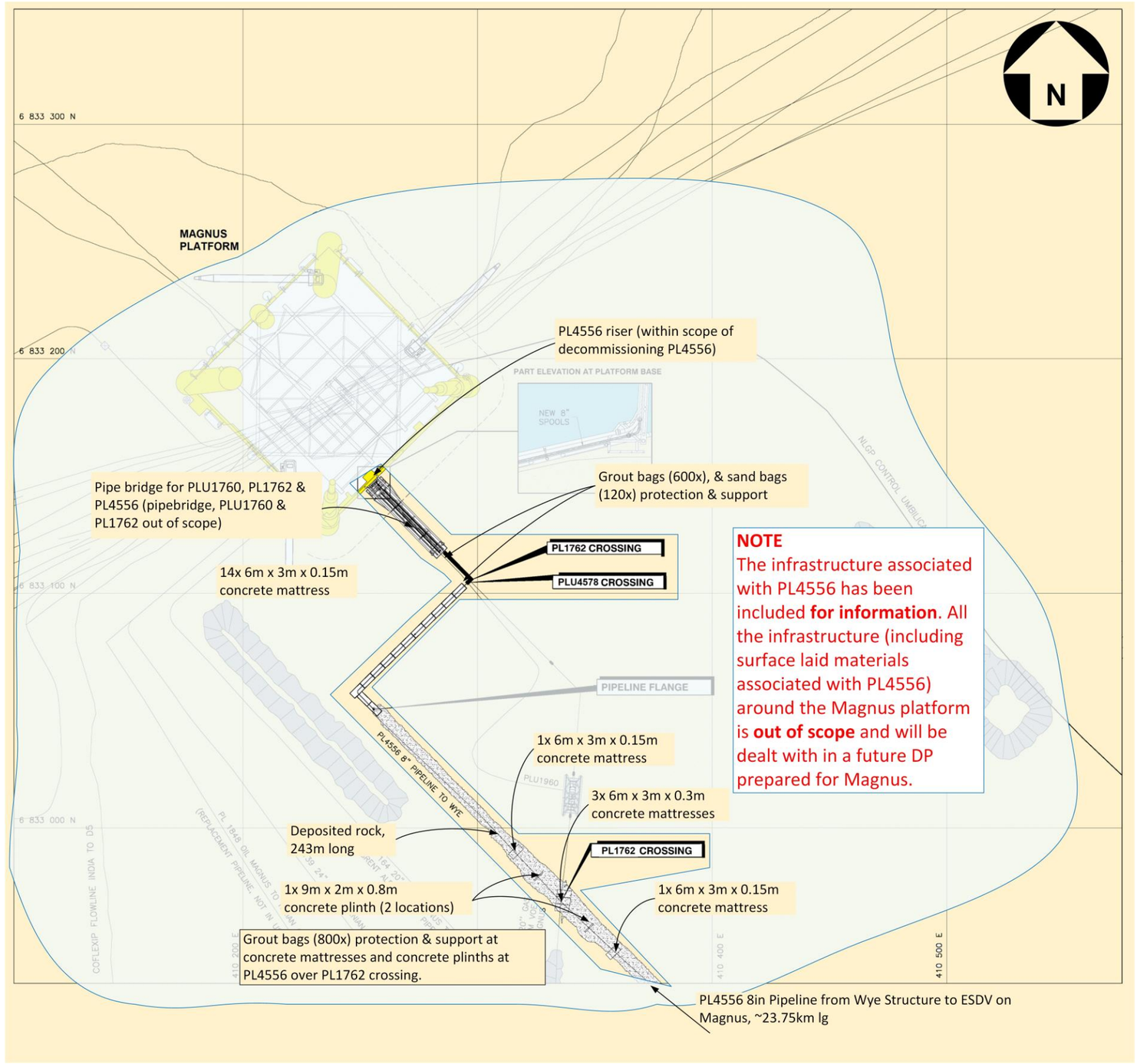


Figure 2.2.4 Magnus platform approaches

2.3 Purpose of the Environmental Appraisal

This Environmental Appraisal ('EA') assesses the potential environmental impacts associated with the proposed Thistle pipelines, SALM base and Don pipelines inside the Thistle 500 m zone. The impact identification and assessment process accounts for stakeholder engagement, comparison of similar decommissioning projects undertaken on the UKCS, expert judgement and the results of supporting studies which aim to refine the scope of the Decommissioning Programmes ('DPs'). This EA Report documents this process and details, in proportionate terms, the extent of any potential impacts and any proposed mitigation/control measures.

2.4 Regulatory Context

The Petroleum Act 1998 (as amended by the Energy Act 2008) governs the decommissioning of offshore oil and gas infrastructure, including pipelines, on the UKCS. The responsibility for ensuring compliance with the Petroleum Act 1998 rests with the Department for Energy Security and Net Zero ('DESNZ'). The Petroleum Act requires the Operator of an offshore installation or pipeline to submit a draft DP for statutory and public consultation, and to obtain approval of the DP from the Secretary of State. The DP should outline in detail the infrastructure being decommissioned and the method by which the decommissioning will take place. Well decommissioning is determined under a different process to the DP, called the Well Operations Notification System ('WONS').

This EA has been conducted to assess the potential environmental impacts that may result from undertaking the subsea decommissioning activities as part of the decommissioning of the Thistle pipelines, SALM base, Don pipelines inside the Thistle 500 m zone, subsea infrastructure including umbilicals, cables and associated protection and stabilisation materials. This EA supports the Thistle pipeline DP [27] and the Don DP for pipelines inside the Thistle 500 m zone [7] submitted to Offshore Petroleum Regulator for Environment and Decommissioning ('OPRED'), under DESNZ. The EA has been written considering the OPRED Guidance Notes [67] and the Decom North Sea EA Guidance [16].

The Scottish National Marine Plan ('NMP') has been adopted by the Scottish Government to help ensure sustainable development of the marine area and will be considered throughout this EA. This NMP has been developed in line with UK, European Union ('EU') and Oslo-Paris Convention (for the Protection of the Marine Environment of the North-East Atlantic) ('OSPAR') Legislation, Directives and Guidance. With regards to decommissioning, the NMP states that '*where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage ('CCUS'), decommissioning must take place in line with standard practice, and as allowed by international obligations. Re-use or removal of decommissioned assets from the seabed will be fully supported where practicable and adhering to relevant regulatory process*' [75]. EnQuest has given due consideration throughout this EA to the NMP during project decision making and the interactions between the project and NMP.

2.5 Environmental Assessment Process

To evaluate the environmental impact of the proposed DPs on the environment, the chosen decommissioning option must be supported with an EA. This EA documents the results of the EA process and is used to communicate the process. An overview of the EA process is provided in Figure 3.5.1. The full method can be found in Appendix A.

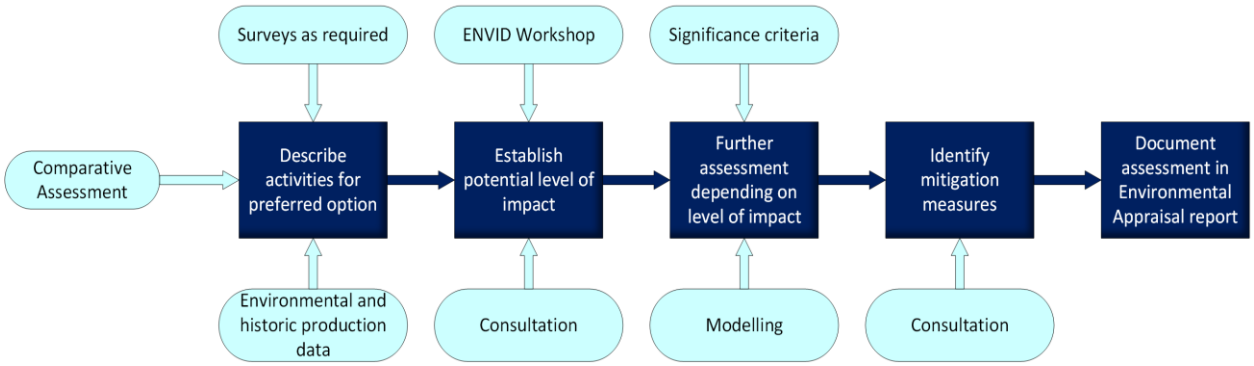


Figure 2.5.1 EA process

2.6 Stakeholder Engagement

Engagement with stakeholders is an important part of the decommissioning process as it enables their issues and concerns to be incorporated into the EA and presented within the DPs, where applicable, and acted upon during the subsequent planning and implementation stages of the project.

EnQuest recognise the importance and benefit of early engagement and as a result has regularly engaged with regulatory bodies and stakeholders such as OPRED, North Sea Transition Authority ('NSTA') and Scottish Fishermen's Federation ('SFF') where the initial recommendations from the Comparative Assessment ('CA') were presented and no significant comments were received.

Formal stakeholder consultation will begin with the submission of the draft DPs, supported by this EA report, to OPRED. The consultation process, at this stage, will include the use of the EnQuest website to make these documents publicly available.

2.7 Environmental Appraisal Scope and Structure

This EA supports the Thistle pipeline DP and the Don DP which is concerned only with the decommissioning of the Thistle pipelines, SALM base, Don pipelines inside the Thistle 500 m zone and associated protection & stabilisation features. The EA report sets out to describe, in a proportionate manner, the potential environmental impacts of proposed activities associated and aims to demonstrate the extent to which these impacts can be mitigated and controlled to an acceptable level. This is presented in the following sections, which will cover:

- A project description (Section 3), including:
  - Infrastructure and protection and stabilisation materials (Section 3.1, Section 3.2, Section 3.3 and Section 3.4);
  - The process by which EnQuest has arrived at the selected decommissioning strategy (Section 3.7);
  - Proposed schedule (Section 3.8);
  - A description of the proposed decommissioning activities (Section 3.9) and
  - Waste management (Section 3.10).
- Description of the environment and identification of the key environmental sensitivities which may be impacted by the proposed decommissioning activities (Section 4);
- A review of potential impacts from the proposed decommissioning activities and justification

for the assessments that support this EA (Section 5);

- Assessment of the key environmental impacts (Section 6); and
- Conclusions (Section 7).

The following key elements are also included in the EA:

- EA Method (Appendix A); and
- Environmental Risk Identification ('ENVID') results summary (Appendix B).

This EA report has been prepared in line with EnQuest's environmental assessment requirements and has given due consideration to the Regulatory Guidance [67] and to Decom North Sea's Environmental Appraisal Guidelines [16].

3. PROJECT SCOPE

This section outlines the infrastructure being decommissioned as part of the Thistle pipelines, SALM base and Don pipelines project (covered by this EA) and describes the manner in which the assets will be removed and/or be decommissioned *in situ*.

3.1 Subsea Installations

Table 3.1.1 outlines the subsea installations associated with the Thistle field.

Table 3.1.1 Thistle Subsea Installations

Description	Location		Weight (Te) / Size (m)	Comments/Status
	WGS84 Decimal	WGS84 Decimal Status Minute		
SALM base	61.377684° N 1.605636° E	61°22.6610' N 1°36.3382' E	1,450 14.65x14.65x7.8	Not piled. Refer Figure 3.1.1.

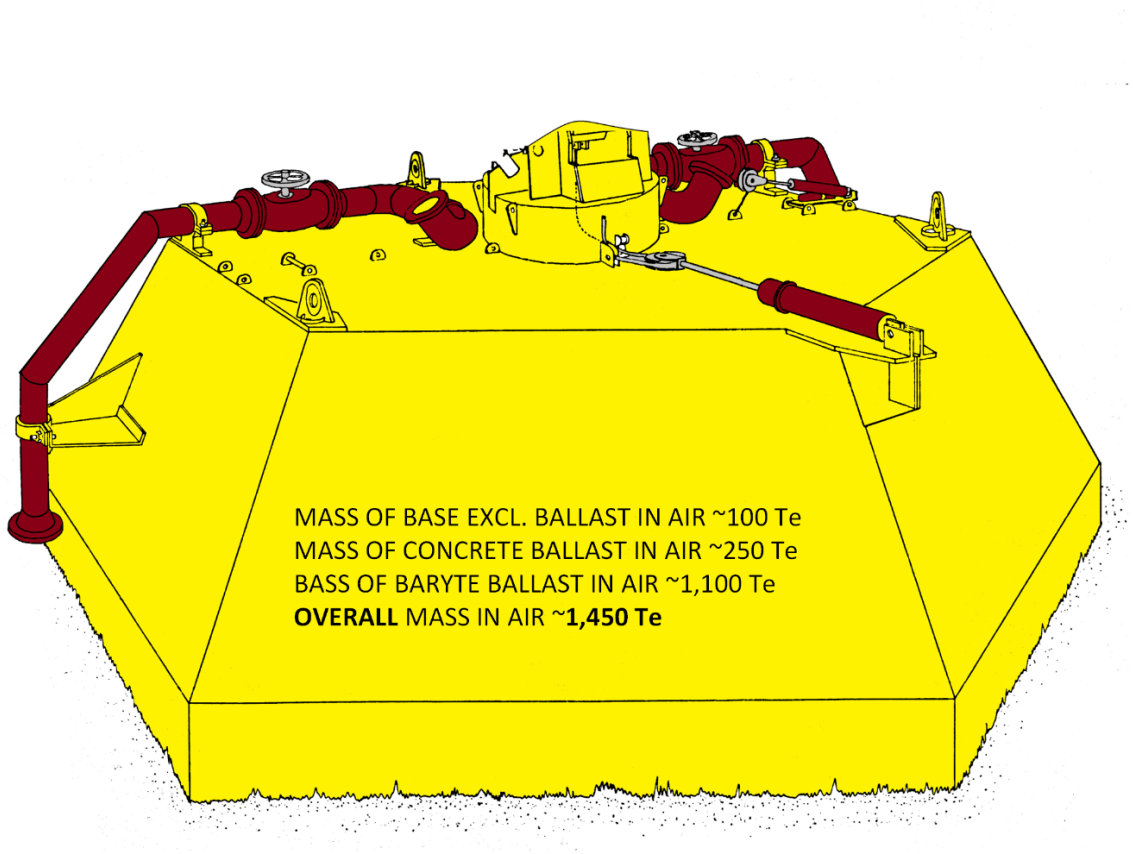


Figure 3.1.1 SALM base

3.2 Pipelines

Table 3.2.1 summarises the pipelines and umbilicals associated with the Thistle field. Table 3.3.2 summarises the Don pipelines and umbilicals inside the Thistle 500 m zone.

Table 3.2.1 Thistle pipelines information

Description	Pipeline Number (as per PWA)	Diameter (NB) (in)[1]	Length (km)	Description of Component Parts	Product Conveyed	From – To End Point[2]	Burial Status	Pipeline Status	Current Content
16in pipeline	PL13	16	12.69	Carbon steel pipeline, coated with 4.8mm thick CTEE coating and CWC 36.6mm thick.	Oil, condensate	Thistle 'A' pig trap to Dunlin Alpha leg C Hang Off	Trenched, natural backfill. 3,645m exposed, 5x spans reportable (2018)	Out of use	Inhibited seawater
16in pipeline	PL74	16	2.4		Seawater	From SALM base to base of riser at Thistle	Surface laid. 344m spans, no spans reportable (2021)	Out of use	Seawater
16in pipeline	PL75	16	2.4		Oil, condensate	Base of riser at Thistle to SALM base	Surface laid. 267 m spans, no spans reportable (2021)	Out of use	Seawater

Table 3.2.1 Thistle pipelines information									
Description	**Pipeline Number (as per PWA)**	**Diameter (NB) (in)[1]**	**Length (km)**	**Description of Component Parts**	**Product Conveyed**	**From – To End Point[2]**	**Burial Status**	**Pipeline Status**	**Current Content**
6in riser	PL166	6	0.19	Carbon steel pipeline riser, epoxy coated, routed within a J tube	Oil, condensate	From and including PL166 demarcation – 1m from bellmouth away from Thistle platform to and including Thistle ESDV	n/a	Out of use	Treated seawater
8in pipeline	PL4555	8	10.26	Carbon steel pipeline coated in 3LPP for most of its length. Risers and pipespools coated in epoxy based Interzone 954.	Exported oil	SSIV spool flange to comingling Wye structure	Trenched and buried under rock	Operational	Oil
8in pipeline	PL4556	8	23.39			From comingling Wye structure to Pipeline flange near on Magnus	Trenched and buried partly under rock	Out of use	Inhibited seawater
Control umbilical riser	PLU6221	94mm	0.17	Electro-hydraulic umbilical, 4x9.5mm cores	Hydraulic oil	Thistle TUTU to 1m outside the bellmouth away from Thistle platform	n/a	Operational	Hydraulic fluid, Brayco Micronic SV3

NOTES:

1. For brevity, the description of the end-to-end points may differ slightly from those consented in the Pipeline Works Authorisation ('PWA').
2. If dimensions are expressed in mm this refers to outside diameter of the product.
3. Reference PWA **PL13** (PWA dated 18 May 1976, 19-V-96, 80-V-19, and 187-V-19); **PL74 & PL75** (PWA dated 06 Aug 1980, 19-V-96, 80-V-96, 13-V-10), **PL4555** (PWA 136-V-19); **PL4556** (PWA 136-V-19), and **PLU6221** (PWA 379/V/22, 60/V/24).).

Table 3.2.2 Don pipelines information									
Description	**Pipeline Number (as per PWA)[1]**	**Diameter (NB) (in)[2]**	**Length (km)[3]**	**Description of Component Parts**	**Product Conveyed**	**From – To End Point[4, 5]**	**Burial Status**	**Pipeline Status**	**Current Content**
Oil production pipeline	PL598	8	0.57	Carbon steel pipeline coated with 13mm thick EPDM. Tie-in pipespools (85 m long excluding 25 m length on pipebridge) are provided with 50mm CWC (81 m).	Oil, condensate	From edge of Thistle 500 m zone to base of riser caisson 930 at the Thistle platform[4]	Trenched and buried, surface laid at ends	Partly decommissioned	Inhibited seawater
			(17.44)			From Don manifold to base of riser caisson 930 at the Thistle platform			
Water injection pipeline	PL599	8	0.57	Carbon steel pipeline coated with 13mm thick EPDM. Tie-in pipespools (85 m long) excluding 25 m length on pipebridge are provided with 50mm CWC (81 m).	Seawater	From base of riser caisson 930 on the Thistle platform to edge of Thistle 500 m zone	Trenched and buried, surface laid at ends	Partly decommissioned	Inhibited seawater
			(17.34)			From base of riser caisson 930 on the Thistle platform to the Don manifold			

Table 3.2.2 Don pipelines information									
Description	**Pipeline Number (as per PWA)[1]**	**Diameter (NB) (in)[2]**	**Length (km)[3]**	**Description of Component Parts**	**Product Conveyed**	**From – To End Point[4, 5]**	**Burial Status**	**Pipeline Status**	**Current Content**
Chemical injection umbilical	PL600	70mm	0.56	Steel armoured chemical injection umbilical, 2x6.3mm, 2x9.5mm bore	Corrosion inhibitor chemicals	From base of riser caisson 930 on the Thistle platform to edge of Thistle 500 m zone	Trenched and buried, surface laid at ends	Partly decommissioned	Surflo SI6772, Surflo 6442, Surflo H356, Methanol[6]
			(17.73)			From base of riser caisson 930 on the Thistle platform to the Don manifold			
Control & monitoring umbilical	PLU6267	88mm	0.54	Steel armoured electrohydraulic and hydraulic fluids umbilical.	Electrical power, signals, and hydraulic fluid	From base of riser caisson 930 on the Thistle platform to edge of Thistle 500 m zone	Trenched and buried, surface laid at ends	Partly decommissioned	Oceanic HW540, a water based hydraulic fluid
			(17.73)			From base of riser caisson 930 on the Thistle platform to the Don manifold			

Table 3.2.2 Don pipelines information									
Description	**Pipeline Number (as per PWA)[1]**	**Diameter (NB) (in)[2]**	**Length (km)[3]**	**Description of Component Parts**	**Product Conveyed**	**From – To End Point[4, 5]**	**Burial Status**	**Pipeline Status**	**Current Content**

NOTES:

1. Reference PWA 16/W/88.
2. If diameter is expressed in mm it refers to outside diameter of umbilical or flexible flowline
3. All pipeline lengths are estimated to the edge of the Thistle 500 m zone, with the full length of the pipelines given in brackets. The Don Decommissioning Programmes quotes the full length of the pipelines and does not explicitly define the length of pipeline inside the 500 m zone.
4. For brevity, the description of the end-to-end points are quoted for the full pipeline and may differ slightly from those consented in the PWA.
5. The 30in riser caisson 930 at the Thistle platform is out of scope and is dealt with in the Thistle Upper Jacket DP [28].
6. Attempts to flush PL600 were not successful due to internal core blockages.

3.3 Pipeline Structures

Table 3.3.1 summarises the Thistle pipeline structures and associated features. Table 3.3.2 summarises the Don pipeline structures and associated features.

Table 3.3.1 Thistle pipeline structures and associated features

Description	No	Weight (Te)	Location		Comments/Status
		Size (m)	WGS84 Decimal	WGS84 Decimal Status Minute	
Wye structure	1	30.7 10.5 x 6.2 x 1.8	61.445088° N 1.486407° E	61°26.7053' N 1°29.1844' E	Not piled. Refer Figure 1.7.4 and Figure 3.3.1.
Concrete mattress	2	15.0 12 x 3 x 0.15	As above	As above	Not shown in Figure 3.3.1.
Concrete mattress	2	13.1 8 x 3 x 0.15	As above	As above	Not shown in Figure 3.3.1.

Table 3.3.2 Don pipeline structures and associated features

Description	No	Weight (Te)	Location		Comments/Status
		Size (m)	WGS84 Decimal	WGS84 Decimal Status Minute	
Pipebridge	1	10 22.35 x 4 x 1.5	61.362533° N 1.578017° E	61°21.7520' N 1°34.6810' E	Pinned to base of riser caisson 930 with the other end resting on a grout bag support on the seabed. Refer Figure 3.3.2.
Grout bag support under mudmat	1	1 4.5 x 4.5 x 0.3	As above	As above	Exposed. Burial status to be confirmed during decommissioning operations. Size not specified. Estimated. Refer Figure 3.3.2.

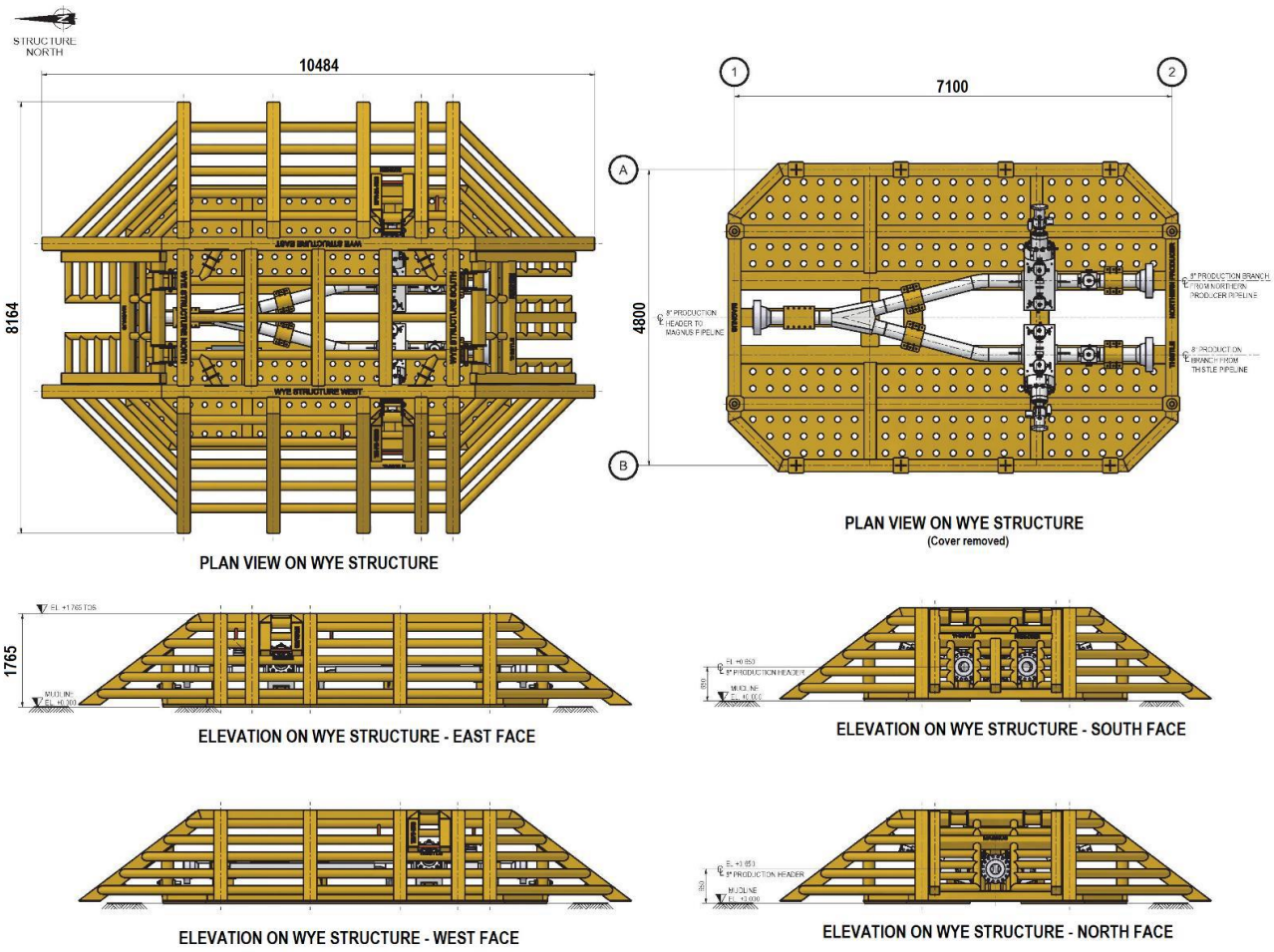


Figure 3.3.1 PL2578, PL4555 & PL4556 Wye structure

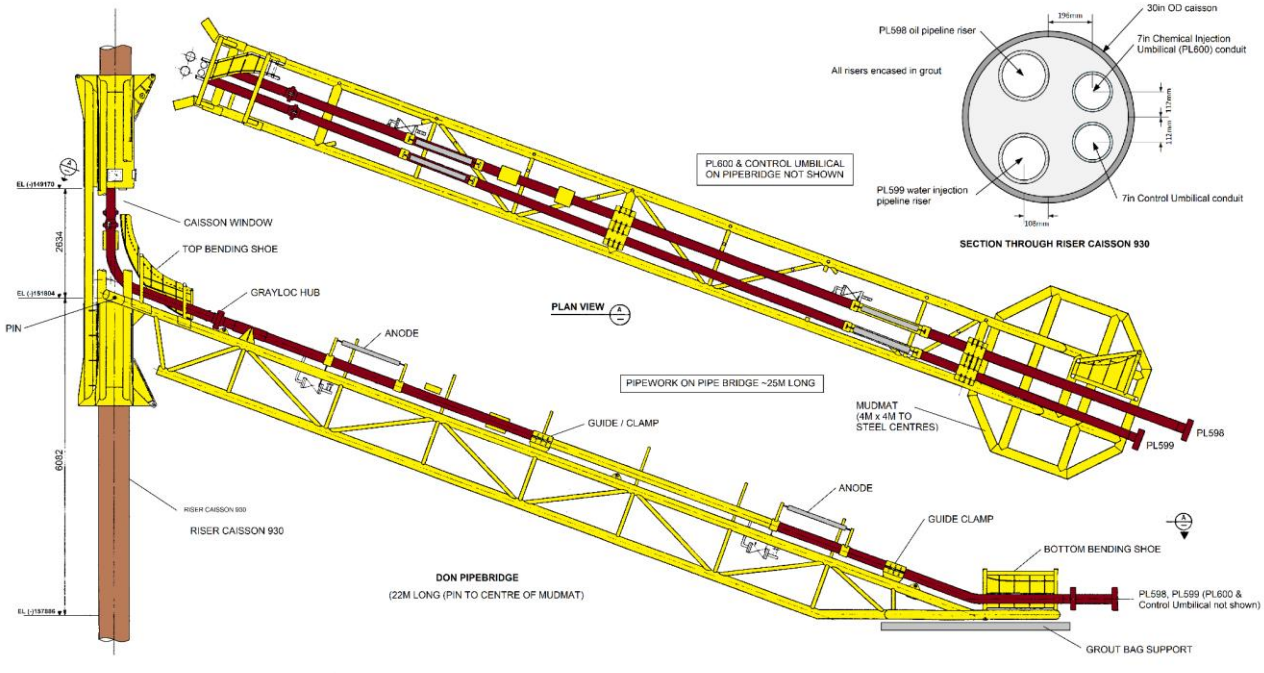


Figure 3.3.2 Don Pipebridge (next to riser caisson 930 on Thistle jacket)

3.4 Pipeline Protection and Stabilisation

The pipeline protection and stabilisation features associated with the Thistle field are summarised in Table 3.4.1. The pipeline protection and stabilisation features associated with the Don pipelines inside the Thistle 500 m zone are summarised in Table 3.4.2.

Table 3.4.1 Thistle pipeline protection and stabilisation feature

Stabilisation Feature	Total Number	Total Weight (Te)	Location	Exposed/Buried/Condition
INSIDE THISTLE 500 M ZONE (PL13, PL74, PL75, PL4555, PL4556, PLU6221)				
Concrete mattresses (6 x 2 x 0.15m)	2	5.4	PL4555 at Thistle (inside Thistle 500 m zone). Refer Figure 2.2.1.	Exposed. Burial status will be confirmed during decommissioning operations.
INFIELD BETWEEN THISTLE & DUNLIN (PL13)				
Concrete mattresses (6 x 2 x 0.15m)	17	45.9	On PL13 at KP0.351, KP0.444, KP0.729, KP0.753, KP11.198 (KP0 is at Thistle).	Exposed. Burial status will be confirmed during decommissioning operations.
Grout mattresses (Size not determined, assume 1.8 x 3 x 0.3m)	29	46.4	On PL13 at various locations between KP0.623 and KP11.556, used to remediate spans (KP0 is at Thistle).	
WYE STRUCTURE (PL4555, PL4556)				
Concrete mattresses (6 x 2 x 0.15m)	17	45.9	On PL4555 on southern approach to Wye structure. Refer Figure 2.2.3.	Exposed. Burial status will be confirmed during decommissioning operations.
Concrete mattresses (6 x 2 x 0.15m)	7	28.9	On PL4555 on northern approach to Wye structure. Refer Figure 2.2.3.	
Grout or sandbags (25kg), quantity estimated.	500	12.5	PL4555 pipeline flange protection south of the Wye structure. Refer Figure 2.2.3.	

Table 3.4.1 Thistle pipeline protection and stabilisation feature				
Stabilisation Feature	**Total Number**	**Total Weight (Te)**	**Location**	**Exposed/Buried/Condition**
Grout or sandbags (25kg), quantity estimated.	800	6.25	PL4555 & PL4556 near Wye. Refer Figure 2.2.3.	Exposed. Burial status will be confirmed during decommissioning operations.
MAGNUS 500 M ZONE (PL4556)				
Concrete mattresses (6 x 3 x 0.15m)	14	68.6	Between rock (refer PL1762 crossing below) and pipebridge. Refer Figure 2.2.4.	Exposed. Burial status will be confirmed during decommissioning operations.
Grout or sandbags (25kg) quantity estimated.	720	18.0	Between rock and pipebridge. Refer Figure 2.2.4.	
PIPELINE CROSSING (PL4556)				
Concrete mattresses (6 x 3 x 0.3m)	5	29.4	PL4555 over PL164.	Concrete mattresses and plinths all buried under deposited rock. Refer Figure D.1.1.
Concrete plinths (9 x 2 0.8m)	2	36.8		
Deposited rock	352m	1,773		
Concrete mattresses (6 x 3 x 0.3m)	3	27.3	PL45556 over PL1762 crossing. Refer Figure 2.2.4	Concrete mattresses and plinths all buried under deposited rock. Refer Figure D.2.1.
Concrete plinths (9 x 2 x 0.8m)	2	36.8		
Concrete mattresses (6 x 3 x 0.15m)	2	9.8		
Deposited rock	234m	1,656		

Table 3.4.1 Thistle pipeline protection and stabilisation feature				
Stabilisation Feature	**Total Number**	**Total Weight (Te)**	**Location**	**Exposed/Buried/Condition**
Concrete mattresses (6 x 3 x 0.3m)	3	27.3	PL4555 over PLU4570.	Concrete mattresses and plinths all buried under deposited rock. Refer Figure D.3.1
Deposited rock	198m	36.8		
DEPOSITED ROCK				
Deposited rock on PL4556 (balance of deposited rock on PL4556 after subtracting pipeline crossings)	91m	520	North of Wye structure (between KP0.000 and KP0.083 and between KP9.436 and 9.444).	Exposed. Burial status will be confirmed during decommissioning operations.
NOTES: 1. There are no protection and stabilisation features associated with PL13 inside the Dunlin 500 m zone or PL74 and PL75.				

Table 3.4.2 Don pipeline protection and stabilisation feature				
Stabilisation Feature	**Total Number**	**Total Weight (Te)**	**Location**	**Exposed/Buried/Condition**
THISTLE APPROACHES (INSIDE 500 M ZONE)				
Grout bags (25 kg)	21	0.53	Between KP0.011 and KP0.013	Exposed. Burial status will be confirmed during decommissioning operations.

3.5 Pipeline Crossings

There are several pipeline crossings within the Thistle infrastructure (summarised in Table 3.5.1) and Don infrastructure (summarised in Table 3.5.2).

Table 3.5.1 Thistle pipeline crossing information

ID	Pipeline, umbilical or cable description	Location	Protection
THISTLE 500 M ZONE			
1	PL4555 crosses over PL600 (Don field)	Inside Thistle 500 m zone	None. Refer Figure 2.2.1.
2	PL4555 crosses over PLU6267 (Don field)	Inside Thistle 500 m zone	1x concrete mattress. Refer Table 3.4.1 and Figure 2.2.1.
3	The PL4555 catenary riser crosses over PL598 & PL599 (Don field)	Inside Thistle 500 m zone	None. Refer Figure 2.2.1.
4	PLU6221 crosses over PL166	Inside Thistle 500 m zone	No protection and stabilisation features noted in documentation. Refer Figure 2.2.1.
5	PLU6221 crosses back over PL166	Inside Thistle 500 m zone	
OUTSIDE THISTLE 500 M ZONE			
PL4556 over PL164		413851.1E 6828541N	Refer Table 3.4.1, Figure 3.5.1 and Figure D.1.1.
PL4556 over PLU4570		411423.3E 6831755.2N	Refer Table 3.4.1, Figure 3.5.1 and Figure D.1.1.
PL4556 over PL1762 (crosses twice)		Inside Magnus 500m zone	Refer Table 3.4.1, Figure 2.2.4 and Figure D.2.1.
PL4556 over PLU1960		Inside Magnus 500m zone near pipebridge	None. Refer Figure 2.2.4.

Table 3.5.1 Thistle pipeline crossing information			
ID	**Pipeline, umbilical or cable description**	**Location**	**Protection**
PL4556 over PL1762		Inside Magnus 500m zone near pipebridge	None. Refer Figure 2.2.4.
PL4556 over PLU4578		Inside Magnus 500m zone near pipebridge	None. Refer Figure 2.2.4.
NOTES: 1. Universal Transverse Mercator ('UTM') Eastings and Northings are indicative only. 2. Pipeline crossing ID in Thistle 500 m zone is used in Figure 2.2.1.			

Table 3.5.2 Don pipeline crossing information			
ID	**Pipeline, umbilical or cable description**	**Location**	**Protection**
THISTLE 500 M ZONE			
1	PL4555, PLU2580JSO and PLU2580JSG all cross over PL600	Inside Thistle 500 m zone	None. Refer Figure 2.2.2.
2	PL4555, PLU2580JSO and PLU2580JSG all cross over PLU6267	Inside Thistle 500 m zone	Concrete mattress. Refer Figure 2.2.2.
3	The PL4555 flexible catenary riser and the PLU2580 umbilical riser theoretically cross over PL598 & PL599 but at this location the risers are likely suspended in the water column.	Inside Thistle 500 m zone	None. Refer Figure 2.2.2.
4	The PL2579 catenary umbilical theoretically crosses over PL598 & PL599 but at this location the umbilical is likely suspended in the water column.	Inside Thistle 500 m zone	None. Refer Figure 2.2.2.

Table 3.5.2 Don pipeline crossing information			
ID	**Pipeline, umbilical or cable description**	**Location**	**Protection**

NOTES:

1. For ID (location) refer Figure 2.2.2.
2. All these crossings are third-party crossings are outside of the scope of the Thistle Pipeline DP and Don DP for pipelines in Thistle 500 m zone. For PL2579, PLU2580, PLU2580JSO and PLU2580JSG refer Conrie, DSW, WD and Ythan DP [24] & for PL4555 refer the Thistle pipeline DP [27].

