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Dunlin Alpha Topsides Decommissioning Environmental Appraisal Report

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This Dunlin Alpha Topsides Decommissioning Environmental Appraisal Report is a supporting document to the Draft Dunlin Alpha Topsides Decommissioning Programme and other documentation, available on Fairfield Energy Limited's website (http://www.fairfield-energy.com).

Contents

Acronyms

AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AtoN	Aid to Navigation
BEIS	Department for Business, Energy and Industrial Strategy
CGBS	Concrete Gravity Base Substructure
CGF	Conductor Guide Frame
cm	Centimetre
CO_2	Carbon Dioxide
DECC	Department of Energy and Climate Change (now BEIS)
DP	Decommissioning Programme
EA	Environmental Appraisal
EBS	Environmental Baseline Survey
EMS	Environmental Management System
ENVID	Environmental Impact Identification
EU	European Union
FEL	Fairfield Energy Limited
GJ	Giga Joule
Helideck	Helicopter deck
HLV	Heavy Lift Vessel
HRA	Habitats Regulations Assessment
HSE	Health and Safety Executive
ICES	International Council for the Exploration of the Sea
IMO	International Maritime Organisation
IoP	Institute of Petroleum
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LAT	Lowest astronomical tide
MMO	The Marine Management Organisation
MPA	Marine Protected Area
MSF	Module Support Frame
MSH	Make Safe and Handover
NCMPA	Nature Conservation Marine Protected Area
Nm	Nautical Miles
NORM	Naturally Occurring Radioactive Material
OGA	UK Oil and Gas Authority
OGUK	Oil and Gas UK
OPEP	Oil Pollution and Emergency Plan

OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	Oslo Paris Convention
PETS	Portal Environmental Tracking System
PEXA	Practice and Exercise Areas (Military)
pH	Potential hydrogen
SAC	Special Area of Conservation
SIMOPs	Simultaneous operations
SNH	Scottish Natural Heritage
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area
UK	United Kingdom
UKBAP	United Kingdom Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UXO	Unexploded Ordinance
VMS	Vessel Monitoring System
WEEE	Waste Electrical and Electronic Equipment

Units of measure

%	Percent
£	Pound sterling
°	Degrees
°C	Degrees Celsius
Ft	Feet
ft^3	Cubic feet
g/m^2	Grams per square metre
g/m^3	Grams per cubic metre
kg	Kilogram
km	Kilometre
km^2	Square kilometre
km^3	Cubic kilometre
µgg-1	Microgram per gram
m	Metre
m/s	Metres per second
m^2	Square metre
m^3	Cubic metre
Te	tonnes

Non-Technical Summary

Introduction and background

Fairfield Betula Limited and Fairfield Fagus Limited (collectively termed Fairfield), wholly owned subsidiaries of Fairfield Energy Limited, are the operators of the Dunlin, Merlin and Osprey fields (the 'Greater Dunlin Area'), located in United Kingdom Continental Shelf (UKCS) Block 211/23 of the northern North Sea (Figure i). The Dunlin Alpha installation lies approximately 137 km from the nearest landfall point, 197 km north east of Lerwick and 11 km west of the UK/Norway boundary (Figure i).

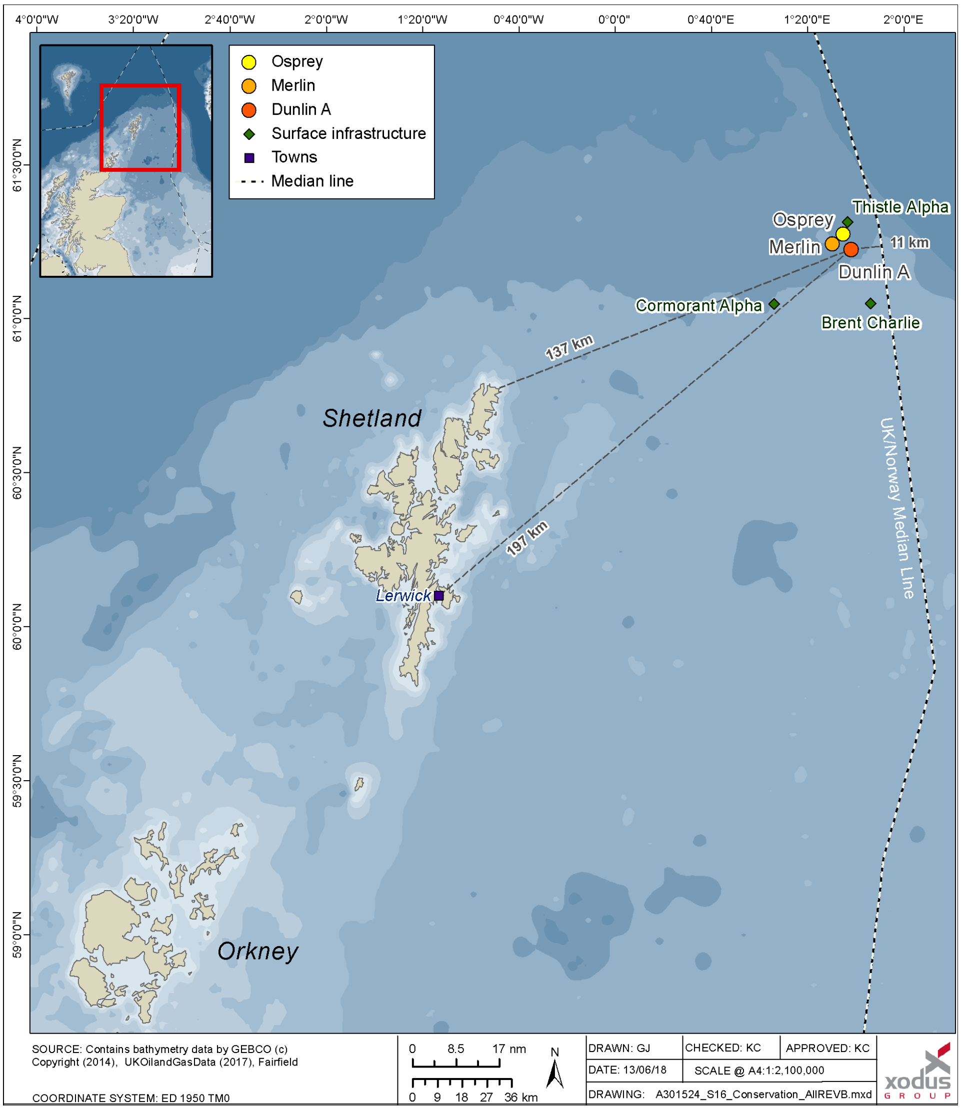

Figure i Location of the Dunlin, Merlin and Osprey Fields

Production at the Dunlin, Merlin and Osprey fields ceased in June 2015 and Fairfield is now in the process of decommissioning all infrastructure associated with the Greater Dunlin Area. The decommissioning of the Dunlin, Merlin and Osprey subsea infrastructure has been considered separately from the Dunlin Alpha installation activities, and approval of the Decommissioning Programmes for that infrastructure has been received. In addition, planning for the decommissioning of the Dunlin Alpha to Cormorant Alpha pipeline (PL5) is also being progressed.

Proposals for the decommissioning of the Dunlin Alpha installation were submitted to the Department of Business, Energy and Industrial Strategy (BEIS) and subjected to formal consultation in Q3-2018. Following this consultation period, and in agreement with OPRED, it has been decided to split the Dunlin Alpha Decommissioning Programme (FBL-DUN-DUNA-HSE-01-PLN-0001) into two separate programmes. These are:

- Dunlin Alpha Topsides Decommissioning Programme; and
- Dunlin Alpha Substructure Decommissioning Programme.

This Environmental Appraisal (EA) report relates specifically to the activities associated with the proposed Dunlin Alpha Topsides Decommissioning Programme. This Non-Technical Summary provides an overview of the Environmental Appraisal Report that has been prepared specifically for the proposed decommissioning of the Dunlin Alpha topsides infrastructure.

Options for Decommissioning Topsides

The Dunlin Alpha installation consists of a four-legged concrete gravity-base substructure (CGBS), with modular topsides facilities supported by a steel box girder module support frame (MSF), as shown in Figure ii. Steel transition columns (transitions) rise above the sea surface, connecting the top of the concrete legs to the bottom of the MSF. The installation is located in 151 m of water and is 240 m high from the seabed to the top of the drilling derrick.

The installation was designed to accommodate 48 wells, with fluids from each well passing from the reservoir to the topsides within steel pipework, protected by an external steel conductor. Conductor stability is provided by three conductor guide frames (CGFs) located between Legs C and D.

OSPAR Decision 98/3 mandates that the topsides of decommissioned offshore installations must be removed. In accordance with this, Fairfield have undertaken extensive engineering study work and engaged with a number of experienced contractors in order to understand the feasibility of different decommissioning methods for the Dunlin Alpha topsides. Following completion of a commercial tendering process, the topsides are planned to be removed by means of 'optimised reverse installation'.

The facilities covered under the Dunlin Alpha Topsides Decommissioning Programme include:

- Dunlin Alpha topsides (full removal of topsides facility);
- Small section of the steel transitions connecting the topsides to the concrete legs;
- Well conductors (removal of well conductors down to the lower CGF); and
- Conductor guide frames (removal of the middle and upper CGFs).

Recovery of the well conductors is being completed under ongoing well decommissioning operations and will be completed down to the lower CGF level before completion of the topsides and CGF removal scopes. As a result, removal of well conductors is not covered under this EA. All remaining infrastructure will be addressed as part of the Dunlin Alpha Substructure Decommissioning Programme.

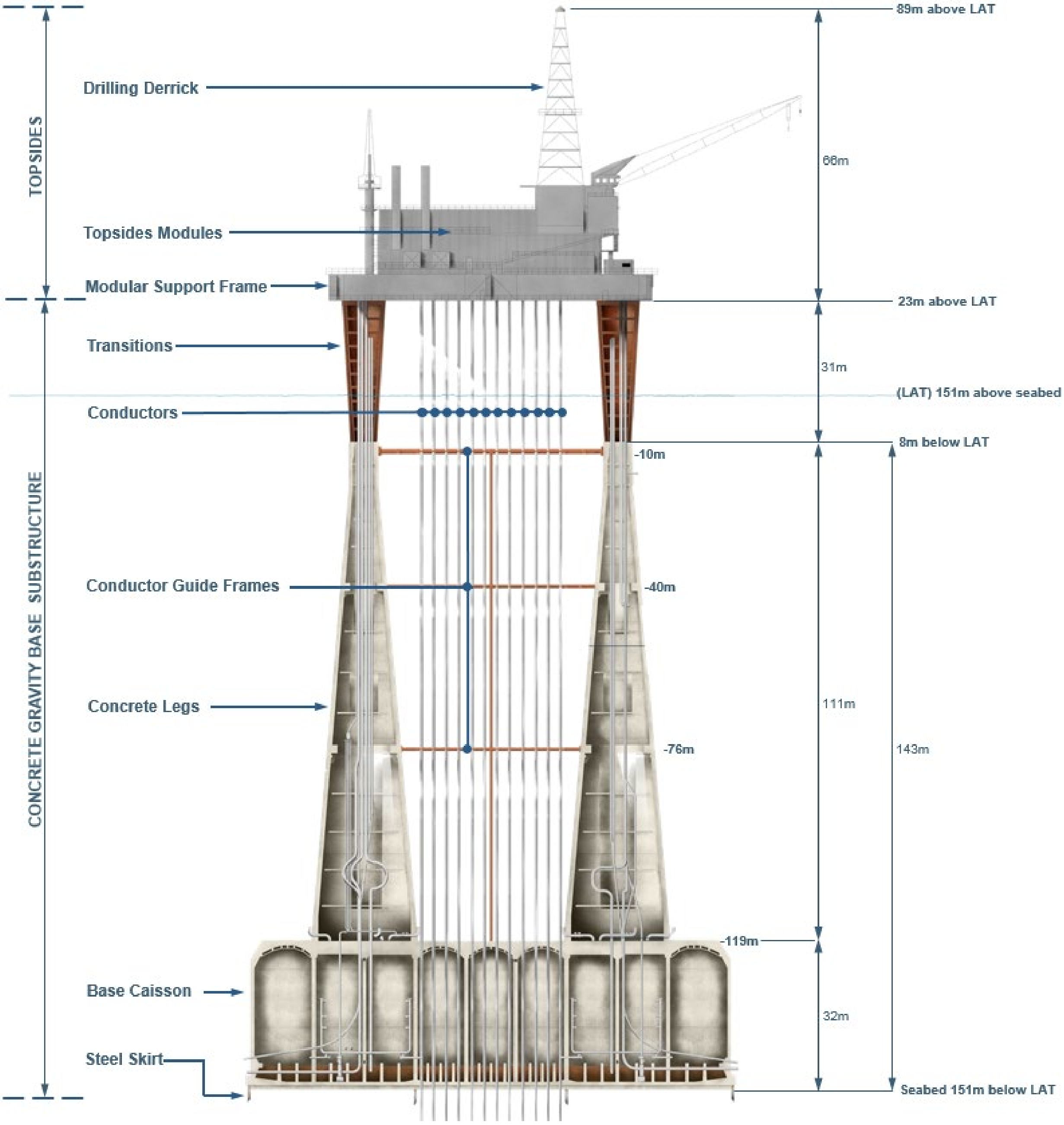

Figure ii Dunlin Alpha Installation

Decommissioning Overview

Prior to decommissioning, a number of activities will be carried out in preparation for the removal of the topsides by the selected decommissioning contractor. These activities are outwith the scope of the EA but are included here for information:

- Well decommissioning;
- Preparation of topsides for removal (Make Safe and Handover operations); and
- Removal of installation well conductors.

Prior to topsides removal, the platform will enter a 'cold stack' period where it will remain unmanned and power generation will be permanently isolated. During this time, Fairfield will continue to maintain navigational aids and an Oil Pollution Emergency Plan (OPEP) will remain in place.

The optimised reverse installation of the topsides means that the modules will generally be removed in the same way they were installed, but optimised within the capabilities of current equipment and taking into account the structural limitations of the platform itself. Apart from the MSF, all modules of the Dunlin Alpha platform can be lifted by the single crane of an HLV, enabling modules to be landed on the vessel deck after removal. The MSF and any remaining modules can then be lifted by the dual cranes of a larger HLV. It is therefore envisaged that the base case topsides removal campaign will be split into two phases, with the use of up to two HLVs.

Following removal of the MSF, an HLV will install a navigational aid on top of one of the CGBS legs. Operations are also proposed to cut and remove the upper and middle CGFs, as well as any remaining conductors.

A marine growth assessment undertaken in 2017 estimated that the infrastructure to be decommissioned under this scope supports approximately 83 tonnes of marine growth. Where practical, marine growth may be removed offshore. Any remaining material will be transported to shore where it will be disposed of in line with current guidelines by a qualified contractor.

During removal operations, navigational aid requirements will be maintained by the decommissioning contractor. Once removal of the MSF has been completed, the HLV will install an aid to navigation (AtoN) unit on top of one of the CGBS legs using the vessel crane. Fairfield will consult with the Northern Lighthouse Board to ensure that the design of the AtoN unit meets all regulatory requirements.

Upon completion of the wider Dunlin Alpha decommissioning operations an environmental survey and post-decommissioning debris clearance survey will be conducted within the installation 500 m safety exclusion zone. An independent verification of the seabed clearance operations will be undertaken and a statement of seabed clearance will be issued. Where OPRED determines that post-decommissioning monitoring is necessary, Fairfield will develop a monitoring strategy in consultation with the Regulator.

The topsides and CGF will be transported to the AF Environmental Base Vats (AFEBV) in Rogaland, Norway for dismantling and disposal. The facility is custom built to handle offshore installations and other marine structures, and the deep-water quay allows for direct offloading of platform modules by the HLV. A project HSE and waste management plan will be developed to ensure that dismantling and disposal operations are undertaken in a manner acceptable to Fairfield, regulatory bodies and interested stakeholders.

Proposed Schedule

The timing of decommissioning activities will be discussed with OPRED and with the Health and Safety Executive (HSE) and applications for all relevant permits and consents will be submitted and approval sought prior to activities taking place. Fairfield anticipates executing the Dunlin Alpha decommissioning project activities between 2021 and 2026; an indicative schedule for the work is shown in Figure iii. The removal of the topsides and transit to the decommissioning facility is likely to be completed over one season.

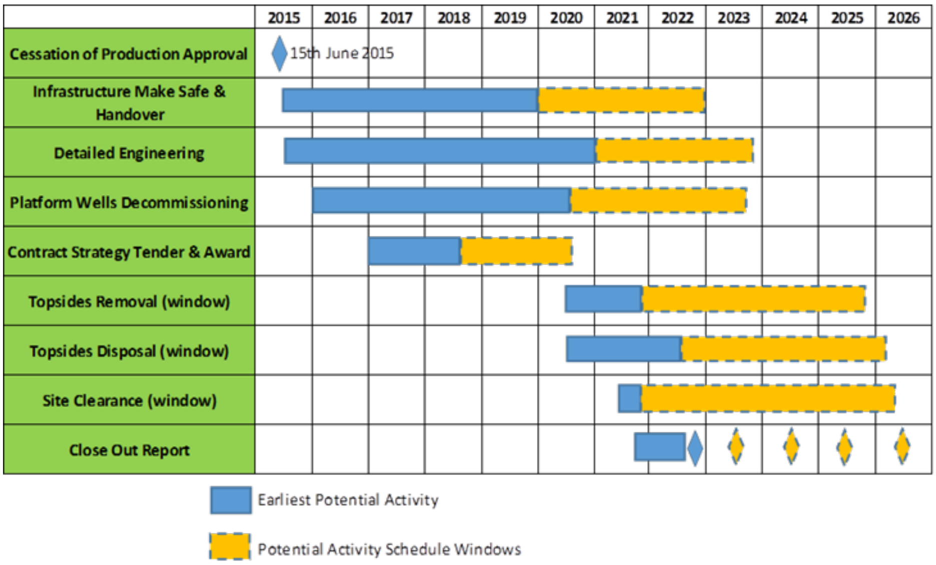

Figure iii Indicative Project Schedule

Environmental and Societal Baseline

Based on previous experience, studies (including Fairfield-commissioned surveys), review of scientific data and consultation, it has been possible to identify the key environmental sensitivities in the project area; these are summarised in Table ii.

Table ii Summary of the key environmental sensitivities of the project area

Environmental Receptor	Description
Conservation interests	
OSPAR (2008) List of Threatened and/or Declining Habitats and Species	
Ocean quahog *Arctica islandica*	The presence of ocean quahog *A. islandica* has been confirmed in most of the survey datasets available around Dunlin. All occurrences of *A. islandica* in these records tend to be of small juvenile specimens in low numbers. However, it is relatively well distributed in the North Sea and the project area is not considered a particularly important area for ocean quahog.
Cold water coral *L. pertusa*	A marine growth study carried out in 2017 indicated that *Lophelia pertusa* (a cold-water coral) was present on the platform legs, conductors and conductor guide frames at approximately 48 m below LAT and deeper. The worst-case estimate of marine growth on the structures being removed is 83 tonnes, some of which may be *L. pertusa*.
Conservation sites (within 150 km) See Figure iv	
Special Areas of Conservation (SACs)	There is only one SAC located within 100 km of the decommissioning project area, the Pobie Bank Reef SAC. The stony and bedrock reefs of the site provide a habitat to an extensive community of encrusting and robust sponges and bryozoans and in the shallowest areas the bedrock and boulders also support encrusting coralline algae. The site is located 98 km to the south-west of the project area.

Special Protection Areas (SPAs)	The nearest SPA to the project area is Hermaness, Saxa Vord and Valla Field SPA, located 137 km to the south-west. It protects a population of European importance including red-throated diver (Annex I species), common guillemot, black-legged kittiwake, European shag, northern fulmar, Atlantic puffin, great skua and northern gannet. The Feltar SPA is approximately 143 km from Dunlin Alpha and comprises a range of habitats including species-rich heathland, marshes and lochan, cliffs and rocky shores. During the breeding season this site supports a population of European importance of Arctic Tern *Sterna paradisaea* and red-necked phalarope *Phalaropus lobatus*. Additionally, it also supports populations of European importance of the following migratory species during the breeding season: dunlin *Calidris alpina schinzii*, great skua and whimbrel *Numenius phaeopus*, and at least 20,000 seabirds. During the breeding season, the area regularly supports 22,000 individual seabirds including Arctic skua, northern fulmar, great skua, Arctic tern and red-necked phalarope.
Nature Conservation Marine Protected Areas (MPAs)	There are two NCMPAs within 150 km of the installation. These are the North East Faroe Shetland Channel NCMPA (117 km) and the Fetlar to Haroldswick NCMPA (141 km). The North East Faroe Shetland Channel is the largest MPA in Europe and the protected features are deep sea sponge aggregations, offshore deep-sea muds, offshore subtidal sands and gravel, continental slope features and a wide range of features associated with key Geodiversity Areas including West Shetland Margin Palaeo-depositional, Miller Slide and Pilot Whale Diapirs. The Fetlar to Haroldswick NCMPA supports a range of high energy habitats and species including horse mussel beds, kelp and seaweed communities and maerl beds. It also encompasses over 200 km^2 of important black guillemot *Cepphus grylle* feeding grounds. It also includes shallow tide-swept coarse sands with burrowing bivalves and marine geomorphology of the Scottish shelf seabed.
Coastal and Offshore Annex II species most likely to be present in the project area	
Harbour porpoise	Harbour porpoise are frequently found throughout the UK waters. They usually occur in groups of one to three individuals in shallow waters, although they have been sighted in larger groups and in deep water. It is not thought that the species migrate.
Killer whale	Widely distributed with sightings across the North Sea all year round; seen in both inshore waters (April to October) and the deeper continental shelf waters (November to March). May move inshore to target seals seasonally.
Minke whale	Minke whales usually occur in water depths of 200 m or less and occur throughout the northern and central North Sea. They are usually sighted in pairs or in solitude; however, groups of up to 15 individuals can be sighted feeding. It appears that animals return to the same seasonal feeding grounds.
Atlantic white-sided dolphin	White-sided dolphins show both season and inter-annual variability. They have been sighted in large groups of 10 - 100 individuals. They have been sighted in waters ranging from 100 m to very deep waters, but also enter continental shelf waters. They can be sighted in the deep waters around the north of Scotland throughout the year and enter the North Sea in search of food.
White-beaked dolphin	White-beaked dolphins are usually found in water depths of between 50 and 100 m in groups of around 10 individuals, although large 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.
Grey seal Harbour seal	As the project area is located approximately 137 km offshore, these species may be encountered in the vicinity from time to time, but the project area is not of

	specific importance for these species. The presence of grey and harbour seals in the project area is between 0 – 1 individual per 25 km^2.
Benthic environment	
Bathymetry	The Dunlin Alpha installation stands in 151 metres of water.
Seabed sediments	Sediment types around the Dunlin Alpha platform, as revealed by site surveys at Dunlin Alpha, Osprey, Merlin, Skye, and Murchison, are predominantly fine to medium sand with a silt/clay (i.e. 'mud') content mostly <20%. In all areas surveyed, sands contain admixtures of shell gravel and pebbles, and occasional small boulders were observed.
Benthic fauna	Species consistently appearing in the lists of most abundant taxa centre around the polychaetes *Galathowenia oculata, Euchone incolor, Aonides paucibranchiata, Paradoneis lyra,* and the bivalve molluscs *Adontorhina similis* and *Axinulus croulinensis.* The epifauna included hermit crabs (usually *Pagurus* spp.), various starfish including *Asterias rubens*, *Porania pulvillus,* and *Luidia sarsi,* and sea urchins such as *Echinus acutus.* Low numbers of juvenile ocean quahog *A. islandica* were observed in the survey areas. This species is on the OSPAR (2008) List of Threatened and/or Declining Habitats and Species however it is well distributed in the North Sea and the project area is not considered a particularly important area for ocean quahog.
Fish – spawning and nursery grounds	
Spawning grounds	The project area is located within the spawning grounds of haddock *Melanogrammus aeglefinus* (February to May, [peak spawning February – April]), saithe *Pollachius virens* (January to April, [peak spawning January – February]), Norway pout *Trisopterus esmarkii* (January to April, [peak spawning February – March]), cod *Gadus morhua* (January to April, [peak spawning February – March]) and whiting *Merlangius merlangus* (February to June).
Nursery grounds	The following species have nursery grounds in the vicinity of the project: anglerfish *Lophiiformes*, cod, haddock, horse mackerel *Trachurus trachurus*, plaice *Pleuronectes platessa*, sandeel *Ammodytes tobianus*, saithe, sprat *Sprattus sprattus*, Norway pout, mackerel *Scomber scombrus*, blue whiting *Micromesistius poutassou*, spurdog *Squalus acanthias*, herring *Clupea harengus* and ling *Molva molva*.
Seabirds	
The project area is important for northern fulmar *Fulmarus glacialis*, northern gannet *Morus bassanus*, great black-backed gull *Larus marinus*, Atlantic puffin *Fratercula arctica*, black-legged kittiwake *Rissa tridactyla*, and common guillemot *Uria aalge* for the majority of the year. In Block 211/23 the sensitivity of seabirds to oil pollution, reflected by the Seabird Oil Sensitivity Index (SOSI), is low between February and October, except in May as no data is available for this month. Between November and January, the SOSI is high.	

