Fotla Field Development

Environmental Statement – Submission Summary | Central North Sea

FOT-PM-ITH-EN-ES-0001 | 15 December 2025

Final

Ithaca Oil and Gas Limited

ENVIRONMENTAL STATEMENT – SUBMISSION SUMMARY

THE OFFSHORE OIL AND GAS EXPLORATION, PRODUCTION, UNLOADING AND STORAGE (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2020

SUBMISSION OF AN ENVIRONMENTAL STATEMENT IN SUPPORT OF AN APPLICATION FOR THE CONSENT OF A PROJECT UNDER THE PETROLEUM ACT 1998 OR THE ENERGY ACT 2008

Section A: Administrative Information

A1 – Project Reference Number

Number ES/2024/018

A2 – Applicant Contact Details

Company name: Ithaca Oil and Gas Limited

Contact name: [redacted]

Contact title: Environmental Advisor

A3 – ES Contact Details

Company name: Ithaca Oil and Gas Limited

Contact name: [redacted]

Contact title: Environmental Advisor

A4 – ES Preparation

Key expert staff involved in the preparation of the ES:

Name	Company	Title	Relevant Qualifications/Experience
[redacted]	Ithaca Oil and Gas Limited	Environmental Advisor	Eighteen years working in the oil and gas industry, in both environmental consultancy and operator roles. Specialisms in Environmental Impact Assessment, Environmental Management and Risk Assessment. MSc Environmental Impact Assessment
[redacted]	Fugro GB Limited	Principal Environmental Consultant	Over twenty five years in environmental consultancy role for the offshore oil and gas industry and other marine industries. MSc Marine Resource Development and Protection BEng Environmental Technology

Name	Company	Title	Relevant Qualifications/Experience
[redacted]	Fugro GB Limited	Senior Environmental Consultant	Fifteen years in environmental consultancy role, in which main specialisms have been environmental impact assessment and permitting applications. MSc Ecology BSc (Hons) Zoology
[redacted]	Fugro GB Limited	Environmental Consultant	Four years in environmental consultancy role in which main specialisms have been environmental impact assessments and desktop studies. MSc Climate Change: Managing the marine environment BSc (Hons) Marine Science
[redacted]	Fugro GB Limited	Environmental Consultant	Two years in environmental consultancy role in which main specialisms have been permitting applications and desktop studies. MSc Marine Systems and Policies BSc Natural Sciences

A5 – Licence Details

a) **Licenses covering proposed activities**

Licence numbers: P2373

b) **Licenses and current equity**

Company	Percentage Equity
Ithaca Oil and Gas Limited	100

Section B: Project Information

B1 - Nature of Project

a) Name of the project: Fotla Field Development

b) Name of the ES: As above

c) Brief description of the project:

Ithaca Oil and Gas Limited is an affiliate of Ithaca Energy (UK) Limited and its affiliated companies, which are collectively referred to as "Ithaca Energy". Ithaca Energy proposes to develop the Fotla field which will comprise two production wells tied back to an existing platform, Britannia, which is operated by Harbour Energy.

The Fotla field will be tied back to the Britannia facilities via a new 14.4 km pipe-in-pipe production pipeline. The Fotla field subsea pipeline system will deliver produced fluids directly to the Britannia Bridge Linked Platform, where all processing will be carried out.

Gas lift will be provided to the Fotla wells from the Britannia Platform itself.

Ithaca Energy proposes to commence drilling and installation operations in Q1 of 2027, with first oil anticipated in Q4 of 2027.

B2 – Project Location

a) Offshore location of the main project elements

Location	Easting [m]	Northing [m]
P1 Well	386,726	6,422,704
P2 Well	386,736	6,422,720
Drill Centre Manifold	386,785	6,422,770
Fotla Production Pipeline and Umbilical (Start point)	386,800	6,422,810
Fotla Production Pipeline and Umbilical (End point)	390,452	6,435,790
Gas Lift Pipeline (Start point)	386,834	6,422,788
Gas Lift Pipeline (End point)	390,491	6,435,801
Riser Base SSIV structure	390,463	6,435,829

Notes:
The coordinates are based on the International Spheroid 1924, European Datum 1950 (ED 50) Zone 31.
SSIV = Subsea Isolation Valve

The Fotla field is located in United Kingdom Continental Shelf (UKCS) Block 22/1b, approximately 176 km east of Peterhead, Scotland and 46 km west of the UK/Norway transboundary line. The Norwegian coastline lies 265 km to the east. The Britannia Platform is located approximately 14.4 km to the north of the Fotla field. Water depths at the Fotla field vary between 119 m and 132 m below LAT.

B3 – Previous Applications

None.

Contents

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Tables

Figures

Appendices

1. Summary of Legislation
2. Production Profiles
3. ENVID Matrices
4. Commitments Register

Glossary

Ambient Noise	Ambient or background noise consists of a range of individual sound sources, which can be both natural and manmade (anthropogenic)
Annex I habitat	A rare or characteristic habitat which is affords protection under on the EU Habitats Directive.
Annex II species	Animal or plant species requiring designation of Special Areas of Conservation under the EU Habitats Directive.
Annex IV species	Animal or plant species in need of strict protection under the EU Habitats Directive.
Anthropogenic emissions	Emissions of greenhouse gases, greenhouse gas precursors, and aerosols caused by human activities. These activities include the burning of fossil fuels, deforestation, land use changes, livestock production, fertilization, waste management, and industrial processes.
Appraisal well	A well drilled after a discovery well to gain more information on the reservoir.
Atmospheric emissions	A collective term for gases and particulates released to the atmosphere.
Backfilling	Backfilling is the process of refilling an excavated hole.
Bathymetry	The measurement of underwater depth in ocean, seas or lakes.
Benthic	Of or relating to the seabed.
Benthos	Animals that occur on or in the seabed.
Biogenic reef	This reef may be composed almost entirely of the reef building organisms and their tubes or shells, or may include sediments, stones and shells bound together by the organism.
Biota	The flora or fauna occurring in a particular area.
Biotope	The region of a habitat associated with a particular ecological community.
Block	Sub-division of territorial seas for the purpose of licensing to a company or group of companies for exploration and production rights. A UK block is approximately 200 to 250 km^2.
Blowout	A blowout occurs when gas, oil or saltwater escapes in an uncontrolled manner from a well.
Blowout preventer	A hydraulically operated wellhead device that can be actuated to close a well in order to prevent an uncontrolled release of fluids (a blow-out).
Bridge Linked Platform	Platform linked to another platform or topside structure by a bridge.
Carbon budget	Legally binding milestone of anthropogenic CO_2 emissions proposed every 5 years to achieve Net Zero targets.
Carbon Capture Storage	Carbon capture and storage (CCS) is a way of reducing carbon emissions, which could be key to helping to tackle global warming.
Carbon sink	Any system, natural or artificial, that absorbs more carbon dioxide (CO_2) from the atmosphere than it releases, thereby reducing the concentration of greenhouse gases in the atmosphere. Natural carbon sinks include forests, soils, and oceans, which capture and store carbon through processes like photosynthesis, carbon sequestration in soil, and oceanic absorption. Artificial carbon sinks or industrial removals involve technologies that capture CO_2 from the atmosphere and store it in underground formations or in other secure locations.
Casing	Steel lining inserted into a well as drilling progresses to prevent the wall of the hole from caving in during drilling, to prevent the inflow of unwanted fluids from surrounding formations and to provide a means of extracting oil (and gas) if a well is productive.
Cephalopods	Class of mollusc characterised by having a prominent head, and a modified mollusc foot in the form of arms or tentacles. Examples include the squid and the octopus.
Cetacean	Aquatic mammals of the order Cetacea, which comprise porpoises, dolphins, and whales.

Circalittoral	The region under shoreline which extends from the lower limit of the shallow waters closest to the shore to the maximum depth at which photosynthesis is still possible.
Concrete Mattress	A structure made from concrete used to support and protect infrastructure on the seabed.
Conductor	First string of casing to be inserted and cemented into the borehole. Its purpose is to prevent the soft formations near the surface from caving in and to conduct drilling mud from the bottom of the hole to the surface when drilling starts.
Continental shelf	The continental shelf refers to the extension of the continent into the ocean.
Continental slope	The continental slope refers to the sloping margin between the shelf break and the shelf basin.
Copepods	Small free-living or parasitic crustaceans of the subclass Copepoda, living in marine and fresh waters. The free-living forms are an important constituent of plankton.
Cumulative Impact	Combined impacts arising from different sources which overlap spatially and / or temporally.
Cuttings	Rock chips produced by chipping and crushing action of the drill bit.
Cuttings pile	An accumulation of rock chips or formation debris, produced by the action of the drill bit, and deposited on the seabed.
Demersal	Living in the water column at or near seabed. Usually in relation to fish.
Deterministic Oil Spill Modelling	Oil spill trajectory predictions for actual spills or exercises. Provides single expected forecasts for spills.
Diatoms	Unicellular planktonic algae with silica shells.
Dinoflagellates	Unicellular planktonic organisms often bearing a tough cellulose shell (theca).
Dispersant	A chemical that breaks up concentrations of oil in water, reducing the oil to small droplets (an emulsion).
Diversity	The variety of life forms i.e. distinct organisms within an area.
Drill centre manifold	A manifold is a system of headers and branched piping that can be used to gather or distribute fluids, as desired.
Drilling mud/fluid	A mixture of base substance and additives used to lubricate the drill bit and to counteract the natural pressure of the formation.
Dynamic positioning/ dynamically positioned	The stationing of a drilling rig at a specific location in the sea by the use of computer-controlled thrusters.
Echolocation	A technique used by some animals to determine the location of different objects using sound waves.
Elasmobranchs	Subclass of cartilaginous fish species, which includes sharks, rays, skates, guitarfish, and sawfish.
Emerald Network Conservation Sites	A site considered suitable to achieve the long term survival of the species and habitats of the Bern Convention requiring specific protection measures.
Environmental aspect	An activity that causes an environmental effect.
Environmental baseline survey	Environmental Baseline Study surveys determine the characterization of an area prior the development of a project and establish the initial environmental status.
Environmental effect	A change to the environment or its use.
Environment Identification (ENVID)	The purpose of the Environment Identification (ENVID) process is for the early identification of aspects that can potentially impact the environment.
Environmental Impact	Measurable changes to the baseline environment conditions, as a direct result of project activities.

Environmental Impact Assessment	A tool used to assess the significant effects of a proposed project or development on the environment.
Environmental Statement	An Environmental Statement (ES) is a developer's assessment of the environmental impact of a project.
Epifauna	Benthic organisms that live on the surface of the seabed, either sessile or free moving.
European Protected Species	Species listed in Annex IV of the Habitats Directive.
Extreme weather event	Rare weather phenomenon at a particular place and time of year.
Field	An accumulation of hydrocarbons in the subsurface. Consists of a reservoir in a shape that will trap hydrocarbons and that is covered by an impermeable, sealing rock.
Finfish	A term describing the strictly classified biological group of fishes. Sometimes they are called true fishes to distinguish them from other aquatic life whose common names also end in "fish", e.g. cuttlefish, or any other aquatic life harvested in fisheries or aquaculture, e.g. shellfish.
Flare	A vent for burning and therefore disposing of unwanted gases or to burn off hydrocarbons when there is no way to transport or utilise them.
Flowline	A pipeline which transports fluids from a wellhead to a manifold or production facility (or vice versa).
Fotla field	Refers to UKCS Licensed Block 22/1b.
Fotla field development	Comprises all project infrastructure proposed to be developed. Includes the Fotla subsea infrastructure (described below) as well as connecting pipelines and umbilicals between the Fotla field and the Britannia Platform and a subsea isolation valve (SSIV) structure at Britannia.
Fotla subsea development	Encompasses the subsea infrastructure to be installed at the Fotla field including production trees (Xmas trees), drill centre manifold and tie in spools.
Gigatonne (Gt)	A unit of mass, equivalent to 1 billion tonnes or 1 trillion kilograms.
Global Warming Potential	A measure of how much a given mass of gas is estimated to contribute to global warming, relative to the same mass of carbon dioxide.
Greenhouse Gas	Gas that contributes to the greenhouse effect. Includes gases such as carbon dioxide (CO_2) and methane (CH_4). The greenhouse effect results in a rise in temperature due to incoming solar radiation being trapped by carbon dioxide and water vapour in the Earth's atmosphere.
Grout Bag	Flexible nylon or canvas bags filled with grout which are usually put under or over a pipeline to stabilise and protect it.
High-Case	Reflects the highest anticipated volume of hydrocarbon production (at least P_{10}).
Hydrocarbon	A compound containing only the elements hydrogen and carbon. May exist as a solid, a liquid or a gas. The term is mainly used in a catch-all sense for crude oil, natural gas, condensate and their derivatives.
Ice sheet	An ice body originating on land that covers an area of continental size and that has formed over thousands of years.
Important Bird Areas	A global network of sites for the conservation of birds and bird habitats, set up by BirdLife International.
Immiscible	Fluids that do not mix one another (e.g. oil and water).
Infauna	Animals living within seabed sediments mostly within the top 10 to 15 cm.
Injectites	Sand deposits which have been remobilised and squeezed through overlying strata to form vertical/inclined dikes or horizontal sills. Sills are emplaced parallel to bedding, whereas dikes cut through bedding.

Low-Case	Reflects the smallest expected volume of hydrocarbon production.
Low toxicity oil-based mud (LTOBM)	Low toxicity oil-based mud (LTOBM) is an invert emulsion mud with synthetic oil as the external phase instead of oil.
Kilotonne (kton)	A unit of mass, equivalent to 1 thousand tonnes or 1 million kilograms.
Macrofauna	Benthic organisms that are retained in a 0.5 mm sieve.
Measured Depth	Depth of the well as measured from the rotary table on the drilling rig, therefore includes the distance between the drilling rig and the seabed
Megatonne (Mt)	A unit of mass, equivalent to 1 million tonnes or 1 billion kilograms.
Mid-Case	Reflects the best estimated volume of hydrocarbon production.
Mobile Offshore Drilling Unit (MODU)	A vessel capable of engaging in drilling or well workover operations for the exploration or exploitation of subsea resources.
Mooring	A permanent structure to which a vessel is secured.
Mud	Fine materials (< 0.063 mm), such as clay and silt.
Mysticetes	Baleen whales, using baleen plates in their mouths to sieve food.
Nature Conservation Marine Protected Area	A type of marine protected area that can be designated in Scottish territorial and offshore waters.
Nautical mile	Nautical measurement of distance, equivalent to 1.852 m or 1.15 miles.
Net Zero	Net zero means cutting greenhouse gas emissions to as close to zero as possible, with any remaining emissions re-absorbed from the atmosphere, by oceans and forests.
Nominal Bore	Approximate measure of the hollow section of a pipe.
North Sea Transition Deal	A plan for how the UK's offshore oil and gas sector and the government will work together to meet greenhouse gas emissions reduction targets.
Nursing	Period of development of fish juveniles.
Offshore Petroleum Regulator for Environment and Decommissioning (OPRED)	OPRED is responsible for regulating environmental and decommissioning activity for offshore oil and gas operations, including carbon capture and storage operations, on the UK continental shelf.
Ocean acidification	A reduction in the pH of the ocean over an extended period, primarily caused by sweater absorbing increasing anthropogenic CO_2 from the atmosphere.
Ocean quahog	A long-lived species of clam which lives buried in sediments.
Offshore Wind Innovation and Targeted Oil and Gas	The Innovation and Targeted Oil and Gas (INTOG) leasing round, announced by Crown Estate Scotland in February 2022 presents an opportunity to secure seabed rights to develop offshore wind projects specifically for the purpose of providing low carbon electricity to power oil and gas installations.
Oil based mud	Drilling mud with oil as the fluid continuous phase.
Odontocetes	Toothed whales (including dolphins and porpoises).
Ozone	Atmospheric gas which acts as a pollutant creating smog at ground level, and in the upper atmosphere filters out ultra-violet light from reaching the earth.
Passive Acoustic Monitoring	Surveying and monitoring using sound recorders (acoustic sensors).
Pelagic	Inhabiting the water column of the sea.
Permafrost	Ground that remains at or below 0°C for at least two consecutive years. It may be ice-free in some instances.

Permanent Threshold Shift	As sound exposure increases this is the level at which the threshold shift will be permanent.
Phytoplankton	Free floating microscopic plants.
Pig	A pipeline inspection gauge, commonly referred to as a pig, is a device used to clean and inspect a pipeline.
Piling	The process of driving or boring pile foundations into the seabed.
Pinniped	Aquatic mammals composed of seals, sea lions, and walrus.
Plankton	Free floating organisms found in the oceans and other aquatic systems.
Pockmarks	Craters in the seabed formed by fluids such as liquid and gas, erupting and streaming through the sediments. They can be classed as Annex 1 habitats "Submarine structures made by leaking gasses", by the Joint Nature Conservation Committee.
Polychaete	A class of marine annelid worms.
Priority Marine Feature	Priority Marine Features (PMFs) are species or habitats which the national conservation bodies responsible for Scottish waters (NatureScot and Joint Nature Conservation Committee (JNCC)) consider to be marine nature conservation priorities. The aim of the PMFs work is to produce a focused list of marine habitats and species to help target future conservation work in Scotland.
Propagation (underwater sound)	Movement of sound through the water.
Ramsar sites	Wetlands of international importance.
Reef	A collection of rocks, corals or ridge of sand just above or below the surface of the sea.
Representative Concentration Pathway	Representative Concentration Pathways or RCP values are scenarios for the future that project greenhouse gas concentrations and their resulting impact on the climate, expressed in watts per square metre (w/m^2). RCPs were used in the previous IPCC assessment reports and are analogous to the 'y' values used in the SSPx-y scenarios used in the IPCC's most recent 6^{th} assessment report (AR6).
Reservoir	The underground formation where oil and gas has accumulated. It consists of a porous rock to hold the oil or gas, and a cap rock that prevents its escape.
Riser	A vertical pipe which connects a subsea wellhead or pipeline to an offshore installation (e.g a MODU or FPSO) during drilling or production operations.
Scope 1 Emissions	Greenhouse gas emissions categorised as Scope 1 emissions are those that a company makes directly such as fuel use when operating vehicles or vessels.
Scope 2 Emissions	Greenhouse gas emissions categorised as Scope 2 emissions are those that a company makes indirectly such as the purchase of energy for heating buildings.
Scope 3 Emissions	Greenhouse gas emissions which include all other indirect emissions that occur in the upstream and downstream activities of an organisation.
Seabed Take	A reduction in the total extent of the original seabed habitat (take) resulting from development infrastructure on the seabed.
Semi-submersible mobile drilling unit	A semi-submersible mobile drilling unit is a floating drilling rig that is capable of working in water depths ranging from shallow.
Separator	A pressure vessel used for separating gas and liquid components from processed fluids.
Site of Community Importance	A site which contributes significantly to the maintenance or restoration at a favourable conservation status of a natural habitat type in Annex I or of a species in Annex II under the EU Habitats Directive.
Site of Special Scientific Interest	An area of land and water considered to best represent Scotland's natural heritage in terms of flora, fauna, geology, and geomorphology. Designated under the Nature Conservation (Scotland) Act 2004 by NatureScot.

Soft Start	Gradual, or incremental, increase in hammer blow energy/frequency.
Sound Exposure Level	A metric that is used to quantify underwater sound.
Source-Pathway-Receptor (SPR) analysis	For the identification of the impact and consequential effects. 'source' describes the origin of the impact. 'pathway' is the means by which the source reaches the affected 'receptor'.
Spawning	The production and release of gametes (eggs or sperm) by animals.
Special Area of Conservation	Protected sites designated under the EU Habitats Directive in order to conserve important habitats and species (excluding birds).
Special Protection Area	Sites designated by the UK Government under the EC Birds Directive to protect certain rare, vulnerable, and regularly occurring migratory species of birds.
Spool	Short segment of rigid pipe with a flange or other connecting fitting at either end and is commonly used to connect flowlines and / or subsea facilities together, e.g. a subsea tree to a subsea manifold.
Stochastic Oil Spill Modelling	Modelling based on actual statistical wind speed and direction frequency data. Provides a probability range of sea surface oil and beaching, representative of the prevailing conditions.
Subsea Isolation Valve (SSIV)	Valve generally used in a manifold that closes or isolates a particular pipeline or process in the event of an emergency.
Temporary Threshold Shift	Threshold shifts that recover to baseline levels relatively soon following exposure, in hours, days or weeks.
Topsides Umbilical Termination Unit (TUTU)	Module adjacent to the umbilical, which functions as the interface between umbilical and platform equipment.
Transboundary Impacts	Potential environmental impacts on the seabed, water column and/or atmosphere, which extend beyond the boundaries of the United Kingdom Continental Shelf.
Trenching	The practice of constructing trenches in or adjacent to a pit for the purpose of relocating all or a portion of the solids so as to facilitate closure.
Umbilical	Connections used between the subsea equipment and/or surface installation (e.g. FPSO) and enabling the provision of control, power, communications and chemical services from the surface.
Umbilical Termination Assembly	Provides the hydraulic, chemical, fibre optic and electrical distribution between the control umbilical and the subsea system.
Underwater Sound Attenuation	As sound spreads underwater, it decreases in strength with distance from the source. This transmission loss is the sum of spreading loss and attenuation loss. Spreading loss is the geometric weakening of a sound signal as it spreads outwards from a source. Attenuation losses are the physical processes in the sea that distort the mathematical spreading laws.
United Kingdom Biodiversity Action Plan (UK BAP)	The UK BAP describes the biological resources of the UK and provides detailed plans for conservation of these resources
Venting	The discharge of un-burnt, unwanted gases or hydrocarbons.
Water based mud	A type of drilling fluid (mud) consisting mainly of water, which has additives to modify it and make it more effective.
Wellhead	The unit at the surface of a well which controls pressure and connects to drilling and production equipment. The wellhead is the upper part of the well, located above the casing and under the drilling floor.
Wildlife Disturbance Licence	It is an offence to deliberately disturb European Protected Species therefore an assessment may be required as to whether proposed activities may cause an offence.
Xmas Tree	Assembly of valves and fittings to control the flow of oil and gas from the target reservoir.
Zooplankton	Animals which drift in the water column along with prevailing currents, mostly microscopic.

Abbreviations

AHV	Anchor Handling Vessel
Al-Zn-In	Aluminium-Zinc-Indium Alloy
ALARP	As Low As Reasonably Practicable
AONB	Areas of Outstanding Natural Beauty
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
$BaSO_4$	Barite
BAT	Best Available Technique
BEIS	Department of Business, Energy and Industrial Strategy
BEP	Best Environmental Practice
BERR	Department for Business, Enterprise and Regulatory Reform
BGS	British Geological Survey
BISE	Biodiversity Information System for Europe
BLP	Bridged Linked Platform
BOD	Biological Oxygen Demand
BODC	British Oceanographic Data Centre
BOP	Blowout Preventer
CA	Comparative Assessment
CAN-ductor	Conductor Anchor Nodes
CAPEX	Capital Expenditure
CB6	Sixth Carbon Budget
CB7	Seventh Carbon Budget
CCC	Climate Change Committee
CCS	Carbon capture and storage
CDP	Carbon Disclosure Project
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CFU	Compact Flotation Unit
CGOC	Coastguard Operations Centre
CH_4	Methane
CHARM	Chemical Hazard Assessment and Risk Management
CNS	Central North Sea
CO	Carbon monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CoP	Cessation of Production
COP21	UN Climate Change Conference
CP-SAT	Chemical Permit-Subsidiary Application Template

CPUE	Catch Per Unit Effort
CSV	Construction Support Vessel
CTIA	Construction and Tie-in Agreement
CtL	Consent to Locate
dB	Decibels
DBT	Department for Business and Trade
DCS	Damped Cylindrical Spreading
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DepCon	Deposit Consent
DESNZ	Department of Energy Security and Net Zero
DNA	Deoxyribonucleic Acid
DP	Dynamically Positioned / Dynamic Positioning
DPM	Diesel Particulate Matter
DREAM	Dose-Related Risks and Effects Assessment Model
DSIT	Department for Science, Innovation and Technology
DSV	Diving Support Vessel
DTI	Department of Trade and Industry
EBS	Environmental Baseline Survey
EC	European Commission
ECD	Early Consultation Document
EEA	European Environment Agency
EEMS	Environmental and Emissions Monitoring System
EIA	Environmental Impact Assessment
EIF	Environmental Impact Factor
EMODnet	European Marine Observation and Data Network
EMP	Environmental Management Plan
EMS	Environmental Management System
ENG	England
ENVID	Environmental Issues Identification
E_p	Sound Exposure
EPS	European Protected Species
ERAP	Emissions Reduction Action Plans
ERL	Effects Range Low
ERRV	Emergency Response and Rescue Vessel
ES	Environmental Statement
ESOS	Energy Savings Opportunity Scheme
ETS	Emissions Trading Scheme

EU	European Union
EUNIS	European Nature Information System
FDP	Fotla Field Development Plan
FeAST	Feature Activity Sensitivity Tool
FEED	Front End Engineering and Design
FEL	Fish Eggs and Larvae
FEPA	Food and Environment Protection Act
FGR	Flare Gas Recovery
FHG	Functional Hearing Group
FNSB	Fish with No Swim Bladder
FPS	Forties Pipeline System
FPSO	Floating Production Storage and Offloading
FSBP	Fish With Swim Bladder Primarily Sensitive To Sound Pressure
FSBV	Fish With Swim Bladder Primarily Sensitive To Particle Velocity
GBA	Greater Britannia Area
GHG	Greenhouse gas
GIS	Geographic Information System
GMP	Garbage Management Plan
GOR	Gas to Oil Ration
Gt	Gigatonnes
GWP	Global Warming Potential
HA	Habitat Assessment
HF	High Frequency (cetacean)
HFC	Hydrofluorocarbons
HM	His Majesty's
HMCS	Harmonised Mandatory Control System
HP	High Pressure
HPU	Hydraulic Power Unit
HRA	Habitat Regulations Appraisal
HSE	Health, Safety and Environmental
HSEx	Health and Safety Executive
HVO	Hydrotreated Vegetable Oil
IAS	International Aviation and Shipping
IBA	Important Bird Areas
ICES	International Council for the Exploration of the Sea
ICSS	Instrumented Control and Safety System
IEMA	Institute of Environmental Management & Assessment
IFCA	Inshore Fisheries and Conservation Authority

INTOG	Innovation and Targeted Oil and Gas
IOGP	International Association of Oil and Gas Producers
IP	Intermediate Pressure
IPCC	Intergovernmental Panel on Climate Change
IPIECA	International Petroleum Industry Environmental Conservation Association
ISGP	Ithaca Energy Stage Gate Process
ISO	International Standards Organisation
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
JV	Joint Venture
KPI	Key Performance Indicators
kton	Kilotonne
LAT	Lowest Astronomical Tide
$L_{E,p}$	Sound Exposure Level (see also SEL)
$L_{E,p,T}$	Cumulative Sound Exposure Level (see also SEL_{cum})
$L_{E,p,24h}$	24-Hour Unweighted Cumulative Sound Exposure Level
$L_{E,p,w,24h}$	24-Hour Weighted Cumulative Sound Exposure Level
LF	Low Frequency (cetacean)
LoF	Life of Field
LP	Low Pressure
$L_{p,pk}$	Peak Sound Pressure Level (see also SPL_{pk})
$L_{p,rms}$	Sound Pressure Level (see also SPL and SL)
$L_{E,p,pk,flat}$	Unweighted Peak Sound Pressure Level
$L_{p,pk\text{-}pk}$	Peak-to-Peak Sound Pressure Level
LTC	Long-Term Compression
LTI	Loss Time Injury
LTOBM	Low Toxicity Oil Based Mud
LULUCF	Land Use, Land-Use Change and Forestry
MA	Major Accidents
MAFA	Mutual Aid Framework Agreement
MAH	Major Accident Hazard
MAT	Master Application Template
MBES	Multibeam Echosounder
MCAA	Marine and Coastal Access Act
MCS	Master Control System
MCZ	Marine Conservation Zones
MD	Measured Depth
MDAC	Methane-Derived Authigenic Carbonate

MEI	Major Environmental Incident
MER	Maximising Economic Recovery
MMO	Marine Mammal Observation
MODU	Mobile Offshore Drilling Unit
MP	Medium Pressure
MPA	Marine Protected Area
MSL	Mean Sea Level
Mt	Megatonne
Mtoe	Million tonnes of oil equivalent
NB	Nominal Bore
NCMPA	Nature Conservation Marine Protected Areas
NDC	North Drill Centre (Section 3 and 4 only)
NDC	Nationally Determined Contributions (Section 5 and 10 only)
Ni	Nichel
NI	Northern Ireland
NLB	Northern Lighthouse Board
nm	Nautical mile
NMFS	National Marine Fisheries Service
NMHC	Non-Methane Hydrocarbons
NMP	National Marine Plan
N_2O	Nitrous oxide
NOAA	National Oceanic and Atmospheric Administration
NORM	Naturally Occurring Radioactive Material
NOS	Naturally Occurring Substance
NO_X	Nitrogen oxide
NPD	Naphthalene, Phenanthrene/Anthracene and Dibenzothiophene
NRC	National Research Council
NSBP	North Sea Benthos Project
NSTA	North Sea Transition Authority
NSTD	North Sea Transition Deal
NTS	Non-Technical Summary
NTT	No Touch Time
O_3	Ozone
OBM	Oil Based Mud
OCNS	Offshore Chemical Notifications Scheme
OEUK	Offshore Energies United Kingdom
OGA	Oil and Gas Authority
OGMP	Oil and Gas Methane Partnership

OGUK	Oil and Gas UK
OH	Hydroxyl
OIM	Offshore Installation Manager
OiW	Oil In Water
O&M	Operation & Maintenance
OMR	Offshore Marine Regulations
OOS	Out of straightness
OPEP	Oil Pollution Emergency Plan
OPEX	Operational Expenditure
OPF	Organic-Phase Drilling Fluids
OPOL	Offshore Pollution Liability Association Limited
OPPC	Oil Pollution Prevention and Control
OPPS	Over Pressure Protection System
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSCAR	Oil Spill Contingency and Response
OSPAR	Oslo and Paris Convention
OSPRAG	Oil Spill Prevention and Response Advisory Group
OSRL	Oil Spill Response Limited
Pa	Pascals
PAH	Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
Pb	Lead
PCV	Pressure Control Valve
PDCA	Plan-Do-Check-Act
PETS	Portal Environmental Tracking System
PEXA	Practice and Exercise Area
PFC	Perfluorocarbons
PIP	Pipe-in-Pipe
PL	Propagation Loss
PLONOR	Pose Little or No Risk to the Environment
PM	Particulate Matter
PMF	Priority Marine Feature
PMI	Potential Mortal Injury
POB	Persons Onboard
POBM	Pseudo-Oil Based Muds
p_{pk}	peak sound pressure
p_{rms}	Root-Mean Square Sound Pressure
PSA	Particle Size Analysis

PSD	Power Spectral Density
p(t)	Squared Instantaneous Sound Pressure
PTS	Permanent Threshold Shift
PW	Pinnipeds/Phocids in Water (Section 12 only)
PW	Produced Water
PWA	Pipeline Works Authorisation
PWR	Produced Water Re-injection
RAMS	Range-dependent Acoustic Model with Shear waves
RBA	Risk-Based Approach
RCP	Representative Concentration Pathways
RESDV	Riser Emergency Shutdown Valve
RFI	Request for Information
RI	Recoverable Injury
RL	Received sound level
RMS	Root-Mean Square
ROV	Remotely Operated Vehicle
RSA	Radioactive Substances Act
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SAGE	Scottish Area Gas Evacuation
SAT	Subsidiary Application Template
SBM	Synthetic-Based Mud
SBP	Sub-Bottom Profiler
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SCI	Sites of Community Importance
SCM	Subsea Control Module
SCO	Scotland
SCOS	Special Committee on Seals
SECR	Streamlined Energy and Carbon Reporting
SEL	Sound Exposure Level (see also $L_{E,p}$)
SEL_{ss}	Single-Strike Sound Exposure Level (see also $L_{E,p}$)
SEL_{cum}	Cumulative Sound Exposure Level
SD	Standard Deviation
SF6	Sulphur hexafluoride
SFF	Scottish Fishermen's Federation
SL	Source Level
SL(f)	Source Level Spectrum
$SL_{E,p}$	Sound Exposure Source Level

$SL_{p,rms}$	Sound Pressure Source Level
SMRU	Sea Mammal Research Unit
SNH	Scottish Natural Heritage
SO_2	Sulphur dioxide
SoS	Secretary of State
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Areas
SPL	Sound Pressure Level (see also $L_{p,rms}$)
SPL_{pk}	Peak Sound Pressure Level (see also $L_{p,pk}$)
SPR	Source-Pathway-Receptor
SS	Sub-Surface
SSIV	Subsea Isolation Valve
SSP	Shared-Socioeconomic Pathways
SSS	Side Scan Sonar
SSSI	Sites of Special Scientific Interest
TCFD	Taskforce on Climate-Related Financial Disclosures
T&D	Transmission and distribution
TEG	Triethylene glycol
THC	Total Hydrocarbon Content
TOC	Total Organic Carbon
TOM	Total Organic Matter
TOOPEP	Temporary Operations Oil Pollution Emergency Plan
TPOSA	Transportation and Processing Operating Service Agreement
TTS	Temporary Threshold Shift
TUTU	Topsides Umbilical Termination Unit
TVDSS	True Vertical Depth Sub-Surface
UCM	Unresolved Complex Mixture
UHB	Upheaval Buckling
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UK	United Kingdom
UKBAP	United Kingdom Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UKOOA	United Kingdom Offshore Operators Association
UTA	Umbilical Termination Assemblies
VHF	Very High Frequency (cetacean)
VOC	Volatile organic compound

WAL	Wales
WBM	Water Based Mud
WMO	World Meteorological Organization
WMP	Waste Management Plan
WONS	Well Operations Notification System
Zn	Zinc
ZRF	Zero Routine Flaring

Non-Technical Summary

Introduction

This Non-Technical Summary provides an overview of the Environmental Statement prepared for the Fotla field development proposed by Ithaca Oil and Gas Limited, an affiliate of Ithaca Energy (UK) Limited (Ithaca Energy (UK) Limited and its affiliated companies being referred to throughout this Environmental Statement as 'Ithaca Energy'). The purpose of the Environmental Statement is to report the results of the Environmental Impact Assessment that has been undertaken by Ithaca Energy to identify any likely significant effects on the environment from the proposed development. The Environmental Statement has been prepared in accordance with the Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 and associated guidelines.