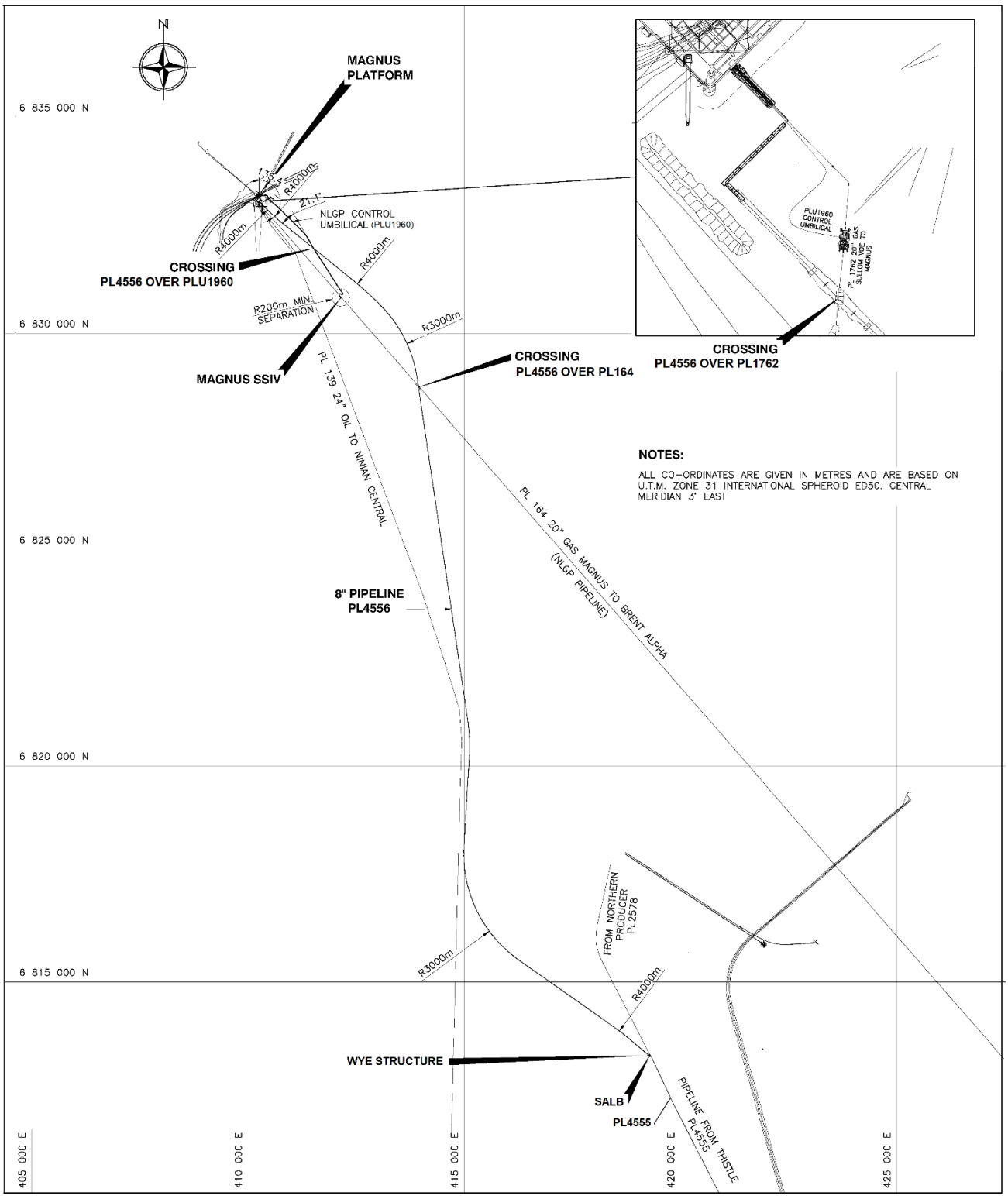


Figure 3.5.1 PL4556 pipeline crossings

3.6 Decision-making Approach

The OPRED Guidance Notes states that subsea installations (e.g., drilling templates, wellheads and their protective structures, production manifolds and risers) must, where practicable, be completely removed for re-use, recycling or final disposal on land [67]. Any piles used to secure such structures in place should be cut below natural seabed level at such a depth to ensure that any remains are unlikely to become uncovered. Should an Operator wish to make an application to leave a subsea infrastructure in place because of the difficulty of removing it, justification in terms of the environmental, technical or safety reasons are required. With regards to pipelines (including flowlines and umbilicals), these are 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 can be decommissioned *in situ*. For example, pipelines that are adequately buried or trenched or which are expected to self-bury. Where an Operator is considering decommissioning pipelines *in situ*, the decision-making process must be informed by CA of the feasible decommissioning options. This 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 sand/grout bags installed to protect pipelines should be removed for disposal onshore if their condition allows. If the condition of the mattresses or sand/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 CA of the options.

3.6.1 Alternatives to Decommissioning

Options for re-use and alternate use were considered at the option screening stage in the decommissioning planning for the pipelines. No opportunities have been identified for the continued use of the Thistle and Don pipelines for the export of oil or gas. All other possible non-oil and gas uses for the infrastructure, at its present location or at another site, are technically infeasible and/or economically unviable.

3.7 Comparative Assessment

The following Thistle and Don pipelines were subject to CA:

Thistle pipelines:

- PL13, 16in CWC, trenched and left to backfill naturally. Buried, but with multiple exposures and spans (3,645 m), ~12.7 km long.
- PL4555, 8in (and piggybacked) trenched and buried with no exposures, ~10.26 km long.
- PL4556, 8in, trenched and buried with no exposures. From the Wye structure to Magnus, 23.75 km long but only 23.39 km of the pipeline (up to the pipeline flange near Magnus) is being decommissioned.

Don pipelines:

- PL598, 8in, trenched and buried, ~0.57 km (overall length, ~17.34 km).
- PL599, 8in, trenched and buried but exposed at KP0.427 for 18 m, measured from the pipeline end flange near Thistle, ~0.57 km (~17.34 km).

- PL600, 70mm umbilical, trenched and buried, ~0.56 km (~17.73 km).
- PLU6267, 88mm umbilical, trenched and buried, 0.54 km (~17.73 km).

The lengths in brackets are the lengths of the pipelines quoted in the original Don DP [6] and are provided for completeness and context.

The approach to a CA is largely qualitative and carried out at a level that is sufficient to differentiate between the options. The 'complete removal', 'partial removal or remediation' and 'leave *in situ*' decommissioning options were compared.

In line with the OPRED Guidance Notes, EnQuest has committed to fully removing all surface laid pipelines, all installations, structures, and associated protection and stabilisation features.

The Thistle pipelines PL13, PL4555 and PL4556, and Don pipelines PL598, PL599, PL600 and PLU6267 have been considered within a CA in order to arrive at an optimal decommissioning method. The CA methodology is described fully within the combined CA for Thistle and Don pipelines [26].

A summary of the infrastructure for which a CA of options was made and the selected option (based on consideration of safety, environmental, technical, societal and economic factors) is given in Table 3.7.1. The CA used a non-weighted process to eliminate any subjectivity. Potential environmental impacts were considered when comparing options including seabed disturbance, habitat loss and underwater noise in line with the conservation objectives and sensitivities of protected sites in the vicinity.

Table 3.7.1 Thistle pipeline decommissioning summary

Pipeline or group	Recommended option	Justification
PIPELINES		
PL13	Remove the surface laid sections of the pipeline on approaches to the Thistle and Dunlin 'A' platforms in accordance with mandatory requirements. Bury the remaining section of the pipeline inside the trench under rock. This will result in ~29,300 Te of rock being deposited on the pipeline. OPRED will be consulted with regards to profiling of the deposited rock along the pipeline. Thereafter, the pipeline burial status will be monitored using a Risk Based Inspection regime to a frequency and timescale agreed with OPRED.	Complies with OPRED guidance notes [67] and is the preferred outcome of the CA [26].
PL4555, PL4556	Completely remove all pipespools and surface laid sections of pipeline and associated protection and stabilisation features up to the point of burial in rock. Deposit ~15 Te of rock on both ends of each pipeline. Total rock ~60 Te. The combined lengths of pipeline and pipespools to be removed are estimated as follows:	Complies with OPRED guidance notes [67] and is the preferred outcome of the CA [26]. Apart from the surface laid ends, the pipelines are buried.

Table 3.7.1 Thistle pipeline decommissioning summary		
Pipeline or group	**Recommended option**	**Justification**
	PL4555 (Thistle) ~200 m long PL4555 (Wye structure) ~112 m long PL4556 (Wye structure) ~80 m long Refer Figure 2.2.1, Figure 2.2.3 and Figure 2.2.4 for details. The deposition of rock on cut pipeline ends (PL4555 and PL4556) will be kept to a practical minimum. For the purposes of the EA, it is assumed that up to 15 Te of rock will be required at a total of four locations to ensure the pipeline ends remain buried. Thereafter, the pipeline burial status will be monitored using a Risk Based Inspection regime to a frequency and timescale agreed with OPRED.	

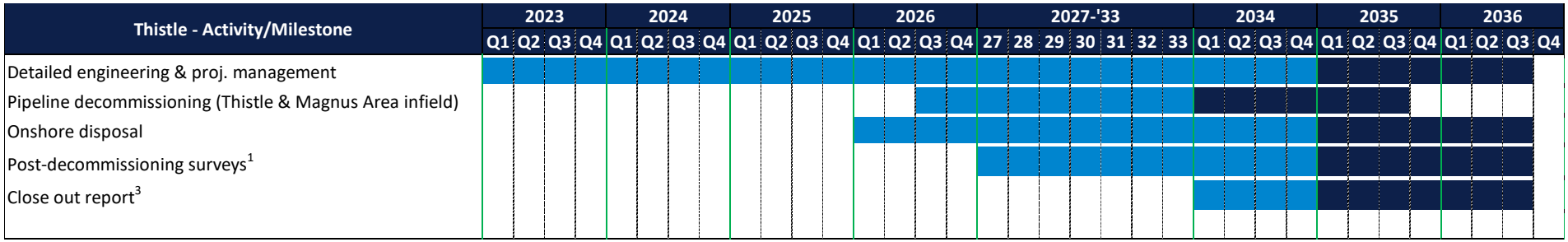
Table 3.7.2 Don pipeline decommissioning summary		
Pipeline or group	**Recommended option**	**Justification**
PIPELINES		
PL598	Remove the surface laid sections from the bottom of riser caisson 930 to the point when the pipeline is buried at end of the transition at trench depth. Estimated length – ~150 m, including length of product on the pipebridge (25 m long). Bury the end with up to 15 Te of deposited rock. Total ~15 Te of deposited rock. Refer Figure 2.2.2.	Complies with OPRED guidance notes [67]. Recommended outcome of the CA(s) [6] [26].
PL599	Remove the surface laid sections from the bottom of riser caisson 930 to the point when the pipeline is buried at end of the transition at trench depth. Estimated length - ~150 m, including length of product on the pipebridge (25 m long). Bury the end with up to 15 Te of deposited rock. Total ~15 Te of deposited rock. Confirm via survey if there is an exposed section starting at KP0.427 (KP measured from pipeline ends flange near Thistle 18.3 m long, including a span 2.5m long, noted in 2013 pipeline survey).	Complies with OPRED guidance notes [67]. Recommended outcome of the CA(s) [6] [26].

Table 3.7.2 Don pipeline decommissioning summary		
Pipeline or group	**Recommended option**	**Justification**
	Thereafter, the burial status of both pipelines should be monitored using a Risk Based Inspection regime to a frequency and timescale agreed with OPRED. Refer Figure 2.2.2.	
PL600, PLU6267	Remove the surface laid sections from the bottom of riser caisson 930 to the point when the umbilical(s) is buried at end of the transition at trench depth. Estimated lengths of PL600 and PLU6267 – 160m including length of product on the pipebridge (25m long). Bury the ends in trench with up to 15 Te of deposited rock. Total ~30Te of deposited rock. Thereafter, the burial status of both umbilicals should be monitored using a Risk Based Inspection regime to a frequency and timescale agreed with OPRED. Refer Figure 3.2.1.	Complies with OPRED guidance notes [67]. Recommended outcome of the CA(s) [6][26].
NOTE: 1. Where the pipelines have been cut, for example where they enter the seabed, remedial work may be required to bury the end of the pipeline. As a contingency measure, small deposits of rock up to 15 Te may need to be used to make sure that the pipeline ends remain buried.		

3.8 Proposed Schedule

The current proposed schedule for the decommissioning of the Thistle pipelines and SALM base can be seen in Figure 3.8.1. The decommissioning of the Don pipelines inside the Thistle 500 m zone are subject to separate schedule as shown in Figure 3.8.2.

The activities are subject to the acceptance of the DPs and any unavoidable constraints (e.g., vessel availability) that may be encountered while executing the decommissioning activities. The commencement of offshore decommissioning activities will depend on commercial agreements and commitments. EnQuest will examine the possibility of including the offshore work in a wider campaign of subsea works to reduce costs.



Notes / Key

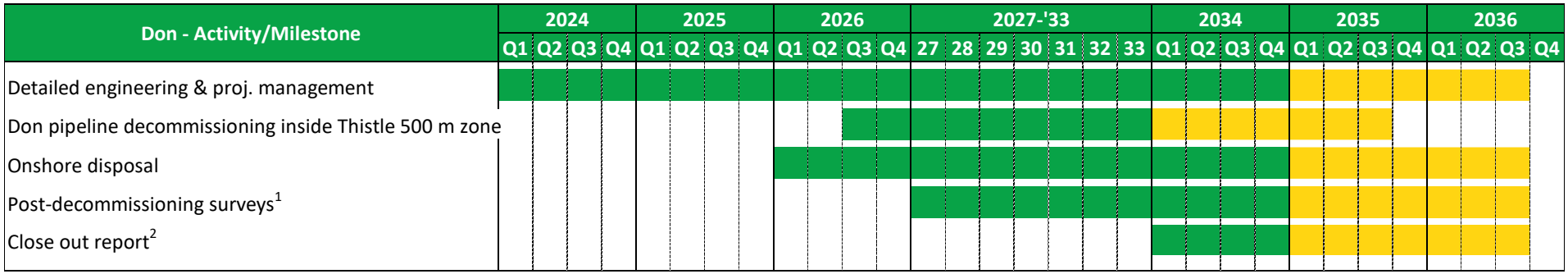
Earliest potential activity

Activity window extended as per NSTA strategy which aspires to combine multiple scopes in a single campaign;

Activity window to allow commercial flexibility associated with decommissioning activities;

1. Post decommissioning surveys to follow completion of decommissioning activities;
2. Decommissioning activities within the Magnus 500m zone will be addressed in a future DP for Magnus
3. Close out report within 1 year of completion of offshore activities.

Figure 3.8.1 Gantt-chart of Thistle project plan



Notes / Key

Earliest potential activity

Activity window extended as per NSTA strategy which aspires to combine multiple scopes in a single campaign

A wide activity window is proposed in order to increase the opportunity to capture cost efficiencies by decommissioning at scale (a strategic priority of the North Sea Transition Authority ('NSTA') Decommissioning Strategy) e.g. via EnQuest's commitment to explore scope aggregation opportunities as a member of the Subsea Decommissioning

1. Post decommissioning surveys to follow completion of decommissioning activities;
2. Close out report within 1 year of completion of offshore activities.

Figure 3.8.2 Gantt-chart of Don project plan

3.9 Decommissioning Activities

This section outlines the proposed decommissioning activities for the Thistle pipelines, SALM base and Don pipelines. The activities described within include activities that are out with the scope of this EA, however they are included within this section to provide an overview of all decommissioning activities.

3.9.1 Preparation for Decommissioning

3.9.1.1 Well Decommissioning

Well decommissioning is not within the scope of this EA. It has been, or will be, assessed as part of well intervention and marine licence applications. A description is included here, to describe the activities leading up to the point that the decommissioning activities that are assessed here, begin.

All well decommissioning activities will be subject to permitting application via the Portal Environmental Tracking System ('PETS') and decommissioned to current industry standard. Each well will be systematically and permanently abandoned with reservoir barriers in accordance with well decommissioning best practice. Well decommissioning is determined under the Well Operations Notification System ('WONS').

3.9.1.2 Flushing and Cleaning Operations

Flushing and cleaning operations are not within the scope of this EA as they have been assessed as part of the ongoing operations of the facilities and are subject to permitting application via the PETS. A description is included herewith to describe the activities which have occurred leading up to the point that the decommissioning activities begin.

EnQuest will flush all the Thistle pipelines with seawater, followed by plugs of gel or foam called 'pigs' propelled through the lines. This activity is designed to remove mobile hydrocarbons and achieve an agreed acceptable level of cleanliness, back to the topsides. These fluids will be subject to the PETS permitting system and if required, will be skipped and shipped back to shore. Chemical injection lines will be subjected to a turbulent seawater flush to displace all contents.

Following isolation from the wells, gas (nitrogen) will be passed through the platform processing systems to ensure that minimal hydrocarbons remained in the system prior to the final cleaning and disconnect. During the final cleaning and disconnect activities, all the processing systems on the platform will be progressively depressurised, purged with gas (nitrogen) and rendered safe for removal operations. All bulk chemicals surplus to requirement will be backloaded onshore for disposal. The pipework and tanks will be visually inspected where possible and may be further treated should any sources of potential spills of oils and other fluids be identified.

All the Don pipelines will have been flushed. As PL600 is impaired by internal core blockages, flushing has not been possible. PL600 and PLU6267 have been cut at multiple locations along their entire length during previous decommissioning activities and the discharges of the contents covered under an approved chemical permit and chemical risk assessment. A new permit application will be submitted to flush PL600 and PLU6267 with potable water or seawater before they are severed inside the Thistle 500m zone.

3.9.2 Subsea Infrastructure Decommissioning

3.9.2.1 Overview

A subsea contractor will mobilise vessels with a range of crane capabilities for lifting objects of different sizes and weights off the seabed, vessels that can support underwater operations including Remotely Operated Vehicle ('ROV') deployment, diving, cutting, excavation and placement of rock, survey vessels and guard vessels. The vessels will deploy ROVs (or divers when necessary) to cut the risers, pipelines and umbilicals. The vessels' cranes will lift the subsea

structures to the vessel and/or a barge.

3.9.2.2 SALM Base

The gravity based SALM base will be completely removed and taken to shore to be dismantled and recycled unless alternative reuse options are found to be viable and more appropriate. It is estimated that there is between 1,100 and 1,350 Te of loose ballast (~250 Te concrete and ~1,100 Te baryte) inside the SALM base. It should be noted that the lifting attachments on the original SALM base will not have sufficient capacity for removing the SALM base complete with the ballast inside. Therefore, the ballast will need to be removed separately before the SALM base can be recovered.

Taking this into account, the SALM base may require dredging or jetting to facilitate recovery. Any potential requirement for dredging or jetting has been included in the area of seabed impact (Section 6.2.2.1) in which a five-metre buffer has been applied to consider such activities.

Environmental permit applications required for work associated with removal of the installation will be applied for and should any difficulties be encountered when dredging the ballast and recovering to the vessel OPRED will be consulted.

3.9.2.3 Pipelines and Umbilicals

There are several options for the removal of the surface laid portions of the pipelines and umbilicals from the seabed including:

- Cut surface laid sections into discrete lengths and recover each section using subsea grab or similar; or
- Cut surface laid sections into discrete lengths and recover multiple sections using subsea baskets to lift the sections onto vessels.

The cutting equipment used to cut the pipeline ends, the pipeline and the umbilicals will typically be either a Diamond Wire Saw ('DWS') or hydraulic shears. In terms of environmental impact and the time taken to complete the cutting operation(s), there is little difference between the two methods, especially given the relatively small diameters of the pipelines and umbilicals.

3.9.2.4 Removal of Protection and Support Material

As per the OPRED Guidance Notes, the base case for mattresses is full removal, with the exception of any protection structures associated with crossing points and any third-party infrastructure. EnQuest plan to fully recover any exposed sand/grout bags and concrete mattresses. Any mattresses or sand/grout bags used to remediate spans or buried under deposited rock will be decommissioned *in situ*. If any mattresses are found to have insufficient integrity to be removed, then EnQuest will engage with the Regulator regarding decommissioning these mattresses *in situ*.

There are approximately 74 concrete mattresses, 29 grout mattresses, 4 concrete plinths, 2,020 grout or sandbags (25 kg each) and 3,985.8 Te of deposited rock associated with the Thistle pipelines and SALM base. There are approximately 21 grout bags (25 kg each) and 1 grout bag support under mudmat associated with the Don pipelines. The burial status of the concrete mattresses and pipeline protection covers will be determined when decommissioning activities are being carried out, however, it is currently proposed that all mattresses and sand/grout bags will be removed where it is practicable to do so. In the event of any difficulties, EnQuest will have contingency measures in place within the work programme to accommodate for the removal of degrading protection and support material. Should any material be unrecoverable, OPRED will be consulted. Those remaining *in situ* are either used in order to remediate spans, are buried under deposited rock or located at pipeline crossings.

3.9.3 Post-decommissioning Surveys and Monitoring

Following the decommissioning of the Thistle pipelines and Don pipelines inside the Thistle 500 m zone, it will be necessary to identify any potential snagging hazards associated with the remaining pipelines or any changes to the seabed and remediate these. A clear seabed will be verified by an independent survey of the installation sites and pipeline corridors. The aim of seabed verification is to ensure the seabed is left in a safe condition for future fishing effort and in line with the Guidance Notes [67] and will be undertaken using non-intrusive methods wherever possible. These may include techniques which do not make contact with the seabed, such as MBES, SSS and ROV surveys. Any oilfield debris identified shall be recovered and recycled or disposed of accordingly.

In the scenario that an overtrawl survey is required to ensure the clearance of the Thistle 500 m safety zone, consultations would be held with the SFF and OPRED to discuss the best way to approach this while taking the environmental sensitivities of the area into account. Subject to acceptance of the close-out report by OPRED, the existing safety zone will be lifted.

A post-decommissioning survey regime will be discussed and agreed with OPRED prior to survey commencement. As it is proposed to decommission Thistle pipelines PL13 *in situ* and buried sections of PL4555 and PL4556 *in situ*, these will be subject to a monitoring programme agreed between EnQuest and OPRED. As it is also proposed to decommission the Don pipelines PL598, PL599, PL600 and PLU6267 *in situ,* they will be subject to a separate monitoring programme agreed between BP and OPRED and carried out by EnQuest. After the survey results have been reviewed, a future monitoring regime will be agreed between parties and will take account of ongoing liability, the status and findings of previous surveys and a risk-based approach to frequency and scope.

3.10 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 the Thistle and Don pipelines will generate a quantity of waste. EnQuest 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 3.10.1).

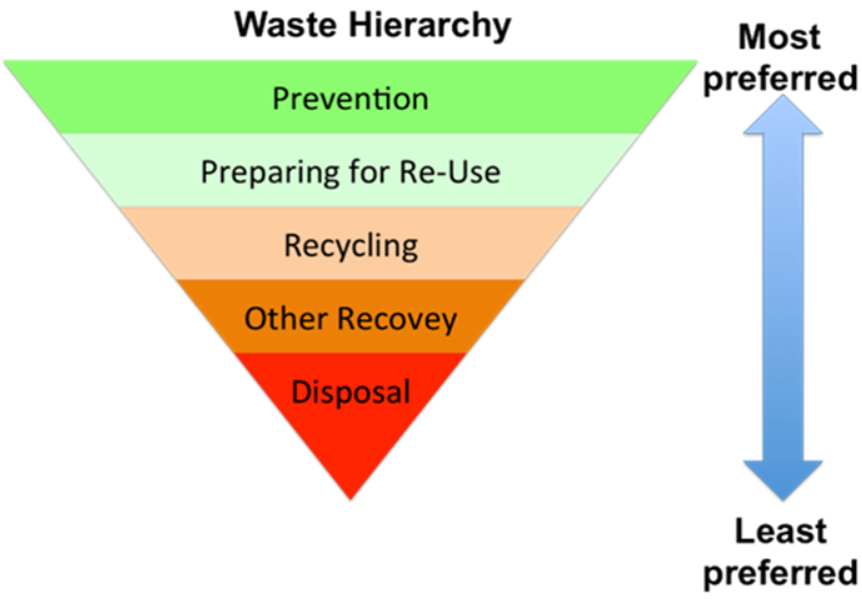


Figure 3.10.1 Waste hierarchy

Until a waste management contractor has been selected and disposal routes identified, the final disposal options for waste materials are unknown. The project aspiration is that all ferrous and non-ferrous metals and concrete will be recycled.

There may be instances where infrastructure returned to shore is contaminated (e.g., Naturally Occurring Radioactive Material ('NORM'), marine growth, hydrocarbons, paints etc) and cannot be recycled, but the weight / volume of such material is not expected to result in substantial landfill use.

Table 3.10.1 summarises the various waste management processes for different waste streams that EnQuest will follow.

Table 3.10.1 Waste stream management process

Waste Stream	Removal and disposal method
Marine growth	Where necessary and practicable, to allow access some marine growth will be removed offshore. The remainder will be brought to shore and disposed of according to guidelines and company policies and under appropriate permit.
NORM	Tests for NORM will be undertaken offshore on the recovery vessel by the Radiation Protection Supervisor and recorded. Any NORM encountered onshore will be dealt with and disposed of in accordance with guidelines and company policies and under appropriate permit.
Other hazardous wastes	Other hazardous waste will be recovered to shore and disposed of according to guidelines and company policies and under appropriate permit.
Onshore dismantling sites	Appropriate licensed sites will be selected. The dismantling site must demonstrate proven disposal track record and waste stream management throughout the deconstruction process and demonstrate their ability to deliver re-use and recycling options.

Table 3.10.2 and Table 3.10.3 depict the total breakdown of the Thistle and Don materials respectively (including and excluding deposited rock).

Table 3.10.2 Thistle material weights removed to shore and decommissioned *in situ*

Inventory	Total inventory (Te)	Planned tonnage to shore (Te)	Planned left *in situ* (Te)
Thistle Installations	1,450	1,450	0
Thistle Pipelines	8,573	1,328	7,246
Deposited rock	4,988	0	4,988
Sub-total (incl. rock)	**15,011**	**2,778**	**12,234**
Sub-total (excl. rock)	**10,023**	**2,788**	**7,246**

Table 3.10.3 Don material weights removed to shore and decommissioned *in situ*			
Inventory	**Total inventory (Te)**	**Planned tonnage to shore (Te)**	**Planned left *in situ* (Te)**
Don pipelines to edge of 500m zone	140.1	61.0	79.1
Pipebridge only	14.3	14.3	0.0
Sub-total (excl. rock)	**154.40**	**75.3**	**79.1**

Figure 3.10.2 and Figure 3.10.3 provide a summary of the material type and volume that will be recovered and/or decommissioned for the Thistle installations and pipelines, respectively.

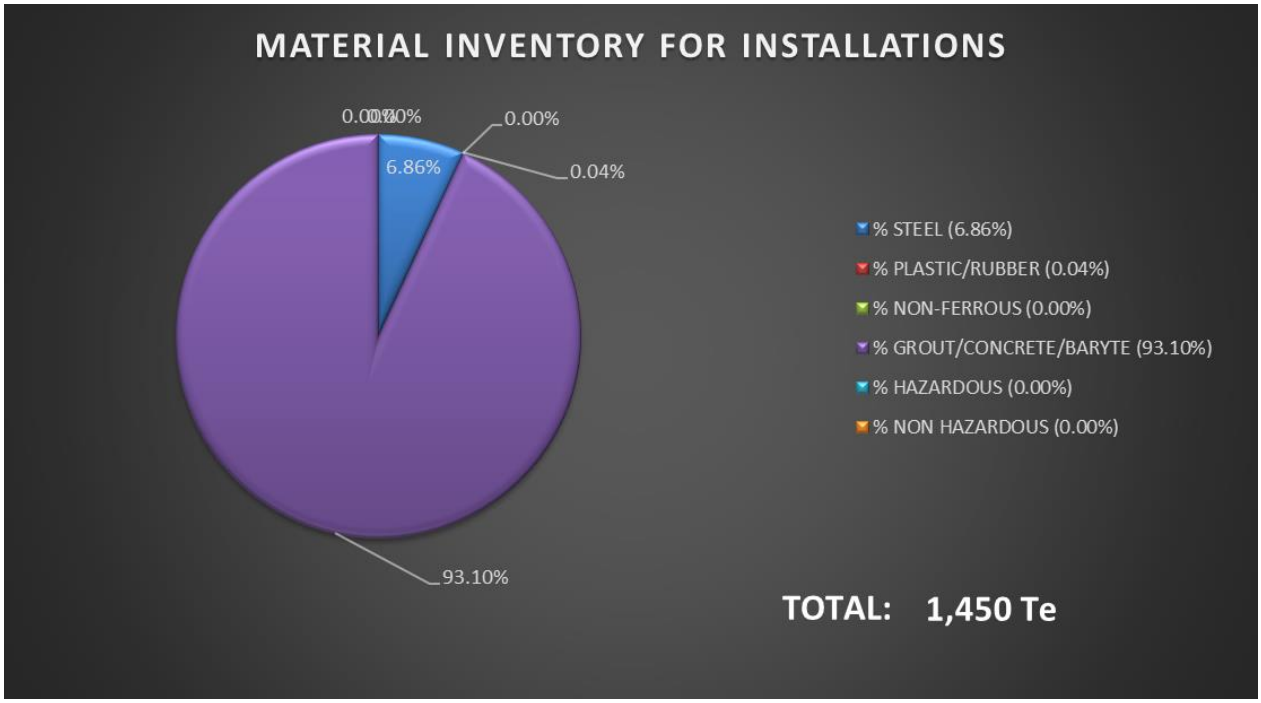


Figure 3.10.2 Estimated material inventory for Thistle installation(s)

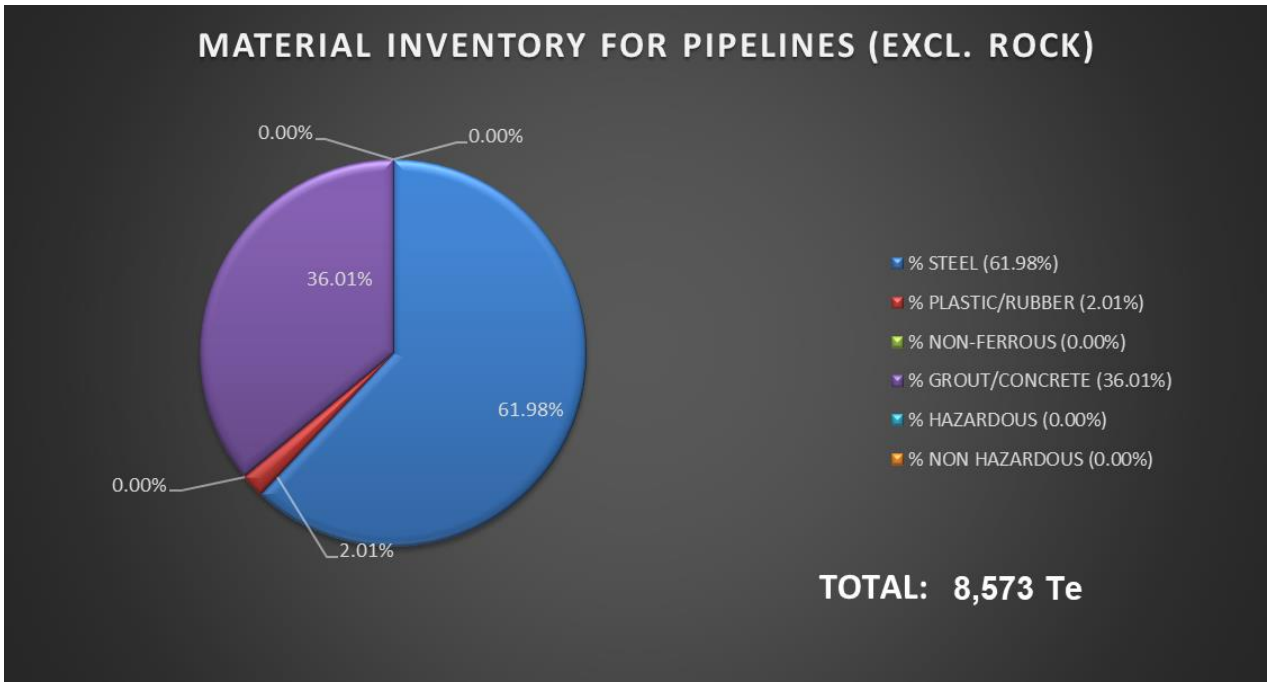


Figure 3.10.3 Estimated material inventory for Thistle pipeline(s)[1]

Figure 3.10.4 and Figure 3.10.5 provide a summary of the material type and volume that will be recovered and/or decommissioned for the Don pipebridge and pipelines, respectively.

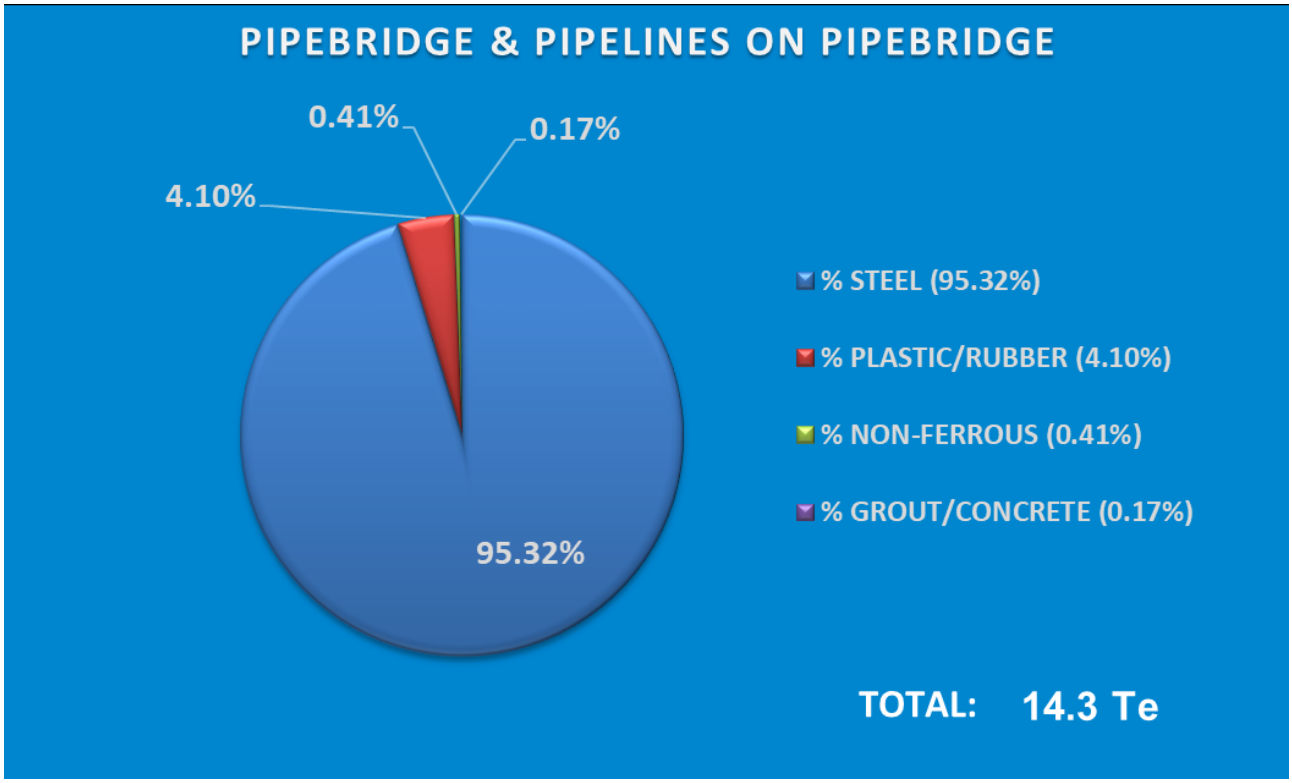


Figure 3.10.4 Estimated material inventory for Don pipebridge

[1] This figure excludes deposited rock.

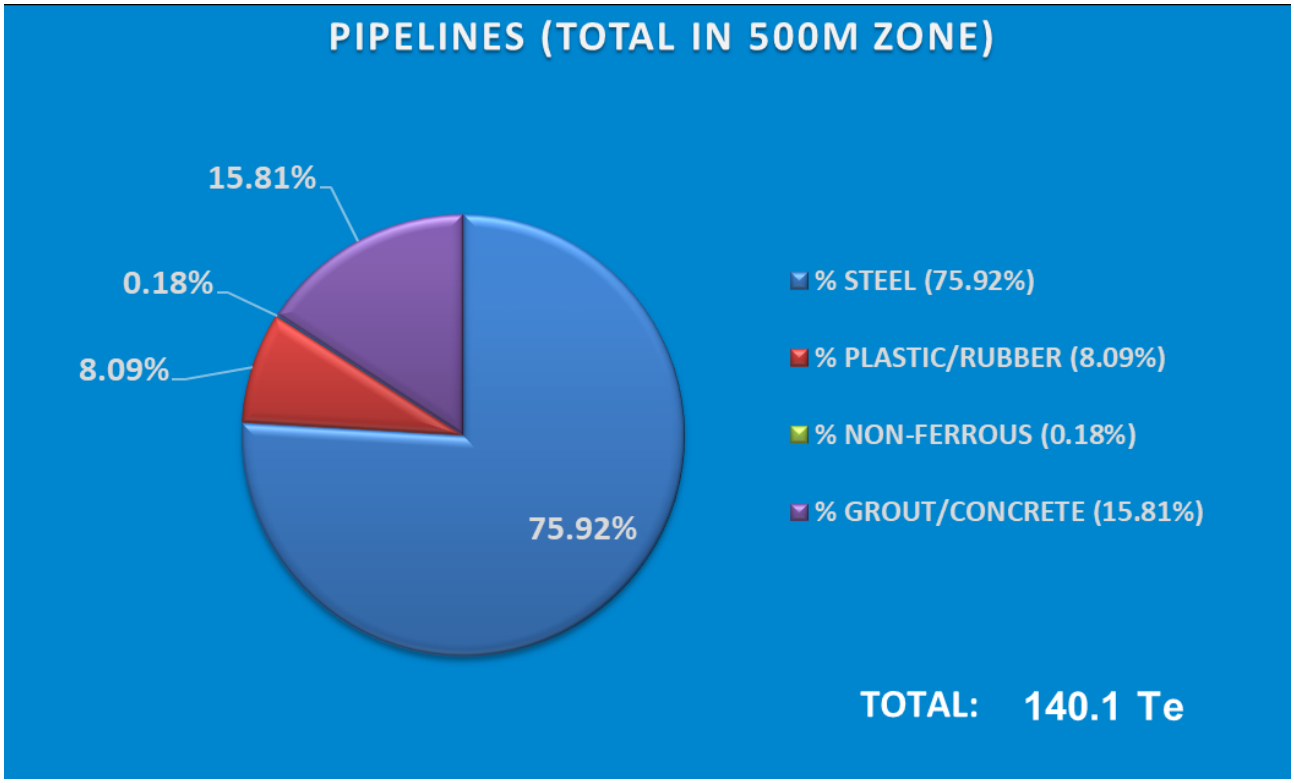


Figure 3.10.5 Estimated material inventory for pipeline(s) (inside Thistle 500m zone)

3.11 Approach to the Environmental Management

EnQuest implements and operates an integrated Health, Safety, Environment and Assurance ('HSE&A') management system which was last audited in 2022 and was granted verification as meeting the requirements of an Environmental Management System ('EMS') in relation to OSPAR Recommendation 2003/5.