Seabed Oil Sensitivity Index (SOSI)												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
211/23	3*	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											

Socio-economic Receptor	Description
Commercial fishing	
Saithe and other demersal species are the key commercial species landed by UK vessels from the project area. However, they are of relatively low value when compared to total landings into Scotland; combined, landings of saithe from the wider area within which the project sits comprises only 0.1% of the value of landings into Scotland in 2016. Other species of commercial value include: mackerel, megrim, cod and monkfish/anglers	
Other users	
Shipping activity	There is very little shipping activity in the project area, and no sites of renewable or archaeological interest. There is also limited infrastructure related to other oil and gas developments.
Oil and Gas	Several offshore platforms surround the Dunlin Alpha installation, these include: Tern, Cormorant North, Eider A, Thistle A, Murchison (being decommissioned), Statfjord B, Brent C, and Heather A.
Telecommunications	There are no cables in the vicinity of the project area other than the Dunlin Power Import cable (running from the Dunlin Alpha platform to the Brent Charlie platform).
Military activities	There are no charted military Practice and Exercise Areas (PEXAs) and Unexploded Ordinances (UXOs) in the vicinity of the project area.
Renewables	There is no renewable energy activity in the vicinity of the project area; the closest potential renewable site is a Draft Plan Option for tidal energy, at Muckle Flugga (north of Shetland), located approximately 120 km south-west of Block 211/23.
Wrecks	There are no designated wreck sites in the vicinity of the project area. There is a non-designated wreck record to the north of Block 211/23, where the Dunlin Alpha platform is located.

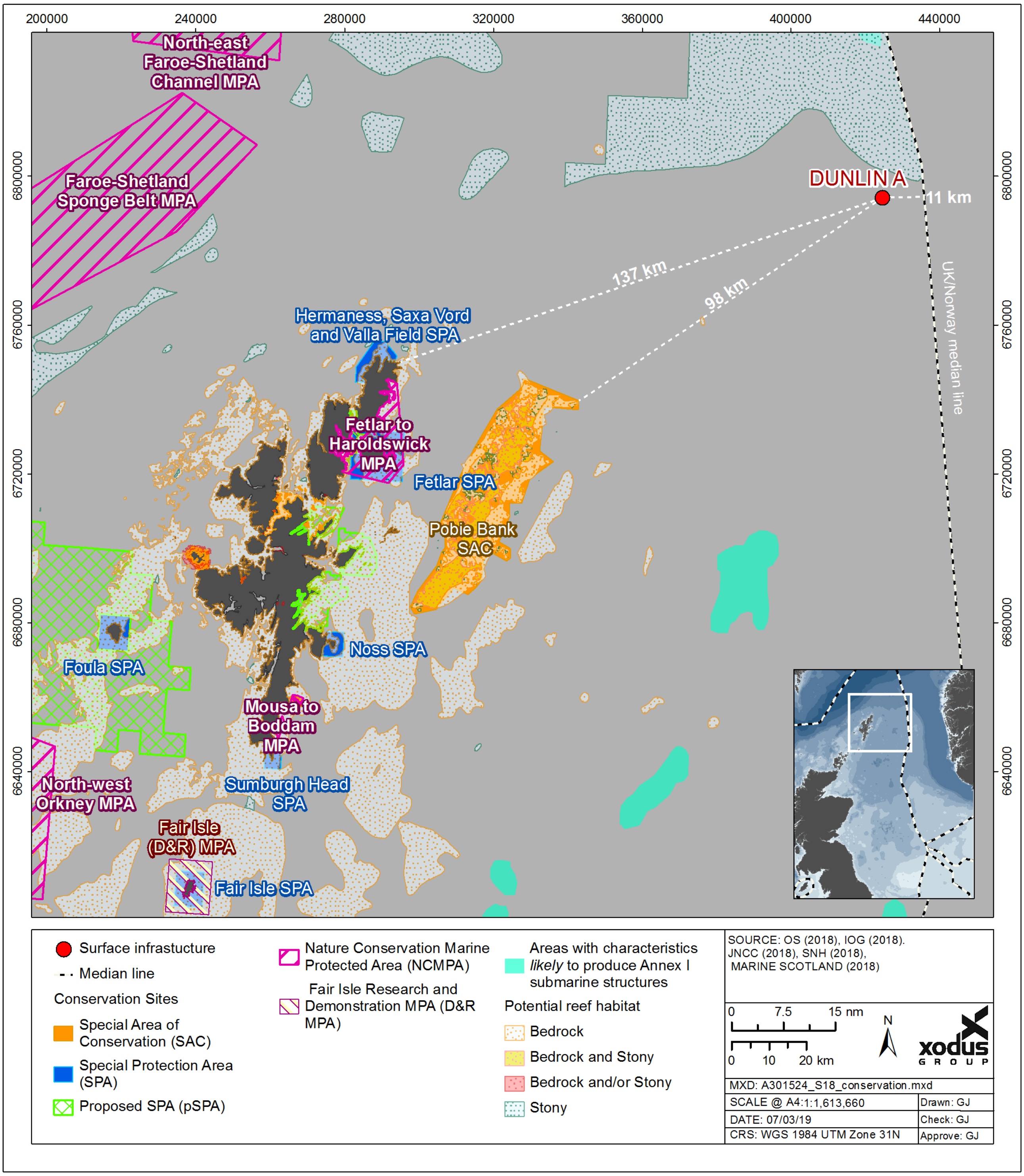

Figure iv Conservation Areas in Proximity to Dunlin Alpha Installation

Impact Assessment

An initial screening of the impacts and receptors was undertaken as part of the environmental identification (ENVID) process (Appendix A).

Where potentially significant impacts have been identified, mitigation measures have been considered. The intention is that such measures should remove, reduce or manage the potential impacts to a point where the impacts are not significant or 'as low as reasonably practicable' (ALARP). Table iii presents the findings of the environmental impact assessment for the potentially significant impacts identified for the project. The potential for cumulative and transboundary impacts is also considered.

Table iii Details of the Potential Environmental Impact of the Proposed Activities

Impact	Further assessment	Rationale
Emissions to air	No	Fairfield recognises that atmospheric emissions generated from vessels can act cumulatively with those from other activities (such as onshore power generation and use of vehicles) to contribute to global climate change. However, emissions during decommissioning activities (largely comprising fuel combustion gases) will occur in the context of the cessation of production. As such, emissions from operations and vessels associated with operation of the Dunlin Alpha topsides will cease. Reviewing historical European Union (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 production. A review of previous decommissioning environmental impact assessment reports shows that atmospheric emissions in highly dispersive offshore environments are exclusively concluded to have no significant impact and are usually extremely small in the context of UKCS/global emissions. Most reports also note that emissions from short-term decommissioning activities are small compared to those previously arising from the asset over its operational life. The majority of emissions for the Dunlin Alpha topsides decommissioning relate to the vessel time or are associated with the recycling of material returned to shore. As the decommissioning activities proposed are of such short duration (54 days) this aspect is not anticipated to result in significant impact. Atmospheric emissions were calculated in line with IoP guidelines (IoP, 2000). The estimated CO_2 emissions to be generated by the selected decommissioning options are 41,956.2 Te, equating to less than 0.03% of the total UKCS vessel emissions (excluding fishing vessels) in 2014 (BEIS, 2017). Summary tables and assumptions used during the calculation of this estimate are provided in Appendix C. Considering the above, atmospheric emissions do not warrant further assessment.
Disturbance to the seabed	No	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 seabed interaction associated with the decommissioning of the topsides. Should this change following the detail design process and an anchor vessel be required, any potential impact would be assessed and

Impact	Further assessment	Rationale
		captured in any supporting permit applications via the Portal Environmental Tracking System (PETS). On this basis, no further assessment need be undertaken.
Physical presence of vessels in relation to other sea users	No	The presence of a small number of vessels for topsides decommissioning activities will be relatively short-term in the context of the life of the Dunlin Alpha installation. Activity will occur using similar vessels to those currently deployed for oil and gas installation, operation and decommissioning activities. The small number of vessels required will also generally be in use within the existing 500 m safety exclusion zone and will not occupy 'new' areas. Other sea users will be notified in advance of activities occurring meaning those stakeholders will have time to make any necessary alternative arrangements for the very limited period of operations. The decommissioning of the Dunlin Alpha topsides is estimated to require up to five vessels depending on the selected method of removal, however these would not all be on location at the same time (maximum of three at any one time). A review of previously submitted decommissioning environmental impact assessment reports and environmental appraisals show that some projects indicate a greater potential issue with short-term vessel presence, but those largely relate to project-specific sensitive locations, which is not the case for this decommissioning project. Considering the above, temporary presence of vessels does not need further assessment.
Physical presence of infrastructure decommissioned *in situ* in relation to other sea users	No	As topsides will be fully removed, there will be no mechanism for associated long-term impact through physical presence. Once the topsides are removed the 500 m safety exclusion zone will remain in effect alongside the deployment and maintenance of suitable navigational aids. The subsequent use and fate of these aspects will be discussed as part of the CGBS EA. Considering the above, no further assessment relating to the long-term presence of infrastructure will be covered within this EA.
Discharges to sea (short-term and long-term)	No	Discharges from vessels are typically well-controlled activities that are regulated through vessel and machinery design, management and operation procedures. In addition, topsides process pipework and equipment will be drained and flushed prior to any decommissioning activities commencing. There would be no planned discharges from the topsides themselves. Any residual material which remains will be expected to be at trace levels/volumes following the flushing regime and therefore would not pose any significant risk. OPEP modelling for a release of hydrocarbons associated with a collision of vessels indicates no significant impact based on distance from shore. This was based on a volume of 3,500 m^3 of diesel; any residual hydrocarbons are expected to be significantly smaller in volume than those present on that of the modelled vessel. As topsides will be fully removed, there will be no potential for long-term release from the facilities. Considering the above, discharges to sea from the topsides do not need to be assessed further.
Underwater noise emissions	No	Cutting required to remove the topsides will take place primarily above the waterline with only a short period of cutting below the

Impact	Further assessment	Rationale
		waterline, associated with the CGF removal activities. Vessel presence will be limited in duration. The project is not located within an area protected for marine mammals. With industry-standard mitigation measures and JNCC guidance, EAs for offshore oil and gas decommissioning projects typically show no injury, or significant disturbance associated with these projects (Shell, 2017; CNRI, 2013; CNRI, 2017; and Marathon, 2017). On this basis, underwater noise assessment does not need to be assessed further.
Resource use	No	Generally, resource use from the proposed activities will require limited raw materials and be largely restricted to fuel use. Such use of resources is not typically an issue of concern in offshore oil and gas. The estimated total energy usage for the proposed topsides decommissioning project is 497,607 GJ. Material will be returned to shore as a result of project activities and the expectation is that at least 95% of this will be recycled. There may be instances where infrastructure returned to shore is contaminated and cannot be recycled, but the weight/volume of such material is not expected to result in substantial landfill use (e.g. NORM circa 30 Te). Considering the above, resource use does not warrant further assessment.
Onshore activities	No	The OPRED decommissioning guidance notes state that onshore activities are not in scope of decommissioning EAs, and this topic does not require further assessment. It should be noted that through Fairfield's waste management strategy only licensed contractors will be considered who can demonstrate they are capable of handling and processing the types and quantities of material to be brought ashore. This will form part of the commercial tendering process.
Waste	No	It is waste management, not generation, that is the issue across decommissioning projects, with capacity to handle waste within the UK often cited as a stakeholder concern. All waste materials brought to shore, which will be routine in nature, will be managed as part of the project waste management plan, using approved waste contractors. Waste will be managed in line with Fairfield's waste management strategy and an active waste management plan will be developed and maintained. On this basis, no further assessment of waste is necessary.
Unplanned events	No	The topsides process system will have been flushed and drained prior to the decommissioning activities described here being carried out. Release of a live hydrocarbon and chemical inventory is therefore not a relevant impact mechanism. The HLV to be used for removing the topsides is likely to have the largest fuel inventory of the few vessels involved in the decommissioning activities. However, the inventory is likely to be less than the worst-case crude oil spill from loss of well containment modelled and assessed in the Dunlin field OPEP. In addition, the vessel's fuel inventory is likely to be split between a number of separate fuel tanks, significantly reducing the likelihood of an instantaneous release of a full inventory. Overall, therefore, the

Impact	Further assessment	Rationale
		potential impact from fuel inventory release will be at worst equivalent to that already assessed and mitigated for the operational phase of Dunlin Alpha. The current OPEP for the Dunlin Alpha topsides considers a diesel release of approx. 3,500 m^3. The results of the spill modelling indicate a very low probability of landfall (less than 5%, after 6 days) and any beached volume would be extremely small (circa. 35 m^3). As the methodology for the topsides removal to shore has not been defined in detail, there exists the possibility that during transport of the topsides materials, elements may dislodge and drop from the transport vessel. Dropped object procedures are industry standard and there is only a very remote probability of any interaction with any live infrastructure. Considering the above, the potential impacts from accidental chemical/hydrocarbon releases during decommissioning activities do not warrant further assessment. Although the risk of oil spill is remote, an OPEP will remain in place for the duration of the Dunlin Alpha decommissioning activities. Any spills from vessels in transit and outside the 500 m safety exclusion zone are covered by a separate Shipboard Oil Pollution Emergency Plan (SOPEP). Up to five vessels will be deployed during decommissioning activities, including two HLVs, two tug vessels and a standby/support vessel.

Environmental Management

The project has limited activity associated with it beyond the main period of preparation for decommissioning activities (engineering down and cleaning) and removal of the topside components themselves; there are likely to be only a small number of post-decommissioning surveys. The focus of environmental performance management for the project is therefore to ensure that the activities that will take place during the limited period of decommissioning happen in a safe, compliant and acceptable manner. The primary mechanism by which this will occur is through Fairfield's Environmental Management Policy and specifically through the associated Environmental Management System that Fairfield operates.

Fairfield senior management is responsible for ensuring that the company's Environmental Management System is applied to all activities. To support this, a project Health, Safety and Environment (HSE) Plan will be developed which outlines how HSE issues will be managed and how the policies will be implemented effectively throughout the project. The plan will apply to all work carried out, whether onshore or offshore. Performance will be measured to satisfy regulatory requirements including compliance with environmental consents, as well as to identify progress on fulfilment of project objectives and commitments.

Fairfield has also developed a waste management strategy for the project in order to describe the types of materials identified as decommissioning waste and to outline the processes and procedures necessary to support the Decommissioning Programme for the Dunlin Alpha topsides. The waste management strategy details the measures in place to ensure that the principles of the waste management hierarchy are followed during the decommissioning (as shown in Figure v).

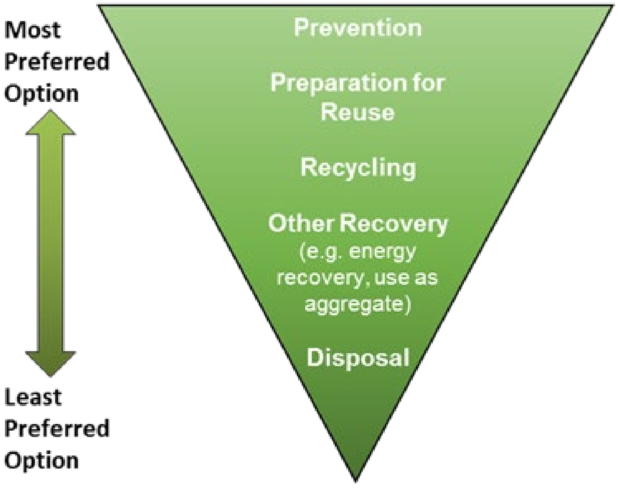

Figure v Waste Hierarchy

Conclusions

The proposed topsides decommissioning operations have been assessed for the potential to cause significant impacts on environmental or social receptors across the UKCS. Following review of the relevant activities associated with the Dunlin Alpha topsides decommissioning project, the environmental sensitivities of the project area, industry experience with decommissioning activities and of stakeholder concerns, it has been determined that there are no issues associated with the decommissioning that pose any significant risk to these receptors.

1. Introduction

1.1. The Greater Dunlin Area

Fairfield Betula Limited and Fairfield Fagus Limited, wholly owned subsidiaries of Fairfield Energy Limited (Fairfield), are the operators of the Dunlin, Merlin and Osprey fields (the 'Greater Dunlin Area'), located in United Kingdom Continental Shelf (UKCS) Block 211/23 of the northern North Sea. The Dunlin field lies approximately 137 km from the nearest landfall point, 197 km north east of Lerwick and 508 km north east of Aberdeen. The field sits 11 km from the United Kingdom (UK)/Norway median line and in a water depth of approximately 151 m (Figure 1.1).

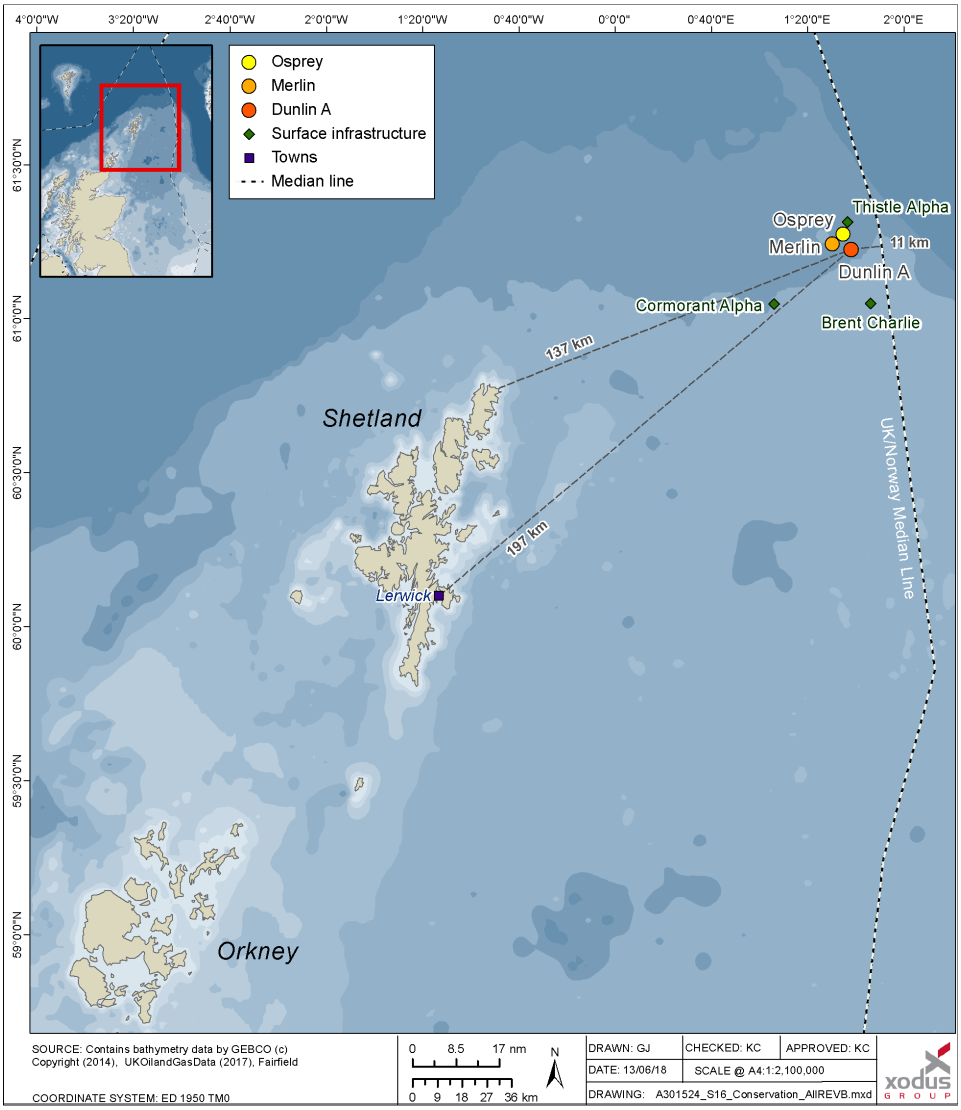

Figure 1.1 Location of the Dunlin, Merlin and Osprey Fields

A layout of the infrastructure associated with these fields, in the context of the wider area, is shown in Figure 1.2.

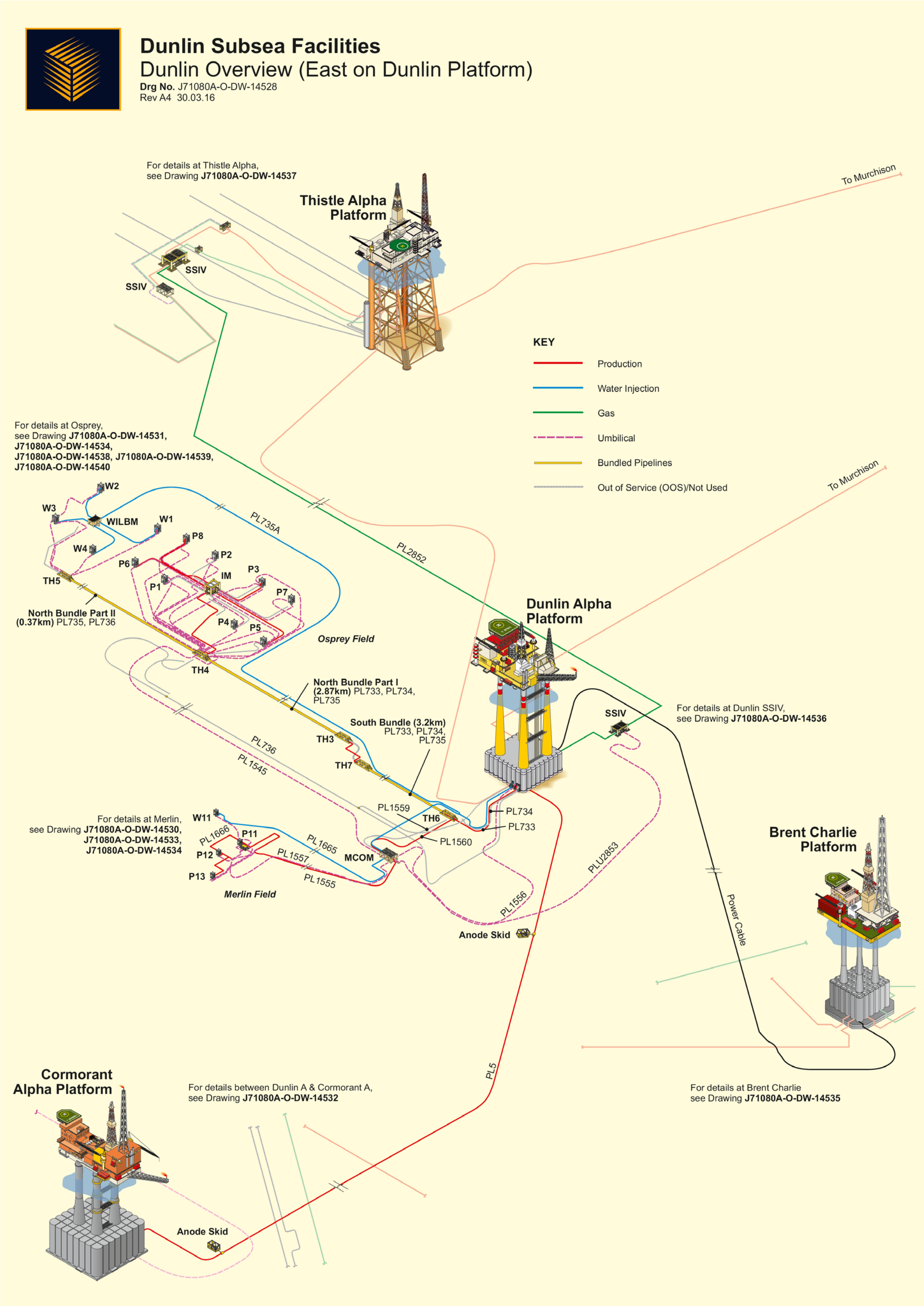

Figure 1.2 Dunlin Alpha Installation in the Context of the Wider Area

Production at the Dunlin, Merlin and Osprey fields ceased in June 2015 and Fairfield is now in the process of decommissioning all infrastructure associated with the Greater Dunlin Area. The decommissioning of the Dunlin, Merlin and Osprey subsea infrastructure has been considered separately from the Dunlin Alpha installation activities, and approval of the Decommissioning Programmes for that infrastructure has been received. In addition, planning for the decommissioning of the Dunlin Alpha to Cormorant Alpha pipeline (PL5) is also being progressed.

Proposals for the decommissioning of the Dunlin Alpha installation were submitted to the Department of Business, Energy and Industrial Strategy (BEIS) and subjected to formal consultation in Q3-2018. Following this extensive consultation, and in agreement with OPRED, it has been decided to split the Dunlin Alpha Decommissioning Programme (FBL-DUN-DUNA-HSE-01-PLN-0001) into two separate programmes. These are:

- Dunlin Alpha Topsides Decommissioning Programme; and
- Dunlin Alpha Substructure Decommissioning Programme

This Environmental Appraisal (EA) report relates specifically to the activities associated with the proposed Dunlin Alpha topsides decommissioning programme. Consultation feedback relating to the environmental impacts associated with topsides removal has been considered and is addressed, where applicable, in this document. A description of the infrastructure covered under this EA is provided in Section 2.2.

Consultation feedback relating to environmental impacts associated with the substructure will similarly be addressed and incorporated into the Dunlin Alpha Substructure Decommissioning Environmental Appraisal Report, which will be submitted in support of consultation with the OSPAR Contracting Parties.

1.2. The Dunlin Alpha Topsides Decommissioning Project

The Dunlin Alpha installation is a four-leg installation, constructed on a concrete gravity base substructure (CGBS), with a steel box girder-based topsides supporting two levels of modules. The structures visible above the sea surface in its current offshore location are shown in Figure 1.3. The Dunlin Alpha installation was installed in 1977 and, after the drilling of initial wells, oil production began in 1978. A schematic of the Dunlin Alpha installation is shown in Figure 1.4.