The Fotla field is located in United Kingdom Continental Shelf Block 22/1b, approximately 176 km east of Peterhead and 46 km west of the UK/Norway transboundary line. The proposed development comprises up to two production wells to be drilled and which will be tied back to the Britannia Platform, operated by Harbour Energy, which is located 13.5 km to the north in Block 16/26a. The pipeline route from the Fotla field to the Britannia Platform will pass through Blocks 16/26a, 22/1a and 22/1b. The Fotla field is operated by Ithaca Energy.

The Assessment Process and Environmental Management

The Environmental Impact Assessment process evaluates several environmental interactions and impacts of the project including operational emissions and discharges and general construction disturbances and mitigate likely significant adverse effects. This will be achieved through incorporating environmental considerations into the project planning and design activities, ensuring that best environmental practice is followed, and that a high standard of environmental performance is achieved. A key component of the process is the identification of any issues that stakeholders may have regarding the development proposals, so that that can be addressed and incorporated within mitigation designs.

Ithaca Energy has an Environmental Management System, which is independently certified to the international standard ISO14001:2015 (last certified in April 2024) and is fully integrated into the Company Business Management System. The Environmental Management System is designed to support the implementation of Ithaca Energy's Health, Safety, and Environmental Policy. Ithaca Energy's Environmental Management System reflects the Company's commitment to complying with environmental legislation and upholding the standards, processes, and objectives for the environmental management of hydrocarbon exploration and production. It also demonstrates a commitment to conducting activities in compliance with all applicable legislation and in a manner that minimises impacts on the environment.

Ithaca Energy's Health, Safety, and Environmental Policy is in place to assess and manage the risks and impacts associated with operations; and a commitment to comply with legislative requirements and corporate policies.

Ithaca Energy is registered with the Offshore Pollution Liability Association Limited and will retain membership and registration in respect to the Fotla field. As a party to the Offshore Pollution Liability Association Limited agreement, Ithaca Energy has therefore agreed to accept strict liability for pollution damage and the cost of remedial measures and has established financial responsibility, in order to meet claims arising under Offshore Pollution Liability Association Limited.

Net Zero Action Plan

The UK has a legally binding target to reduce greenhouse gas emissions to Net Zero by 2050. Whilst continued exploration and production on the United Kingdom Continental Shelf is supported, these activities must be undertaken in a manner that ensures compliance with Net Zero targets for the industry, including the reduction, as far as reasonable, of greenhouse gas emissions from sources such as flaring, venting and power generation.

Ithaca Energy recognises that the sector has a role to play, in conjunction with key stakeholders such as government and regulatory authorities, to reduce the impacts of climate change from carbon related emissions. To date, Ithaca Energy has been able to reduce methane emissions and emissions intensity from its portfolio and remains on track to meet the North Sea Transition Deal reduction targets. Further opportunities to improve efficiencies and decarbonise operations are under consideration including electrification of assets, flare gas recovery and upgrades to power generators to reduce diesel consumption.

As part of the Option Selection process for the Fotla field development, Ithaca Energy undertook a review of candidate host platforms against a variety of criteria including alignment with Net Zero targets. A review was undertaken of a prospective host platforms emissions associated with peak production and cessation of production, emission reduction measures being implemented, potential for future electrification of the platform and net zero solutions being considered by the host platform operator.

Ithaca Energy continues to liaise with the NSTA and operators of its non-operated assets regarding future decarbonisation opportunities both at the Fotla field and across Ithaca Energy's portfolio of assets.

Option Selection

The Environmental Statement sets out the various project options which have been considered as part of the option selection process for the Fotla field development. Various options were evaluated in terms of their technical feasibility, health and safety risks, environmental impact, reputation and cost. Consideration of environmentally related issues and initiatives, such as life of field emissions, emissions reduction measures and net zero solutions, were factored into the option selection process, and used to actively drive mitigation measures where certain impacts could not be avoided.

The option selection process was broken down into the following five categories:

- Type of development options – a new standalone fixed installation or a new floating production storage and offloading unit, a re-deployed floating production storage and offloading unit or a tie-back to an existing host facility with modifications to the topside facilities;
- Subsea tie-back options - requests for information were sent to potential candidate host facility operators to ascertain whether nearby platforms would be suitable tie back options for the Fotla field development;
- Drilling and wells options – different mobile offshore drilling unit types were considered for their suitability at the Fotla field including jack-up, moored semi-submersible or dynamically positioned semi-submersible drilling units. In addition, different well designs were considered including vertical/low angle wells, horizontal/high angle wells or multilateral wells;
- Subsea facilities options – various types of subsea infrastructure were reviewed for suitability at the Fotla field including pipeline configurations, installation of manifolds or "daisy chaining" the production wells;
- Topsides production and process facilities options – where a potential host platform requires modifications to the platform topsides to handle production from the Fotla field, a review of these modifications was undertaken to ensure that Fotla fluids could be processed. This review involved 11 Best Available Technique or Best Environmental Practice options which included an appraisal of produced water treatment systems and power systems.

After review of the various development options, Ithaca Energy proposes to develop the Fotla field by drilling two horizontal production wells using a moored semi-submersible mobile drilling unit. The wells will be connected to a subsea manifold tied back to the existing Britannia platforms via a new 14.4 km pipe-in-pipe production pipeline. All processing of the produced Fotla fluids will be carried out at Britannia, with the Fotla subsea pipeline system delivering produced fluids direct to the Britannia Bridged Linked Platform. Gas lift will be provided to the Fotla wells from the Britannia Platform itself.

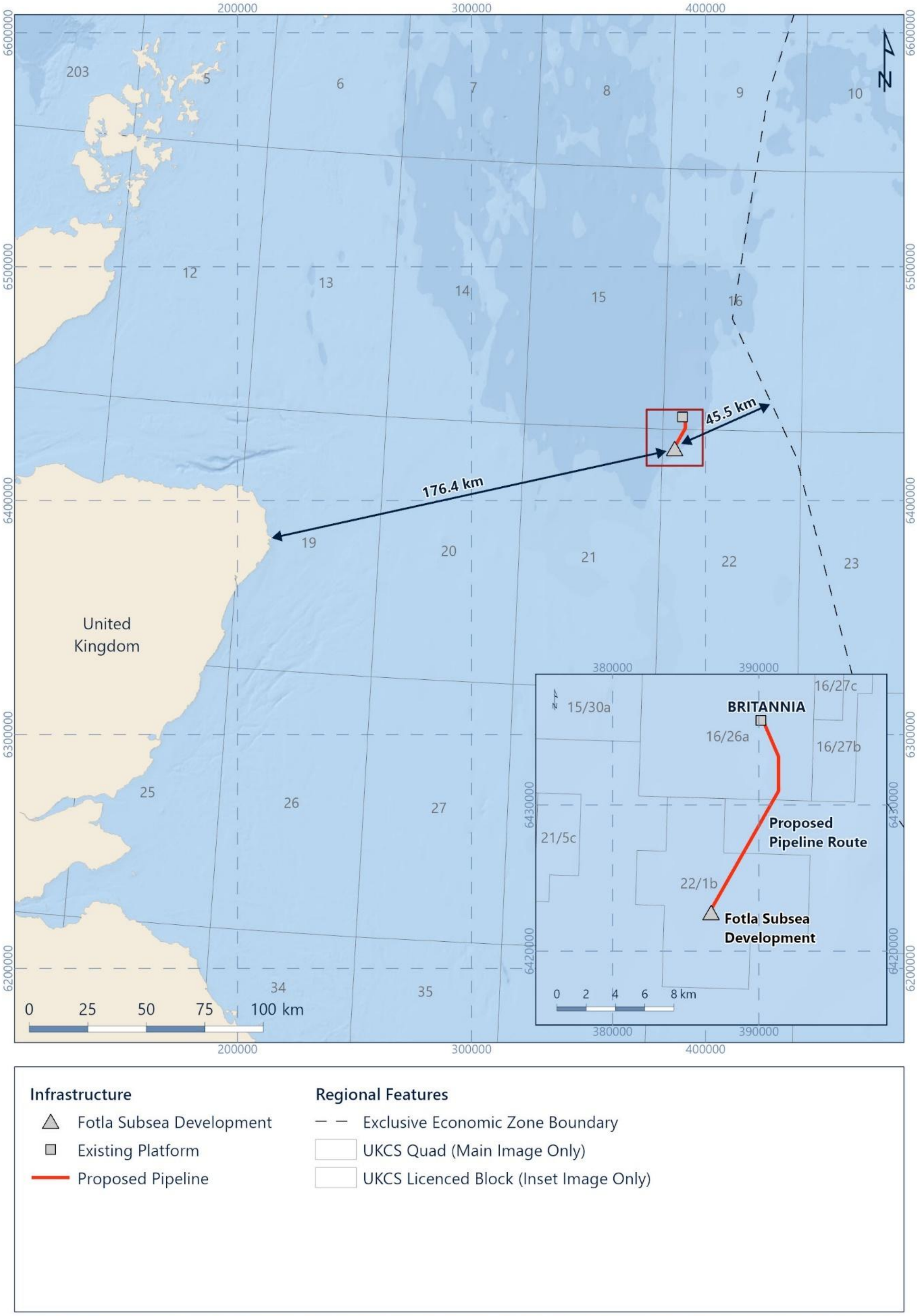
Project Description

The Fotla field is located 176 km off the northeast coast of Scotland and 46 km from the UK/Norway transboundary line (Figure 1). The proposed development will include the following subsea infrastructure:

- Two horizontal subsea production wells completed with two horizontal subsea Xmas trees;
- A three slot production and gas lift drill centre manifold;
- Two rigid tie-in spools connecting the Xmas trees to the manifold;
- A 14.4 km pipe in pipe production pipeline and a controls umbilical, which will be trenched and covered with rock protection material, between the Fotla field and the Britannia platforms;
- A separate 14.4 km gas lift pipeline, which will be trenched and backfilled between the Fotla field and the Britannia installations. Trench transitions will be covered with rock placement;
- A new riser base subsea isolation valve structure at Britannia, housing production and gas lift system subsea isolation valves and the umbilical termination assemblies;

- Existing spare risers on the Britannia platforms for the Fotla pipelines and umbilical; and
- Temporary anchored mooring system for the mobile offshore drilling unit during drilling operations.

An illustrative schematic of the proposed Fotla field development is shown in Figure 2.



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** OceanWise, Esri, GEBCO, Garmin, NaturalVue, OceanWise, Esri, Garmin, NaturalVue; Esri, 2024; Contains information provided by the OGA; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12.

Figure 1: Location of the Fotla field and proposed pipeline route

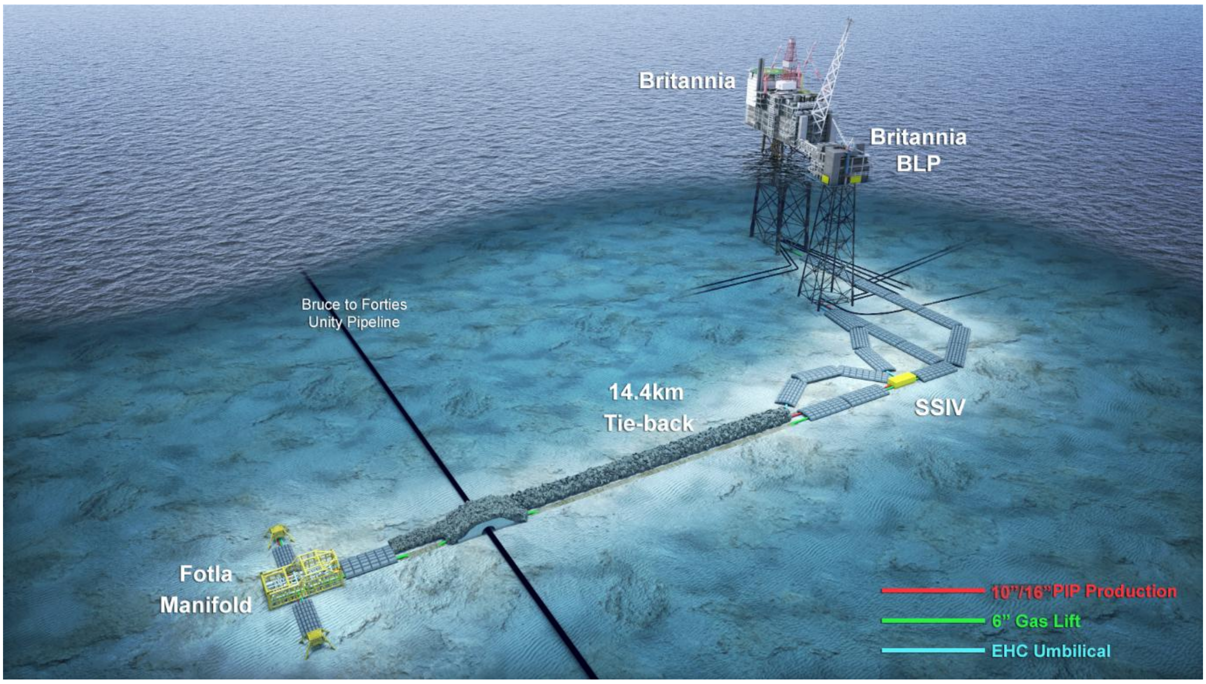


Figure 2: Indicative overview of the Fotla field development (not to scale)

Table 1 shows the opportunity schedule, indicating the earliest anticipated start date for the Fotla development, commencing drilling operations in Q1 2027 and with first oil estimated for Q4 2027. The Fotla field development is expected to produce hydrocarbons for 15 years, after which it will be decommissioned.

Table 1: Opportunity schedule for the proposed Fotla field development

Activity	2026				2027			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Drilling & completions								
Umbilical & pipeline installation								
Topsides - Britannia / Alder construction / modifications								
Tie-in & commissioning activities								
First Oil								

Local Environment

Environmental Surveys Relevant to the Proposed Fotla Field Development

Several site-specific surveys have previously been undertaken at the location of the proposed Fotla field development. These surveys provide information on seabed sediments and habitats present in and around the Fotla field and along the planned pipeline route. The most recent of these surveys were undertaken in 2023 and 2019 and included seabed sediment sampling at locations shown in Figure 3. Previous seabed information from the Alba field was also reviewed to provide additional contextual information about environmental conditions in the wider area.

Information on local physical environmental conditions were collected from literature review.

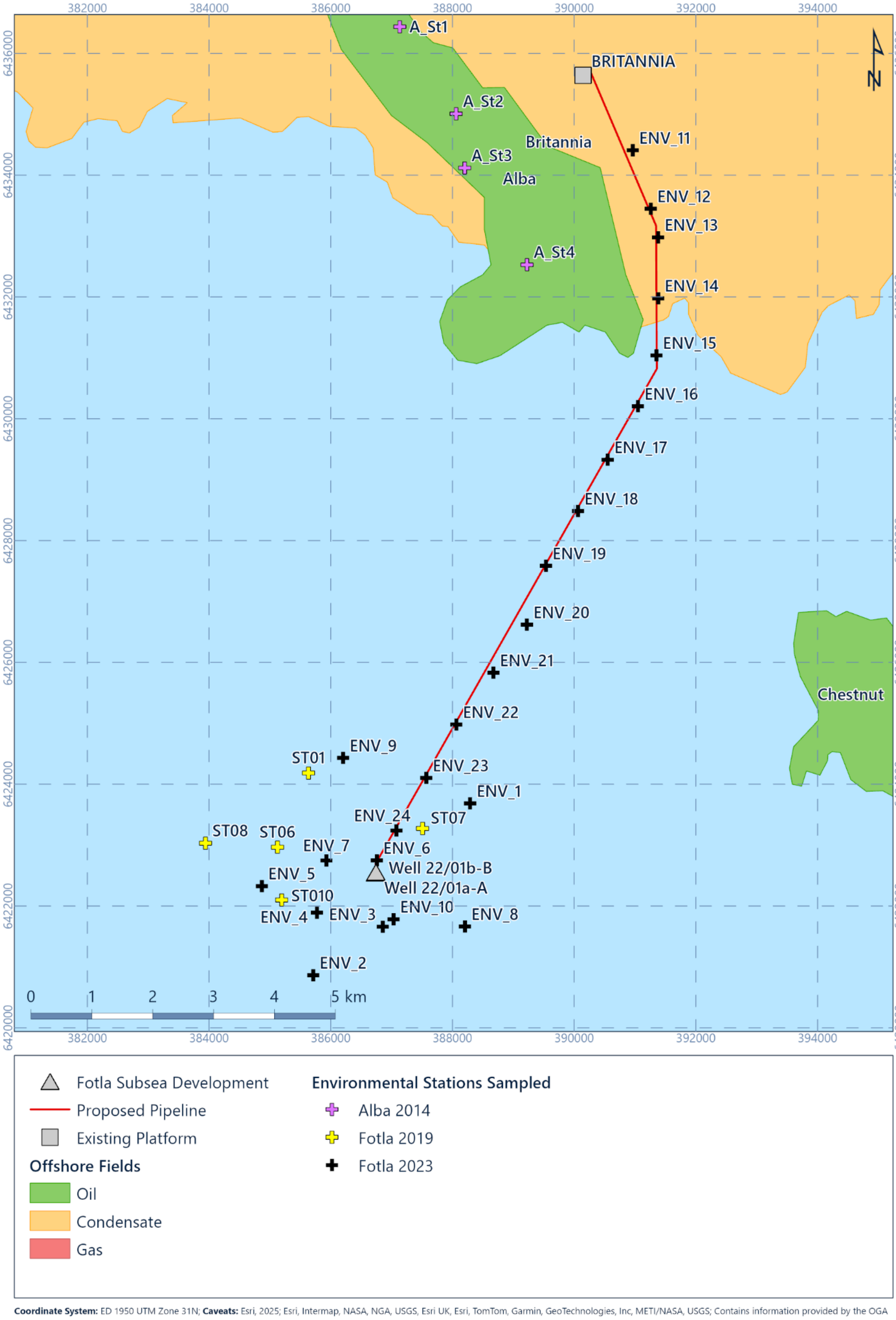


Figure 3: Environmental stations sampled at the Fotla field and wider region

Physical and Chemical Environment

Tidal currents in the offshore waters of the North Sea decrease in velocity as they move from south to north. Wave direction at the Fotla field is mainly from north to north north-west, with significant wave height averaging between 2.2 m and 3 m.

Wind direction is generally from north-west, with average wind speeds of around 8.3 m/s and with the strongest wind speeds recorded between December and February. Mean annual rainfall in the project area is low.

Water depths at the Fotla field range from 119 m to 132 m and between 128 m and 137 m along the pipeline route to Britannia. Water depth at the Britannia Platform is approximately 136 m. Mean sea surface temperatures at Fotla and Britannia vary between 5.9 °C and 13.7 °C throughout the year. Annual mean sea surface salinity is approximately 35 ‰ at Fotla and Britannia.

Seabed sediments across the Fotla field and at the Britannia Platform comprise extremely low strength sandy clay. Pockmarks are present in the vicinity of the Fotla field development area, with the closest located 185 m to the south of the Fotla drill centre manifold. Debris and trawl scars occur on the seabed.

Sediment contaminants, such as organic content, hydrocarbons and heavy metals, are observed at varying concentrations along the pipeline route between Fotla to Britannia. Some mean concentrations are recorded as exceeding the mean background concentrations reported previously in the central North Sea at locations closer to the Britannia Platform. However, these concentrations are below thresholds that have the potential to result in adverse effects on the local fauna.

Biological Environment

Benthos

A sparse epifaunal community is present within the Fotla field, with sea pen species, echinoderms (starfish and ophiuroids), molluscs and burrows being mostly observed on the seabed. The infauna is dominated by polychaetes, with *Paramphinome jeffreysii* being the most characteristic species. The biotopes present correspond to the European Nature Information System biotopes MD621: Faunal communities on Atlantic offshore circalittoral mud (a classification of higher level to MD6218) and MD6218: *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in Atlantic offshore circalittoral sandy mud. The OSPAR listed and Priority Marine Feature habitat 'Sea pens and burrowing megafauna communities', as well as the ocean quahog (also an example of a OSPAR listed, Priority Marine Feature) were recorded around the Fotla field development area.

Fish and Shellfish

The proposed Fotla field development area falls within spawning grounds for cod, *Nephrops*, and Norway pout, as well as nursery grounds for anglerfish, blue whiting, cod, European hake, herring, ling, mackerel (North Sea), *Nephrops*, plaice, sandeel, spotted ray, spurdog, and whiting. For most of these species, peak spawning activity occurs between January and April. Spotted ray, Norway pout, ling, sand eels, whiting, cod, mackerel, herring, spurdog and blue whiting are Priority Marine Features in Scotland, noted for their nature conservation interest. Cod, spurdog and spotted ray are also listed on the OSPAR list of threatened and/or declining species.

Hagfish, haddock, monkfish, Norway pout (all examples of Priority Marine Features) and flatfish (Pleuronectiformes) have been recorded during site specific surveys within the Fotla field.

Marine Mammals

Several cetacean species are likely to be observed locally including harbour porpoise, minke whale, Atlantic white-sided dolphin, Risso's dolphin, white-beaked dolphin and killer whale. These species are Priority Marine Features in Scotland and are listed on Annex IV of the Habitats Directive. Harbour porpoise is also listed on the OSPAR list of Threatened and/or Declining Species.

Two seal species, the grey and harbour seal, are resident in Scottish waters but are not expected to be encountered within or close to the location of the proposed development, as the Fotla field is beyond their typical foraging range.

Seabirds

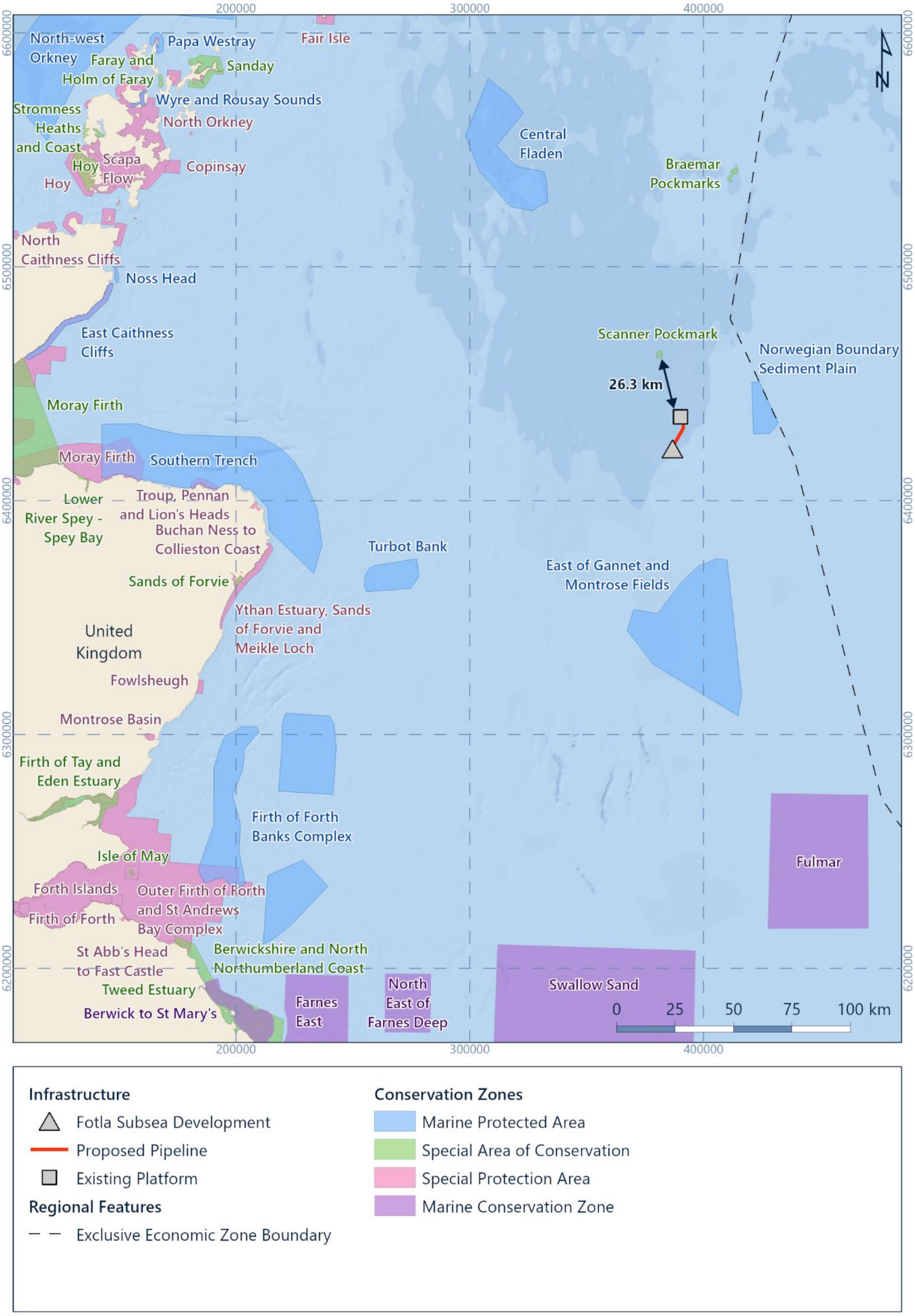
Seabird distribution and abundance in and around the proposed Fotla field development varies seasonally and annually. Common seabird species in the area include black-legged kittiwake, northern fulmar, common guillemot, little auk and northern gannet. Black-legged kittiwake is listed on the OSPAR list of Threatened and/or Declining Species. Other frequently occurring species include Atlantic puffin, herring gull, European storm petrel, great skua and razorbill.

Seabird vulnerability to oil pollution in the area around the proposed Fotla development is classified as low throughout the year based on the Joint Nature Conservation Committee's Seabird Oil Sensitivity Index.

Protected Sites and Sensitive Habitats

The project area is also located within a network of Nature Conservation Marine Protected Areas although does not encroach upon any boundaries. The locations of these protected sites in relation to the proposed Fotla field development are shown in Figure 4.

The closest protected area is the Scanner Pockmark Special Area of Conservation, located approximately 26.3 km to the northwest. The site is designated for submarine structures made by leaking gases. The Norwegian Boundary Sediment Plain Nature Conservation Marine Protected Areas is located approximately 30 km to the east. This site is designated for the presence of ocean quahog and their supporting habitat of sands and gravels.



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** OceanWise, Esri, GEBCO, Garmin, NaturalVue; Esri, 2024; NatureScot, Contains public sector information licensed under the Open Government Licence v3.0; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2024; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12.

Figure 4: Offshore and coastal conservation areas in the area of the proposed Fotla field development

Other Users of the Sea

The proposed Fotla field development is located within International Council for the Exploration of the Sea (ICES) fisheries statistical rectangles 44F1 and 45F1. The main species targeted in the area include haddock, monkfish, gurnards, cod and whiting as well as *Nephrops*. Fishing effort varies throughout the year, but typically peaks in October and November. The annual value of landings from the local area was nearly £2.3 million in 2023.

Shipping density within the area is low to moderate with approximately 2 to 3 vessels passing through per day, mostly comprising oil industry support and service vessels.

The proposed Fotla field development sits within an area extensive zone of oil and gas activity. The nearest surface infrastructure to the proposed well location are the Britannia Platform and the Britannia Bridge Linked Platform, located 13.5 km to the north-east. The Bruce to Forties Unity 24" Gas Condensate Pipeline runs across the northern portion of the Fotla field development area. The Tampnet CNS fibre optic cable is located 15 km south of the proposed Fotla field development.

No operational windfarms and no carbon capture and storage areas are located in the vicinity of the proposed development area. The closest Innovation and Targeted Oil & Gas lease areas are located approximately 9.6 km south-east and around 25 km to the east of the Fotla field development.

No practice and exercise areas and no wrecks have been identified within the Fotla field or along the pipeline route.

Climate Change

As greenhouse gas emissions to the atmosphere resulting from the Fotla field development will contribute to the global effects on climate, the baseline greenhouse gas emissions and their effect on climate change are presented at a global scale.

The greenhouse effect is a natural process where Earth's atmosphere traps the Sun's heat, but an increase in carbon dioxide and other greenhouse gas emissions to the atmosphere from human activities can intensify this effect, leading to global warming and climate change. The majority of emissions are carbon dioxide emissions and come from the combustion of coal, oil and gas, and from the production of metals, cement and other materials.

As the UK has signed up to the Paris Agreement, it is required to set out actions to address climate change. In 2019, the UK committed to reach Net Zero greenhouse gas emissions by 2050. Carbon budgets, where a limit is placed on the total amount of greenhouse gas emissions that can be emitted, define how this target will be achieved. The UK has met all three initial carbon budget targets to date, with greenhouse gas emissions having halved since 1990, and the current Sixth Carbon Budget is in line with Net Zero targets.

The level of climate change over the coming decades will be determined by the amount of greenhouse gases that will be emitted. Emissions levels will depend how society grows and develops.

To evaluate the most likely range of potential future global warming levels the Intergovernmental Panel on Climate Change developed 8 future categories, based on possible socioeconomic trends that could shape future society, after running more than 1,200 climate model scenarios. From all these model runs, it picked 5 'illustrative' future pathways, representative of very low, low, intermediate, high and very high-emissions scenarios. Global warming will continue to increase in the near term in nearly all considered scenarios. Considerable, rapid, and sustained greenhouse gas emissions reductions are necessary to limit warming below 2 °C by the end of century, with an overall aim of limiting global warming to 1.5 °C.

Several chemical, physical, and biological processes are affected by the increased concentration of greenhouse gases in the Earth's atmosphere. These processes include changes in global temperatures, mean sea level, ocean acidification, ice mass extent, precipitation, and changes in the intensity and frequency of extreme weather events. The rate and extent of these changes will vary depending on the climate scenario followed.

In the UK, climate predictions scenarios show that temperatures are projected to rise. Extreme heatwave events, which impact on people's health and wellbeing, are likely to become more common. Rainfall is predicted to decrease in summer and increase in winter, making periods of water scarcity more common. Sea level rises will be very location specific, but are generally set to increase across the UK.

Assessment of Potential Impacts

Drilling Impacts

The Fotla proposals will result in the discharge of drill cuttings during drilling on the seafloor. These may either be contained and shipped to shore for appropriate treatment and disposal or they may be thermally treated offshore and disposed to sea. The chosen option will be dependent on the availability of a suitable mobile offshore drilling unit at the time the wells are drilled.

As a worst-case option, disposal to sea has the potential to cause localised impacts on benthic habitats and species through burial and smothering and associated alterations to the physical or chemical nature of the seabed and water column and impairment benthic organisms feeding and respiratory activities. Important benthic features potentially affected include sea pen and burrowing megafauna habitat and individuals of ocean quahog (*Arctica islandica*) which are OSPAR listed threatened and/or declining features in the wider region. However, local accumulation of cuttings will gradually disperse to the wider environment over time, resulting in a thickness of less than 10 mm within approximately 140 m from the point of discharge, as indicated by numerical modelling. Effects will therefore be localised and temporary for the duration of drilling operations. Seabed communities at the Fotla field development are typical of those found in the wider central North Sea (CNS) such that biodiversity is not anticipated to be significantly affected regionally and recovery will be relatively rapid via locally available reproducing populations. Effects due to the release of drill cuttings are therefore judged to be of 'Minor adverse' significance.

No significant in-combination, cumulative or transboundary effects are forecast in respect of drill cuttings discharges.

Mitigation

Mitigation measures which will be employed to minimise the effects of drilling operations include:

- Wherever practicable and technically feasible, chemicals with the lowest CEFAS ranking scores (i.e. OCNS E, Gold rated and without substitution warnings) will be prioritised over those that do have warnings;
- Where practicable and technically feasible, Ithaca Energy will prioritise the use of chemicals which pose little or no risk, or have the lowest Risk Quotient (RQ);
- Mud and chemical usage will be monitored during drilling operations and subsequently reported to Environmental and Emissions Monitoring System (EEMS), which is maintained by the OPRED;
- Cement discharges discharged during installation of the top section casing will be minimised by visual monitoring of the operation by a Remotely Operated Vehicle (ROV). Once returns are observed, pumping will be stopped in order to minimise discharged volume; and
- Where technically feasible, the design of the project will seek to minimise produced volumes of drill cuttings, mud and excess cement, as well as the chemical volumes discharged.

Physical Presence Impacts

The physical presence of vessels and project infrastructure has the potential to disrupt fishing operations in the area, present an obstacle to vessel traffic and cause temporary or permanent seabed impacts affecting habitats and species.

The wider area is important for commercial fishing, particularly shellfish (for example *Nephrops*). Fishing vessels would be temporarily excluded from an area around the mobile offshore drilling unit during drilling operations (180 days), temporarily excluded from the area of installation of the seabed pipeline and umbilicals (120 days) and permanently excluded from the area of the subsea infrastructure for the duration of the development (15 years). This will result in fishing vessels fishing elsewhere for the period of the exclusion potentially increasing fishing pressure in adjacent areas. Given the small area of the exclusion in relation to the wider region, no likely significant adverse effects on commercial activities are forecast across the wider region. Effects of displacement will be localised, temporary for the drilling rig and seabed infrastructure installation and reversible upon decommissioning.

The area is subject to low to moderate shipping density. Obstruction effects caused by the temporary presence of the mobile offshore drilling unit, construction and support vessels and infrastructure on shipping were not considered to be significant.