The HSE&A Policy and Principles is an integral part of the overall management system. It is laid down in policies, procedures, standards and work instructions. Its general purpose is to prevent EnQuest activities from putting people, the environment, property or the reputation of the company at risk. EnQuest's HSE&A Policy and Principles is shown in Appendix C.

4. ENVIRONMENTAL AND SOCIETAL BASELINE

4.1 Summary of Environmental Surveys

As discussed in Section 1.1, the Thistle field is located in UKCS Blocks 211/18 and 211/19. The Don fields are located in Block 211/18. The most recent environmental survey undertaken in the area is the Thistle Pre-Decommissioning Survey which was conducted around the Thistle platform and is therefore used to inform this environmental assessment [31][32]. The Environmental Baseline Survey ('EBS'), Habitat Assessment ('HAB') and Cuttings Pile Report have been used to describe the seabed and benthic environment for the Thistle field and Don pipelines within the Thistle 500 m zone; which are listed in Table 4.1.1. The locations of the environmental stations and sample points from these surveys are presented in Figure 4.1.1.

Table 4.1.1 Environmental survey data used to describe the Project area

Survey Report	Description
Thistle field	
Environmental Baseline Report	During May 2021, Benthic Solutions Ltd (BSL) (on behalf of EnQuest), conducted an EBS, HAB and cuttings pile assessment around the Thistle platform [31][32]. Environmental sampling and ground-truthing was carried out at a total of 28 sampling locations and video transects across the Thistle field survey area. The cuttings pile assessment comprised of 20 push core sampling locations. In addition, five stations within the cuttings pile were sampled for macrofaunal analysis. The main objectives of the environmental survey were to assess the different habitats and environmental conditions within the Thistle 1,000 m zone, establishing the gradients of physical, chemical, and biological perturbation. The cuttings pile characterisation aimed to determine the physical, chemical, and biological characteristics of cuttings piles associated with the respective drill centres in line with OSPAR Recommendation 2006/5.
Habitat Assessment Report	
Cuttings Pile Assessment	

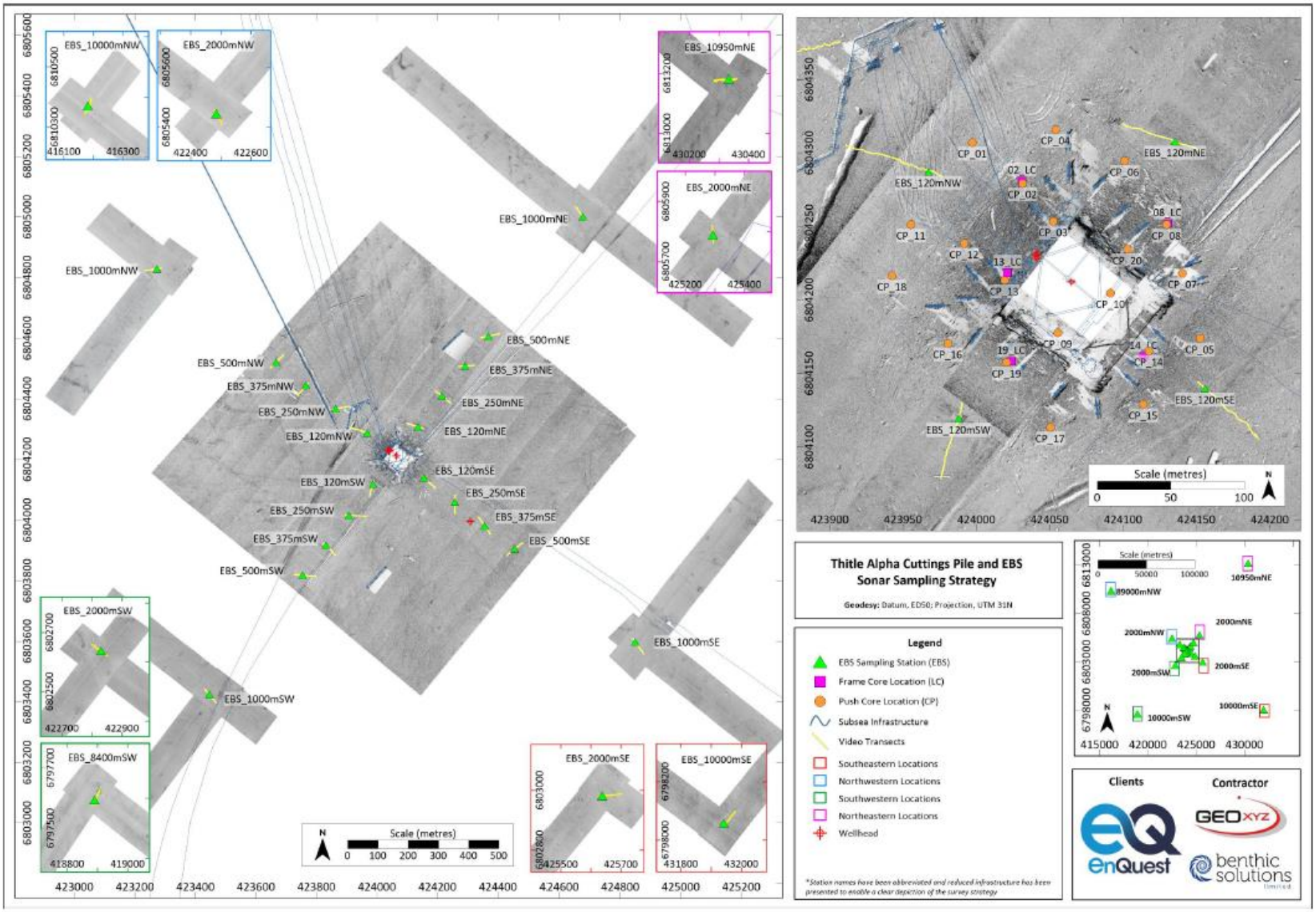


Figure 4.1.1 EBS and cuttings pile sample stations around Thistle platform [31][32]

4.2 Summary of Receptors

The baseline environmental and societal receptors for the Thistle pipelines, SALM base and Don pipelines (inside the Thistle 500 m zone) decommissioning area (Blocks 211/12, 211/13, 211/18 211/19, 211/23 and 211/24); here after referred to as the 'project area') are summarised in Table 4.2.1 and Table 4.2.2, respectively. For most receptors, the information provided below is considered sufficient to inform the environmental assessment of potential impacts of the DPs. Receptors of potential concern identified during the ENVID (see Appendix B) are presented in more detail in Sections 4.3 to 4.6.

Table 4.2.1 Key environmental receptors for the project area

Environmental receptor	Description
Physical environment	
Weather and sea conditions	The mean residual current through the project area is approximately 0.05 to 0.15 m/s [82]. Wave energy at the seabed is 'moderate' (between 0.21-1.2 N/m^2) within the area [54]. The annual mean wave height within the area ranges from 2.71 -3.00 m and the annual mean wave power is 36.1-42.0 kW/m [2][54].
Key conservation interests	
Conservation sites and habitats	
Special Area of Conservation ('SAC')	The nearest SAC to the project area is the Pobie Bank Reef SAC, located approximately 103 km southwest of the Thistle platform. It is protected for bedrock and stony reefs which provide a habitat to an extensive community of encrusting and robust sponges and bryozoans (*Ectoprocta*). These include encrusting coralline algae (*Corallinales*), cup sponges, and bryozoans in the shallower areas; and small erect sponges, cup corals (*Stryphnus ponderosus*) and brittlestars (*Ophiuroidea*)in the deeper areas [59].
Nature Conservation Marine Protected Area ('NCMPA')	The nearest NCMPA to the project area is the North-East Faroe-Shetland Channel NCMPA, located approximately 143 km northwest of the Thistle platform. It is the largest designated NCMPA and protects several features of habitat and geological importance including deep-sea sponge aggregations, offshore subtidal sands and gravels, offshore deep-sea muds and continental slope [46].
Special Protection Area ('SPA')	The nearest SPA to the project area is the Hermaness, Saxa Vord and Valla Field SPA, located approximately 140 km west of the Thistle platform. This site is important for a number of breeding seabird species that nest on the cliffs and the heathland and grassland here. During the breeding season, the area regularly supports 152,000 seabirds including guillemots (*Uria aalge*), kittiwakes (*Rissa*), shags (*Phalacrocoracidae*), fulmars (*Fulmarus*), puffins (*Fratercula*), great skuas (*Stercorarius skua*) and gannets (*Morus*) [58].
'Sea Pens and Burrowing Megafauna Communities'	Survey imagery showed evidence of "lebensspuren" features and the presence of sea pen species as such as, *Virgularia mirabilis* and *Pennatula phosphorea*. However, the density of sea pens recorded at Station EBS_250_NE is unknown and resulted in insufficient evidence that the Thistle survey would constitute a 'Sea Pen and Burrowing Megafauna Communities' habitat [31].

Table 4.2.1 Key environmental receptors for the project area	
Environmental receptor	**Description**
'Submarine Structures Made by Leaking Gases'	Seabed depressions were noted on the geophysical and photographic data across the Thistle survey areas, however, no Annex I habitat 'Submarine structures made by leaking gases' were identified in the depressions ground-truthed [31].
'Stony Reef'	Two transects that contained areas of cobbles and boulders assigned the biotope 'Low energy circalittoral rock' (EUNIS MC1), were assessed for the potential to be 'Annex I Stony Reef'. Overall areas assessed were categorised as 'Not a Reef' due to their limited expanse of >25m^2, however contained patches with significant elevation and composition to be defined as 'Low' in terms of reef structure [31].
Conservation species	
Pinnipeds – Harbour and Grey Seals	Pinnipeds (*Pinnipedia*) are not expected in significant numbers within the project area, given its distance from shore. Grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) densities are expected to be very low. This is confirmed by the grey and harbour seal density maps published on National Marine Plan interactive ('NMPi'), where the mean percentage at-sea population for grey seals and harbours seals in the area is >0 to <=0.001% per 25 km [10][59]. This is due to the site being approximately 103 km offshore and even further from important seal haul outs. Both harbour and grey seals are listed as Priority Marine Features ('PMFs'), European Protected Species ('EPS') and are listed on the International Union for Conservation of Nature ('IUCN') Global Red List as species of lower risk.
European Protected Species most likely to be present in the project area	
Harbour porpoise	The harbour porpoise (*Phocoena phocoena*) is a small, highly mobile species of cetacean that is the most commonly occurring cetacean in UK waters. They are listed as PMFs, EPS are covered by OSPAR and the UK Biodiversity Action Plan ('BAP') and are listed on the IUCN Global Red List as species of lower risk. Harbour porpoise can be found in the waters of the proposed decommissioning area where particularly large numbers occur in the project area during the summer months, with a peak in numbers in July and August [72][33]. The density of harbour porpoise is roughly estimated at 0.4393 animals/km^2 across the project area [33].
White-beaked dolphin	White-beaked dolphins (*Lagenorhynchus albirostris*) are usually found in water depths of between 50 and 100 m in groups of around 10 individuals, though groups of up to 500 animals have been seen. They are present in the UK waters throughout the year, however more sightings have been made between June and October. The relative density of white-beaked dolphin is estimated at 0.3056 animals/km^2 in the project area [33]. White-beaked dolphin are PMFs, EPS and are covered by OSPAR and the UK BAP. They are also listed on the IUCN Global Red List as species of lower risk.
Minke whale	Minke whales (*Balaenoptera acutorostrata*) are usually observed in pairs or in solitude, though groups of up to 15 individuals can be sighted feeding within their seasonal feeding grounds. The relative density of minke whales is estimated at 0.0271 animals/km^2 in the project area [33]. Minke whale are PMFs, EPS and are covered by OSPAR and the UK BAP. They are listed on the IUCN Global Red List as species of lower risk.

Table 4.2.1 Key environmental receptors for the project area	
Environmental receptor	**Description**
Benthic environment	
Bathymetry and seabed features	The general water depth within the Thistle survey area ranged from 151.8 m LAT in the southeast to 169.0 m in the northwest with a natural slope of 0.06°. The Thistle cuttings pile revealed to be the main feature in the area with two distinct piles which merged in the centre present at the north and southwestern platform legs with bathymetric highs of 6.2 m and 8.6 m respectively [31]. Review of the bathymetry and Side-scan sonar ('SSS') within the survey area revealed various features adjacent to the platform, including numerous anthropogenic debris construction and fishing activities, exposed infrastructure etc.), in addition to potential pockmarks / seabed depressions [31]. Video transects showed evidence of seabed depressions which were often recorded to contain grave and/or cobbles. Due to the size and circular shape of the depressions, they appear to be "unit pockmarks" [80] [31].
Seabed type	Four JNCC/European Nature Information System ('EUNIS') habitats were assigned across the survey areas: 'Circalittoral muddy sand' (MD4); 'Circalittoral sandy mud' (MC6), 'Offshore circalittoral mixed sediment' (MD5) and 'Low energy circalittoral rock' (MC1). Most stations sampled across the cuttings pile did not conform to JNCC/EUNIS habitats because of the high levels of contamination and the sediments observed and have therefore been assigned to the BSL biotope 'Enriched gravelly mud' [31]. The SSS data indicated medium reflectivity across most of the sampling area relating to the ambient muddy sand sediment. Areas of higher reflectively were typically associated with areas close to the platform which corresponded to the mixed sediment present consisting of cohesive silt intermixed with coarse sediment and *Mytilus* shells [31]. Particle size analysis ('PSA') indicated sediment at EBS stations to be primarily composed of sand, with smaller contributions of fines and gravels. The sediment composition at the cuttings pile stations was also mixed but contained a greater percentage of gravelly shell material within a matrix of fines relating to lose muddy cuttings material. The samples collected in the survey area represented nine Folk classifications with most stations being assigned to the categories of 'muddy sand' (38% of the total) and 'gravelly mud' (36% of the total) [31].
Benthic fauna	A highly variable macrofaunal community was present within the Thistle survey area, with most stations sampled near or within the physical extent of the cuttings pile showing a reduced species richness and an increase in abundance of opportunistic phyla, such as Nematoda. Macrofauna analysis identified a total of 94,549 individuals, of which Nematoda dominated and totalled 82.3% of the total. Evidence of organic enrichment was present at stations within the physical cuttings pile with macrofaunal communities assigned to 'changed' or 'degraded' classifications using the Infaunal Trophic Index ('ITI'). In contrast, the observed species richness, abundance, and diversity indices data was particularly high at stations >250 m from the physical limits of the cuttings pile, reflecting low contaminated background conditions within these areas. Several species considered to be indicative of environmental disturbance and hydrocarbon contamination (e.g. *Cirratulus cirratus*, and *Thyasira flexuosa*), were identified from the macrofaunal sample; however, Nematoda dominated and appeared to have

Table 4.2.1 Key environmental receptors for the project area	
Environmental receptor	**Description**
	outcompeted other species usually indicative of organically enriched sediments [31].
Plankton	In both the northern and central regions of the North Sea, the phytoplankton community is dominated by dinoflagellates of the genus *Ceratium* (*fusus*, *furca*, *lineatum*) and diatoms such as *Thalassiosira* spp. and *Chaetoceros* spp. In recent years the dinoflagellate *Alexandrium tamarense* and the diatoms *Pseudo-nitzschia* (known to cause amnesic shellfish poisoning) have been observed in the area [34]. Zooplankton species richness is greater in the northern and central areas of the North Sea, than in the south and displays greater seasonality. Zooplankton in this area is dominated by calanoid copepods, in particular *Calanus* and *Acartia* spp. and Euphausiids and decapod larvae are also important to the zooplankton community in this region [34]. *Calanus finmarchicus* has historically dominated the zooplankton of the North Sea and is used as an indicator of zooplankton abundance. Analysis of data provided by the Continuous Plankton Reader ('CPR') surveys in the 10-year period between 1997 and 2007 shows a sharper spring increase in *C. finmarchicus* biomass in May in the NNS compared to more southerly areas [20]. This peak in numbers is 70% greater than seen in the Central North Sea and 88% greater than the SNS over the same period [74]. The increase is likely a reflection of the increased availability of nutrients and food (including phytoplankton) in spring. Overall abundance of *C. finmarchicus* has declined dramatically over the last 60 years, which has been attributed to changes in seawater temperature and salinity [3][29]. *C. finmarchicus* has largely been replaced by boreal and temperate Atlantic and neritic (coastal water) species and a relative increase in the populations of *Calanus helgolandicus* has occurred [34][18][3].
Fish – spawning and nursery grounds	
Spawning grounds	The project area is located within the spawning grounds of cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), Norway pout (*Trisopterus esmarkii*), saithe (*Pollachius virens*) and whiting (*Merlangius merlangus*) [14][22]. Peak spawning occurs in February – March for cod, February – April for haddock, February – March for Norway pout and January – February for saithe [14][22]. Norway pout, cod, saithe and whiting are PMF species in offshore waters. Cod are also listed as vulnerable on the IUCN Global Red List.
Nursery grounds	The project area is located within a high nursery intensity area for blue whiting (*Micromesistius poutassou*). In addition, the following species have nursery grounds near the project area: European hake (*Merluccius merluccius*); haddock; herring (*Clupea harengus*); ling (*Molva molva*); mackerel (*Scomber scombrus*); Norway pout; spurdog (*Squalus acanthias)* and whiting [14] [22]. Herring, ling, Norway pout and whiting are also PMF species in offshore waters.
Probability of 0 age group fish aggregation	Aires *et al.* provides modelled spatial representations of the predicted distribution of 0 age group fish [1]. The modelling indicates the presence of juvenile fish (less than one year old) for multiple species: anglerfish, blue whiting, European hake, haddock, herring, mackerel, horse mackerel horse mackerel (*Trachurus trachurus*), Norway pout, plaice (*Pleuronectes platessa),* sprat (*Sprattus sprattus*) and whiting. Across the project area the probability of juvenile fish aggregations occurring is very low for all species (<0.2), except for hake and blue whiting for which the probability is up to medium [1].

Table 4.2.1 Key environmental receptors for the project area												
Environmental receptor	**Description**											
Fish spawning and nursery times												
Species	**Month**											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Blue Whiting	N	N	N	N	N	N	N	N	N	N	N	N
Cod	S	S*	S*	S								
European hake	N	N	N	N	N	N	N	N	N	N	N	N
Haddock	N	S*N	S*N	S*N	SN	N	N	N	N	N	N	N
Herring	N	N	N	N	N	N	N	N	N	N	N	N
Ling	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel	N	N	N	N	N	N	N	N	N	N	N	N
Norway Pout	SN	S*N	S*N	SN	N	N	N	N	N	N	N	N
Saithe	S*	S*	S	S								
Spurdog	N	N	N	N	N	N	N	N	N	N	N	N
Whiting	N	SN	SN	SN	SN	SN	N	N	N	N	N	N
Key	S = Spawning, S* = Peak spawning, N = Nursery, Species = High nursery intensity as per Ellis *et al.* (2012), Species = High intensity spawning as per Ellis *et al.* (2012) [22].											
Seabirds												
The following species could be found within the project area: northern fulmar (*Fulmarus glacialis*), razorbill (*Alca torda*), lesser black-backed gull (*Larus fuscus*), European storm-petrel (*Hydrobates pelagicus*), northern gannet (*Morus bassanus*), great skua (*Stercorarius skua),* black-legged kittiwake (*Rissa tridactyla*), great black-backed gull (*Larus marinus*), herring gull (*Larus argentatus*), glaucuous gull (*Larus hyperboreus*), common guillemot (*Uria aalge*), little auk (*Alle alle*) and Atlantic puffin (*Fratercula arctica*) [50]. Birds are attracted to offshore infrastructure as they offer a variety of opportunities for refuge, roosting, loafing foraging and for nesting. A long-term bird monitoring programme in the North Sea (Norwegian waters), has recorded 159 different bird species utilising platforms. Black-legged kittiwake, having a maximum foraging range of 120 km, have been recorded nesting on offshore platforms before, as have herring gulls and black legged kittiwake [45]. Seabird Oil Sensitivity Index ('SOSI') identifies areas at sea where seabirds are likely to be most sensitive to surface pollution. Seabird sensitivity to oil within the project area (Blocks 211/12, 211/13/, 211/18, 211/19, 211/23 and 211/24), except for November-January where it is considered 'high'. March in Block 211/12 is considered 'medium' [81]. However, the risk of an oil spill from the proposed operations at the project area is considered remote and therefore the overall risk to birds is considered negligible.											

SOSI for Thistle infrastructure area and surrounding Blocks

Block	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
211/12	3*	5	4	5	5*	5*	5	5	5*	N	3*	3
211/13	3*	5	5	5	5*	5*	5	5*	N	N	3*	3
211/14	3*	5	4	4	4*	5*	5	5*	N	N	3*	3
211/17	3*	5	5	5*	N	5*	5	5	5*	N	3*	3
211/18	3*	5	5	5*	N	5*	5	5	5*	N	3*	3
211/19	3*	5	5	5*	N	5*	5	5*	5*	N	3*	3
211/22	5	5	5	5*	N	5*	5	5	4	4*	4*	4
211/23	5	5	5	5*	N	5*	5	5	5	5*	3*	3
211/24	5	5	5	5*	N	5*	5	5	5	5*	3*	3
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.											

Table 4.2.2 Key societal receptors for the project area

Societal Receptor	Description
Commercial fishing	
	The project area is located in International Council for the Exploration of the Sea ('ICES') Rectangle 51F1 and 52F1. ICES Rectangles 51F1 and 52F1 are predominantly targeted for demersal fish in terms of both landed weights and value. In 2022, demersal fisheries landed 100% of the total value and 100% of the total weight of fish landed in 51F1 and 52F1 [53]. Vessel Monitoring System ('VMS') data from 2010-2020 indicates that fishing intensity within the project area is low for dredges. Bottom trawl fishing is lowest in Block 211/18 and highest in Blocks 211/13 and 211/19 [47]. Fishing effort within ICES Rectangle 51F1 varied throughout 2022 with notable peaks in March and May which, combined, accounted for more than 28% of the total annual fishing effort. There was noticeably low effort in January and August. In 52F1, fishing effort was much lower, with only 4 and 8 days fished in March and September, respectively, accounting for 23% of the total annual fishing effort as the rest were disclosive. Most of the months experienced disclosive effort in 52F1, with only 58 days fished compared to 215 days fished in 51F1. Overall, fishing effort for both ICES Rectangles 51F1 and 52F1 is relatively low as there are <100 days of fishing effort in each recorded month [53]. Trawls were the most utilised gear in Rectangle 51F1 and 52F1, accounting for 86% and 91% of the total number of days fished in 2022, respectively. Seine nets were also used in Rectangles 51F1 and 52F1, however attributed disclosive effort in recent years [53]. The five top landed species in Rectangle 51F1 in 2022 in terms of weight included haddock, whiting, saithe, hake and cod. Saithe, hake, haddock, ling and whiting were the five top landed species in Rectangle 52F1 [53].

<table>
<tr><th colspan="6">Table 4.2.2 Key societal receptors for the project area</th></tr>
<tr><th>Societal Receptor</th><th colspan="5">Description</th></tr>
<tr><td colspan="6">Other Sea Users</td></tr>
<tr><td>Shipping activity</td><td colspan="5">Shipping activity is assessed to be low in Blocks 211/12, 211/18, 211/23 and very low in Blocks 211/13, 211/19, 211/24 [34][63].</td></tr>
<tr><td rowspan="14">Oil and Gas</td><td colspan="5">The project area is located in the NNS within an area of extensive oil development. There are numerous oil and gas surface installations within 40 km of the project area as described below:</td></tr>
<tr><td>Installation</td><td>Installation Type</td><td>Operator</td><td>Status</td><td>Distance & direction</td></tr>
<tr><td>Dunlin A</td><td>Platform</td><td>Fairfield</td><td>Topsides removed</td><td>9.9 km SSE</td></tr>
<tr><td>Eider A</td><td>Platform</td><td>TAQA</td><td>Active</td><td>22.4 km WSE</td></tr>
<tr><td>Penguins Waverider</td><td>Monitoring Buoy</td><td>Shell</td><td>Active</td><td>24.1 km NNW</td></tr>
<tr><td>Penguins</td><td>FPSO</td><td>Shell</td><td>Active</td><td>24.6 km NNW</td></tr>
<tr><td>North Cormorant</td><td>Platform</td><td>TAQA</td><td>Active</td><td>26.8 km WSW</td></tr>
<tr><td>Brent D</td><td>Platform</td><td>Shell</td><td>Topsides removed</td><td>27 km SSE</td></tr>
<tr><td>Brent C</td><td>Platform</td><td>Shell</td><td>Topsides removed</td><td>30.7 km SSE</td></tr>
<tr><td>Magnus</td><td>Platform</td><td>EnQuest</td><td>Active</td><td>32.1 km NNW</td></tr>
<tr><td>Brent B</td><td>Platform</td><td>TAQA</td><td>Topsides removed</td><td>34.9 km SSE</td></tr>
<tr><td>Tern</td><td>Platform</td><td>TAQA</td><td>Active</td><td>36.7 km WSW</td></tr>
<tr><td>Brent A</td><td>Platform</td><td>Shell</td><td>Topsides removed</td><td>37.2 km SSE</td></tr>
<tr><td>Cormorant A</td><td>Platform</td><td>TAQA</td><td>Active</td><td>39.8 km SSW</td></tr>
<tr><td>Tele-comms and power cables</td><td colspan="5">There are no telecommunications or power cables within 40 km of the project area, the nearest telecommunications cable is the CANTAT 3 SEG.F3C cable which is currently active; it is located approximately 58 km northeast of the Thistle platform. There is one historic power cable passing through Block 211/18, owned by OceanWise and another historic cable owned by OceanWise, is located in Blocks 211/23 and 211/24. Though disused, sections of these cables may remain on the seabed [49][62].</td></tr>
<tr><td>Military activities</td><td colspan="5">Blocks 211/12, 211/13, 211/18, 211/19, 211/23 and 211/24 are all in an area of concern to the Ministry of Defence ('MoD') as they lie within training ranges [64].</td></tr>
</table>

Table 4.2.2 Key societal receptors for the project area	
Societal Receptor	**Description**
Renewable energy	There are no operational renewable energy sites within 100 km of the project area [49]. However, the project area is close to areas identified under the Innovation and Targeted Oil and Gas ('INTOG') scheme. The project area is located within INTOG area NE-b and INTOG area NE-a is located approximately 42 km northwest of the Thistle platform. In addition to the INTOG areas, the NE1 ScotWind area lies approximately 124 km southwest of the Thistle platform. Given that these projects are only in their embryonic form at present, it is unlikely that they will be installed within the window of proposed decommissioning activities.
Wrecks	The nearest wreck to the project area is located approximately 0.3 km northeast of the Thistle platform which is unknown [2] [64].

4.3 Seabed Habitats and Benthos

4.3.1 Physical Characteristics

According to the British Geological Survey ('BGS') sediment type available on NMPi (2024), sediments within the project area comprise of sand with areas of slightly gravelly muddy sand, gravelly muddy sand and gravelly sand [62]. The predicted EUNIS habitat in the vicinity of the project area is said to be MD52: Atlantic offshore circalittoral sand [23].

Seabed imagery and video footage obtained in the BSL (2021) survey indicated that the seabed across the project area was heterogenous in nature, varying between sandy mud and coarse sediment. A total of four JNCC/EUNIS habitat classifications were assigned to the survey area: 'Circalittoral Muddy Sand' (EUNIS: MD4/A5.26); 'Circalittoral Sandy Mud' (EUNIS: MC6/A5.35); 'Offshore Circalittoral Mixed Sediment' (EUNIS: MD5/A5.45), 'Low Energy Circalittoral Rock' (EUNIS: MC1). In addition, the BSL designated biotype 'Organically enriched gravelly mud' was assigned to 13 of the 16 cuttings pile stations [31]. Three stations located to the southeast of the Thistle platform (EBS_250mSE, EBS_375mSE and EBS_500mSE; Figure 4.1.1) were assigned the biotope circalittoral muddy sand even though the PSA data contained sedimentary fines material between 28.5% and 34.3% [31]. These stations are dominated by sand and show some impact from drilling activity as evidenced by high levels of Total Hydrocarbon Concentration ('THC') (Section 4.3.2). However, only a thin layer of fine materials has been deposited which is not enough to change the SSS texture and therefore could not be delineated as a separate biotope.

Bathymetry data of the survey area showed the presence of two distinct elongated cuttings piles at the Thistle platform, with both piles extending beyond the jacket extents [32]. The piles merge in the centre and form an area approximately 100 m in diameter. The cuttings pile elevation decreased to <10cm above the natural seabed (measured at approximately 160 m to 161 m below LAT) at 100 – 130m in all compass directions from the centre of the Thistle platform. The extent of the cuttings pile was estimated to cover an area of 37,041m^2 with a pile volume of 31,816m^3 which would be categorised as a "large cuttings pile" (>20,000m^3) according to The Norwegian Oil and Gas Authority (OLF/'NOREG') guidelines [61]. However, this volume may be slightly overestimated due to the difficulty of accurately quantifying and accounting for the volume of subsea infrastructure, including the jacket and debris within the pile area, as well as the natural variation in the seabed elevation across the Thistle site [32]. The physical cutting limit boundary in relation to the Thistle jacket is displayed in Figure 4.3.1.

PSA analysis indicated a mixed sediment type composed primarily of sedimentary sands with

varying smaller contributions of fines and gravels at all stations that fall outside the physical cuttings pile limit (Figure 4.3.1). The sediment composition at stations sampled within the physical cuttings pile contained higher proportions of gravelly material across the surface of the pile; with a matrix of fine sedimentary material relating to loose drill mud derived sediment. Mean particle size ranged from 0.02 mm at Station CP_01 (Figure 4.1.1) 2.17mm at station CP_13 demonstrating the high variability in sediment sizes based upon the proportions of silts, clays, sands, and gravels recorded. Most stations out with the physical cuttings pile predominantly comprised of sedimentary sands, ranging from 29.7% at Station EBS_120mNE to 91.6% at Station EBS_10000mSE (Figure 4.1.1). Peak proportions of fines were observed at cuttings pile and EBS stations surrounding the platform and can be attributed to the expulsion of drilling material onto the seabed surface within 120 m of the platform. Gravel was the least dominant proportion of the sediment across the EBS areas outside the physical cuttings pile limit. The samples collected in the survey area represented nine Folk classifications with most stations being assigned to the categories of 'muddy sand' (38% of the total) and 'gravelly mud' (36% of the total) [31].

SSS data indicated medium reflectivity across most of the sampling area relating to the ambient muddy sand sediment. Areas of higher reflectively were typically associated with areas close to the platform which corresponded to the mixed sediment present consisting of cohesive silt intermixed with coarse sediment and *Mytilus shells*. A significant layer of mussel shells were observed on the surface of the Thistle cuttings pile and under the OLF/NOREG Guidelines, review of SSS and MBES data was used to calculate the volume of the 'significant layer' of mussel shells. The volume of the layer of mussel shells was estimated to be 2,934 m^3 [32]. This had negligible effect on the overall estimated volume of the Thistle cuttings pile, reducing the estimated volume to 28,881m^3, which is still classed as a 'large' cuttings pile under the OLF/NOREG (2016) guidelines [61].

Review of the bathymetry and SSS within the survey area revealed various features adjacent to the platform, including numerous anthropogenic debris (e.g. construction and fishing activities, exposed infrastructure etc.), in addition to potential pockmarks/seabed depressions. The video transects showed evidence of seabed depressions and were often recorded to contain gravel and/or cobbles [31].

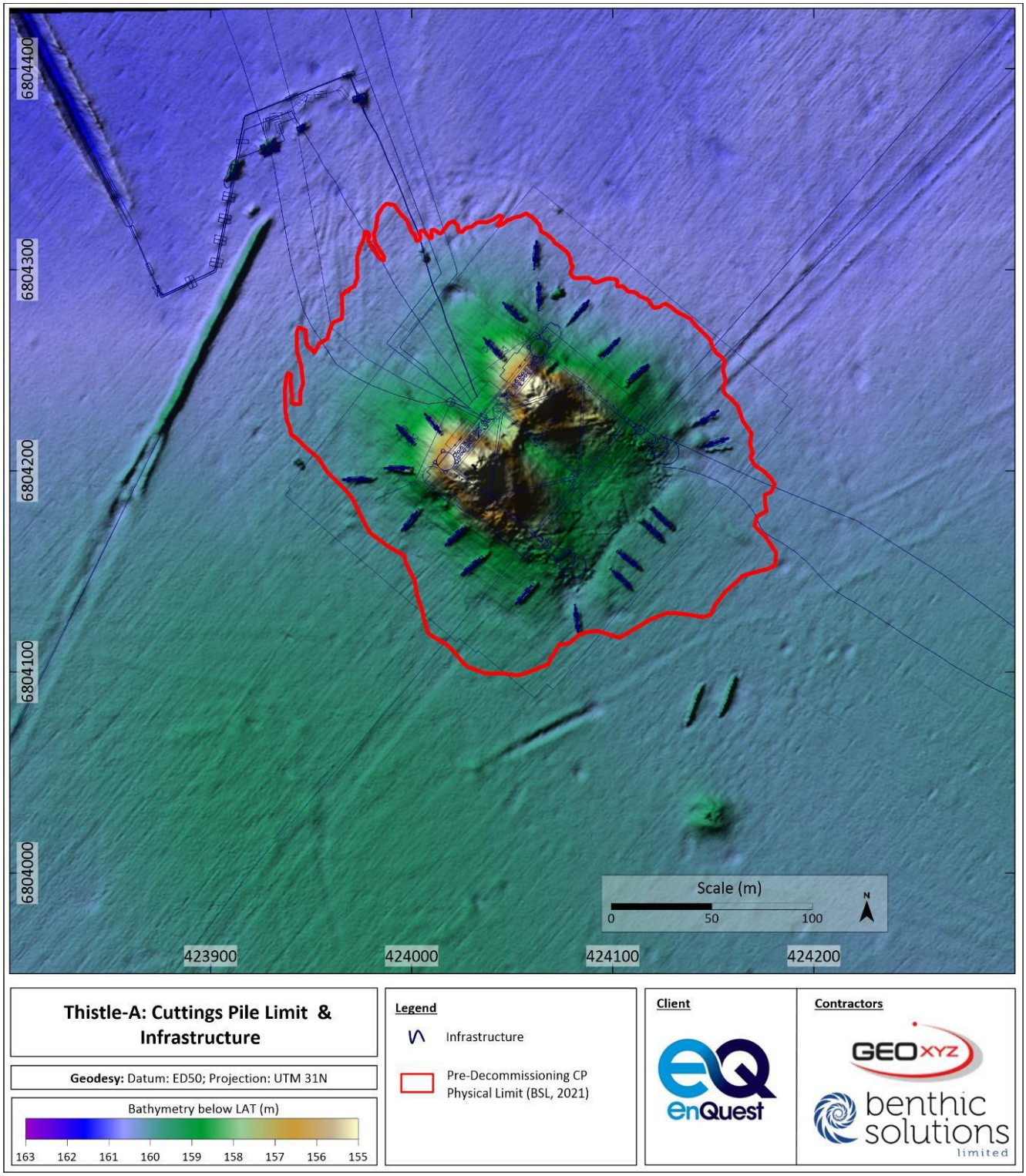


Figure 4.3.1 Thistle Cuttings Pile Physical Boundary [32]

4.3.2 Chemical Characteristics

Concentrations of Total Organic Carbon ('TOC') at stations outside the physical cuttings pile were generally low, reflecting ambient NNS conditions. However, higher concentrations were recorded at EBS stations up to 120 m southwest (1.8%) and 250 m southeast (1.0-2.2%) of the platform, indicating the spread of organic enrichment from the cuttings pile in the dominant current direction of northwest to southeast. High levels of TOC were observed across the stations within the physical cuttings pile, with peak levels recorded at Station CP_12 (4.9%; Figure 4.1.1). A similar pattern was observed for Total Organic Matter ('TOM'), levels were generally consistent at stations at EBS stations >250m northwest, northeast and southwest from the platform and ranging between 1.0% to 1.6%. The levels at these stations fell below the United Kingdom Offshore Operators Association ('UKOOA') 95th percentile for the NNS (2.0%) [79]. However, organic enrichment was evident at stations up to 375 m southeast of the platform where concentrations did exceed the background reference level with station EBS_375mSE recording a TOM value of 10.9%. The organic enrichment observed at this station could, however, relate to the nearby 211/18-2 well. All stations sampled within the physical limit of the cuttings pile recorded high levels of TOM, exceeding the UKOOA 95th percentile for the NNS (2.0%) [79]. TOM levels ranged between 5.1% at Station CP_07 to 10.2% at Station CP_18, providing further evidence of the high levels of organic enrichment within the CP [31] [32]. Overall, high TOC and TOM levels observed along with sample photographs from the cuttings pile and stations to the southeast of the Thistle platform confirm the wide footprint of organically enriched sediment, derived from drilling related discharges.