Figure 1.3 Dunlin Alpha Installation

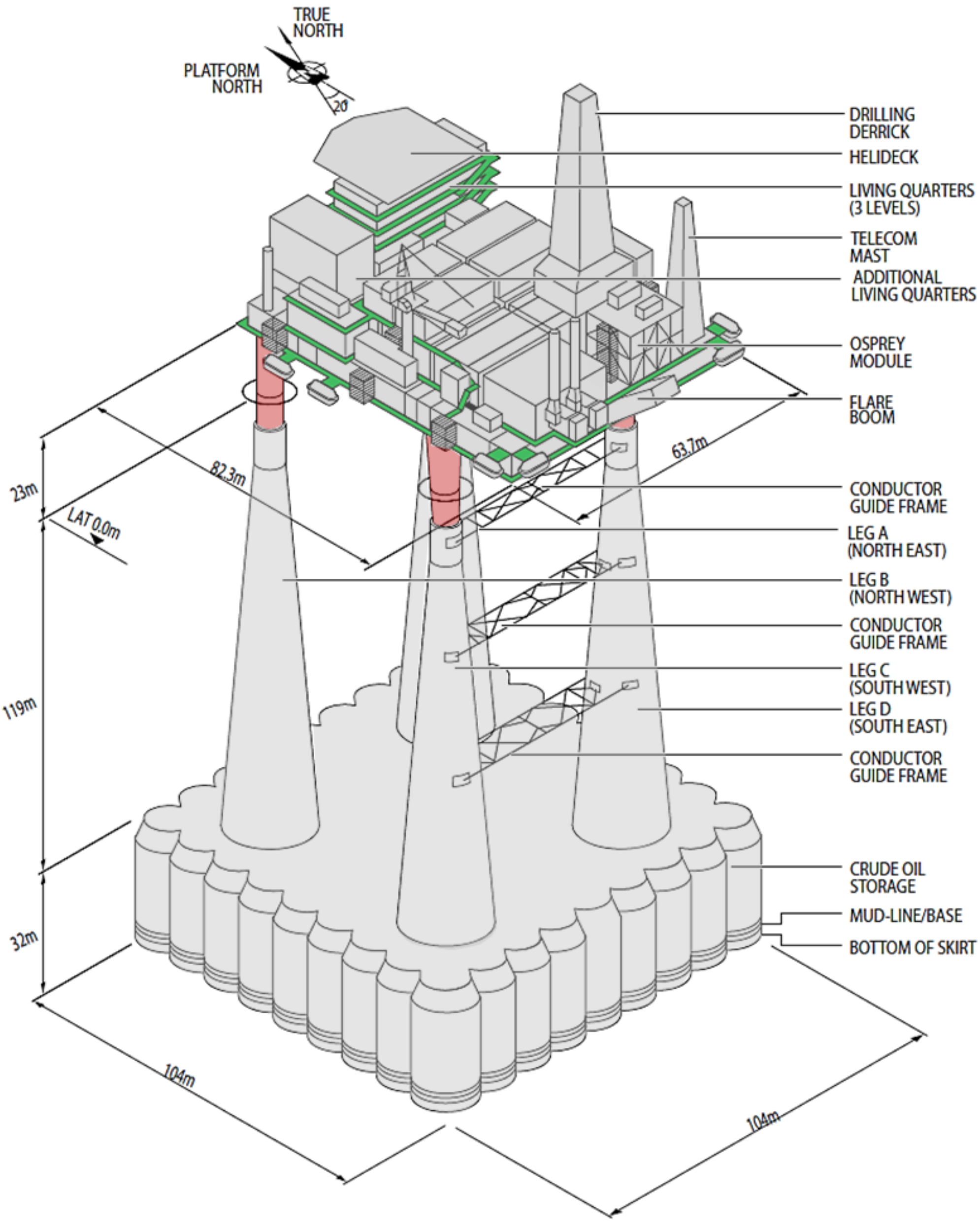

Figure 1.4 Schematic of the Dunlin Alpha Installation

1.3. Regulatory Context

1.3.1. Decommissioning Overview

The decommissioning of offshore oil and gas installations and pipelines on the UKCS is controlled through the Petroleum Act 1998 (as amended[1]). Decommissioning activities are also regulated under the Marine and

[1] The most recent amendment to the Petroleum Act 1998 was by the Energy Act 2016 which, amongst others, requires relevant persons to consult the UK Oil and Gas Authority (OGA) before submitting an abandonment programme to the

Coastal Access Act 2009 and Marine (Scotland) Act 2010 ('the Marine Acts'). The UK's international obligations on decommissioning are primarily governed by the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (the Oslo Paris (OSPAR) Convention).

The responsibility for ensuring compliance with the Petroleum Act 1998 rests with Department of Business, Energy and Industrial Strategy (BEIS), formerly the Department for Energy and Climate Change (DECC) and is managed through its regulatory body the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED). OPRED is also the Competent Authority on decommissioning in the UK for OSPAR purposes and under the Marine Acts.

The Petroleum Act 1998 (as amended) governs the decommissioning of offshore oil and gas infrastructure on the UKCS. The Act 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 OPRED, before initiating decommissioning work. The DP must outline in detail the infrastructure to be decommissioned and the method by which the decommissioning will take place.

The primary guidance for offshore decommissioning from the regulator OPRED (BEIS, 2018) details the need for an EA to be submitted in support of the DP. The guidance notes set out a framework for the required environmental inputs and deliverables throughout the approval process. The guidance outlines that an EA should be a document providing necessary content in proportion to the complexity and magnitude of a project. DECOM North Sea's Environmental Appraisal Guidelines for Offshore Oil and Gas Decommissioning (Decom North Sea, 2017) provides further definition on the requirements of EA Reports.

1.3.2. OSPAR Decision 98/3

As a Contracting Party of the OSPAR Convention, the UK is required to implement OSPAR Decision 98/3, which prohibits leaving offshore installations wholly or partly in place. The legal requirement for operators to comply with the OSPAR Convention is transposed through the Petroleum Act 1998 (as amended), as detailed in the guidance notes – Decommissioning of Offshore Oil and Gas Installations and Pipelines (BEIS, 2018) which outline the expectations of the UK regulator in terms of complying with the relevant OSPAR decisions. OSPAR Decision 98/3 states that the topsides of all installations should be returned to shore.

1.4. Environmental Management

Relevant to the EA, and to all of Fairfield's activities, is the company's commitment to managing all environmental impacts associated with its activities. Continuous improvement in environmental performance is sought through effective project planning and implementation, emissions reduction, waste minimisation, waste management, and energy conservation. This mind set has fed into the development of the mitigation measures developed for the project (and detailed in Section 6.1). These include both industry standard and project-specific measures. A summary of Fairfield's Environmental Management Policy is presented in Figure 1.5.

Fairfield has a structured Environmental Management System (EMS), which is certified to the ISO 14001:2015 standard and which establishes the company standards for environmental risk management in accordance

Secretary of State for the department of Business, Energy and Industrial Strategy (BEIS), and to require the Secretary of State to consider representations from the OGA when deciding whether to approve a programme.

with the environmental policy. The EMS is an integral part of the overall business management system and provides a structured and systematic framework for implementing environmental policy as well as outlining the mechanisms through which compliance is maintained.

1.5. Scope and Structure of this Environmental Appraisal Report

As stated in Section 1.3.2, OSPAR Decision 98/3 states that the topsides of offshore installations must be removed during decommissioning. In accordance with this, Fairfield proposes to fully recover the topsides to shore. This EA report sets out to describe, in a proportionate manner, the potential environmental impacts of the proposed activities associated with decommissioning of the Dunlin Alpha topsides and to demonstrate the extent to which these can be mitigated and controlled to an acceptable level. This is achieved in the following sections, which cover:

- A description of the proposed decommissioning activities (Section 2);
- A discussion of the methodology used to assess the potential impact associated with the decommissioning work (Section 3);
- A summary of the baseline sensitivities relevant to the assessments that support this EA (Section 4);
- A review of the potential impacts from the proposed decommissioning activities and justification for the assessments that support this EA (Section 5); and
- Conclusions (Section 6).

This EA report has been prepared in line with Fairfield's environmental assessment requirements and has given due consideration to the OPRED decommissioning guidance notes (BEIS, 2018) and to Decom North Sea's Environmental Appraisal Guidelines for Offshore Oil and Gas Decommissioning (Decom North Sea, 2017).

It is the policy of Fairfield Energy Limited (Fairfield) to seek to conduct its business in a responsible manner that prevents pollution and promotes the preservation of the environment. Fairfield appreciates that our activities can interact with the natural environment in many ways. We recognise that sustained development of Fairfield and our long-term success depends upon achieving high standards of environmental performance. We are therefore committed to conducting our undertakings in an environmentally responsible manner. This means that we will:

- Integrate environmental considerations within our business and ensure that we treat these considerations with at least equal importance to those of productivity and profitability;
- Incorporate environmental risk assessment in our business management processes, and seek opportunities to reduce the environmental impact of our activities;
- Continually improve our environmental management performance;
- Comply with all environmental laws, regulations and standards applicable to our undertakings;
- Allocate necessary resources to implement this policy; and
- Communicate openly in matters of the environment with government authorities, industry partners and through public statements.

In particular, we will:

- Maintain an environmental management system in accordance with international best practice and with the BS-EN-ISO 14001:2015 standard, including arrangements for the regular review and audit of our environmental performance;
- Conduct environmental analyses and risk assessments in our areas of operation, in order to ensure that we understand the potential environmental impacts of our activities and that we identify the necessary means for addressing those impacts;
- Manage our emissions according to the principles of Best Available Techniques;
- Publish an annual statement on our public web site, providing a description of our environmental goals and performance; and
- Maintain incident and emergency systems in order to provide assessment, response and control of environmental impacts.

Ultimate responsibility for the effective environmental management of our activities rests with the Managing Director and the Board. This policy shall be implemented by line management through the development and implementation of working practices and procedures that assign clear responsibilities for specific environmental activities with our employees and contractors. In addition, each of our employees has a personal responsibility to conduct themselves in a manner that enables us to implement this policy and our environmental management system.

John Wiseman, Managing Director

Figure 1.5 Environmental Management Policy

2. Project Description

2.1. Description of Facilities to be Decommissioned

The Dunlin Alpha installation consists of a four-legged concrete gravity-base substructure (CGBS), with modular topsides facilities supported by a steel box girder module support frame (MSF), as shown in Figure 2.1. Steel transition columns (transitions) rise above the sea surface, connecting the top of the concrete legs to the bottom of the MSF. The installation is located in 151 m of water and is 240 m high from the seabed to the top of the drilling derrick. The installation was designed to accommodate 48 wells, with fluids from each well passing from the reservoir to the topsides within steel pipework, protected by an external steel conductor. Conductor stability is provided by three conductor guide frames (CGFs) located between Legs C and D (leg labels are shown on Figure 1.4).

As described in Section 1.1, the decision has been made, in agreement with OPRED, to split the Dunlin Alpha decommissioning programme into two separate programmes. The facilities covered under the Dunlin Alpha topsides decommissioning programme include:

- Dunlin Alpha topsides (full removal of topsides facility);
- Small section of the steel transitions connecting the topsides to the concrete legs;
- Well conductors (removal of well conductors down to the lower conductor guide frame); and
- Conductor guide frames (removal of the middle and upper conductor guide frames).

Figure 2.1 provides an illustration of the infrastructure to be recovered (indicated in brown). Recovery of the well conductors is being completed under ongoing well decommissioning operations and will be completed down to the lower CGF level before completion of the topsides and CGF removal scopes. As a result, removal of well conductors is not covered under this EA. All remaining infrastructure will be addressed as part of the Dunlin Alpha Substructure Decommissioning Programme.

2.1.1. Topsides

The Dunlin Alpha topsides comprises the MSF and all facilities and modules that it supports. It was originally designed as a drilling and production installation, with accommodation facilities for over 140 personnel. The topsides package is constructed over three levels and weighs approximately 19,640 tonnes.

Figure 2.2 shows the topsides construction/layout of modules, comprising:

- The lower deck (known as the module support frame (MSF)) with six sections creating 45 void spaces. This deck consists of compartmentalised steel box girders, and is approximately 85 m x 67 m. The flare boom is cantilevered from the back of the lower deck on the southern side.
- The module deck with 10 main modules and additional utility modules for various services. The module deck is located above the MSF and consists of ten main production and utilities modules, including the well bay, process vessels, and power generation equipment.
- The drilling deck with 14 modules including the accommodation. The drilling deck is located above the module deck and consists of the drilling package, platform cranes and living quarters. The helideck is located above the accommodation modules.

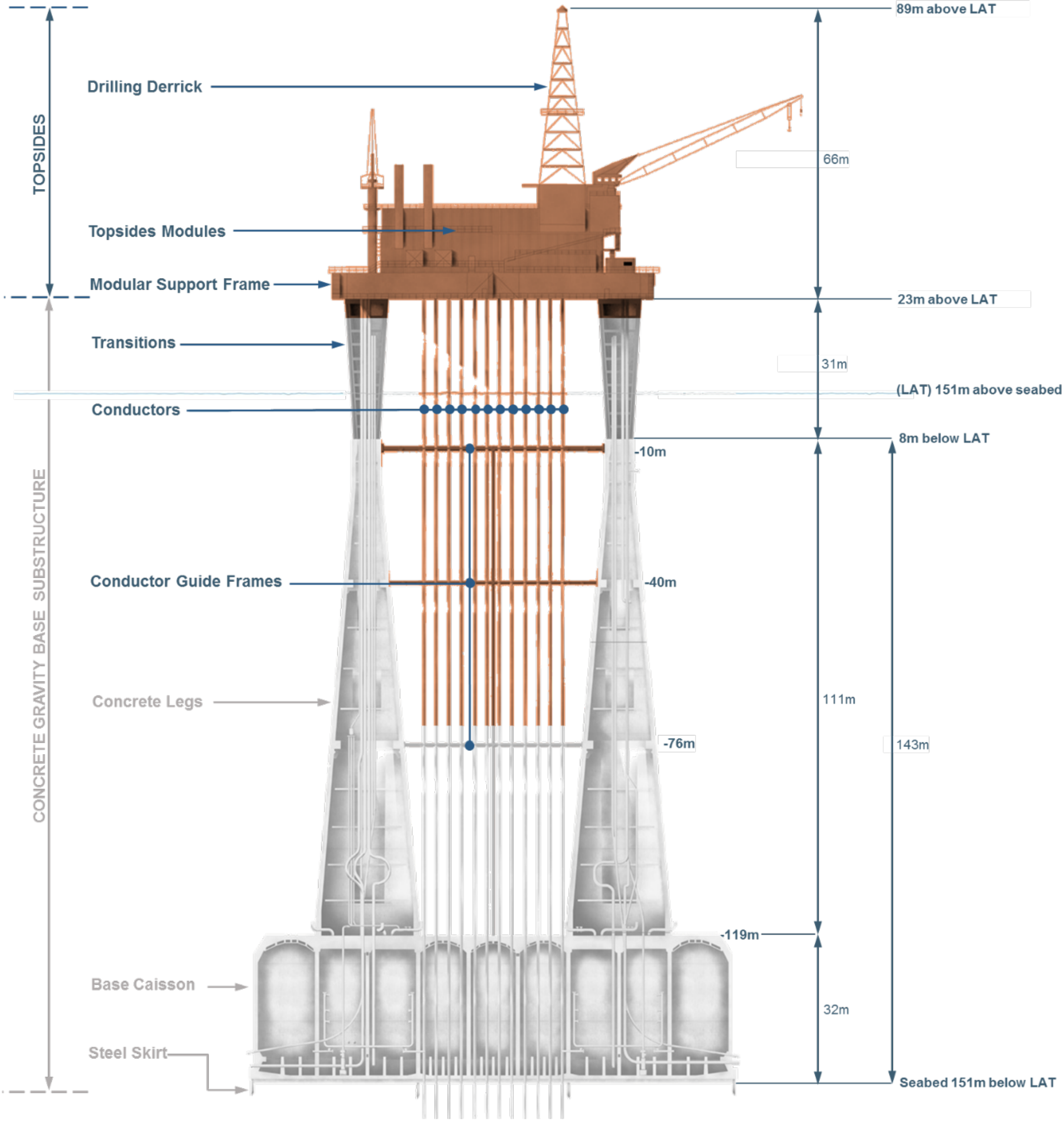

Figure 2.1 Dunlin Alpha installation

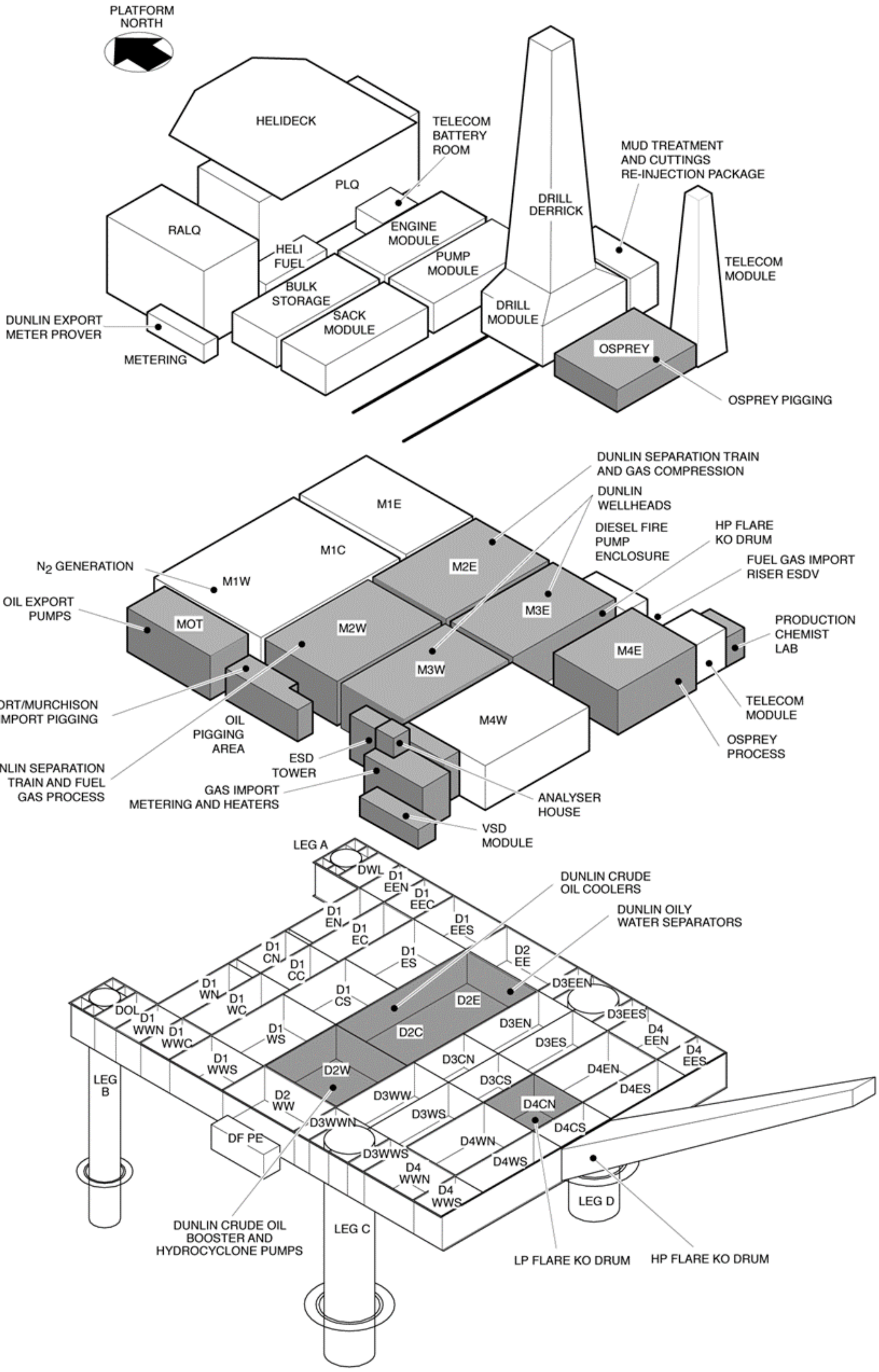

Figure 2.2 Isometric Description of the Dunlin Alpha Topsides

2.1.2. Steel Leg Transitions and Conductor Guide Frames

The topsides are secured to the concrete legs with four stiffened steel plate leg transitions. The 31 m tall leg transitions are attached to the concrete legs at 8 m below LAT and the bottom of the MSF at 23 m above LAT. The transitions on Legs C and D weigh approximately 500 Te each and change in cross section from approximately 6 m circular shape diameter at the top of the concrete legs to approximately 8.7 m square section at the underside of the MSF. The other two steel transitions (on Legs A and B) weigh approximately 295 Te each and are 5.4 m circular shape diameter changing to a 5.4 m square section at the deck underside. This is represented graphically in Figure 2.3.

The topsides will be separated from the CGBS by cutting through the steel transitions at a point below the interface with the MSF. As such, short sections of the top of each transition piece will be removed and transferred to shore along with the platform topsides[2].

Spanning between Legs C and D at 10 m, 40 m and 76 m below LAT are three horizontal steel guide frames. The function of these frames is to provide horizontal support to the 48 well conductors against wave action forces. The conductors are supported in a matrix of holes through the frames arranged in a 12 x 4 pattern (Figure 2.3). Each of the three CGFs weighs approximately 200 Te. As stated in Section 2.2, the top two conductor guide frames will be removed to shore as part of the proposed decommissioning scope.

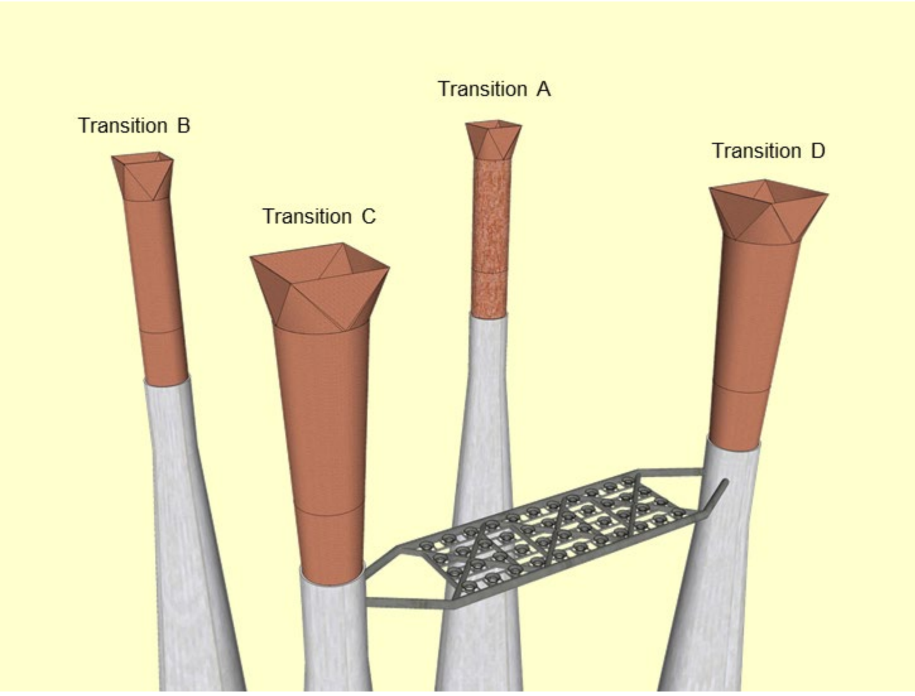

Figure 2.3 Leg Transitions and Conductor Guide Frame (topsides and conductors not shown)

[2] The optimum cut point will be determined following ongoing engineering study. The base-case for the project assumes a 3 m section of the top of each transition piece will be removed and transferred to shore along with the platform topsides.

2.1.3. Materials Inventory

During the decommissioning of the Dunlin Alpha topsides, there will be a wide range of materials that will need to be processed and, where possible either reused or recycled. Detailed inventory assessments have been undertaken to characterise and quantify both hazardous and non-hazardous materials to be decommissioned. A summary of the estimated materials inventory to be recovered as a result of the proposed topsides decommissioning operations is provided in Table 2.1 and Figure 2.4.

Table 2.1 Estimated Inventory of Recovered Materials

Dunlin Alpha Topsides		
Material	Description	Mass (Te)
Steel	Ferrous	17,790
	Non-Ferrous (Copper, Aluminium, Alloys…)	750
Concrete	Aggregates (concrete; cement)	110
Plastics	Polymers (PVC/uPVC; nylon)	340
Hazardous	Asbestos (asbestos containing material)	170
	Residual fluids (hydrocarbons; chemicals; control fluid)	30
	Heavy metals (batteries; paint coatings)	45
	WEEE; Cables	105
	NORM scale	30
	Other hazardous	10
Other	Fibreglass, Manolite, Insulation, Wood, Glass, Ceramics	260
	Subtotal	19,640
Transition Pieces		
Material	Description	Mass (Te)
Steel	Ferrous	153
Hazardous	Paint Coatings	2
	Marine Growth	tbc*
	Subtotal	155
Conductors		
Material	Description	Mass (Te)
Steel	Ferrous	2,290
Hazardous	Marine Growth	tbc*
	Subtotal	2,290
Conductors Guide Frames		
Description	Description	Mass (Te)
Steel	Ferrous	440
Hazardous	Paint Coatings	5
	Marine Growth	tbc*
	Subtotal	445
	Total (tonnes)	**≈ 22,530**

* The weight of marine growth returned to shore will be confirmed at the receiving yard. As a worst-case estimate the total marine growth likely to be on the structures will be approximately 83 Te. However, it is highly likely a large portion of this will be removed offshore during the cutting and lifting operations.