The placement of seabed anchors, movement of anchor lines, trenching and installation on the seabed infrastructure will cause temporary disturbance effects on benthic habitats and species as well as sediment plumes within the overlying water column. However, effects will be highly localised and will cease on completion of the installation of the infrastructure. Local benthic habitats and features, including high value sea pen and burrowing megafauna habitat and individuals of ocean quahog, are represented across the wider area and significant loss of biodiversity at the regional level is not anticipated. Ocean quahog are long-lived and may take several years to mature and therefore populations will take a long time to recover if killed. Effects of temporary seabed disturbances is therefore judged to be 'Minor adverse'.

There will be a permanent reduction in the available natural seabed habitat within the footprint of placed subsea infrastructure and protection material on the seabed. However, the rock placement along the trenched infrastructure will be below the seabed height and will likely be backfilled naturally by adjacent soft sediments in the future. Sedimentary benthic habitats and communities are expected to fully recover once the infrastructure is removed upon decommissioning and species will begin to re-colonise affected seabed areas as seabed topography and stability is gradually restored. The effects of placement of subsea infrastructure and protection material will be highly localised to within the footprint of the protection material and permanent, but reversible, on decommissioning and unlikely to be significant within the context of the wider region. Therefore, the effect significance from permanent impacts is judged to be 'Minor adverse'.

No significant in-combination, cumulative or transboundary effects are forecast in respect of physical presence of the infrastructure.

Mitigation

The following mitigation measures are proposed:

- An update to the Vessel Traffic Survey will be prepared and, if required, a Collision Risk Assessment undertaken to inform vessel movements prior to drilling and construction operations commencing;
- All construction vessels will be highly visible and display the appropriate light or daytime signals to warn other sea users of the presence and their activities;
- Vessel use will be optimised by minimising the number of vessels required and length of time vessels are on site;
- Following pipeline trenching operations, Ithaca Energy will liaise with the Scottish Fishermen's Federation, to discuss any safety risks for the fishermen from mud berms being left behind;
- Prior to the mobile offshore drilling unit moving onto location, a Notice to Mariners will be issued together with Navtex and NAVAREA warnings. In addition, the Aberdeen Coastguard Operations Centre and Northern Lighthouse Board will be notified. This will ensure that all vessels, including fishing vessels, are aware of all planned operations at the Fotla field;
- The Seafish Kingfisher Information Service will be notified of the exact location of the mobile offshore drilling unit, other construction vessels and subsea infrastructure, to allow their inclusion in fortnightly bulletins issued to fishing vessels;
- The UK Hydrographic Office will be notified as to the location of the Fotla wells, manifold and pipelines, so that these can be marked on navigational charts;
- A 500 m safety exclusion zone will be imposed around the mobile offshore drilling unit during the drilling of the wells, which will be enforced by a dedicated Emergency Response and Rescue Vessel;

- A 500 m safety exclusion zone will remain in place around the drill centre manifold and Xmas trees for the duration of the development (i.e. approximately 15 years);
- The mobile offshore drilling unit, construction vessels and any other vessels operating in the area, will be equipped with the appropriate navigational aids and aviation obstruction lights system; and
- The use of subsea infrastructure stabilisation features (mattresses, grout bags and rock material) will be minimised throughout project design and will be installed in accordance with industry best practice (e.g. by using a fall pipe when placing rock protection).

Atmospheric Emissions

Atmospheric emissions will be produced during drilling, installation and commissioning operations, as a result of power generation onboard the MODU, support & installation vessels, helicopters. During the production phase, the Fotla development will add a small amount (< 1 %) to the existing overall emissions at Britannia over its life of field. In addition, emissions will be generated during the transportation, distribution and processing (refining) of the produced Fotla hydrocarbons and ultimately also during the combustion of the processed/refined oil and gas products by the end user. All these emissions will contribute to local and global environmental effects. At a local/regional level, such impacts are mitigated by health and safety measures in place to control emissions onboard the vessels, as well as by the dispersive nature of the offshore environment (i.e. the wind and weather conditions). These emissions contribute to local and regional air pollution. Additionally, in combination with all other emissions in the world, they will also contribute cumulatively to global effects, such as climate change.

The most commonly used general indicator for global climate change is the global warming potential, expressed in tonnes of carbon dioxide equivalents. The global warming potential can be used to estimate the potential future impacts of gaseous emissions, upon the climate system. Carbon dioxide equivalents are a unit of measurement for climate change potential, which enables various different emission gases to be compared in one single unit.

In 2024, a total of 11.8 million tonnes of carbon dioxide equivalent were released from the UK upstream oil & gas industry, equating to 3 % of the total UK greenhouse gas emissions. At peak production in 2028, Fotla's contribution to the Britannia emissions will be 8,800 tonnes of carbon dioxide equivalents. Over the life of field, the annual contribution of Fotla to the overall emissions at Britannia is around 1,600 tonnes of carbon dioxide equivalents per year on average. Therefore, compared to 2024, Fotla's emissions in relation to the whole UK oil and gas upstream sector will only contribute 0.01 % on average per year and 0.07 % during peak production in 2028.

The assessment of greenhouse gas emission impacts differs from the other impacts assessed in this Environmental Statement, as they contribute to cumulative global effects, rather than having a direct impact affecting a discrete localised area that can be directly attributed to a specific emission source. As such, the impact assessment for climate change impacts is not based on whether a project emits greenhouse emissions or the magnitude of greenhouse emissions alone, but whether it contributes to the energy transition with the aim of reducing greenhouse gas emissions relative to a comparable baseline consistent with the UK's current energy transition trajectory towards Net Zero by 2050 and the objectives agreed in the Paris (climate) Agreement.

Given that global climate change emissions span the entire planet, the receptor score for all greenhouse gas emissions, regardless size or location is classed as 'high'. When reviewing the Fotla emissions against industry specific, UK national and international emission reduction and global warming reduction targets, it can be concluded that the Fotla emissions are most likely to be in line with a climate pathway that limits warming to 2 °C by 2100 but exceeds warming of 1.5 °C during the 21st century. Consequently, the overall cumulative effect on global climate change of all Fotla emissions is considered as 'Minor adverse' and therefore may be considered as not significant. The greenhouse gas emissions impacts associated with the Fotla field development are fully consistent with applicable existing and emerging policy requirements and good practice design standards for this type of development. The minor adverse effects are fully in line with measures necessary to achieve the UK's (as well as the global) trajectory towards net zero.

Mitigation

During the drilling and subsea installation activities the use of vessels will be optimised in order to minimise the number of vessel trips and their length of time present at the Fotla field.

Once drilled and ready for production, the two Fotla wells will be temporarily shut in (i.e. closed off), so that they can be cleaned up after the pipelines are installed, so that the fluids can be processed through the production stream at Britannia, minimising flaring during well clean-up.

Using existing Britannia processing facilities significantly reduces the overall carbon footprint of the Fotla project, compared to constructing and operating a dedicated new installation at the Fotla location.

The additional Fotla fluids will increase efficiency of the Britannia processing equipment due to the composition of the Fotla gas, making it heavier and giving it more thermal energy. This results in a minimal increase (less than 1 %) in the overall emissions at Britannia, compared to a Britannia only base-case scenario without Fotla.

Ithaca Energy's Net Zero targets are fully supportive of national and industry targets set by the UK government and the industry body 'Offshore Energies UK' (OEUK).

In order to reduce Fotla's production emissions Ithaca Energy will be largely dependent on how Harbour Energy manages the energy supply and associated combustion emissions and process emissions onboard the Britannia complex. Ithaca Energy will monitor, support and assist Harbour Energy in any planned, existing or future initiatives aimed at improving the emissions footprint of the Britannia complex, where possible.

Marine Discharges

It is anticipated that the Fotla production wells will start producing water early in the production process (i.e. in 2028). The Fotla field will be tied back via a 14.4 km pipeline to the Bridged Linked

Platform (operated by Harbour Energy) where the produced water from the Fotla field will be processed, before being discharged to sea.

Currently, Britannia and the Bridge Linked Platform discharges 4,280 m^3/day but this will increase to 5,701 m^3/day with the inclusion of fluids from the Fotla field. To accommodate the produced water from Fotla, the currently mothballed Alder separator on Britannia will be reinstated and, if required, upgraded to handle fluids from the Fotla field. Upgrades to these separators is likely to maintain an improved average oil in water discharge specification of < 25 mg/l which is within the OSPAR standard limit.

To support the assessment of potential environmental impacts, numerical modelling was undertaken to assess the change in produced water risk at the Britannia facility as a result of the additional fluids produced from the Fotla field. The model showed that corrosion inhibitors are the largest contributors to risk associated with the discharge of produced water from Britannia, the Bridge Linked Platform and Fotla, specifically in relation to the chemicals Corton RN-633 and EC1545A which contribute 36.79 % and 4.53 % of the modelled risk respectively. However, Corton RN-633 is applied to the Britannia and Bridge Linked Platform produced water streams and is not proposed for use at Fotla which will include the corrosion inhibitor EC1545A. The modelled contribution of dispersed oil was small at 3.19 % which is marginally greater than the current discharges from Britannia and the Bridge Linked Platform (3.18 %).

Any discharges of produced water are predicted to disperse fairly rapidly in an open water environment such as the North Sea. There have been a number of studies which have concluded that a no effect concentration of produced water would be reached at < 10 to 100 m and usually less than 500 m from the discharge point. Therefore, any potential effects on local marine life are limited to being close to the discharge point and potential higher concentrations of produced water. No impacts are predicted on the seabed as the discharged produced water will remain close to the sea surface. No significant cumulative or transboundary impacts are considered likely.

Mitigation

No specific mitigation measures are proposed in respect of produced water discharge. However, the discharge of oily water is strictly regulated by a permitting system. A chemical permit (CP-SAT) is required for any chemicals used during operations offshore. Ithaca Energy (via Harbour Energy) will target as low an oil in water concentration as possible (≤ 25 mg/l) in produced water prior to discharge. Ithaca Energy will replace the upgrade the Alder Separator at the Bridge Linked Platform to target as low an oil in water concentration as possible, and within the typically permitted ≤ 25 mg/l limit, prior to discharge.

In addition, only industry standard production chemicals will be used and all chemicals will be included in the Offshore Chemical Notifications Scheme and the most environmentally friendly options evaluated and, where possible, chemicals that pose little or no risk to the environment may be used. Supporting assessments will be undertaken as part of the environmental permitting process which Harbour Energy (as the platform operator) will submit to the Offshore Petroleum Regulator for

Environment and Decommissioning to obtain approval, prior to use and discharge of any chemicals. All discharges will be monitored and reported.

Underwater Noise Impacts

During the drilling activities, underwater noise will be generated by the mobile offshore drilling unit and support vessels. In the installation phase, underwater noise will be generated by impact piling operations required for the installation of the drill centre manifold. Noise will also be propagated underwater from support and construction vessels.

Due to their hearing abilities, marine mammals and fish are at risk from significance levels of underwater noise. To protect local marine species, mitigation to cease noisy activities in the presence of a marine mammal within the mitigation zone will be implemented. The mitigation is informed by underwater noise propagation modelling which indicated that permanent physiological effects are unlikely to occur due to the noisiest activity (impact piling) with a mitigation strategy in place. However, impact piling has the potential to evoke behavioural responses from any marine mammal up to 2.4 km away. Fish may also be displaced from the area during impact pile driving, but they are also likely to return soon after the piling activity has ceased.

No significant cumulative and/or transboundary impacts from noise generated during the proposed piling, drilling, pipeline installation, and vessel operations are expected. Subject to the mitigation measures summarised below being adhered to during piling operations, no likely significant adverse effects as a result of underwater noise are considered likely to arise.

Mitigation

The planned piling operations will be undertaken in accordance with the Joint Nature Conservation Committee Protocol for minimising risk of injury to marine mammals from piling noise at all times. Mitigation measures proposed to reduce the significance of effects on the receiving environment include the use of a trained and dedicated Marine Mammal Observer to undertake monitoring duties before and during any piling operations. In addition, the use of “soft start” procedures, which slowly build up the intensity of the piling sequence to allow any marine mammals in the area to move away from the noise source before full intensity is reached, will be enacted.

During times of poor visibility, a Passive Acoustic Monitoring system may be used to detect the presence of marine mammals. The marine mammal observer and passive acoustic monitoring specialists will ensure that marine mammals remain outside the established 500 m mitigation zone during and prior to commencement of the piling activity.

Waste Management

Small quantities of waste will be produced throughout the development’s lifespan, which require appropriate management procedures to be implemented to ensure correct disposal.

Waste such as cements, chemicals, scrap metals, and wood will be generated during drilling and installation activities as well as food waste, recycled materials and waste oils. Decommissioning activities will also generate both hazardous and non-hazardous waste. All waste generated during the development will be minimised through appropriate controls measures and will be properly segregated for recycling, disposal, and treatment once returned to shore.

Ithaca Energy will ensure that waste management will be undertaken in line with best industry practice, current environmental legislation and the Waste Hierarchy. Additionally, any waste will be recorded in the UK Environmental Emissions Monitoring System. All waste produced will be managed in compliance with Ithaca Energy's Waste Management Procedures whilst waste generated onboard vessels will be governed by each vessel's Waste Management Plan.

Waste management at the Britannia installations is covered under Harbour Energy's own waste management procedures and managed by their appointed waste contractors.

No significant effects (including in-combination, cumulative or transboundary impacts) are anticipated as a result of the Fotla field development.

Mitigation

Mitigation measures that will be implemented regarding waste management are as follows:

- Application of the Waste Hierarchy to all produced waste;
- Compliance with Ithaca Energy's Waste Management Plan and use of a Garbage Management Plan for the management of waste produced from vessels;
- Compliance with Ithaca Energy's Waste Management Procedures for waste produced during the proposed development activities;
- Compliance with Harbour Energy's Waste Management Procedures for the management of waste produced on Britannia installations; and
- Segregation, transfer onshore and disposal of waste through licensed contractors and sites.

Accidental Events

The risk of an accidental hydrocarbon spillage to sea is often one of the main environmental concerns associated with oil-industry activities. The severity of impacts depends on many factors, including the volume and type of hydrocarbon spilled, the sea and weather conditions at the time of the spill, and the effectiveness of the oil spill response. The risk of a large-scale hydrocarbon spill during drilling operations or during the subsequent production phase of the proposed Fotla field is very low.

Oil spill modelling undertaken to inform the impact assessment considered two release scenarios which were an uncontrolled well blow out and a release of diesel from the mobile offshore drilling unit. The modelling predicted that oil would typically travel eastwards and north-eastwards and therefore a release has the potential to reach the coasts of Norway, Denmark, Sweden and UK. However, this assumes that there would be no intervention in the event of an accidental release of oil. In the event of a spill, Ithaca Energy would enact all appropriate oil spill response methods to ensure no spilled oil would impact the coastline.

Throughout the life of development, the focus will be on the prevention of oil spills. Stringent safety and operational procedures will be in place to ensure that immediate and appropriate action is taken in the event of any hydrocarbon spillage, minimising any impact to the marine environment.

Ultimately, the type and size of spill, along with the meteorological and oceanographic conditions at the time of the spill, will dictate which resources are most suitable for the spill event. A detailed Temporary Operations Oil Pollution Emergency Plan and Oil Pollution Emergency Plan will be in place covering drilling and production operations respectively at the Fotla field. The Temporary Operations Oil Pollution Emergency Plan and Oil Pollution Emergency Plan will ensure immediate and appropriate action is taken in the event of any hydrocarbon spillage, minimising any impact to the marine environment.

Given the likelihood of an accidental release of oil occurring, and with the planned mitigation measures to prevent an oil spill incident from occurring in place, the potential environmental risk posed by the proposed Fotla field development is judged to be reduced to an acceptable level.

Mitigation

Mitigation measures which are proposed include:

- Use of a drilling rig which will be appropriately certified to undertake the work and have an approved safety case to demonstrate that the drilling rig can safely undertake the operations;
- Use of a blow-out preventer which, in addition to the standard control systems, has several other backup emergency control systems;
- All hoses used during loading and offloading will be frequently inspected and tested. Hoses will be segmented with pressure valves that close automatically in the event of a drop in pressure;
- All equipment used on the mobile offshore drilling unit will have safety measures built in to minimise the risks of any hydrocarbon spillage. Spill kits will be available to deal with smaller spillages;
- Use of the Oil Spill Prevention and Response Advisory Group Capping Device to cap a well in the event of an uncontrolled release of hydrocarbons;
- Ithaca Energy is a member of Oil Spill Response Limited and is signed up to the UK Mutual Aid Framework Agreement which facilitates mutual aid of personnel between UK operators in the event of a sustained incident response;
- Preparation of a Temporary Operations Oil Pollution Emergency Plan and an Oil Pollution Emergency Plan to cover drilling and production operations respectively;
- Specific members of the mobile offshore drilling unit and standby vessel crew will be trained to the appropriate level in oil spill response training. The mobile offshore drilling unit will regularly undertake training exercises, including vessel-based oil spill response exercises and an offshore Temporary Operations Oil Pollution Emergency Plan Exercise while on site; and
- Pipelines will have pressure monitoring and low pressure alarms.

Overall Conclusions

The proposed Fotla field development will contribute to the United Kingdom's supply of energy by maximising recovery of hydrocarbons from the United Kingdom Continental Shelf whilst also aligning with the Net Zero target through optimisation of the project's design reducing emissions wherever practicable.

In line with the relevant regulations, an Environmental Impact Assessment has been undertaken to assess the potential impacts from the Fotla field development on the receiving environment with the scope of the assessment discussed with OPRED and relevant advisors. The Environmental Impact Assessment considered the worst-case impacts from the Fotla field development and is therefore a conservative consideration of the potential effects on the environment.

For the majority of impacts from the proposed Fotla field development, the outcomes of the Environmental Impact Assessment concluded that the proposal will not result in any likely significant effects on the environment. Where likely significant adverse effects were identified, mitigation measures have been proposed to reduce the significance of the effect to minor adverse or negligible (i.e. insignificant). The mitigation measures identified in the Environmental Statement will be fully implemented by Ithaca Energy during the respective stages of the Fotla field development. These are summarised in a Commitments Register which can be found in Appendix 4 of the Environmental Statement.

No significant in-combination, cumulative or transboundary effects are considered likely to arise from the Fotla field development.

Overall, it is judged that the environmental impacts of the proposed Fotla field development, when undertaken in conjunction with the mitigation measures identified in the Environmental Statement, will not incur any likely significant adverse effects.

1. Introduction

Ithaca Oil and Gas Limited, an affiliate of Ithaca Energy (UK) Limited (Ithaca Energy (UK) Limited and its affiliated companies being referred to throughout this environmental statement as 'Ithaca Energy') proposes to develop the Fotla field located in United Kingdom Continental Shelf (UKCS) Block 22/1b, approximately 176 km east of Peterhead and 46 km west of the UK/Norway transboundary line.

The proposed development comprises up to two production wells which will be drilled and tied back to the Britannia Platform, operated by Chrysaor (U.K.) Britannia Limited (hereafter referred to as "Harbour Energy"). The Britannia platform is located 13.5 km to the north in UKCS Block 16/26a. The pipeline route from the Fotla field to Britannia will pass through UKCS Blocks 16/26a, 22/1a and 22/1a. The Fotla field is 100 % operated by Ithaca Energy.

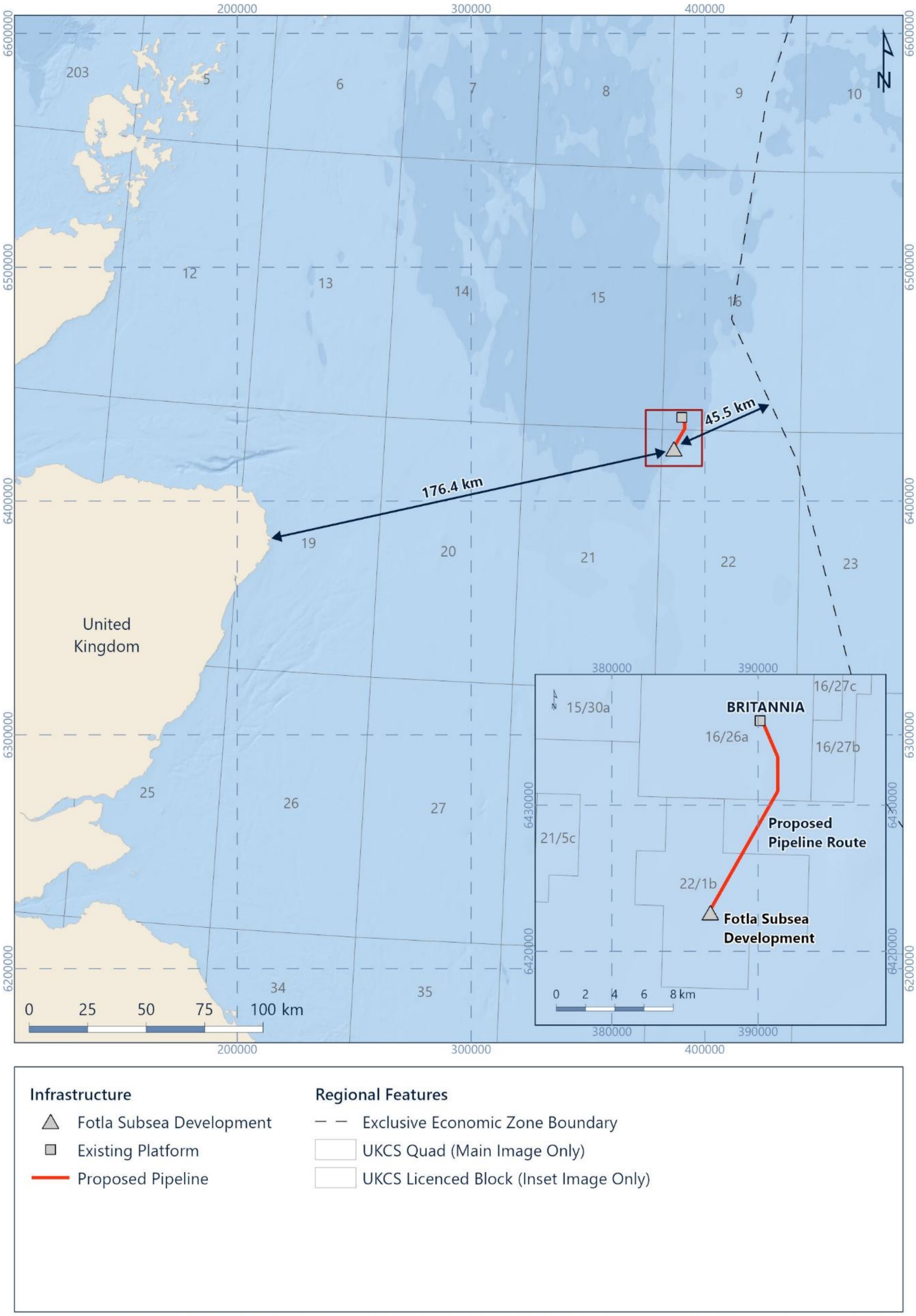
The location of the Fotla field is shown in Figure 1.1.

The purpose of this Environmental Statement (ES) is to present the results of the Environmental Impact Assessment (EIA) for the proposed Fotla field development and to identify the measures which will be put in place to remove or minimise likely significant adverse effects.

This ES has been produced in accordance with the Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 and associated guidelines. It also addresses issues and mitigation associated with the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended), the Offshore Chemicals Regulations 2002 and the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended), as well as other relevant legislation.

This introductory section explains the background and purpose of the proposed development and describes the EIA process. The underlying regulatory and other environmental requirements are also outlined.

This ES has been prepared in support of the Fotla Field Development Plan (FDP) which is submitted to the North Sea Transition Authority (NSTA).



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** OceanWise, Esri, GEBCO, Garmin, NaturalVue, OceanWise, Esri, Garmin, NaturalVue; Esri, 2024; Contains information provided by the OGA; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12.

Figure 1.1: Location of Fotla field and proposed pipeline route.

1.1 Project Background and Summary

The Fotla field was discovered in 2021 through the drilling of well 22/1b-12. Subsequently, two sidetracks were drilled for further appraisal of reserves within the Fotla field.

The Fotla field will comprise two subsea production wells connected to a single drill centre manifold which will in turn be tied back to the Britanna complex by a 14.4 km long 10"/16" (pipe-in-pipe) production pipeline. A 6" gas lift line will also be installed. The Fotla manifold will be a piled structure (fishing friendly).

The subsea equipment will be controlled through a multiplexed electro-hydraulic control umbilical system (power/signal, hydraulics and chemicals). The controls umbilical will be installed in the same trench as the production pipeline.

The wells will be tied into the manifold by rigid 6" production spools and 3" rigid gas lift spools. Concrete protection mattresses (and grout bags) will be used to protect the spools and control jumpers.

Pre-lay rock berm and potentially crossing supports and concrete mattresses (and grout bags) will also be used at the crossing of the 24" Bruce to Forties Unity condensate pipeline. The crossing will include placement of rock for protection.

A gravity-based riser base structure on the seabed at Britannia will house the subsea isolation valves (SSIVs) for the production and gas lift pipelines, as well as the riser and infield riser Umbilical Termination Assemblies (UTAs) for the controls umbilical.

At the Britannia Platform, existing equipment and process facilities will be re-used as far as possible. However, a number of topsides modifications and additions will be required to accommodate production from the Fotla field. These will include the need to address additional produced water discharges and atmospheric emissions from the Greater Britannia Area (GBA), as a result of the additional produced fluids from the Fotla field.

For the purposes of this EIA, a 'worst-case realistic scenario' has been considered for aspects of the project scope, where uncertainty still exists.

An indicative schematic of the proposed Fotla field development is shown in Figure 1.2.

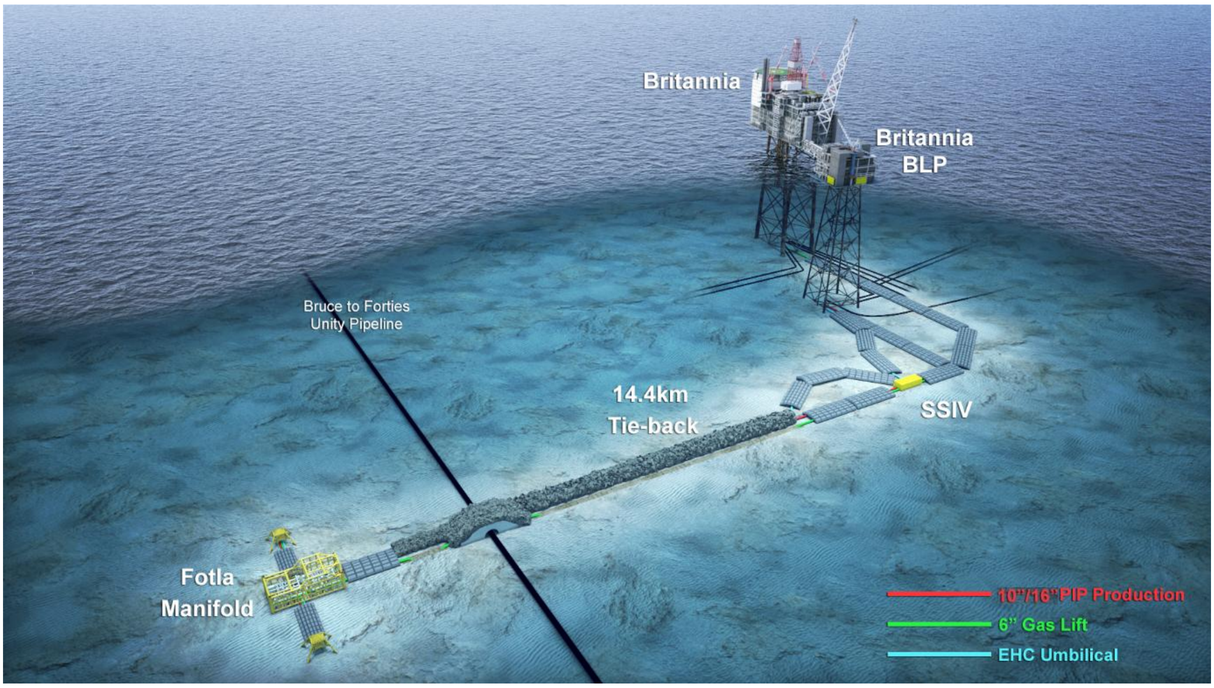


Figure 1.2: Indicative schematic of the proposed Fotla field development tied back to the Britannia Platform (not to scale)

Ithaca Energy proposes to commence drilling operations in Q1 2027, with construction on any topside modifications commencing Q3 2026. Installation of the subsea infrastructure is scheduled for Q2 2027. First oil is anticipated in Q4 2027.

Once operational, the Fotla field is estimated to produce 1.95 million cubic metres (12.2 million bbls) of oil over the anticipated 15-year life based on the highest production case scenario of hydrocarbons (Appendix 2).

1.2 The Environmental Impact Assessment (EIA) Process

Offshore oil and gas activities can have several environmental interactions and impacts due to operational emissions and discharges and general construction disturbances. The Environmental Impact Assessment process evaluates several environmental interactions and impacts of the project including operational emissions and discharges and general construction disturbances and mitigate significant adverse effect. A key component of the process is the identification of any issues that stakeholders may have regarding the development proposals so that that can be addressed and incorporated within mitigation designs. Finally, the process ensures that the planned activities are compliant with both legislative requirements and Ithaca Energy's environmental management procedures (Section 1.4). The main elements of the EIA process followed are outlined below.

1.2.1 Scoping and Consultation

Informal consultation was undertaken by means of a scoping meeting between Ithaca Energy and the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED).

During these consultations, the scope of the project was outlined to the OPRED, along with a summary of the perceived environmental sensitivities potentially impacted by the project.

Environmental concerns were identified during Environmental Issues Identification Workshops (ENVIDs) between Ithaca Energy and Fugro in 2024, based on the project designs. The results of the ENVIDs, including a summary of the impacts brought forward for further assessment in this ES, are included in Appendix 3.

In May 2024, an Early Consultation Document (ECD) was produced which summarised the proposed Fotla field development, the main environmental receptors likely to be present and any identified impacts likely to arise from the project. The ECD was distributed to OPRED, the Joint Nature Conservation Committee (JNCC), Marine Directorate (previously Marine Scotland) and the Scottish Fishermen's Federation (SFF), who were invited to comment on the proposals. Comments received from the consultees are summarised in Section 6. The formal statutory consultation process takes place following submission of this ES to OPRED which is subject to public consultation.

1.2.2 Information Gathering

Information was gathered on the natural and the socio-economic environment in the vicinity of the proposed well(s) and the GBA and used here to describe baseline physico-chemical, ecological, cultural and socio-economic conditions (Section 5). Data were sourced from publicly available national and regional datasets and reports as well as from published journals. Information was also gathered on the proposed operations, including the alternative options considered (Section 3).

1.2.3 Assumptions and Areas of Uncertainty

At this stage, some project parameters are yet to be confirmed. Therefore, some assumptions and worst-case realistic options have been used for the purposes of impact assessment. Assumptions or areas of uncertainty which have been made in the course of the assessment are set out in the following sections.

1.2.3.1 Selection of the Mobile Offshore Drilling Unit (MODU)

The specific Mobile Offshore Drilling Unit (MODU) which will be used to drill the two production wells at Fotla has not been confirmed and a final decision will be taken at a later stage in the project development.

Therefore, in order to undertake the assessments in Section 9 Physical Presence and 10 Atmospheric Emissions, a semi-submersible MODU which has previously undertaken operations on the UKCS for Ithaca Energy was selected as a proxy.

1.2.3.2 Well Locations

The Fotla field development comprises two production wells and the planned locations for these wells are detailed in this ES (Section 4 Project Description). Prior to drilling operations commencing, there may be a requirement to relocate the production wells. However, any change in well location is likely to be within a few metres of the locations stated in the ES and would not alter the impact assessment undertaken in Section 8 Drilling Impacts.

1.2.3.3 Placement of protective deposits

During the planned operations at the Fotla field development, protective material such as concrete mattresses, grout bags and rock material will be required to be installed to stabilise and protect subsea infrastructure such as the pipelines and umbilical. For the purposes of the EIA the maximum anticipated quantities of rock material, mattresses and grout bags have been presented in the ES (Section 4 Project Description). This allows for the worst-case scenario to be assessed (see Section 9 Physical Presence) ahead of final requirements for protective material which will be clarified in a Pipeline Works Authorisation (PWA) to be submitted to the North Sea Transition Authority (NSTA) at a later date.

1.2.3.4 Production Profiles

Production profiles for the proposed Fotla field development are included in this ES (Appendix 2) and detail different production scenarios (high, medium or low-case). The profiles presented here, and used in the impact assessment, are based on Ithaca Energy's best understanding the projected production from the Fotla field at the current time (Section 10 Atmospheric Emission Impacts and S14 Accidental Events). These also align with the values presented in the FDP. The impact assessment for the proposed Fotla field development has been undertaken against the high-case production profile scenario.

1.2.3.5 Fate of LTOBM Drilling Muds

The deeper well sections of the wells will be drilled using low-toxicity oil based muds (LTOBM), the disposal of which will depend on the selection of the drilling rig which, in turn, will depend on rig availability at the time of drilling. After most of the LTOBM is removed via the shale shakers onboard the MODU, the recovered cuttings will have traces of low-toxicity oil left on them and thus cannot be discharged directly to sea.

In general, cuttings contaminated with LTOBM are transported to shore for appropriate treatment and disposal, a process referred to as 'skip and ship'. Alternatively, certain MODUs can accommodate thermal treatment equipment to remove any remaining oil and water in the cuttings, after which the cleaned cuttings can be discharged to sea. In order to assess the potential worst-case discharge scenario, it has therefore been assumed that all cuttings will be discharged to sea for the purposes of the impact assessment (Section 8 Drilling Impacts).