Varying levels of THC was observed between EBS stations, with only a total of 6 of the 27 EBS stations sampled outside the physical cuttings pile recording THC levels exceeding the UKOOA 95th percentile for the NNS (20.3 mg.kg^{-1}) [79]. As expected, stations closest to the Thistle platform exceeded the OSPAR 50 mg.kg^{-1} THC threshold, with the chemical impact zone associated with the cuttings pile extending up to approximately 450m northwest and up to 2km south. Highly elevated THC was noted across the cuttings pile (mean 37,691 mg.kg^{-1}), with peak THC recorded at CP_19 (142,104 mg.kg^{-1}; Figure 4.1.1). Almost all samples (88% of the total) obtained from the cuttings pile recorded THC above 2,000 mg.kg^{-1}. The dispersion of contaminants around the Thistle platform indicates the enrichment derives from a long-term chronic input from oil exploration at the site. It is worth noting, elevated THC above the OSPAR threshold was also recorded at the southwest reference station EBS_8400mSW (83.3 mg.kg^{-1}). However, given the stations proximity to the Merlin field (<1km), which has undergone decommissioning, the elevated concentration of THC is thought to relate to contamination within the Merlin field rather than being associated with the Thistle cuttings pile Overall, most of the THC contamination within the Thistle survey area was in the form of oil-based contamination, typical of a North Sea cuttings pile drilled in the 1970s and 1980s [31] [32].

Petroleum hydrocarbon is one source of Polycyclic Aromatic Hydrocarbons ('PAHs'). These are typically lighter more volatile PAHs, such as Naphthalene, Anthracene and Dibenzothiophene ('NPDs'), and their presence is often associated with localised drilling activities. Similar to other hydrocarbon results, total PAH concentrations (2-6 compounds) were significantly higher at stations to the south of the platform, with peak concentrations recorded at CP_08 (2,020 mg.kg^{-1}) and CP_08 (1,846 mg.kg^{-1}). High total PAH concentrations were recorded at EBS stations up to 250 m northwest, 120 m northeast and 500 m southeast and southwest of the Thistle platform, along with all cuttings pile stations exceeding the UKOOA 95th percentile concentration for the NNS background sediments (0.8 mg.kg^{-1}) [79]. As expected, the petrogenic NPD fraction (2 and 3 ring aromatics) was low across the EBS stations outside the physical pile limit, with generally higher values recorded at stations to the south of the platform. The cuttings pile stations with PAH concentrations above the background reference values also recorded relatively high concentrations of NPD indicating a residual petrogenic signature. PAH compounds were normalised to allow comparison to OSPAR Background Assessment Concentration ('BAC')

values [70]. Results indicated that stations greater than 250 m from the Thistle platform were below the reference levels for all normalised PAHs, except for station EBS_500mSE, however, this station only exceeded the Background Concentration ('BC') [70] for of the normalised PAH dibenzothiophene. Stations within the physical extent of the cuttings pile reported normalised PAHs that often exceeded their respective OSPAR BC and BACs (naphthalene, phenanthrene, dibenzothiophene and anthracene) also exceeded their respective BACs at all but two stations (T_CP_07 and T_CP_20) [31] [32].

Moderate to high levels of heavy metal contamination were evident at stations closely associated with the Thistle cuttings pile, with several metals including barium ('Ba'), cadmium ('Cd'), chromium ('Cr'), lead ('Pb') and zinc ('Zn') exceeding their corresponding OSPAR Effect Range Low ('ERL') reference values at stations within 250 m of the cuttings pile. Most stations outside of the physical cuttings pile extent fell well below the OSPAR Effects Range Median ('ERM') thresholds. However, five stations (EBS_120m, NW, EBS_120mNE, EBS_120mSE, EBS_250mSE and EBS_120mSW; Figure 4.1.1) outside of the physical cuttings pile exceeded the National Oceanic and Atmospheric Administration ('NOAA') ERM for Zn (410.0 $mg.kg^{-1}$), with station T_EBS_120mSE also exceeding the NOAA ERM for Pb (218.0 $mg.kg^{-1}$), Cu (270.0 $mg.kg^{-1}$), and Nickel ('Ni') (51.6 $mg.kg^{-1}$). This pattern appears to be a result of drilling fluids rich in Ba, present within the cutting pile. Overall, heavy metal concentrations highlighted decreasing levels of contamination with increasing distance from the Thistle platform, indicative of point source contamination of drilling discharge from this site. Concentrations of heavy metals peaked within the physical cuttings pile and decreased to concentrations below the UKOOA 95th percentile for most metals within 500 m of the platform. Most stations sampled on the periphery of the survey area demonstrated metal concentration representative of uncontaminated sediment and background concentrations expected for the NNS [31].

The OSPAR recommendation 2006/5 on a management regime for offshore cuttings piles states that piles with an oil loss to the water column of less than 10 $t.yr^{-1}$ and a persistence seabed area smaller than 500 $km^2.yr^{-1}$ may be left *in situ* to degrade naturally. Hydrocarbon leaching analysis was undertaken to estimate the rate of oil loss per annum from the Thistle cuttings pile. The chemical footprint of the cuttings pile at Thistle covered an area of approximately 4.94k m^2 with a persistence of 349.26 km^2 per year, indicating the pile was below the OSPAR threshold of 500 $km^2.yr^{-1}$. Leachate analysis showed that the yearly oil loss based on the physical extent of the cuttings pile would be low at 0.12 $t.yr^{-1}$ and as such falling significantly below the OSPAR oil loss threshold (10 $t.yr^{-1}$).

In summary, the results of the Thistle pre-decommissioning survey suggest that most EBS stations demonstrated normalised metal concentrations that were deemed environmentally inadmissible and most of the THC contamination within the survey area was in the form of oil-based contamination, considered typical of a North Sea cuttings pile drilled in the 1970s and 1980s.

4.3.3 Benthos

The macrofaunal community was highly variable within the Thistle survey area, with most stations sampled near or within the physical extent of the cuttings pile showing a reduced species richness and an increase in abundance of opportunistic phyla, such as *Nematoda*. In contrast, the observed species richness, abundance, and diversity indices data was highest at stations 375m and 500m southeast of the platform, that demonstrated impact from the Thistle platform, possibly displaying the intermediate disturbance hypothesis. Lower values reflecting the uncontaminated background conditions were observed in stations on the periphery of the survey area. A total of 94,549 individuals were recorded, representing 395 taxa. Of the taxa recorded, 9 were solitary epifauna and 379 were infaunal, consisting of annelids that were represented by 171 species accounting for 8.4% of the total individuals. The Crustacea were represented by 80 species (1.7% of total individuals), the molluscs by 82 species (2.4% of total individuals) and the echinoderms by 23 species (only 0.4% of the total individuals). All other groups (Chaetognatha, Hemichordata,

Nemertea, Nematoda (individuals >1cm) Phoronida, Platyhelminthes, Sipuncula) were represented by 14 species, accounting for 83.0% of the total individuals. Nematoda dominated and totalled 82.3% of the total individuals [31]. These pollutant tolerant taxa often reflect high levels of hydrocarbon and heavy metal contamination, therefore, supporting the assignment of the stations to the BSL assigned 'organically enriched gravelly mud' habitat.

Evidence of organic enrichment was present at stations within the physical cuttings pile with macrofaunal communities assigned to 'changed' or 'degraded' classifications using the ITI. Variation in the macrofauna community composition was significantly correlated to sediment particle size composition, hydrocarbons, and heavy metal concentrations. Several species considered to be indicative of environmental disturbance and hydrocarbon contamination (e.g. *Cirratulus cirratus* and *Thyasira flexuosa*) were identified from the macrofaunal samples indicating contamination of the sediment in close proximity to the cuttings pile; however, Nematoda dominated and appeared to have outcompeted other species usually indicative of organically enriched sediments such as *Capitell*a [31].

Conspicuous fauna varied across the survey area relating to the different sediment type and the presence of infrastructure. Photographic data showed evidence of seabed depressions, aggregations of boulders, "lebensspuren" features, and the presence of Sea pen species such as, *Virgularia mirabilis* and *Pennatula phosphorea*." Seapen and Burrowing Megafauna Communities" are listed as a OSPAR threatened and/or declining habitat, UK BAP habitat and Feature of Conservation Interest ('FOCI'). Sea pen species were observed in the seabed imagery at one station (EBS_250_NE; Figure 4.1.1). However, as no faunal burrows were identified and the number of sea pens found within the Thistle survey area was not stated, it can be concluded that Thistle survey area does not constitute a 'Sea Pen and Burrowing Megafauna Communities' habitat [31].

4.4 Commercial Fisheries

The project area is in ICES Rectangles 51F1 and 52F1, which are predominantly targeted for demersal fish in terms of both landed weights and value. Since 2018, demersal catch has contributed over 84% of the annual catch weight and over 92% of the catch value in 51F1. Demersal catch was higher in 52F1, with over 100% of the annual catch weight and catch value from 2017-2022.

In 2022, demersal fisheries landed 100% of the total value and 100% of the total weight of fish landed in 51F1 and 52F1 (Table 4.4.1). The five top landed species in Rectangle 51F1 in 2022 in terms of weight included haddock, whiting, saithe, hake and cod. Saithe, hake, haddock, ling and whiting were the five top landed species in Rectangle 52F1 [53].

To put landings into context, catches amounting to 481,398 Te with a value of £684,497,956 were landed across the UK in 2022. Therefore, ICES Rectangle 51F1 presents a relatively low contribution to the UK total, comprising 0.28% of Te landed and providing a 0.35% contribution to the total value of the UK commercial fisheries in 2022 [53]. ICES rectangle 52F1 presents an even lower contribution to the UK total, with 0.10% of Te landed, proving a 0.09% contribution to the total value of the UK commercial fisheries in 2022 [53].

Fishing effort amounted to 215 days in ICES rectangle 51F1 and 58 days in 52F1 in 2022, as detailed in Table 4.4.2. This represents a considerable decrease in effort in both ICES Rectangles compared to the four preceding years. In 2022, fishing effort in ICES Rectangle 51F1 was highest in be March, accounting for 17% of the total number of days fished, followed by May contributing to 12% of fishing effort. The highest fishing effort in ICES Rectangle 52F1 was recorded in September, accounting for 14% of the total number of days fished (Table 4.4.2) [53].

Trawls were the most utilised gear in Rectangles 51F1 and 52F1, accounting for 86% and 91% of the total number of days fished in 2022, respectively. Seine nets were also used in both 51F1 and

52F1, and attributed disclosive[2] effort in recent years [53]. Average value and weight for trawls used within the project area can be seen in Figure 4.4.1. VMS data from 2010-2020 indicates that fishing intensity within ICES Rectangle 51F1 is higher for demersal species than in Rectangle 52F1 [47].

[2] The term 'disclosive' is used when fewer than five vessels have been recorded fishing in an area, meaning that detailed data cannot be shown in order to preserve data privacy. It therefore indicates very low levels of effort within the area.

Table 4.4.1 Commercial fisheries landings in ICES Rectangles 51F1and 52F1 2018 – 2022 [53]											
ICES Rectangle	Fisheries type	2022		2021		2020		2019		2018	
		Value (£)	Live weight (tonnes)	Value (£)	Live weight (tonnes)	Value (£)	Live weight (tonnes)	Value (£)	Live weight (tonnes)	Value (£)	Live weight (tonnes)
51F1	Demersal	2,398,088	1,327	2,914,228	1,702	1,301,666	877	2,136,673	1,204	1,381,095	846
	Pelagic	-	-	236,261	324	199	0	59,457	175	637	1
	Shellfish	9,137	2	11,430	3	5,734	2	12,507	3	3,272	1
Total		**2,407,225**	**1,329**	**3,161,919**	**2,029**	**1,307,599**	**879**	**2,208,637**	**1,382**	**1,385,005**	**848**
52F1	Demersal	639,852	491	832,068	819	264,567	203	800,087	690	258,004	283
	Pelagic	-	-	0	1	0	0	-	-	-	-
	Shellfish	2,526	1	3,954	1	502	0	2,239	1	0	0
Total		**642,378**	**492**	**836,022**	**821**	**265,069**	**203**	**802,326**	**691**	**258,004**	**283**

Note: Landings data within ICES Rectangles 51F1 and 52F1 from 2018-2022:

Table 4.4.2 Days of fishing effort within ICES Rectangle 51F1 from 2018-2022 [53]														
ICES Rectangle	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
51F1	2022	10	D	37	23	25	14	D	9	21	24	20	14	**215**
	2021	9	D	13	46	68	31	35	10	18	D	15	7	**278**
	2020	D	9	11	16	D	11	24	14	7	12	11	D	**128**
	2019	11	18	14	32	9	D	D	18	38	21	6	D	**191**
	2018	D	10	D	27	14	D	7	17	18	19	D	N/A	**131**
52F1	2022	D	D	4	D	D	D	D	D	8	D	D	D	**58**
	2021	D	D	D	6	D	17	32	D	D	D	D	D	**110**
	2020	D	12	D	D	D	D	D	D	D	D	D	D	**36**
	2019	D	D	D	D	N/A	N/A	D	D	D	D	D	N/A	**22**
	2018	D	D	D	D	D	D	D	D	D	D	N/A	N/A	**21**

Note: Days of fishing effort within ICES Rectangles 51F1 and 52F1 from 2018-2022: D = Disclosive data (indicating very low effort) N/A = Data not available., green = 0 – 100 days fished.

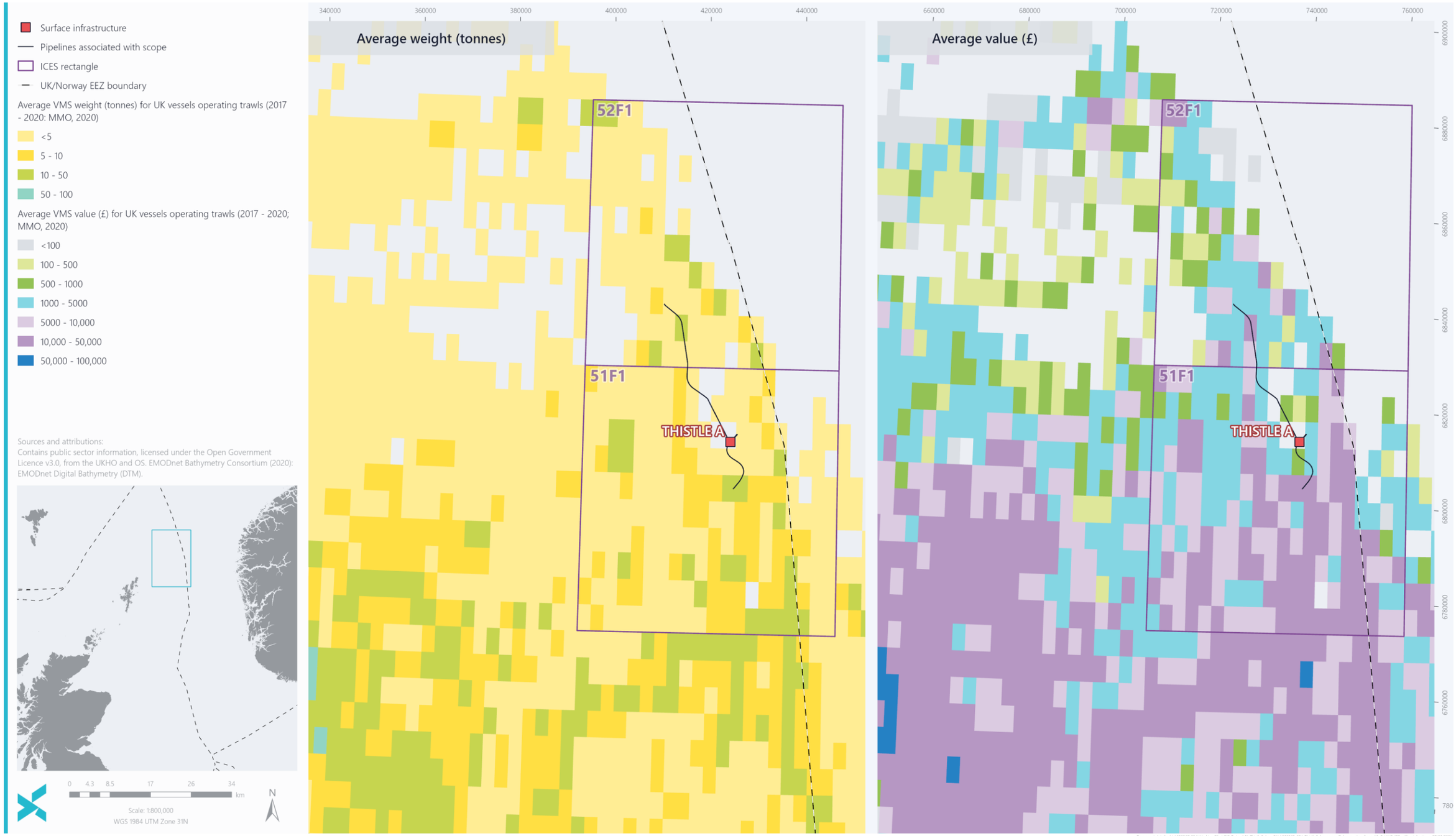


Figure 4.4.1 Average fishing value and weight for trawls in the project area

4.5 Sites and Species of Conservation Importance

4.5.1 Offshore Conservation

There are no protected areas within 40 km of the project area. The closest protected area is the Pobie Bank Reef SAC, located approximately 103 km southwest of the Thistle platform as shown in Figure 4.5.1. The site is protected for bedrock and stony reefs which provide a habitat to an extensive community of encrusting and robust sponges and bryozoans. These include encrusting coralline algae, cup sponges, and bryozoans in the shallower areas, and small erect sponges, cup corals and brittle stars in the deeper areas [59]. Protected sites in the wider vicinity of Thistle are shown in Figure 4.5.1.

4.5.2 Onshore Conservation

The project area is located approximately 140 km from the northeast coast of Shetland. The closest onshore conservation site is the Hermaness, Saxa Vord and Valla Field SPA, located approximately 139 km west of the Thistle platform [59]. Due to this distance, there will not be interactions with onshore conservation sites from operations taking place within the project area.

4.5.3 Protected Species

Four species listed under Annex II of the EU Habitats Directive are found in UK waters: harbour porpoise, bottlenose dolphin, grey seal and harbour seal. Grey and harbour seals are unlikely to be observed near the project area with any regularity. Harbour porpoise are an Annex II species which could be present near the project area.

All species of cetacean recorded within the proposed operations area are listed as EPS and are also PMFs. Other marine species listed as EPSs include turtles and sturgeon (*Acipenser sturio*), which are not likely to be present within this area of the North Sea.

It cannot be ruled out that sea pens are present in the area. Sea pens of the order *Pennatulacea* are listed on the OSPAR (2008) list of threatened and/or declining species and habitats under the 'sea pen and burrowing megafauna communities' habitat [68]. OSPAR defines this habitat as plains of fine mud, extending over an area of at least 25 m^2 and at water depths ranging from 15 m to 200 m or more [69]. Furthermore, these areas are defined as being heavily bioturbated by burrowing megafauna with burrows and mounds typically forming a prominent feature of the sediment surface, and which may include conspicuous populations of seapens (*Pennatulacea*). As described in Section 4.3.3 sea pen species (*Pennatula phosphorea* and *Virgularia mirabilis*) were noted in the seabed imagery acquired across the Thistle survey area. However, as the number of sea pens observed across the area was not stated during the pre-decommissioning survey and there was no evidence of faunal burrows to constitute a 'sea pen and burrowing megafauna communities' habitat [31].

As noted in Section 4.3.1, several seabed depressions were observed on the SSS and MBES data that resembled unit pockmarks. Depression features are sometimes associated with the Annex I habitat 'Submarine structures made by leaking gases'. However, no methane-derived authigenic carbonates ('MDAC'), often formed within larger pockmarks, which can form bubbling reefs and the Annex I habitat 'Submarine structures made by leaking gases' were identified in the depressions ground-truthed. This suggests that they were formed by the disruption of the seabed caused by the installation of pipelines, cables, and sediment scour. None of the depressions showed evidence of the rugose and high reflectivity SSS signature typically associated with MDAC and there was no evidence of MDAC on ground-truthing data [31]. As such, no Annex I habitat 'Submarine structures caused by leaking gases' were thought to occur within the Thistle survey area.

As cobbles and boulders were recorded along two transects within the Thistle survey area (EBS_8400mSW and EBS_10950mNW; Figure 4.1.1), they were subject to further investigation to assess whether any areas have the potential to be classified as Annex I stony reef. The seabed camera ground-truthing data was assessed for potential stony reefs using criteria to measure 'quality' or 'reefiness'. This is based on a minimum cobble size of 64 mm being present and indicating relief above the natural seabed where >10% of the matrix are cobble related and a minimum area of 25m^2 is recorded. The results of the stony reef assessment of both transects showed points along the transects that were classified as 'Low' reef structure, with no evidence of 'Medium' or 'High' reefiness structures observed. Only two sections were assessed along video transect EBS_ 10950mNE with one classified as 'Low Reef' for composition (10% to 40% cover of cobbles/boulders) and/or elevation (64 mm – 5 m above ambient seabed). The other assessed section was >10% coverage and was therefore considered 'Not a Reef'. Therefore, the southwest and northeast reference stations were categorised as 'Not a Reef' due to their limited expanse of >25 m^2 but did contain patches of rock with significant elevation and composition to be termed 'Low' in terms of the reef structure [31].

The ocean quahog (*Arctica islandica*) bivalve species is included on the OSPAR List of Threatened and/or Declining Species in the Greater North Sea. This species is also listed as a marine conservation zone (MCZ), FOCI for both inshore and offshore protection) and is on the list of the PMF in Scotland's seas. No adult specimens of ocean quahogs were recorded in the entire survey area from macrofaunal analysis and there was no evidence of distinct *A. islandica* siphons on any of the video footage or still photographs within the survey area [31].

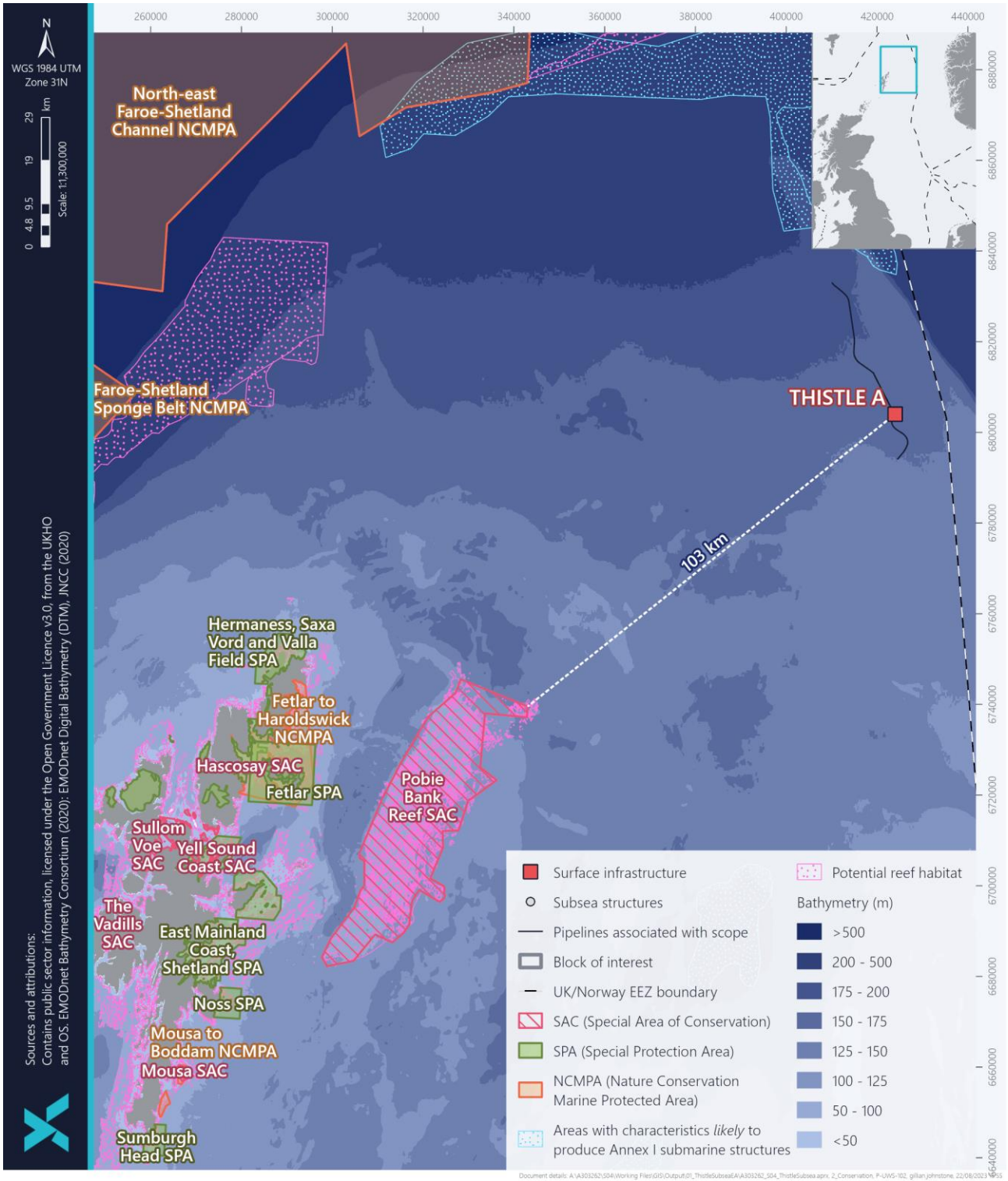


Figure 4.5.1 Protected sites around the project area

4.6 Oil and Gas Activity

There are several installations and pipelines located within the vicinity of the Thistle decommissioning area. The locations of these activities and related infrastructure within the project area are illustrated in Figure 4.6.1.

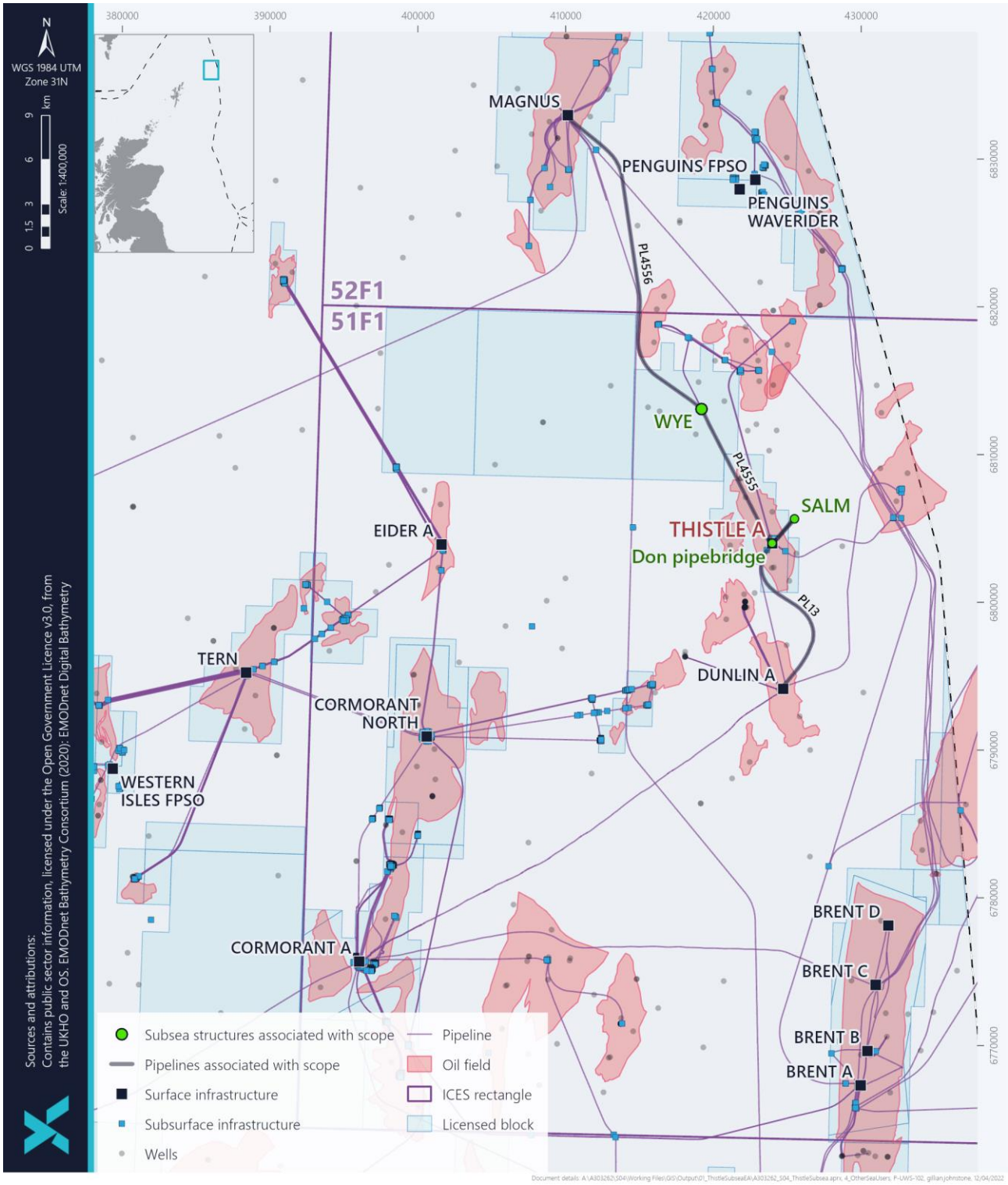


Figure 4.6.1 Location of Oil and Gas infrastructure within 40 km of the project area

4.7 National Marine Plan

In addition to adhering to the suite of marine policies, regulations, and guidance for the offshore oil and gas industry, this project considers the objectives set by the Scottish NMP [75]. The NMP covers the management of both Scottish inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles). The aim of the NMP 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 proposed operations described in this EA have been assessed against the NMP's objectives and policies, specifically GEN 1, 4, 5, 9, 12, 14 and 21 and OIL AND GAS 2, 3 and 6.

Assessment of compliance against relevant policies has already been achieved through the ENVID process. The proposed operations do not contradict any of the marine plan objectives and policies. EnQuest will ensure they comply with any new policies that have been introduced; with particular attention being made to the following existing policies:

GEN 4 – Co-existence

Where conflict over space or resource exists or arises, marine planning should encourage initiatives between sectors to resolve conflict and take account of agreements where this is applicable.

Potential impacts to other users of the sea during execution will be managed through existing safety zones, UK Hydrographic Office ('UKHO') standard communication channels (including Kingfisher, Notice to Mariners and radio navigation warnings) and the use of Automatic Identification System ('AIS') as well as other navigational controls. Upon completion of the operations, the area of sea from which other users of the sea have been excluded throughout the operational phase of the project area will be made available for them once again.

GEN 5 – Climate Change

Marine planners and decision makers should seek to facilitate a transition to a low carbon economy. They should consider ways to reduce emissions of carbon and other greenhouse gasses ('GHGs').

EnQuest will ensure that the minimal number of vessels will be deployed and the streamlining of activities through planning to reduce the time required for vessels to undertake these activities and, in doing so, will support the drive to reduce emissions. Each vessel will have a Shipboard Energy Efficiency Management Plan ('SEEMP') which contains information on minimising fuel consumptions.

GEN 1 – General Planning and Principle

Development and use of the marine area should be consistent with the NMP, ensuring activities are undertaken in a sustainable manner that protects and enhances Scotland's natural and historic marine environment.

Decommissioning of the Thistle field will result in the removal of infrastructure and the recovery of debris as well the cessation of produced water discharges already achieved via Cessation of Production ('CoP'), all of which will enhance the local marine environment in the longer term.

GEN 9 – Natural Heritage

Development and use of the marine environment must:

- *Comply with legal requirements for protected areas and protected species;*
- *Not result in significant impact on the national status of PMF; and*
- *Protect and, where appropriate, enhance the health of the marine area.*

Legal requirements will be adhered to throughout the duration of the project, including those relating to the protected species which may be present within the project area. There are no

protected areas within 40 km of the project area. There a number of PMFs expected within the project area however the proposed operations will not result in significant impact on their national status. As previously mentioned, decommissioning of the Thistle field project area will result in the removal of infrastructure which will enhance the local marine environment in the longer term.

GEN 12 – Water Quality and Resource

Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives that apply.

All pipelines and umbilicals will be cleaned and flushed prior to decommissioning. A new permit application will be submitted to flush PL600 and PLU6267, which have not been previously flushed. The discharges of PL600 and PLU6267 will be covered through the appropriate environmental regulatory and permitting regime, and will be subject to a chemical permit and chemical risk assessment. Discharges from vessels are typically well-controlled activities that are regulated through vessel and machinery design, management and operation procedures. Controls will be in place, as required, through compliance with the Offshore Chemical Regulations and the Oil Pollution Prevention and Control Regulations.

GEN 14 – Air Quality

Development and use of the marine environment should not result in the deterioration of air quality and should not breach any statutory air quality limits. Some development and use may result in increased emissions to air, including particulate matter and gasses. Impacts on relevant statutory air quality limits must be considered and mitigation measures adopted, if necessary, to allow an activity to proceed within these limits.

EnQuest will ensure that the minimal number of vessels will be deployed and the streamlining of activities through planning to reduce the time required for vessels to undertake these activities and, in doing so, will support the drive to reduce emissions. Each vessel will have a SEEMP which contains information on minimising fuel consumptions.

GEN 21 – Cumulative Impacts

Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation.

In terms of air and water quality, EnQuest's approach and project-specific mitigation measures will minimise the potential negative aspects contributing towards cumulative impacts as detailed in the responses to GEN 12 and GEN 14. In terms of seabed disturbance, it is reasonable to presume that the proposed operations are not of significant magnitude to have any discernible contribution to cumulative impacts in the broader context though this presumption is qualified in Section 6.2.3.

OIL AND GAS 2 – Decommissioning end-points

Where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage, decommissioning must take place in line with standard practice, and as allowed by international obligations. Re-use or removal of decommissioned assets from the seabed will be fully supported where practicable and adhering to relevant regulatory process.

EnQuest 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. In accordance with the Waste Hierarchy, EnQuest will continue review reuse options for elements of the subsea infrastructure.

OIL AND GAS 3 - Minimising environmental and societal impacts

Supporting marine and coastal infrastructure for oil and gas developments, including for storage, should utilise the minimum space needed for activity and should take into account environmental and societal constraints.

EnQuest will identify an appropriately authorised disposal company and fit for purpose yard through a selection process that will ensure that the chosen facility demonstrates a proven track record of waste stream management throughout the deconstruction process, the ability to deliver innovative reuse / recycling options, and thus minimises the space required to process recovered items.

OIL AND GAS 6 – Risk reduction

Consenting and licensing authorities should be satisfied that adequate risk reduction measures are in place, and that Operators should have sufficient emergency response and contingency strategies in place that are compatible with the National Contingency Plan and the Offshore Safety Directive.

EnQuest has the relevant risk reduction measures in place for the proposed decommissioning activities and will demonstrate this appropriately through this DP/EA process, through stakeholder engagement and ultimately through the submission of notifications and applications for the authorisations, permits, licences and consents required to execute the work.

5. IMPACT ASSESSMENT SCREENING AND JUSTIFICATION

5.1 Assessment of Potential Impacts

An ENVID was undertaken to discuss the proposed decommissioning activities and any potential impacts these may pose. The discussion identified nine impacts that either have the potential to arise based on the proposed removal methods or required inclusion and further discussion due to current regulatory and industry interest. Of these nine potential impacts, six were screened out of further assessment based on the low level of severity or likelihood of significant impact occurring (Appendix B). The potential impacts are tabulated in Table 5.1.1 together with justification statements for the screening decisions and proposed mitigation. Atmospheric emissions, seabed disturbance and physical presence of infrastructure decommissioned *in situ* in relation to other sea users were scoped in for further assessment and are discussed in Section 6.

EnQuest 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. EnQuest will ensure that lessons learnt from previous decommissioning scopes will be reviewed and implemented as appropriate to all aspects of the Thistle pipeline DP [27].

Table 5.1.1 Impact assessment screening

Potential impact	**Atmospheric Emissions**	**Further assessment?**	**Yes**
Rationale			
Emissions during decommissioning activities (largely comprising fuel combustion gases), will occur following CoP. Emissions generated by infrastructure, equipment and vessels associated with operation of the asset will be replaced by those from vessel use as well as the recycling of decommissioned materials. Reviewing historical EU Emissions Trading Scheme data and comparison with the likely emissions from the proposed work scope suggests that emissions relating to decommissioning will be small relative to those during the lifetime of production. The total GHG emissions, when considering all aspects of the planned Thistle pipelines, SALM base and Don pipelines decommissioning activities are estimated to be in the region of 22.19 $KtCO_2e$, this equates to 0.17% of the 13.2 $MtCO_2e$ of the total UKCS oil and gas emissions in 2018 [66]. These emissions have been calculated assuming a worst case of approximately 176 days of vessel emissions across the duration of the decommissioning project. This vessel time is split across four types of vessels which will participate in a variety of activities including: structure removal, pipeline/umbilical end cutting, placement of rock, an overtrawl survey and post-decommissioning monitoring. The total emissions estimate also includes the embodied carbon associated with the re-manufacture of steel decommissioned *in situ* (8,702 $TeCO_2e$ and 113 $TeCO_2e$ for the Thistle pipelines and Don pipelines, respectively). Review of available decommissioning EAs suggests that atmospheric emissions in highly dispersive offshore environments are not considered to 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. Furthermore, in line with the NSTA's (2021) expectations (in particular, Stewardship Expectation 11) [60]. EnQuest is dedicated to minimising GHG emissions from decommissioning operations, as far as is reasonable for each project. EnQuest is committed to working with the supply chain and joint ventures as part of meeting these commitments. Due to stakeholder, scientific and public concern around the cumulative impact of GHGs, atmospheric emissions resulting from project activities are assessed further in Section 6.1.			