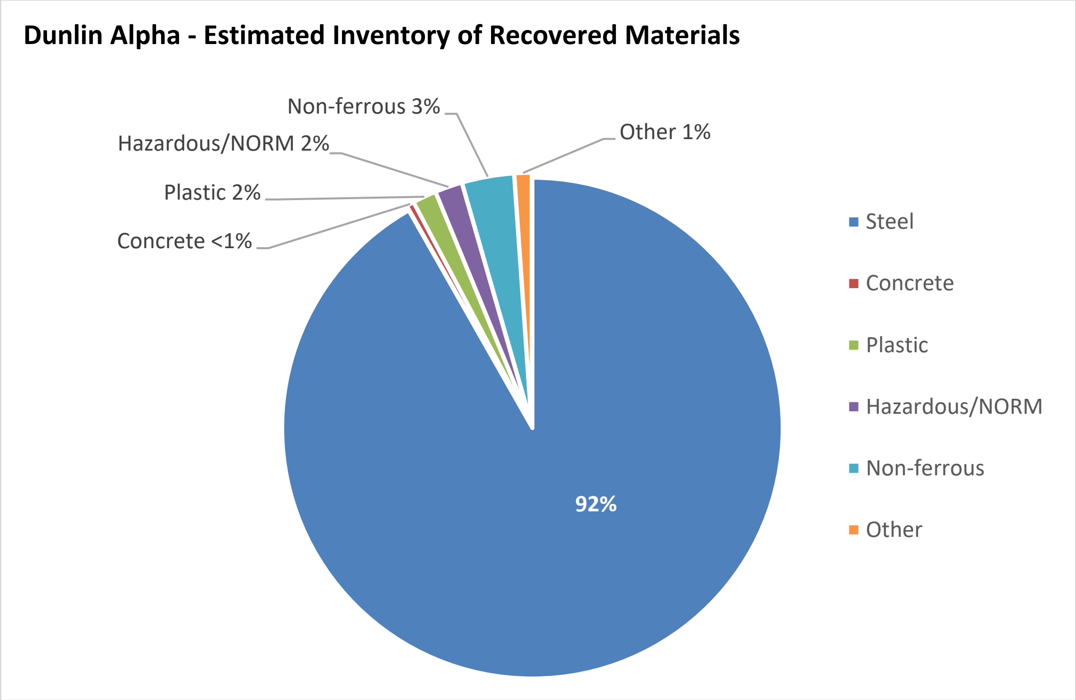

Figure 2.4 Breakdown of Recovered Materials from the Proposed Decommissioning Activities

2.2. Consideration of Alternatives and Selected Approach

2.2.1. Alternative to Decommissioning

The Dunlin Alpha installation supported production from the Dunlin, Merlin and Osprey fields. Options to re-use the infrastructure *in situ* for future hydrocarbon developments were assessed but did not yield any viable commercial opportunity. There are several reasons for this, including the absence of remaining hydrocarbon reserves in the vicinity of Dunlin Alpha. It is considered unlikely that any opportunity to reuse the infrastructure *in situ* will be feasible. As such, there is no reason to delay decommissioning of the Dunlin Alpha installation.

In line with the latest OPRED decommissioning guidance notes (BEIS, 2018), Fairfield has committed to decommissioning the Dunlin Alpha topsides as described below.

2.2.2. Options for Decommissioning the Dunlin Alpha Topsides

As discussed in Section 1.3.2, OSPAR Decision 98/3 mandates that the topsides of decommissioned offshore installations must be removed. In accordance with this, Fairfield have completed extensive engineering study work and engaged with a number of experienced contractors in order to understand the feasibility of different decommissioning methods for the Dunlin Alpha topsides. These options are outlined in Table 2.2.

Table 2.2 Description of Topsides Removal Options

Method	Description
Single lift removal by SLV	Removal of topsides as a complete unit using a Single Lift Vessel (SLV), and transportation to onshore facility for deconstruction. Selected equipment to be re-used, and deconstructed material to be recovered for recycling and/or disposal.
Reverse installation (piece large) by SLV/HLV	Removal of separated topsides modules by Heavy Lift Vessel (HLV) for transportation to onshore facility for deconstruction. Selected equipment to be re-used, and deconstructed material to be recovered for recycling and/or disposal.
Offshore deconstruction (piece small)	Removal of topsides by breaking up offshore and transporting to shore using monohull crane vessel and work barge. Recovered materials will be sorted for re-use, recycling or disposal at an onshore facility.
Combination of removal methods	A combination of piece small and reverse installation methods, with potential single or multi-lift of the MSF (one to six sections) using a HLV. All materials will be transported to onshore facility for reuse, recycling and/or disposal.

Fairfield have subsequently completed a commercial tendering process that has resulted in the selection of an ‘optimised’ reverse installation as the preferred topsides removal method. Further information on how this will be achieved is provided in Section 2.3.3.1.

2.3. Decommissioning Activities

2.3.1. Schedule

The specific timing of decommissioning activities will be discussed with OPRED and with the Health and Safety Executive (HSE) and applications for all relevant permits and consents will be submitted and approval sought prior to activities taking place. Fairfield anticipates executing the Dunlin Alpha topsides decommissioning activities between 2021 and 2026. An indicative schedule for the work is shown in Figure 2.4. The removal of the topsides and transit to the decommissioning facility is likely to be completed over one season.

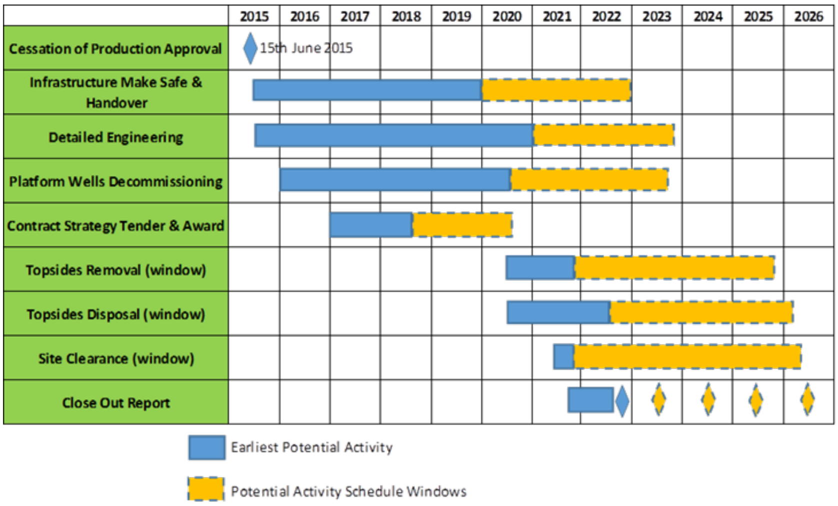

Figure 2.4 Indicative Schedule

2.3.2. Preparation for Decommissioning

The following sections provide a brief description of the main activities being undertaken on Dunlin Alpha prior to removal of the topsides by the selected decommissioning contractor.

2.3.2.1. Well Decommissioning

Note: Well decommissioning is not within the scope of this Environmental Appraisal, and 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 within this report will begin.

All 45 Dunlin platform wells are in the process of being permanently decommissioned as part of a large-scale well decommissioning campaign which commenced in 2016. Well decommissioning is achieved by the establishment of barriers (i.e. the placement of cement plugs in the well) which are necessary to isolate permeable zones, fluids and pressures permanently. Well decommissioning activities are conducted in accordance with the policies and standards outlined in the Oil & Gas UK Well Decommissioning Guidelines, Issue 6 (June 2018), Fairfield's Well Design and Operations Management System and the Fairfield Well Abandonment Basis of Design Document.

2.3.2.2. Make Safe and Handover Preparations

Note: These operations are not within the scope of this Environmental Appraisal, and they have been or will be assessed as part of ongoing operations of the facilities. A description is included here to describe the activities leading up to the point that the decommissioning activities that are assessed within this report will begin.

Production operations on Dunlin Alpha ceased in June 2015. Since then, the Make Safe and Handover (MSH) team have been responsible for transitioning the Dunlin Alpha from a live production installation to a state of permanent shutdown (known as 'cold stack'), with all systems isolated and process equipment de-oiled, flushed and drained in preparation for the topsides removal phase.

During flushing and isolation activities, all the processing systems on the installation will be progressively depressurised and rendered safe for removal operations. Fairfield and the selected decommissioning contractor will jointly ensure that this standard has been achieved. Any remaining hydrocarbons, chemicals and other hazardous materials will be managed onshore at an appropriately licensed facility.

Where possible, pipework and tanks will be visually inspected to identify potential safety and environmental hazards and may be further treated should any sources of potential spills of oils and other fluids be identified. Removal of residual materials (i.e. hydrocarbons, sand, naturally occurring radioactive materials (NORM), process chemicals) may be required in order to reduce safety risks and prevent the release of pollutants during topsides removal operations.

MSH activities will also be undertaken to prepare the concrete legs prior to removal of the Dunlin Alpha topsides. These activities will involve the de-oiling of pipework and the removal of hazardous materials and substances from within the legs. Process pipework will be grouted to isolate the topsides facilities from the base caisson storage cells, and each of the legs will be partially flooded. Fairfield then proposes to install reinforced concrete plugs at the top of each of transition piece prior to topsides removal. Further information regarding the condition of the CGBS will be provided in the Dunlin Alpha Substructure DP and EA.

Environmental impacts associated with these activities will be managed through the application of permits (either under existing permits amended as necessary or under new permits) in accordance with relevant regulations (e.g. Offshore Chemical Regulations 2002 (as amended), Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended)).

2.3.2.3. Removal of Installation Conductors

Note: Conductor removals are not within the scope of this Environmental Appraisal, and 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 within this report will begin.

Tubulars (pipework) for each of the 45 platform wells are protected by 30 inch environmental conductors. The conductors extend from below the seabed to the platform module deck, and run through three CGFs located between Leg C and Leg D of the Dunlin Alpha CGBS (Figure 2.3) as described in Section 2.1.2.

The conductors will be removed as part of the Dunlin well decommissioning programme. These operations will involve cutting each conductor at a depth just above the lower conductor guide frame and removing them to shore for recycling or disposal. The lower sections of the conductors will be left *in situ* and managed as part of the Dunlin Alpha CGBS Decommissioning Programme. Any discharges from these operations will be managed in accordance with approved environmental permits as required.

2.3.2.4. Cold Stack Phase

Upon completion of decommissioning and MSH activities, the installation will be placed in a cold stack prior to the topsides removal phase. During this period, the platform will remain unmanned and power generation will be permanently isolated. Temporary, Aid to Navigation (AtoN) units will be installed prior to cold stack to ensure that the installation meets all operational and regulatory requirements. It is envisaged that the system will be developed in consultation with the Northern Lighthouse Board (NLB), and monitoring and maintenance of the system will be via a service contract with a specialist contractor. The existing 500 m safety exclusion zone will remain in operation during the cold stack phase.

In addition to the maintenance of navigational aids, Fairfield will continue to maintain an Oil Pollution Emergency Plan (OPEP) for the installation and a Dismantling Safety Case will be in place to cover all activities required to complete topsides removal operations.

2.3.3. Decommissioning Activities

2.3.3.1. Topsides

The Dunlin Alpha topsides are planned to be removed by means of “optimised reversed installation”, which means that the modules will generally be removed in the same way they were installed but optimised within the capabilities of current equipment and considering structural limitations of the platform itself. Fairfield has selected Heerema Marine Contractors (HMC) and AF Offshore Decom (AFOD), together known as the HAF consortium, as the decommissioning contractor for the topsides removal project. HAF have extensive experience of the proposed removal method based on numerous successful projects both in the past and currently ongoing.

Apart from the module support frame (MSF), all modules of the Dunlin Alpha platform can be lifted by single crane of a Heavy Lift Vessel (HLV), enabling modules to be landed on the vessel deck after removal. The MSF can then be lifted by the dual cranes of a larger HLV. It is therefore envisaged that the base case topsides removal campaign will be split into two phases, using two different HLVs.

Phase 1 of the removal operations will use an HLV to remove the first batch of modules and perform the majority of the removal preparations on the platform. The large accommodation capacity of the HLV will allow the platform removal preparations to be completed as swiftly and efficiently as possible, reducing the scope of work for the second, larger HLV. Once separated, modules will be lifted to the vessel deck before sailing to the decommissioning yard for offloading. Some of the modules will also be transferred to a cargo barge at a suitable moment with favourable weather, in order to accommodate all Phase 1 removals in a single mobilisation of the HLV.

Phase 2 of the removal operations will then use a larger HLV to lift and secure the MSF and any remaining modules for transport to the decommissioning yard. Separation of the MSF from the CGBS will be achieved by cutting the steel transition pieces at the top of each leg, just below the MSF. As a result, a short section of each steel transition piece will also be recovered and transported to the decommissioning yard for recycling.

Positioning of the HLVs will be done using the class III dynamic positioning system, allowing the vessels to be optimally positioned to ensure proper clearance between the vessel and the lift object.

As described above, the Dunlin Alpha topsides will be placed in a ‘cold stack’ state prior to commencing removal operations. Utilities required for platform removal activities will therefore be provided by the HLV. Power for lighting and tools will be supplied from temporary generators and air will either be supplied from the HLV directly, or via a compressor located on the platform. The capacity, design and layout of the system will be defined through detailed engineering.

Module separation will require removal of some secondary structures such as stairs and walkways, pipes, ducting and electrical equipment that connects a module to another, as well as the cutting of floors, roof and walls in between modules. Separation techniques may involve both hot cutting techniques (i.e. gas cutting, arc air cutting gouging, plasma cutting) and cold cutting methods (i.e. hydraulic shears; clamshell cutters; manual electrical, pneumatic or hydraulic saws). Where required, hazardous materials will be removed to facilitate removal operations. All removed hazardous material will be stored and transported in suitable packaging and placed into hazardous waste containers, in accordance with relevant waste regulations.

2.3.3.2. Removal of conductor guide frames

In addition to removing the Dunlin Alpha topsides, operations are also proposed to cut and remove the upper and middle CGFs, as well as any remaining conductors. The CGFs are located at -10 m and -40 m below sea level respectively and will require a suitable cutting technique to separate them from the CGBS. Once cut, it is envisaged that the CGFs will be lifted and secured onto a CSV or HLV for transport to the selected decommissioning yard. The lower guide frame will be left attached to the concrete legs.

Marine growth remaining on the CGFs after the removal process will be disposed of onshore, and Fairfield will ensure that the selected decommissioning yard has the appropriate licenses to manage any remaining marine growth.

2.3.3.3. Marine Growth

As part of preparation activities for decommissioning, visual inspections of the subsea parts of the Dunlin Alpha installation were commissioned by Fairfield. The objective of these studies was to record information on the types and levels of marine fouling growth present on the CGBS (including transitions, conductors and conductor guide frames). A marine growth assessment was undertaken (Xodus, 2017) to assess the total marine growth present. A total of 1,400 tonnes of marine growth is estimated to be spread across the Dunlin Alpha installation. However, the only parts of the infrastructure due to be removed and transported to shore under the topsides decommissioning project are the upper two conductor guide frames. These two items were estimated to support approximately 83 tonnes of marine growth, although the exact tonnage of *Lophelia* is not known the 83 tonnes of marine growth will constitute a range of soft and hard marine growth and therefore not all of the 83 tonnes will be *Lophelia*. Where practical, marine growth may be removed offshore. Any remaining marine growth will be shipped to shore for treatment and disposal in line with all relevant regulatory requirements.

2.3.3.4. Installation of Navigation Aids

During removal operations, navigational aid requirements will be fulfilled by the decommissioning contractor. Fairfield proposes to pre-install a concrete platform at the top of one of the CGBS legs to support an AtoN unit. Once removal of the MSF has been completed, the HLV will install the AtoN on top of one of the CGBS legs using the vessel crane (Figure 2.5).

Fairfield will consult with the NLB to ensure that the design of the AtoN unit meets all regulatory requirements. It is anticipated that the unit will be of a self-contained offshore lighthouse (SCOL) design and will be helicopter portable to facilitate maintenance and replacement as required. Fairfield proposes to undertake monitoring and maintenance of the AtoN through a service contract with a specialist contractor, including real time status and analysis.

Further information on the long-term monitoring and management of AtoN requirements will be provided within the Dunlin Alpha Substructure Environmental Appraisal and Dunlin Alpha Substructure Decommissioning Programme.

Figure 2.5 AtoN Unit Deployment by Helicopter

2.3.4. Post-Decommissioning Survey and Debris Clearance

During site clearance activities, Fairfield will make best endeavours to recover any dropped objects subject to any outstanding Petroleum Operations Notices (PON). All recovered seabed debris related to offshore oil and gas activities will be returned for onshore disposal or recycling in line with existing disposal methods. A post-decommissioning site survey will be carried out around a 500 m radius of the installation site. This will be followed by independent verification and a statement of seabed clearance to all relevant authorities.

2.3.5. Post-Decommissioning Monitoring and Evaluation

The arrangements for post-decommissioning monitoring and evaluation, including a second environmental survey, will be covered in the Dunlin Alpha Substructure Decommissioning Programme (FBL-DUN-DUNA-HSE-01-PLN-0001-02).

2.3.6. Onshore Dismantling and Disposal

The Dunlin Alpha topsides will be transported to Rogaland, Norway for dismantling and disposal at the AF Environmental Base Vats (AFEBV) decommissioning yard. AFEBV has considerable experience in the dismantling and disposal of offshore installations and has repeatedly demonstrated the ability to receive, dismantle and dispose of all platform objects in a safe and environmentally responsible manner.

The facility is custom built to handle offshore installations and other marine structures, and the deep-water quay allows for direct offloading of platform modules by the HLV. This allows the modules to be transported on the deck of the vessel and reduces the need for offshore set-down and transportation of removed modules on cargo barges with associated environmental risks.

The facility holds all relevant permits and consents required for dismantling the Dunlin Alpha topsides, as well as the handling of all associated waste streams. A project HSE and waste management plan will be developed to ensure that dismantling and disposal operations are undertaken in a manner acceptable to Fairfield, regulatory bodies and interested stakeholders. Further details of Fairfield's waste management strategy are provided in Section 2.4, including relevant information the transboundary shipment of waste.

At the dismantling site the following will occur:

- Equipment suitable for reuse will be segregated;
- Pipework that has been in contact with hydrocarbons and potentially contains NORM will be assessed, and removed to a licensed facility if decontamination is necessary;
- Marine growth that has not been removed offshore will be removed and sent for appropriate disposal (Section 2.4 provides further detail on handling of marine growth); and
- Topsides sections will be stripped to recover copper cable, steel and other recyclable materials.

Management of waste from these activities is detailed in Section 2.4.

2.4. Waste Management

2.4.1. Project-Specific Challenges

The main challenges associated with waste management for the Dunlin Alpha topsides decommissioning project include:

- The generation of controlled waste within a short period of time which will require detailed planning to manage the logistics associated with the transport to shore, temporary storage and onward treatment/ disposal of materials;
- The potential for so-called hazardous materials to be generated. This can be due to contamination of existing process equipment or due to the cross–contamination of non-hazardous waste with substances that have hazardous properties. This will result in an increase in the overall volume of waste being classified as special waste. Special waste is defined as material that has one, or more, properties that are described in the Hazardous Waste Directive (91/689/EEC) as amended by Council Directive 94/31/EC. Outside of Scotland such material is referred to as hazardous waste; and
- The problems associated with materials with unknown properties at the point of generation. These quantities of “unidentified waste” require careful storage and laboratory analysis to determine whether they are special waste or non-hazardous waste.

2.4.2. Duty of Care

The duty of care with regards to appropriate handling and disposal of waste from the Dunlin Alpha installation rests with Fairfield. To enable Fairfield to manage waste appropriately, it is necessary to understand the regulations under which waste is handled and the key sources of waste. Section 2.4.3 describes the regulatory control of waste material whilst Section 2.4.4 outlines the types of waste material that will be generated as a result of the proposed decommissioning activities. Section 2.4.5 details the measures that will be in place to ensure waste is appropriately managed.

2.4.3. Regulatory Control

The EU’s Revised Waste Framework Directive (Directive 2008/98/EC) was adopted in December 2008. The aim of the Directive is to ensure that waste management is carried out without endangering human health and without harming the environment. Article 4 of the Directive also states that the waste hierarchy shall be applied as a priority order in waste prevention and management legislation and policy.

The Waste (Scotland) Regulations 2012 (which transposes the Directive into Scottish law) controls the generation, transportation and disposal of waste from Scotland and the shipment of waste into and out of the EU. It covers controlled waste, duty of care, registration of carriers and brokers, waste management licensing, landfill, hazardous waste, producer responsibility, packaging waste, end-of-life vehicles, waste electrical and electronic equipment and the trans-frontier shipment of waste.

Whether a material or substance is determined as a ‘waste’ is determined under EU law. The Waste Framework Directive defines waste as “any substance or object in the categories set out in Annex 1 of the Directive which the holder discards or intends or is required to discard”. Materials disposed of onshore must comply with the relevant health and safety, pollution prevention, waste requirements and relevant sections of the Environmental Protection Act 1990. Management of radioactive materials is governed under the Radioactive Substances Act 1993, Trans-frontier Shipment of Radioactive Waste and Spent Fuel Regulations

2008. The handling and disposal of radioactive waste requires additional authorisation. Onward transportation of waste or recycled materials must also be in compliance with applicable legislation, such as the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009, a highly prescriptive regulation governing the carriage of dangerous goods by road.

2.4.4. Sources of Waste

Detailed inventory assessments have been undertaken in order to characterise and quantify both hazardous and non-hazardous materials to be decommissioned. Where required, this has involved specific sampling and analysis by competent specialists in order to ensure materials are classified correctly. A summary of the types of material on the Dunlin Alpha topsides is provided in Table 2.3. The materials inventory will be managed as a live inventory within the waste management plan developed for the project.

Table 2.3 Summary of Materials Types Being Recovered

Item	Description	Location (s)
Non-hazardous materials		
Ferrous metals	Carbon steel; stainless steel; titanium, cast iron	Structural steel; piping; bulk tanks; machinery; equipment
Non-ferrous metals	Copper; aluminium; nickel; zinc	Copper wiring, aluminium
Plastic	PVC/uPVC; rubber	Piping; hoses; insulation
Concrete	Concrete; cement	Structural/construction material
Wood	Wood	Construction material; furniture
Marine growth	Marine growth	Conductor Guide Frames
Hazardous materials		
Bulk liquids	Hydrocarbons; process chemicals; sludge	Bulk tanks; pipework; equipment
Heavy metals	Mercury; lead; cadmium	Batteries; paint coatings; light-fittings; Waste Electrical and Electronic Equipment
Radioactive material	NORM	NORM (Scale, sediments, sludge); smoke detectors
Asbestos	Asbestos; asbestos containing material	Gaskets, cladding; work tops

2.4.5. Management of Waste

Environmental management of the Dunlin Alpha topsides decommissioning project activities will include waste management as a key factor in limiting potential environmental impact. Management of waste will therefore be dealt with in accordance with Fairfield's EMS, certified to the international standard ISO 14001:2015.

As operator of the Dunlin Alpha installation, Fairfield recognises its duty of care for all waste materials generated from the forthcoming decommissioning activities. As a result, Fairfield must consider the complete life cycle of decommissioning waste, including:

- Waste identification;
- Offshore treatment and storage;
- Offshore preparation/cleaning;
- Shipment of waste;
- Onshore deconstruction;
- Onshore transportation;
- Final disposal/recovery; and
- Ongoing monitoring.

To this end, Fairfield has developed a waste management strategy for the project in order to outline the processes and procedures necessary to ensure that waste is managed in a manner that complies with legislative requirements and prevents harm to people and the environment (Fairfield, 2017).

The waste management strategy provides guidance on waste management options and details project requirements for the successful management of decommissioning waste, including:

- Development of detailed materials inventory;
- Use of competent waste contractors and appropriately licensed sites;
- Contractors to develop and implement Active Waste Management Plans;
- Documentation requirements (i.e. waste transfer notes, disposal certificates);
- Targets for reuse, recycling and disposal;
- Regular engagement with waste regulators; and
- Assurance audits of disposal yard and contractor waste management systems.

Fairfield's waste management strategy is underpinned by the waste hierarchy, shown in Figure 2.6. The hierarchy is based on the principle of waste disposal only where reuse, recycling and waste recovery cannot be undertaken.

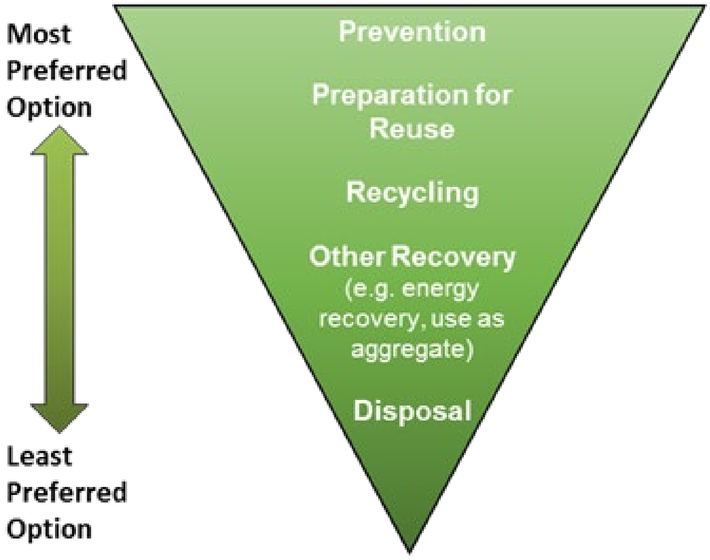

Figure 2.6 Waste Hierarchy

Steel and other recyclable metals are estimated to account for the greatest proportion of the materials to be removed to shore. Typically, around 95% of the materials from decommissioning projects can be recycled (OGUK, 2017). OGUK (2018) report that of the 7,289 tonnes of waste brought onshore from decommissioning projects in 2016, 91% was reused, recycled or used for power generation. Given that much of the material to be returned to shore from the decommissioning of the Dunlin Alpha topsides will be recyclable (steel and non-ferrous metals), it is expected the same high proportion of recycling will be true for the Dunlin Alpha topsides decommissioning project. A summary of Fairfield's waste management aspirations for material brought to shore is given in Table 2.4.

Table 2.4 Waste Management Aspirations

Waste stream	Reuse	Recycle	Other recovery	Landfill
Ferrous metal	0 - 15%	95 - 98%	0%	0 - 5%
Non-ferrous metal	0%	95 - 98%	0%	0 - 5%
Concrete (aggregates)[1]	0 - 50%	0%	50 - 100%	0 - 25%
Plastics	0%	50 - 75%	15 - 40%	0 - 10%
Residual hydrocarbons	0%	0%	85 - 100%	0 - 15%
NORM	0%	0%	0%	100%[2]
Marine growth	0%	0%	75 - 100%	0 - 25%

[1] Reuse/recovery opportunities will be dependent on availability of infrastructure projects
[2] NORM may be sent for incineration prior to landfill in order to reduce volume

For materials where reuse or recycling is not an option, these will be sent to an appropriately licensed disposal facility for recovery, or landfill where no other options are viable. In terms of the waste hierarchy, recovery is more beneficial than landfill since it means a waste product is used to replace other materials that would otherwise have been used to fulfil a particular function.