1.2.4 Commissioning Specialist Studies

There have been two environmental surveys previously conducted at the Fotla field in 2019 (Fugro, 2020) and 2023 (Gardline, 2023 and 2024) from which site-specific data have been collated. Contextual environmental data for the wider area are drawn from similar surveys undertaken at nearby fields. Site-specific and contextual environmental data are discussed in Section 5.

In addition, the following modelling studies were undertaken: drill cuttings dispersion modelling (Xodus, 2025a), oil spill modelling (OSRL, 2024) and produced water dispersion modelling (Xodus, 2025b) to cover the worst-case release scenarios which have been identified during the EIA.

1.2.5 Identification and Assessment of Potential Environmental Impacts

A core element of the EIA process is the identification of environmental effects associated with the proposed project activities, which may have a 'potentially significant' impact. This process is called 'scoping'.

The first step was to determine all stages in the project process ensuring that all activities were fully considered. Central to this process were the ENVID workshops, attended by key members of the Ithaca Energy project team. The workshops were undertaken out to evaluate the project for potential environmental interactions and to identify key issues which required further consideration.

Section 7 of the ES describes the process which has been used to assess the potential effects from the Fotla field development on the environment.

1.2.6 Development of Mitigation Measures

Identifying and assessing impacts from the proposed Fotla field development, and mitigating their significance, is an iterative process conducted throughout the course of a project. Mitigation measures were explored during the assessment process, in order to eliminate or reduce the significance of the identified environmental impacts. Mitigation measures adopted are described in each of the individual impact sections (Sections 8 to 14) and are summarised in the Commitments Register (Appendix 4).

1.2.7 Purpose and Scope of the Environmental Statement

The proposed Fotla field development is considered a 'Schedule 1' project under The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 (as amended) and therefore requires an EIA to be undertaken and the subsequent ES submitted to the OPRED for approval.

The scope of the EIA and ES covers the important potential environmental implications of the proposed Fotla field development and includes the following activities associated with the project:

- Drilling and commissioning of two production wells at the Fotla field;
- Installation and commissioning of the associated subsea infrastructure;
- Trenching, installation and commissioning of pipelines and umbilicals;
- Modifications to the topsides of the Britannia Platform;

- Operation of the Fotla infrastructure; and
- Decommissioning.

This ES reports the findings of the EIA process and explains how the conclusions have been reached. The intention has been to present the information in such a way that allows readers to form their own opinions on the acceptability of the residual levels of impact, associated with the project.

The ES covers:

- The legislative and policy justifications for developing the Fotla field and the role of the EIA process (Section 1);
- Ithaca Energy's Net Zero Action Plan (Section 2);
- A description of the option selection process and detailed description of the proposed Fotla field development (Sections 3 and 4 respectively);
- A description of the environment and key receptors in the vicinity of the proposed Fotla field development (Section 5);
- The methods used to identify the environmental concerns associated with the Fotla field development (Sections 6 and 7);
- A detailed assessment of each concern, including any potential cumulative and transboundary impacts, and mitigation measures (Sections 8 to 14);
- The mitigation measures that have been proposed summarised in a Commitments Register (Appendix 4); and
- Conclusions (Section 15).

In addition, the ES is summarised in the Non-Technical Summary (NTS).

1.3 Legislative and Policy Framework

The main legislation applicable to the proposed development operations is summarised in Appendix 1 (Summary of Legislation) together with the relevant consents, authorisations and exemptions that are required. An overview of the pertinent and impending legislative requirements is given below. Legislation and policy pertinent to climate change and Net Zero is described in Section 2 of the ES.

1.3.1 The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020

These regulations replace The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended) and implement the requirements of European Commission (EC) Directive 2011/92/EC (the EIA Directive) for offshore oil and gas operations in the UK. The EC Directive 2011/92/EU revokes the 85/337/EEC and its amendments 97/11/EC, 2003/35/EC and 2009/31/EC. These regulations require that an EIA must be undertaken for an offshore development considered to fall within the scope of a Schedule 1 project and that a public consultation document (the ES) is submitted to OPRED and made available to any interested party for comment prior to approval by the Secretary of

State (SoS). The assessment of likely significant effects of a project on the environment, must as per Schedule 6(5)(d) of the Offshore EIA Regulations, *"take into account environmental protection objectives established in retained EU law or at national level*".

OPRED has prepared guidance notes on the regulations, issued in December 2020 and most recently revised in July 2021, which detail the information the ES must contain. Essentially the document must describe the proposed project and identify any impacts it is likely to have on the receiving environment, together with any measures to reduce the significance of any impacts. Consent for an activity will be granted only when the SoS is satisfied that the environmental implications of the proposed project have been properly considered.

In June 2025, OPRED issued a supplementary guidance document, which provides advice on assessing the effects of downstream emissions on the climate from offshore oil and gas projects, in response to the Finch judgment, 2024 and subsequent Jackdaw and Rosebank Judgment, 2025.

1.3.2 The Climate Change Act 2008 (as amended)

On 22 April 2016 the UK was a Party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement which aims, among other things, to "*Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change*" (Article 2(1)(a)). In addition, in order to achieve the long-term temperature goal, Parties to the Paris Agreement aim to "… *achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, …*" (Article 4(1)). The UK ratified the Paris Agreement on 18 November 2016.

In the UK, the principal basis for giving effect to the reduction of territorial GHG emissions is through the Climate Change Act 2008, which sets binding carbon budgets and a net zero target by 2050. The expectation is that Scope 1 and 2 GHG emissions are assessed by the developer for the impact of the project on climate, which should include consideration of the Climate Change Act 2008, and associated carbon budgets.

1.3.3 The Offshore Petroleum and Pipelines (Environmental Impact Assessment and other Miscellaneous Provisions) (Amendment) Regulations 2017

The Offshore Petroleum and Pipelines (Environmental Impact Assessment and other Miscellaneous Provisions) (Amendment) Regulations 2017 came into force on 16 May 2017. These regulations transpose the requirements of Directive 2014/52/EU into the EIA regulations. Directive 2014/52/EU amends the EIA Directive 2011/92/EU to strengthen the quality of the EIA process and align the process with smart regulation and improves environmental protection.

1.3.4 The Offshore Chemicals Regulations 2002 (as amended)

The Offshore Chemicals Regulations 2002 were developed in response to the Harmonised Mandatory Control System (HMCS) for the use and discharge of offshore chemicals, first introduced by the Convention for the Protection of the Marine Environment of the North east Atlantic (the OSPAR Convention) in 2000.

The regulations stipulate that operators have to apply for a permit to use and discharge chemicals offshore. This permit must be in place before commencement of operations. Chemical Permit applications are Subsidiary Application Templates (SATs), embedded within Master Application Templates (MATs) and are submitted electronically to the OPRED via the online Portal Environmental Tracking System (PETS).

An application for a Chemical Permit from the OPRED typically contains:

- A description of the offshore source on, or from which, the offshore chemical is to be used or discharged, and the location of the offshore source in the relevant area;
- A description of the proposed technology and other techniques for preventing or, where this is not possible, reducing the use or discharge of the offshore chemical from the offshore source;
- A description of the measures planned to monitor the use or discharge of chemicals; and
- An assessment of the risk of harm to the environment from the use and discharge of the offshore chemicals proposed.

Chemical permits last for the duration of the activity and require reporting of actual chemical use and discharge when the activity is complete. These regulations were amended in 2011, making it an offence to unintentionally release a chemical offshore. The updated regulations clarify the legal distinction between accidental "releases" and operational "discharges" and increase the powers of OPRED inspectors to investigate non-compliances/risk of significant pollution from chemical discharge.

1.3.5 The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended)

These regulations, generally referred to as the Oil Pollution Prevention and Control (OPPC) Regulations, introduced a permitting system for oil discharges to sea.

In 2011, amendments were made to the OPPC Regulations to align them with amendments to the Offshore Chemical Regulations (Section 1.3.4). The amendments made it unlawful to unintentionally release oil into the offshore environment. All oil discharges must be in accordance with the terms and conditions of an OPPC permit.

The OPPC Regulations also amend the Offshore Chemicals Regulations 2002, as discussed in Section 1.3.4, to increase the powers of OPRED inspectors to investigate non-compliances and risk of significant pollution from chemical discharges, including the issue of prohibition or enforcement notices. Operators are required to report all unpermitted oil discharges, regardless of size, to the His Majesty's (HM) Coastguard, OPRED and other relevant authorities.

Under the amendments, the OPPC Regulations now also apply to offshore pipeline operations.

1.3.6 The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended)

These regulations, as amended in 2007, seek to ensure that oil and gas activities on the UKCS are carried out in a manner that is consistent with the requirements of the EC Habitats Directive (92/43/EEC).

These Regulations are designed to ensure that the integrity of either a Special Area of Conservation (SAC) or a Special Protection Area (SPA) is not significantly affected by activities occurring either within, or outside, those sites. Any plan or project which either alone, or in combination with, other plans or projects would be likely to have a significant effect on a site, must be subject to an appropriate assessment of its implications for a site's conservation objectives. Such a plan or project may only be agreed after ascertaining that it will not adversely affect the integrity of a SAC or SPA, unless there are imperative reasons of overriding public interest for carrying out a plan or project.

1.3.7 The Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 (as amended)

These Regulations, as amended in 2010, implement the EC Habitats Directive and Birds Directive in the UKCS outside the 12 nautical mile (nm) zone. The Regulations make provision for the selection, registration, notification and management of European offshore marine sites. Competent authorities are required to ensure that steps are taken to avoid the disturbance of species and deterioration of habitat, in respect of the offshore marine sites and that any significant effects are considered before authorisation of certain plans or projects. Provisions are also in place for issuing of licences for certain activities and for undertaking monitoring and surveillance of offshore marine sites.

These Regulations also make it an offence to deliberately disturb wild animals of a European Protected Species (EPS), in such a way as to significantly affect the ability of any significant group of animals to survive or breed, or the local distribution or abundance of that species. If appropriate, a Wildlife Disturbance Licence may be required.

1.3.8 The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019

Due to the UK's exit from the European Union (EU), legislative amendments have been undertaken with respect to some of the main pieces of legislation, that afford protection to particular habitats and species in this country. These are the Conservation (Natural Habitats, &c.) Regulations 1994, the Conservation of Habitats and Species Regulations 2017, the Conservation of Offshore Marine Habitats and Species Regulations 2017 and the Offshore

Petroleum Activities (Conservation of Habitats) Regulations 2001, known collectively as "the Habitats Regulations", as well as The Wildlife and Countryside Act 1981.

In Scotland, these changes are enacted through The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019, which seek to ensure that Scotland maintains the standards required by the EU Habitats and Wild Birds Directives, commonly referred to collectively as "the EU Nature Directives", which set out rules for the protection and management of certain habitats and species and all wild bird species to ensure their conservation in the long term.

For Scotland and the rest of the UK, the Habitats Regulations continue to remain in force, including the general provisions for the protection of European sites and the procedural requirements to undertake Habitats Regulations Appraisal (HRA) to assess the implications of plans or projects for European sites.

1.3.9 Petroleum Act 1998 (as amended)

The Petroleum Act 1998 establishes the regulatory regime applying to oil and gas exploration and production in the UK (other than onshore in Northern Ireland). The Petroleum Act (as amended) vests all rights to the nation's petroleum resources to the Crown but allows licences to be granted, that confer exclusive rights to 'search and bore for and get' petroleum on the UKCS. The vast majority of offshore energy activities relating to oil and gas exploration and production are controlled under the Petroleum Act 1998 (as amended) and the Energy Act 2008 (as amended) or are exempted under the Marine Licensing (Exempted Activities) Order 2011 (as amended).

1.3.10 Shipping (Oil Pollution Preparedness, Response and Cooperation Convention) Regulations 1998

These regulations require that all operators have a formally approved Oil Pollution Emergency Plan (OPEP) in place for each offshore operation or agreed grouping of facilities. The regulations also stipulate legal oil spill reporting requirements.

These Regulations, which came into force on 19 July 2015, together with the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015 and the Offshore Petroleum Licensing (Offshore Safety Directive) Regulations 2015, implement the European Union Directive 2013/30/EU on the safety of offshore oil and gas operations.

1.3.11 The Offshore Installations (Offshore Safety Directive (Safety Cases etc.) Regulations 2015

The Offshore Installation (Offshore Safety Directive) (Safety Case etc.) Regulations 2015 came into force on 19 July 2015, replacing the 2005 Safety Case Regulations. The 2015 Regulations apply to all oil and gas operations in UK waters and implement the EC Directive on safety of offshore oil and gas operations 2013/30/EU. The EU has put in place a set of rules to help prevent accidents, as well as respond promptly and efficiently should one occur. The 2015

Regulations provide for the preparation of safety cases for offshore installations and the notification of specified activities to the competent authority.

1.3.12 The Energy Act

1.3.12.1 The Energy Act 2008 (as amended)

The Energy Act 2008, as amended in 2016, makes provisions for the decommissioning of offshore oil and gas installations. Part III of the Energy Act 2008 amends Part 4 of the Petroleum Act 1998 and contains provisions to enable the SoS to make all relevant parties liable for the decommissioning of an installation or pipeline; provide powers to require decommissioning security at any time during the life of the installation and powers to protect the funds put aside for decommissioning in case of insolvency of the relevant party.

Part 4a of The Energy Act, created through Section 314 of the Marine and Coastal Access Act 2009 (see below), transferred the Consent to Locate provisions of Section 34 of the Coast Protection Act 1949 to the Energy Act. This gives the SoS power to grant Consents to Locate to an individual or organisation under Part 4a of the Energy Act, which would permit installation of an offshore structure, or the carrying out of offshore operations, providing that they are undertaken in accordance with the conditions of any consent granted.

1.3.12.2 The Energy Act 2016 (as amended)

The Energy Act 2016, as amended, contains provisions to establish the Oil and Gas Authority (OGA) a new regulatory body for the oil and gas industry in the UK and transfers regulatory powers and functions to it as well as providing it with new powers. The OGA is now known as the North Sea Transition Authority (NSTA), however its remit remains the same.

Further to the establishment of the OGA the Act as makes provisions regarding abandonment of offshore installations which require to have an abandonment programme approved by the Secretary of State in place before any such operations commence. The OGA requires to be consulted before submission of an abandonment programme to allow the OGA to consider and advise in possible alternatives to decommissioning such as reuse of infrastructure.

1.3.12.3 The Energy Act 2023

The Energy Act 2023 became law in October 2024 and implements the goals of a number of energy policies such as the British Energy Security Strategy and the Powering up Britain: Net Zero Growth Plan to increase energy security whilst transitioning to Net Zero.

With respect to the oil and gas sector the Act includes powers to ensure that the regulatory regime for the industry remains fit for purpose by permitting future changes through introduction of secondary legislation. Amendments to cost recovery mechanisms and measures to discourage potentially undesirable changes of ownership and control of assets on the UKCS are also included in the Act.

1.3.13 Marine and Coastal Access Act 2009

The Marine and Coastal Access Act (MCAA) provides a legal mechanism for improved management and protection of the marine and coastal environment, with particular relevance to biodiversity and nature conservation. This legislation makes provision for the designation of Marine Conservation Zones (MCZs) in the territorial waters adjacent to England and Wales and UK offshore waters. Operators will need to apply for a Marine Licence to undertake certain licensable marine activities as per Part 4 of the Regulations.

1.3.14 Scottish National Marine Plan (NMP)

EU Directive 2014/89/EU introduced a framework for maritime spatial planning, with the aim to promote the sustainable development of marine areas and the sustainable use of marine resources. In accordance with this Directive, the Scottish National Marine Plan (NMP) was published in March 2015 and was subsequently reviewed in 2018 and 2021. The Scottish NMP sets out strategic policies for the sustainable development of Scotland's marine resources through informing and guiding regulation, management, use and protection of the marine plan areas. Ithaca Energy will ensure compliance with all the NMP policies throughout the proposed Fotla field development. Section 6.3 summarises the general and oil and gas specific policies and objectives, which are of relevance to the Fotla field, and explains how they align with the project.

1.4 Ithaca Energy Environmental Management System

The proposed Fotla field development will be delivered in compliance with Ithaca Energy's Environmental Management System (EMS), which is independently certified to the international standard ISO14001:2015 (last certified in April 2024) and is fully integrated into the Company Business Management System. Ithaca Energy is required to engage independent auditors who verify that Ithaca Energy's onshore and offshore operations meet requirements of the Standard. All Ithaca Energy operated assets are included in the ISO 14001:2015 certification.

The EMS is designed to support the implementation of Ithaca Energy's Health, Safety, and Environmental (HSE) Policy. Ithaca Energy's EMS reflects a commitment to complying with environmental legislation and upholding the standards, processes, and objectives for the environmental management of hydrocarbon exploration and production. It also demonstrates a commitment to conducting activities in compliance with all applicable legislation and in a manner that minimises impacts on the environment.

Ithaca Energy's HSE Policy Statement (Figure 1.3) is endorsed by the Chief Executive Officer and the Executive Chairman of Ithaca Energy on behalf of the Board of Directors and is a commitment to assess and manage the risks and impacts associated with our operations; and a commitment to comply with legislative requirements and corporate policies.

The Ithaca Energy HSE Policy Statement places environment at the heart of everything Ithaca Energy does. Ithaca Energy recognises the importance of effectively managing its activities and their potential impacts on the environment. Under the EMS, Ithaca Energy takes a proactive approach to managing environmental aspects by systematically identifying, monitoring, and reducing environmental impact. Ithaca Energy regularly assesses its operations, sets measurable environmental objectives, and engages employees in environmental awareness and initiatives. Through this structured approach, Ithaca Energy strives to minimise waste, reduce emissions, and promote environmental stewardship while achieving business goals.

Further details of Ithaca Energy’s approach to environmental management are provided in Section 2.5.

ITHACA ENERGY

Health, Safety and Environmental Policy Statement

Our Vision

It is the vision of Ithaca Energy plc, its affiliates, and subsidiaries (the "Company") to be the highest performing UK North Sea independent oil and gas company, focused on sustainably growing value. We strive to be leaders in terms of process safety; occupational health and safety; environmental responsibility; asset reliability and efficiency.

We will:

- Put our people, their safety and environmental responsibility at the heart of everything we do.
- Ensure no harm to our people or environment, by excelling as safety leaders.
- Ensure our operations are governed by robust procedures and management systems as described within our Business management System (BMS).
- Ensure risks related to occupational health, process safety and environment, including major accident hazards are assessed and controlled.
- Ensure the provision and maintenance of safe means of access to and egress from our facilities.
- Ensure adequate facilities and arrangements for welfare at work are in place at our facilities.
- Ensure systems are place for the safe use, handling, storage and transport of articles and substances.
- Promote a culture in which our people express themselves and can trust that our leaders will listen and act where necessary.
- Acknowledge that making mistakes is human and that focus must be on learning and supporting our frontline teams regarding strength of barriers to prevent major accident hazards.
- Protect the environment, prevent pollution, and minimise emissions, waste, and use of natural resources.
- Be considered and support physical, social, and emotional wellbeing.
- Meet legal requirements and other compliance requirements/obligations, ensuring effective stakeholder engagement.
- Set objectives and targets to focus on improvement in HSE performance.
- Ensure risks related to occupational health, process safety and environment, including major accident hazards are assessed.
- Provide appropriate HSE information, instruction, training, and supervision.
- Through audit and workplace monitoring, assess our processes and operations looking for opportunities to continually improve our HSE performance.
- Investigate and learn from near misses and incidents.
- Plan and prepare for potential emergencies.
- Provide sufficient resources for implementation of this policy.
- Ensuring everyone is empowered to stop a job if there are any concerns regarding HSE risks.

We all have a responsibility at Ithaca Energy to follow this Policy and assist the business in its implementation.

Luciano Vasques	**Yaniv Friedman**
Chief Executive Officer, Ithaca Energy	**Executive Chairman, Ithaca Energy**

Figure 1.3: Ithaca Energy Health, Safety and Environmental Policy Statement

2. Net Zero Action Plan

This section discusses Ithaca Energy's greenhouse gas (GHG) emissions strategy, policy and targets and how these are embedded in the Company's management systems.

2.1 Legislative and Regulatory Framework

The United Kingdom's Climate Change Act 2008 sets a legal requirement to achieve a 100 % reduction in GHG emissions by 2050 relative to 1990 levels. In Scotland, The Climate Change (Scotland) Act 2009, as amended by The Climate Change (Emissions Reductions Targets) (Scotland) Act 2019, sets targets to reduce Scotland's emissions of all GHG to net-zero by 2045.

These targets are mirrored by sector-specific policy commitments, such as the North Sea Transition Deal (NSTD) and the British Energy Security Strategy, which support oil and gas production while mandating emissions reductions and decarbonisation through measures such as offshore electrification.

Ithaca Energy's approach to reducing emissions is guided by the Oil and Gas Authority (OGA) Strategy (now administered by the North Sea Transition Authority (NSTA)), which replaced the earlier Maximising Economic Recovery (MER) UK Strategy. The updated OGA Strategy retains the focus on maximising the economic recovery of petroleum while integrating obligations to reduce GHG emissions as far as reasonably possible. Licensees must take reasonable steps to limit emissions from flaring, venting, and power generation, and support carbon capture and storage (CCS) initiatives. Deployment of emerging and existing technologies is expected to be optimised for emissions control.

The NSTA has also produced a series of documents, referred to as Stewardship Expectations. These expectations promote responsible emissions monitoring, reporting, and reduction initiatives and reinforce the industry's role in achieving Net Zero by 2050. A total of 12 Stewardship Expectations have been produced to date. Stewardship Expectation 11 'Net Zero' sets out typical examples of actions that could be undertaken to reduce emissions during all stages of the project lifecycle. Developments which are considered to align with the aims of Stewardship Expectation 11 will contribute to meeting the Net Zero target.

In addition, the Zero Routine Flaring (ZRF) Initiative, introduced by the World Bank in 2015, commits government and industry to end routine flaring at production sites no later than 2030 and to ensure that new developments are designed without the need for routine flaring of any associated gas which may be produced from the field. Where routine flaring occurs at existing fields, operators should seek to implement solutions to eliminate flaring as soon as possible and no later than 2030. The ZRF Initiative relates to routine flaring operations and does not encapsulate flaring for safety reasons or non-routine flaring. However, these types of flaring operations should be minimised as far as possible. Under this initiative, venting is not an acceptable substitute for flaring.

2.2 Emissions Baseline and Performance

Ithaca Energy's emissions baseline is established through data recorded in line with the GHG Protocol[1] and is used for regulatory submissions, including those for the Emissions Trading Scheme (ETS) and the Environmental and Emissions Monitoring System (EEMS), covering direct emissions from production operations. Aligned with the NSTA targets, Ithaca Energy's baseline year for performance tracking is 2018.

From 2018 to 2024, Ithaca Energy has achieved a 21 % reduction in GHG emissions compared to the baseline year. This was driven by:

- Operational efficiencies;
- Reduction in flaring and venting;
- Asset divestment and decommissioning;
- Routine equipment upgrades and maintenance improvements; and
- Execution of projects as per the Company's Emissions Reduction Action Plan (ERAP) (Section 2.6).

In addition, gross operated emissions intensity reduced from 25 kg CO_2e/boe in 2023 to 23.9 kgCO_2e/boe in 2024 on a Scope 1 and 2 basis, and methane intensity reduced from 0.2 % to 0.1 % over the same period. Ithaca Energy is committed to the continual year-on-year emissions intensity reduction and maintaining lower than basin average intensities.

2.3 Emissions Reporting and Governance

Accurate recording and reporting of emissions is central to Ithaca Energy's environmental governance framework. The company reports atmospheric emissions under multiple schemes:

- UK Emissions Trading Scheme (UK ETS) — for installations regulated under emissions permits;
- EEMS — annual environmental reporting;
- Energy Savings Opportunity Scheme (ESOS) and Streamlined Energy and Carbon Reporting (SECR) — corporate-level reporting requirements;
- Carbon Disclosure Project (CDP) and Task Force on Climate-Related Financial Disclosures (TCFD) submissions — for transparency to investors and regulators; and
- Oil and Gas Methane Partnership (OGMP) 2.0 – for improving the monitoring and verification of the Company's methane emissions data, so that it may identify areas for further methane reduction and mitigation. Ithaca Energy was awarded a 'Gold Standard Pathway' certification from OGMP 2.0 in recognition of the efforts made in improving methane management across the Company's operations.

[1] The GHG Protocol (https://ghgprotocol.org/) provides standards, guidance, tools and training for business and government to measure and manage climate-warming emissions.

Responsibility for emissions management lies with Ithaca Energy's Environmental & Energy Transition Manager, supported by the wider HSE (Health, Safety and Environment) Team, while Board-level accountability is maintained through quarterly HSE performance reviews.

2.4 Environmental Management System

Ithaca Energy takes a proactive approach to managing environmental aspects by systematically identifying, monitoring, and reducing environmental impact. The Company regularly reviews its operations, sets measurable environmental objectives, and engages employees in environmental awareness and initiatives. Through this structured approach, Ithaca Energy aims to minimize waste, reduce atmospheric emissions and promote environmental stewardship.

All Ithaca Energy operations and projects have the potential to impact on the environment and they are all subject to strict environmental regulatory controls. These require Ithaca Energy to prepare and submit regulatory applications to gain approval before activities commence. Ithaca Energy constantly monitors operational activities and reports ongoing emissions, discharges and waste streams to ensure regulatory compliance and to ensure that there is no significant impact on the environment. In the event of an unplanned release/spill to sea, or a non-compliance with regulatory requirements, the relevant regulatory authorities would be notified and immediate actions taken to respond to any threat of or actual pollution. Investigations of incidents are conducted to gain any learnings or actions to prevent recurrence.

Ithaca Energy's Environmental Management System (EMS) follows the Plan-Do-Check-Act (PDCA) cycle, elements of which are embedded in the Company's day-to-day activities. Increasing awareness of environmental compliance, ensuring that the environmental considerations are embedded in everything that Ithaca Energy does and ensuring processes and control measures are robust are just some examples of how the Company works to ensure continual improvement.

Ithaca Energy takes pride in:

- Having a relentless focus on high performance;
- Continuously reducing the health, safety and environmental impact of its operations;
- Developing an engaged workforce, in an inclusive, dynamic workplace; and
- Striving for efficiency and simplicity in all that is done.

Ithaca Energy's leadership team have set ambitious company targets and asset specific emissions reduction Key Performance Indicators (KPIs). Performance is reviewed by leadership on a monthly basis and communicated to Company employees at regular intervals.

In addition, the Ithaca Energy HSE Team has annual integrated objectives and an improvement plan which outline key elements for measuring success in progressing towards climate targets. This plan is endorsed by the Company's Executive Leadership Team and the Board.

Using the EMS process, Ithaca Energy regularly assesses emissions abatement opportunities. Using these processes, Ithaca Energy has overseen a net reduction in flaring and venting emissions across all assets since 2018. As responsible joint venture (JV) partners, Ithaca Energy also encourage and support large emissions abatement projects, such as electrification, on non-operated assets.

2.5 Net Zero Targets and Objectives

As stated above, Ithaca Energy's emission reduction targets are aligned with the NSTD with an interim target of a 50 % reduction in operated emissions by 2030 (relative to the 2018 baseline). These targets are for Scope 1 and 2 GHG emissions, on a Net Equity basis.

Ithaca Energy's roadmap includes annual asset emissions targets, operational improvement initiatives, and decarbonisation projects aligned with industry best practice.

Interim milestones include:

- Completing planned and approved emissions reduction projects;
- Continual evolvement of the ERAP, including completing ongoing new studies;
- Deploying methane detection technologies;
- Developing a supplier engagement program for emissions assessment and reduction; and
- Collaborating with industry on low-carbon project collaborations.

2.6 Emissions Reduction Action Plans

Ithaca Energy's emissions reduction initiatives span operational controls, infrastructure modifications and technology adoption.

2.6.1 Recent Initiatives

- On the Captain Wellhead Protection Platform (WPP), Ithaca Energy reached a major milestone in its key emissions reduction projects by completing the key construction of the tie ins required for the commissioning of the flare gas recovery system in 2026 and the detailed design phase of the flare gas recovery project. Major upgrades also began in 2025 to re-wheel the power water injection pumps so that they are right sized and more efficient to the operation. Furthermore, Gas Export Compressor B has been recommissioned to improve reliability on the asset and reduce flaring;
- On the Captain FPSO, new more efficient burners are being installed in the fired heaters allowing for increased efficiency and lower operating CO_2 and improved NO_x emissions. The control system of the fired heaters is due to be upgraded in 2027, which will allow dual fuel operations and reduce reliance on diesel;

- At the FPF1 production facility, Ithaca Energy optimised the gas processing system to only use a single compressor to deliver gas to the mainland. This achieved a material reduction of around 34,000 tonnes of CO_2e per year;
- On the Alba Northern Platform , the process was modified to allow gas import to top up the field's own gas in its compressor and utilise it in both turbines. This resulted in minimal flaring and diesel usage as the field recovered from the long-term outage of the John Brown turbine that occurred in 2023, and will reduce reliance on diesel during the planned plugging and abandonment campaign after cessation of production in 2026; and
- At the Cygnus field, Ithaca Energy has continued to reduce the stripping gas rate from its triethylene glycol (TEG) system with the ultimate aim to reduce it from 12 kg/h to 0 kg/h, equating to a reduction of 70 tonnes of CO_2e per year. The asset is utilising appropriately sized temporary electrical generators during shutdowns. This has reduced the quantity of fuel required saving approximately 334 tonnes of CO_2e per year. A feasibility study looking at flare gas recovery is currently underway which has the potential, if implemented, to save approximately 5,000 tonnes of CO_2e per year. The de-energising of the Bravo Normally Unmanned Installation (NUI) is also at the define stage with an opportunity to save 89 tonnes of CO_2e per year.

Across Ithaca Energy's non-operated portfolio of assets, a range of emission reduction projects have been implemented including:

- Sanctioning the flare gas recovery project at the Elgin-Franklin field which is predicted to reduce emissions by 40,000 tCO_2e/year; and
- At Britannia, the ZRF project was approved to enter Front-End Engineering Design (FEED) Stage which is predicted to reduce emissions by an estimated 36,000 tCO_2e/year.

Onshore, to reduce Scope 2 emissions, Ithaca Energy installed a number of solar panels at their office in 2023 which are capable of providing 18 % of the typical annual electrical demand. The solar panels will result in an estimated reduction in the buildings' carbon footprint of 30 tonnes of CO_2e per year.

2.6.2 Ithaca Energy's Emissions Reduction Action Plan

Ithaca Energy's ERAP demonstrates its commitment to meeting NSTD objectives to reduce emissions from the sector in line with the UK's Net Zero targets. The ERAP is aligned with Stewardship Expectation 11 (SE-11) of the NSTA and covers all Ithaca Energy operated assets, with topsides equipment.

The ERAP is reviewed and updated to take account of work completed each year and to review and agree opportunities to reduce emissions. ERAP projects under consideration and which are at varying stages of construction / implementation include:

- Projects which allow zero routine flaring, including flare gas recovery
- Cargo tank vent vapour minimisation and recovery;
- Replacement of all hydrocarbon blanket gas with nitrogen;

- Right size equipment to fit its duty and avoid waste;
- Control logic improvements to reduce likelihood of trips and flaring events; and
- Alternative fuels to replace diesel used offshore.

A database (also referred to as the 'opportunity hopper') of all potential emissions reduction opportunities is managed on behalf of the assets by the Environment Team. The database comprises opportunities in all stages of development, from ideas and areas to explore, to projects undertaking feasibility studies, right through to already completed scopes. The database is updated frequently as new ideas and added information is made available. It is periodically reviewed by all levels of the organisation up to the executive leadership team.

Emissions benefits are determined based upon their relative performance to Ithaca Energy's baseline year of 2018.

2.6.3 Harbour Energy Britannia Emissions Reduction Action Plan

As noted in Section 2.1, Ithaca Energy recognises the need to meet Asset Stewardship Expectations and in particular SE-11 in relation to Net Zero. In addition, Expectation D.6 requires developers to demonstrate that they have considered emission reduction actions plans. Ithaca Energy has engaged with the host operator (Harbour Energy) regarding the Fotla field development to understand their commitments in support of the transition of the UKCS to Net Zero and what measures they are putting in place to manage GHG emissions in terms of abatement measures and other initiatives. Harbour Energy has several emission reduction initiatives being assessed with a number of projects being considered for Britannia, as set out by their Britannia ERAP.

Harbour Energy has confirmed that the delivery of the emissions reduction opportunities within the ERAP are not dependent on, or impacted by, the proposed Fotla field development.

The Fotla production profiles do not present incremental increases in the host installations production forecast in excess of current throughput. As such, the host installation absolute atmospheric greenhouse gas emissions profiles are not anticipated to be incrementally increased but the additional production compared to the base case will present a positive impact on the overall emissions intensity. The committed ERAP opportunities will deliver the targeted emissions reduction performance on the Britannia Facilities associated with the total production throughput inclusive of that attributed to Fotla. The majority of the ERAP initiatives are scheduled to be implemented before Fotla production comes online.

2.6.4 Low Carbon Power

Ithaca Energy recognises the potential to reduce GHG emissions by sourcing electrical power for its assets from onshore or offshore renewables. The proposed electrification of the Captain field is an example of recognising this potential to provide low carbon power to Ithaca Energy assets. Several options remain under consideration for future use including power from shore. Engineering assessments have been undertaken to understand the modifications required to accept these sources of low carbon power. Depending on the extent of the electrification and existing operations, these modifications can include both electrical system changes and modifications to processing facilities.

2.6.5 Alternative Fuels

Electrical power generation on all Ithaca Energy operated assets is predominately from fuel gas with the exception of the Captain Floating Production Storage and Offloading (FPSO) which is powered from imported diesel and some low-pressure fuel gas. Ithaca Energy has been investigating other low carbon power solutions beyond major electrification projects. Lower carbon intensity fuels, include gas hydrotreated vegetable oil (HVO).