Table 5.1.1 Impact assessment screening			
Mitigation measures			
• See Section 6.1.7.			
Potential impact	**Seabed disturbance**	**Further assessment?**	**Yes**
Rationale			
Decommissioning activities will generate disturbance to the seabed; these include activities associated with decommissioning of the pipelines *in situ*, the removal of the SALM Base, subsea protection structures and surface laid pipelines and umbilicals. Currently it is envisaged that all vessels undertaking the decommissioning and removal works would be dynamically positioned vessels. As a result, there will be no direct interaction between vessels and the seabed from vessel anchoring. Seabed impacts may range in duration from temporary sediment suspension or smothering to permanent impacts, such as the introduction of new substrate or any consequential habitat and community level changes which may transpire. As Thistle pipelines PL13, PL4555, PL4556 and Don pipelines PL598, PL399, PL600, and PLU6267 will be decommissioned *in situ,* there is an associated potential long-term impact from degrading infrastructure on the surrounding sediments. The release of degrading components are expected to occur in very small quantities and over a long period of time and will be highly localised as the pipelines will not degrade equally along their length. The burial profiles (Section 6.3.2) confirm the top of the pipelines and that the pipelines are not covered under the cuttings. This is supported by visual evidence that the pipelines in scope are not buried under the drill cuttings piles present at the north and southwestern legs of the Thistle platform [19].Therefore, as the cuttings piles will be left undisturbed, it is not considered in the assessment of seabed disturbance. EnQuest is committed to leaving a clear, safe seabed in the wake of the decommissioning activities. The clear seabed will be validated by an independent verification survey over the installation sites and pipeline corridors. Survey methods will be agreed with OPRED, and non-intrusive verification techniques will be considered in the first instance. Impacts to the seabed from project activities are assessed further in Section 6.2.			
Mitigation measures			
• See Section 6.2.5.			
Potential impact	**Physical presence of vessels in relation to other sea users**	**Further assessment?**	**No**
Rationale			
The presence of a small number of vessels for the Thistle pipelines, SALM base and Don pipelines decommissioning activities will be relatively short-term in the context of the life of the Thistle and Don fields. Activity will occur using similar vessels to those currently deployed for oil and gas installation, operation and decommissioning activities. Other sea users will be notified in advance of activities occurring (via the UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings) meaning those			

Table 5.1.1 Impact assessment screening			
stakeholders will have time to make any necessary alternative arrangements for the very limited period of operations. AIS and other navigational controls will be utilised. The decommissioning of the Thistle pipelines, SALM base and Don pipelines is estimated to require four vessels, however these would not all be on location at the same time (maximum of two at any one time). Considering the above, temporary presence of vessels does not need further assessment.			
Mitigation measures			
• Minimal vessel use/movement; • Notification to Mariners; and • Opening up of 500 m safety exclusion zone following close-out.			
Potential impact	**Physical presence of infrastructure decommissioned *in situ* in relation to other sea users**	**Further assessment?**	**Yes**
Rationale			
The physical presence of infrastructure decommissioned *in situ* has limited potential of impacting other sea users and is limited to potential snagging risks to commercial fisheries. The Thistle pipelines and umbilicals to be decommissioned *in situ* are PL13, PL4555 and PL4556. PL13 was trenched however approximately one–third of the pipeline remains exposed and historical survey data indicates that the pipeline suffers from degradation in some areas and there is evidence of snagged fishing nets on the pipeline. Seabed and burial profiles from a 2018 survey identified 150 exposures with an overall exposed length of 3645 m and 66 spans, 5 of which are considered reportable [19]. PL4555 is trenched and overlain with deposited rock. It is expected to have a reasonable depth of cover inside the trench and there is no evidence to suggest any exposures or spans exist except possibly at the ends. PL4556 is trenched and the trench backfilled. Rock (875 m in length) was deposited over areas that were susceptible to upheaval buckling or as protection and stabilisation at pipeline crossings near Magnus. The Don pipelines and umbilicals to be decommissioned *in situ* are PL598, PL599, PL600 and PLU6267. PL598 and PL599 were trenched and the trench actively backfilled when installed. Both have had a consistent burial profile and have been subject to annual inspections between 1990 and 2002. PL598 suffered from a number of spans which were remediated by 1994. The most recent survey (2013) of PL599 found a partly (50% - top half) exposed section ~18 m long, which contained a span (2.5 m long x 0.1 m high span). This was not reportable, and it is unknown whether the exposure or span still exists as no other recent survey data has been found. PL600 suffers from one span at the Thistle tie-in location, however this will be removed along with the surface paid infrastructure. PLU6267 is reported to have experienced a consistent burial profile, with the level of exposure in the field being low except for the surface laid section on the approaches at Thistle (which will be removed as part of the decommissioning of pipeline sections in the Thistle 500 m zone). The burial status of these pipelines is such that, following placement of rock over cut pipeline ends and an estimated ~29,300 Te along the remaining length of PL13, they are not expected to pose any risk of interaction with other sea users. Future monitoring work will monitor the burial of these pipelines and the status of the PL13, ensuring that snagging risks do not arise. The frequency of this monitoring work and any subsequent maintenance regime will be established after consultation with OPRED. EnQuest is committed to leaving a clear, safe seabed. The clear seabed will be validated by an independent verification survey, the methodology for which will be agreed with OPRED.			

Table 5.1.1 Impact assessment screening			
To address any Stakeholder concerns and to provide more detail with regards to the proposed mitigation measures, assessment of potential snagging risks associated with the decommissioning of the pipelines and umbilicals *in situ*, as well as the condition of the seabed following the decommissioning of infrastructure via full removal, is provided in 6.3.5.			
Mitigation measures			
• See Section 6.3.5.			
Potential impact	**Discharges to sea**	**Further assessment?**	**No**
Rationale			
Discharges from vessels are regulated activities that are managed on an ongoing basis through existing legislation and compliance controls. All pipelines in the project area will have been drained and flushed following CoP. PL600 and PLU6267 were not previously flushed before the execution of previous decommissioning activities (out with the Thistle 500 m zone). A new permit application will be submitted to flush PL600 and PLU6267 with potable water or seawater before they are severed inside the Thistle 500m zone. As this is a pre-decommissioning activity which has been / will be permitted as appropriate, it therefore falls outside the scope of this EA. Any discharges from infrastructure occurring during the decommissioning activities of the Thistle and Don pipelines will be assessed as part of the environmental permitting process (e.g., through Master Application Templates/Subsidiary Application Templates). Controls will be in place, as relevant, through the Offshore Chemical Regulations and the Oil Pollution Prevention and Control regulations. Residual liquids, containing hydrocarbons, present during the decommissioning of pipelines and SALM base will be treated before being discharged to sea, such that the discharge will comprise treated water. Considering the above, discharges to sea during decommissioning activities are not assessed further herein.			
Mitigation measures			
• MARPOL compliance; • Bilge management procedures; • Vessel audit procedures; • Monitoring and treatment of pipeline fluids being flushed; and • Contractor management procedures.			
Potential impact	**Underwater noise**	**Further assessment?**	**No**
Rationale			
There is potential for localised injury and disturbance to marine mammals and fish through noise from cutting operations and vessels across the project area, however, recent research findings regarding noise levels emitted during DWS procedures determined they were not easily discernible above the background noise levels (mostly attributed to vessel activity) [71]. In the absence of recorded field measurements, it seems likely that this form of cutting would not generate a great deal of noise and may not be detectable above other sources operating simultaneously (i.e. vessels) within the project area.			

Table 5.1.1 Impact assessment screening			
The need for geophysical surveys undertaken for post-decommissioned infrastructure left *in situ* will be determined in the future and assessed through the process of permit applications as appropriate. MBES and/or SSS equipment is likely to be used for imaging and identification of pipeline exposures. The JNCC (2017) Guidelines will be employed for mitigation of noise impacts to marine mammals for future survey work involving seismic survey equipment [44]. As presented in the ENVID exercise, the activities associated with the decommissioning of the Thistle pipelines, SALM base and Don pipelines are likely to be minor and are unlikely to generate significant noise levels. As the project is not located within a marine mammal protection area and EAs for offshore oil and gas decommissioning projects generally show no potential injury or significant disturbance associated with the non-survey decommissioning activities. Further assessment of the impact of the decommissioning on this receptor is therefore not required.			
Mitigation measures			
• Minimal vessel use/movement; • Vessel sharing where possible; and • Cutting activities will be minimised and carried out in isolation where possible.			
Potential impact	**Resource use and waste**	**Further assessment?**	**No**
Rationale			
Generally, resource use from the proposed activities will require limited raw materials and be largely restricted to fuel use. Any opportunities for increasing fuel efficiency and reducing use of resources will be identified and implemented by EnQuest where possible. The onshore treatment of waste from the decommissioning activities will be undertaken according to the principles of the waste hierarchy, a conceptual framework which ranks the options for dealing with waste in terms of sustainability. The waste hierarchy is a key element in the OPRED Guidance Notes [67]. Waste material 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 non-hazardous material. Other non-hazardous waste which cannot be reused or recycled will be disposed of to a landfill site. There may be instances where infrastructure returned to shore is contaminated (e.g., by NORM, hazardous, and/or special wastes) and cannot be recycled. In these instances, the materials will require disposal. Special waste resulting from the dismantling of the Thistle infrastructure will be pre-treated to reduce hazardous properties or render it non-hazardous prior to recycling or disposing of it to a suitable landfill site. Under the Landfill Directive (The Landfill (Scotland) Regulations 2003), pre-treatment is necessary for most special wastes destined to be disposed of to a landfill site. However, the weight and/or volume of such material is not expected to result in substantial landfill use. The recycling and disposal of wastes are covered by EnQuest's Waste Management Strategy, which is compliant with relevant regulations relating to the handling of waste offshore, transfer of controlled, hazardous (special) waste and Trans-Frontier Shipment of Waste ('TFSW'). The Waste Management Strategy is guided by EnQuest HSEA Policy (Appendix C) and commitments to best practice in waste management. This includes the mapping and documenting of waste management arrangements for ongoing monitoring of waste procedures and performance review against target Key Performance Indicators ('KPIs'). It should be noted that, 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. Due diligence audits will take place of waste			

Table 5.1.1 Impact assessment screening			
contractors/sub-contractors to ensure that all necessary handling and reporting measures (including tracking of wastes, accounting and identification of wastes, wastes generated per asset and waste segregation) are taking place. Specific audit/monitoring schedules will be set up as part of the disposal yard contract award. No further assessment of resource use or waste is necessary.			
Mitigation measures			
• Adherence to the Waste Hierarchy; • Waste Management Strategy and active waste tracking; • Selection of suitably licenced landfill/disposal sites (if applicable); • Communication with relevant Regulator(s) (e.g., Scottish Environmental Protection Agency ('SEPA')) established; • Vessel management; • Minimal vessel use/movement; • Vessel sharing where possible; • Engine maintenance; and • EEMS ('Environmental and Emissions Monitoring System') tracking and close-out reporting.			
Potential impact	**Accidental events**	**Further assessment?**	**No**
Rationale			
Well decommissioning is outside of the scope of this specific impact assessment since it not dependent on approval of the DPs. The possibility of a well blowout therefore does not require consideration in this assessment (it is assessed as part of separate well intervention applications). The pipelines will have been flushed and cleaned prior to the decommissioning activities described herein being carried out. PL600 is known to be impaired by internal blockages, hence flushing has not been possible. Prior to decommissioning of PL600 and PLU6267 inside the Thistle 500 m zone, a permit application will be submitted to flush PL600 and PLU6267 with potable water or seawater. Release of a hydrocarbon and chemical inventory is therefore also out of scope of this assessment. Therefore, the most likely origin of an accidental event would be from an unplanned instantaneous diesel release from the largest vessel employed in the decommissioning activities. The worst-case scenario would be a Construction Support Vessel ('CSV') with a maximum fuel capacity of approximately 1,941 m^3. The fuel inventory of the CSV vessel is likely to be split between several separate fuel tanks, significantly reducing the likelihood of an instantaneous release of the full inventory. Any spills from vessels participating in decommissioning activities are covered by the EnQuest NNS Offshore Oil Pollution Emergency Plan ('OPEP') [25], Communication and Interface Plan ('CIP') and respective Shipboard Oil Pollution Emergency Plans ('SOPEPs'). EnQuest will support response of any vessel-based loss of fuel containment through the vessel owner's SOPEP. There is a very low likelihood of vessel-to-vessel collision occurrence, an estimated one collision in 685 years. Considering this, and in line with the mitigation measures in place, a vessel collision scenario does not require further assessment here. Vessel collision with any of the surface installations is in some cases an order of magnitude less likely.			

Table 5.1.1 Impact assessment screening
In addition to the mitigation measures outlined in the individual vessel SOPEPs, EnQuest requires manned bridges, navigational aids and monitoring of safety zones. Only project vessels will be present when activity is taking place within 500 m safety exclusion zones. 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. The post-decommissioning clear seabed verification survey will aid in the identification of in-field dropped objects. All lift operations will happen within the Thistle safety zone therefore there is minimal risk from dropped objects on live third-party infrastructure from these activities. During transport the infrastructure will be transported on deck with suitable sea fastening as per safe vessel operating procedures. As a result, there will be minimal risk from significant dropped objects during transport. Should such an event occur, the likely destination ports would mean transport over gas or condensate lines only which would result in a low-risk hydrocarbon release which could be managed by offshore spill procedures with minimal environmental impact. Dropped object procedures are industry standard and there is a very remote probability of any interaction with any live infrastructure. When planning for such transport efforts will be made to minimise the transit over live infrastructure. In line with the mitigation measures in place, accidental events are not assessed further herein.
Mitigation measures
• OPEP in place for operations; • SOPEP on all vessels; • CIP in place; • Navigational warnings in place; • Safety zone; • Spill response procedures; • Contractor management and communication; • Lifting operations management of risk; • Dropped object recovery and debris clearance surveys; • PON2 submission; and • Careful planning, selection of equipment, management and implementation of activities.

5.2 Aspects Taken Forward for Further Assessment

Based on the ENVID results (Appendix B) which informed the screening process in Section 5, atmospheric emissions, seabed disturbance and the physical presence of infrastructure decommissioned *in situ* have been identified as requiring further assessment within the EA. These potential impacts are addressed in detail within the Section 6.1, Section 6.2 and Section 6.3.

6. IMPACT ASSESSMENT

6.1 Atmospheric Emissions

6.1.1 Introduction

On a global scale, concern regarding atmospheric emissions of direct and indirect GHGs (including water vapour, carbon dioxide ('CO_2'), methane ('CH_4'), nitrous oxides ('NO_X'/'N_2O'), ozone ('O_3'), chlorofluorocarbons ('CFCs') and Volatile Organic Compounds ('VOCs') is focused on the impact they have on global climate change. The Intergovernmental Panel on Climate Change ('IPCC') in its sixth assessment report ('AR6') states that it is unequivocal that the increase of CO_2, CH_4 and NO_X in the atmosphere over the industrial era is the result of human activities. Human influence is the principal driver of many changes observed across the atmosphere, ocean, cryosphere and biosphere [42]. Climate change estimates in the AR6 report state that each of the last four decades have been successively warmer than any decade that preceded it since 1850. IPCC (2021) reports a 47% increase in CO_2 concentrations since 1750, which far exceeds the natural multi-millennial changes between glacial and interglacial periods over at least the past 800,000 years, and states that fossil fuel combustion is the primary contributor to the observed climate change [42]. This has prompted increasing public and stakeholder concern regarding the impacts of anthropogenic climate change on the environment and the potential contribution of GHG emissions to global warming.

The information on the quantification and impact assessment of the emissions is presented in this section of the EA represents atmospheric emissions associated with the proposed Thistle subsea decommissioning activities:

- Offshore vessel use for decommissioning activities;
- Lifecycle emissions (onshore transport, recycling, new manufacture of recyclable material decommissioned *in situ*).

On a local-scale, emissions such as sulphur oxides ('SO_X'), NO_X and carbon monoxide ('CO') may affect air quality. These emissions may be assessed against onshore local air quality guidelines to understand the potential magnitude of impact on human health and the environment. These guidelines are intended to mitigate the regional, national, and transboundary issues caused by these pollutants such as acid rain and eutrophication.

6.1.2 Regulatory Controls

In the UK, there are several atmospheric regulatory controls which apply to offshore developments and require the provision of atmospheric emissions inventories and management. Following the UK's departure from the EU, the atmospherics legislation that is derived from EU regulations was transcribed into UK law.

Relevant legislation for offshore combustion equipment includes:

- Climate Change Act 2008.
- The National Emission Ceilings Regulations 2002.
- The Greenhouse Gas Emissions Trading Scheme Order 2020.
- Pollution Prevention and Control Act 1999.
- The Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 as amended by The Offshore Combustion Installations (Pollution Prevention and Control) (Amendment) Regulations 2018.
- The Pollution Prevention and Control (Designation of Medium Combustion Plant Directive)

(Scotland) Order 2017.

- The Pollution Prevention and Control (Scotland) Amendment Regulations 2017.
- The Pollution Prevention and Control (Designation of the Medium Combustion Plant Directive) (Offshore) Order 2018.
- The Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008 implement MARPOL Annex VI in the UK and establish controls on marine engines and marine fuel in order to limit emissions, in particular NO_x and SO_x. All vessels used during the proposed project will have the appropriate UK Air Pollution Prevention Certificate ('UKAPP') or International Air Pollution Prevention Certificate ('IAPP') in place, as required.
- Regulation 14 designated the North Sea for the purposes of SOx and particulate matter control Sulphur Oxides Emission Control Areas ('SECA').
- Regulation 13 requires Nitrogen Oxides Emissions Control Areas ('NECA') to be included within Emission Control Areas ('ECA') as evidenced by the issue of Engine International Air Pollution Prevention Certifications ('EIAPP').
- Directive 2005/33/EC amending Directive 1999/32/EC as regards the sulphur content of marine fuels:
  - The Sulphur Content of Liquid Fuels (England and Wales) Regulations 2000.
  - The Sulphur Content of Liquid Fuels (Scotland) Regulations 2014.

6.1.3 Description and Quantification of Impacts

6.1.3.1 Offshore vessel use

The emissions of relevant GHGs, for which the Global Warming Potentials ('GWPs') are listed in Table 6.1.1 have been calculated from the estimated total amount of fuel that will be required by vessels [41][57]. Vessels emissions for combustion gases other than CO_2 were converted into an overall CO_2e using their GWP as defined by the IPCC. The emissions of individual GHGs were then summed to a single value of CO_2e, to describe different GHGs in a common unit (Table 6.1.2 and Table 6.1.3). For any quantity and type of GHG, CO_2e signifies the amount of CO_2 with the equivalent global warming impact. CO_2e was then used to compare the emissions from the Thistle and Don subsea decommissioning vessel activities with total UKCS emissions and the UK carbon budget.

Table 6.1.1 GWP (100-year horizon) of relevant GHGs (Te CO2e) [42]

CO_2	CH_4	N_2O	CO	VOC
1	29.8	273	1.6	5.6

Table 6.1.2 Thistle pipelines and SALM base decommissioning vessel activity

Activity	Vessel	Duration (days)[1]	Fuel use (Te)
Subsea installation removal	CSV	10.38	205.91
Pipeline end removal	CSV	8.45	130.63
Pipeline removal	CSV	52.08	1,141.00

Table 6.1.2 Thistle pipelines and SALM base decommissioning vessel activity			
Structure removal	CSV	10.38	205.91
Mattress removal	CSV	8.78	58.50
Rock remediation	Rock-dump vessel	24.93	282.95
Post-decommissioning surveys (x4)	Survey vessel	43.44	570.20
Overtrawl survey	Fishing trawler	16.69	166.70
	Total	**176**	**2,762**

NOTE:

1. Vessel days include mobilisation, demobilisation, working days and 15% waiting on weather (based on working days).

Table 6.1.3 Don pipelines decommissioning vessel activity			
Activity	**Vessel**	**Duration (days)[1,2]**	**Fuel use (Te)**
Pipeline end removal	CSV	9.94	168.00
Structure removal	CSV	10.38	205.91
	Total	**21**	**374**

NOTES:

1. Vessel days include mobilisation, demobilisation, working days and 15% waiting on weather (based on working days).
2. Post-decommissioning survey and overtrawl survey are accounted for in Table 6.1.2 as Don pipelines are inside the Thistle 500 m zone.

In 2020, commercial fishing in UK waters emitted 646 $KtCO_2e$, coastal shipping 3,940 $KtCO_2e$, and leisure craft 674 $KtCO_2e$ [57]. The maximum emissions from the Thistle pipelines and SALM decommissioning vessels would amount to approximately 9.04 $KtCO_2e$ (Table 6.1.4). This represents approximately 0.17% of the sum of the emissions (5,259 $KtCO_2e$) from the sources described above for shipping in 2020. The maximum emissions from the Don pipelines decommissioning vessels would amount to approximately 1.22 $KtCO_2e$ (Table 6.1.5), which represents approximately 0.02% of the 2020 shipping emissions (5,259 $KtCO_2e$).

Table 6.1.4 Thistle pipelines and SALM base decommissioning vessel emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
Subsea installation removal	652.73	3.23	12.15	0.05	2.47	0.04	0.49	674.15
Pipeline end removal	414.08	2.05	7.71	0.03	1.57	0.02	0.31	427.66
Pipeline removal	3,616.97	17.91	67.32	0.25	13.69	0.21	2.74	3,735.62

Table 6.1.4 Thistle pipelines and SALM base decommissioning vessel emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
Structure removal	652.73	3.23	12.15	0.05	2.47	0.04	0.49	674.15
Mattress removal	185.45	0.92	3.45	0.01	0.70	0.01	0.14	191.53
Rock remediation	896.95	4.44	16.69	0.06	3.40	0.05	0.68	926.37
Post-decommissioning surveys (x4)	1,807.53	8.95	33.64	0.13	6.84	0.10	1.37	1,866.83
Overtrawl survey	528.44	2.62	9.84	0.04	2.00	0.03	0.40	545.77
TOTAL	**8,755**	**43**	**163**	**1**	**33**	**0**	**7**	**9,042**
NOTE: 1. Emission Factors ('EFs') for marine diesel are included in Appendix E.								

Table 6.1.5 Don pipelines decommissioning vessel emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
Pipeline end removal	532.56	2.64	9.91	0.04	2.02	0.03	0.40	550.03
Structure removal	652.73	3.23	12.15	0.05	2.47	0.04	0.49	674.15
TOTAL	**1,185**	**6**	**22**	**0**	**4**	**0**	**1**	**1,224**
NOTE: 1. EFs for marine diesel are included in Appendix E.								

Impacts on local air quality and global warming due to vessel use in the project area are not expected to be detectable above current background levels due to the limited number of vessels and time spent of decommissioning activities. As with all other sectors of UK industry, shipping is identifying opportunities to decarbonize and therefore the atmospheric emissions from the decommissioning vessels may be less than those predicted for installation and commissioning.

6.1.4 Lifecycle Emissions

6.1.4.1 Onshore Transport

Onshore transport emissions are those associated with the transport of waste from the arrival port to treatment, landfill and/ or recycling facilities. As waste contractors have not been identified yet, the distance travelled is based on a worst-case scenario of transport to a recycling and/ or treatment facility within a 150 km radius (300 km round trip) of the port location. The total (worst-case) emissions associated with onshore transport for the Thistle pipelines and SALM base were estimated to be 18.35 $TeCO_2e$ (Table 6.1.6). The total (worst-case) emissions associated with onshore transport for the Don pipelines were estimated to be 1.5 $TeCO_2e$ (Table 6.1.6).

Table 6.1.6 Thistle pipelines and SALM base onshore transport emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
Onshore transport (Lorry) Emissions	17.77	0.09	0.33	0.00	0.07	0.00	0.01	18.35
ND: No EFs available. EFs for diesel are included in Appendix E.								

Table 6.1.7 Don pipelines onshore transport emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
Onshore transport (Lorry) Emissions	1.42	0.01	0.03	0.00	0.01	0.00	0.00	1.47
ND: No EFs available. EFs for diesel are included in Appendix E.								

6.1.4.2 Recycling

Inevitably, recycling creates carbon emissions as energy is required to re-process recyclable waste. GHG emissions are estimated using EFs that relate the quantity of a pollutant emitted to a unit of activity (e.g., kg fossil CO_2 per tonne of material reprocessed). In the case of waste material recycling, EFs are often expressed per tonne of waste material collected and sent for recycling (kg CO_2e/Te). The total emissions associated with recycling of the Thistle pipelines and SALM base waste materials listed in Table 3.10.2 and were estimated to be 1,415 TeCO_2e, as shown in Table 6.1.8. Emissions associated with the recycling of the Don pipelines waste materials listed in Table 3.10.3 are shown below in Table 6.1.9 estimated to be 88 TeCO_2e.

Table 6.1.8 Thistle pipelines and SALM base decommissioning lifecycles emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
Recycling	ND	ND	ND	ND	ND	ND	ND	1,414.60
New manufacture and transport of rock	289.65	0	3.76	2.35	0.01	0.07	0.00	1,013.15
New manufacture to replace recyclable materials	9,213.14	ND	16.12	ND	25.34	ND	ND	9,213.14
Total	**9,503**	**0**	**19.88**	**2.35**	**25.35**	**0.07**	**0**	**11,641**
ND: No EFs available. EFs for specific materials and activities are included in Appendix E.								

Table 6.1.9 Don pipelines decommissioning lifecycles emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
Recycling	ND	ND	ND	ND	ND	ND	ND	87.83

Table 6.1.9 Don pipelines decommissioning lifecycles emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
New manufacture and transport of rock	0.69	0.00	0.01	0.01	0.00	0.00	0.00	2.39
New manufacture to replace recyclable materials	132.41	0.00	0.21	0.00	0.33	0.00	0.00	132.41
Total	**13**	**0**	**0**	**0**	**0**	**0**	**0**	**223**
ND: No EFs available. EFs for specific materials and activities are included in Appendix E.								

6.1.4.3 New Manufacture

New manufacture emissions are included in this assessment to represent the embodied carbon in the infrastructure decommissioned *in situ* which would otherwise be recyclable and fed back into society. The material quantities were calculated based on the available data with expert engineering knowledge. EFs were applied to obtain the values for the embodied carbon in the materials. The total embodied carbon for the Thistle pipelines and SALM base (material quantities presented in Table 3.10.2) was estimated to be 9,213TeCO_2e (Table 6.1.8.). The total embodied carbon for the Don pipelines (material quantities presented in Table 3.10.3) was estimated to be 132 TeCO_2e (Table 6.1.9).

6.1.4.4 Emissions Summary

The maximum emissions from the Thistle pipelines and SALM base decommissioning vessels would amount to approximately 20,701 TeCO_2e (Table 6.1.4). This represents about 0.39% of all the emission sources for shipping on the UKCS in 2020 (5,259 K KtCO_2e) [57].

Table 6.1.10 Summary of estimated Thistle pipelines and SALM base decommissioning emissions (Te)								
Activity	**CO_2**	**CO**	**NOx**	**N_2O**	**SO_2**	**CH_4**	**VOC**	**CO_2e**
Offshore transport (Vessels)	8,755	43	163	1	33	0	7	9,042
Onshore transport (Lorry)	18	0	0	0	0	0	0	18
Recycling	ND	ND	ND	ND	ND	ND	ND	1,415
New manufacture and transport of rock	290	ND	4	2	0	0	0	1,013
New manufacture to replace recyclable materials	9,213	ND	16	ND	25	ND	ND	9,213
Total	**18,275**	**43**	**183**	**3**	**59**	**1**	**7**	**20,701**
ND: No EFs available. EFs for specific materials and activities are included in Appendix E.								

The maximum emissions from the Don pipelines decommissioning vessels would amount to approximately 1,488 $TeCO_2e$ (Table 6.1.5). This represents about 0.03% of all the emission sources for shipping on the UKCS in 2020 (5,259 K $KtCO_2e$) [57].

Table 6.1.11 Summary of estimated Don pipelines decommissioning emissions (Te)

Activity	CO_2	CO	NOx	N_2O	SO_2	CH_4	VOC	CO_2e
Offshore transport (Vessels)	1,185	6	22	0	4	0	1	1,224
Onshore transport (Lorry)	1	**0**	**0**	**0**	**0**	0	0.	1
Recycling	ND	ND	ND	ND	ND	ND	ND	88
New manufacture and transport of rock	1	0	0	0	0	0	0	2
New manufacture to replace recyclable materials	132	ND	0	ND	0	ND	ND	132
Total	**1,320**	**6**	**22**	**0**	**5**	**0**	**1**	**1,488**

ND: No EFs available. EFs for specific materials and activities are included in Appendix E.

The new manufacture of materials to replace the Thistle pipelines materials decommissioned *in situ* makes the largest contribution to the lifecycle carbon inventory for the project with an associated 9,213 $TeCO_2e$ GHG emissions (Table 6.1.10). This is closely followed by the total emissions associated with offshore transport (8,755 $TeCO_2e$). The total (worst-case) emissions associated with the recycling of materials is estimated to be 1,415 $TeCO_2e$ and 290 $TeCO_2e$ for the new manufacture of rock with an associated 18 $TeCO_2e$ (Table 6.1.10) for the onshore transport of this material.

The embodied carbon associated with the decommissioning of the Don pipelines *in situ* makes the largest contribution to the lifecycle carbon inventory for the Don pipelines with an associated 132 $TeCO_2e$ GHG emissions. The total emissions associated with the recycling of the Don pipelines were estimated to be 88 $TeCO_2e$ and new manufacture of rock for cut pipeline ends were estimated to be 2 $TeCO_2e$. (Table 6.1.11).

Despite the release of emissions during recycling activities, international studies have also shown that the recycling of waste materials can result in net savings of GHG emissions in contrast to new manufacture [5][30][51][77][84]. This is because recycling materials into new ("secondary") products can displace production of "primary" products that can require even more significant inputs of energy and raw materials.

The total GHG emissions, when considering all aspects of the planned Thistle pipelines and SALM base decommissioning activities are estimated to be in the region of 20,701 $TeCO_2e$ (Table 6.1.10). Combined with the total GHG emissions associated with the planned Don pipelines decommissioning activities (1,488 $TeCO_2e$; Table 6.1.11), the overall total GHG emissions for the

project activities are estimated to be 22,189 TeCO_2e, which equates to approximately 0.17% of the total UKCS oil and gas emissions in 2018[3] (13.2 million Te) [66].

6.1.5 Effects on Sensitive Receptors

To determine the significance level of impacts resulting from atmospheric emissions, there is a requirement to understand the sensitive receptors. Gaseous emissions from the proposed decommissioning activities include CO_2, CO, NO_X, N_2O, SO_X, CH_4 and VOCs. These have the potential to impact sensitive receptors in the area.

The direct effect of the emission of CO_2, CH_4, N_2O and VOCs is the implication for climate change and the contribution to localised air quality deterioration due to low-level ozone [42]. The indirect effects of low-level ozone include deleterious health effects, as well as damage to ecosystems. The direct effect of NO_X, SO_X and VOC emissions is the formation of photochemical pollution in the presence of sunlight. Low level ozone is the main chemical pollutant formed, with by-products that include nitric and sulphuric acid and nitrate particulates, contributing to acid rain formation.

The exposed offshore conditions will promote the rapid dispersion and dilution of these emissions. Outside the immediate vicinity of the decommissioning activities, all released gases would only be present in low concentrations. Potential impacts from onshore emissions are likely to be relatively minor and within local and regional air quality criteria.

6.1.6 Cumulative and Transboundary Impacts

6.1.6.1 Local air quality

Throughout the decommissioning activities, atmospheric emissions will be released, which have the potential to have local, regional (including transboundary) effects. The closest oil and gas installation to Thistle is the Dunlin Alpha structure (9.9 km southeast), which will be decommissioned by the time the Thistle pipelines and SALM base decommissioning activities are anticipated to commence.

Local air quality decline is therefore not likely to be cumulative in nature. There are no offshore windfarms in the direct vicinity (and therefore no associated vessel emissions). There is unlikely to be a noticeable cumulative effect in terms of local air quality above the current levels, given the transitory nature of the decommissioning activities. The main activities and associated emissions arising from the decommissioning activities will be approximately 140 km from the UK coastline and 11 km from the UK/Norway European Economic Zone ('EEZ') boundary line.

Any releases will be limited to the duration of the decommissioning activities and will be minimised as far as possible following the mitigation approaches outlined in Section 6.1.7.

6.1.6.2 Global Climate Change

Atmospheric emissions from fuel supply (of which production of oil and gas is part) was 39 million TeCO_2e in 2018, which represents 7% of the UK total emissions for that year, according to the Committee on Climate Change ('CCC') latest Progress report to Parliament [13]. Of this sector-specific emissions, oil and gas production comprise approximately 40% (16 MtCO_2e), including onshore petroleum production. In context, the total offshore emissions from the UKCS (14.63 MtCO_2e) represents only 3% of the UK's total emissions for the same year [57]. The estimated CO_2 emissions to be generated by the Thistle pipelines, SALM base and Don pipelines decommissioning activities are estimated to be 23.68 KtCO_2e, which represent 0.18% of the total UKCS oil and gas emissions in 2018 (13.2 MtCO_2e) [66].

Any releases will be limited to the duration of the decommissioning activities in contrast to the

[3] 2018 values have been used for comparison as they provide the greatest level of detail in terms of oil and gas specific emissions.

continuous emissions associated with live production operations and will be minimised as far as possible following the mitigation approaches outlined in Section 6.1.7.

6.1.7 Mitigation Measures

Most emissions during the decommissioning activities will be the result of combustion of hydrocarbons for power generation related to vessels. Vessels will be owned by a 3rd Party and the activities are therefore subject to supply chain processes of contract selection and management. Minimisation of emissions from vessels will form part of the selection criteria for the installation vessels though the tendering and selection process.

- Minimal number of vessels deployed and streamlining of activities through planning to reduce the time required for vessels will be required for these activities and will support the drive to reduce emissions;
- Each vessel will have a SEEMP which contains information of minimising fuel consumptions e.g., economical speeds when operationally appropriate;
- Vessel equipment maintained according to manufacturer's recommendation;
- Use of low sulphur diesel,
- Green dynamic positioning or economical speeds when operationally appropriate;
- EnQuest Third Party Contractor Assurance process / procedure.

6.1.8 Residual Impact

The overall assessment for atmospheric emissions was of 'Low' significance. However further investigation was deemed necessary due to increasing scientific, public and stakeholder concern regarding the impacts of anthropogenic climate change on the environment and the potential contribution of GHG emissions to global warming.

The atmospheric emissions from the Thistle pipelines, Don Pipelines and SALM base decommissioning activities will be temporary and limited in nature. It is not expected that atmospheric emissions will negatively impact local air quality or result in significant local cumulative impacts. In terms of global climate change (i.e., cumulative and transboundary impacts), the decommissioning activities will add a very small (0.17%) contribution to the overall offshore emissions in the UK (based on 2020 reported values) and the release of GHG into the environment. The contribution to global warming will be negligible in relation to those from the wider offshore industry and outputs at a national or international level. However, EnQuest is aware of the impact of operational emissions, including those which may be an indirect result of decommissioning operations.

The CCC concluded in their 2019 report, that it is achievable for the UK to implement a new target of net-zero GHG emissions by 2050 in England and Wales, and by 2045 in Scotland. To achieve the net-zero goal, the CCC report calls for concerted effort and action by all to reduce emissions and for any remaining emissions in 2050 to be offset. As part of this, the offshore oil and gas industry is focussed on the continued management and reduction of its operational emissions and the recently announced North Sea Transition Deal [4] further commits the sector to early targets for the reduction of GHG emissions from production, against a 2018 baseline.

In line with the NSTA Stewardship Expectation 11 [60], EnQuest is committed to reduce, as far as is reasonably practicable, GHG emissions from all aspects of our operated assets and to collaborate with and facilitate partners to do the same for our non-operated portfolio. This includes: the development of new hydrocarbon projects; existing producing assets; the abandonment and decommissioning of fields; and the progression of potential energy integration/net zero solutions to assist the governments in our areas of active operations in

meeting Net Zero targets.

6.2 Seabed Disturbance

6.2.1 Introduction

This section discusses the potential environmental impacts associated with seabed interaction resulting from the proposed Thistle subsea decommissioning activities.

The base-case decommissioning activities have the potential to impact the seabed in the following main ways:

- Direct impact through:
  - Removal of subsea installations, pipeline structures, protection and stabilisation materials;
  - Removal of pipelines and umbilicals; and
  - Rock-placement for pipeline and umbilical ends.
- Indirect impact through:
  - Re-suspension and re-settling of sediment; and
  - Footprint of remaining infrastructure.

These activities all represent the 'base-case' for seabed impact. As a 'worst-case' scenario, overtrawl surveys would be undertaken inside the Thistle 500m safety zone to demonstrate that no snagging risks remain on the seabed. However, EnQuest will use non-intrusive and remote methods wherever possible, giving due consideration to the seabed habitats and species.

Direct disturbance, the physical disturbance of seabed sediments and habitats has the potential to cause temporary or permanent changes to the marine environment, depending upon the nature of the associated activity. Indirect disturbance occurs outside of the direct disturbance footprint. It may be caused by the suspension and re-settlement of natural seabed sediments disturbed during activities. Indirect disturbance is considered temporary in all instances. For calculation of the temporary indirect impact to the seabed, the area is double the direct impact area.

Vessels utilising dynamic positioning will be deployed to carry out the decommissioning activities, therefore there are no additional seabed impacts associated with anchors and mooring lines. A semi-submersible rig may be utilised to complete well decommissioning activities however, these activities fall outside the scope of this EA. The appropriate permits will be applied for in support of well decommissioning activities via the DESNZ PETS. An application to decommission the wells will be made via the online WONS on the NSTA Energy Portal.

6.2.2 Description and Quantification of Impacts

6.2.2.1 Subsea Installation Decommissioning

All subsea installations within the Thistle area are to be fully removed (as described in Section 3.7). The direct and indirect disturbance areas associated with these proposed operations are summarised in Table 6.2.1.

To calculate the area of direct disturbance the dimensions of the structures have been used. A five-metre buffer, which considers allowance for any minor excavations and jetting associated with prepping the SALM base and deployment of any tooling etc., has been added to the length and width of the structure. This methodology has been used in the interest of adopting a conservative approach to calculating a worst-case possible impact for the removal of the Thistle subsea infrastructure.