Preparation of Dunlin Alpha topsides infrastructure for removal may result in the generation of special waste streams as equipment is flushed and isolated. Such wastes will be disposed of under an approved regulatory permit, as required, and in accordance with Dunlin Alpha Safe Operating Procedures and the Fairfield waste management strategy, with consideration of specific sampling, classification, containment, and consignment conditions. It is likely that there will be small volumes of residual hydrocarbons, chemicals and naturally occurring radioactive material in some equipment recovered to shore. Any special wastes remaining in recovered infrastructure will be disposed of under an appropriate license or permit.

As stated in Section 2.3.3.3, marine growth may be removed offshore where practical. Any marine growth that is transferred to shore will be managed by an appropriately licensed decommissioning facility. Options for the disposal of marine growth include composting, land spreading or landfill.

A key factor in the successful execution of the Dunlin Alpha Topsides Decommissioning Programme will be the selection of a competent decommissioning contractor and suitable decommissioning facility. The decommissioning yard chosen for dismantling the Dunlin Alpha topsides has all relevant permits and consents required for handling anticipated waste streams, and Fairfield believe that the selected decommissioning contractor has the required expertise to achieve the highest level of recycling.

An active waste management plan (AWMP) will be developed in order to address all Fairfield decommissioning project requirements, agree waste management objectives, and establish project assurance and reporting protocols. The AWMP will detail the measures in place to ensure all permits and licenses are in place for the handling and disposal of the waste types identified, and that all waste is transferred by an appropriately licensed carrier. The selected contractor will be required to maintain a waste audit trail through to recycling or disposal facility. The AWMP will be kept under constant review and appropriately updated throughout execution of the decommissioning project.

2.4.6. Transfrontier Shipment of Waste

The *Transfrontier Shipment of Waste Regulations 2007 (as amended)* sets out rules for shipping waste within the European Union (EU), as well as importing and exporting to and from countries outside the EU. The main objective of these regulations is to prevent hazardous waste from developed countries being exported and dumped in developing countries. As described in Section 2.3.6, the Dunlin Alpha topsides will be transported to the AFEBV decommissioning yard in Rogaland, Norway for dismantling and recycling. The facility holds all relevant permits and consents required for dismantling the topsides, and has repeatedly demonstrated the ability to receive, dismantle and dispose of all platform objects in a safe and environmentally responsible manner. Fairfield will undertake early engagement with relevant Regulatory Authorities to ensure that all application, permit and notification requirements are met.

3. Environmental Appraisal Methodology

3.1. Identification of Environmental Issues

The main objective of the Environmental Impact Identification (ENVID) process is to identify the key potential environmental impacts requiring discussion and assessment, and to agree practicable measures (mitigation) to eliminate or minimise harm to the environment.

An ENVID has taken place based on:

- Known potential environmental issues specifically related to the project area. These are already well understood due to the amount of environmental work that has been conducted during the broader decommissioning project's lifetime;
- An ENVID workshop, which brought together informed judgement of environmental practitioners and project engineers; and
- Project specific stakeholder engagement and a review of stakeholder comments in relation to the Greater Dunlin Area decommissioning projects and the engagement undertaken as part of these.

A summary of the key environmental sensitivities identified by the ENVID process, including an explanation of why some topics were considered sufficiently well-understood to require no further assessment is provided in Section 5. Further detail is provided in Appendix A – ENVID Matrix.

3.2. Stakeholder Engagement

Since 2011, the Dunlin Alpha topsides have featured in the broader engagement activity for the Greater Dunlin Area (covering subsea and platform decommissioning as a whole). The engagement for the topsides specifically has been largely based on sharing project expectations, approach and specific considerations, no specific issues have been raised for consideration beyond the fora where discussions were held. Full details of the consultation to date is provided in the Stakeholder Engagement Report, available on the Fairfield Energy Limited website, which supports Section 5 of the raft Decommissioning Programme.

3.3. Environmental Appraisal

3.3.1. Overview

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

The method presented here has been developed by reference to the Institute of Ecology and Environmental Management (IEEM) guidelines for marine impact assessment (IEEM, 2010), the Marine Life Information Network (MarLIN) species and ecosystem sensitivities guidelines (Tyler-Walters *et al*., 2004) and guidance provided by Scottish National Heritage (SNH) in their handbook on environmental impact assessment (SNH, 2013) and the Institute of Environmental Management and Assessment (IEMA) guidelines for environmental impact assessment (IEMA, 2015, 2016).

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

In general, impacts are specific, measurable changes in the receiving environment (volume, time and/or area). Effects (the consequences of those impacts) consider the response of a receptor to an impact. The relationship between impacts and effects is not always so straightforward; for example, a secondary effect may result in both a direct and indirect impact on a single receptor. There may also be circumstances where a receptor is not sensitive to a particular impact and thus there will be no significant effects/consequences.

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

- Identification of receptor and impact (including duration, timing and nature of impact);
- Definition of sensitivity, vulnerability and value of a receptor;
- Definition of magnitude and likelihood of impact; and
- Assessment of consequence of the impact on the receptor, considering the probability that it will occur, the spatial and temporal extent and the importance of the impact. If the assessment of consequence of impact is determined as moderate or major, it is considered a significant impact.

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

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

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

3.3.2. Baseline Characterisation and Receptor Identification

As part of preparation for the Dunlin Alpha decommissioning project, and as part of earlier operation of the Greater Dunlin Area, the following surveys have been undertaken in recent years:

- Surveys at the Dunlin Alpha platform and cuttings pile:
- Dunlin Field Pre-Decommissioning Habitat Survey and Environmental Baseline Survey (EBS) (Fugro, 2016a, Fugro 2017b);
- Dunlin Alpha Pre-Decommissioning Cuttings Assessment Survey (Fugro, 2015); and
- Dunlin Development Debris Clearance, 'Mud Mound' and EBS (Gardline, 2009);
- Surveys in the wider area:
- Dunlin Fuel Gas Import Route Survey (Gardline, 2011);
- Dunlin Fuel Gas Import Pre-Decommissioning Habitat Survey and EBS (Fugro 2016b; Fugro 2016c);

- Dunlin to Northern Leg Gas Pipeline Route Survey (Gardline, 2010a);
- Dunlin Power Import Cable Pre-Decommissioning Habitat Survey and EBS (Fugro 2016d; Fugro 2016e); and
- Quad 211 Infield Environmental Survey (Gardline, 2010b).

The surveys undertaken closest to the Dunlin Alpha platform are reported in Gardline (2009), Fugro (2016a), Fugro (2017a) and Fugro (2017b). The locations of stations sampled during these surveys are presented in Figure 3.1. The description of bathymetry, seabed conditions and benthos in the project area draws on these surveys. Sample stations from the wider area surveys listed above are also presented in Figure 3.1. The results of these surveys were used to provide a baseline with which to compare the survey stations close to Dunlin Alpha. Information obtained through consultation with key stakeholders was also used to help characterise specific aspects of the environment in more detail.

The environmental impact assessment process requires identification of the potential receptors that could be affected by the project (e.g. marine mammals, seabed species and habitats). High level receptors are identified within the impact assessments (Section 4.1).

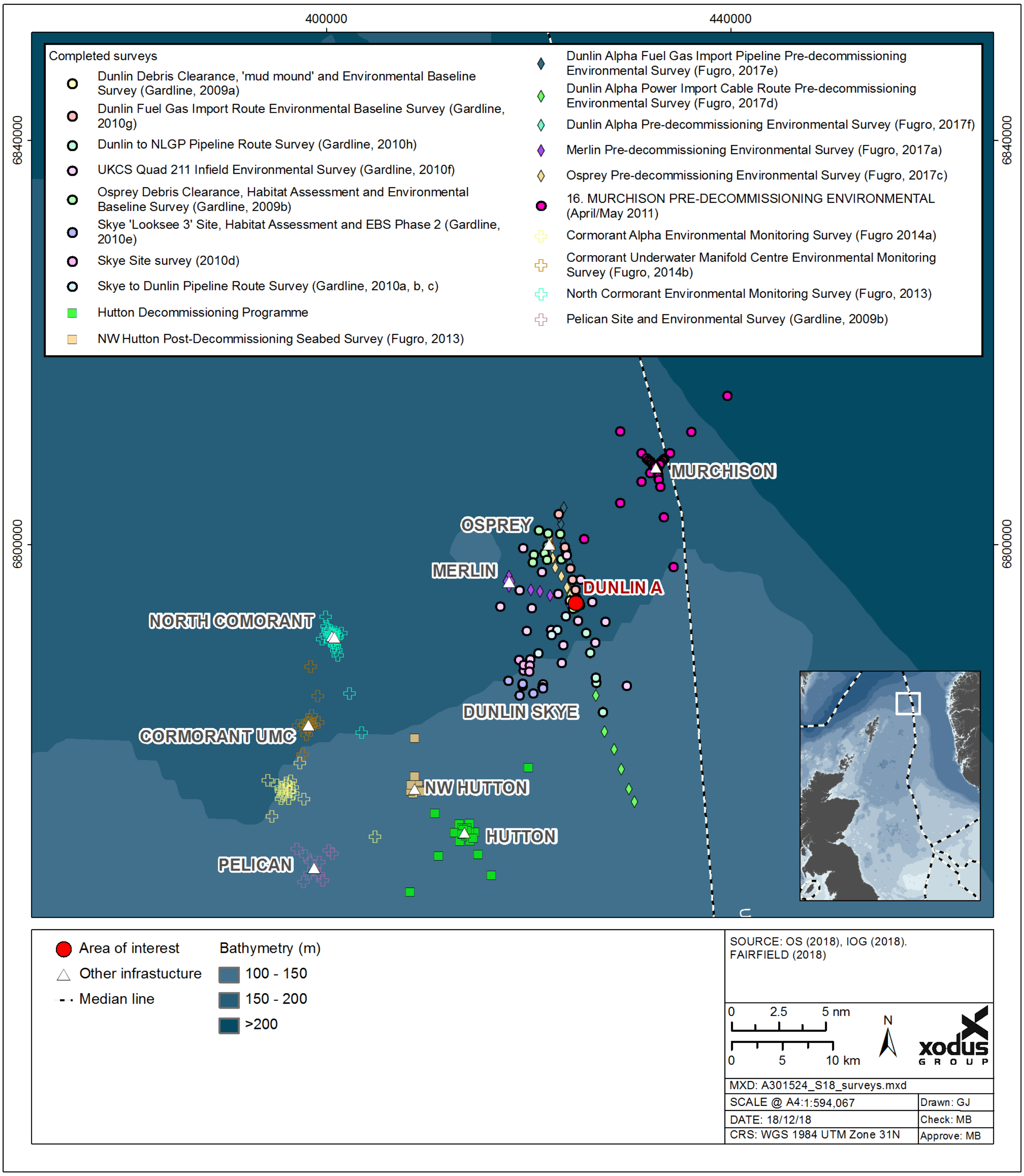

Figure 3.1 Baseline environmental survey coverage

3.4. Impact Definition

3.4.1. Impact Magnitude

Determination of impact magnitude requires consideration of a range of key impact criteria including:

- Nature of impact, whether it be beneficial or adverse;
- Type of impact, be it direct or indirect etc.;
- Size and scale of impact, i.e. the geographical area;
- Duration over which the impact is likely to occur i.e. days, weeks;
- Seasonality of impact, i.e. is the impact expected to occur all year or during specific times of the year e.g. summer; and
- Frequency of impact, i.e. how often the impact is expected to occur.

Each of these variables are expanded upon in Appendix B, Table B 1 to Table B 4 provide consistent definitions across all environmental impact assessment topics. In each impact assessment, these terms are used in the assessment summary table to summarise the impact and are enlarged upon as necessary in supporting text. With respect to the nature of the impact (Table 3.1), it should be noted that all impacts discussed in this EA are adverse unless explicitly stated.

Table 3.1 Nature of Impact

Nature of impact	Definition
Beneficial	Advantageous or positive effect to a receptor (i.e. an improvement).
Adverse	Detrimental or negative effect to a receptor.

3.4.1.1. Impact Magnitude Criteria

Overall impact magnitude requires consideration of all impact parameters described above. Based on these parameters, magnitude can be assigned following the criteria outlined in Table B 5. The resulting effect on the receptor is considered under vulnerability and is an evaluation based on scientific judgement.

3.4.1.2. Impact Likelihood for Unplanned and Accidental Events

The likelihood of an impact occurring for unplanned/accidental events is another factor that is considered in this impact assessment. This captures the probability that the impact will occur and also the probability that the receptor will be present.

3.4.2. Receptor Definition

3.4.2.1. Overview

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

3.4.2.2. Receptor Sensitivity

These range from negligible to very high and definitions for assessing the sensitivity of a receptor are provided in Table B 6.

3.4.2.3. Receptor Vulnerability

Information on both receptor sensitivity and impact magnitude is required to be able to determine receptor vulnerability as per Table B 7.

It is important to note that the above approach to assessing sensitivity/vulnerability is not appropriate in all circumstances and in some instances professional judgement has been used in determining sensitivity. In some instances, it has also been necessary to take a precautionary approach where stakeholder concern exists with regard to a particular receptor. Where this is the case, this is detailed in the relevant impact assessment (Section 5).

3.4.2.4. Receptor value

The value or importance of a receptor is based on a pre-defined judgement based on legislative requirements, guidance or policy. Where these may be absent, it is necessary to make an informed judgement on receptor value based on perceived views of key stakeholders and specialists. Examples of receptor value definitions are provided in Table B 8.

3.4.3. Consequence and Significance of Potential Impact

3.4.3.1. Overview

Having determined impact magnitude and the sensitivity, vulnerability and value of a receptor, it is then necessary to evaluate impact significance. This involves:

- Determination of impact consequence based on a consideration of sensitivity, vulnerability and value of the receptor and impact magnitude;
- Assessment of impact significance based on assessment consequence;
- Mitigation; and
- Residual impacts.

3.4.3.2. Assessment of Consequence and Impact Significance

The sensitivity, vulnerability and value of a receptor are combined with magnitude (and likelihood, where appropriate) of impact using informed judgement to arrive at a consequence for each impact, as shown in Table B 9. The significance of impact is derived directly from the assigned consequence ranking.

3.4.3.3. Mitigation

Where potentially significant impacts (i.e. those ranked as being of moderate impact level or higher in Table B 9) are identified, mitigation measures must be considered. The intention is that such measures should remove, reduce or manage the impacts to a point where the resulting residual significance is at an acceptable or insignificant level. For impacts that are deemed not significant (i.e. low, negligible or positive in Table B 9), there is no requirement to adopt specific mitigation. However, mitigation can be adopted in such cases to ensure impacts that are predicted to be not significant remain so. Section 6.1 provides detail on how any mitigation measures identified during the impact assessment will be managed.

3.4.3.4. Residual Impacts

Residual impacts are those that remain once all options for removing, reducing or managing potentially significant impacts (i.e. all mitigation) have been taken into account.

3.5. Cumulative Impact Assessment

Although the scope of this impact assessment is restricted to the decommissioning of the Dunlin Alpha topsides as outlined in Section 2, it is recognised that the decommissioning work scope will also occur in the context of the subsea decommissioning at Dunlin, Osprey and Merlin, and other oil and gas and non-oil and gas activities, with which there is the potential to interact. To this end, the impact assessments presented in Section 5 specifically consider the potential for cumulative impact within the definition of significance.

3.6. Transboundary Impact Assessment

The impact assessments presented in Section 5 contain sections which identify the potential for, and where appropriate, assessment of transboundary impacts. For the Dunlin Alpha decommissioning project, this needs to be considered given the proximity to the UK/Norway median line (11 km) and that the topsides will be transported through Norwegian waters for onshore processing.

3.7. Habitats Regulations Assessment (HRA) and Nature Conservation Marine Protected Area Assessment

Under Article 6.3 of the Habitats Directive, it is the responsibility of the Competent Authority (in this case, OPRED) to undertake Appropriate Assessment, if necessary, of the potential impacts of a plan, programme or project, alone or in combination, on a Natura site (Special Area of Conservation, (SAC), or Special Protection Area, (SPA)) in view of the site's conservation objectives and the overall integrity of that site. In a similar but separate process of assessing impact on protected sites, there is also a requirement under the Marine and Coastal Access Act 2009 and the Marine (Scotland) Act 2010 (collectively known as 'the marine acts') for the Competent Authority to consider the potential for the proposed activities to impact upon Nature Conservation Marine Protected Areas (NCMPAs). As with SACs and SPAs, OPRED is the Competent Authority for NCMPAs with respect to oil and gas development. Where relevant, the impact assessments presented in Section 5 provide information on the potential for the proposed activities to affect the protected features of SPA, SAC and NCMPAs, or to affect ecological or geomorphological processes on which these marine protected areas are dependent.

4. Environment Baseline

Environmental Baseline characterisation describes the current conditions of the receiving environment within the project area. This informs the potential interactions between project activities and environmental receptors and allows the evaluation of potential impacts discussed in Section 5.

4.1. Summary of Receptors

The baseline environment in the project area is summarised in Table 4.1. For most receptors, the information provided in Table 4.1 is considered sufficient to inform the environmental assessment of potential impacts within this EA. Specific receptors identified during the ENVID and consultation meetings as potentially of specific interest to stakeholders include commercial fisheries, other sea users and the cold-water coral *Lophelia pertusa*, which has previously been identified on the platform legs, conductors, conductor guide frames and CGBS. These three receptors are discussed in more detail in Sections 4.2 to 4.4.

Table 4.1 Environmental Baseline Summary

Environmental Receptor	Description
Conservation interests	
OSPAR (2008) List of Threatened and/or Declining Habitats and Species	
Ocean quahog *Arctica islandica*	The presence of ocean quahog *A. islandica* has been confirmed in most of the survey datasets available around Dunlin. All occurrences of *A. islandica* in these records tend to be of small juvenile specimens in low numbers. However, it is relatively well distributed in the North Sea and the project area is not considered a particularly important area for ocean quahog.
Cold water coral *L. pertusa*	See Section 4.4.
Conservation sites (See Figure 4.1)	
Special Areas of Conservation (SACs)	There is only one SAC located within 100 km of the decommissioning project area, the Pobie Bank Reef SAC. The stony and bedrock reefs of the site provide a habitat to an extensive community of encrusting and robust sponges and bryozoans and in the shallowest areas the bedrock and boulders also support encrusting coralline algae. The site is located 98 km to the south-west of the project area.
Special Protection Areas (SPAs)	The nearest SPA to the project area is Hermaness, Saxa Vord and Valla Field SPA, located 137 km to the south-west. It protects a population of European importance including red-throated diver (Annex I species), common guillemot, black-legged kittiwake, European shag, northern fulmar, Atlantic puffin, great skua and northern gannet. The Fetlar SPA is approximately 143 km from Dunlin Alpha and comprises a range of habitats including species-rich heathland, marshes and lochan, cliffs and rocky shores. During the breeding season this site supports a population of European importance of Arctic Tern *Sterna paradisaea* and red-necked phalarope *Phalaropus lobatus*. Additionally, it also supports populations of European importance of the following migratory species during the breeding season: dunlin *Calidris alpina schinzii*, great skua and whimbrel *Numenius phaeopus*, and at least 20,000 seabirds. During the breeding season, the area regularly supports 22,000 individual seabirds including Arctic skua, northern fulmar, great skua, Arctic tern and red-necked phalarope.

Nature Conservation Marine Protection Area (MPAs)	There are two NCMPAs within 150 km of the installation. These are the North East Faroe Shetland Channel NCMPA (117 km) and the Fetlar to Haroldswick NCMPA (141 km). The North East Faroe Shetland Channel is the largest MPA in Europe and the protected features are deep sea sponge aggregations, offshore deep-sea muds, offshore subtidal sands and gravel, continental slope features and a wide range of features associated with key Geodiversity Areas including West Shetland Margin Palaeo-depositional, Miller Slide and Pilot Whale Diapirs. The Fetlar to Haroldswick NCMPA supports a range of high energy habitats and species including horse mussel beds, kelp and seaweed communities and maerl beds. It also encompasses over 200 km^2 of important black guillemot *Cepphus grylle* feeding grounds. It also includes shallow tide-swept coarse sands with burrowing bivalves and marine geomorphology of the Scottish shelf seabed.
Coastal and Offshore Annex II species most likely to be present in the project area	
Harbour porpoise	Harbour porpoise are frequently found throughout the UK waters. They usually occur in groups of one to three individuals in shallow waters, although they have been sighted in larger groups and in deep water. It is not thought that the species migrate.
Killer whale	Widely distributed with sightings across the North Sea all year round; seen in both inshore waters (April to October) and the deeper continental shelf waters (November to March). May move inshore to target seals seasonally.
Minke whale	Minke whales usually occur in water depths of 200 m or less and occur throughout the northern and central North Sea. They are usually sighted in pairs or in solitude; however, groups of up to 15 individuals can be sighted feeding. It appears that animals return to the same seasonal feeding grounds.
Atlantic white-sided dolphin	White-sided dolphins show both season and inter-annual variability. They have been sighted in large groups of 10 - 100 individuals. They have been sighted in waters ranging from 100 m to very deep waters, but also enter continental shelf waters. They can be sighted in the deep waters around the north of Scotland throughout the year and enter the North Sea in search of food.
White-beaked dolphin	White-beaked dolphins are usually found in water depths of between 50 and 100 m in groups of around 10 individuals, although large 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.
Grey seal Harbour seal	As the project area is located approximately 137 km offshore, these species may be encountered in the vicinity from time to time, but the project area is not of specific importance for these species. The presence of grey and harbour seals in the project area is between 0 – 1 individual per 25 km^2.
Benthic environment	
Bathymetry	The Dunlin Alpha platform stands in 151 metres of water.
Seabed sediments	Sediment types around the Dunlin Alpha platform, as revealed by site surveys at Dunlin Alpha, Osprey, Merlin, Skye, and Murchison, are predominantly fine to medium sand with a silt/clay (i.e. 'mud') content mostly <20%. In all areas surveyed, sands contain admixtures of shell gravel and pebbles, and occasional small boulders were observed.
Benthic fauna	Species consistently appearing in the lists of most abundant taxa centre around the polychaetes *Galathowenia oculata, Euchone incolor, Aonides paucibranchiata, Paradoneis lyra,* and the bivalve molluscs *Adontorhina similis* and *Axinulus croulinensis.* The epifauna included hermit crabs (usually *Pagurus* spp.), various starfish including *Asterias rubens*, *Porania pulvillus,* and *Luidia sarsi,* and sea urchins such as *Echinus acutus.* Low numbers of juvenile ocean quahog *A. islandica* were

	observed in the survey areas. This species is on the OSPAR (2008) List of Threatened and/or Declining Habitats and Species.
Fish – spawning and nursery grounds	
Spawning grounds	The project area is located within the spawning grounds of haddock *Melanogrammus aeglefinus* (February to May, [peak spawining February – April]), saithe *Pollachius virens* (January to April, [peak spawning January – February]), Norway pout *Trisopterus esmarkii* (January to April, [peak spawning February – March]), cod *Gadus morhua* (January to April, [peak spawning February – March]) and whiting *Merlangius merlangus* (February to June).
Nursery grounds	The following species have nursery grounds in the vicinity of the project: anglerfish *Lophiiformes*, cod, haddock, horse mackerel *Trachurus trachurus*, plaice *Pleuronectes platessa*, sandeel *Ammodytes tobianus*, saithe, sprat *Sprattus sprattus*, Norway pout, mackerel *Scomber scombrus*, blue whiting *Micromesistius poutassou*, spurdog *Squalus acanthias*, herring *Clupea harengus* and ling *Molva molva*.
Seabirds	
The project area is important for northern fulmar *Fulmarus glacialis*, northern gannet *Morus bassanus*, great black-backed gull *Larus marinus*, Atlantic puffin *Fratercula arctica*, black-legged kittiwake *Rissa tridactyla*, and common guillemot *Uria aalge* for the majority of the year. In Block 211/23 the sensitivity of seabirds to oil pollution, reflected by the Seabird Oil Sensitivity Index (SOSI), is low between February and October, except in May, where the picture is unclear as no data is available for this month. Between November and January, the SOSI is high.	

Seabed Oil Sensitivity Index (SOSI)												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
211/23	3*	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											

Socio-economic Receptor	**Description**
Commercial fishing	
See Section 4.2	
Other users	
Shipping activity	See Section 4.3.
Oil and Gas	Several offshore platforms surround the Dunlin Alpha installation, these include: Tern, Cormorant North, Eider A, Thistle A, Murchison (jacket footings being decommissioned *in situ*), Statfjord B, Brent C, and Heather A.
Telecommunications	There are no cables in the vicinity of the project area other than the Dunlin Power Import cable (running from the Dunlin Alpha platform to the Brent Charlie platform).
Military activities	There are no charted military Practice and Exercise Areas (PEXAs) and Unexploded Ordinances (UXOs) in the vicinity of the project area.
Renewables	There is no renewable energy activity in the vicinity of the project area; the closest potential renewable site is a Draft Plan Option for tidal energy, at Muckle Flugga (north of Shetland), located approximately 120 km south-west of Block 211/23.
Wrecks	There are no designated wreck sites in the vicinity of the project area. There is a non-designated wreck record to the north of Block 211/23, where the Dunlin Alpha platform is located.