While replacement of diesel as a fuel source could result in important CO_2e reductions, alternative fuels present significant challenges such as safety implications, availability of supply and delivery logistics, making them non-viable at present. However, as a key member of the Offshore Energies United Kingdom (OEUK) sustainable fuels group, Ithaca Energy continues to regularly review alternative fuels in the UKCS.

2.7 Fotla Field Development

The Fotla field development will be included in any future updates to the ERAP. For the purposes of assessment in this ES, the estimated emissions from the Fotla field development, including the downstream Scope 3 emissions, during drilling and construction and increased production at Britannia, as well as an assessment of the potential impacts from atmospheric emissions are assessed in Section 10, Atmospheric Emissions Impacts.

3. Option Selection

3.1 Introduction

This section of the Environmental Statement (ES) describes the main alternatives considered for the proposed Fotla field development during the early Assess and Select (Concept and Pre-FEED) and Define (Front End Engineering and Design, FEED) stages of the Ithaca Stage Gate Process (ISGP). Figure 3.1 outlines the six stages (Initiate, Assess, Select, Define, Execute and Handover) of the ISGP.

	INITIATE	ASSESS	SELECT	DEFINE	EXECUTE	HANDOVER
	OPPORTUNITY IDENTIFIED	IDENTIFY OPTIONS	EVALUATE ALTERNATIVES	SCOPE DEFINITION & DETAILED PLANNING	ENGINEER, PROCURE, CONSTRUCT & DELIVER	ACCEPT & CLOSE OUT
Gate Decision	The opportunity identified. This opportunity is worth pursuing and fits the portofolio.	Commercially viable. There is at least one concept that will work in most outcomes.	We have selected the best concept and are ready to start the project definition.	Project definition is ready and the project is attractive enough to take sanction.	Construction and pre-commissioning are complete. It is safe to energise and/or introduce hydrocarbons.	Project is delivered and reached steady-state. We have collected the Lessons Learned. Operations can accept the project.
Direction from Owner	Establish project 'frame' (purpose, perspective and scope) and check against the portfolio for strategic fit.	Assess the range of feasible options and the range of possible outcomes. Identify scope and reduce uncertainty.	Make all strategic and conceptual decisions.	Draw up the specification(s) for the project and prepare for project sanction. Obtain firm quotations.	Deliver the promise made during sanction safely and responsibly.	Establish stable operations, check against the Business Case and collect Lessons Learned. Disband the Team.
Main Activities	Opportunity Framing. Establishing the Business Case.	Choosing a range of options and outcomes. Demonstrating feasibility.	Selecting the best alternative. Planning the Field Development and completing the design basis.	Establishing the Basis for Design and the Project Specification(s) (FEED).	Awarding to selected bidders. Managing detail design, procurement, construction and pre-commissioning	Assisting with commissioning and establishing stable operation. Collecting Lessons Learned and disbanding the Team.

Figure 3.1: Ithaca Energy Stage Gate Process

Having a common understanding and alignment amongst project teams, management, joint venture partners and other key stakeholders on strategic project issues is key to ensure that the field development opportunity is appropriately framed. This ensures that decision criteria for the selection of alternatives are agreed and established early in the project life cycle i.e. during the Assess and Select Phases.

3.1.1 Legislative Requirements

The option selection process forms an integral part of the overall Environmental Impact Assessment (EIA) process and, in line with Schedule 6 of The Offshore Oil and Gas

Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 (as amended), should provide *"A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment and including a comparison of environmental effects."*

The guidance notes published by the Department for Business, Energy and Industrial Strategy (BEIS)[1] and Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) in support of the above EIA Regulations (Current version: July 2021, Revision 3, (BEIS, 2021)), provide further guidance on this topic and stipulate that the ES should *"describe the main alternatives to the proposed project that have been considered, and clearly describe the advantages and disadvantages of each option. The main reasons for selection of the preferred option should be summarised, taking particular account of the environmental issues. Other factors influencing the final choice should also be recorded, e.g. feasibility including technical constraints and cost-effective issues relating to each option. If a formal option appraisal system has been used, it should be described, and the relevant decision factors identified.*

Where appropriate, consideration should always be given to alternative sites (including pipeline routes), alternative timing, alternative construction methods, alternative plant and equipment and alternative operating practices. Wherever possible, OPRED would always encourage the use of existing infrastructure, and if there is existing infrastructure available but its use is not the selected option then a robust justification should be provided. The consideration of alternatives may also be relevant for the drilling of a well and details of the decision-making process should be included, e.g., alternative sites, alternative rig types, alternative timing, slim hole, horizontal or extended reach technologies, alternative drilling muds and alternative cuttings treatment and disposal options.

Where final option selection has not been made before the submission of the ES, it is acceptable for more than one option to be presented in the assessment. However, sufficient detail must be provided to enable a full assessment of each option. OPRED may then provide its agreement to the grant of consent for all the options, or where applicable for a specific option, if other options are determined to have a significant effect."

The ISGP outlined in Figure 3.1 and above mentioned 2020 EIA Regulations and associated guidance document provide the framework for the option selection process described in the remainder of this section of the ES.

3.2 Development Justification

The Department for Energy Security and Net Zero (DESNZ) is responsible for setting out the overall energy policy for the United Kingdom. The most recent energy policy paper 'Powering Up Britain' (DESNZ, 2023a) and its associated Energy Security Plan (DESNZ, 2023b) were

[1] The energy policy responsibilities of the Department for Business, Energy, and Industrial Strategy (BEIS) were transferred to the Department for Energy Security and Net Zero (DESNZ) in February 2023

published in March 2023. Both policy papers refer to the requirement for "*maximising the vital production of UK oil and gas as the North Sea basin declines*".

Similarly, the revised Oil and Gas Authority (OGA)[2] Strategy published on 11 February 2021, reiterates in its central obligation that "*Relevant persons must, in the exercise of their relevant activities, take the steps necessary to:*

a) *secure that the maximum value of economically recoverable petroleum is recovered from the strata beneath relevant UK waters; and, in doing so,*

b) *take appropriate steps to assist the Secretary of State in meeting the net zero target, including by reducing as far as reasonable in the circumstances greenhouse gas emissions from sources such as flaring and venting and power generation, and supporting carbon capture and storage projects.*"

In addition, the supporting obligations for developments state that "*Relevant persons must plan, commission and construct infrastructure in a way that meets the optimum configuration for maximising the value of economically recoverable petroleum that can be recovered from the region in which the infrastructure is to be located.*"

Consequently, the development of the Fotla field is in line with the objectives set out in these Government policy and strategy documents.

Whilst not developing the Fotla field (i.e. the so-called 'Do nothing' scenario) would avoid any potential for environmental impact, it would also prevent the extraction of a viable local hydrocarbon resource that could contribute to the UK's energy security requirements and would also not provide any economic benefits to Ithaca Energy and the UK.

Therefore, Ithaca Energy would like to take this opportunity to develop the Fotla field in order to maximise its economic return whilst taking due consideration of and by minimising its environmental impacts in doing so (Figure 3.2).

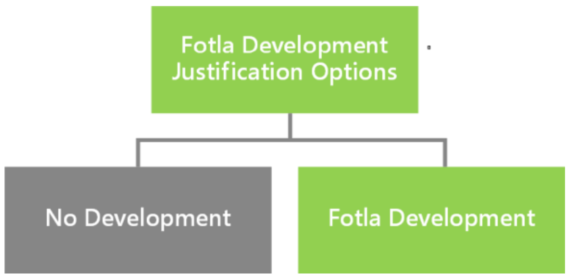


Figure 3.2: Option decision tree for Fotla field development justification

[2] The Oil and Gas Authority (OGA) changed its name to become the North Sea Transition Authority (NSTA) on 21 March 2022.

3.2.1 Critical Success Factors and Project Objectives

Ithaca Energy is committed to producing oil and gas responsibly. As it navigates the energy transition it recognises that oil and gas will continue to play an important part of the long-term energy mix to meet the UK's energy demands. Ithaca Energy's Environmental Management process identifies and addresses the environmental impact of all aspects of its operations, driving continuous improvement in environmental performance and reducing its environmental impact. To put this into practice, Ithaca Energy has adopted a number of Critical Success Factors and Project Objectives in the project decision making process, as outlined in Figure 3.3.

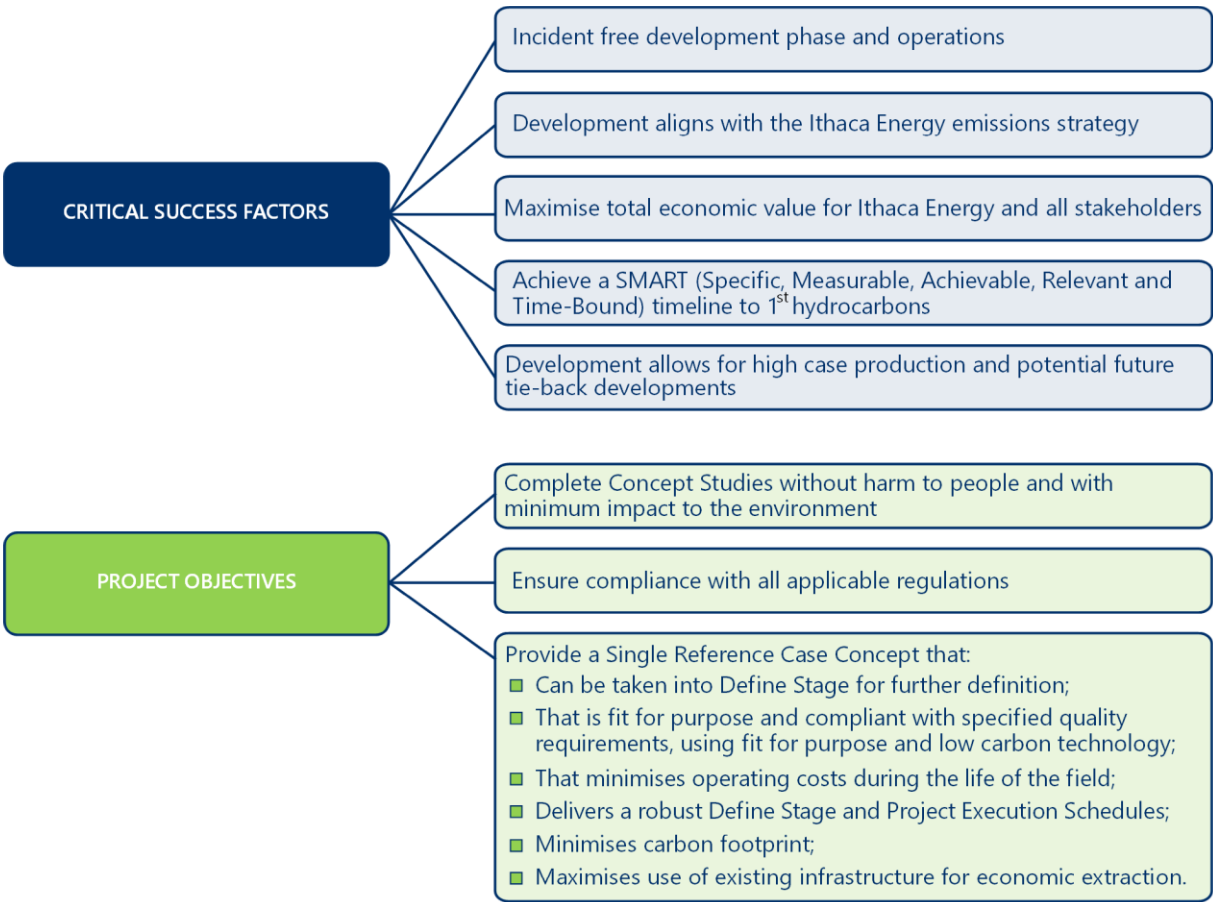


Figure 3.3: Critical success factors and project objectives

3.3 Development Option Identification and Selection

In addition to the critical success factors and project objectives outlined above, a number of desirable objectives and aspects were identified during the kick-off framing session of the Select Stage:

- First oil target date no later than end 2027, recognising challenges with supply chain and expected long lead deliveries;
- Potential future tie-backs local to the Fotla discovery (e.g. Fortiu, Congress);
- The Greater Britannia Area (GBA) wider strategy including current discoveries (e.g. Leverett), future license rounds and exploration prospects.

Within this framework, various development options for the Fotla field were considered, which were each evaluated in terms of their technical feasibility, health and safety risks, environmental impact, reputation and cost. The concept select process was broken down in the following five categories:

- Type of Development Selection
- Subsea Tie-back Options
- Drilling / Wells Options
- Subsea Facilities Options
- Topsides Production and Process Facilities Options

The results and justification of the concept select process are described in more detail below. Flow diagrams for each of the key decisions and elements of the project have been provided for ease of reference in which the green boxes indicate the selected options.

3.3.1 Type of Development

Initial development screening options for the Fotla field included the following alternatives:

- A new standalone fixed installation or new floating production storage and offloading (FPSO) unit;
- A re-deployed (small Sevan type) FPSO with minimum modifications;
- A tie-back to an existing host facility requiring new risers and significant topsides modifications; and
- A tie-back to an existing host facility requiring relatively simple topsides modifications.

Based on the relatively low recoverable reserves and the associated costs of a new build, a new standalone fixed production platform or newly built FPSO was discounted on economic grounds early in the decision-making process (Figure 3.4). The construction of a new facility would also result in the highest resource use (e.g. steel to construct the facility) and consequently would have the highest carbon footprint of all three options considered.

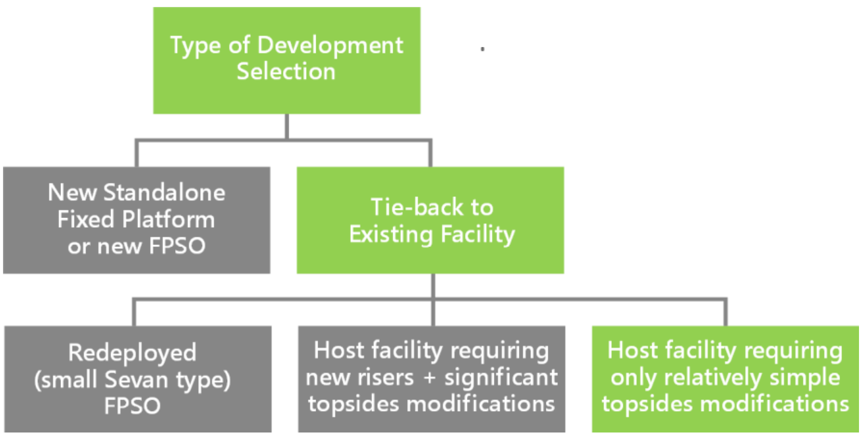


Figure 3.4: Option decision tree for development type selection

Detailed comparison of the three tie-back options showed all three options proved to be technically and commercially feasible, a short tie-back to an existing host facility with spare riser capacity and requiring relatively simple topsides modifications showed clear advantages over the other two tie-back scenarios. Hence, this option was selected as the preferred develop option to pursue further.

✓ **Type of Development Decision:** Short tie-back requiring minimum topsides modifications to host facility

3.3.2 Subsea Tie-Back Host Options

A number of potential tie-back host opportunities (comprising platform tie-back and subsea tie-in options) were identified within an approximate range of 30 km from the Fotla field (Figure 3.5). Flow assurance for any tie-back options extending much beyond 30 km distance would be technically challenging and as such were not considered further.

A formal request for information (RFI) was sent to the following potential host facility operators to gauge their potential interest to facilitate the Fotla tie-back (in order of closest to Fotla first):

- The Alba Northern Platform: direct (14 km) or via Alba XS (10 km), and SADIE (8 km) for water injection;
- The Britannia Platform: direct (14 km) or subsea via Finlaggan (11 km) or Enochdhu (15 km);
- The Andrew Platform direct (~23 km);
- The Forties Alpha Platform direct (~24 km) or subsea via Bacchus (20 km); and
- The Nelson Platform direct (~ 31 km).

The potential tie-back option to Chestnut was discounted at this stage, as the Chestnut Hummingbird FPSO was removed in 2022 and therefore this option was no longer available.

The next step in this screening process was to compile a shortlist by directly comparing each potential host to these Fotla field development base requirements, based on the responses received on the RFI requests, supplemented with public domain data.

The comprehensive RFI responses for the Alba and Britannia host options allowed a full screening to be completed, whereas the screening for Andrew, Forties and Nelson could only be based upon available public domain data.

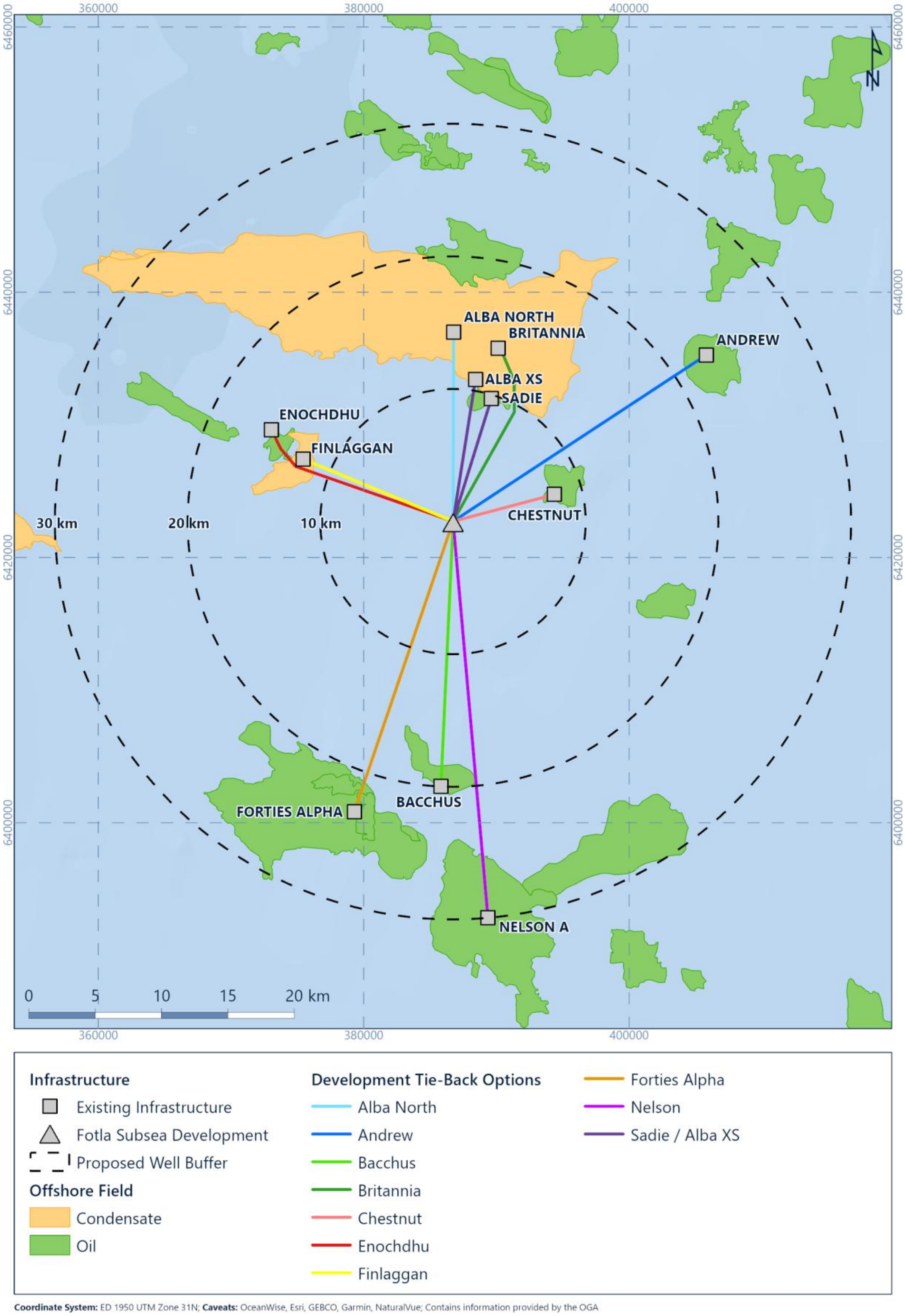


Figure 3.5: Subsea tie-back host options considered

The available host options were then screened based on the Fotla requirements outlined in Table 3.1.

Table 3.1: Initial screening key parameters / criteria

Consideration	Key Parameters / Criteria
Base technical requirement for feasibility	Commercial (including operating efficiency, cessation of production (CoP) date).
	Redelivery / Export Route (for oil and gas).
	Subsurface (including water flood, depletion plus gas lift and gas injection).
	Subsea (including step-out distance, production tie-in / risers, umbilical & controls).
	Topsides Ullage (including oil and gas processing, gas re-injection, gas lift, produced water handling / disposal, seawater injection, produced water re-injection (PWRI), allocation metering and sampling & power / utilities impact).
	Topsides Facilities Impact (including new and modifications space/ weight, asset integrity and project implementation).
Environmental considerations	Life of Field (LoF) Emissions associated with peak production and CoP.
	Emissions Reduction measures being implemented at the host and associated CO_2e savings per annum, including future plans for electrification.
	Net Zero Solutions being considered by the potential host facility operator.

Table 3.2 outlines the environmental factors used for each option during the initial screening process (i.e. life of field emissions, emissions reduction measures and net zero solutions).

Table 3.2: Environmental factors considered

Potential Host Facility	Life of Field (LoF) Emissions	Emissions Reduction Measures	Net Zero Solution
Alba	Peak 2023: c. 160 kt CO_2e pa	Actual 2019 to 2021: c. 35 kt CO_2e pa (18 %)	In progress
	CoP 2027: c. 130 kt CO_2e pa	3 to 5 year plan: c. 30 kt CO_2e pa	
		Electrification being considered	
Britannia	Peak 2023: c. 352 kt CO_2e pa	Actual 2018 to 2021: c. 76 kt CO_2e pa (c. 17 %)	In progress
		3 to 5 year plan: c. 43 kt CO_2e pa	
	CoP 2039: c. 300 kt CO_2e pa	> 5 year plan: c. 11 kt CO_2e pa (FGR)	
		Electrification: c. 40 to 200 kt CO_2e pa	
Andrew	Approx. 35 to 45 ktCO_2e pa	2018 to 2022: Increase of c.30 kt CO_2e pa	No Information
	Increasing to CoP	No info on planned reductions in the future	
Forties Alpha	Approx. 300 to 350 ktCO_2e pa	Approx. 300 to 350 ktCO_2e pa	No Information
	Increasing to CoP	Increasing to CoP	
Nelson	Approx. 100 to 160 ktCO_2e pa	2017 to 2022 increase of c.50 ktCO_2e pa	No Information
	Increasing to CoP	No info on planned reductions in the future	

Notes:
FGR = Flare Gas Recovery

The five available host options were then compared using a basic traffic lighting system as follows:

- Green - Suitable with none or limited impact expected to meet criteria;
- Amber - Suitable with modifications, impact expected to meet criteria; and
- Red - Not suitable, or significant impact expected to meet criteria;
- Grey - Not applicable or no data available.

A summary of the initial RFI screening study results is provided in Table 3.3.

Table 3.3: RFI data screening summary table

SCREENING FACTOR	ALBA	BRITANNIA	ANDREW	FORTIES	NELSON
Commercial					
Ithaca Equity	Green	Green	Amber	Amber	Amber
Operating Efficiency	Green	Green	Amber	Grey	Grey
Cessation of Production (CoP) Date	Amber	Green	Red	Grey	Grey
RFI Response	Green	Green	Amber	Red	Red
Construction and Tie-in Agreement (CTIA) / Transportation and Processing Operating Service Agreement (TPOSA) Complexity	Green	Amber	Amber	Amber	Amber
Redelivery / Export Route					
Oil	Green	Green	Green	Green	Green
Gas	Green	Green	Green	Red	Green
Subsurface					
Water Flood	Green	Grey	Grey	Red	Red
Depletion + Gas Lift	Grey	Green	Red	Red	Amber
Gas Injection	Grey	Amber	Amber	Amber	Amber
Subsea					
Step-out Distance	Green	Green	Amber	Amber	Amber
Production Tie-in / Risers	Green	Green	Red	Red	Red
Water Injection Tie-in / Risers	Green	Grey	Red	Red	Red
Gas Injection Tie-in / Risers	Grey	Green	Red	Red	Red
J-tube / Umbilical	Amber	Green	Red	Red	Red
Controls	Amber	Amber	Red	Red	Red
Topsides Ullage					
Oil Processing / Export	Green	Green	Green	Green	Green
Gas Processing / Export	Amber	Green	Amber	Red	Amber
Gas Injection	Grey	Amber	Amber	Amber	Amber
Gas Lift	Grey	Green	Red	Amber	Amber
Produced Water Handling / Disposal	Green	Amber	Green	Amber	Red

SCREENING FACTOR	ALBA	BRITANNIA	ANDREW	FORTIES	NELSON
Seawater Injection Water					
Produced Water Re-Injection					
Allocation Metering and Sampling					
Instrumented Control and Safety System (ICSS) / Power / Utilities Impact					
Topsides Facilities Impact					
New and Modifications Space / Weight					
Asset Integrity / Life Extension					
Project Implementation / Persons onboard (POB)					
Environmental					
Life of Field (LoF) Emissions					
Emissions Reduction Measures					
Net Zero Solution					
Preferred Shortlist Options					
All Screening Factors Combined	Shortlisted	Shortlisted	Rejected	Rejected	Rejected

The overall scoring at the bottom of Table 3.3 shows that the Alba Northern Platform and the Britannia Platform were shortlisted as the host facilities showing most potential for the Fotla field development. The main reasons for rejecting the Andrew, Forties and Nelson tie-back options at this stage are summarised in Table 3.4 below.

Table 3.4: Rationale summary for rejection of host facility alternatives

Rejected Options	Rationale for Rejection
Andrew Platform	• Long step-out distance (~23 km); • Limited tie-in and support systems data; • No gas lift capacity; • No water injection facilities; • CoP in 2024 and already in planning stage; • Increase in emissions between 2018 and 2022, with potential for further increase in run down to CoP; • Unknown emissions reductions plans.
Forties Alpha Platform	• Long step-out distance (~24 km); • Limited tie-in and support systems data; • No gas compression or gas lift available; • No seawater injection facilities and no PWRI available capacity; • Not technically feasible without a gas export route; • Unknown emissions reductions plans.
Nelson Platform	• Distance from Fotla is ~31 km to the south;

Rejected Options	Rationale for Rejection
	• Nelson does not expect any further activity before CoP; • Limited tie-in and support systems data; • No produced water handling capacity; • No gas compression, processing, export or gas lift capacity; • Increase in emissions between 2017 and 2022; • Unknown emissions reductions plans.

Following a further review of technical, commercial and environmental factors associated with the remaining two options (Alba and Britannia), the Alba field facilities was deselected for the following reasons:

- Potentially significant brownfield modifications and associated cost;
- Sensitivities around early Alba CoP (2025 – 2027) and potential for timing of CoP to be accelerated (Alba is already in select phase decommissioning preparation);
- Due to the age of the asset and the nature of the Alba field, the current emissions intensity of Alba production is very high compared to the United Kingdom Continental Shelf (UKCS) average;
- CO_2 emissions would be expected to increase further as a result of Fotla; and
- In its current state Alba would be unable to process additional fluids from Fotla, particularly in relation to gas handling. Therefore, a gas export route, via Britannia, would also need to be reinstated to avoid increased flaring.

Consequently, a subsea tie-back to the Britannia Platform is considered the optimum host option and was selected as the preferred tie-back host facility.

✓ **Host Facility Decision:** Tie-back to Britannia

3.3.3 Britannia Tie-back Options and Topsides Constraints

The Britannia Platform already hosts a number of other tie-backs and therefore offers a number of potential tie-in options for Fotla. A feasibility (modelling) study was undertaken to review the capacity constraints in the GBA topsides processing and utility facilities over the life of field for each of the tie-in options under review. A summary of the technical and capacity constraints identified during this study is presented in Table 3.5.

Table 3.5: Preliminary screening using topsides capacity constraints

Option	Main Constraints	Capacity for Fotla	Retain/ Discard Option
Option A1 – Tie-back directly to Britannia Platform	• Britannia Multi-phase Separator water nozzle; • Britannia hydrocyclones; • Britannia Degasser;	Full Fotla profile can be accommodated with new or upgraded produced water treatment equipment	Retain

Option	Main Constraints	Capacity for Fotla	Retain/ Discard Option
	• HM flow / duty (when arrival temperature drops in mid-life).		
Option A2 – Tie-back to Brodgar	• Brodgar high pressure (HP) Separator liquid capacity / liquid out nozzle; • Brodgar intermediate pressure (IP) Separator water capacity/ water nozzle; • Britannia Multi-phase Separator water nozzle; • Britannia Hydrocyclones; • Briannia Degasser.	Brodgar produced water treatment system has no ullage available for Fotla	Discard
Option A3 – Tie-back to Callanish	• Callanish Separator water capacity / water nozzle; • Callanish Degasser.	Callanish produced water treatment system has no ullage available for Fotla	Discard
Option A4 – Tie-back to Finlaggan	• Finlaggan water capacity / water nozzle; • Britannia Degasser.	Available ullage for Fotla is 635.9 m^3 per day (4,000 bwpd) (This equates to only 20 % of Fotla's water cut)	Discard
Option B – Tie-back to Bridge Linked Platform (BLP) (Alder facilities) with new 3-phase Fotla separator and produced water equipment	• No constraints identified.	Full Fotla profile can be accommodated with new 3-phase Fotla separator and produced water treatment equipment	Retain
Option C – Tie-back to BLP (Alder Facilities) with no topsides modifications	Alder oil and water capacity / water nozzle Alder hydrocyclones Alder PW Degasser	Available ullage for Fotla is 1,033.4 m^3 per day (6,500 bpd) (This equates to only 30 % of Fotla's water cut)	Discard
Option D – Tie-back to BLP (Alder Facilities) with topsides modifications	Alder separator upgrade Alder Hydrocyclones upgrade Alder Degasser upgrade	Available ullage for Fotla is 2,225.8 m^3 per day (14,000 bpd) which is limited by the produced water handling capacity of the Degasser at 1,589.9 m^3 (10,000 bbls) of water per day	Retain

Options A2, A3, A4 and C were disregarded due to limited processing capacity and in particular water handling. The three remaining options (A1, B and D) were taken forward for further assessment:

- Option A1 – tie-in to the existing Britannia HP Separator and produced water treatment systems.
- Option B – new dedicated Fotla facilities (inlet system, 3-phase production separator and produced water treatment).

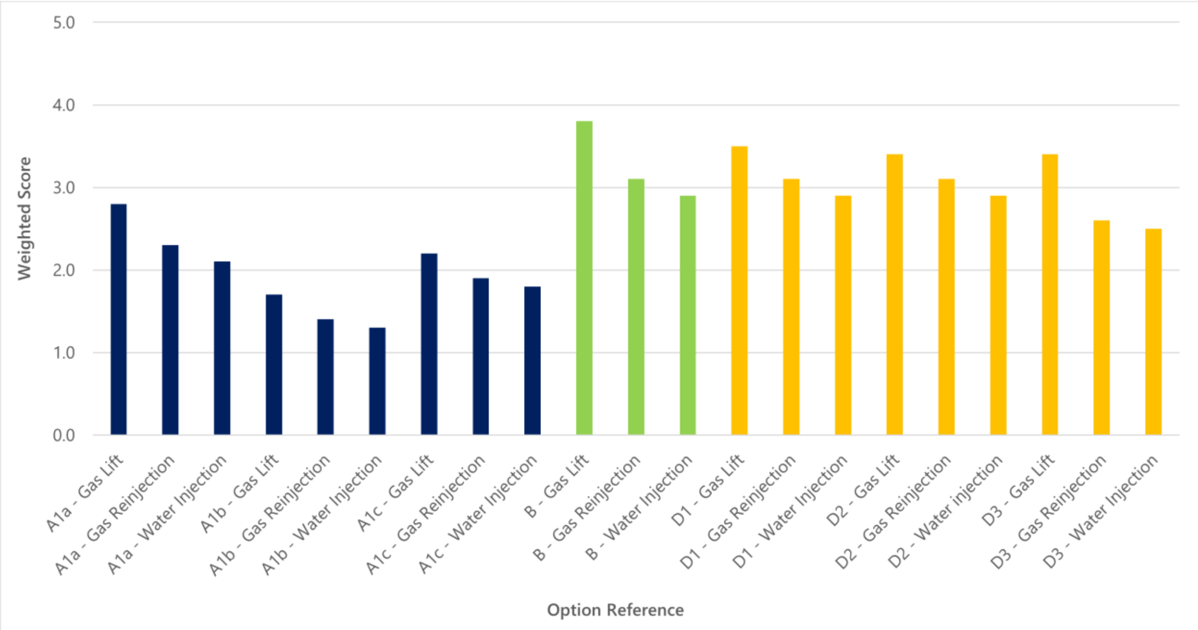
- Option D – tie-in to the existing Alder facilities (inlet system, separation and produced water treatment).

These shortlisted options were split out further into a number of sub-options to accommodate for various topsides modification options, as well as for the inclusion of gas lift, water injection and gas reinjection. All sub-options were then scored using the weighted evaluation criteria outlined in Table 3.6.

Table 3.6: Key performance indicator weighting factors

Indicators	Weighting
Basic system performance	25 %
Technical robustness	15 %
System operability	20 %
Construction and its impact	15 %
Safety and environment	10 %
Cost and schedule	15 %

The outcomes of this screening exercise are summarised in Figure 3.6.