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. Again, adopting a conservative approach, the area of indirect disturbance has been assumed to be double the area of direct disturbance. This disturbance will be temporary, and resettlement will only occur when activities are underway and shortly afterwards.

Table 6.2.1 Seabed footprint for the decommissioning of subsea installations

Item	Quantity and dimensions (m)	Decommissioning Approach	Expected duration of disturbance	Total[1] (km^2)	
				Temporary Direct disturbance area	Temporary Indirect disturbance area
SALM base	1 x (14.65 x 14.65 x 7.8)	Remove	Temporary	0.000386	0.000772
			Total	**0.000386**	**0.000772**

NOTE:

1. Assumes a 5 m buffer (added to length and width) for SALM base recovery.

6.2.2.2 Pipeline Decommissioning

Thistle pipelines PL74 and PL75 will be completely removed. For PL13, surface laid sections of the pipeline on approaches to the Thistle and Dunlin 'A' platforms will be removed and the remaining section of the pipeline will be buried inside the trench under ~29,300 Te of deposited rock. The surface laid sections of PL4555 and PL4556 will be completely removed up to the point of burial in rock and up to ~15 Te of rock will be deposited on both ends of each pipeline, with a total quantity of ~60 Te. The short-surface laid sections of the Don pipelines PL598, PL599, PL600 and PLU6267 will be removed down to trench depth and up to ~15 Te of rock will be deposited on cut pipeline ends, with a total quantity of ~60 Te.

Table 6.2.2 presents the approximate footprint of seabed affected by decommissioning the Thistle pipelines (or components of) and the umbilicals. Whereas Table 6.2.3 presents the approximate footprint of seabed affected by the decommissioning of the Don pipelines and umbilicals within the Thistle 500 m zone. Where the pipelines are to be removed (including partial removal) and decommissioned *in situ*, a 5 m corridor centred around each pipeline has been assumed. The areas disturbed by recovery of each individual line have then been summed to give an overall area of disturbance. Indirect disturbance has been assumed to be twice that of the direct area. This accounts for the resuspension of sediment generated due to the direct disturbance, most of which will settle within the direct footprint.

Any associated placement of rock is calculated separately as a source of permanent impact (Table 6.2.4 and Table 6.2.5). An estimated 15 Te (covering an area of 15 m^2) of rock is thought to be required per cut end for the Thistle and Don pipelines. Where PL13 is to be decommissioned *in situ*, a 3 m corridor centred around the pipeline has been assumed for the remedial placement of rock. As before, the indirect impact area is double the direct impact area (Table 6.2.4).

Table 6.2.2 Seabed footprint for the decommissioning of the Thistle pipelines and umbilical							
Item	**Total length (m)**	**Decommissioning Approach/ length (m)**		**Expected duration of disturbance**	**Total[1](km²)**		
					Temporary Direct disturbance area	**Temporary Indirect disturbance area**	**Long-term disturbance area**
PL13	12,694	Decommission *in situ*	9,071	Long-term			0.049041
		Remove surface laid sections	3,623	Temporary	0.019587	0.039175	
PL74	2,400	Remove	2,400	Temporary	0.012975	0.025951	
PL75	2,400	Remove	2,400	Temporary	0.012975	0.025951	
PL4555	10,260	Decommission *in situ*	9,948	Long-term			0.051761
		Remove ends	312	Temporary	0.001623	0.003247	
PL4556	23,390	Decommission *in situ*	23,310	Long-term			0.121287
		Remove ends	80	Temporary	0.000416	0.000833	
				Total	**0.047578**	**0.095156**	**0.222090**

NOTE:

1. Assumes a 5 m wide disturbance corridor (for both direct and indirect disturbance) for each pipeline/umbilical.

Table 6.2.3 Seabed footprint for the decommissioning of the Don pipelines and umbilicals							
Item	**Total length (m)**	**Decommissioning Approach/ length (m)**		**Expected duration of disturbance**	**Total[1](km²)**		
					Temporary Direct disturbance area	**Temporary Indirect disturbance area**	**Long-term disturbance area**
PL598	567	Decommission *in situ*	417	Long-term			0.000085
		Remove ends	150	Temporary	0.000780	0.001561	
PL599	570	Decommission *in situ*	420	Long-term			0.000085
		Remove ends	150	Temporary	0.000780	0.001561	
PL600	560	Decommission *in situ*	410	Long-term			0.0000287
		Remove ends	150	Temporary	0.000761	0.001521	
PLU6267	539	Decommission *in situ*	389	Long-term			0.000034
		Remove ends	150	Temporary	0.000763	0.001526	
				Total	**0.003085**	**0.006169**	**0.000233**

NOTE:

1. Assumes a 5 m wide disturbance corridor (for both direct and indirect disturbance) for each pipeline/umbilical.

Table 6.2.4 Seabed footprint for remedial placement of rock at Thistle pipelines					
Pipeline(s)	**Rock Location**	**Rock Dimensions**	**Quantity of rock (Te)**	**Total (km^2)**	
				Permanent direct disturbance area	**Temporary indirect disturbance area**
PL13	Pipeline within trench	30,899 m^2	29,300	0.03090	0.06180
PL4555	Pipeline ends	15 m^2 x 2 (pipeline ends)	30	0.00003	0.00006
PL4556	Pipeline ends	15 m^2 x 2 (pipeline ends)	30	0.00003	0.00006
			Total	**0.030959**	**0.061919**

NOTE:

1. Assumes a 3 m wide disturbance corridor (for both direct and indirect disturbance) for PL13.

Table 6.2.5 Seabed footprint for remedial placement of rock at Don pipelines					
Pipeline(s)	**Rock Location**	**Rock Dimensions**	**Quantity of rock (Te)**	**Total**	
				Permanent direct disturbance area (km^2)	**Temporary indirect disturbance area (km^2)**
PL597	Pipeline end	15 m^2 (pipeline end inside Thistle 500 m zone)	15	0.000015	0.00003
PL599	Pipeline end	15 m^2 (pipeline end inside Thistle 500 m zone)	15	0.000015	0.00003
PL600	Pipeline end	15 m^2 (pipeline end inside Thistle 500 m zone)	15	0.000015	0.00003
PLU6267	Pipeline end	15 m^2 (pipeline end inside Thistle 500 m zone)	15	0.000015	0.00003
			Total	**0.000060**	**0.000120**

6.2.2.3 Pipeline Structures

All pipeline structures and associated features within the Thistle area are to be fully removed (as described in Section 3.7). The direct and indirect seabed disturbance areas associated with these proposed operations are summarised in Table 6.2.6 and Table 6.2.7.

To calculate the area of direct disturbance the dimensions of the structures have been used. A 3 m buffer, which considers allowance for any minor excavations associated with prepping the items to be recovered and deployment of any tooling etc., has been added to the length and width of the structures. A 1 m buffer, which considers allowance for any minor excavations associated with prepping the items to be recovered and deployment of any tooling etc., has been added to the length and width of the protection and stabilisation materials. This methodology has been used in the interest of adopting a conservative approach to calculating a worst-case possible impact for the removal of the Thistle and Don pipeline structures.

Table 6.2.6 Seabed footprint related to the decommissioning of Thistle pipeline structures					
Item	**Quantity and dimensions (m)**	**Decommissioning Approach**	**Expected duration of disturbance**	**Total[1] (km²)**	
				Temporary Direct disturbance area	**Temporary Indirect disturbance area**
Wye structure	1 x (10.5 x 6.2 x 1.8)	Remove	Temporary	0.000124	0.000248
Concrete mattress	2 x (12 x 3 x 0.15)	Remove	Temporary	0.000120	0.000240
Concrete mattress	2 x (8 x 3 x 0.15)	Remove	Temporary	0.000088	0.000176
			Total	**0.000332**	**0.000664**
NOTE: 1. Assumes a 3 m buffer (added to length and width) for Wye structure. 2. Assumes a 1 m buffer (added to length and width) for each concrete mattress.					

Table 6.2.7 Seabed footprint related to the decommissioning of Don pipeline structures					
Item	**Quantity and dimensions (m)**	**Decommissioning Approach**	**Expected duration of disturbance**	**Total[1] (km²)**	
				Temporary Direct disturbance area	**Temporary Indirect disturbance area**
Pipebridge	1 x (22.35 x 4 x 1.5)	Remove	Temporary	0.000177	0.000355
Grout bag support under mudmat	1 x (4.5 x 4.5 x 0.3)	Remove	Temporary	0.000041	0.000083
			Total	**0.000219**	**0.000437**
NOTE: 1. Assumes a 3 m buffer (added to length and width) for pipebidge. 2. Assumes a 1 m buffer (added to length and width) for grout bag support.					

6.2.2.4 Pipeline Stabilisation Materials

There are approximately 74 concrete mattresses associated with the Thistle pipelines and subsea infrastructure (4 of which are described in Section 3.3 supporting the pipeline structures). There are no concrete mattresses associated with the Don pipelines inside the Thistle 500 m zone. An estimated 29 grout mattresses, 4 concrete plinths, 2,020 grout or sandbags (25 kg each) and 3,985.8 Te of deposited rock also act as protection and stabilisation features for the Thistle pipelines and pipeline structures. There are approximately 21 grout bags (25 kg each) and 1 grout bag support under mudmat associated with the Don pipelines. The burial status of the majority of concrete mattresses, sand/grout bags and deposited rock on PL4556 will be determined when decommissioning activities are being carried out. The aim is to recover all mattresses and sand/grout bags to shore for recycling and disposal, except for the 29 grout mattresses at PL13 and stabilisation materials at the PL4556 pipeline crossing which are all buried under deposited rock. These will be left *in situ* along with the 3,985.8 Te deposited rock.

The dimensions have been used to calculate an area for all stabilisation materials associated with the Thistle pipelines and SALM base, as shown in Table 6.2.8. The area for stabilisation materials associated with the Don pipelines has been calculated separately which is shown in Table 6.2.9. The dimensions of the concrete mattresses vary, and the dimensions of the grout mattresses are assumed as the size are not determined. A 1 m buffer, which considers allowance for any minor excavations associated with prepping the items to be recovered and deployment of any tooling etc., has been added to the length and width of the protection and stabilisation materials. The method of calculation assumes that all mattresses and grout or sandbags will be laid on the seabed in a single layer, however it is important to note that this is highly unrealistic. Mattresses and grout or sandbags are used to stabilise and support infrastructure therefore they are more likely to be piled on top of one another, or even on top of certain items/structures. As such the numbers presented are conservative estimates (Table 6.2.8 and Table 6.2.9) and the methodology has been used in the interest of adopting a conservative approach to calculating a worst-case possible impact for the removal of the Thistle and Don stabilisation materials.

Table 6.2.8 Seabed footprint related to the Thistle pipeline stabilisation and protection materials							
Location	**Stabilisation type**	**No.**	**Dimensions (m)**	**Disposal route**	**Total[1, 2] (km²)**		
					Temporary direct disturbance area	**Temporary indirect disturbance area**	**Long-term disturbance area**
Inside Thistle 500m zone (PL13, PL74, PL75, PL4555, PL4556, PLU6221)	Concrete mattresses	2	6 x 2 x 0.15	Remove	0.000042	0.000084	
Infield between Thistle & Dunlin (PL13)	Concrete mattresses	17	6 x 2 x 0.15	Remove	0.000357	0.000714	
	Grout mattresses (size not determined)	29	1.8 x 3 x 0.3	Decommission *in situ*			0.000157
Wye structure (PL4555, PL456)	Concrete mattresses	17	6 x 2 x 0.15	Remove	0.000357	0.000714	
	Concrete mattresses	7	6 x 2 x 0.15	Remove	0.000147	0.000294	
	Grout or sandbags (25 kg)	500	0.5 x 0.5	Remove	0.000375	0.000750	
	Grout or sandbags (25 kg)	800	0.5 x 0.5	Remove	0.000600	0.001200	
Magnus 500 m zone (PL4556)	Concrete mattresses	14	6 x 3 x 0.15	Remove	0.000392	0.000784	
	Grout or sandbags (25 kg)	720	0.5 x 0.5	Remove	0.000540	0.001080	

Table 6.2.8 Seabed footprint related to the Thistle pipeline stabilisation and protection materials							
Location	**Stabilisation type**	**No.**	**Dimensions (m)**	**Disposal route**	**Total[1, 2] (km²)**		
					Temporary direct disturbance area	**Temporary indirect disturbance area**	**Long-term disturbance area**
Pipeline crossing (PL4556)	Concrete mattresses	5	6 x 3 x 0.3	Decommission *in situ*			0.000090
	Concrete plinths	2	9 x 2 0.8	Decommission *in situ*			0.000036
	Deposited rock	1	1,773	Decommission *in situ*			0.001733
	Concrete mattresses	3	6 x 3 x 0.3	Decommission *in situ*			0.000054
	Concrete plinths	2	9 x 2 0.8	Decommission *in situ*			0.000036
	Concrete mattresses	2	6 x 3 x 0.15	Decommission *in situ*			0.000036
	Deposited rock	1	1,656	Decommission *in situ*			0.001656

Table 6.2.8 Seabed footprint related to the Thistle pipeline stabilisation and protection materials							
Location	**Stabilisation type**	**No.**	**Dimensions (m)**	**Disposal route**	**Total[1, 2] (km²)**		
					Temporary direct disturbance area	**Temporary indirect disturbance area**	**Long-term disturbance area**
	Concrete mattresses	3	6 x 3 x 0.3	Decommission *in situ*			0.000054
	Deposited rock	1	198	Decommission *in situ*			0.000198
PL4556, balance of deposited rock on PL4556 after subtracting pipeline crossings)	Deposited rock	1	91	Decommission *in situ*			0.000091
				Total	**0.005840**	**0.011680**	**0.004141**

NOTES:

1) Assumes a 1 m buffer (added to length and width) for each concrete mattress to be removed.
2) A maximum area of 1 m^2 of impact has been assumed for each individual grout bag.

Table 6.2.9 Seabed footprint related to the Don pipeline stabilisation and protection materials							
Location	**Stabilisation type**	**No.**	**Dimensions (m)**	**Disposal route**	**Total[1, 2] (km²)**		
					Temporary direct disturbance area	**Temporary indirect disturbance area**	**Long-term disturbance area**
Thistle approaches (inside 500 m zone between KP0.011 and KP0.013)	Grout bags (25 kg)	21	0.5 x 0.5	Remove	0.000016	0.000032	
				Total	**0.000016**	**0.000032**	

NOTES:

1) Assumes a 1 m buffer (added to length and width) for each stabilisation and protection material.
2) A maximum area of 1m² of impact has been assumed for each individual grout bag.

6.2.2.5 Overtrawl trial

If non-intrusive methods are not deemed sufficient then overtrawl trials may be required to demonstrate a 'safe seabed'. The area covered will overlap the footprint of activities captured within Table 6.2.1 - Table 6.2.8; therefore, assuming a worst-case scenario. The area impacted by the overtrawl trial is estimated to be 0.785 km^2 of temporary direct impact.

The overtrawl will be supported by a Certificate of Clearance. Evidence of a clear seabed will also be included in the Close Out Report and sent to the Seabed Data Centre (Offshore Installations) at the Hydrographic office.

6.2.2.6 Summary

Table 6.2.10 provides a summary of the estimated potential seabed disturbance associated with the various decommissioning activities outlined in Section 3.7.

The overall base-case for the temporary area of disturbance associated with all the decommissioning activities is 0.25 km^2. A further 0.043 km^2 of permanent impact, exclusively attributed to the placement of rock is also expected. The long-term impact associated with decommissioning infrastructure *in situ* accounts for 0.226 km^2. As a worst-case, should overtrawl trials be required, the temporary (direct) disturbance would be in the region 0.785 km^2.

Table 6.2.10 Seabed footprint summary

Activity	Temporary direct disturbance (km^2)	Temporary indirect disturbance (km^2)	Permanent direct disturbance (rock) (km^2)	Long-term disturbance (decommission *in situ*) (km^2)
THISTLE				
Subsea installations decommissioning	**0.000386**	**0.000772**		
Pipeline and umbilical decommissioning	**0.047578**	**0.095156**		**0.222090**
Placement of rock		**0.086438**	**0.043219**	
Pipeline structures and associated features decommissioning	**0.000332**	**0.000664**		
Pipeline stabilisation and protection materials decommissioning	**0.002810**	**0.005620**		**0.004141**
Total	**0.051106**	**0.188650**	**0.043219**	**0.226230**
DON				
Pipeline and umbilical decommissioning	**0.003085**	**0.006169**		**0.000233**
Placement of rock		**0.000120**	**0.000060**	
Pipeline structures and associated features decommissioning	**0.000219**	**0.000437**		
Pipeline stabilisation and protection materials decommissioning	**0.000016**	**0.000032**		
Total	**0.003319**	**0.006758**	**0.000060**	**0.000233**
Overall Temporary Total (Thistle and Don)	**0.25**			

6.2.3 Effects on Sensitive Receptors

Decommissioning activities are expected to lead to two types of physical disturbance. The first is temporary disturbance, which will result from the removal of the pipelines, umbilicals, subsea structures, installations, protection and stabilisation materials from the seabed and overtrawl trials (if required). The sediment will be disturbed by the action of retrieving equipment from the seabed and placement of rock, but once decommissioning is complete, the affected areas will be free of anthropogenic material. 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 disturbance will be permanent disturbance caused by the deposition of additional remedial rock 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 silty sand to a hard substrate. While the seabed may 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.

6.2.3.1 Temporary disturbance

Removal of the structures, spools, pipeline ends and stabilisation material from the seabed will cause sediment disturbance and re-distribution in the localised area. The base-case area of impact of is expected to be 0.25 km^2. The worst-case is expected to be in the region of 0.785 km^2.

Two main factors minimise the impacts of seabed disturbance:

1. Biological communities are in a continual state of flux and can either adjust to disturbed conditions or rapidly re-colonise areas that have been disturbed.
2. The moderate dynamic nature of much of the seabed environment will aid the recovery of disturbed areas.

The seabed is inhabited by numerous organisms, including mobile fauna (e.g., crustaceans) which may be able to vacate an area following a disturbance and less mobile, or sessile fauna. Past surveys of this area indicate that it is typical of the wider area; characterised by various sessile benthic species associated with specific sediment types. For instance, finer areas are colonised by the heart urchin (*Spantangus purpureus),* common starfish *(Asteria rubens),* hermit crab (*Pagurus bernhardus)* and sea star (*Astropectin irregularis)*, and coarser areas are inhabited by common brittlestars (*Ophiothrix fragilis)*. Direct mortality of such limited mobility seabed organisms and direct loss of habitat would be expected.

The predicted EUNIS habitat in the vicinity of the project area is 'Atlantic offshore circalittoral sand' (MD52) [23]. SSS data from the Thistle pre-decommissioning survey indicated medium reflectivity thought to relate to ambient muddy sand sediment with higher reflectivity sediments corresponding to mixed sediment consisting of cohesive silt intermixed with coarse sediment and *Mytilus shells*. PSA identified a mixed sediment type composed primarily of sedimentary sands at stations out with the physical cuttings pile limit whereas stations sampled within the cuttings pile contained higher gravel proportions and demonstrated high variability in sediment sizes [31]. Spawn is usually deposited demersally, on marine vegetation or on a substrate with a high percentage of gravel and a low fine sediment component [52]. This habitat would therefore support the high intensity spawning grounds of cod and high intensity blue whiting nursery grounds [22], which are identified in this area of the NNS. Seabed disturbance could therefore also present a risk to fish and shellfish species which use the seabed for spawning and/or nursery grounds.

Given the localised area of decommissioning activities and the transient nature of the disturbance to benthic sediments in this area with good recovery potential, disturbance to fish and shellfish is not expected to be significant. Fish are highly mobile organisms and are likely to avoid areas of re-

suspended sediments and turbulence during the activities and these spawning and nursery grounds will be 'recolonised' over time [14]. Therefore, the proposed activities are unlikely to have an impact on fish and shellfish species populations or their long-term survival.

Post-disturbance recovery of the seabed is dependent both on the strength of the seabed soils and the ability of the hydrological regime to rework disrupted sediments and return the seabed to its original contours. Sediments that are redistributed and mobilised because of the proposed decommissioning activities will be transported by the seabed currents before settling out over adjacent seabed areas. The natural settling of the suspended sediments is such that the coarser material (sands) will quickly fall out of suspension with the finer material being the last to settle. This natural process will ensure that all the suspended sediment is not deposited in one location. With the area being classified as EUNIS biotope complex MD52 'Atlantic offshore circalittoral sand [23], it is likely that much of this sediment will fall out of suspension in a matter of minutes.

The re-settlement of sediments may result in the smothering of epifaunal species [35] with the degree of impact related to their ability to clear particles from their feeding and respiratory surfaces [73]. Infaunal communities are naturally habituated to sediment transport processes and are therefore less susceptible to the direct impact of temporarily increased sedimentation rates. Depending on the sedimentation rates, infaunal species and communities can also work their way back to the seabed surface through blanket smothering. The Department for Food & Environmental Affairs ('DEFRA') (2010) states that impacts arising from sediment re-suspension are short-term (generally over a period of a few days to a few weeks) [18].

Recovery of communities will be monitored and assessed by post-decommissioning surveys.

6.2.3.2 Permanent disturbance

Permanent direct disturbance will occur due to placing further rock cover on the seabed *in perpetuity*.

The proposed decommissioning activities will cause a direct impact to fauna living on and in the sediments. Mortality is more likely in non-mobile benthic organisms, whereas mobile benthic organisms are more sparsely distributed and may be able to move away from the area of disturbance. Whilst the introduction of a new substratum into the area may be influenced by scour from tides and mobile sediments and it may even become partially buried in places from time to time, it is likely that parts of it will eventually support a low diversity epifaunal community like that already present on naturally occurring stones and boulders in the area. This will occur because of natural settlement by larvae and plankton and through the migration of animals from adjacent undisturbed benthic communities.

While the introduction of rock cover 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 seabed of a similar composition available. Rock remediation will be targeted and localised.

6.2.3.3 Impact on protected habitats

There are no protected areas within 40 km of the project area. The closest protected area is the Pobie Bank Reef SAC, located approximately 103 km southwest of the Thistle platform [59]. The site is protected for bedrock and stony reefs which provide a habitat to an extensive community of encrusting and robust sponges and bryozoans. These include encrusting coralline algae, cup sponges, and bryozoans in the shallower areas; and small erect sponges, cup corals and brittlestars in the deeper areas. Protected sites in the wider vicinity of Thistle area shown in Figure 4.5.1.

Given the distance between the closest conservation sites and the proposed decommissioning activities, it is very unlikely that any impacts will be felt.

6.2.3.4 Long-term presence of infrastructure decommissioned *in situ*

Structural degradation of the Thistle and Don pipelines will be a long-term process caused by corrosion and the eventual collapse of the pipelines under their own weight and that of the

overlying mattresses, 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;
- Coal tar enamel coating;
- Concrete coating;
- Plastic coating.

6.2.3.5 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 [48]. Concentrations of the metals are not expected to exceed acute toxicity levels at any time. However, chronic toxicity levels may be reached for short periods within the interstitial spaces of the sediments or near 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. Inhibition of growth may also occur in crustaceans, molluscs, echinoderms, hydroids, protozoans and algae [48]. It is expected that any toxic impacts will be 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.

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 [36]).

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) is 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 [55]. Much of the surrounding seabed is composed of sand and may therefore release any metals to the surrounding seawater, making them bioavailable, but also diluting them into the wider environment.

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. As a result, no likelihood of significant effect is expected to any of the designated sites within which a pipeline will be decommissioned *in situ*.

6.2.3.6 Naturally Occurring Radioactive Material

Marine organisms can potentially bioaccumulate radium from solution in seawater, from ingested seabed sediments or from their food. Studies of the impacts of ^{226}Ra released into the North Sea via produced water and natural processes indicate that it is unlikely that observed levels of radioactive substances entrained in sediments or found in seawater will cause effects on marine organisms [37]. NORM scale discharged from offshore installations is known to be insoluble in seawater and when produced water, rich in barium and radium, is discharged to sulphate rich

seawater, the radium precipitates rapidly as a complex of barium, radium and sulphate which is also insoluble. ^{226}Ra therefore has a very low concentration in solution in seawater and has a low bioavailability to marine organisms. Dissolved cations in seawater, particularly calcium and magnesium, also inhibit the bioaccumulation of NORM [15].

Due to the highly localised nature of any degradation products and the potentially very low concentrations of NORM being released over an elongated period, it is highly unlikely that these will be detectable above current background conditions in the area. As a result, no likelihood of significant effect is expected on the environment generally or to any designated site.

6.2.3.7 Polycyclic Aromatic Hydrocarbons

The likely base material of some of the concrete coated pipelines is coal tar; PL13 is coated with Coal Tar Epoxy Enamel ('CTEE'). There is no standardised formula for the composition of coal tar, but it is thought that its constituents are over 60% inert and may comprise up to 15% of PAHs [55].

The coal tar 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 PAHs will be released once the coal tar layer is open to the seawater, and over time will be released into the surrounding environment. PAHs in marine sediments will have a low biodegradation potential due to low oxygen and low temperatures [11]. PAHs are almost insoluble and only become available to marine organisms through ingestion of particulate matter [55][15].

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 [55]. 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 [56]. 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 and no likelihood of significant effect is expected to any designated sites.

6.2.3.8 Plastics

The Thistle and Don pipelines are coated with either 3 Layer Polypropylene ('3LPP') or Ethylene Propylene Diene Monomer ('EPDM'). However, as no micro-organisms have evolved to utilise the chemically resistant polymer chains as a carbon source, these plastics can be expected to persist in the environment for centuries [65]. As biodegradability in the marine environment (when buried within sediment) is also low, it can be assumed that the environmental effect of leaving these plastics in place is negligible [56].

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 and no likelihood of significant effect is expected to any designated sites.

6.2.3.9 Blue carbon

Marine sediments are the primary store of biologically derived carbon (mostly inorganic carbon). Biogenic marine habitats are highly productive places, with a very high rate of assimilation of carbon into plant material (662 gC/m^2/yr), mostly in coastal areas. However, their overall contribution to the carbon budget is relatively small compared to sediments [8][9]. Carbon stored in organisms can be broadly defined as either 'transient', such as the carbon stored in seagrass beds, kelp and macroalgae; or 'long term', such as biogenic structures (e.g. coral reefs, serpulid reefs, mussel beds).

Carbon may be sequestrated in marine sediments as Precipitated Carbonates ('PCO') or as Particulate Organic Carbon ('POC'). While it is known that sediment accumulation rates tend to be faster nearer to land (e.g., in sea lochs), it is unclear what processes maintain the accumulation basins, or whether any of the rich supply of organic material from phytoplankton in productive shelf waters becomes refractory and remains there [8]. The principal threat to long term carbon burial in sediments is any process that stirs up the sediment, particularly the top few millimetres of sediment. Resuspension of sediment allows rapid consumption of buried carbon by organisms and its subsequent release as carbon dioxide. This effectively reduces the carbon burial rate significantly and reduces the blue carbon inventory.

Patterns of standing stocks and sequestration capacity of organic carbon follow the distribution of mud and mud-sand-gravel combinations. Most organic carbon and the largest capacity for sequestration of organic carbon appears to be in deep mud off the continental shelf [8].

The average percentage carbonate in the top 10 cm of superficial sediments in the offshore Thistle area ranges from between 0-20%, which is above average for Scottish waters [8]. However, with the small area of total seabed disturbance resulting from the proposed decommissioning activities, the impact on any blue carbon stores is therefore expected to be negligible.

6.2.4 Cumulative Assessment

The decommissioning activities taking place within the Thistle field will not concur with the with the current decommissioning of the Dunlin Alpha platform, which is located 9.8 km southeast of the Thistle platform. Although, decommissioning works will be required at Magnus (located 32.1 km northwest) and inside the Magnus 500 m safety zone for PL4556. As it stands there is no anticipated cumulative seabed impact with the other decommissioning activities. Therefore, cumulative impacts on the seabed caused by decommissioning activities are considered negligible.

The Thistle platform is located approximately 11 km from the UK/Norway median line. Given this distance, and the area of temporary disturbance being a worst-case of 0.785 km^2, there is no potential for sediment to travel beyond the immediate vicinity of the decommissioning area and into neighbouring territorial waters. The potential for transboundary impacts is therefore highly unlikely.

6.2.5 Mitigation Measures

Mitigation measures to minimise seabed impacts within the Thistle area are detailed below:

- Cutting and lifting operations will be controlled by ROV to ensure accurate placement of cutting and lifting equipment and minimise any impact on seabed sediment.
- The requirements for excavation will be assessed on a case-by-case basis and will be minimised to provide access only where necessary.
- Vessels will be equipped with dynamic positioning rather than relying on anchors to remain in position which interact with the seabed.

- The rock mass will be carefully placed over the designated areas of the pipelines and seabed in order to ensure rock is only placed within the planned footprint with minimal spread over adjacent sediment, minimising seabed disturbance.
- Data collected in the area will be reviewed for potential sensitive seabed habitats prior to the commencement of operations.
- Post decommissioning debris clearance, surveys and monitoring shall be carried out after decommissioning activities have been completed.
- Non-intrusive seabed clearance and survey methods will be used wherever possible. These may include techniques which do not make contact with the seabed, such as MBES, SSS and ROV surveys.
- Any oil field debris identified shall be recovered and recycled or disposed of accordingly.

6.2.6 Residual Impact

Thistle subsea decommissioning activities (including the Don pipelines within the Thistle 500 m zone) will result in temporary direct and indirect disturbance to the seabed. As a base-case, temporary direct disturbance has the potential to impact approximately 0.054 km^2 of seabed. Temporary indirect disturbance has the potential to impact approximately 0.195 km^2. In a worst-case (overtrawl) scenario, this would increase to approximately 0.785 km^2. There will be a 0.043 km^2 area of permanent disturbance as a result of the placement of new rock (for pipeline ends and burial of PL13) and 0.226 km^2 of long-term disturbance as a result of decommissioning infrastructure *in situ* (Table 6.2.10).

These are considered highly conservative estimations of the likely impact of the proposed decommissioning activities, as the buffers added to the structures are likely to overestimate the range of impact generated by various removal methods. Overall, given the localised nature of the seabed disturbance, and the very small area of seabed that will be permanently impacted the magnitude of the impacts on seabed habitats and fauna is considered minor.

Direct loss of habitat and direct mortality of sessile seabed organisms that cannot move away from the contact area would be expected. Impacts arising from sediment re-suspension are expected to be short-term and mobile species will be able to avoid the area during the course of activities and 'recolonise' it in the future. Although substratum loss may cause a decline of individuals in the area of direct footprint, wider species populations that inhabit this type of benthic habitat are deemed to be highly recoverable.

While demersal fish species using the area as a nursery or spawning grounds may coincide with the decommissioning activities, given the very localised nature of decommissioning activities and the transient nature of the disturbance to benthic sediments, disturbance to fish and shellfish nursery and spawning grounds is not expected to be significant.

The long-term decommissioning of the Thistle pipelines and Don pipelines *in situ* is expected to represent a footprint of approximately 0.0041 km^2 and 0.0002 km^2, respectively (Table 6.2.10). As the pipelines will be buried under deposited rock, the release of primary degraded products such as plastics, NORM, PAHs and heavy metals are predicted to cause negligible impacts on the surrounding sediments.

The addition of rock is also unlikely to disturb the natural physical processes of the area. While the addition of rock will change the substrate, this covers such a small area in proportion to the area of available sandy habitat. There is potential that the colonisation of hard substrate may result in a habitat moderately comparable to that of a typical rocky reef. For these reasons, the impact consequence is considered low across all receptors.

Initial assessment of this aspect within the ENVID (Appendix B) yielded; 'Low' Consequence (spatial extent), 'Medium' Frequency, 'Medium' Magnitude and 'High' Probability. These scores gave an overall level of 'Medium'. However, following full assessment of this aspect, taking into

consideration the benthic environment, seabed characteristics, commercial fishing, relatively small size of disturbance area along with industry and EnQuest mitigation measures, the overall assessment was reduced to 'Low'. While the Probability of this aspect could not be lowered, both Magnitude and Frequency were reduced to 'Low'. Overall, the impact of seabed disturbance due to the proposed decommissioning activities, in combination with consideration of mitigation measures, is not significant.

6.3 Physical Presence of Infrastructure Decommissioned *In Situ* for Other Sea Users

6.3.1 Introduction

The proposed Thistle pipelines, SALM base and Don pipelines decommissioning activities have the potential to impact upon other users of the sea, namely commercial fisheries. This may happen during the decommissioning activities themselves or after decommissioning should any infrastructure decommissioned *in situ* interact with fishing gear. Sea users, other than commercial fisheries, are unlikely to be affected by the proposed decommissioning. The following was considered as potentially having a significant impact on commercial fisheries:

- Physical presence of Thistle pipelines PL13, PL4555, PL4556 and Don pipelines PL598, PL599, PL600 and PLU6267 decommissioned *in situ* posing a potential snagging risk.

This is anticipated to be the only potential impact to fisheries as a result of the decommissioning process and is assessed against the potential impact on fisheries throughout the rest of this section.

6.3.2 Physical Presence of Infrastructure Decommissioned *In Situ* Posing a Potential Snagging Risk

The long-term presence of infrastructure decommissioned *in situ* has the potential to interfere with other sea users that may use the area. The proposed Thistle pipeline decommissioning activities that are deemed to represent a potential impact are the leaving of PL13 and the buried sections of PL455 and PL4556. The proposed Don pipeline decommissioning activities that are deemed to represent a potential impact are the leaving of buried sections of PL598, PL599, PL600 and PLU6267.

6.3.2.1 PL13

PL13 is a 16in carbon steel pipeline coated with 4.8 mm CTEE and furnished with a 36.6 mm CWC. Burial profiles all show that PL13 has experiences multiple exposures and spans along much of its length. Historical survey data indicates that the pipeline suffers from degradation in some areas and there is evidence of snagged fishing nets on the pipeline. The presence of grout mattresses underneath the pipeline in areas populated by multiple spans would suggest that remedial works have been carried out in the past. A summary of the historical data obtained is presented in Table 6.3.1.

Since the 2016 survey, approximately one-third of the pipeline remains exposed, and the cumulative length and number of pipeline spans appear to have increased. The 2018 survey identified 150 exposures with an overall exposed length of 3644.7 m (shown in Figure 6.3.1) and 66 spans,5 of which are considered reportable (Table 6.3.1)[19]. Generally, the exposures have been observed throughout the whole length of the pipeline, although spans appear to mostly occur between KP10.5 and the end of the pipeline in the Dunlin 'A' 500m zone as shown in Figure 6.3.2. Considering the historical data, it would be fair to assume that without some form of remediation the exposures and spans will not naturally disappear once the pipeline has been decommissioned.

Table 6.3.1 PL13 historical exposure and span summary									
Year	Length surveyed (km)	No. of exposures	Σ Length (m)	Min. exp. length (m)	Max. exp. length (m)	No. of spans	Σ Length (m)	Min. span length (m)	Max. span length (m)
2008	12.234	261	1.215	0.2	30.0	52 (0)	352.8	1.2	15.0
2010	12.232	172	4,689	0.6	775.7	13 (0)	141.0	5.2	18.7
2012	12.232	165	4,468	0.1	696.0	10 (0)	75.0	5.1	12.6
2014	0.739	2	720	205.5	514.4	1	12.3	12.3	12.3
2016	11.069	140	3,265	1.1	700.9	23 (4)	210.4	1.1	28.0
2018	11.635	150	3,645	0.1	697.9	66 (5)	358.0 (78.1)	0.9	25.3

NOTES:

1. The exposure data for 2008 are calculated, using the depth of cover profile obtained during the pipeline survey. No length of exposure or length of span data are recorded in the event listings.
2. Only part of the pipeline was surveyed in 2014 from the Dunlin riser flange to outside the Dunlin 500m zone, noting that this was before implementation of the DFGI project and the installation of PL2852.
3. Figure in brackets under "No. of spans" is the number of reportable spans noted from an examination of the events listings.