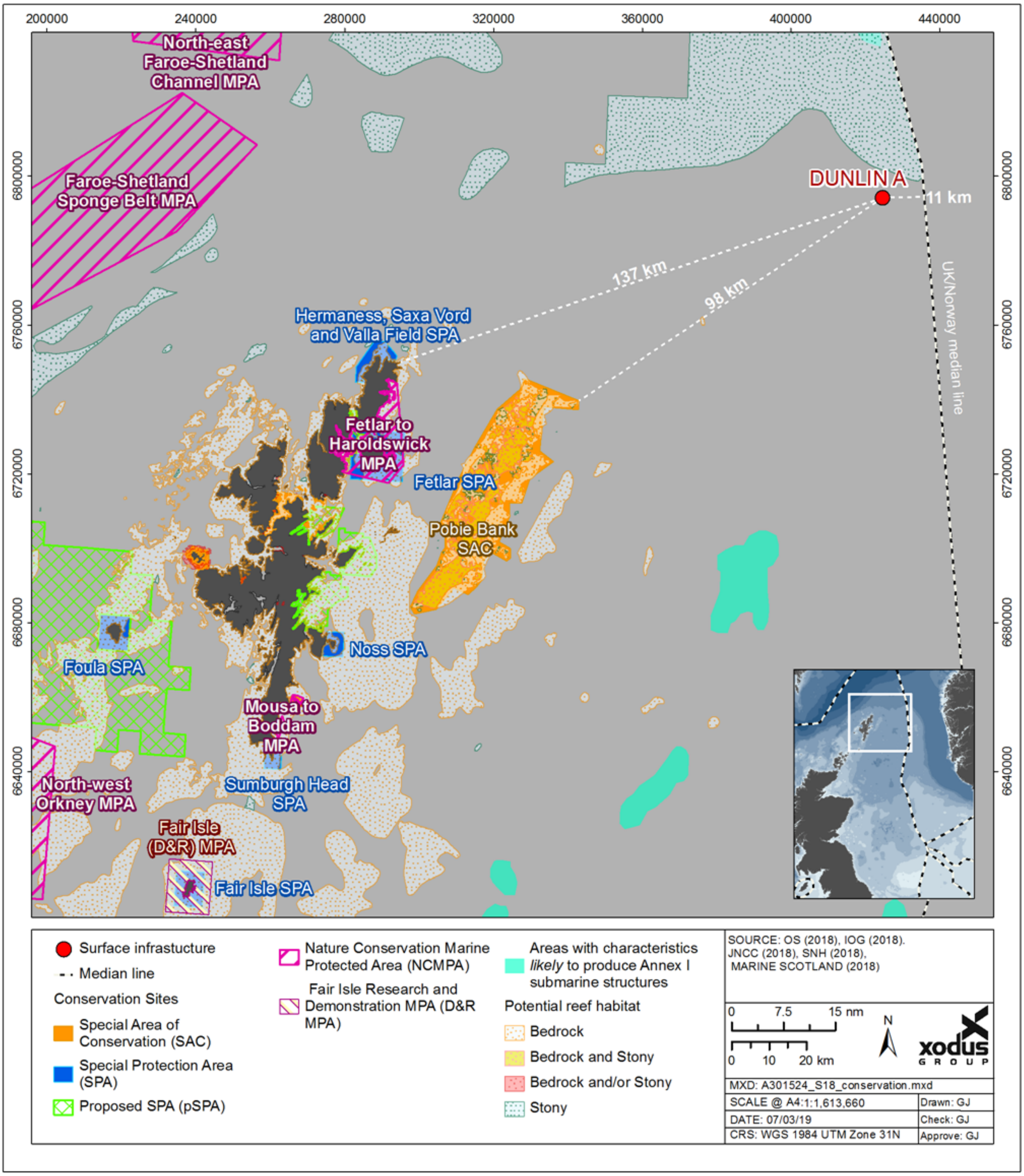

Figure 4.1 Conservation Areas in the Vicinity of the Dunlin A Installation

4.2. Commercial Fisheries

Fishing intensity in the project area is low in comparison to other areas in the North Sea. This section describes the type of fishing vessels occurring in the area, the weight and value of fish landed in the UK and the fishing effort.

4.2.1. Baseline Fishing Activity Analysis

Fairfield commissioned Xodus (2016) to complete a fishing risk assessment, which included an analysis of the potential impact of the subsea infrastructure decommissioning options on fisheries. As part of this, the baseline fishing activity in the vicinity of the Greater Dunlin Area was reviewed (Xodus, 2016). The study area considered to be relevant for the decommissioning activities is shown in relation to the International Council for the Exploration of the Sea (ICES) rectangle 51F1 in Figure 4.2.

A commercial fisheries risk assessment was commissioned to look at all nationalities which fish within the vicinity of the Dunlin Alpha infrastructure (Anatec, 2017) using data from Automatic Identification System (AIS) satellite tracking data. The distribution of AIS from fishing vessels with positions recorded between June 2016 and July 2017 revealed that Norway was the main fleet present in the project area (45% of AIS), followed by the UK (28%), and France (21%), the remainder being Germany, Faroe Islands, Ireland, the Netherlands and Denmark (Figure 4.3).

Whilst trawl gear use forms the predominant fishing type undertaken by UK vessels across the project area, this comprises mostly of demersal UK gears such as bottom trawls. Pelagic trawl gear is associated with a small number of UK vessels but its use is more prolific with international vessels. Of the actively fishing national and international vessels, demersal gears contributed to 63% of the total activity, with static gear contributing 20% (mainly from Norway) and the remainder of the total active fishing coming from pelagic gears (Anatec, 2017)(Figure 4.3 to Figure 4.6). Pelagic species are often caught as a bycatch species by the demersal fisheries, thereby contributing to the revenue generated by such vessels. However, pelagic species, such as mackerel targeted by the UK fleet, while high in value, are still relatively low in terms of volume compared to other regions of the UKCS and are not considered the target fisheries within this area for the UK fleet. The landings in the last five years for mackerel are equivalent to only a small number of trips, as an individual pelagic vessel can regularly land 1,000 – 2,000 tonnes of mackerel per trip. The primary fisheries in this area for the UK fleet would be demersal finfish and shellfish.

Across the project area, UK fishing effort using mobile gears is considered low compared to other areas in the North Sea, averaging between 0 – 1 days of fishing effort per year for the period 2012 – 2016. Published VMS data from the UK fishing fleet show that the number of fishing tracks recorded between 2012-2016 within 1km^2 squares is low at the installation, in comparison to other regions of the North Sea (Scottish Government, 2017) (Figure 4.6).

To further inform this assessment, Scottish Fisherman's Federation (SFF) Services were contracted to carry out a consultation with relevant members of the fishing industry. SFF Services collected primary data by interviewing fishermen who utilise the waters around the Dunlin Alpha area. The vessel representatives interviewed provided output from their Global Positioning System (GPS) plotters to highlight the fishing areas within the study area that they used.

Fishing activity in the offshore areas was widely influenced by the Cod Recovery Plan (CRP) and the Scottish Conservation Credit Scheme (SCCS). Through the duration of the CRP and SCCS, the number of days at sea for fishing vessels was considerably reduced. This often resulted in vessels changing their working practice so as not to waste valuable days at sea on steaming to offshore grounds. As a result, steaming time was accounted for as fishing time, which therefore impacted on the grounds that vessels operated on. Coincidentally, at the ICES Benchmark Workshop on North Sea Stocks (WKNSEA 2015), presentations demonstrated that the largest biomass of adult cod in the North Sea was found in the Viking area (which encompasses the area relating to the Greater Dunlin Area).

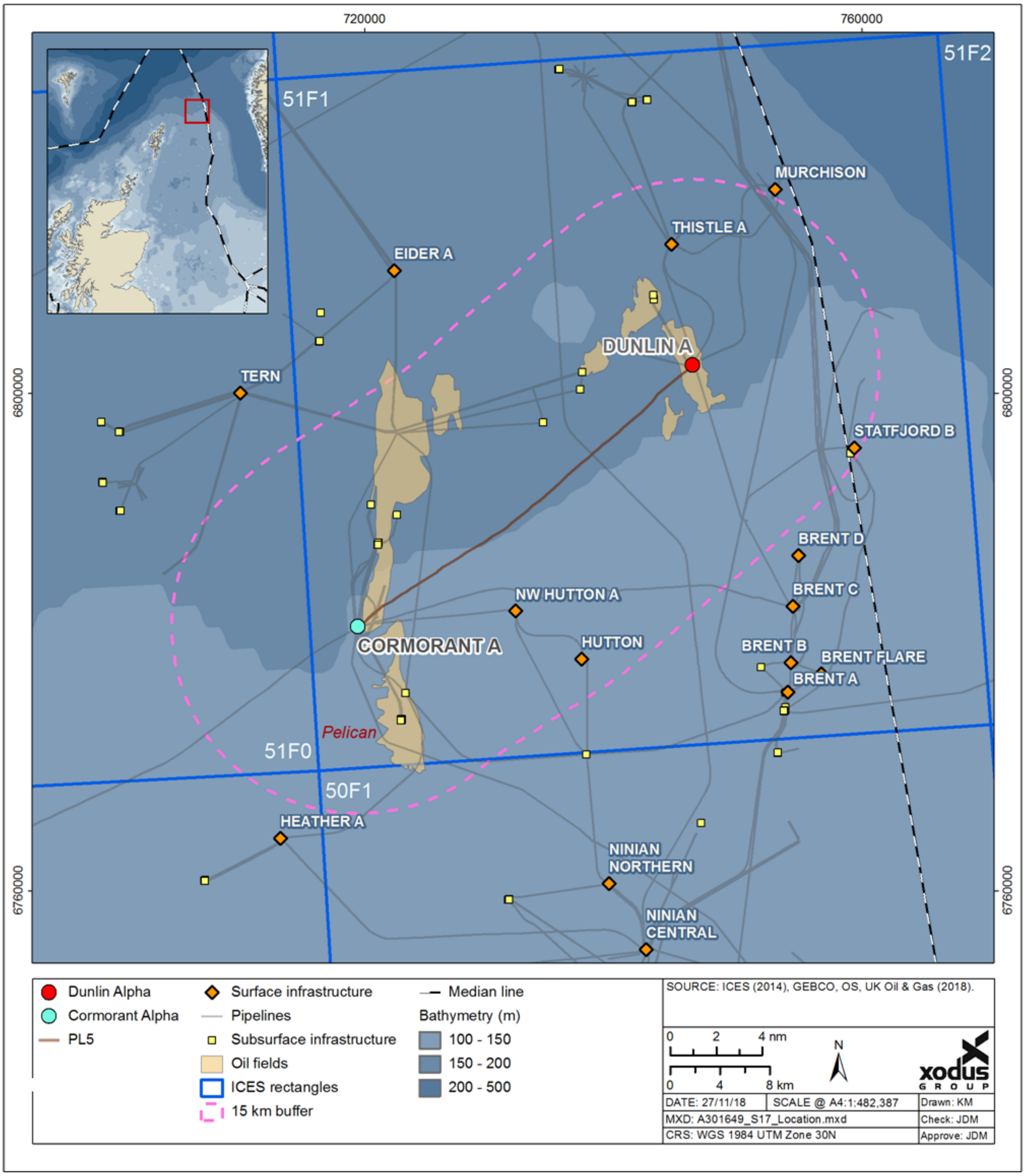

Figure 4.2 Baseline Fishing Activity Study Area Relevant to Dunlin Alpha Topsides: ICES Rectangle

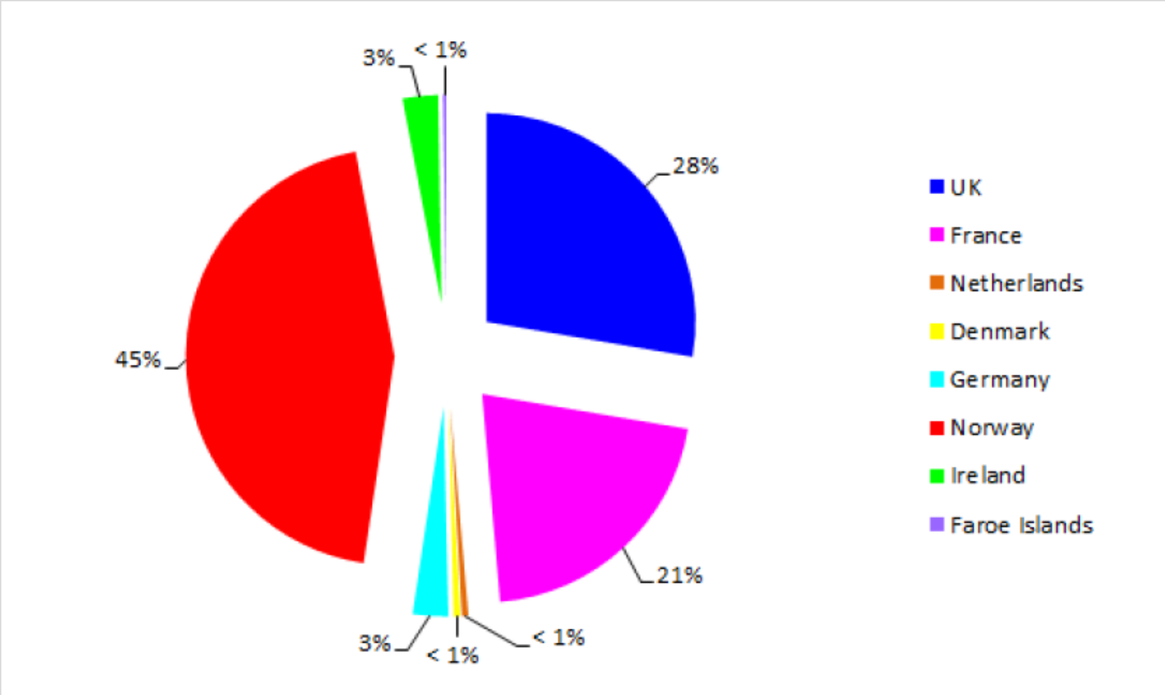

Figure 4.3 AIS Nationality Distribution (June 2016 – July 2017) (Anatec, 2017)

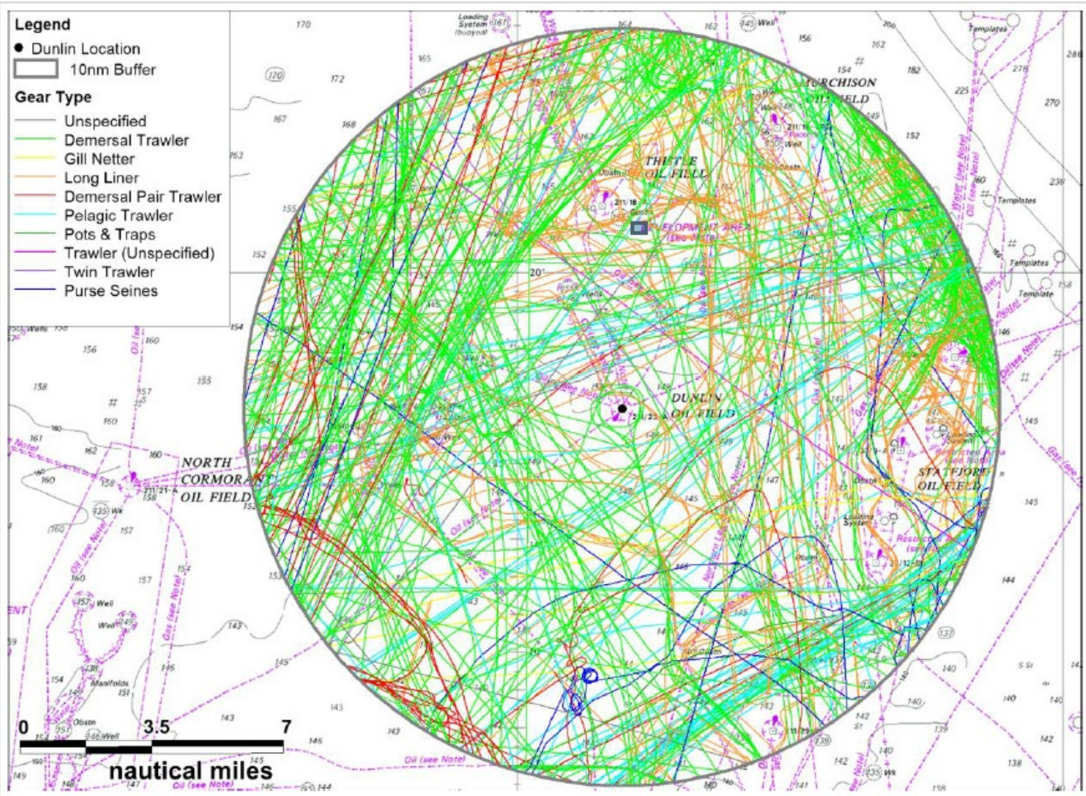

Figure 4.4 Fishing Vessel Activity Over the Period July 2016 - June 2017 (Anatec, 2017)

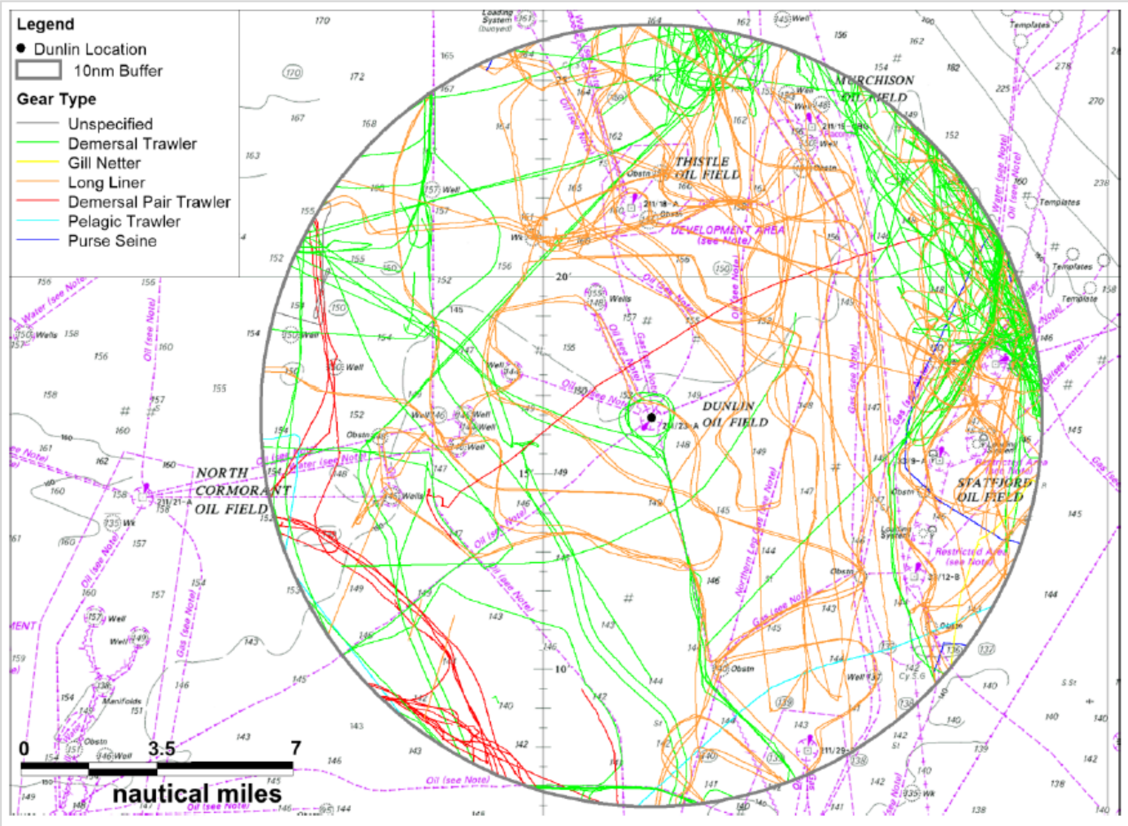

Figure 4.5 Vessels Actively Engaged in Fishing (July 2016 – June 2017) (Anatec, 2017)

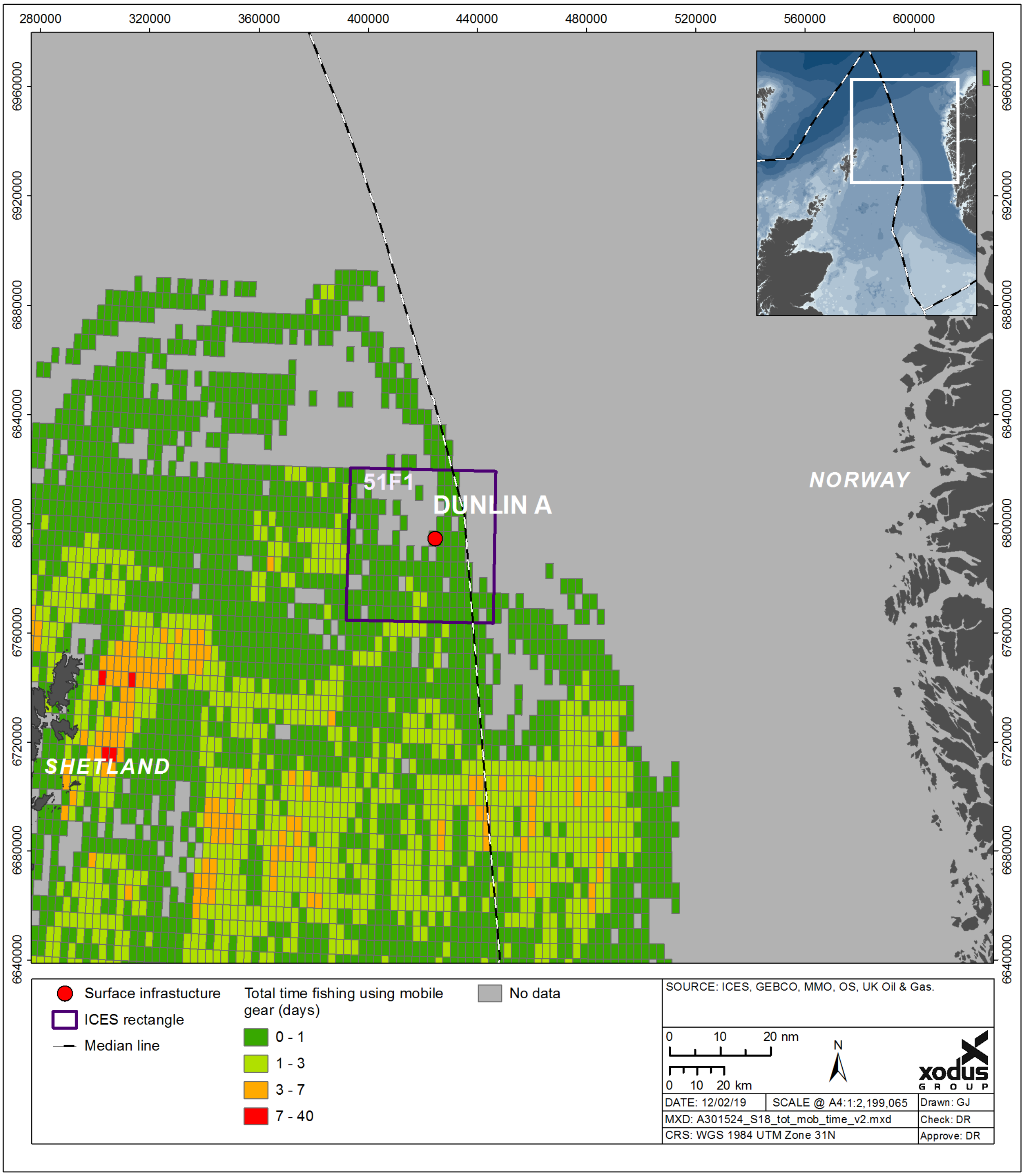

Figure 4.6 Relative Distribution of Fishing Effort (time in days) of Vessels Using Mobile Gear (averaged across 2012 – 2016) (MMO, 2017)

4.2.2. Types of Fishery

Commercial fishing is excluded within 500 m of the Dunlin Alpha installation as a result of a 500 m platform safety exclusion zone having been implemented, but beyond this area within the surrounding ICES rectangle 51F1 there are two main types of fishery; demersal and pelagic.

Figure 4.7 shows the average annual value and live weight of fish landed in the UK between 2012 – 2016. The area surrounding the Dunlin and North Cormorant, South Cormorant and Pelican fields is used by pelagic and demersal trawl fisheries, with the demersal fishery being most productive in terms of the value and live weight (tonnage) of landings. Some shellfish species are landed from within ICES rectangle 51F1 in trawls, though the value and tonnage are comparatively very low (i.e. near zero).

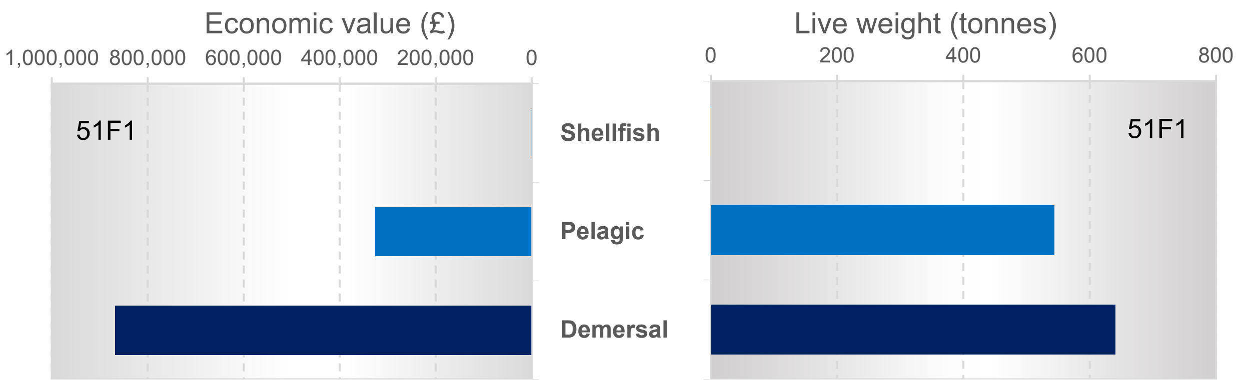

Figure 4.7 Annual Economic Value and Live Weight Tonnage from ICES Rectangle 51F1 (averaged across 2012 – 2016) (Scottish Government, 2018)

4.2.3. Fishery Value

Kafas *et al.* (2012) report the Greater Dunlin Area as being at the northern extent of a large band of higher value demersal fishing effort, which stretches from the Outer Hebrides in the west, around Orkney and Shetland and down into the southern North Sea. Kafas *et a*l. (2012) also report the Greater Dunlin Area being at the eastern-most extent of a large band of higher value pelagic fishing area that runs from the northern North Sea out to the west of the Outer Hebrides.