A1a	Tie-back to Britannia with dedicated Fotla Produced Water Treatment (Full unconstrained Fotla production profile)
A1b	Tie-back to Britannia with upgrade of the Britannia Multi-phase Separator (Constrained Fotla production profile)
A1c	Tie-back to Britannia with upgrade of the Britannia Multi-phase Separator (Full unconstrained Fotla production profile)
B	Tie-back to BLP with a new Fotla separator and produced water treatment equipment (Full unconstrained Fotla production profile)
D1	Tie-back to BLP using existing Alder riser and Alder separator requiring minor topsides modifications (Constrained Fotla production profile)
D2	Tie-back to BLP using existing Alder riser and Alder separator requiring medium topsides modifications (Constrained Fotla production profile)

D3	Tie-back to BLP using existing Alder riser and Alder separator requiring extensive topsides modifications (Full unconstrained Fotla production profile)

Figure 3.6: Weighted scores for the remaining tie-back options

Overall, the scoring and ranking decision analysis results showed a clear preference for gas lift as the preferred development concept for all options, as the existing export compressors can deliver the required lift gas pressure with no or minimal modifications. Gas reinjection would require a new compressor stage and supporting items. There is currently no water injection system on Britannia. Therefore, either gas or water injection would require significant new facilities and structural deck extensions and increased operating emissions.

Options A1a would require significant modifications on the Britannia Platform with several deck extensions on a structure that is already heavily utilised. Conversely, Options A1b and A1c would require upgrading the multiphase separator which would operate at its water capacity limit. In addition, commingling Britannia and Fotla fluids would lead to operational complexity and risk associated with fluid compatibility. Hence, the A1 sub-options scored lowest and were dismissed at this point.

A single preferred option could not be clearly selected between the remaining Options B and D and both options were carried forward for further review to allow a better understanding of their required brownfield modifications, risks and construction complexity. This study showed that, upon reviewing various constrained and unconstrained peak production cases, both options proved to be technically feasibly with no showstoppers identified.

Ultimately, when considering the combined results of the feasibility studies, the initial flow assurance work and the internal economic analyses utilising a range of low, mid and high production profiles, Option D1 (tie-back to BLP using existing Alder riser and separator requiring minor topsides modifications) was selected as the preferred Fotla field development option.

✓ **Host Tie-In Decision:** Tie-in to the Alder System with minimum modifications

3.4 Drilling, Well Design and Completion Options

3.4.1 Mobile Offshore Drilling Unit (MODU)

When drilling for oil and gas in the North Sea, three types of mobile drilling unit (MODU) can be used, namely:

- A jack-up drilling unit;
- A moored semi-submersible drilling unit; and
- A dynamically positioned (DP) semi-submersible drilling unit.

For the Fotla wells, the concept selection mainly focussed on the technical suitability of the drilling unit, environmental considerations and rig availability. The key criteria considered when reviewing the type of MODU to use included:

- Capability of working comfortably in ~131.4 m (431 ft) of water depth;
- Operational efficiency in subsea tree installation; and
- Operational safety working in areas of shallow gas.

Given the soft seabed sediments at Fotla, substantial rig stabilisation measures would be required when using a jack-up drilling rig, resulting in additional seabed impacts. In addition, the use of a jack-up drilling rig would require rig moves between the two wells to be undertaken, which would further increase the seabed disturbance caused by the rigs spud cans. Also, the number of jack-up MODUs that can work at the required depth (> 130 m) is limited.

In contrast, semi-submersible MODUs are designed to operate comfortably at these water depths. Semi-submersible MODUs are typically also more accustomed to performing subsea well activities, such as running subsea trees compared to jack-up rigs. A semi-submersible MODU is also deemed to be safer if shallow gas is encountered, as it can move away more easily from the well centre than a jack-up drilling rig.

Based on these factors, the use of a semi-submersible MODU is preferred over a jack-up drilling rig.

Due to the constant use of their DP system, DP semi-submersible MODUs have markedly higher fuel consumption rates, compared to anchored semi-submersible drilling units, resulting in a larger CO_2e footprint. The DP systems of a DP Semi-submersible MODU will also generate more underwater noise than anchored drilling units. On the other hand, anchored semi-submersible MODUs disturb the seabed with their anchors and anchor lines. However, given the close distance between the wells (21 m), an anchored MODU will be able to skid on its anchor chains between the two well centres using a single mooring pattern, which will minimise this impact.

Consequently, Ithaca Energy has selected an anchored semi-submersible drilling rig as the preferred option (Figure 3.7).

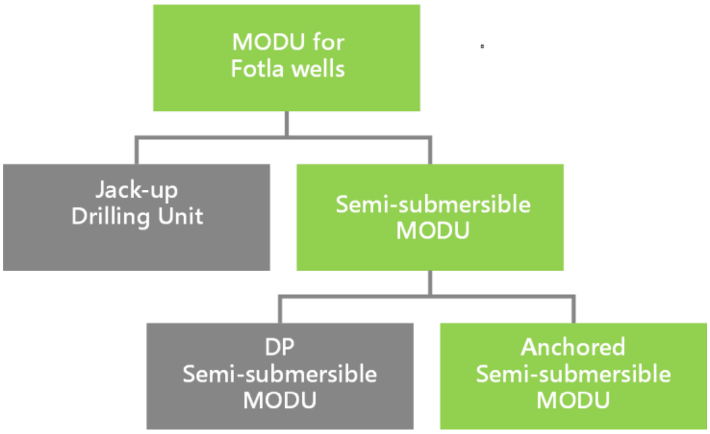


Figure 3.7: Option decision tree for Fotla field development mobile drilling unit selection

✓ **MODU Decision:** Anchored Semi-Submersible Drilling Rig

3.4.2 Well Design

In principle, various well designs are available to drill an oil production well including, vertical/low angle wells, horizontal/high angle wells or multilateral wells. Selecting the best well design will depend on the specific objectives of each well, local conditions and any technical, safety and environmental constraints present. Fotla's well construction objective is to maximise reservoir recovery and to avoid any potential complications by using a safe well design.

The oil leg in the Fotla reservoir is approximately 12.2 m (40 ft) thick. Therefore, the oil contact in any vertical/low angle well would be very short, making this option not very cost effective. A much larger oil contact can be achieved by drilling a high angle production well with a long high angle horizontal reservoir section, which will maximise recovery and limit the required well count (thereby minimising potential environmental impacts of drilling and production operations e.g. drill cuttings disposal, energy and resource use etc.).

Multilateral wells (i.e. wells producing from multiple reservoir sections within the same well bore) can also potentially reduce the required overall well count and the construction costs of the upper hole sections. However, their inherently more complex well designs potentially introduce extra complications and risks for a successful completion, can compromise well locations and can sometimes reduce production rates.

The optimum number of production wells was determined by modelling the following two scenarios:

- 2 wells – Core South and East;
- 3 wells – Core South, East and North.

The static-dynamic modelling taking all these factors into account showed that the optimum design concept for the Fotla field development comprises two long horizontal (gas-lifted) production wells. The modelling showed that the 2-well option has similar reserves recovery of the life of field compared to the 3-well development option. The 2-well option also results in lower Capital Expenditure (CAPEX) and overall environmental impact.

The final well design option considered whether to drill both wells using conventional full hole sizes or as slim hole wells. While slim hole wells often have some economic and environmental benefits due to shorter drilling times and less cuttings being generated, the main consideration in selecting the correct casing sizes will be safety related. In order to select the best casing design, offset wells within a 10 km radius of Fotla (including the previously drilled appraisal well on Fotla - 22/01b-12) were reviewed, which highlighted a number of potential key hazards present in this area (Table 3.7).

Table 3.7: Hazards informing the well design

Hazzard	Comment
Shallow gas	Shallow gas anomalies are present in the area which need to be avoided.
Over pressured shales	Well bore instability issues have been experienced in the Lark and Horda formations (from around 914.4 m TVDSS - 1676.4 m TVDSS (3,000 ft TVDSS - 5,550 ft TVDSS), which were exacerbated by the use of water based mud and wellbore inclination. Therefore, well trajectory and operational parameters are considered key mitigating factors.
Kick tolerances / Pressures	Formation strength at shoe setting depths.

Notes:
TVDSS = True Vertical Depth Sub-Surface

Based on these potential hazards, drilling conventional full hole wellbores will provide the most flexibility if any of the hazards were to be encountered, and is therefore the preferred option (Figure 3.8).

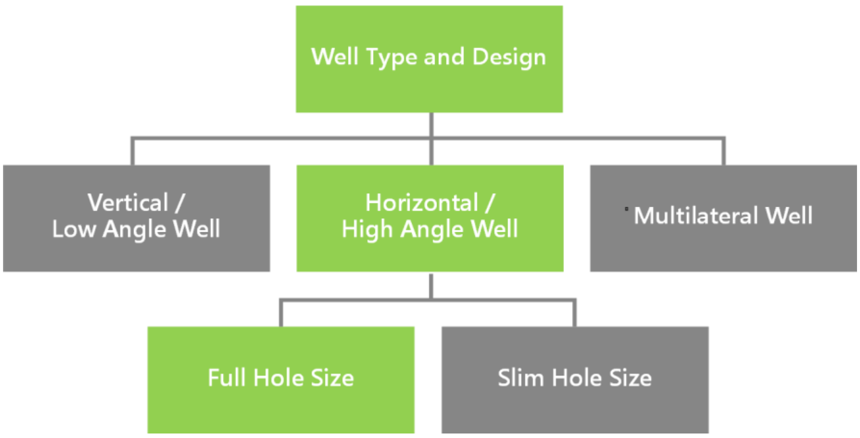


Figure 3.8: Option decision tree for well design selection

✓ **Well Design Decision:** Two conventional production wells with long horizontal reservoir sections, completed with sand screens.

3.4.3 Tophole Casing Design - CAN-ductor / Conductor

During the FEED/evaluation process for the tophole casing design of the Fotla wells, the potential to use 'Conductor Anchor Nodes' (CAN-ductors) was assessed versus the use of traditional cemented conductor casings.

A CAN-ductor is a pre-rig stage well construction technology designed to replace a conventional tophole section and associated conductor. It comprises a specially designed cylindrical suction anchor containing an integrated continuous conductor pipe.

The pre-drilling installation of the CAN-ductor effectively installs the initial tophole and conductor sections without the need for a MODU, providing support in soft seabed sediments as well as increased horizontal stability, verified load capacity and improved fatigue management. This removes the need for tophole drilling, conductor installation and subsequent cementing operations. Consequently, if CAN-ductors are used there will be no discharge of cuttings and excess cement at the seabed in relation to the first section of each well. The CAN-ductor must be installed well in advance of the actual drilling operations to allow surrounding sediments to re-stabilise, providing a structurally sound basis for installation of the Blowout Preventer (BOP) and running of other well structures. Once installed the top of the CAN-ductor will sit up to 0.5 m proud of the seabed, with the integrated conductor pipe projecting roughly 2 m above the sediment surface. Therefore, a guard vessel would be required for several months until the wells are drilled and completed with fishing friendly protection structures.

Although the use of CAN-ductors has some environmental benefits with regard to reducing some of the cuttings and cement discharges and potentially reducing some MODU time on site, these effects are largely offset by the larger well footprint of the CAN-ductors and the requirement for a high-capacity construction support vessel (CSV) and guard vessel. Typically, the slight environmental benefits of CAN-ductors become more apparent when drilling several wells during (much) larger drilling campaigns.

In addition, the sheet sands and the crenulate formations have numerous seismic anomalies within 100 m of the selected well locations and the well architecture for both wells may therefore still change in the detailed design phase. Having ordered / installed a CAN-ductor that is suitable for slim hole well architecture in advance would limit the ability to change well architecture at a later date.

CAN-ductors also have a relatively long (9 months) lead time and together with the time required to re-stabilise the local sediments and permitting requirements could (severely) impact the project flexibility and current schedule. All wells within 10 km radius of Fotla have used conventional conductors with minimal tophole issues so there is no direct offset to help justify the use of CAN-ductors. Therefore, Ithaca Energy has selected conventional conductors for the Fotla wells (Figure 3.9).

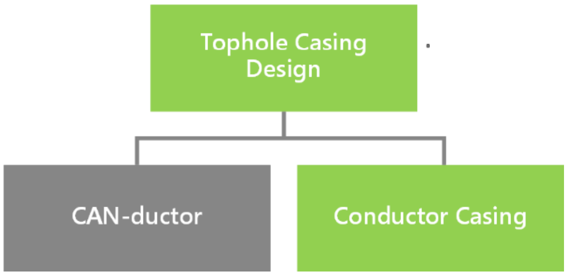


Figure 3.9: Option decision tree for tophole casing design

✓ **Tophole Casing Design Decision:** Conductor

3.4.4 Well Locations

The flexibility of the well locations is limited by the location of the Fotla discovery itself. However, within these spatial constraints the well locations have been selected based on the following criteria:

- To be located in an area considered to reduce the risk of shallow gas to As Low As Reasonably Practicable (ALARP);
- To be located in a relatively flat area of seabed;
- To avoid statutory protected areas (e.g. Marine Protected areas (MPAs), Special Areas of Conservation (SACs), etc.);
- Ability to access both wells by means of a rig skid only i.e., no additional rig move required; and
- To facilitate optimised well trajectories to each of the well targets.

Based on these factors the Fotla well locations have been selected as per the provisional locations presented in Table 4.5 (see Section 4: Project Description).

3.4.5 Drill Fluids and Cuttings Disposal

Drilling fluid (or drilling mud as it is commonly known) is pumped in the borehole when drilling oil and gas wells. The drilling mud fulfils several functions, such as lubrication and cooling of the drill bit, suspension and transport of rock cuttings to the surface, and the provision of 'weight' (hydrostatic pressure) to counter-balance formation pressure. A good mud system will provide an overbalance to the formation pressure and is the first line of defence in Well Control. Several types of drilling fluids are available, each with their own specific benefits and challenges and the ultimate selection of which type to use is generally dictated by safety and environmental factors. Drilling fluids are categorised based on their principal constituent in the continuous phase, which may be water, oil, synthetic-oil or gas. The resulting drilling fluids are called water base muds (WBMs), oil base muds (OBMs), synthetic or pseudo-oil based muds (SBMs or POBMs) and foam muds, respectively. Depending upon the type of drilling fluid, the continuous phase may also contain dissolved organic and inorganic additives as well as finely divided suspended solids of various types. The preferred type of drilling fluid generally depends on the downhole conditions (formations being encountered and pressures) in the prospective well, both anticipated beforehand, as well as those encountered in real-time during drilling, where each of these mud types will have certain advantages and disadvantages.

Where technically possible, WBMs are now most commonly used and discharged on the UKCS, due to their much improved environmental credentials compared to the OBMs used (and discharged) until the end of the last century. Where used, the WBMs and generated cuttings from the wellbore are generally discharged to sea.

Modern low toxicity oil-base muds (LTOBMs) are also widely used for the deeper well sections, especially in deviated wells and/or those with challenging and unstable formations. However, due to their oil content, these cannot be discharged to sea. All LTOBM mud and associated LTOBM contaminated cuttings from the well are collected onboard the drilling rig and shipped to shore for appropriate treatment and disposal. Alternatively, oil contaminated cuttings can be thermally treated onboard the drilling unit, after which they are allowed to be discharged, if they contain less than 1 % oil (by weight). Various types of thermal treatment technology are available in which OBM cuttings are crushed and heated to a temperature which is high enough for oil and water to vaporise from the cuttings. The liquid is separated from the solids, with oil and water condensed later in the treatment process. The advantages of treating and discharging the cleaned cuttings in situ will be a reduction in supply vessel journeys, with the potential to eliminate the need for dedicated skip and ship operations. However, it should be noted that thermal treatment units for cuttings are physically large in size and cannot always be accommodated on mobile drilling units that are deck space constraint by design.

All well sections of the two Fotla wells will be drilled ‘overbalanced’, i.e. the hydrostatic pressure exerted by the drilling mud column inside the borehole will be kept higher that the formation pressure. This is particularly important to provide wellbore stability in high inclination wells, such as at Fotla. To keep the drilling mud overbalanced, the mud weight in the borehole will be carefully managed throughout the drilling process, by regulating its density with weighting additives such as barite and bentonite. One of the primary hazards associated with drilling the Fotla wells is the wellbore stability within the over-pressured shales at the transitions between the injectite sands[3] present in the deeper 17½",12¼" and 8½" hole sections of both Fotla wells. Therefore, low toxicity oil based mud (LTOBM) has been selected to drill these sections to mitigate against shale instability, as WBM may affect the structure and permeability of the shale.

[3] Injectites are sand deposits which have been remobilised and squeezed through overlying strata to form vertical/inclined dikes or horizontal sills. Sills are emplaced parallel to bedding, whereas dikes cut through bedding.

LTOBM contaminated cuttings may either be contained and shipped to shore for appropriate cleaning and disposal or thermally treated offshore and disposed to sea, depending on the availability of a suitable drilling unit and treatment equipment at the time of drilling.

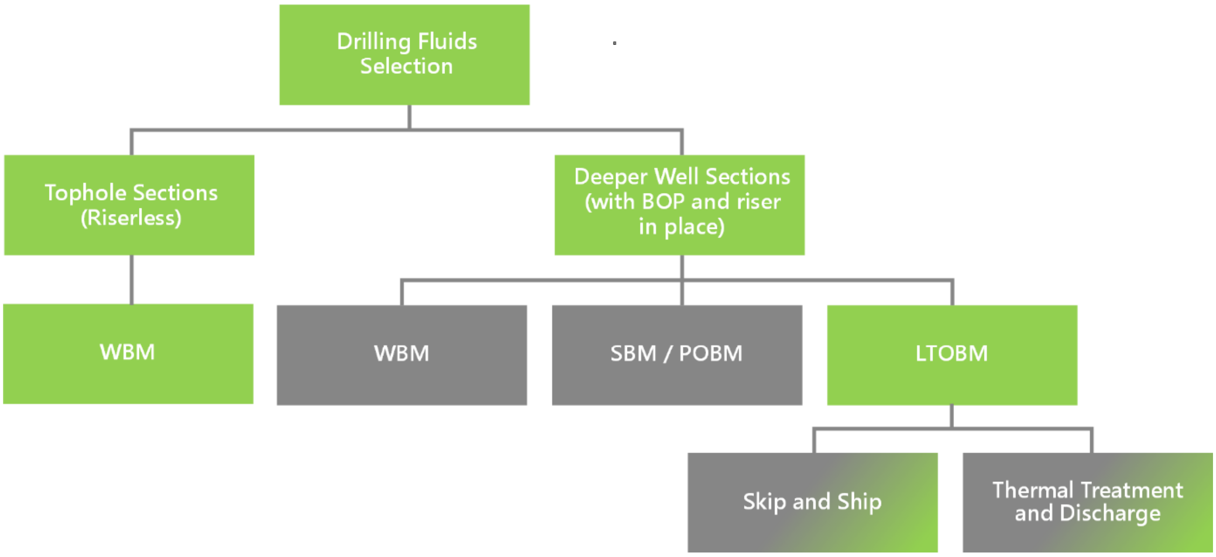


Figure 3.10: Option decision tree for drilling fluids

✓ **Drilling Fluids Decision:** Seawater with high viscosity sweeps for the two tophole sections and LTOBM for the three deeper well sections. LTOBM contaminated cuttings will be skipped and shipped to shore or thermally treated and discharged to sea.

3.4.6 Xmas Trees

A subsea Xmas tree (wet tree) is a system of valves, flow paths, piping, and connectors installed on a subsea wellhead to contain and control the flow of fluids from the reservoir. Subsea Xmas trees can be split into two categories, namely conventional vertical Xmas trees and horizontal Xmas trees. The vertical and horizontal designations refer to the way the primary valves are arranged on the Xmas trees.

Horizontal trees are designed so that all flow control valves are outside the central wellbore, allowing the installation and retrieval of a completion string, downhole equipment, artificial lift completions, etc. through a tree body without having to nipple down the tree or disconnect flow lines. Horizontal trees are therefore known as workover-friendly trees. In contrast, a vertical Xmas tree would need to be recovered to the surface prior to completing any workover operations on the well. Although no workover operations are planned over the life of field, the potential for a workover can never be ruled out completely.

In addition, the horizontal trees generally have a lower height profile than vertical trees, making them inherently less of a snagging hazard.

Ithaca Energy has extensively used standardised horizontal Xmas in other UKCS oil and gas developments and can therefore leverage this experience, the previous installation programmes and tooling to optimise the installation, commissioning and operations throughout the life of the field.

Therefore, standardised horizontal Xmas tree systems have been selected as the preferred option for both Fotla wells (Figure 3.11).

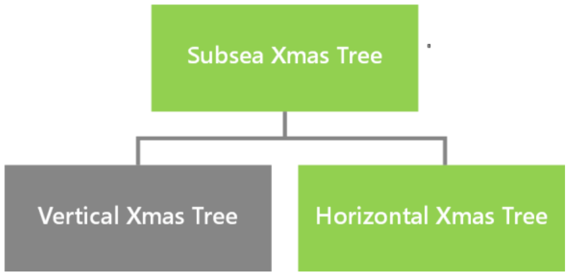


Figure 3.11: Option decision tree for Xmas tree selection

✓ **Xmas Tree decision:** Horizontal Xmas Tree

3.5 Subsea Facilities Options

3.5.1 Well Tie-in Options - Drill Centre Manifold vs Daisy Chained Wells

Flow assurance was the key deciding factor between opting for daisy chaining the wells, or to tie-back both wells individually into local drill centre manifold.

The management and control of the Fotla wells and the produced well fluids will require the installation of a warm-up spool, gas lift choke valves and flowmeters, as well as a secure location for the umbilical termination assembly, chemical injection points (including potential requirement for scale squeeze facilities and pigging access). Furthermore, it will be useful to be prepared for potential future expansion (i.e. tie-in points). While some of these requirements, such as the gas lift choke, flowmeters and chemical injection points could be provided on pipe spools located on the seabed inside the tree protection structure, it will not be possible to satisfy all of the requirements listed above, when daisy-chaining the wells.

Therefore, the option to tie both wells into a newly installed 3-slot drill centre manifold (including Subsea Control Module (SCM)) is the preferred option (Figure 3.12). The requirements for the Fotla drill centre manifold are very similar to those of the Ithaca Energy Operated Greater Stella Area Northern Drill Centre (NDC). Hence, replicating the tried and tested design of the Stella NDC manifold is expected to result in further efficiencies and other additional benefits, when designing, constructing, installing and operating the Fotla drill centre manifold.

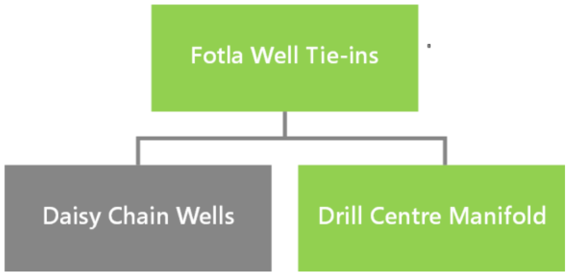


Figure 3.12: Option decision well tie-ins

✓ **Well Tie-in Decision:** 3-slot Manifold based on Stella NDC Design

3.5.2 Production Pipeline

Ithaca Energy considered two options for the Fotla production pipeline, including:

- Wet Insulated pipelines; and
- Pipe in Pipe (PIP) Insulated pipelines.

Wet insulated pipelines are single walled steel pipelines coated with insulation. These pipelines, which are generally lighter in weight, but cannot achieve the same levels of insulation as a PIP system.

A wet insulated single pipeline would require less CAPEX to procure, fabricate and install. However, as noted below a PIP system is considered a necessity from a flow assurance perspective. Furthermore, due to the soft sediments in the area and expected flowing wellhead temperature, it was considered that there was a significant risk of buckling (upheaval buckling / downward buckling) along the pipeline route and at the pipeline crossing (24" Bruce to Forties Unity pipeline). This would result in significant volumes of rock placement, which would be required to mitigate against upheaval buckling. A wet insulated pipeline was therefore discounted.

PIP pipelines have inner and outer steel pipe with an insulating material in between i.e. within the annular space. A PIP solution offers a more robust design and greater protection from physical damage and is generally heavier than wet insulated pipelines. While the pipeline crossing of the Bruce to Forties Unity pipeline will require rock placement for protection, a PIP pipeline would result in a simpler crossing configuration (compared to the wet insulated pipeline) and significantly less rock placement. In addition, due to its additional weight, the PIP solution provides improved on-bottom stability prior to trenching and its higher specific gravity will prevent potential floatation of the pipeline during trenching (compared to the specific gravity of the wet insulated pipeline option which would be marginal for trenching).

There were also a number of other factors taken into consideration when considering the type of pipeline to be installed, including:

- **Flowline depressurisation** - In the event that depressurisation is required at Britannia, it is expected that existing fields tied into Britannia will be given priority over Fotla and as such Fotla will require a longer than typical No Touch Time (NTT). This is the time within which no action needs to take place after a pipeline shutdown. The PIP solution significantly increases the NTT and is advantageous in reducing the requirement for flowline depressurisation. Work to date has also concluded that PIP tie-in spools may also be required, particularly at the Britannia end of the pipeline (these were utilised on Alder);
- **Wax management** - Fotla has a high wax dissolution temperature of 60 °C, therefore a highly insulated PIP pipeline would be beneficial. While the wax appearance temperature is significantly lower at 23 °C, a PIP solution will be beneficial in terms of maintaining temperatures throughout field life and reducing wax inhibitor injection requirements on resumption from turndown and shutdown;
- **Inlet heater and chemical injection** - Late life arrival temperatures from Fotla are predicted to be close to hydrate conditions therefore a PIP solution would be beneficial in maintaining temperatures throughout field life and reducing inlet heater and chemical injection requirements;
- **Surge volumes / slugging** – There is a potential for slugging (intermittent movement of gas and liquid surges which can cause significant flow and pressure oscillations) particularly at the riser base location due to the seabed slope from Fotla to Britannia. A detailed flow assurance assessment has confirmed that a 10" PIP solution will be operable throughout field life and topsides choking can be used to ensure slugs volumes remain within acceptable limits for reuse of the Alder separator; and
- **Hydraulic constraint** – Consideration was given to installation of an 8” pipeline however further assessments indicated that this option would be hydraulically constrained across field life and would not deliver the forecasted production profiles.

A highly insulated PIP has therefore been selected as the preferred pipeline solution for Fotla (Figure 3.13).

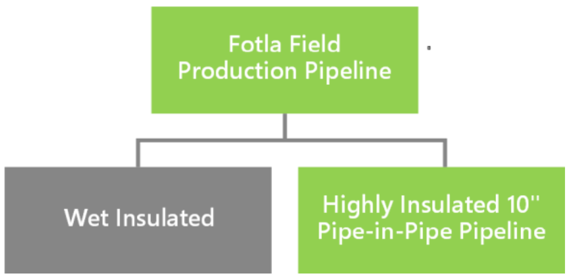


Figure 3.13: Production pipeline insulation options considered

✓ **Subsea Production Pipeline Configuration Decision:** Highly Insulated 10" Pipe in Pipe Production Pipeline

3.5.3 Gas Lift Pipeline

The Fotla wells will require gas lift to optimise their production rates, which will be provided from Britannia. Initially, three pipeline sizes were considered (4", 5" and 6" diameter).

The main factors that need to be considered when determining the diameter of the Fotla gas lift pipeline are the topsides gas compressor, gas lift supply and delivery pressure, temperature limits, pressure drop and location of the gas lift mandrel/valve in the wells.

The 4" pipeline option was dismissed early in the decision process, as this would require significant topsides modification in the form of installing a new additional suction cooler for the compressor to allow the higher discharge pressures required for a smaller diameter (4") pipeline.

A 5" diameter gas lift pipeline (instead of 6") could potentially be piggy-backed in the same trench as the production pipeline, resulting in significant savings in installation costs and less seabed disturbance (less trenching). In addition, there would be a reduction in procurement and fabrication costs associated with a smaller pipeline. However, after investigating the 5" and 6" diameter gas lift pipelines options in more detail, it was found that the required flow rates and delivery pressures for the Fotla wells without the requirement for further topsides changes can only be achieved by a 6" diameter gas lift pipeline, as a 5" diameter gas lift pipeline would also require new pre-coolers (similar to the 4" pipeline option). Therefore, the larger 6" gas lift pipeline was selected.

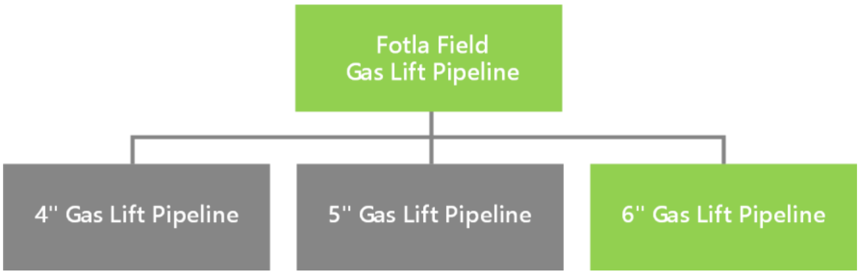


Figure 3.14: Gas lift pipeline selection

✓ **Gas Lift Pipeline Size Decision (for EIA purposes):** 6" Gas Lift Pipeline

3.5.4 Pipeline and Umbilical Installation

An upheaval buckling (UHB) study was undertaken to determine the optimum pipeline installation, protection and backfilling options available for the Fotla pipelines to prevent upheaval buckling (Genesis, 2025a). The UHB study showed that due to the high pressure and temperature of the produced fluids, backfilling the trench with the local soft soils from the area would not provide adequate cover to stabilise and secure the Fotla production pipeline in place therefore resulting in an unacceptable risk for pipeline upheaval buckling. To minimise the risk of upheaval buckling, and to provide adequate protection, blanket placement of 0.6 m of rock material will therefore be required along the entire pipeline corridor. The UHB risk of the gaslift pipeline is much lower and the UHB study showed that 0.8 m deep backfill cover with local soils may potentially provide enough protection and pipeline stability to avoid potential UHB with no or minimal additional rock protection required. However, this can only be confirmed during detailed design trenching analysis by assessing the reconsolidation capability, fluidisation, and other parameters of the local sediments, during trenching operations. Given this uncertainty at this point in time, a blanket placement of 0.6 m of rock material over the entire length of the gas lift pipeline is assumed for the purposes of the impact assessment in this ES, as a worst-case scenario.

Two methods for pipeline trenching are currently still under review, namely using a jetting trencher or using a mechanical pipeline trenching plough.

A jetting trencher modifies the initial seabed soil matrix with high-speed water jets so that the flowlines and umbilical sink to a pre-determined depth, dragged by their own weight. The fluidised spoil then reconsolidates over the lines, naturally backfilling along the route. Any seabed disturbance will be limited mainly to the corridor bounded by the tracks of the jet trencher itself, which are typically between 5 and 10 m. A mechanical trenching plough is typically much wider, with a physical seabed footprint that is approximately 25 m wide. To allow for installation tolerances, the two pipeline trenches will be installed approximately 40 m away from each other.

Jet-trenching would require three separate trenches for the production pipeline, gas lift pipeline and the umbilical, compared to only two trenches if a plough is used instead, as the umbilical can then be installed in the same trench as the Fotla production pipeline. However, given the much wider seabed footprint of a mechanical trenching plough (25 m width) compared to a typical jet-trencher (5 to 10 m track width), a wider area of seabed would be disturbed during installation, when using a mechanical trenching plough. In addition, the narrower trench profile of a jetting trencher, would potentially also reduce the amount of rock protection material required compared to using a mechanical trenching plough.

The ultimate decision between the plough or jetting trencher will be confirmed during detailed design and will depend on selection of installation contractor and further geotechnical analysis to confirm whether local seabed sediments are amenable to jet-trenching. Therefore, the option using a mechanical trenching plough has been selected as the base-case for the ES in order to represent the potential worst-case seabed disturbance scenario.

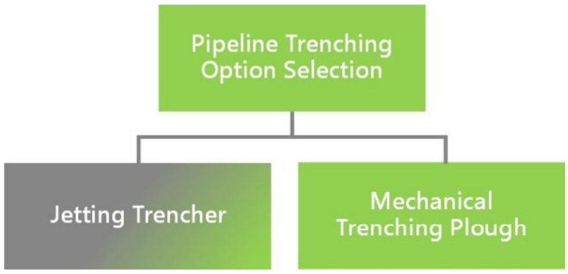


Figure 3.15: Pipeline trenching method selection

✓ **Pipeline Trenching Method Decision (for EIA purposes):** Mechanical Trenching Plough

3.6 Topsides Production and Process Facilities Options

As explained in Section 3.3.3 the Fotla pipeline will be tied back to the (former) Alder facilities onboard the BLP, whereas gas lift will be delivered directly from the Britannia Platform. As existing installations, already servicing multiple oil and gas fields, the BLP and Britannia platforms already have an existing environmental footprint. Consequently, the only notable environmental impact changes to this existing footprint will be associated with produced water management and power requirements and their subsequent atmospheric emissions.

In summary, the Fotla process train (previously Alder process train) will be as follows:

- Dedicated Fotla production through the riser, inlet systems, separation and produced water treatment system to the produced water overboard caisson on the Britannia BLP;
- Gas from the Fotla separator is delivered to the main Britannia Platform gas compression trains where it is commingled with other Britannia gas production for further processing and export into the Scottish Area Gas Evacuation (SAGE) pipeline system;
- Oil (plus any remaining traces of water) from the Fotla separator is delivered to the main Britannia Platform medium pressure (MP) heater, separation and produced water treatment systems, where it is commingled with other Britannia oil production streams for export into the Forties Pipeline System (FPS). Comingled MP system produced water is processed and discharged to sea via a shared caisson; and
- The Fotla processing train is also connected to the other shared utility systems on the Britannia asset, e.g. flare, heating medium.

A full description of the Britannia facilities and Fotla fluids processing and export is provided in Sections 4.7 and 4.8.

3.6.1 Produced Water Management

In order to determine the best way to manage the produced water from Fotla, Ithaca Energy commissioned a Best Available Technique / Best Environmental Practice (BAT/BEP) study for the separation and produced water treatment systems (NOV Wellstream UK (NOV), 2024).