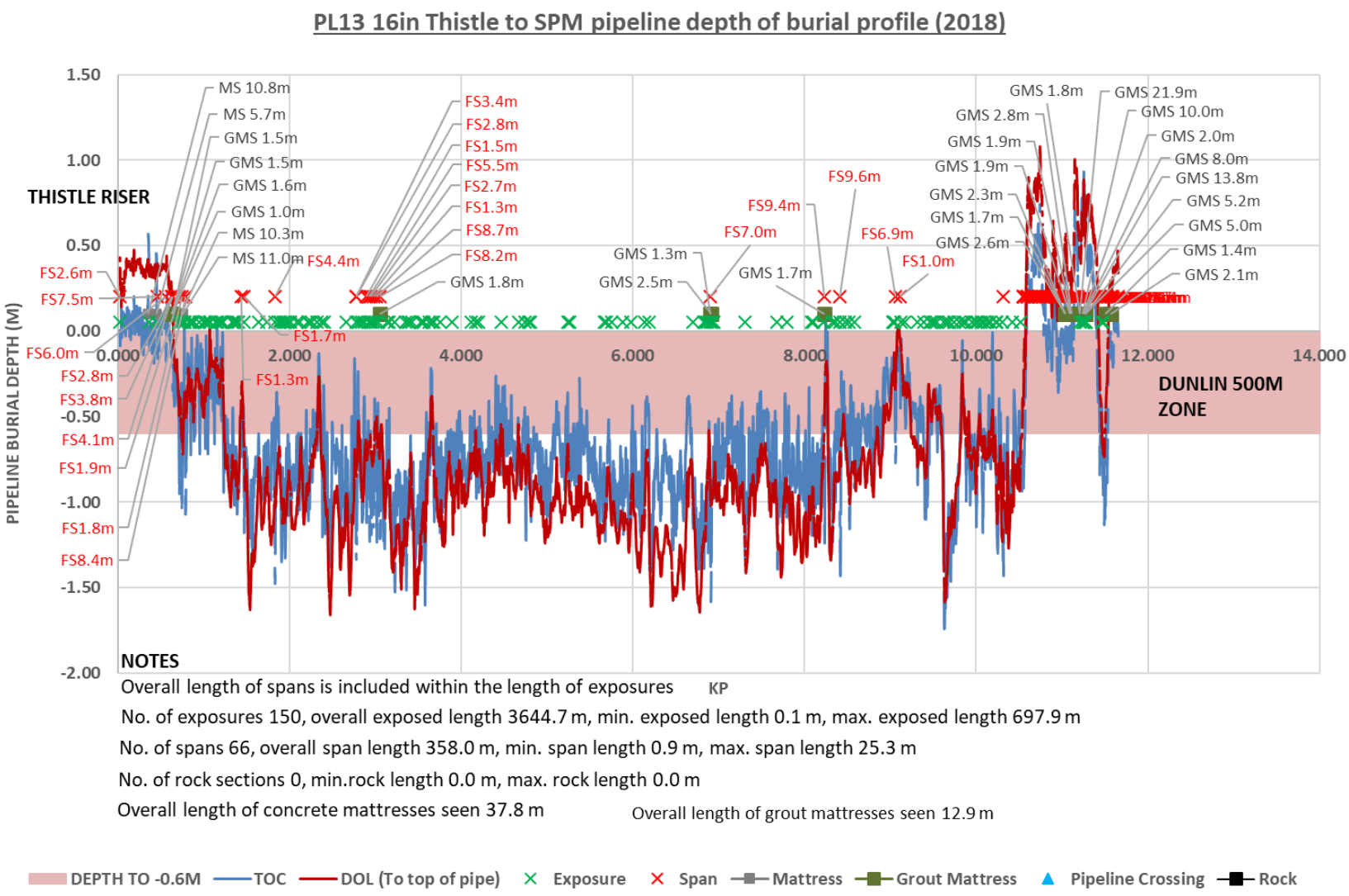


Figure 6.3.1 PL13 pipeline depth of burial profile (2018) [19]

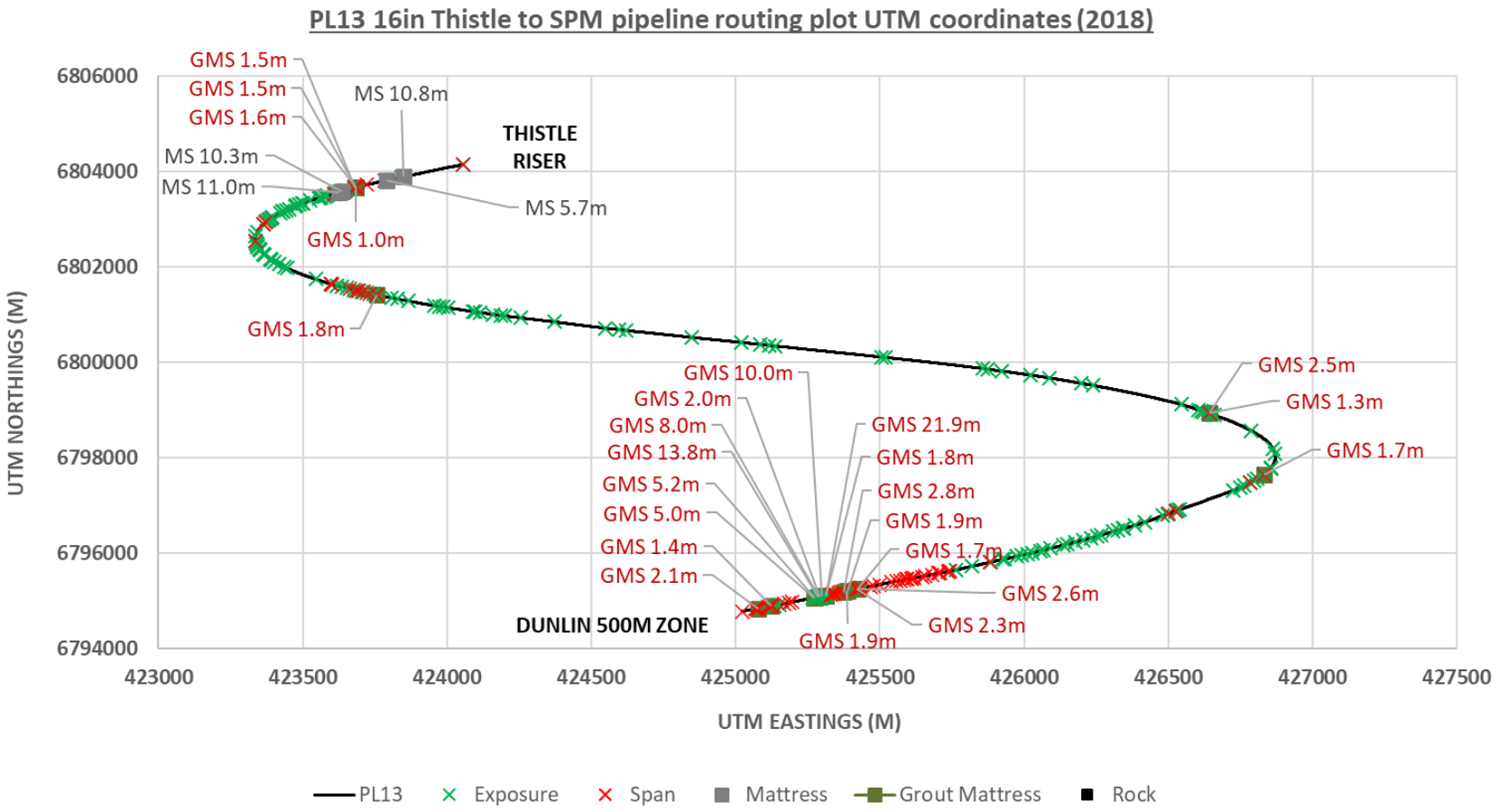


Figure 6.3.2 PL13 pipeline route (2018) [19]

6.3.2.2 PL4555

PL4555 is an 8in carbon steel pipeline coated with 3 mm 3LPP which is routed from the Thistle SSIV to the Wye structure. In 2019, part of PL278 which used to be rerouted between Thistle and the disused Single Anchor Leg Base ('SALB') was repurposed as an export route for Thistle and renumbered PL4555 (Figure 6.3.3). PL2758 (now PL4555) was piggybacked by PL2579, a 3in carbon steel pipeline also coated using 3LPP.

Most of PL4555 lies in a trench overlain with deposited rock. Both pipeline(s) PL4555 (and PL2579) are expected to have a reasonable depth of cover inside the trench as shown in Figure 6.3.4. There is no evidence to suggest any exposures or spans except possibly at the ends, which are be removed as part of the decommissioning activities in accordance with mandatory requirements.

6.3.2.3 PL4556

PL4556 is an 8in carbon steel pipeline coated using 3 mm 3LPP. It was installed in 2019 and routed from the Wye structure to the Magnus platform. The pipeline was trenched, and the trench was backfilled. Rock (total length 875 m) was deposited over areas that were perceptible to upheaval buckling or as protection and stabilisation at pipeline crossings near Magnus. No exposures or spans were observed in the as-built alignment sheets.

In 2021, as part of the Northern Producer decommissioning activities a short 26 m length of pipespool near the Wye structure was removed and taken to shore.

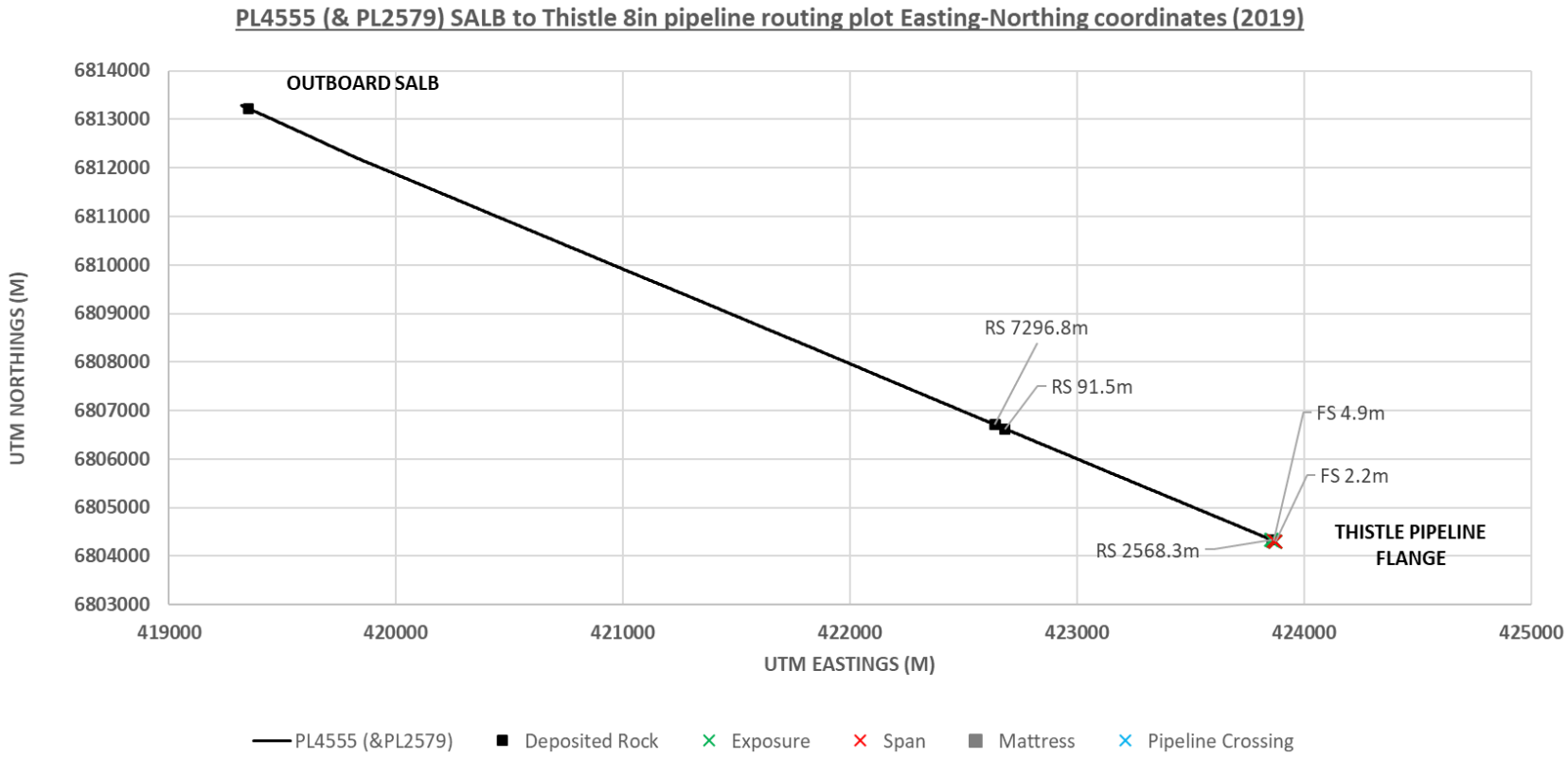


Figure 6.3.3 PL4555 (PL2579) pipeline route (2019)

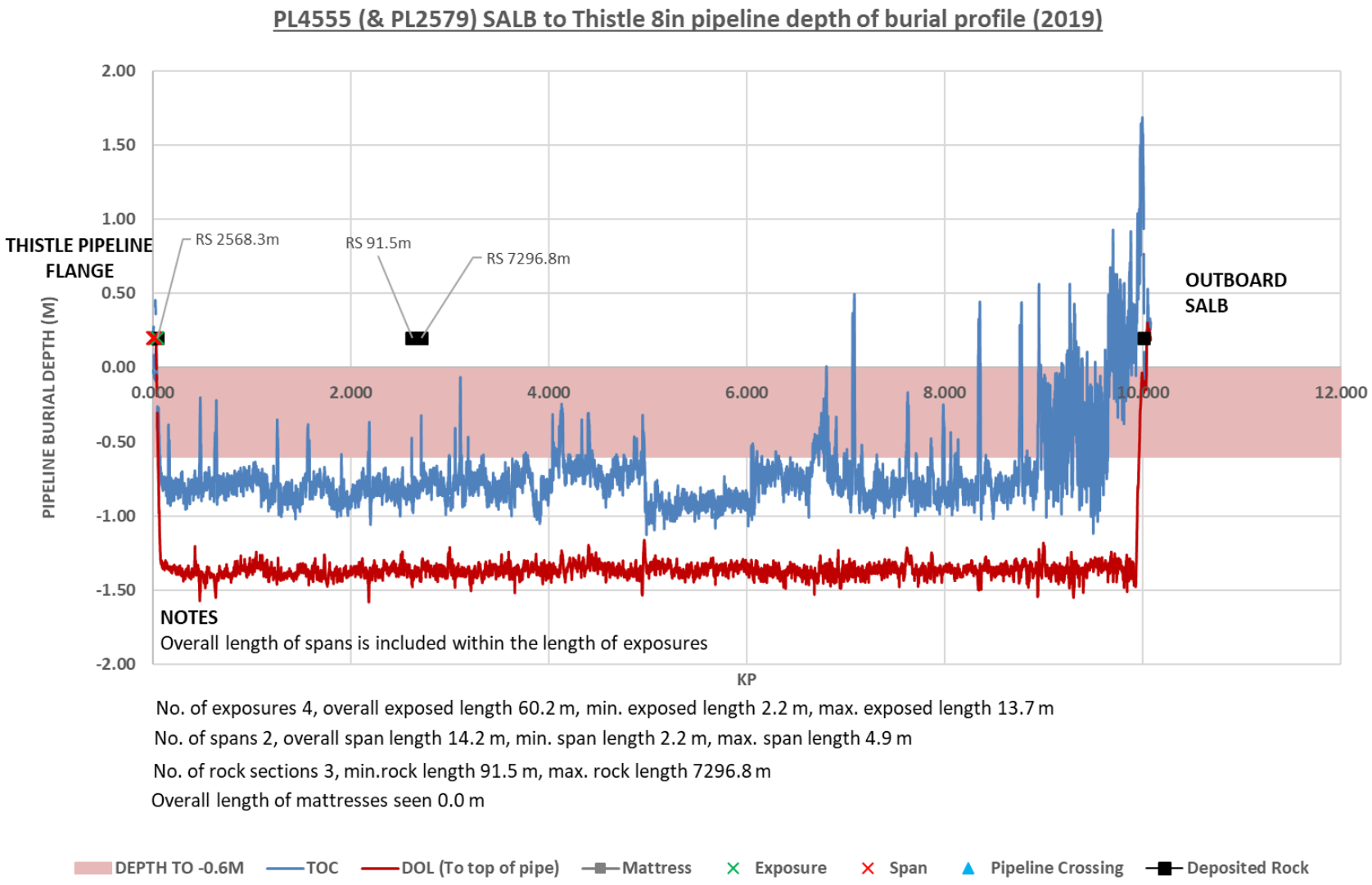


Figure 6.3.4 PL4555 (& PL2579) pipeline depth of burial profile (2019)

6.3.2.4 PL598

PL598 is an 8in carbon steel pipeline coated with 13 mm thick EPDM which is a rubber used for thermal insulation. PL598 was trenched with the trench actively backfilled when it was installed. The pipeline has been out of service since 2003 and has been partly decommissioned. The length of pipeline inside the Thistle 500 m zone is ~567 m [6].

Prior to being partly decommissioned, the pipeline was subject to annual inspections in the period 1990 to 2002. According to the original Don DP, PL598 has had a consistent burial profile with a typical depth of cover ranging between 0.3 m and 0.5 m, with very few spans. All spans had been remediated by 1994. The original CA concluded that the pipeline would remain stable once it has been decommissioned [6].

The most recent pipeline survey was conducted in 2013 and no exposures or spans were found inside the 500 m safety zone. More recent survey data have not been found.

6.3.2.5 PL599

PL599 is an 8in carbon steel pipeline coated with 13 mm thick EPDM. When PL599 was installed, it was trenched with the trench actively backfilled. The pipeline has been out of service since 2003 and has been partly decommissioned. The length of pipeline inside the Thistle 500 m zone is ~570 m [6].

Prior to being partly decommissioned, the pipeline was subject to annual inspections in the period 1990 to 2002. According to the original Don DP, PL599 has had a consistent burial profile with a depth of cover ranging between 0.24 m and 0.53 m. The original CA concluded that the pipeline would remain stable once it has been decommissioned and no known spanning was known to occur [6].

However, the most recent survey (2013) along the pipeline and beyond the surface laid section(s) near Thistle found a partly (50% - top half) exposed section ~18 m long, starting at KP0.427. This contained a 2.5 m long x 0.1 m high span (starting at KP0.438). The span was not reportable to FishSAFE and it is not known whether the exposure or span still exists as more recent survey data has not been found.

6.3.2.6 PL600

PL600 is a 70 mm diameter chemical injection umbilical. It is ~17.73 km long comprising hoses, copper wire and filler, all protected by a double layer of galvanised steel wire housed in a 70 mm nominal diameter polyethylene outer sheath. The length of PL600 inside the Thistle 500 m zone is ~560 m.

The original DP [6], reported that there was one span located at the Thistle tie-in, however, this will be removed along with the surface paid infrastructure. The DP also reported that the trenched (and buried) condition was expected to continue due to the secure soil and low seabed currents associated with the area.

6.3.2.7 PLU6267

PLU6267 is an 88 mm diameter hydraulic control umbilical. It is ~17.73 km long comprising hoses, copper wire and filler, all protected by a double layer of galvanised steel wire housed in an 88 mm nominal diameter polyethylene outer sheath. The length of umbilical inside the Thistle 500 m zone is ~540 m.

When PLU6267 was installed, it was trenched with the trench actively backfilled with a design of 0.3 m depth of cover. According to the original DP [6], the control umbilical was subject to annual inspections between 1991 and 1998, and then every two years from 1998 until when the Don DP was submitted for approval in 2011. PLU6267 is reported to have experienced a consistent burial

profile, with the level of exposure in the field being low, except for the surface laid section on the approaches at the Don manifold and Thistle, the umbilical was reported to be buried. The DP also reported that the trenched (and buried) condition was expected to continue due to the secure soil and low seabed currents associated with the area.

6.3.3 Effects on Sensitive Receptors

The long-term presence of pipelines 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 pipelines 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 decommissioned *in situ*, local placement of rock also increase the potential for interaction with fishing gear.

Demersal fishing gear which interacts with the seabed are vulnerable to snagging. Snagging may lead to the loss or damage of catch or fishing gear and in extreme circumstances may result in vessel destabilisation. There have been reports of 15 fishing vessels sinking due to snagged gear between 1989 and 2014 which resulted in 26 fatalities on the UKCS [46][73]. Generally, the pattern of interactions between oil and gas infrastructure and fishing gear are spatially concentrated in the muddy NNS where demersal fisheries are generally concentrated [73] as opposed to the SNS. On review of demersal trawling activity on the UKCS, it was determined that a low percentage (0.93%) of demersal trawling trips specifically targeted oil and gas pipelines compared with surrounding areas [73].

Annual fishing effort in the project area (ICES Rectangles 51F1 and 52F1) is low. In 2022, there were 215 days of effort in 51F1 and 58 days of effort in 52F1 (Table 4.4.1). Within ICES 51F1 and 52F1, demersal species made up 100% of the catch by weight and approximately 100% of the value of landings in 2022 (Table 4.4.1). Demersal catch includes trawl gears which interact with the seabed. Trawls were the main gear type used in 51F1 and 52F1, making up 86% and 91% of the effort in 2022, respectively. Seine nets are also used in the area but to a lesser extent [53].

6.3.4 Cumulative and Transboundary Impacts

There is the potential for cumulative impacts to occur with other activities occurring nearby which could also interfere with commercial fishing activity as most of the surrounding NNS oil and gas assets will be subject to decommissioning in the coming years. EnQuest, will, however, continue to maintain a thorough understanding of decommissioning activity and programmes occurring within the NNS region during the course of this operation schedule.

The Thistle field is located approximately 11 km from the UK/Norway border. AIS tracks of the average weekly density of fishing vessels between 2012 and 2017 show a low transiting density (0-20 transits per week) [62] which suggests that, despite proximity to an international border, there is limited vessel movement associated with fishing vessels around the project area.

There are no negative cumulative impacts expected as a result of the Thistle decommissioning activities. As the decommissioning activities proceed, new areas of sea/seabed will become available to fisheries and other sea users, reducing the overall cumulative impact and resulting in a positive impact to these users. These include removal of the 500 m safety zone within the Thistle area. In terms of the scale of the decommissioning activities with regards to other sea users, there are an estimated 651 safety zones in the within the UKCS, as of 2015 [64]. Since the decommissioning of the Thistle area will see the removal of the safety zone resulting in approximately 0.785 km^2 of occupied sea area being returned to navigable water. This will assist in reducing the areas of the currently unavailable to commercial fisheries and in reducing the potential for cumulative impact from decommissioning of structures.

Despite the likely presence of foreign fishing fleets within the Thistle field, the snagging risk

remains small. All EU fisheries will also be informed of the presence of the infrastructure via Kingfisher notification. Therefore, there is no transboundary impact on commercial fisheries as a result of the decommissioning of the Thistle pipelines, SALM base and Don pipelines.

6.3.5 Mitigation Measures

The following measures will be adopted to ensure that snagging risks to commercial fisheries as a result of the Thistle pipelines PL13, PL4555, PL4556 and Don pipelines PL598, PL599, PL600 and PLU6267 being decommissioned *in situ* and being partially decommissioned *in situ*, are minimised to a level that is as low as reasonably practicable ('ALARP'):

- Prior to commencement of operations, the appropriate notifications will be made, and maritime notices posted;
- UKHO, FishSAFE and Kingfisher will be informed of any remaining infrastructure decommissioned *in situ*. This information will be divulged to EU member parties fishing within UK waters;
- The 500 m safety exclusion zone will remain in operation during the decommissioning activities reducing risk of non-project related vessels entering into the area where substructure decommissioning activities are taking place;
- Ongoing consultation with fisheries representatives;
- The exposed cut ends of the pipelines will be remediated with placement of rock which will be verified to be overtrawlable and a long-term monitoring programme will be implemented;
- Post-decommissioning, a clear seabed verification survey will be undertaken for the area. The method of verification will be confirmed with the regulator in due course; and
- EnQuest commit to a post-decommissioning monitoring campaign, the frequency and number of which will be agreed with the regulator and appropriate stakeholders.

6.3.6 Residual Impacts

Of all sea users, commercial fisheries are most likely to be affected by the proposed decommissioning activities. Impacts to fisheries mainly arise from the potential for snagging generated by the decommissioning *in situ* of pipelines.

Residual impacts from the degradation of the Thistle and Don pipelines decommissioned *in situ* will be managed through continued monitoring and communications with other sea users and are not expected to have any long-term impacts on the access or functioning of currently exploited fishing grounds.

While the impact magnitude may be considered 'High' owing to the potential severity of a snagging event, the frequency of such an event is highly unlikely due to the notification and navigational warnings which will be in place, and thus considered to be 'Low' risk. The probability is measured as 'Low' due to the relatively localised area of remaining infrastructure and monitoring schedule in place to alert of any potential changes in burial depth. The 'Low' probability of the proposed decommissioning operations generating a snagging risk, combined with the management and control measures that will be in place to mitigate against such risk, conclude that the decommissioning of the Thistle and Don pipelines will not adversely impact upon commercial fisheries operating within the project area. For these reasons, impacts to commercial fisheries was assessed as low.

7. CONCLUSIONS

The decommissioning options for the Thistle pipelines PL13, PL4555 and PL4556; and the Don pipelines PL598, PL599, PL600 and PLU6267 were compared using a CA. PL13 will be decommissioned *in situ* following removal of surface laid ends down to trench depth and ~29,300Te of rock to bury the remaining length of the pipeline inside the trench (9,071 m). PL4555 and PL4556 buried sections will be decommissioned *in situ*. Surface laid ends of PL4555 and PL4556 up to the point of burial in rock will be completely removed along with all associated protection and stabilisation features in with mandatory requirements. PL598, PL599, PL600 and PLU6267 will be decommissioned *in situ* following the removal of the surface laid sections from the bottom of riser caisson 930 to the point when the pipeline(s)/umbilical(s) is buried at end of the transition at trench depth. The exposed cut ends of the Thistle and Don pipelines will be remediated with the placement of rock and a long-term monitoring programme will be implemented. This option was considered and assessed in line with a tried and tested EA method and the results detailed in Sections 5 and Section 6.

The Thistle and Don fields are located offshore in the NNS, away from coastal sensitivities and from any designated sites. Therefore, no significant impact to any protected sites is expected. The marine environment where the Thistle and Don infrastructure is located is typical of the NNS. Whilst recognising there are certain times of the year when populations of seabirds, fish spawning and commercial fisheries are vulnerable to oil pollution, the area is not considered particularly sensitive to the proposed decommissioning activities.

Following detailed review of the project activities, the environmental sensitivities of the project area, industry experience with decommissioning activities and stakeholder concerns, it was determined that three out of the nine potential impacts required further assessment. The aspects scoped in for further assessment were:

- Atmospheric emissions;
- Seabed disturbance; and
- Physical presence of items decommissioned *in situ*.

The overall assessment for **atmospheric emissions** was of 'Low' significance. However further investigation was deemed necessary due to increasing scientific, public and stakeholder concern regarding the impacts of anthropogenic climate change on the environment and the potential contribution of greenhouse gas emissions to global warming. Emissions during decommissioning activities, (largely comprising fuel combustion gases) will occur following CoP. Emissions generated by equipment and vessels and those associated with production from the fields will be replaced by those from vessel use as well as the recycling of decommissioned materials and the emissions relating to new manufacture of materials for replacement of items decommissioned *in situ*. The estimated CO_2 emissions represent 0.17% of the 13.2 $MtCO_2e$ generated offshore on the UKCS in 2018 [66]. Mitigation to reduce and manage emissions will include careful planning of the offshore vessel programme, vessel speeds and fuel type (i.e., low sulphur), all of which will be subject of a SEEMP. Overall, when considering the spatial and temporal scale of the disturbance, and accounting for the following mitigation measures, the impact of the emissions associated with subsea decommissioning activities was considered not significant.

The **seabed disturbance** resulting from the proposed Thistle pipelines, SALM base and Don pipelines decommissioning activities has the potential to cause a direct loss of habitat, mortality of sessile organisms and a change in the natural physical processes of the area. Initial assessment of this aspect yielded an overall level of 'Medium'. However, taking into consideration the benthic environment, seabed characteristics, commercial fishing, relatively small disturbance area and along with industry and EnQuest mitigation measures, the overall assessment was reduced to

'Low'.

The **physical presence of infrastructure decommissioned *in situ*** potential impacts identified to commercial fisheries were limited to possible legacy impacts, such as the snagging of fishing gears. While the impact magnitude may be considered 'High' owing to the potential severity of a snagging event, the frequency of such an event is low therefore overall, the magnitude is considered 'Low/Medium'. The presence of the Thistle and Don pipelines are not likely to influence fishing activity in the area beyond current natural variation. The value of commercial fisheries is also considered 'Low' when comparing the financial value and contribution of the catch within the wider regional context. Overall, due to the small area of remaining infrastructure, the commitment to over-trawlability, the likelihood of a snagging event being 'Low' and the anticipated impact on commercial fisheries, considering all available mitigation measures, this impact was assessed as 'Low'.

This EA has considered the Scottish NMP, adopted by the Scottish Government to help ensure sustainable development of the marine area. EnQuest considers that the proposed decommissioning activities are in alignment with its objectives and policies.

Based on the findings of this EA, including the application of appropriate mitigation measures and project management according to EnQuest's HSE&A Policy and Principles, it is considered that the proposed decommissioning activities do not pose any significant threat to environmental or societal receptors within the UK.

8. REFERENCES

[1] Aires, C., Gonzalez-Irusta, J.M. and Watret, R. (2014). Scottish Marine and Freshwater Science Report. (Updating Fisheries Sensitivity Maps in British Waters): Available online at: https://www.scotland.gov.uk/Publications/2014/12/3334 [Accessed 30/08/2023].

[2] Baxter, J. M., Boyd, I. L., Cox, M., Donald, A. E., Malcolm, S. J., Miles, H., Miller, B. and Moffat, C. F. (2011). Scotland's Marine Atlas: Information for the national marine plan. (Marine Scotland). Available online at: https://www.scotland.gov.uk/Publications/2011/03/16182005/0 [Accessed 30/08/2023].

[3] Beare, D.J., Batten, S., Edwards, M. and Reid, D.G. (2002). Prevalence of boreal Atlantic, temperate Atlantic and neritic zooplankton in the North Sea between 1958 and 1998 in relation to temperature, salinity, stratification intensity and Atlantic inflow. *Journal of Sea Research*, 48, pp. 29-49.

[4] BEIS (2021). North Sea Transition Deal. March 2021.

[5] Björklund, A and Finnveden, G (2005). Recycling revisited–life cycle comparisons of global warming impact and total energy use of waste management strategies. *Resource, Conservation and Recycling*, 44, pp. 309-317.

[6] BP (2011). Don Decommissioning Programme, DON-BP-001, published May 2011. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1069899/don-dp__4_.pdf [Accessed 07/08/2023].

[7] BP (2023). Don Decommissioning Programme for pipelines inside Thistle 500 m zone, DECOM-DON-HS-PRO-BP

[8] Burrows M.T., Kamenos N.A., Hughes D.J., Stahl H., Howe J.A. and Tett P. (2014). Assessment of carbon budgets and potential blue carbon stores in Scotland's coastal and marine environment. Scottish Natural Heritage Commissioned Report. Available online at: https://www.nature.scot/doc/naturescot-commissioned-report-761-assessment-carbon-budgets-and-potential-blue-carbon-stores [Accessed 30/08/2023].

[9] Burrows, M.T., Hughes, D.J., Austin, W.E.N., Smeaton, C., Hicks, N., Howe, J.A., Allen, C., Taylor, P. & Vare, L.L. (2017). Assessment of Blue Carbon Resources in Scotland's Inshore Marine Protected Area Network. Scottish Natural Heritage Commissioned Report No. 957.

[10] Carter MID, Boehme L, Cronin MA, Duck CD, Grecian WJ, Hastie GD, Jessopp M, Matthiopoulos J, McConnell BJ, Miller DL, Morris CD, Moss SEW, Thompson D, Thompson PM and Russell DJF (2022) Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management. Front. Mar. Sci. 9:875869. doi: 10.3389/fmars.2022.875869

[11] Cerniglia, C. E. (1992). Biodegradation of polycyclic aromatic hydrocarbons. *Biodegradation*, 3, pp. 351–368.

[12] 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

[13] Committee on Climate Change (2020). Reducing UK emissions – Progress Report to Parliament (2020). Available online at: https://www.theccc.org.uk/wp-

content/uploads/2020/06/Reducing-UK-emissions-Progress-Report-to-Parliament-Committee-on-Cli.. -002-1.pdf -[Accessed 28/08/2023].

[14] Coull, K.A., Johnstone, R. and Rogers, S.I. (1998). Fisheries Sensitivity Maps in British Waters. UKOOA.

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

[16] Decom North Sea (2018). Environmental Appraisal Guidelines: Offshore Oil and Gas Decommissioning.

[17] DEFRA (2005). Available online at: https://www.webarchive.nationalarchives.gov.uk/ukgwa/20130402151656/http:/archive.defra.gov.uk/environment/business/reporting/pdf/envrpgas-annexes.pdf [Accessed 12/03/2023]

[18] DEFRA (2010). Charting Progress 2, the State of UK Seas. Available online at: https://tethys.pnnl.gov/sites/default/files/publications/UKMMAS_2010_Charting_Progress_2.pdf [Accessed 30/08/2023].

[19] DeepOcean (2018) Thistle Pipelines Survey Report. Ref: M2758-DEP-THI-SS-0000-REP-0001.

[20] Edwards, M., Beaugrand, G., Johns, D.G., Licandro, P., McQuatters-Gollop, A and Wootton, M. (2010). Ecological Status Report: results from the CPR survey 2009. Available online at: https://www.semanticscholar.org/paper/Ecological-Status-Report%3A-results-from-the-CPR-2009-Edwards-Beaugrand/a3fc53ff4f07376800a4bec79f488aa64eb1a1ea [Accessed 30/08/2023].

[21] EEMS (2008). Atmospheric Emissions Calculations. *Issue 1.810a*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/136461/atmos-calcs.pdf [Accessed 12/03/2023].

[22] Ellis, J.R., Milligan, S., Readdy, L., South, A., Taylor, N. and Brown, M. (2012). Mapping the spawning and nursery grounds of selected fish for spatial planning. Department of Environment, Food and Rural Affairs from Cefas.

[23] Emodnet (2023). EMODnet Seabed Habitats - Launch map viewer. [online] Available at: https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/ [Accessed 17/07/2023].

[24] EnQuest (2021) Conrie, Don South-West, West Don & Ythan Decommissioning Programmes, Doc no:M4109-ENQ-NPR-DN-00-PRG-0002.

[25] EnQuest (2022). Northern North Sea Regional Offshore Oil Pollution Emergency Plan (Doc no: ENQ-CRS-EN-PLA-00001)

[26] EnQuest (2023) Thistle & Don pipeline Comparative Assessment, M3525-ENQ-THI-DN-0000-REP-0006

[27] EnQuest (2023) Thistle pipeline Decommissioning Programme, M3525-ENQ-THI-DN-0000-REP-0012

[28] EnQuest (2023) Thistle Alpha Upper Jacket Decommissioning Programme, M3525-ENQ-THI-DN-0000-REP-0008

[29] FRS (2004). Zooplankton and climate change – the *Calanus* story. Available online at: http://www.vliz.be/docs/Zeecijfers/zooplankton_and_climate_change.pdf [Accessed 30/08/2023].

[30] Franchetti, M. and Kilaru, P (2012). Modeling the impact of municipal solid waste recycling on greenhouse gas emissions in Ohio, USResour., Conserv. Recycl., 58 , pp. 107-113

[31] Benthic Solutions Limited (2021) Thistle Pre-Decommissioning Survey 2021, Final Cuttings Pile Sampling Report, M3525-GXY-THI-DN-0000-REP-0007.

[32] Benthic Solutions Limited (2021) Thistle Pre-Decommissioning Survey 2021, Final Environmental Baseline Survey Results Report, M3525-GXY-THI-DN-0000-REP-0008.

[33] Gilles, A, Authier, M, Ramirez-Martinez, NC, Araújo, H, Blanchard, A, Carlström, J, Eira, C, Dorémus, G, Fernández Maldonado, C, Geelhoed, SCV, Kyhn, L, Laran, S, Nachtsheim, D, Panigada, S, Pigeault, R, Sequeira, M, Sveegaard, S, Taylor, NL, Owen, K, Saavedra, C, Vázquez-Bonales, JA, Unger, B, Hammond, PS (2023). Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. Final report published 29 September 2023. 64 pp. Available online from: https://tinyurl.com/3ynt6swa [Accessed 03/01/2024].

[34] GOV.UK. 2022. Strategic Environmental Assessment 5 (SEA 5). [online] Available online at: https://www.gov.uk/government/consultations/strategic-environmental-assessment-5-sea-5 [Accessed 30/08/2023].

[35] 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.

[36] 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.

[37] Hylland, K. and Erikson, D.O. (2013). Naturally occurring radioactive material in North Sea produced water: environmental consequences. Norsk Olje og Gass.

[38] IEMA (2015). Environmental impact assessment Guide to Shaping Quality Development.

[39] IEMA (2016). Environmental impact assessment Guide to Delivering Quality Development.

[40] International Aluminium Organisation (2021). Available online at: https://international-aluminium.org/statistics/greenhouse-gas-emissions-aluminium-sector/ [Accessed 30/08/2023].

[41] IoP (2000). Guidelines for the Calculation of Estimates of Energy Use and Gaseous Emissions in the Decommissioning of Offshore Structures. Energy Institute, London, UK.

[42] IPCC (2021). AR6 Climate Change 2021. The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press.

[43] JNCC. (2013). SACFOR abundance scale used for both littoral and sublittoral taxa from 1990 onwards. Available online at: https://mhc.jncc.gov.uk/media/1009/sacfor.pdf [Accessed 30/08/2023].

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

[45] JNCC (2021). Advice Note Seabird Survey Methods for Offshore Installations: Black-legged kittiwakes. Available online at: https://www.researchgate.net/publication/353131305_Seabird_Survey_Methods_for_Offshore_Installations_Black-legged_kittiwakes [Accessed 30/08/2023].

[46] JNCC (2022). North-east Faroe-Shetland Channel MPA. Available online at: https://jncc.gov.uk/our-work/north-east-faroe-shetland-channel-mpa/ [Accessed 30/08/2023].

[47] Kafas, A., Jones, G., Watret, R., Davies, I., and Scott, B. (2013). 2009 - 2013 amalgamated VMS intensity layers, GIS Data. Marine Scotland, Scottish Government.

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

[49] KIS-ORCA (2021). Offshore Renewable and Cable Awareness Map. Available online at: https://kis-orca.org/map/ [Accessed 30/08/2023].

[50] Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L.J. and Reid, J.B. (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. JNCC Report, 431.

[51] Manfredi, S., Tonini, D and Christensen, T. H, (2011). Environmental assessment of different management options for individual waste fractions by means of life-cycle assessment modelling. *Resources, Conservation and Recycl*ing, 55 (2011), pp. 995-1004

[52] Maravelias, C.D., Reid, D.G. and Swartzman, G. (2000). Seabed substrate, water depth and zooplankton as determinants of the prespawning spatial aggregation of North Atlantic herring. Marine Ecology Progress Series, 195: 249–259.

[53] Marine Directorate, Scottish Government. 2023. 2022 Scottish Sea Fisheries Statistics - Fishing Effort and Quantity and Value of Landings by ICES Rectangles. doi: 10.7489/12474-1 [Accessed 10/01/2024].