Saithe is the key commercial species landed from ICES rectangle 51F1 for both value (40%) and weight (52%). However, this is of relatively low value when compared to total landings into Scotland; landings of this species from ICES rectangle 51F1 comprise only 0.1% of the value (£) of 2016 landings into Scotland (Scottish Government, 2018).

Data from the Scottish Government (2018) offer insights into the proportion of time spent fishing and average value of landings within ICES Rectangle 51F1 each year. The average fishing effort (days spent fishing) within ICES Rectangle 51F1 over the period 2012 - 2017 was 102.8 days per calendar year (Table 4.2), however in the immediate vicinity (15 km) of the installation this is very low 0-1 days per year. This data covers UK vessels over 10 m in length and non-UK vessels over 15m in length landing in the UK.

Table 4.2 Summary Statistics of Total Annual Fishing Effort by UK Vessels and Average Value and Quantity of Landings by Species from UK/Non-UK Vessels Landing in UK, (Scottish Government, 2018)

Year	Within ICES Rectangle 51F1			Throughout the UK	
	Total fishing effort (days)	Average value of landings (£)	Average quantity (Te)	Average value of landings (£)	Average quantity (Te)
2012	90	£22,249	14.4	£70,763	59.3
2013	183	£47,416	39.1	£108,642	107.7
2014	100	£60,288	71.3	£102,561	99.2
2015	103	£57,886	74.3	£99,452	96.8
2016	62	£42,113	51.7	£113,752	77.6
2017	79	£27,526	18.2	£107,996	85.0
Annual average	**102.83**	**£42,913.00**	**44.83**	**£100,527.67**	**87.6**

4.2.4. Gear and Fishing Effort

Trawl gear is the primary fishing gear type used in ICES rectangle 51F1 by UK vessels (Scottish Government, 2018). Trawls include demersal trawls (including seabed contact) and midwater trawls (i.e. pelagic) which operate within the water column. Fishing activity by gear type recorded between March 2017 – February 2018 shows that the t fleets utilising the project area as fishing grounds are mainly targeting demersal species with trawl gears. However, static gear (ling lining and gill netting) has also been used, this is primarily deployed by Norwegian vessels (Anatec 2017)(Figure 4.8).

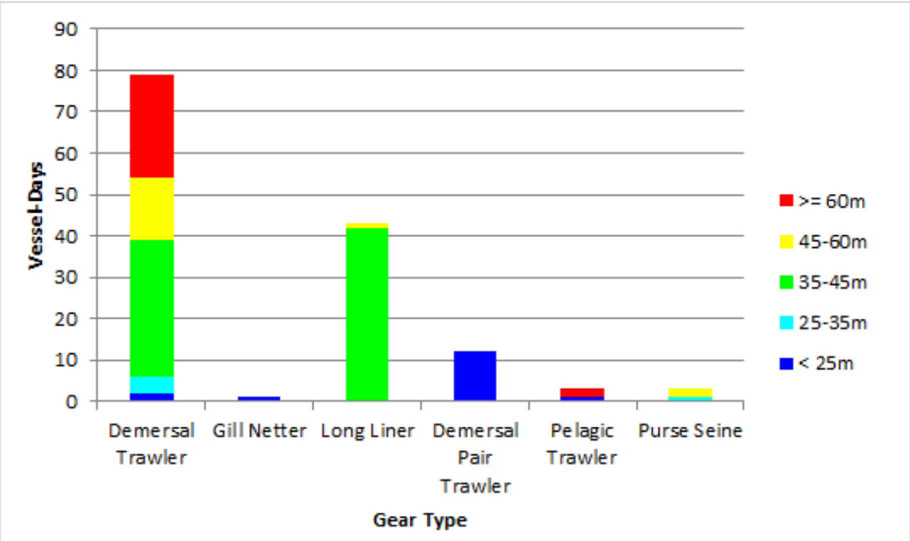

Figure 4.8 Vessel Activity by Gear Type and Length Distribution Over the Period (July 2016 – June 2017)

4.2.5. Seasonality

The average fishing effort in ICES rectangle 51F1 is 130 days per year (average over 2010 – 2014) (Scottish Government, 2018). Data on monthly fishing effort were obtained from the MMO for the time period 2010 – 2014 and analysed to establish seasonal trends. The Vessel Monitoring System (VMS) data show that most activity is concentrated in the spring and early summer months when five to twelve vessels are active in the area compared with fewer than four vessels per month at other times, as shown in Figure 4.9 (MMO, 2016). Review of Automatic Identification System (AIS) data, which represents an alternative method of tracking fishing activity, suggests that activity peaked earlier in the year in 2015 (Figure 4.10, Xodus, 2016). Seasonality must therefore be viewed as changeable over time, depending on market conditions, quota availability and weather.

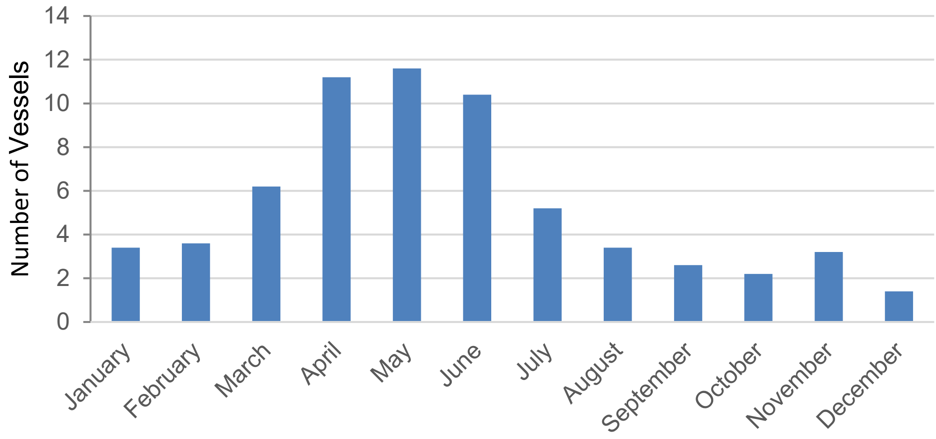

Figure 4.9 Seasonal Distribution of Vessel Presence in ICES Rectangle 51F1 Indicated by VMS Data (average 2010 – 2014) (MMO, 2016)

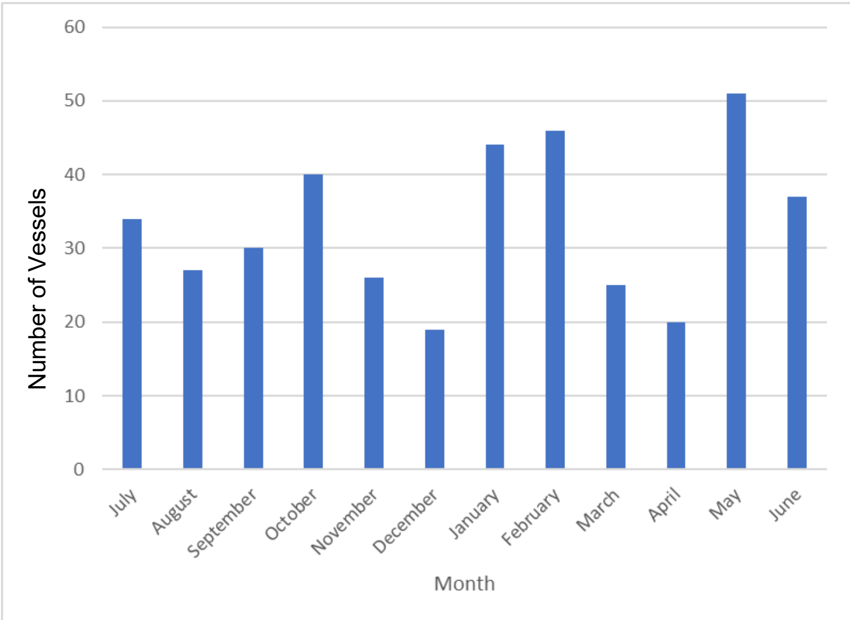

Figure 4.10 Seasonal Distribution of Vessel Presence in the 10 Nautical Miles (nm) Surrounding the Greater Dunlin Area, Based on AIS data for July 2016 – June 2017 (Xodus, 2016)

Monthly distributions of landings data from the Marine Management Organisation (MMO) suggest that landings value (£) is highest in autumn, with the trendline peaking in October and November, though only for the 2014 and 2015 fishing years when mackerel was the predominant catch species. The data suggests that mackerel landings, which are historically infrequent and unpredictable for this region, are likely to be influencing the dramatic climb in landings value data for those months (Xodus, 2018). If those irregular mackerel landings are discounted, a more accurate trend of fishing activity becomes apparent. Fishing peaks during the spring and summer months and falls during the autumn and winter as weather conditions worsen.

4.3. Other Sea Users – Shipping Activity

The North Sea contains some of the world's busiest shipping routes, with significant traffic generated by vessels trading between ports at either side of the North Sea and the Baltic. North Sea oil and gas fields also generate moderate vessel traffic in the form of support vessels (DECC, 2016). Shipping activity is assessed to be low in Block 211/23 (DECC, 2016). An average of between 0.1 to 5 vessels per week pass the vicinity of the project area with the majority of traffic consisting of small to medium sized cargo ships and tankers (MMO, 2014). Other vessels that pass within the vicinity of the project area include dredging or underwater operation vessels and fishing vessels. A composite from AIS tracks of vessels using the project area in 2015 is presented in Figure 4.11.

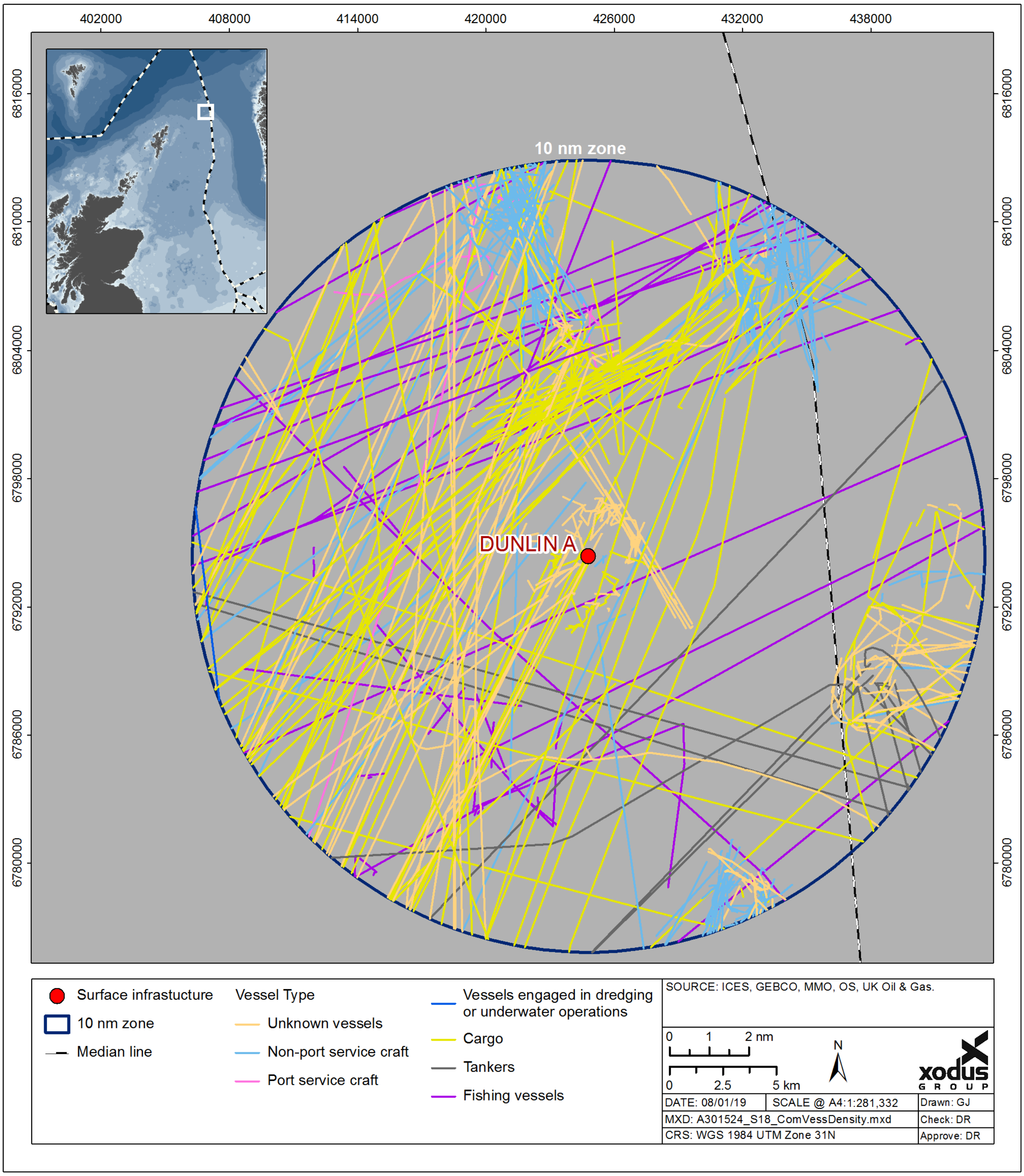

Figure 4.11 Shipping Intensity

4.4. Lophelia pertusa

Lophelia pertusa is a reef-building cold water coral that provides habitats for other epifaunal and fish species, and is a UK habitat of principle importance and a Scottish Priority Marine Feature; it is also highlighted in Annex I of the European Habitats Directive, and is on the OSPAR List of Threatened and/or Declining Species and Habitats. This species is normally restricted to deep water in depth ranges of 200 – 2,000 m on the continental slope and the extent of *L. pertusa* reefs is undergoing an overall decline due to mechanical damage by demersal fishing gear in all OSPAR areas (OSPAR, 2009). However, the species has also been recognised in the scientific literature as one which grows opportunistically on oil and gas subsea infrastructure (e.g. Gass & Roberts, 2006) and which has been recorded from many offshore installations in the northern North Sea at depths between 59 m and 132 m.

The marine growth study (Xodus, 2017) indicated that *L. pertusa* was present on the platform legs, CGBS, conductors and CGFs at approximately 48 m below LAT and deeper (Fugro, 2016a). The activities during this EA only extend to 40 m below LAT (removal of the second conductor guide frame) and as such only small amounts of *L. pertusa* (worse-case estimate of approximately 83 Te) would be expected to be encountered during the proposed operations. Removal or dismantling of structures on which cold water corals are present would most likely result in their destruction, but this is not considered an issue as this species is not naturally present in any reef structures within the vicinity of the Dunlin Alpha platform. Therefore, the removal of the relatively small amount of *L. pertusa* would not affect the natural reefs or extent and distribution of this species.

As further noted in the OPRED decommissioning guidance notes, if the coral is present and the installation upon which it is located is to be returned to shore (particularly if the installation is being sent overseas for further dismantling) it will be necessary to discuss with Defra the requirements of the Convention on International Trade in Endangered Species (CITES). CITES sets controls on the international trade and movement of species that or may be threatened through commercial exploitation, and *L. pertusa* is listed. A CITES certificate would be necessary for transporting sub-sea pieces of the Dunlin Alpha infrastructure with *Lophelia* between states.

5. Impact Assessment and Justification

An assessment screening workshop was undertaken to discuss the proposed decommissioning activities and any potential impacts these may pose. This discussion identified 11 potential impact areas based on the proposed removal methods identified in Section 2.2. All 11 potential impacts were screened out of further assessment based on the low level of severity, or likelihood of significant impact occurring. Justification statements for these screening decisions are provided in Section 5.1.

5.1. Assessment of Potential Impacts

Impact	Further assessment	Rationale
Emissions to air	No	Fairfield recognises that atmospheric emissions generated from vessels can act cumulatively with those from other activities (such as onshore power generation and use of vehicles) to contribute to global climate change. However, emissions during decommissioning activities (largely comprising fuel combustion gases) will occur in the context of the cessation of production. As such, emissions from operations and vessels associated with operation of the Dunlin Alpha topsides will cease. Reviewing historical European Union (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 production. A review of previous decommissioning environmental impact assessment reports shows that atmospheric emissions in highly dispersive offshore environments are exclusively concluded to have no significant impact and are usually extremely small in the context of UKCS/global emissions. Most reports also note that emissions from short-term decommissioning activities are small compared to those previously arising from the asset over its operational life. The majority of emissions for the Dunlin Alpha topsides decommissioning relate to the vessel time or are associated with the recycling of material returned to shore. As the decommissioning activities proposed are of such short duration (54 days) this aspect is not anticipated to result in significant impact. Atmospheric emissions were calculated in line with IoP guidelines (IoP, 2000). The estimated CO_2 emissions to be generated by the selected decommissioning options are 41,952.2 Te, equating to less than 0.03% of the total UKCS vessel emissions (excluding fishing vessels) in 2014 (BEIS, 2017). Summary tables and assumptions used during the calculation of this estimate are provided in Appendix C. Considering the above, atmospheric emissions do not warrant further assessment.
Disturbance to the seabed	No	Currently it is envisaged that all vessels undertaking the decommissioning and removal works would be dynamically positioning vessels. As a result, there will be no direct seabed interaction associated with the decommissioning of the topsides. Should this change following the detail design process and an anchor vessel be required, any potential impact would be assessed and captured in any supporting permit applications via the Portal Environmental Tracking System (PETS).

Impact	Further assessment	Rationale
		On this basis, no further assessment need be undertaken.
Physical presence of vessels in relation to other sea users	No	The presence of a small number of vessels for topsides decommissioning activities will be relatively short-term in the context of the life of the Dunlin Alpha installation. Activity will occur using similar vessels to those currently deployed for oil and gas installation, operation and decommissioning activities. The small number of vessels required will also generally be in use within the existing 500 m safety exclusion zone and will not occupy 'new' areas. Other sea users will be notified in advance of activities occurring meaning those stakeholders will have time to make any necessary alternative arrangements for the very limited period of operations. The decommissioning of the Dunlin Alpha topsides is estimated to require up to five vessels depending on the selected method of removal, however these would not all be on location at the same time (maximum of three at any one time). A review of previously submitted decommissioning environmental impact assessment reports and environmental appraisals show that some projects indicate a greater potential issue with short-term vessel presence, but those largely relate to project-specific sensitive locations, which is not the case for this decommissioning project. Considering the above, temporary presence of vessels does not need further assessment.
Physical presence of infrastructure decommissioned *in situ* in relation to other sea users	No	As topsides will be fully removed, there will be no mechanism for associated long-term impact through physical presence. Once the topsides are removed the 500 m safety exclusion zone will remain in effect alongside the deployment and maintenance of suitable navigational aids until decommissioning works begin on the CGBS. The subsequent use and fate of these aspects will be discussed as part of the CGBS EA. Considering the above, no further assessment relating to the long-term presence of infrastructure will be covered within this EA.
Discharges to sea (short-term and long-term)	No	Discharges from vessels are typically well-controlled activities that are regulated through vessel and machinery design, management and operation procedures. In addition, topsides process pipework and equipment will be flushed and drained prior to any decommissioning activities commencing. There would be no planned discharges from the topsides themselves. Any residual material which remains will be expected to be at trace levels/volumes following the flushing regime and therefore would not pose any significant risk. OPEP modelling for a release of hydrocarbons associated with a collision of vessels indicates no significant impact based on distance from shore. This was based on a volume of 3,500 m^3 of diesel; any residual hydrocarbons are expected to be significantly smaller in volume than those present on that of the modelled vessel. As topsides will be fully removed, there will be no potential for long-term release from the facilities. Considering the above, discharges to sea from the topsides do not need to be assessed further.
Underwater noise emissions	No	Cutting required to remove the topsides will take place primarily above the waterline with only a short period of cutting below the waterline, associated with the CGF removal activities. Vessel

Impact	Further assessment	Rationale
		presence will be limited in duration. The project is not located within an area protected for marine mammals. With industry-standard mitigation measures and JNCC guidance, EAs for offshore oil and gas decommissioning projects typically show no injury, or significant disturbance associated with these projects (Shell, 2017; CNRI, 2013; CNRI, 2017; and Marathon, 2017). On this basis, underwater noise assessment does not need assessed further.
Resource use	No	Generally, resource use from the proposed activities will require limited raw materials and be largely restricted to fuel use. Such use of resources is not typically an issue of concern in offshore oil and gas. The estimated total energy usage for the proposed topsides decommissioning project is 497,607 GJ. Material will be returned to shore as a result of project activities and the expectation is that at least 95% of this will be recycled. There may be instances where infrastructure returned to shore is contaminated and cannot be recycled, but the weight/volume of such material is not expected to result in substantial landfill use (e.g. NORM circa 28 Te). Considering the above, resource use does not warrant further assessment.
Onshore activities	No	The OPRED decommissioning guidance notes state that onshore activities are not in scope of Decommissioning EAs, and this topic does not require further assessment. It should be noted that through Fairfield's waste management strategy only licensed contractors will be considered who can demonstrate they are capable of handling and processing the types and quantities of material to be brought ashore. This will form part of the commercial tendering process.
Waste	No	It is waste management, not generation, that is the issue across decommissioning projects, with capacity to handle waste within the UK often cited as a stakeholder concern. All waste materials brought to shore, which will be routine in nature, will be managed as part of the project waste management plan, using approved waste contractors. Waste will be managed in line with Fairfield's waste management strategy and an active waste management plan will be developed and maintained. On this basis, no further assessment of waste is necessary.
Unplanned events	No	The topsides process system will have been flushed and drained prior to the decommissioning activities described here being carried out. Release of a live hydrocarbon and chemical inventory is therefore not a relevant impact mechanism. The HLV to be used for removing the topsides is likely to have the largest fuel inventory of the few vessels involved in the decommissioning activities. However, the inventory is likely to be less than the worst-case crude oil spill from loss of well containment modelled and assessed in the Dunlin field OPEP. In addition, the vessel's fuel inventory is likely to be split between a number of separate fuel tanks, significantly reducing the likelihood of an instantaneous release of a full inventory. Overall, therefore, the potential impact from fuel inventory release will be at worst equivalent

Impact	Further assessment	Rationale
		to that already assessed and mitigated for the operational phase of Dunlin Alpha. The current OPEP for the Dunlin Alpha topsides considers a diesel release of approx. 3,500 m^3. The results of the spill modelling indicate a very low probability of landfall (less than 5%, after 6 days) and any beached volume would be extremely small (circa. 35 m^3). As the methodology for the topsides removal to shore has not been defined in detail, there exists the possibility that during transport of the topsides materials, elements may dislodge and drop from the transport vessel. Dropped object procedures are industry standard and there is only a very remote probability of any interaction with any live infrastructure. Considering the above, the potential impacts from accidental chemical/hydrocarbon releases during decommissioning activities do not warrant further assessment. Although the risk of oil spill is remote, an OPEP will remain in place for the duration of the Dunlin Alpha decommissioning activities. Any spills from vessels in transit and outside the 500 m safety exclusion zone are covered by a separate Shipboard Oil Pollution Emergency Plan (SOPEP). Up to five vessels will be deployed during decommissioning activities, including two HLVs, two tug vessels and a standby/support vessel.

5.2. Aspects Taken Forward for Further Assessment

Based on the initial screening (Section 5.1), there are no aspects which warrant further assessment within the EA. Any potential impact will be short in duration and of low impact severity, therefore posing no significant risk to the environmental or societal receptors assessed and in line with general permitted offshore and onshore activities.

6. Conclusions

The selected topsides decommissioning option was assessed for the potential to cause significant impacts on environmental or social receptors across the UKCS. Following review of the relevant activities associated with the Dunlin Alpha topsides decommissioning project, the environmental sensitivities of the project area, industry experience with decommissioning activities and of stakeholder concerns, it has been determined that there are no issues associated with the decommissioning that pose any significant risk to these receptors.

6.1. Proposed Mitigation and Control Measures

Following the EA process, it can be concluded that activities associated with the decommissioning of the Dunlin Alpha topsides are unlikely to significantly impact the environment or other users either offshore or onshore, for example shipping traffic, fishing or seabed communities, if the proposed mitigation and control measures are effectively applied. A summary of the proposed control and mitigation measures is shown in Table 6.1. To ensure that impacts remain as described above, Fairfield will follow routine environmental management activities, for example contractor management, vessel audits and legal requirements to report discharges and emissions, such that the environmental and societal impact of the decommissioning activities will be minimised.

Table 6.1 Proposed mitigation and control measures

General and Existing
• Lessons learnt from previous decommissioning scopes will be reviewed and implemented as appropriate; • Vessels will be managed in accordance with Fairfield's existing marine procedures; • The vessels' work programme will be optimised to minimise vessel use; • 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 topsides decommissioning activities are taking place; • Topsides systems will be isolated and process equipment drained and flushed to reduce residual contaminants in the infrastructure being decommissioned; • The OPEP is one of the controls included in a comprehensive management and operational control plan developed to minimise the likelihood of large hydrocarbon releases and to mitigate their impacts should they occur; • All vessels undertaking decommissioning activities will have an approved SOPEP; • Contractor management assurance processes will be developed to ensure environmental and societal impacts are identified and appropriately managed; and • A project management of change process will be developed and implemented should changes of scope be required.
Large-scale Releases to Sea
• Any release will be managed under the existing OPEP. The OPEP will be updated with additional hydrocarbon inventories (e.g. decommissioning vessel fuel inventories) as required, and additional measures will be identified and implemented should modelling of new hydrocarbon inventories show increased risk; and • Risk of a full inventory loss from a vessel is very low given that the majority of vessels have compartmentalised or distributed fuel tanks, making full containment loss highly unlikely and the distance from shore would prevent any significant volume of diesel reaching any shoreline.

Waste Management
• The selected waste management contractor has been subjected to a stringent commercial tendering process to ensure they are capable of handling all materials expected to be present on the Dunlin Alpha topsides; • Fairfield are targeting up to 95% of the material brought back onshore to be recycled and will engage with the supply chain and other operators/ industries to explore opportunities to maximise other recovery options; • All waste will be managed in compliance with relevant waste legislation by a licenced waste management contractor; and • Fairfield will develop and maintain an Active Waste Management Plan to help identify and track all wastes generated.