The premise of the study was to investigate the best options available to adapt and improve the existing 'Alder' separation and produced water treatment systems on the BLP in order to achieve BAT/BEP when Fotla will replace Alder.

NOV reviewed the existing units for treatment of the Fotla fluids against the principles of BAT/BEP and screened potential modifications or additional treatment units to ensure that the concept carried forward on this field development is aligned with these principles. The BAT/BAP analysed the existing 3-stages of separation (Separator, hydrocyclone and degasser) with a focus on achieving an improved produced water discharge specification from the current monthly average of 30 mg/l to ≤ 25 mg/l.

An extensive list of Oslo and Paris Convention (OSPAR) approved technologies, taken from the OSPAR BAT technology list (OSPAR, 2002) was reviewed and the following potential 11 BAT/BEP options were selected to be included in the detailed BAT/BEP analysis:

- Hydrocyclone Liner Replacement;
- Replacement Degasser Internals;
- Replacement of the Alder Separator Internals;
- Low Shear Separator Interface Control Valve;
- Mare's Tail Upstream of Hydrocyclone;
- Mare's Tail Downstream of Separator Interface Control Valve;
- Degasser Flotation Modification;
- Compact Flotation Unit (CFU);
- Produced Water Reinjection;
- Filter Coalescer System; and
- Activated Carbon Filter.

These options were assessed during a workshop with participants from NOV, Harbour Energy and Ithaca Energy to ensure a fair scoring. During this workshop each of the options was scored against the BAT/BEP scoring criteria (Table 3.8 and Table 3.9). Next, weighting factors were agreed (Table 3.10) and specifically aligned to meet Harbour Energy's and Ithaca Energy's priorities and viewpoints. Each individual score was then multiplied by its BAT and BEP weighting factor (Table 3.11). Finally, all weighted scores were added up to generate an overall normalised BAT/BEP assessment score for each option (Figure 3.16).

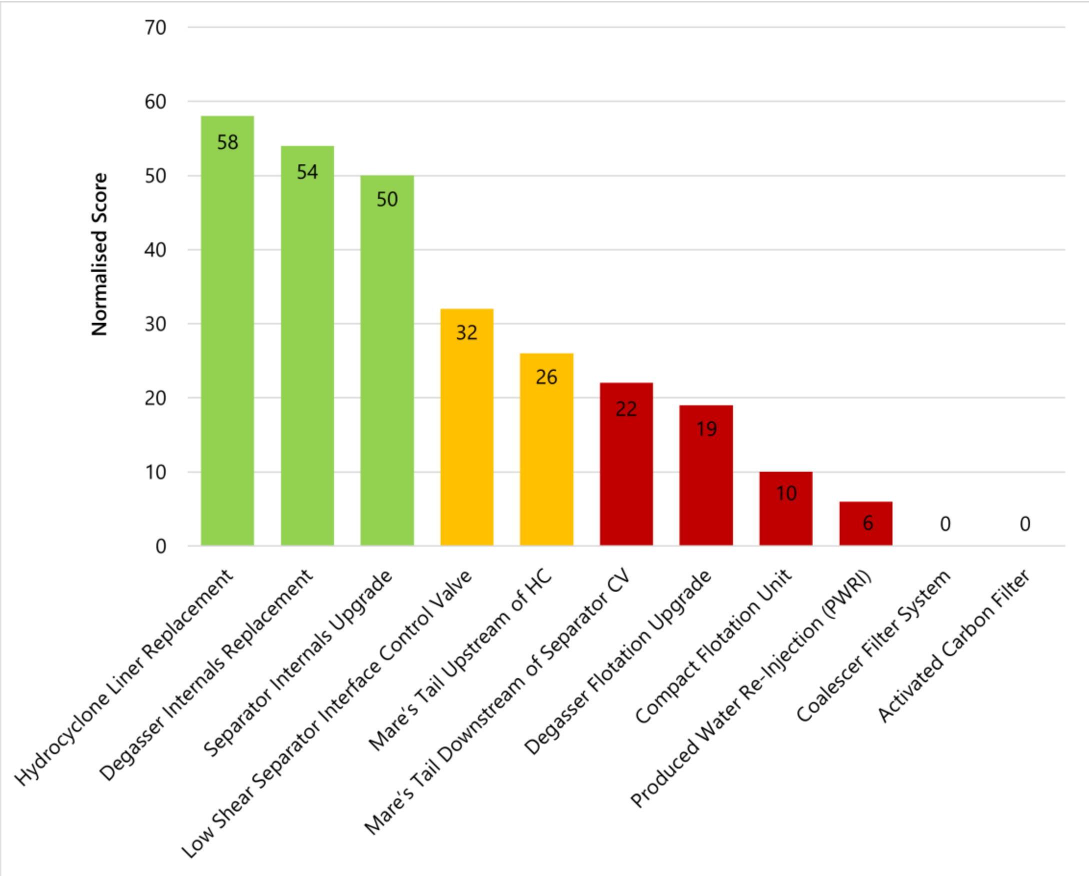


Figure 3.16: Normalised produced water options for BAT/BEP assessment

Table 3.8: BAT scoring criteria

BAT Score	Health & Safety	Technical Risk	Operational Risk	Education Risk	Maintenance	Operational Effects	CAPEX	Timeframe	Ease of Install	OPEX	Economic
	Risks arising from accidents and exposure to chemicals and/or any potential operational related incidents	Technology history; is it new and unproven or well established	Likelihood of failure due to complexity (moving parts, multiple stages etc)	Training requirements for new personnel to operate / control equipment	Frequency of routine maintenance, man power, material and tool requirements, complexity.	Process performance against industry standards / predicted performance numbers	The capital outlay required to purchase the change	Timeframe required to receive modification from PO	The complexity to install the modification / upgrade (new platform, shutdown requirement etc.)	Electrical, chemical and utility usage. Extra manpower, advanced manpower. Parts and maintenance	How does the current operation of the unit impact on the overall asset economic performance
Significant Negativity Score: -3	Extensive LTIs, causing fatalities. Widespread in chronic illnesses from hazard exposure.	Novel technology, conceptual stage	Highly complex process, relies on multiple stages and inputs from pumps / chemicals / numerous control methods	Extensive training required, onsite and/or offsite training or shadowing others	Daily to weekly checks, calibrations, complexity requires more than 1 man. Significant materials / intervention required	50 % worse	Over £5 million	Over 1 year	Significant impact on the operation of the asset. Asset modification required i.e. new cantilever deck	Significant OPEX	Significant negative effect on installation production
Moderate Negativity Score: -2	Several LTIs. Increase in chronic illnesses from hazard exposure, possible fatality.	New technology with field trial history	Moderate operational risk, relies on combination of several moving parts and stages	Onsite training required	Monthly maintenance, consumables, material and man power	20 % worse	£0.5-£5 million	6 months -1 year	Minor impact on the asset. Shutdown of process is required. Confined space entry is required.	Moderate OPEX	Moderate negative effect on installation production
Slight Negativity Score: -1	Few LTIs, some hazard exposure.	Technology which has successful field trials and several full scale installations	Slight operational risk. Some moving parts and/or stages	Minimal training required, procedural reviews	bi-annual to yearly check-ups, minimal maintenance required	10 % worse	0-£0.5 million	0-6 months	Minimal impact on the asset. No Shutdown required	Minimal OPEX	Minimal negative effect on installation production
Score: 0	No HSE concerns	--	--	No training required as no operational or control requirements	Fit and forget	Performing as predictions/industry standards	No CAPEX	Immediate implementation available	No Install required	No OPEX	No effect on installation performance
Slight Positivity Score: 1	--	Established technology through several/multiple installations, positive results, but still relatively young	Minimal risk, possibly some moving parts but standard technology	--	--	10 % better	--	--	--	--	Minimal positive effect on installation production
Moderate Positivity Score: 2	--	Technology established over 5-10 years	Minimal risk, no moving parts	--	--	20 % better	--	--	--	--	Moderate positive effect on installation production
Significant Positivity Score: 3	--	Well established technology, known worldwide, over 10 years old	No risk	--	--	50 % better	--	--	--	--	Significant negative effect on installation production

Notes:
OPEX = Operational Expenditure LTI = Loss Time Injury

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Table 3.9: BEP scoring criteria

BEP Score	Discharges	Ecological	Waste	Public Relations - External	Social - Internal
	Permittable discharges (i.e. OiW, flaregas, solids) related to operating the technology.	Pollution arising by operating technology (discharges and byproducts e.g. chemicals, CO_2 etc.)	Severity of waste produce (e.g. filter media, chemical containers etc) generated during operation of the unit.	Perceptions / concerns or 'buy-in' by external bodies (fishermen, government, marine welfare, public etc) by operating the technology.	Attitude / 'buy-in' from installation personnel, sub-contractors etc. About environmental consequences from operating the technology.
Much worse Score: -3	Significantly higher than discharge specification	Impact is beyond natural variability with long term recovery or widespread impacts	Significant volume and/or types and of waste	Major environmental negativity towards option	Major environmental negativity towards option
Moderately worse Score: -2	Much higher than discharge specification	Moderate impact on ecosystems that is beyond natural variability with short term recovery	Moderate amounts of volume and types of waste	Significant environmental negativity towards option	Significant environmental negativity towards option
Slightly worse Score: -1	Slightly higher than discharge specification	Slight impact on ecosystem but good recovery potential, or limited to small areas	Minimal amounts of waste produced	Slight environmental negativity towards option	Slight environmental negativity towards option
Score: 0	On discharge specifications	No impact on ecosystems	No waste produced	Little concerns regarding social /PR	Little concerns regarding social /PR
Slightly better Score: +1	Slightly better than discharge specification	--	--	Slight environmental positivity towards option	Slight environmental positivity towards option
Moderately better Score: +2	Much better than discharge specification	--	--	Moderate environmental positivity towards option	Moderate environmental positivity towards option
Much better Score: +3	Significantly better than discharge specification	--	--	Significant environmental positivity towards option	Significant environmental positivity towards option

Notes:
OiW = Oil in Water

Table 3.10: BAT weighting criteria

Best Available Techniques		
Criteria	**Description**	**Weighting**
Health & Safety	Risks arising from accidents and exposure to chemicals/agents and/or any potential operational related incidents	5
Technical Risk	Technology history; is it new and unproven or well established	4
Operational Risk	Likelihood of failure due to complexity (moving parts, multiple stages etc.)	4
Education Risk	Training requirements for new personnel to operate/control equipment	2
Maintenance	Frequency of routine maintenance, manpower, material and tool requirements, complexity	4
Operational Effects	Process performance against industry standards/predicted performance numbers	4
CAPEX	The capital outlay required to purchase the change	2
Timeframe	Timeframe required to receive modification from PO	2
Ease of Install	The complexity to install the modification/upgrade (new platform, shutdown requirement etc.)	4
OPEX	Electrical, chemical and utility usage. Extra manpower, advanced manpower. Parts and maintenance.	3
Economic	How does the current operation of the unit impact on the overall asset economic performance	3

Table 3.11: BEP weighting criteria

Best Environmental Practice		
Criteria	**Description**	**Weighting**
Discharge	Permittable discharges (i.e. OiW, flare gas, solids) related to operating the technology	5
Ecological	Pollution arising by operating technology (discharges and by-products e.g. chemicals, CO_2 etc.)	5
Waste	Severity of waste produce (e.g. filter media, chemical containers etc.) generated during operation of the unit	3
Public Relations - External	Perceptions/concerns or 'buy-in' by external bodies (fishermen, government, marine welfare, public, etc.) by operating the technology	4
Social - Internal	Attitude / 'buy-in' from installation personnel, sub-contractors etc. About environmental consequences from operating the technology	3
Source: NOV, 2024.		

The normalised scores in Figure 3.16 show that the greatest gains can be made by implementing the highest three ranked options, namely: modifications to the internals of the Alder separator and degasser and upgrades to the hydrocyclone liners. After these three options, there is notable step-change in the normalised scores, showing their implementation becoming quickly less effective/desirable. Ithaca Energy is confident that implementing the three highest scoring options (i.e. those scored 'green' in Figure 3.16) will deliver discharge levels of ≤ 25 mg/l oil in water (OiW) content.

Consequently, Ithaca Energy propose to implement the three highest 'green' scoring BAT/BEP options in the base design scope of the Fotla produced water treatment plant. The BAT/BEP options scored 'amber' will be considered further during FEED. The options scored in red have been scoped out. Locating the Mare's Tail Upstream of Hydrocyclone provides better results than placing it Downstream of the Separator Interface Control Valve, hence the latter option has been dismissed. The high pressure drop upstream of the degasser will provide a large volume of evolved gas for flotation. Therefore, the addition of another stage of flotation gas that would be added by the degasser flotation upgrade would have limited impact on the separation performance, and thus this option has also been dismissed.

The lowest scoring four options (Compact Flotation Unit, Produced Water Re-injection, Coalescer Filter System and Activated Carbon Filter) would require significant topsides modifications, including the installation of a new deck on the BLP, resulting in significant costs and an increase to the carbon footprint of the installation due to increased power demands, and thus have been dismissed on that basis.

4. Project Description

4.1 Project Overview

Based on the outcomes of the option selection process described in Section 3, Ithaca Energy proposes to develop the Fotla field by drilling of two production wells which will be connected to a subsea manifold and tied back to the existing Britannia platforms, located to the north of the Fotla field, via a new 14.4 km Pipe-in-Pipe (PIP) production pipeline (Figure 4.1). All processing of the produced Fotla fluids will be carried out at Britannia, with the Fotla subsea pipeline system delivering produced fluids direct to the Britannia Bridge Linked Platform (BLP). Gas lift will be provided directly to the Fotla production wells from the Britannia Platform.

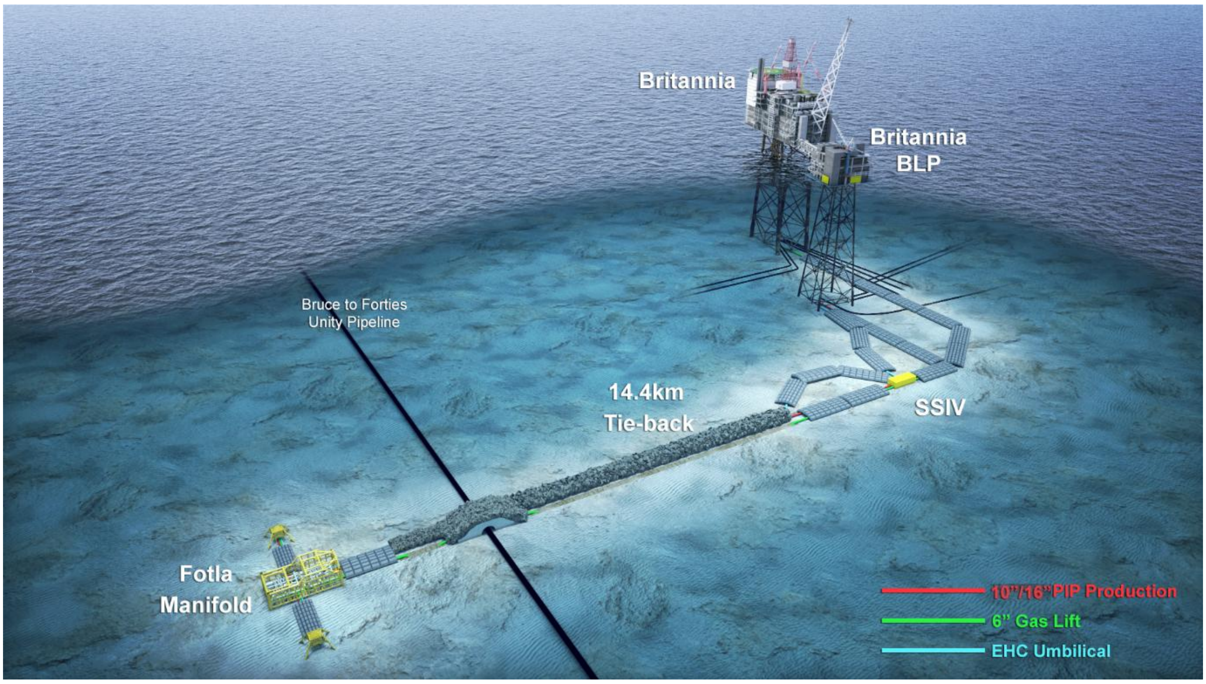


Figure 4.1: Indicative overview of the Fotla field development (not to scale)

4.2 The Fotla Field

The Fotla field is located in United Kingdom Continental Shelf (UKCS) Block 22/1b, approximately 176 km east of Peterhead, Scotland and 46 km west of the UK/Norway transboundary line (see Figure 1.1 in Section 1). Fotla is situated directly south of the Britannia and Alba oil fields on the UKCS in a local water depth of 131.4 m (431 ft) mean sea level (MSL).

The field was discovered by Ithaca Energy during an exploration and appraisal campaign in 2021. During this campaign, oil was encountered in exploration well 22/01b-12, which was subsequently appraised by drilling two additional side-tracks (22/01b-12Z and 22/01b-12Y).

Prior to the 2021 campaign, three exploration wells were drilled nearby, but all three wells failed to encounter hydrocarbons. The first of these was Well 22/01-2A (1974), which was located outside the Caran sandstone fairway and did not penetrate any significant Eocene sandstones. Two further exploration wells were drilled in 1988 (Well 22/01a-4) and 1992 (Well 22/01b-8) but were both located just outside the Fotla closure and were water-bearing.

The Fotla discovery comprises a light oil and gas accumulation in the Eocene Caran reservoir interval (Figure 4.2). The Caran sands are of excellent reservoir quality (unimodally fine-grained, 30 %+ porosity and Darcy-scale permeability), occurring in two distinct stratigraphic intervals. The 'Massive Sand' zone is typically 15.2-24.4 m (50-80 ft) thick comprising gas, oil- and water-bearing amalgamated sandstones, with the overlying 'Injected Halo' zone primarily composed of thin, gas-bearing injected sands. The oil leg in this reservoir is approximately 12.2 m (40 ft) thick and is generally contained within the 'Massive Sand' zone, overlain by a gas cap which extends into the overlying 'Injected Halo' unit (Figure 4.3).

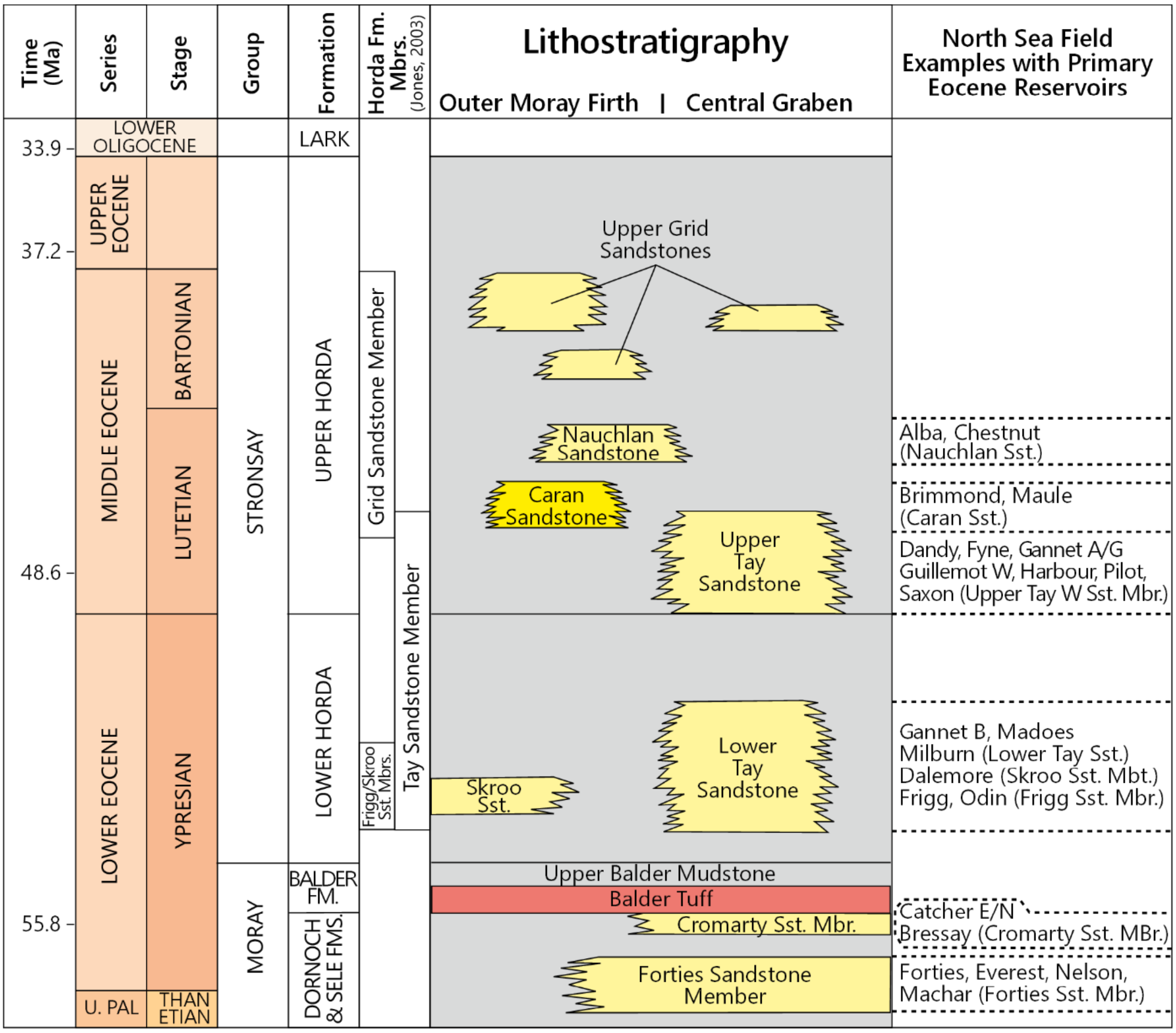


Figure 4.2: Stratigraphy of the Fotla field zone of interest

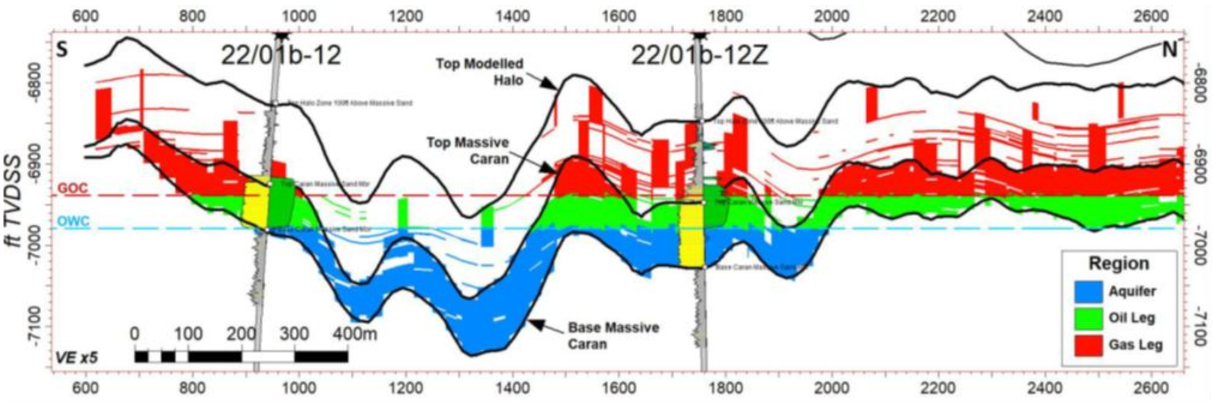


Figure 4.3: Fotla field inter-well cross-section showing average fluid contacts

Fotla is a modest sized hydrocarbon accumulation with approximately 7.1×10^6 to 11.9×10^6 m^3 (~45-75 MMboe) of oil equivalent reserves in-place. The oil recovered from the exploration well is light (807.3 kg/m^3) with a high Gas to Oil Ratio (GOR) of 1,187 scf/bbl. Table 4.1 presents the main oil characteristics, based on a sample from Well 22/1b-12Y.

Table 4.1: Fotla crude oil characteristics

Oil Characteristics	Value
Specific gravity at 15.6 ºC	0.8073
Oil Gravity °API	41.9
GOR [scf/bbl]	1,187
Pour point [°C]	-36
Wax content [% m/m]	4.8
Asphaltene content [% m/m]	< 0.05
Viscosity (cP at reservoir conditions)	0.244

4.3 Production Profiles

The production forecasts presented here are based upon an opportunity case schedule that anticipates first oil in Q4, 2027. The proposed Fotla field development is expected to produce for approximately 15 years. Peak production will be constrained due to the capacity of the host facility, as summarised in Table 4.2.

Table 4.2: Facilities production constraints

Production	Peak Flowrate*	
	Metric	Imperial
Gas	1,415,829.0 m^3/d	50 MMscfd
Oil	2,225.8 m^3/d	14,000 std bpd
Produced water	1,589.9 m^3/d	10,000 std bpd
Gas lift	283,165.8 m^3/d	10 MMscfd
Notes: * Under standard conditions (i.e. at a temperature of 15 ºC and 101.3 kPa (1 atmosphere) of pressure.		

Table 4.3 and Figure 4.4 present the anticipated production profile for Fotla, based on the highest anticipated annual average wellhead production forecasts (High-case), whilst taking into account the capacity constraints of the host facility, summarised in Table 4.2 above. The production rates presented in Table 4.3 and Figure 4.4 therefore represent the 'worst-case' scenario with regard to environmental impacts.

Table 4.3: Forecast wellhead production from the Fotla field

Year	Oil (High-case)		Gas (High-case)	Water (High-case)
	m^3/day	Tonnes/day	Sm^3/day	m^3/day
2027	503	406	114,889	0
2028	1,577	1,273	1,221,874	507
2029	797	643	1,269,129	1,122
2030	561	453	1,159,616	1,421
2031	413	333	954,649	1,425
2032	325	262	828,542	1,429
2033	264	213	720,134	1,425
2034	219	177	648,220	1,425
2035	185	149	559,058	1,415
2036	109	88	225,276	1,278
2037	89	72	151,075	1,272
2038	82	66	124,462	1,272
2039	76	61	104,330	1,261
2040	70	57	88,957	1,246
2041	65	53	76,367	1,217
2042	46	37	50,527	892

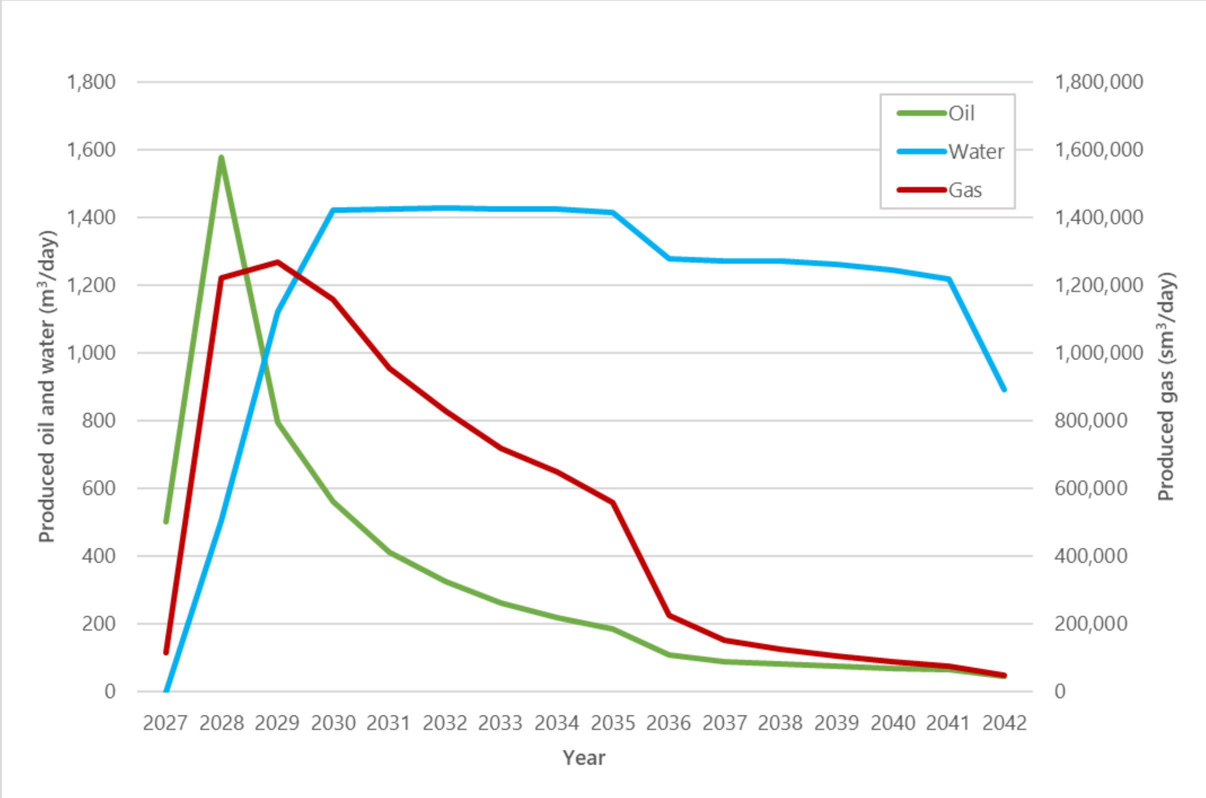


Figure 4.4: Environmental high-case production profiles of the proposed Fotla field development

Appendix 2 provides the details of the individual production forecast scenarios for the high , mid and low-case volumes of hydrocarbon production.

4.4 Schedule of Activity

Table 4.4 shows the opportunity schedule, indicating the earliest anticipated start date for the drilling and installation phase of the proposed Fotla field development.

Table 4.4: Opportunity schedule for the proposed Fotla field development

Activity	2026				2027			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Drilling & completion					■	■		
Umbilical & pipeline installation						■	■	
Topsides - Britannia / Alder construction / modifications			■	■	■	■		
Tie-in & commissioning activities							■	■
First Oil								■

4.5 Drilling and Completion Operations

The Fotla reservoir will be developed with two production wells with surface locations spaced approximately 21 m (69 ft) apart. The provisional well locations for both wells are presented in Table 4.5. Both wells will be tied into a drill centre manifold (see Section 4.6.3).

Table 4.5: Proposed production wells locations

Well	Co-ordinates (ED50 Zone 31)	
Production Well 1 (22/01b-A)	386,726 E	6,422,704 N
Production Well 2 (22/01b-B)	386,736 E	6,422,720 N

4.5.1 Drilling Rig

A moored semi-submersible Mobile Offshore Drilling Unit (MODU) will be used to drill the wells, designed to operate in the water depths and metocean conditions present at the Fotla location.

4.5.2 Positioning and Anchoring of the MODU

For the purposes of the Environmental Impact Assessment (EIA), it is assumed that the MODU will be held in position using eight anchors. Given the local water depth at Fotla, the mooring lines are expected to extend approximately 1,450 m from the MODU, whereby up to 750 m of each anchor chain will be resting on the seabed. The exact length of anchor chain resting on the seabed may vary slightly between rigs. Details of the proposed mooring lines are summarised in Table 4.6. It is assumed that the anchors and chains will be pre-laid onto the seabed using up to two anchor handling vessels (AHV). The location of the anchors and chains on the seabed will be indicated by buoys connected to the anchor chains, until the MODU arrives on location. Once on location, the same AHV will assist with the hookup of the anchor lines to the MODU. If the arrival of the MODU does not align with the laying of the anchor lines, a guard vessel will remain on location until the MODU arrives.

Table 4.6: Mooring line composition

Mooring Line	Dimensions / Length
Anchor (×8)	7.1 m (L) × 6.4 m (W)
Anchor Chain Dimensions	1,450 m (L) x 0.076 m (W)
Length of Anchor Line resting on the seabed	750 m

A rig heading of 315°N is planned, which is very common for semi-submersible MODUs operating in the central North Sea. This heading provides a lee side to the prevailing weather for the supply vessels and facilitates an anchor pattern that does not conflict with any existing infrastructure or the planned pipeline route. Figure 4.5 provides an indicative mooring pattern for the MODU. No potential conflicts with existing infrastructure have been identified in the Fotla field.

Given the close distance between the wells (21 m), the MODU will be able to skid on anchor chains between the two well centres using a single mooring pattern. Therefore, the anchors will only be required to be laid once during the whole drilling campaign.

The anchors will be deployed using up to two AHVs. The precise anchor mooring spread for the drilling rig will be defined by a mooring analysis, which will consider the water depth, currents, tides, prevailing wind conditions and any seabed features at the drilling locations. Details of the placement of the anchors will be provided in a Consent to Locate (CtL) permit application which will be submitted before the drilling rig is mobilised. Whilst in position, a statutory 500 m safety exclusion zone will be established around the MODU, in accordance with the Petroleum Act 1998.