[54] McBreen, F., Askew, N., Cameron, A., Connor, D., Ellwood, H. and Carter, A. (2011). UK SeaMap 2010. Predictive mapping of seabed habitats in UK waters. Available online at: https://hub.jncc.gov.uk/assets/07a4513b-f04a-41c2-9be2-4135a14d0d15 [Accessed 30/08/2023].

[55] Meador, J.P., Stein, J. E., Reichert, W. L., and Varanasi, U. (1995). Bioaccumulation of polycyclic aromatic hydrocarbons by marine organisms. Reviews of Environmental Contamination and Toxicology, 143, pp.79-165.

[56] 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.

[57] NAEI (National Atmospheric Emissions Inventory), (2024). Available online at: https://naei.beis.gov.uk/data/data-selector [Accessed 09/01/2024].

[58] NatureScot (2021). Hermaness, Saxa Vord and Valla Field SPA. Available online at: https://sitelink.nature.scot/site/8512

[59] NatureScot (2010). Pobie Bank Reef SAC. Available online at: https://sitelink.nature.scot/site/10258 [Accessed 30/08/2023].

[60] North Sea Transition Authority, 2021. Stewardship Expectation 11. *Net Zero*,. Available online at: https://www.nstauthority.co.uk/media/7184/se11_net-zero.pdf [Accessed 30/08/2023].

[61] Norwegian Oil and Gas Association (NORSK) olje&gass or OLF., 2016. Guidance document for characterization of offshore drill cuttings piles.33p.

[62] NMPi (2024). The Scottish Government National Marine Plan Interactive. Available online at: https://marinescotland.atkinsgeospatial.com/nmpi/ [Accessed 04/04/2024].

[63] OGA (2016). Information of levels of shipping activity. 29th Offshore Licensing Round information and resources. Available online at: https://www.ogauthority.co.uk/licensing-consents [Accessed 30/08/2023].

[64] OGA (2016). Offshore Oil and Gas Activity: Offshore Interactive Map. Available online at: https://ogauthority.maps.arcgis.com/apps/webappviewer/index.html?id=adbe5a796f5c41c68fc762ea137a682e [Accessed 30/08/2023].

[65] OGUK (2013). Long term Degradation of Offshore Structures and Pipelines Decommissioned and left *in situ*, Oil and Gas UK. February 2013.

[66] OGUK (2019). Environment Report, 2018. Available online at: https://oilandgasuk.cld.bz/Environment-Report-2019/4/#zoom=z [Accessed 29/08/2023].

[67] OPRED (2018) Guidance Notes, Decommissioning of Offshore Oil and Gas Installations and Pipelines under the Petroleum Act 1998, Version 6, Department of Business, Energy, and Industrial Strategy. Available online at: https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines [Accessed 10/08/2023].

[68] OSPAR (2008). OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR Reference Number: 2008-6). Available online at: https://qsr2010.ospar.org/media/assessments/p00358_case_reports_species_and_habitats_2008.pdf [Accessed 28/08/2023].

[69] OSPAR (2010b) OSPAR Background Document for Seapen and Burrowing megafauna Communities (OSPAR ref. no. 481/2010). Available online at: https://www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats/habitats/sea-pen-burrowing-megafauna [Accessed 28/08/2023].

[70] OSPAR (2014). Levels and Trends in Marine Contaminants and their Biological Effects. CEMP Assessment Report 2013. Publication number: 631/2014, OSPAR Commission 2014.

[71] Pangerc, T., Robinson, S., Theobald, P., and Galley, L. (2016). Underwater sound measurement data during diamond wire cutting: First description of radiated noise. In Proceedings of Meetings on Acoustics 4ENAL (Vol. 27, No. 1, p. 040012). ASA.

[72] Reid, J., Evans, P. G. H. and Northridge, S. (2003). An atlas of cetacean distribution on the northwest European Continental Shelf. Joint Nature Conservation Committee, Peterborough.

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

[74] SAHFOS (2015). Sir Alister Hardy Foundation for Ocean Science. CPR Data: Standard Areas. Available online at: https://marine.gov.scot/copyright/sir-alister-hardy-foundation-ocean-science-sahfos [Accessed 30/08/2023].

[75] Scottish Government (2015). Scotland's National Marine Plan. Available online at: https://www.gov.scot/publications/scotlands-national-marine-plan/pages/10/ [Accessed 23/08/2023].

[76] SNH (2013). A handbook on environmental impact assessment Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland. Available online at: http://www.snh.gov.uk/docs/A1198363.pdf.

[77] Turner, D. A., Williams, I. D and Kemp, S. (2015). Greenhouse gas emission factors for recycling of source-segregated waste materials. *Resources, Conservation and Recycling*, Vol. 105, Part A, pp 186- 197.

[78] Tyler-Walters, H., Lear, D. and Allen J.H. (2004). Identifying offshore biotope complexes and their sensitivities. Report to Centre for Environmental, Fisheries, and Aquaculture Sciences from the Marine Life Information Network (MarLIN). Plymouth: Marine Biological Association of the UK.

[79] UKOOA, 2001. An analysis of U.K Offshore Oil & gas Environmental Surveys 1975-95, pp. 141.

[80] Webb, K.E., Barnes, D.K.A., Planke, S. 2009. Pockmarks: Refuges for marine benthic biodiversity. Limnol. Oceanogr, 54:1776-1788.

[81] Webb, A., Elgie, M., Irwin, C., Pollock, C. and Barton, C. (2016). Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK. Available online at: https://data.jncc.gov.uk/data/4253a571-146c-48bf-bf06-6fb29b8f59b1/SOSI-report.pdf [Accessed 30/08/2023].

[82] Wolf, J. Yates, N., Brereton, A., Buckland, H., De Dominicis, M., Gallego, A. and O'Hara Murray, R. (2016). The Scottish Shelf Model. Part 1: Shelf-Wide Domain. Scottish Marine and Freshwater Science, 7(3), 144pp.

[83] World Steel association (2021). Available online at: https://worldsteel.org/wp-content/uploads/Life-cycle-inventory-LCI-study-2020-data-release.pdf [Accessed 30/08/2023]

[84] WRAP (2006). Environmental Benefits of Recycling. Waste & Resources Action Programme, Banbury, UK (2006).

APPENDIX A EA METHOD

Appendix A.1 Method

The decision-making process related to defining if a project is likely to generate a significant impact on the environment is integral to the environmental impact assessment process; the methods used for identifying and assessing potential impacts should be transparent and verifiable.

The method utilised for the Thistle Subsea ENVID has been developed by reference to the Chartered Institute of Ecology and Environmental Management ('CIEEM') guidelines for marine impact assessment [12], The Marine Life Information Network ('MarLIN') species and ecosystem sensitivities guidelines [78] and guidance provided by NatureScot in their handbook on environmental impact assessment [76] and by The Institute of Environmental Management and Assessment ('IEMA') in their guidelines for environmental impact assessment [36][38][39].

EA 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.

For each impact, a systematic approach is applied to understand its significance on a receptor. 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 **frequency and duration** of the effect of the receptor;
- Definition of **magnitude** of impact, based on the magnitude of the shift from the environmental baseline conditions; and
- Definition of the **probability** of impacts.

These different aspects are taken into consideration when determining an overall assessment of the impact significance.

In line with the CA method, the ENVID used a qualitative approach. Ultimately, any impacts which fall into the medium and high categories is carried forward for further assessment. Any impacts falling below this level (i.e., low or low / medium) are deemed to be ALARP and were scoped out of further assessment in the EA.

Appendix A.2 Consequence (Geographical Extent)

The impact consequence is based on the geographical extent, as described in the table below.

Appendix Table A.2.1 Impact Consequence		
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.
Low/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.

Appendix A.3 Frequency / Duration

The duration of effect is key to determining the final ranking of impact significance. This criterion considers the following:

- Duration over which the impact is likely to occur (e.g., days, weeks, etc.); and
- Frequency and/or intensity of impact (i.e., how often the impact is expected to occur).

These variables are defined below with the overall ranking method of duration of effects.

Appendix Table A.3.1 Impact frequency/duration		
Ranking	**Duration**	**Criteria**
High	Major	Frequency/intensity of impact: high frequency (occurring repeatedly or continuously for a protracted period) 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.
Low/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).

Appendix A.4 Magnitude

The impact magnitude requires an understanding of how far the receptor will deviate from its baseline condition because of the impact. The resulting effect on the receptor is considered under vulnerability and is an evaluation based on scientific judgement.

The table below defines the criteria for impact magnitude.

Appendix Table A.4.1 Impact magnitude

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.
Low/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.

Appendix A.5 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 the probability that the receptor will be present and is based on knowledge of the receptor and experienced professional judgement. The table below provides definitions of the different levels of probability of impact that will be used in the Thistle pipelines, Don Pipelines and SALM base decommissioning impact assessment.

Appendix Table A.5.1 Impact probability

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

APPENDIX B ENVID

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment							Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
Preparatory activities	Engineering down and cleaning	Discharges to Sea Flushing/ cleaning operations for pipelines- discharge targeted 30 ppm Liquid discharge to sea - Water quality in immediate vicinity of discharge will be reduced slightly, but effects are usually minimised by rapid dilution in massive receiving body of water; planktonic organisms most vulnerable receptor. Potential NORM impacts.	• Controls will be in place, as relevant, through the Offshore Chemical Regulations and the Oil Pollution Prevention and Control regulations. • Work will be undertaken within permit consent agreement limits. • Any chemical and solids would be collected, skipped and shipped to shore for treatment and disposal.	Procedural cleaning and/or containment process. •Maintenance procedures. • 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. • Pre-mobilisation audits will be carried out including a comprehensive review of spill prevention procedures • Arrangements in place to track spills. • Residuals at cut ends released into the marine environment (post-flushing - should be low). A new permit application will be submitted to flush PL600 and PLU6267 with potable water or seawater.	L	L	L	L	L	These are routine operations and will be conducted within the agreed permit conditions and using EnQuest's procedural cleaning and containment processes. Any residual material will be in trace levels/volumes following the DFPV regime and will not pose any significant risk to water quality. Well cleaning is out with the scope of this EA and will be covered by its own permitting regime.	Out
Physical presence	Vessels	Disturbance to vessel operations offshore during operations (e.g. fisheries and other maritime users); disturbance to marine species	• Navigational updates • Notifications to mariners.	• Minimal vessel use/movement. • Vessel sharing where possible. • A SIMOPS plan for vessel activity in the field will be put in place.	L	L	L	L	L	Vessel traffic is low in Blocks 211/12, 211/18, 211/23 and very low in Blocks 211/13, 211/19, 211/24. Activity in line with usual vessel presence.	Out
	Vessel power generation	Impact on climate change / consumption of finite resource. Contribution to global warming. Gaseous emissions to atmosphere cause increased degradation of local / regional air quality.	• Minimal number of vessels deployed • Use of low sulphur diesel • Vessel equipment maintained according to manufacturer's recommendations	• EnQuest vessel assurance process / procedure • Third Party Contractor Assurance process / procedure	M	L	L	L	L	Additional controls do not reduce Ranking but demonstrate due diligence and assurance that Existing Controls are appropriately implemented.	In (Stakeholder/ public concern)

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment							Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
Resource use (landfill)	Discharges	Vessel discharge of grey water, bilge water, etc.	• MARPOL compliance. • Bilge management procedures. • Vessel audit procedures. • Contractor management procedures.	Covered by existing controls and permitting	L	L	L	L	L	Discharges will not be constant.	Out
	Vessel engine noise	Underwater noise - behavioural modifications to marine mammals, turtles and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	• Adherence with vessel maintenance procedures	• Vessel management. • Minimal vessel use/movement. • Vessel sharing where possible. • A SIMOPS plan for vessel activity in the field will be put in place.	L/M	L	L/M	L/M	L/M	Vessel noise will not have significant sound levels unlikely to be far above ambient noise levels. Not within an area protected for marine mammals. Particularly large numbers of harbour porpoise occur in the project area during the summer months, with a peak in numbers in July and August. The density is roughly estimated at 0.4393 animals/km^2 across the project area. Other European protected species (minke whale and white-beaked dolphin) and pinnipeds (grey and harbours seals) may also be present but in lower densities.	Out
	Onshore disposal	Use of landfill and landfill resource take (non-hazardous); special disposal (hazardous)	• Waste Management Plan • Active Waste Management Plan • Waste Hierarchy adherence • Transfrontier shipment of waste (if applicable)	•All wastes, including normal, hazardous/special wastes, will be shipped to shore for processing •Duty of Care •Management of contractors and relevant licences	L/M	M	L	M	L/M	Covered under waste management strategies. Recognise that the addition of project waste to landfill will remain in perpetuity. The expectation is that a low volume of material recovered to shore would be destined to landfill with material being disposed in this way would likely to be limited to marine growth should it not be recycled.	Out
	Onshore transport, treatment and recycling	Impact on climate change / consumption of finite resource. Contribution to global warming. Gaseous emissions to atmosphere cause increased degradation of local / regional air quality.	• Waste Management Plan • Active Waste Management Plan • Waste Hierarchy adherence	•Duty of Care •Management of contractors and relevant licences	M	L	L	L	L	Additional controls do not reduce Ranking but demonstrate due diligence and assurance that Existing Controls are appropriately implemented.	In (Stakeholder/ public concern)
Subsea infrastructure decommissioning	Cutting and removal	Underwater noise - behavioural modifications to marine mammals and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	• Cutting operations will use industry standard methods and equipment where available.	• In this instance EnQuest would be reliant on the removal, contractors' methods, processes and procedures.	L/M	L/M	L/M	L/M	L/M	Diamond wire cutting (Worst case method assessed) noise will not have significant sound levels. Not within an area protected for marine mammals. Particularly large numbers of harbour porpoise occur in the project area during the summer months, with a peak in numbers in July and August. The density is roughly estimated at 0.4393 animals/km^2 across the project area. Other European protected species (minke whale and white-beaked dolphin) and pinnipeds (grey and harbours seals) may also be present but in lower densities.	Out

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment							Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
		Seabed disturbance - Disturbance to the seabed, including to features of conservation importance during removal Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	Pre-decommissioning seabed surveys '-Stakeholder consultation	Review of survey data for potential sensitive habitats of seabed. • Cutting and lifting operations controlled by ROV. • Vessels are likely to be equipped with dynamic positioning rather than relying on anchors to remain in position.	L/M	L/M	L/M	H	L/M	No evidence of *S. spinulosa or A. islandica* aggregations within the area A single sea pen and faunal burrows were observed in the project area. However, the densities of faunal burrows and sea pen observed were insufficient across the pipeline route survey to constitute a 'sea pen and burrowing megafauna communities' habitat. Deemed to be a minor risk and therefore insignificant. Hard and soft sponge communities were observed across the survey area. The majority of sponges observed comprised <1% coverage in each image and therefore were not present to constitute a 'Sponge Dominated Habitat'. Particularly large numbers of harbour porpoise occur in the project area during the summer months, with a peak in numbers in July and August. The density is roughly estimated at 0.4393 animals/km^2 across the project area. Other European protected species (minke whale and white-beaked dolphin) and pinnipeds (grey and harbours seals) may also be present but in lower densities. Independently this is not significant however scope in under cumulative seabed disturbance.	In (Cumulative)
		Blue Carbon - (linked to seabed disturbance) - Disturbance to top layers of sediment during removal activities, leading to the release of a potential carbon store	• Pre-decommissioning seabed surveys • Stakeholder consultation	• Review of survey data for potential sensitive habitats of seabed. • Cutting and lifting operations controlled by ROV. • Vessels are likely to be equipped with dynamic positioning rather than relying on anchors to remain in position.	L	L	L	M	L	Area of disturbance will be minimal – but due to emerging stakeholder and regulatory interest it will be cumulatively assessed under seabed disturbance.	In (Cumulative)
Pipeline decommissioning	Cutting and removal	Underwater noise - behavioural modifications to marine mammals and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	• Cutting operations will use industry standard methods and equipment where available.	• In this instance EnQuest would be reliant on the removal, contractors' methods, processes and procedures.	L/M	L/M	L/M	L/M	L/M	Diamond wire cutting (Worst case method assessed) noise will not have significant sound levels. Not within an area protected for marine mammals Particularly large numbers of harbour porpoise occur in the project area during the summer months, with a peak in numbers in July and August. The density is roughly estimated at 0.4393 animals/km^2 across the project area. Other European protected species (minke whale and white-beaked dolphin) and pinnipeds (grey and harbours seals) may also be present but in lower densities.	Out

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment								Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
		Seabed disturbance - Disturbance to the seabed, including to features of conservation importance during removal Localised physical seabed disturbance resulting in community change. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from physical abrasion; Smothering of organisms following settlement of resuspended particles.	• Pre-decommissioning seabed surveys • Stakeholder consultation	• Review of survey data for potential sensitive habitats of seabed. • Cutting and lifting operations controlled by ROV. • Vessels are likely to be equipped with dynamic positioning rather than relying on anchors to remain in position.	L/M	L/M	L/M	H	L/M	No evidence of *S. spinulosa or A. islandica* aggregations within the area A single sea pen and faunal burrows were observed in the project area. However, the densities of faunal burrows and sea pen observed were insufficient across the pipeline route survey to constitute a 'sea pen and burrowing megafauna communities' habitat. Deemed to be a minor risk and therefore insignificant. Hard and soft sponge communities were observed across the survey area. The majority of sponges observed comprised <1% coverage in each image and therefore were not present to constitute a 'Sponge Dominated Habitat'. Deemed to be a minor risk and therefore insignificant. Potential concern due to large numbers of harbour porpoise occur in the project area during the summer months, with a peak in numbers in July and August. The density is roughly estimated at 0.4393 animals/km^2 across the project area. Other European protected species (minke whale and white-beaked dolphin) and pinnipeds (grey and harbours seals) may also be present but in lower densities. Independently this is not significant however scope in under cumulative seabed disturbance.	In (Cumulative)
		Blue Carbon - (linked to seabed disturbance) - Disturbance to top layers of sediment during removal activities, leading to the release of a potential carbon store	• Pre-decommissioning seabed surveys • Stakeholder consultation	• Review of survey data for potential sensitive habitats of seabed. • Cutting and lifting operations controlled by ROV. • Vessels are likely to be equipped with dynamic positioning rather than relying on anchors to remain in position.	L	L	L	M	L	Area of disturbance will be minimal – but due to emerging stakeholder and regulatory interest it will be cumulatively assessed under seabed disturbance.	In (Cumulative)
	Physical presence of free spans/ exposures	Other Users - Snagging risk to trawl and other demersal fisheries from bundle and any sediment berms or depressions. Risk over time due to sediment movement and exposure.	• Seabed clearance certificate required before the 500 m safety zone is opened up for use. • Continued monitoring for an agreed period and remediation if required, accurate mapping of decommissioned *in situ* location and state • Following seabed clearance, the opening of the subsea 500 m zones to other sea users will also have a positive impact. • Navigational updates • Notifications to mariners • FishSAFE system	• Remediation on free spans and monitoring or exposures. • The profile of the rock-placement allow fishing nets to trawl over the rock unobstructed. Suitably graded rock will be used to minimise the risk of snagging fishing gear. •Final visual and/ or overtrawl seabed survey will be undertaken following decommissioning. •Stakeholder engagement Long-term monitoring	M	L	H	L/M	M	Rock remediation of ~29,300 Te rock deposited on PL13 to bury the remaining pipeline in the trench which suffers from an overall exposed length of 3644.7 m and 66 spans, 5 of which are considered reportable. Following removal of the surface laid ends, most of the pipeline is buried inside the trench (2018 data). Burial status suggests that the placement of ~29,300 Te of rock along the remaining length of PL13 inside the trench will ensure a consistent profile. Therefore, the exposures and spans present in are not expected to pose any risk of interaction with other sea users. Stabilisation and protection infrastructure (including deposited rock) associated with remediation of exposures/spans will be left *in situ*. Deemed to be a minor risk and therefore insignificant. Potential Stakeholder concern due to demersal fishery snagging risk, therefore scoped into further assessment.	In

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment							Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
	Long term degradation of pipelines decommissioned *in situ* (offshore)	Seabed disturbance - Gradual breakdown of infrastructure and release of contaminants. Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	• Continued monitoring for an agreed period and remediation if required, accurate mapping of decommissioned *in situ* location and state • Prior to disconnection, the pipelines will be flushed clean of hydrocarbons and chemicals. A new permit application will be submitted to flush PL600 and PLU6267 prior to disconnection. • EnQuest would be obliged to carry out legacy surveys in perpetuity.	• Same as existing controls	L	L	L	L/M	L	Not an acute impact as breakdown of components will occur over decades, 100s of years. Effects are usually minimised by rapid dilution in massive receiving body of water Deemed to be a minor risk and therefore insignificant. Scoped into further assessment due to cumulative impact.	In (Cumulative)
	Pipeline remediation	Seabed Disturbance - Introduction of new substrate which may alter habitat architecture, influencing water movement, sediment accumulation and light conditions.	•Minimise introduction of material where possible	•A rock-placement vessel or ROV support vessel will be used. The rock mass will be carefully placed over the pipeline and pipeline ends by the use of an ROV-controlled fall pipe equipped with cameras, profilers, pipe tracker and other sensors as required. •Implementation of EnQuest's' Environmental Management Strategy. •Visual surveys of the seabed where possible to locate obstructions and to localise (and minimise) any post-decommissioning overtrawl surveys that may be required	L	M	M	H	M	The deposition of rock on PL13 and pipeline ends will be undertaken using controlled methods (PL4555, PL4556, PL598, PL599, PL600 and PLU6267). This may be carried out by a fall pipe vessel or an ROV and builder's bags. The rock depositing vessel will record the quantities of rock used and the end of project reports will be used to inform the decommissioning close out reports. As-left surveys may also be used to confirm the location and placement of rock. Deemed to be a medium risk and therefore potentially significant.	In
Dropped objects	Seabed Disturbance	Localised physical seabed disturbance resulting in community change and potential release of contaminants. Recovery time and extent dependent on type of seabed and species present and location specific estimate within EA. Lethal/sub-lethal effects on benthic and epibenthic fauna from potential bioaccumulation; physical abrasion; smothering of organisms following settlement of resuspended particles.	• PON2 submission	•Lifting operations management of risk •Dropped object recovery and debris clearance surveys •Careful planning, selection of equipment, subsequent management and implementation of activities	L	L	L/M	L	L	Everything will be endeavoured to be retrieved. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. Debris clearance surveys will aid in the identification of any dropped objects.	Out

Environmental and Societal Impact Review			Controls, Mitigations, Review and Assessment							Comments and Actions
Operation / Aspect	**Activity**	**Summary of Environmental and/or Societal Impact**	**Existing Controls (Standards, Legislative, or Prescriptive)**	**EnQuest -Specific / Best Practice Standards**	**Consequence**	**Frequency**	**Magnitude**	**Probability**	**Overall assessment**	**Comment**	**Potentially significant environmental impact and/or stakeholder concern (Scope in or out of further assessment)**
Significant hydrocarbon release	Loss of containment	Catastrophic loss of containment Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	• OPEP • MAS • Navaids • SOPEP • CIP	• All contracted vessels will have a SOPEP in place • A Collision Risk Management Plan will be developed and implemented • Agreed arrangements in place with oil spill response organisation for mobilising resources in event of a spill • Existing field OPEP in place to reduce the likelihood of hydrocarbon release and define spill response in place • Lifting operations will be planned to manage the risk • Vessel contactors will have procedures for fuel bunkering that meet EnQuest's standard • Where practicable, re-fuelling will take place during daylight hours only.	M	L	L/M	L	LM	Risk of collision is low given low shipping activity in Blocks 211/12, 211/18, 211/23 and very low in Blocks 211/13, 211/19, 211/24. Well decommissioning is outside of the scope of this specific impact assessment since it not dependent on approval of the DP. The possibility of a well blowout therefore does not require consideration here. Reduced to ALARP	Out

APPENDIX C ENQUEST HSEA POLICY

HSEA Policy

Health, Safety, Environment & Assurance

EnQuest is a production and development company, with operations in the UK and Malaysia. We are committed to operating responsibly and will not compromise our health, safety or environmental standards to meet our business objectives.

Through respect for our people, our contractors, our customers, our stakeholders and the environment, we will operate to achieve our principal aim: *safe results, with no harm to people and respect for the environment.*

To achieve this, we will manage our business such that we:

Safety Management
- Demonstrate strong safety leadership
- Provide trained and competent resources
- Maintain high-quality systems and processes
- Maintain the integrity of our assets over their life cycles
- Recognise, assess and manage HSE risks
- Plan and be prepared for potential emergencies

Environment
- Integrate environmental management into all aspects of our operations
- Manage and mitigate our impact on the environment, including emissions

Wellbeing
- Maintain safe and healthy workplaces
- Provide wellbeing awareness and support

Engagement
- Encourage open and honest communication
- Ensure our contractors and suppliers comply with our policies and procedures
- Comply with all applicable legislation and industry standards
- Recognise, assess and manage change

Sharing & Learning
- Investigate and learn from HSE events
- Strive for continual improvement in our HSE performance

Should operational results and this policy ever come into conflict, we all have a responsibility to our principal aim of *safe results, with no harm to people and respect for the environment* over operational results. This includes the responsibility to stop a job whenever activities may conflict with this policy.

Richard Hall

Amjad Bseisu
Chief Executive Officer

Richard Hall
Managing Director – Global Operations and Developments

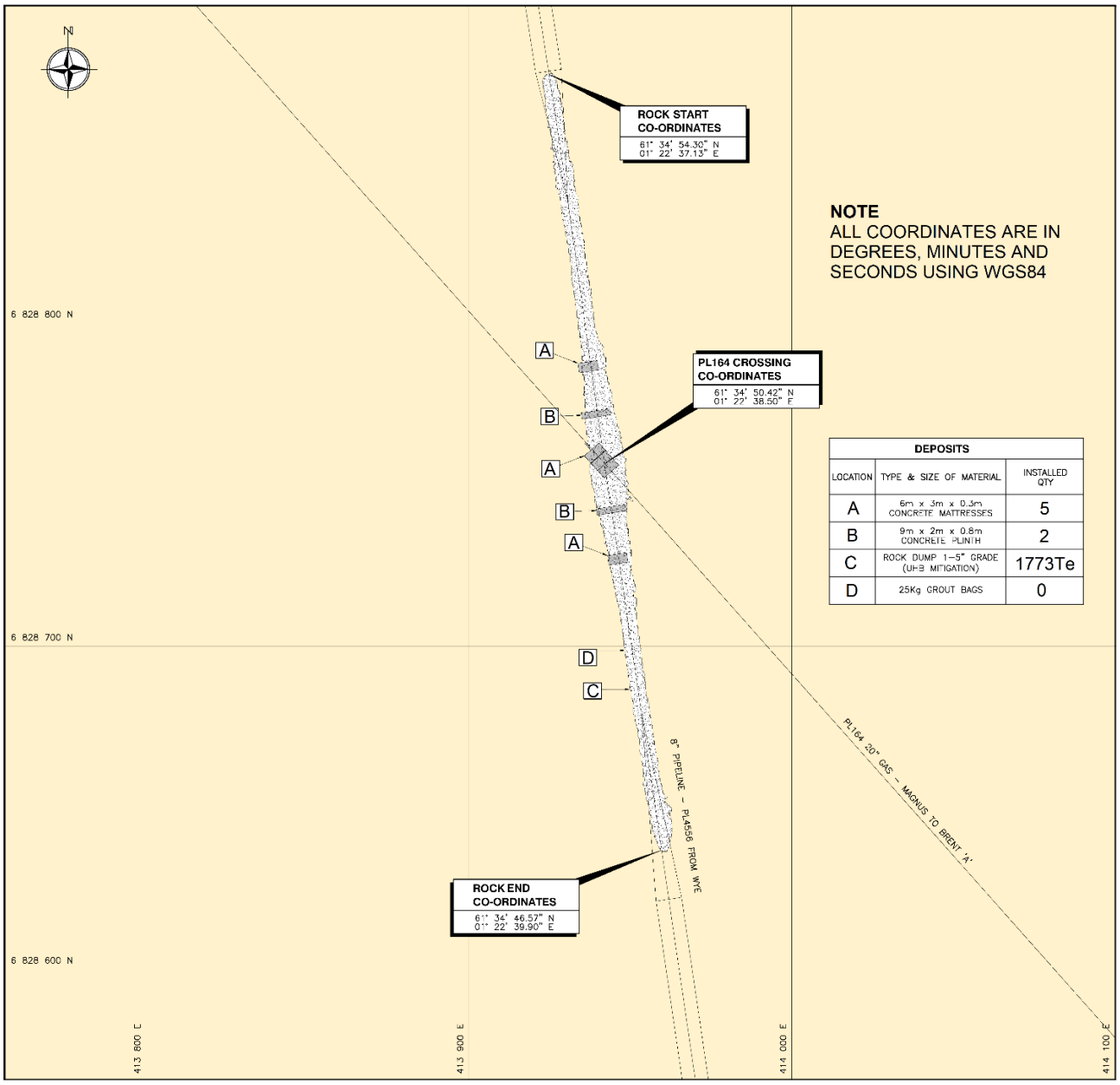
ENQ-COR-HS-POL-00005 Rev C12 August 2022

www.enquest.com

C.1 EnQuest HSEA Policy

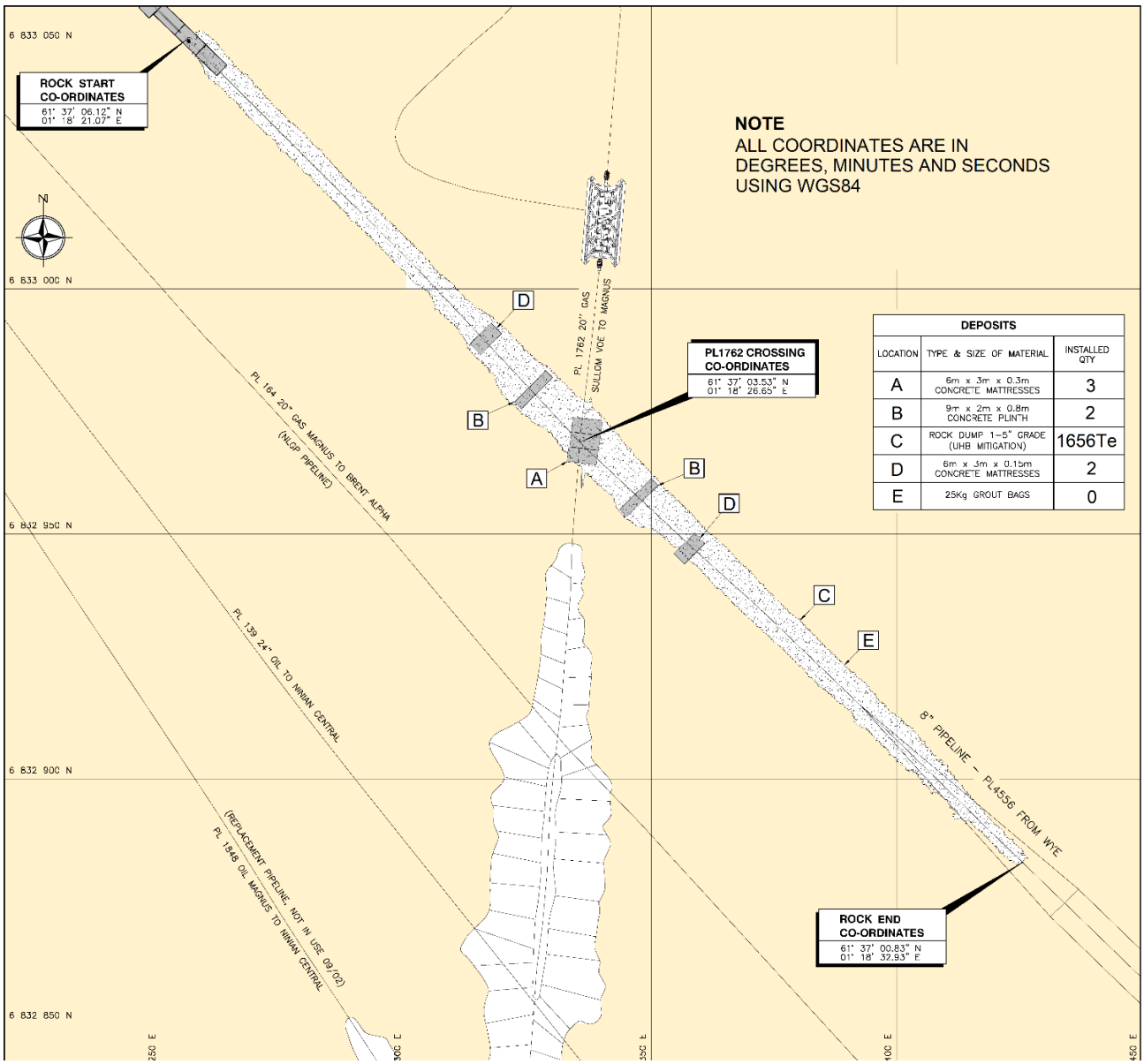
APPENDIX D PIPELINE CROSSINGS

Appendix D.1 PL4556 over PL164



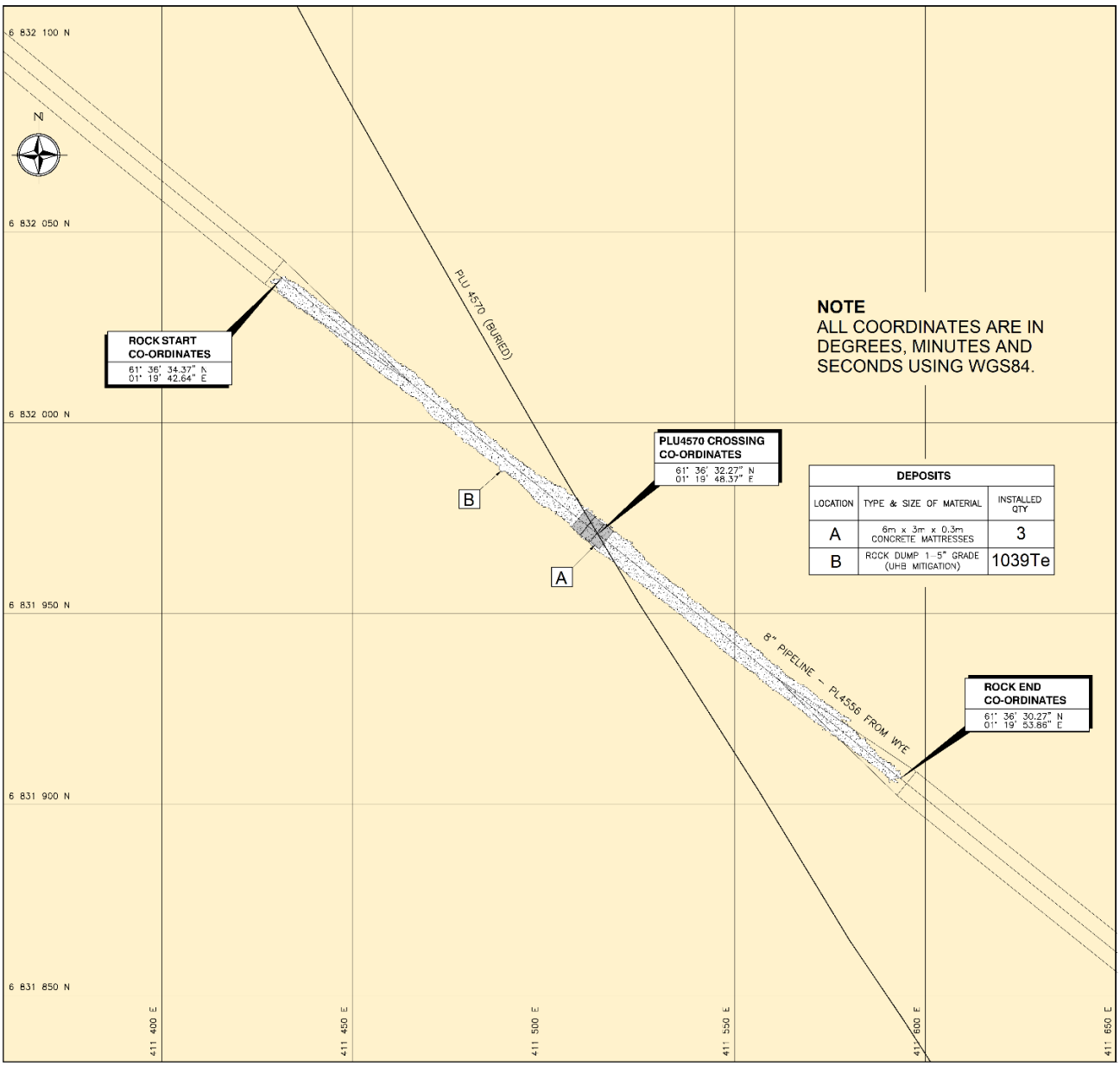
D.1.1 PL4556 over PL164 pipeline crossing

Appendix D.2 PL4556 over PLU1762



D.2.1 PL4556 over PL1762 pipeline crossing

Appendix D.3 PL4556 over PLU4570



D.3.1 PL4556 over PLU4570 pipeline crossing

APPENDIX E EMISSIONS FACTORS

Emissions factors (Te/Te)		CO_2	N_2O	CH_4	CO	VOC	NOx	SO_2	Source data
Marine diesel		3.17	0.00022	0.00018	0.0157	0.0024	0.059	0.012	[41][21]
Diesel (Articulated HGV)		3.08	0.025	0.00071	0.0000008	0.0000001	0.04	0.00012	[17]
Recycling	**Steel**	1.63	ND	ND	ND	ND	ND	ND	[83]
	Non-ferrous (Aluminium)	0.5	ND	ND	ND	ND	ND	ND	[40]
New Manufacture	**Steel**	1.89	ND	ND	ND	ND	0.0035	0.0055	[41]
	Non-ferrous (Aluminium)	3.59	ND	ND	ND	ND	0.0041	0.025	[41]
	Concrete	0.88	ND	ND	ND	ND	0.0054	0.0001	[41]
	Plastics	3.18	ND	ND	ND	ND	ND	ND	[41]