7. References

Anatec (2017). Shipping and Fishing Decommissioning Risk Assessment Dunlin Alpha (Block 211/23). August 2017. A4045-FE-CR-1.

BEIS (2018). Guidance Notes - Decommissioning of Offshore Oil and Gas Installations and Pipelines.

BEIS, 2017. A review of the NAEI Shipping Emissions Methodology. Report for the Department of Business, Energy and Industrial Strategy, Ricardo Energy and Environment. PO number 1109088. Issue number 5. Date: 12/12/2007

CNRI, 2013. Environmental Statement of the Murchison Facilities. MURDECOM-BMT-EN-REP-00198. May 2013.

CNRI, 2017. Ninian Northern Platform Decommissioning Programme. P0005-CNR-PM-REP-00004. February 2017.

DECC (2016). UK Offshore Energy Strategic Environmental Assessment. OESEA3 Environmental Report. Future Leasing/Licensing for Offshore Renewable Energy, Offshore Oil & Gas, Hydrocarbon Gas and Carbon Dioxide Storage and Associated Infrastructure. Online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/504827/OESEA3_Environmental_Report_Final.pdf [Accessed 12/02/2019].

Decom North Sea (2017). Environmental Appraisal Guidelines. Online at http://decomnorthsea.com/about-dns/projects-update/environmental-appraisal-guidelines [Accessed 12/02/2019].

Fairfield (2017). Fairfield Waste Management Strategy. Document No. FBL-DUN-HSE-STR-00003.

Fugro (2013). North Cormorant Environmental Monitoring Survey UKCS Block 211/26a July 2012. Fugro reference J-1-22-2236-4(2).

Fugro (2014a). Cormorant Alpha Environmental Monitoring Survey UKCS BLOCK 211/26A May 2013. Fugro reference J/1/20/2324-4(2).

Fugro (2014b). Cormorant Underwater Manifold Centre Environmental Monitoring Survey UKCS Block 211/26A May 2013. Fugro reference J/1/20/2324-6(2).

Fugro (2016a). Fairfield Pre-decommissioning Habitat Assessment Survey Report: Dunlin Field November 2015 to April 2016.

Fugro (2016b). Fairfield Pre-decommissioning Habitat Assessment Survey Report: Dunlin Fuel Gas Import Pipeline November 2015 to April 2016.

Fugro (2016c). Dunlin Alpha Fuel Gas Import Pipeline Pre-Decommissioning Environmental Baseline Survey Report UKCS 211/23 November 2015 to April 2016.

Fugro (2016d). Fairfield Pre-decommissioning Habitat Assessment Survey Report: Dunlin A to Brent C Power Import Cable Route November 2015 to April 2016.

Fugro (2016e). Dunlin Alpha Power Import Cable Route Pre-Decommissioning Environmental Baseline Survey Report UKCS Block 211/23 November 2015 to April 2016.

Fugro (2017a). Merlin Pre-decommissioning Environmental Survey UKCS Blocks 211/23 21 November 2015 to 12 April 2016. Fugro reference 60120_08rev3.

Fugro (2017b). Merlin Pre-decommissioning Cuttings Assessment Survey UKCS Block 211/23 November 2015 to April 2016.

Fugro (2017c). Osprey Pre-decommissioning Environmental Survey UKCS Block 211/23 21 November 2015 to 12 April 2016. Fugro reference 60120_09rev3.

Fugro (2017d). Dunlin Alpha Power Import Cable Route Pre-Decommissioning Environmental Survey UKCS Blocks 211/23 to 211/29 21 November 2015 to 12 April 2016. Fugro reference 160120_11rev3.

Fugro (2017e). Dunlin Alpha Fuel Gas Import Pipeline Pre-Decommissioning Environmental Survey UKCS Blocks 211/18 to 211/23 21 November 2015 to 12 April 2016. Fugro reference 160120_12rev3.

Fugro (2017f). Dunlin Alpha Pre-Decommissioning Environmental Survey UKCS Block 211/23. 21 November 2015 to 12 April 2016. Fugro reference 160120_10rev3.

Fugro (2015). Dunlin Alpha Pre-Decommissioning Cuttings Assessment Survey UKCS Block 211/23, 21st November 2015 to 12th April 2016. Fugro Project No: 160120_15Rev6. Report to Fairfield Energy Limited.

Gardline (2009a). Dunlin Debris Clearance, 'mud mound' and Environmental Baseline Survey. December 2008. Gardline Report Ref 7859.

Gardline (2009b). Osprey Debris Clearance, Habitat Assessment and Environmental Baseline Survey. November/December 2008. Gardline Report Ref 7858.1.

Gardline (2010a). Skye to Dunlin Pipeline Route Survey UKCS Block 211/23a October 2009; Survey Report. Gardline reference 8204, Client reference 1601.

Gardline (2010b). Skye to Dunlin Pipeline Route Survey UKCS Block 211/23a October 2009; Environmental Baseline Survey. Gardline reference 8204.1, Client reference 1600.

Gardline (2010c). Skye to Dunlin Pipeline Route Survey Phase 2 UKCS Block 211/23a April/May 2010; Survey Report. Gardline reference 8372, Client reference 1670.

Gardline (2010d). UKCS Block 211/23a Skye Phase 2 Site, Habitat Assessment and Environmental Survey April/May 2010; Survey Report. Gardline reference 8375, Client reference 1669.

Gardline (2010e). UKCS 211/23a Skye ‘Looksee 3’ Site, Habitat Assessment and Environmental Survey Phase 2 April/May 2010; Environmental Baseline Report. Gardline reference 8375.1, Client reference 1669.

Gardline (2010f). UKCS Quad 211 Infield Environmental Survey November to December 2008 and September to October 2009; Environmental Baseline Report. Gardline reference 7860, Client reference 1559.

Gardline (2010g). Dunlin Fuel Gas Import Route Survey and Environmental Baseline Survey UKCS Blocks 211/18a and 211/23a. August to September 2010. Environmental Baseline Report. Gardline Report Ref 8529.1.

Gardline (2010h). Dunlin to NLGP Pipeline Route Survey UKCS Block 211/24. August to November 2009. Environmental Baseline Report. Gardline Report Ref 8122.1.

Gardline (2011). Dunlin Fuel Gas Import Route Survey and Environmental Survey UKCS Blocks 211/18a and 211/23a August to September 2010; Environmental Baseline Report. Gardline reference 8529.1.

Gass, S. and Roberts, J.M. (2006). The occurrence of the cold-water coral *Lophelia pertus*a (Scleractinia) on oil and gas platforms in the North Sea: Colony growth, recruitment and environmental controls on distribution. Marine Pollution Bulletin 52 (5) 549-559.

ICES. 2015. Report of the Benchmark Workshop on North Sea Stocks (WKNSEA), 2–6 February 2015, Copenhagen, Denmark. ICES CM 2015/ACOM:32. 253 pp.

IEEM (2010). Guidelines for Ecological Impact Assessment in Britain and Ireland, marine and Coastal. August 2010. Final Version 5.

IEMA (2015). environmental impact assessment Guide to Shaping Quality Development.

IEMA (2016). environmental impact assessment Guide to Delivering Quality Development.

IoP (2000). Guidelines for the Calculation of Estimates of Energy Use and Gaseous Emissions in the Decommissioning of Offshore Structures. Institute of Petroleum. February 2000. ISDN 0 85293 255 3.

Kafas, A., Jones, G., Watret, R., Davies, I. and Scott, B. (2012). Representation of the use of marine space by commercial fisheries in marine spatial planning. ICES CM I:23.

Marathon Oil U.K. LLC, 2017. Brae Alpha, Brae Bravo, Central Brae, West Brae and Sedgwick – Combined Decommissioning Programmes. Document reference number: 9000-MIP-99-PM-RP-00003-000,102. June 2017.

MMO (2016). Active vessel numbers and port of landing for UK and non-UK vessels landing from ICES rectangle 51F1 for the period 2010 – 2014. Data requested directly from MMO by Xodus.

MMO (2017). Economic value of landings (£), fishing effort (time) and quantity (tonnes) by gear type at the ICES statistical sub-rectangle level for the period 2012 – 2016. Data requested directly from MMO by Xodus

OGUK (2015b). Oil & Gas UK Well Decommissioning Guidelines, Issue 6. June 2018.

OGUK (2017). Decommissioning insight 2016. Online at http://oilandgasuk.co.uk/decommissioninginsight.cfm [Accessed 14/03/17].

OGUK (2018). Environment Report 2017. Online at https://oilandgasuk.co.uk/environment-report/ [Accessed 16/06/2018].

OSPAR (2008). Case Reports for the OSPAR List of threatened and/or declining species and habitats. OSPAR Commission. Online at: http://qsr2010.ospar.org/media/assessments/p00358_case_reports_species_and_habitats_2008.pdf [Accessed 12/02/2018].

OSPAR (2009b). Background Document for *Lophelia pertusa* reefs. Biodiversity Series. ISBN 978-1-906840-63-1, Publication Number: 423/2009.

Scottish Government (2018). Scottish Sea Fisheries Statistics, 2012 - 2017. Available online at http://www.scotland.gov.uk/Topics/Statistics/Browse/Agriculture-Fisheries/RectangleData [Accessed 18/06/2018].

Shell U.K. Limited, 2017. Brent Topsides Decommissioning Technical Document. Document Reference: BDE-F-TOP-HE-0709-00001. February 2017.

SNH (2013). A handbook on environmental impact assessment Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland. Online at http://www.snh.gov.uk/docs/A1198363.pdf [Accessed Dec 2018].

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. [Sub contract reference A1148]. Online at http://www.marlin.ac.uk/assets/pdf/Cefas_Rpt_revised.pdf [Accessed Dec 2018].

Xodus (2018). Dunlin Alpha to Cormorant Alpha Pipeline Fisheries Baseline Report. Document No. A-301649-S17-REPT-007, Rev. A01

Xodus (2017). Dunlin CA Studies – Marine Growth Assessment. Document Number: A301649-S09-REPT-001.

Xodus (2016). Commercial Baseline Fisheries Report. Document Number: A-301524-S00-REPT-003.

8. Appendix A – ENVID Matrix

Activity /Aspect / Impact				Controls, Mitigations and Ranking							Actions	
				Existing controls - Industry Standard, Legislative or Prescriptive	Initial Ranking taking into account 'routine' controls and mitigation: Impact			Probability (Likelihood)	Rank	Project Specific and Best Practice		
Project Infrastructure	General Activity	Detailed Activity	Summary of Environmental Impact		Consequence / Extent	Duration of harmful effect	Impact	Probability (Likelihood)	Initial Risk / Impact Ranking		Comment	Taken Forward for Further Assessment
Recovery of topside infrastructure	Recovery of infrastructure Reverse installation	Engineering down and cleaning	**Discharges to Sea** Flushing/ cleaning operations - overboard discharge targeted 30ppm	**Planned** Work 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	These are routine operations and will be conducted within the agreed permit conditions.	N
		Separation of topside modules and lifting to barge/transport	**Dropped objects (Small)** Behavioural modifications to marine mammals and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	**Unplanned** Dropped objects. Small objects but higher frequency (scaffolding poles, grating etc) - Fairfield Environmental Management System. - Procedures will be in place to reduce the potential for dropped objects. - Training and awareness of contractors will be required. - Lift planning will be undertaken to manage risks during lifting activities, including the consideration of prevailing environmental conditions and the use of specialist equipment where appropriate. - All lifting equipment will be tested and certified. - Procedures will be put in place to make sure that the location of any lost material is recorded and that significant objects are recovered where practicable.						- Dropped objects would be recovered where practicable	Dropped object procedures are industry standard and there is minimal risk of objects dropping on live infrastructure. All efforts will be made to recover any materials that are dropped.	N
			Dropped objects (large) Behavioural modifications to marine mammals and potentially fish. Population impacts due to cumulative impact or impacting a reproductively significant number of individuals or location.	**Unplanned** Dropped objects. Large objects but low frequency (topside modules) - Fairfield Environmental Management System. - Procedures will be in place to reduce the potential for dropped objects. - Training and awareness of contractors will be required. - Lift planning will be undertaken to manage risks during lifting activities, including the consideration of prevailing environmental conditions and the use of specialist equipment where appropriate. - All lifting equipment will be tested and certified. - Procedures will be put in place to make sure that the location of any lost material is recorded and that significant objects are recovered where practicable.						- Dropped objects would be recovered where practicable	Dropped object procedures are industry standard and there is minimal risk of objects dropping on live infrastructure. All efforts will be made to recover any materials that are dropped.	N
			Noise in water (From DP) Physiological harm, 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.	**Planned Minimal.** HLV vessel - DP most likely used. Thruster noise when initially deploying anchors and if DP used. Comparable with background vessel noise.						- Campaign, logistics, sharing vessels (across FEL portfolio) optimising vessels to minimise use - Main potential impact likely to be from disturbance rather than injury - Contractor selection - Suitable technology for cutting will be selected to ensure the effectiveness of the cutting (conductors and guideframes likely to be cut using diamond wire or similar mechanical form of cutting, and not water jetting) - Minimising the duration, disturbance and risk of requiring the activity to be repeated.	Not deemed to be significant in relation to current vessel activity already being moderate, activities are far offshore and not in the vicinity of key areas for receptors and that the planned activities will be short in duration.	N
			Discharges to Sea (small residuals) Overboard discharge of residual contaminants in vessels or pipework	**Unplanned** Accidental discharge of small volumes of contaminants from vessels or pipework on topsides. All topsides will have been cleaned to an agreed ALARP standard.						- 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	Any residual material will be small in volume and infrastructure will have been cleaned	N
			Noise in air Impact on environment e.g. birds	**Planned** - Not considered due to offshore location being away from established seabird sites. Cutting noise - will not have significant sound levels.						- Limit the duration of the noise emitting activities - Environmental audit of dismantling yard (including site visit) - Contractor management / selection - Yard to engage with local communities - Review records of engagement with communities and close out of issues - Contract award could include recognition of social issues including noise	Not deemed to be significant in relation to current vessel activity already being moderate, activities are far offshore and not in the vicinity of key areas for receptors and that the planned activities will be short in duration.	N

Activity /Aspect / Impact				Controls, Mitigations and Ranking	Initial Ranking taking into: Impact			Probability (Likelihood)	Rank		Actions	
Project Infrastructure	**General Activity**	**Detailed Activity**	**Summary of Environmental Impact**	**Existing controls - Industry Standard, Legislative or Prescriptive**	**Consequence / Extent**	**Duration of harmful effect**	**Impact**	**Probability (Likelihood)**	**Initial Risk / Impact Ranking**	**Project Specific and Best Practice**	**Comment**	**Taken forward for further assessment**
General	Waste Management	Onshore treatment and disposal of liquids, sludge's	**Solid deposit to land** Use of landfill and landfill resource take.	**Planned -** Approximately 98% of material recovered will be recycled. A target of less than 2% to go to landfill. There will be an inventory of hazardous waste compiled (including asbestos) to aid the segregation and recycling of waste. Inventory of additional waste e.g. chemicals, spent filters, smoke detectors, misc items. NORM - present. (dealt with below) Hg - maybe present							Not scored as all will be managed through a waste management plan and recorded through the project materials inventory. All waste will be managed in line with current legislation.	
		Onshore materials reuse, recycling and residue disposal	**Solid deposit to land** Use of landfill and landfill resource take.	**Planned** - All waste will be handled and disposed of in line with regulations as detailed in the Waste Management Plan. Inventory of waste - tracking materials to final place Potential positive impact from recycling of steel - not easily scored using Fairfield's impact matrix Negative impact of residue disposal less significant than above.								
		Onshore disposal of NORM material	**Solid deposit to land** Use of specialist landfill and landfill resource take.	**Planned** - All waste will be handled and disposed of in line with regulations as detailed in the Waste Management Plan.								
	Power generation	Fuel combustion	**Resource use** Steel strengthening temporary topsides to enable lifting. Vessel grillage for sea fastening etc,	**Planned** - Additional material required, gratings, bracing etc						- Planning of activities will minimise use of materials (there is also a financial driver for this) - Recycling as much as possible - Stakeholder consultation	-	N
			Gaseous emissions to atmosphere Increased degradation of local/regional air quality (NOx and particulates). Transboundary air pollution. Contributing to global warming (CO2).	**Planned** - Additional equipment required for decom not vessel use etc. Powering spread on back of support vessel. Short duration - low impact Emissions due to recycling. Largest contributor of steel - covered by recycling site PPC. HLV emissions.						- Low sulphur diesel. - Contractor selection - maintenance programmes and audits. - MARPOL compliance - Campaign, logistics, sharing vessels (across FEL portfolio) optimising vessels to minimise use.	-	N
			Resource use - energy Impact on climate change and reduction of resources of hydrocarbons. Products used for recycling.	**Planned** - Onshore recycling and HLV energy use. Lift vessel and onshore smelting processes will dominate energy usage. Not assessed at this stage due to global scale. This would be a very small amount of fuel usage.						- Maximise recycling opportunities - FEL Environmental Management System - Follow FEL waste management strategy and project management plan	-	N
	Physical Presence	Vessel Spread	**Catastrophic loss of containment** Pollution of the marine ecosystem. Organic enrichment and chemical contaminant effects in water column and seabed sediments.	**Unplanned -** Project will introduce new diesel inventory to the site with additional inherent spill / pollution risk e.g. from heavy lift vessel. OPEP MAS Navaids SOPEP						- OPEP/SOPEP, including modelling and appropriate response planning - Collision risk assessment - Maintenance procedures - SIMOPs - Bulk handling procedures and personnel training - Vessels will be selected which comply with IMO/MCA codes for prevention of oil pollution - Preferred operational procedures to be in place onboard vessels including use of drip trays under valves, use of pumps to decant lubricating oils, use of lockable valves on storage tanks and drums - Chemical storage areas contained to prevent accidental release of chemicals - Maintenance procedures - Pre-mobilisation audits will be carried out including a comprehensive review of spill prevention procedures - Arrangements in place to track spills - Adverse weather working procedures - Use of existing 50m safety exclusion zone at platform during lifting operations.	Reduced to 'as low as reasonably practicable'	Y
			Physical presence of vessels during operations.	**Planned** - Stakeholder engagement. Existing controls through the Consent to Locate process.						- Campaign, logistics, sharing vessels (across FEL portfolio) optimising vessels to minimise use. - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings. - Collision risk assessment. - Stakeholder consultation. - Logistics plan.	Not expected to be significant over normal vessel traffic and implementation of notifications etc.	N
Residual infrastructure	Physical presence	Remaining jacket structure	Potential collision risk	Unplanned - Project will introduce new diesel inventory to the site with additional inherent spill / pollution risk e.g. from heavy lift vessel.						-Navigation aids, lighting in line with HSE and MCA requirements, 500 m safety exclusion zone to remain in operation.	Not directly part of this scope as this will be part of the CGBS scope. Not expected to be significant over normal vessel traffic and implementation of notifications etc.	N

9. Appendix B – Impact Assessment Methodology

9.1. Impact Definition

9.1.1. Impact Magnitude

Table B 1 Type of Impact

Type of impact	Definition
Direct	Impacts that result from a direct interaction between the project and the receptor. Impacts that are actually caused by the introduction of project activities into the receiving environment. E.g. The direct loss of benthic habitat.
Indirect	Reasonably foreseeable impacts that are caused by the interactions of the project, but which occur later in time than the original, or at a further distance from the proposed project location. Indirect impacts include impacts that may be referred to as 'secondary', 'related' or 'induced'. E.g. The direct loss of benthic habitat could have an indirect or secondary impact on by-catch of non-target species due to displacement of these species caused by loss of habitat.
Cumulative	Impacts that act together with other impacts (including those from any concurrent or planned future third-party activities) to affect the same receptors as the proposed project. Definition encompasses "in-combination" impacts.

Table B 2 Duration of Impact

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

Table B 3 Geographical Extent of Impact

Geographical extent	Description
Local	Impacts that are limited to the area surrounding the proposed project footprint and associated working areas. Alternatively, where appropriate, impacts that are restricted to a single habitat or biotope or community.
Regional	Impacts that are experienced beyond the local area to the wider region, as determined by habitat/ecosystem extent.
National	Impacts that affect nationally important receptors or protected areas, or which have consequences at a national level. This extent may refer to either Scotland or the UK depending on the context.
Transboundary	Impacts that could be experienced by neighbouring national administrative areas.
International	Impacts that affect areas protected by international conventions, European and internationally designated areas or internationally important populations of key receptors (e.g. birds, marine mammals).

Table B 4 Frequency of Impact

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

9.1.2. Impact Magnitude Criteria

Table B 5 Impact Magnitude Criteria

Magnitude	Criteria
Major	Extent of change: Impact occurs over a large scale or spatial geographical extent and /or is long term or permanent in nature. Frequency/intensity of impact: high frequency (occurring repeatedly or continuously for a long period of time) and/or at high intensity.
Moderate	Extent of change: Impact occurs over a local to medium scale/spatial extent and/or has a prolonged duration. 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.
Minor	Extent of change: Impact occurs on-site or is localised in scale/spatial extent and is of a temporary or short-term duration. Frequency/intensity of impact: low frequency (occurring occasionally/intermittently for short periods of time) and/or at low intensity.
Negligible	Extent of change: Impact is highly localised and very short term in nature (e.g. days/ few weeks only).

Magnitude	Criteria
Positive	An enhancement of some ecosystem or population parameter.
Notes: Magnitude of an impact is based on a variety of parameters. Definitions provided above are for guidance only and may not be appropriate for all impacts. For example, an impact may occur in a very localised area (minor to moderate) but at very high frequency/intensity for a long period of time (major). In such cases informed judgement is used to determine the most appropriate magnitude ranking and this is explained through the narrative of the assessment.	

9.1.3. Receptor Sensitivity

Table B 6 Sensitivity of Receptor

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

9.1.4. Receptor Vulnerability

Table B 7 Vulnerability of Receptor

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

9.1.5. Receptor Value

Table B 8 Value of Receptor

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

9.1.6. Assessment of Consequence and Impact Significance

Table B 9 Assessment of Consequence

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

10. Appendix C – Energy and Emissions Summary Tables

The energy and emissions estimates were calculated based on the methodology described in the Institute of Petroleum (IoP) "Guidelines for the Calculation of Estimates of Energy Use and Gaseous Emissions in the Decommissioning of Offshore Structures" (IoP, 2000). The Assessment includes:

- Identification of all structures to be decommissioned;
- Establishment of a materials inventory for each structure to be decommissioned;
- Identification of all operations associated with the decommissioning options (where operations are defined as all of the offshore and onshore activities associated with dismantling and transporting the components and recycling or treating any recovered materials);
- Identification of all end points associated with decommissioning each structure (end points are defined as the final states of the decommissioned materials);
- Identification of the associated activities that will be a source of energy expenditure and gaseous emissions for each operation and end point; and
- Selection of conversion factors and subsequent calculation of energy use and atmospheric emissions.

10.1. Approach

The calculations predominantly use the energy use and atmospheric emission factors provided within IoP (2000) guidelines. In accordance with these guidelines, alternative factors may be used where specific equipment is considered to have a significantly different fuel use from that presented in the IoP database.

The factors used for the energy and emissions calculations associated with the recycling of materials, general fuel consumption and vessel fuel use are detailed in Table C1.

Table C2 details the following sources, which were considered to have an associated impact on the energy and emissions associated with the proposed topsides decommissioning activities:

- Vessels for transportation and offshore operations;
- Onshore dismantling and/ or processing materials; and
- Recycling.

As all the topsides material is coming back to shore there is a limited tonnage of material that is expected to be landfilled and cannot be reused or recycled as a result the remanufacture of this material has not been calculated as it would not significantly affect the outcome.

Table C1 Emissions and Associated Factors by Vessel Type

Vessel	Gases Emitted to the Atmosphere (Te)							
	CO_2	CO	NO_x	N_2O	SO_2	CH_4	VOC	CO_2e
Emission factors - all vessels	3.17	0.0157	0.059	0.00022	0.012	0.00018	0.0024	
HLV - Thialf[1]	6,974.00	34.54	129.80	0.48	26.40	0.40	5.28	7,128.13
HLV - Sleipnir	8,844.30	43.80	164.61	0.61	33.48	0.50	6.70	9,039.77
Assisting Tug[3]	2,973.46	14.73	55.34	0.21	11.26	0.17	2.25	3,039.18
Tug[3]	1,439.18	7.13	26.79	0.10	5.45	0.08	1.09	1,470.99
Standby/ safety vessel[4]	862.24	4.27	16.05	0.06	3.26	0.05	0.65	881.30
TOTAL (tonnes)	21,093.18	104.47	392.59	1.46	79.85	1.20	15.97	21,559.36

Table C2 Summary of Associated CO_2 Emissions and Energy Use

Source	Energy Use (GJ)	CO_2 (tonnes)
Vessels	286,787.4	21,093.2
Recycling	186,057.0	20,071.0
Dismantling	24,763.0	792.0
Total	497,607.4	41,956.2

10.2. Assumptions

Table C3 details the estimated duration of vessel use that has been assumed during the calculation of the energy use and emissions associated with decommissioning activities. The general assumptions which have been used during the calculation of this estimate include:

- Assumes no onshore transportation as yard will handle recycling and processing;
- Assumes no wait on weather time;
- Durations based on contract schedule; and
- Non-ferrous metals have been assumed to be predominantly copper.

Table C3 Vessel Durations

Vessel Type	Vessel Days
Topside decommissioning activities	
SSCV Thialf[1]	32
SSCV Sleipnir[2]	19
Assisting tug[3]	32
Tow tug (inc. barge)[3]	20
SeaZip[4]	54
Removal of the conductors and CGFs	
SSCV Thialf	10
Assisting tug	10
Tow tug (inc. barge)	10
SeaZip	10

Notes:
[1] Fuel use rate based on IoP, 2000 (HLV – with propulsion)
[2] Fuel use rate based on IoP, 2000 (Semi-submersible crane vessel (200,000 t))
[3] Fuel use rate based on IoP, 2000 (Launch barge tug)
[4] Fuel use rate based on IoP, 2000 (Safety vessel)