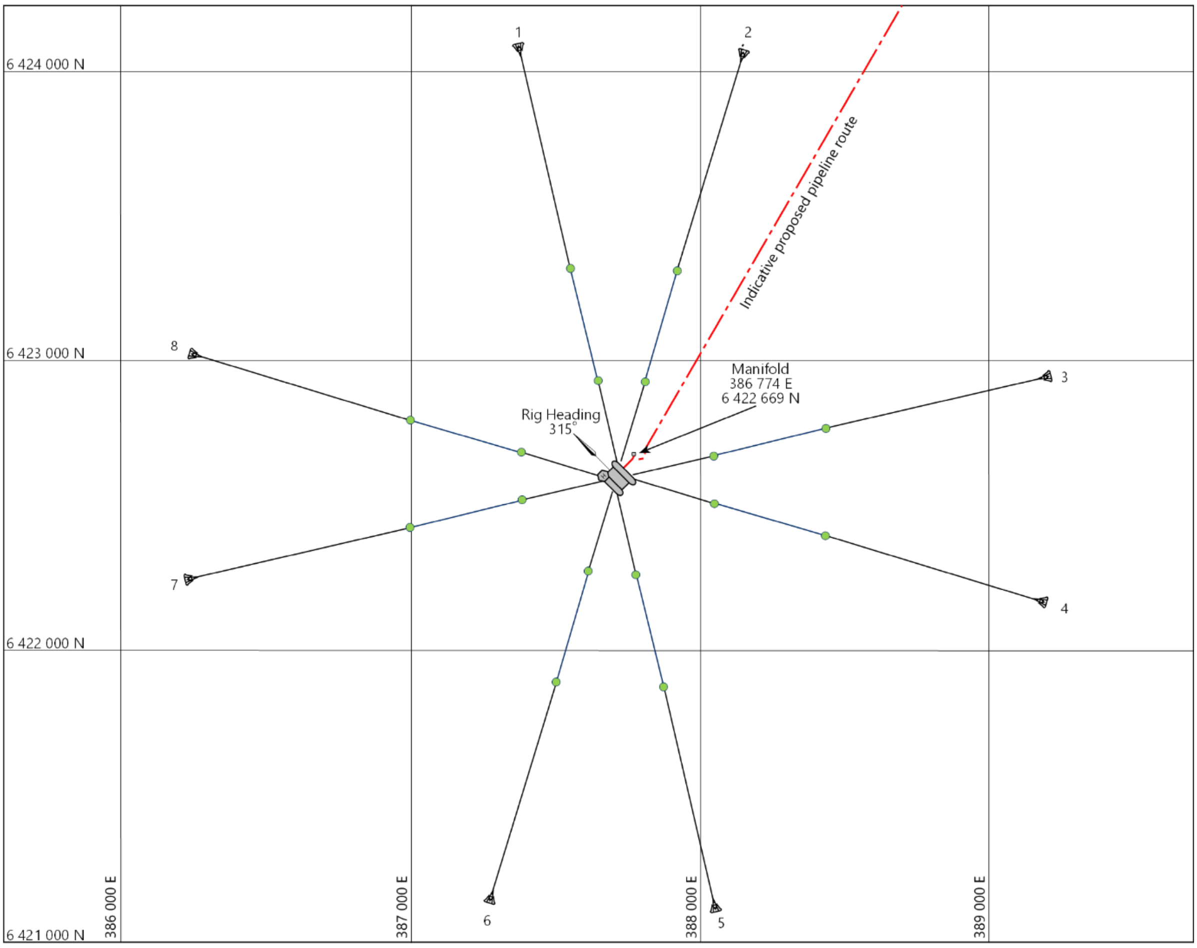


Figure 4.5: Indicative anchor pattern

4.5.3 Blowout Preventer and Well Control Equipment

The drilling rig will be equipped with a Blowout Preventer (BOP) to prevent uncontrolled flow from the wells to the surface during drilling by positively closing in the well in the event of an uncontrolled release from the reservoir into the well bore. The BOP is made up of a series of hydraulically operated rams that can be closed in an emergency from the drill floor, or from a safe location elsewhere on the rig. The BOP can also be operated subsea from a Remotely Operated Vehicle (ROV).

The BOP will be rated for pressures beyond the maximum pressure anticipated for the two wells being drilled and its integrity will be tested prior to usage and periodically during the drilling. Inspection and testing of the BOP will be undertaken in line with the operator, Ithaca Energy procedures and UK legislation.

4.5.4 Well Design

The detailed design of the two Fotla production wells (referred to as Well 'F' and Well 'C') is still being matured. However, it is anticipated that both wells will follow a proven design that has been used successfully on previous wells in this region of the North Sea. Both wells are planned to be drilled horizontally through the lower Massive Sand zone of the Caran reservoir to maximise the reservoir contact and drainage footprint. The wells will target the oil column within the Massive Sand, at a point midway between the oil-gas and oil-water contacts at approximately 2,121.1 m (6,959 ft) true vertical depth sub-surface[1] (TVDSS) in the central 'F' well and 2,122.3 m (6,963 ft) TVDSS at the eastern 'C' well.

Each well will be drilled in five sections with successively smaller diameter wellbores, so that well casings can be inserted and secured in place to prevent the borehole from collapsing.

The first step in drilling each well will be to drill a 36" × 26" hole diameter top-hole section into the seabed to a depth of 73.2 m (240 ft) below the seabed. The upper part of this section (usually around 16 m (50 ft)) of the borehole will be opened up further to 42" to enable installation of a 36" conductor housing joint after which the 30" conductor will be installed. The conductor will be cemented firmly in place all the way back to seabed level, before the subsequent 534.3 m long 26" hole section will be drilled and a 20" surface casing will be installed. This surface casing will also be cemented in place all the way back to seabed level. The two tophole sections will now provide a firm basis for the wellhead and BOP to be installed. At this stage the BOP will be connected to the drilling rig via a marine riser, creating a closed circulation system for the drilling fluids between the MODU and the well. The subsequent 17½", 12¼" and 8½" sections of the well will then be drilled using a low toxicity oil-based mud (LTOBM) system, which can now be circulated back to the MODU. Figure 4.6 shows the preliminary well trajectory and casing designs for both of the Fotla production wells.

The well trajectories for both wells start off vertically through the soft tophole formations and will start to deviate from the vertical at a measured depth[2] (MD) of around 883.9 m (2,900 ft) at a rate of 2° per 30.5 m (100 ft) until they reach a 23° inclination. The wells will maintain this angle until they reach a depth of 1,981.2 m (6,500 ft) MD, where the deviation is increased further with 3° per 30.5 m until they are completely horizontal when they reach the reservoir. Once the wells have reached the reservoir section, they will continue on their horizontal

[1] The sub-surface (SS) datum used in this instance is mean sea level (MSL).

[2] Measured Depth (MD) represents the depth of the well as measured from the rotary table on the drilling rig and therefore also includes the distance between the drilling rig and the seabed.

trajectories through the reservoir with only slight variations in azimuth to maximise sand exposure.

As the oil-bearing part of the Fotla reservoir is just 12.2 m (40 ft) thick, it is critical that the 8½" section will be drilled completely horizontal at the correct depth, in order to maximise the oil production from the reservoir. Therefore, before drilling the 12¼" and 8½" mainbore sections, a 12¼" appraisal section (pilot hole) will be drilled first to confirm the exact levels of the oil-gas and oil-water contacts of the oil bearing layer. The 12¼" appraisal section is expected to be approximately 1,333 m long and will be deviated downwards, in order to cross the planned well trajectory of the mainbore well close to the anticipated start of the 8½" section, as indicated in Figure 4.6. Upon confirmation of the oil-gas and oil-water contacts, the pilot hole section will be plugged and abandoned (i.e closed off with cement), before the mainbore 12¼" section (1,216 m long) and subsequent 8½" section (1,456 m long) will be drilled.

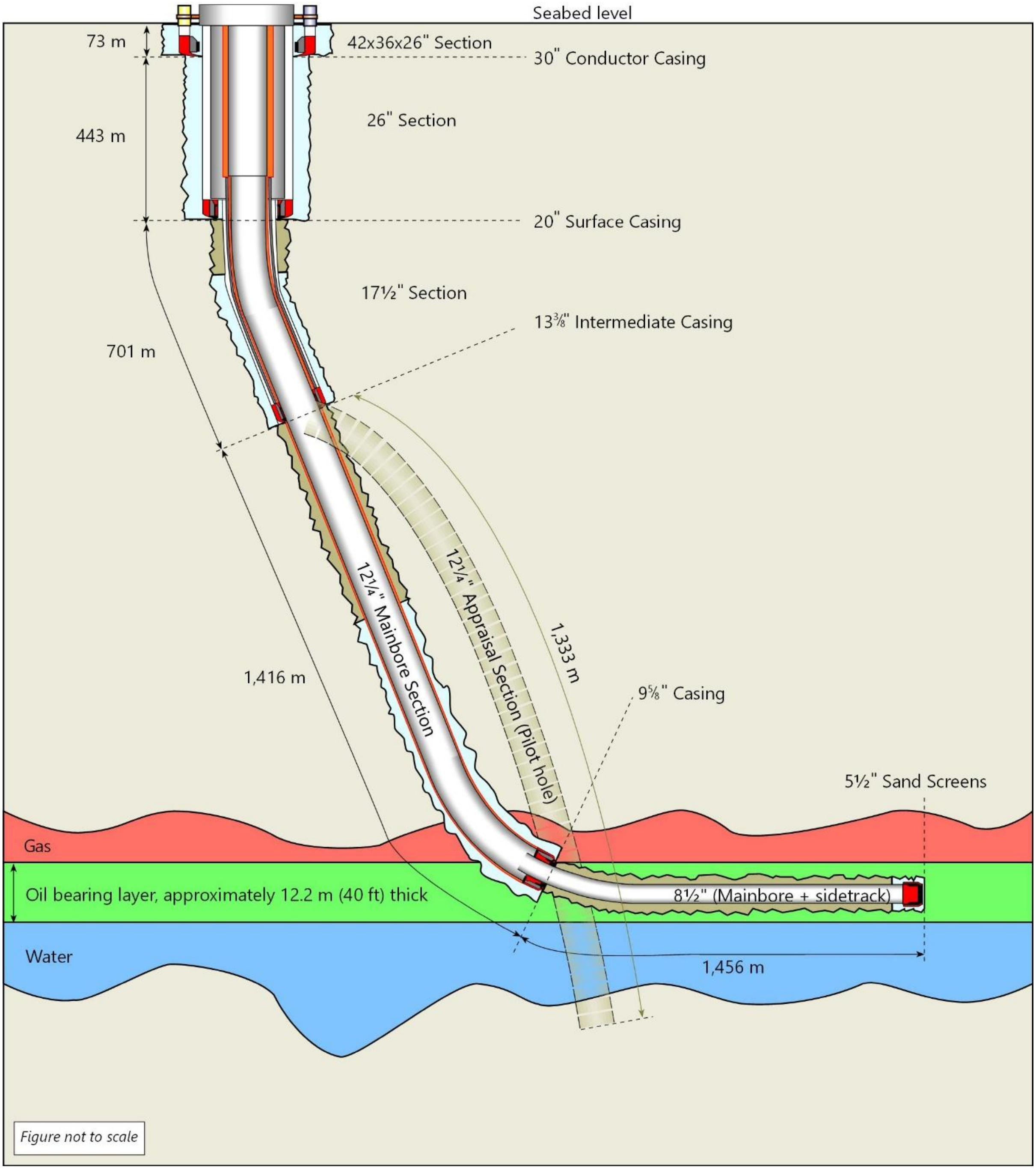


Figure 4.6: Preliminary well trajectory and casing design scheme for both Fotla wells

4.5.5 Drilling Muds and Cuttings

As explained in Section 4.5.4, both Fotla production wells will be drilled with a combination of seawater with high viscosity sweeps for the riserless tophole sections and low toxicity oil-based drilling fluids for the deeper well sections. Table 4.7 provides an overview of the expected amounts of cuttings generated per well and the amounts of drilling fluids to be used.

A 12¼" contingency sidetrack has been included as this represents the largest potential cuttings volume and therefore represents the absolute worst-case discharge scenario if a contingency sidetrack was to be required in any part of the well. This information is used to inform the modelling study on drilling discharges (Section 8). However, in reality, such emergency sidetracks are very rare and, if required, would be more likely to occur somewhere in the 8½" section instead which would result in a reduced quantity of cuttings being discharged.

Table 4.7: Fotla cuttings and drilling fluids volumes (per well)

Well Section	Section Length (m)	Drilling Fluid Type	Drilling Muds (Te)	Cuttings Generated (Te)	Cuttings Discharge Point*
42" × 36" × 26"	73	Seawater with high viscosity sweeps	97	140	Seabed
26"	443	Seawater with high viscosity sweeps	303	334	Seabed
17½"	701	LTOBM*	109	311	Surface
12¼" (Appraisal Section)	1,333	LTOBM*	123	352	Surface
12¼" (Mainbore)	1,416	LTOBM*	131	374	Surface
12¼" (Contingency sidetrack)	1,456	LTOBM*	134	374	Surface
8½" (Mainbore & sidetrack)	1,456	LTOBM*	67	146	Surface
Total			**964**	**2,031**	**N/A**

Notes:
* LTOBM contaminated cuttings may either be contained and shipped to shore for appropriate treatment and disposal or may be thermally treated offshore and disposed to sea, depending on the availability of a suitable drilling unit at the time of drilling

4.5.6 Cementing Strategy

All well casings will be cemented in place to provide hydraulic isolation and structural integrity to the wells. As described above, the two tophole sections of both wells will be cemented in place completely, all the way back up to the seabed. It is critical to return cement back to seabed level to ensure the structural integrity of the wells. Therefore, it is expected that some cement will be discharged onto the seabed during these operations.

The cement operations of the 30" conductor and 20" surface casings will be monitored by ROV, so that the cementing can be stopped as soon as cement is observed back at the seabed, in order to minimise the amount of cement to be discharged onto the seabed. In line with good industry practice, the planning of the cementing operations will allow for up to 300 % excess cement, to ensure cement returns to seabed for wellbore safety reasons.

Therefore, as a worst-case estimate the cement discharge for this section is 47 m^3 per well. This estimate is based on the entire 300 % excess reaching seabed, in the very unlikely event that the hole is perfectly in gauge (so all estimated excess cement proves to have been unnecessary) and/or the ROV was unable to monitor the cement returns, due to poor visibility or poor weather preventing ROV launch. Similarly, assuming a worst-case 150 % excess cement return from the subsequent 20" (surface casing) section would result in up to 249 m^3 cement being discharged on the seabed surface per well. Hence, the maximum amount of cement discharged from both wells combined will be 492 m^3.

The lower part of the subsequent 13⅜" (intermediate) casing and 9⅝"casing will also be cemented in place. These two casings are generally cemented in place for approximately 457 m (1,500 ft) from each casing shoe, and thus no cement returns to the surface are expected. No cementing is required in the 8-1/2" (mainbore) reservoir section for the 5½" production liner/sand screens, as the sand screens provide the conduit for producing reservoir fluids.

The final cementing design will take into account the actual formations encountered and the optimised cement placement techniques, as well as consider the future abandonment requirements.

4.5.7 Chemical Additives used During Drilling and Cementing Operations

The specific chemicals and additives used during drilling and cementing will be dependent upon the mud and cement composition which, in turn, will be determined by the down-hole conditions encountered whilst drilling. In addition to the chemicals used during standard drilling and cementing operations, a certain quantity of chemical additives will be stored on the MODU to deal with any contingencies such as a stuck drill pipe or loss of circulation.

All chemicals that will be used and discharged are regulated under the Offshore Chemicals Regulations 2002 (as amended) and have been assessed and approved for use on the UKCS by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS).

Chemicals will be selected on their technical specifications but will also be assessed on their potential environmental impacts, using the regulatory Offshore Chemical Notification Scheme (OCNS) incorporating the Chemical Hazard Assessment and Risk Management (CHARM) model, where applicable. Where technically possible, chemicals with substitution warnings (i.e. chemicals that are considered to be harmful to the environment) will be avoided.

Chemical usage will be detailed in a Chemical Permit-Subsidiary Application Templates (CP-SATs), to be submitted via the Portal Environmental Tracking System (PETS) on the online UK Energy Portal, as part of the well consenting process.

4.5.8 Well Completions and cleanup

Due to the weak Caran sands in the Fotla reservoir, sand control will be required from the start of production to prevent sand being produced to the surface. Particle size analysis of the formation sands indicate a very uniform, well sorted, low fines content sand with a median diameter (D50) size of approximately 120 microns. Based on this data the lower (sandface) completions will comprise 5½" premium mesh stand-alone sand screens. The optimum screen sizing will be confirmed via a series of sand retention tests and the potential application of inflow control devices will be reviewed prior to Fotla coming into production.

Reservoir production modelling showed that the optimum tubing size is 5½" and that the wells will require artificial lift. A gas lift system with two offloading valves and an injection valve will provide suitable production enhancement. Lift gas is assumed to be provided at 120 bar at the wellhead and at a rate of 141,309.6 m^3/day (5 MMscf/d) per well.

Flow assurance studies indicate that there is a low risk of organic or inorganic deposits forming within the tubing, nonetheless, a single deep-set chemical injection valve will be installed in the well completion to provide future functionality, if required.

The well completion design will be suitable for allowing the wells to be temporarily suspended before commencing production without performing a flow back/clean up to the drilling rig. The base-case for cleaning up the Fotla wells after drilling and completion is to send all well fluids through the pipeline to the process facilities at Britannia minimising any flaring requirements. However, the exact well clean-up method will only be confirmed as part of full analysis of detailed start-up procedures and the initial start-up programme. Therefore, the impact assessment will be based on a worst-case estimate of a maximum of 2,000 tonnes of hydrocarbons being flared off per well (i.e. up to 4,000 tonnes in total), either via Britannia or from the MODU. Flaring associated with clean-up through the Britannia facilities would be significantly less than this. In both cases the well clean-up operations will be taking less than 96 hours per well. As the wells will be suspended with their subsea trees installed ready for tie-in, there will be no need for a guard vessel during this period.

4.5.9 Relief Well Location

For any well that is capable of flowing hydrocarbons to the surface, a relief well planning package must be developed before any drilling operation commence. Ithaca Energy will put in place a plan for drilling of a relief well to intersect the well trajectory in the event of an uncontrolled well blowout from any of the Fotla wells, which will include a proposed drilling rig location from which a relief well can be drilled safely.

4.5.10 Vessel Use and Resource Consumption During the Drilling Campaign

The drilling and completion operations of the two Fotla production wells are estimated to take up to 203 days in total. This includes an allowance for bad weather delays, as well as the potential need to re-spud the two topholes for both wells, and thus represents the worst-case estimate duration. In addition to the MODU itself, various support vessels will be involved with the drilling and completion operations, including AHVs, supply vessels and the standby Emergency Response and Rescue Vessel (ERRV). Personnel will be transferred to and from the MODU by helicopter. Helicopters may also be used to supply the MODU with equipment at short notice and in the event of an emergency. It is estimated that there will be three scheduled helicopter visits to the rig per week. Otherwise, all transport of drilling equipment, supplies, water, fuel and food will be undertaken by supply vessels, which will also return waste and surplus equipment to shore. It is estimated that supply vessels will visit the MODU two to three times a week.

Table 4.8 summarises the estimated duration that each vessel/aircraft will be on site and their estimated fuel use.

Table 4.8: Fuel consumption of vessels associated with the drilling of the Fotla wells

Activity	Vessel	Fuel Type	Consumption~ Rate †	Duration	Total Fuel Consumption (tonnes)
Anchoring operations (incl. AHVs transiting to/from site)	AHVs (×2)	Diesel	2×16 tonnes / day	4 days	128
Removing anchors ((incl. AHVs transiting to/from site)	AHVs (×2)	Diesel	2×16 tonnes / day	4 days	128
MODU transit to location and return	Tug*	Diesel	3×25 tonnes / day	4 days	300
Drilling wells - MODU on Location‡	Anchored MODU	Diesel	20 tonnes / day	203 days	4,060
Supply Vessels (24 hrs per round trip)	Supply vessels	Diesel	10 tonnes / day	70 days	700
Standby / Support Vessel	ERRV	Diesel	6 tonnes / day	204 days	1,224
Total Marine Fuel Oil / Diesel Consumption					**6,540**
Transport (1.5 hrs per round trip)	Helicopter	Helifuel	0.7 tonnes (per round trip)	87 (trips)	61
Total Aviation Fuel Consumption					**61**

Notes:
* = It is not yet known whether the MODU will self propel to site or if a tug will be required. For the purposes of this assessment it is assumed that the MODU will need to be towed to location requiring up to 3 tugs.
† = Consumption rates taken from Guidelines for the Calculation of Estimates of Energy Use and Gaseous Emissions in the Decommissioning of Offshore Structures (Institute of Petroleum, 2000)
‡ = Typical fuel consumption for jack-up or anchored semi-submersible drilling rig operating in the North Sea

4.6 Pipeline and Subsea Infrastructure

4.6.1 Overview

A range of infrastructure requires to be installed to support the Fotla field development. The subsea system associated with the Fotla field development will comprise the following:

- Two horizontal subsea trees;
- A 3-slot production and gas lift manifold;
- Two rigid tie-in spools[3] connecting the trees to the manifold;
- An 10" nominal bore (NB) 'pipe-in-pipe' production pipeline;
- A 6" NB gas lift pipeline;
- A control umbilical to provide power/signal, hydraulics and chemicals to the wells;
- A new riser base subsea isolation valve (SSIV) structure at Britannia, housing production and gas lift system SSIVs; and
- Existing spare risers on the Britannia Platform (×1) and BLP (×2) for the Fotla pipelines and umbilical.

4.6.2 Subsea Production Trees (Xmas Trees)

The two subsea production trees (also known as Xmas trees) will be based upon a standardised horizontal tree system, as explained in Section 3.4.6. It is currently planned to install the lower completion prior to installing the Xmas trees onto the wells. This will reduce the number of days required to have the BOP in place.

The two subsea tree systems will house chemical injection points, pressure / temperature sensors and chokes. The subsea well control systems will also be mounted within the tree structure.

A 500 m statutory exclusion zone will be established around the Fotla wells and drill centre manifold to prevent any potential inadvertent interaction with other users of the sea. In addition, the Xmas trees will have fishing-friendly structures to reduce the snagging risks, whilst being able to withstand any snag loads of 65 tonnes from a dragged item, such as an anchor.

Figure 4.7 shows an example of a typical horizontal subsea production tree.

[3] A spool is a short segment of rigid pipe with a flange or other connecting fitting at either end and is commonly used to connect flowlines and/or subsea facilities together, e.g. a subsea tree to a subsea manifold.

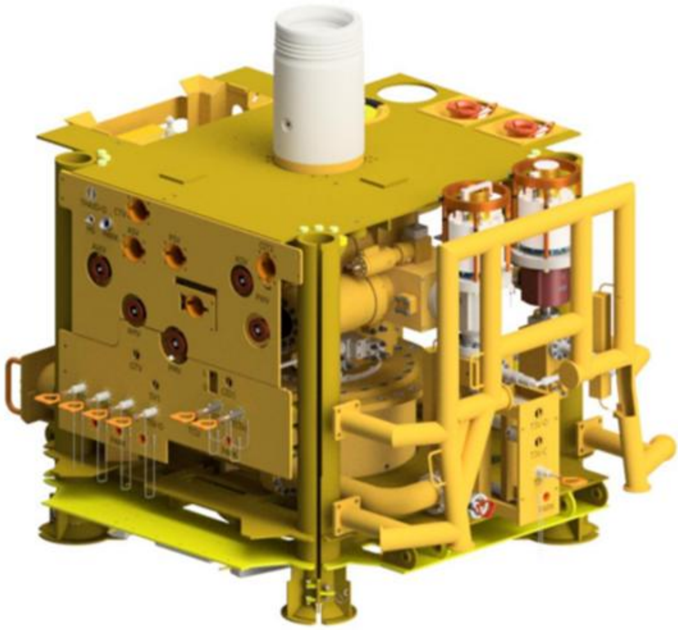


Figure 4.7: Example of a typical production tree

4.6.3 Fotla Drill Centre Manifold

The Fotla wells will be tied into a non-insulated 3 slot manifold, which is based on Ithaca's Stella North Drill Centre (NDC) manifold design (Figure 4.8). The key dimensions and provisional proposed location of the Fotla manifold are provided in Table 4.9. The exact location of the Fotla manifold will be confirmed during Detailed Design.

The drill centre manifold and SSIV riser base will be installed using a dynamically positioned (DP) construction support vessel (CSV) during a single installation campaign lasting approximately 8 days, including mobilisation, transits, working infield and demobilisation. The Fotla drill centre manifold will be a piled structure with a fishing friendly design and will be connected to the production and gas lift pipelines to/from Britannia via rigid 10" and 6" spools, respectively. The two Fotla wells will also be connected to the manifold via rigid tie-in spools. The production spools will be thermally insulated to mitigate the risk of hydrate formation and wax deposition. All tie-in spools and the controls umbilical will be protected by the placement of concrete mattresses (and grout bags) on top of them. As mentioned above, a 500 m exclusion zone will also be established around the Fotla manifold (and the subsea production trees).

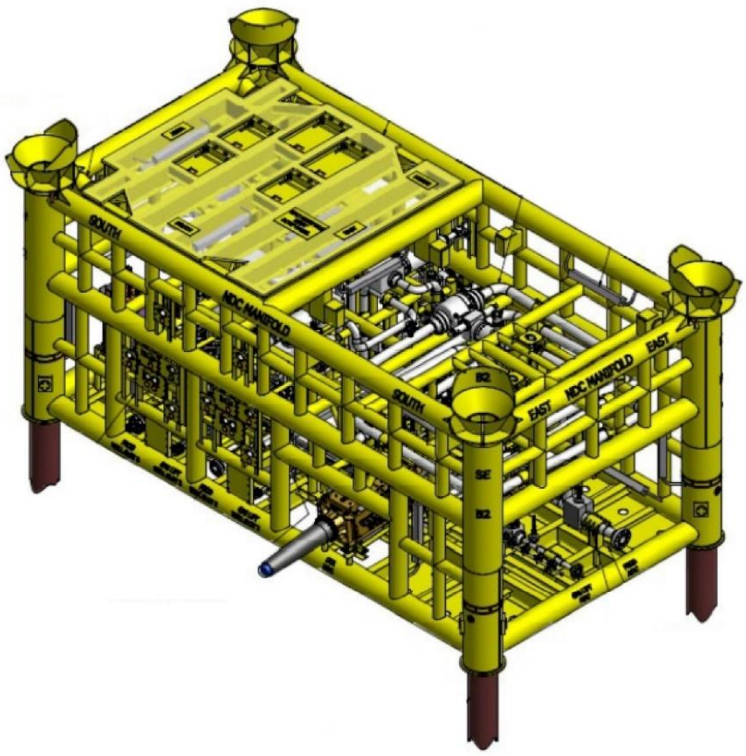


Figure 4.8: Indicative design for Fotla manifold

Table 4.9: Fotla drill centre manifold properties

Parameter	Value
Length	13.85 m
Width	7.35 m
Height	6.15 m
Number of Piles	4
Pile Dimensions	914 mm in diameter × 31.8 mm wt × 25 m long
Proposed Location Co-ordinates (ED50 Zone 31)	386,785 E 6,422,770 N

4.6.4 Pipeline System

To prevent the produced fluids from cooling down too much and affecting the flow assurance, the production pipeline between the Fotla manifold and the Britannia field will be constructed in an 10" NB carbon steel PIP (10"/16") configuration. In addition, a 6" NB carbon steel gas lift pipeline and a controls umbilical for power/signal, hydraulics and chemical injection will be installed. Figure 4.9 shows the location and pipeline/umbilical routes.

A cathodic protection system, comprising sacrificial Aluminium-Zinc-Indium Alloy (Al-Zn-In) anodes, will be designed to protect all pipeline, spool piece and piping surfaces exposed to seawater from corrosion. In addition, the outer carrier pipe of the production pipeline, as well as the gas lift pipeline will have anti-corrosion coatings.

To minimise the amount of crossings with other local subsea pipelines and cables, the Fotla pipeline routes pass east of the Sadie drill centre and are routed parallel to the Finlaggan pipeline. Consequently, the proposed pipeline routes will only cross the 24" Bruce to Forties Unity condensate pipeline. The risk of any potential snagging or other potential impact damage is mitigated by protecting the pipeline crossing with rock placement.

The Fotla pipelines will be installed by reel lay vessel over a period of two (2) weeks. The umbilical will be installed using a separate construction support vessel utilising a reel or carousel and will take approximately one (1) week to complete.

Both pipelines and associated subsea structures (i.e. the manifold and SSIV) will be designed to allow for inline inspection pigging from subsea to surface. However, regular operational pigging for wax management is not considered a requirement, as wax deposition inside the pipeline will be managed via chemical additives, insulation and pipeline operational temperatures instead.

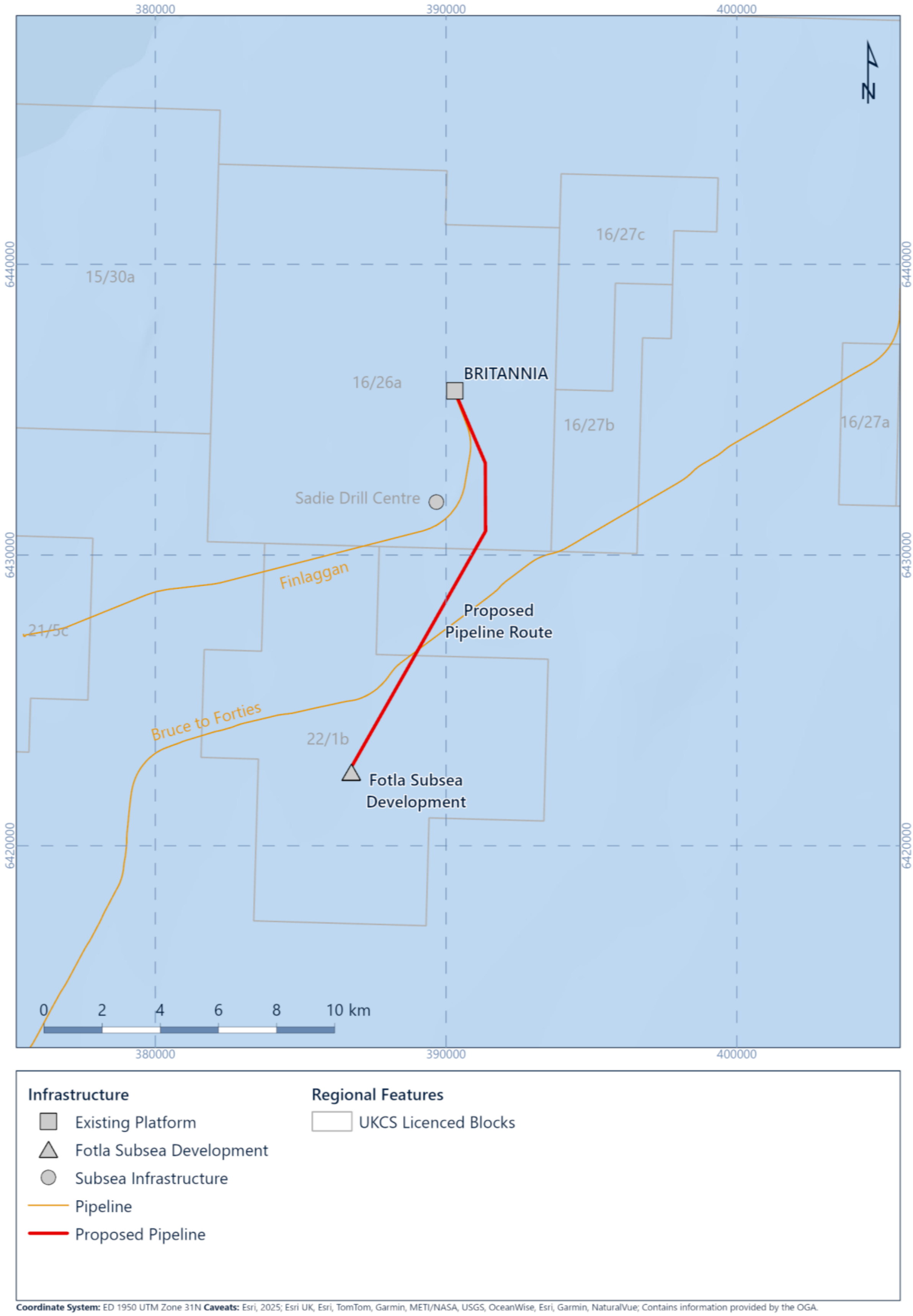


Figure 4.9: Umbilical and pipeline route

4.6.5 Pipeline and Umbilical Installation and Rock Protection

As described in Section 3.5.4, it is assumed that both the production and gas lift pipeline will be trenched into the seabed using a mechanical pipeline trenching plough and both pipelines will have blanket 0.6 m rock cover protection installed, as a worst-case scenario. The production and gas lift pipelines will be installed in separate trenches 40 m distance from each other. The umbilical will be installed in the same trench as the Fotla production pipeline. Both pipeline trenches will be cut to a depth of 1.2 m to 1.5 m below the mean seabed level (Figure 4.10).

In order to keep the amount of rock material to a minimum, it will be placed directly on top of the pipeline, confining the rocks within the contour of the trench itself.

Figure 4.10 shows the rock protection profile inside the trench showing that the top of the rock protection material remains just below the original seabed level.

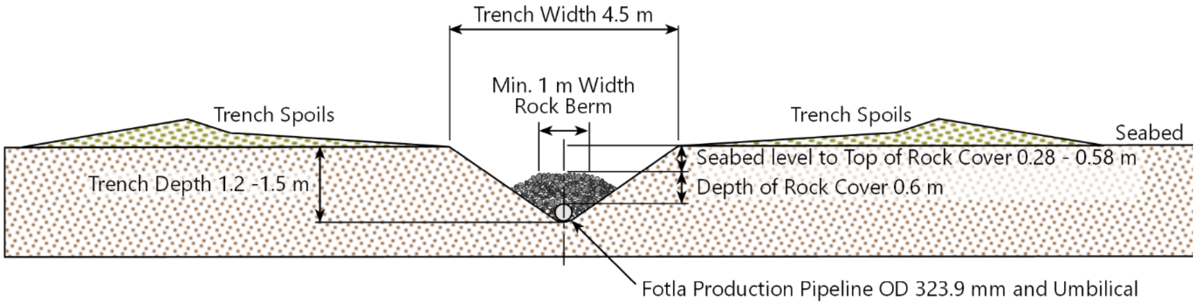


Figure 4.10: Rock protection profile for both Fotla pipelines

All rock placement operations will be undertaken using a dedicated Fall Pipe Vessel to ensure accurate placement of the rock protection material, which will minimise the amount of rocks to be used (Figure 4.11).

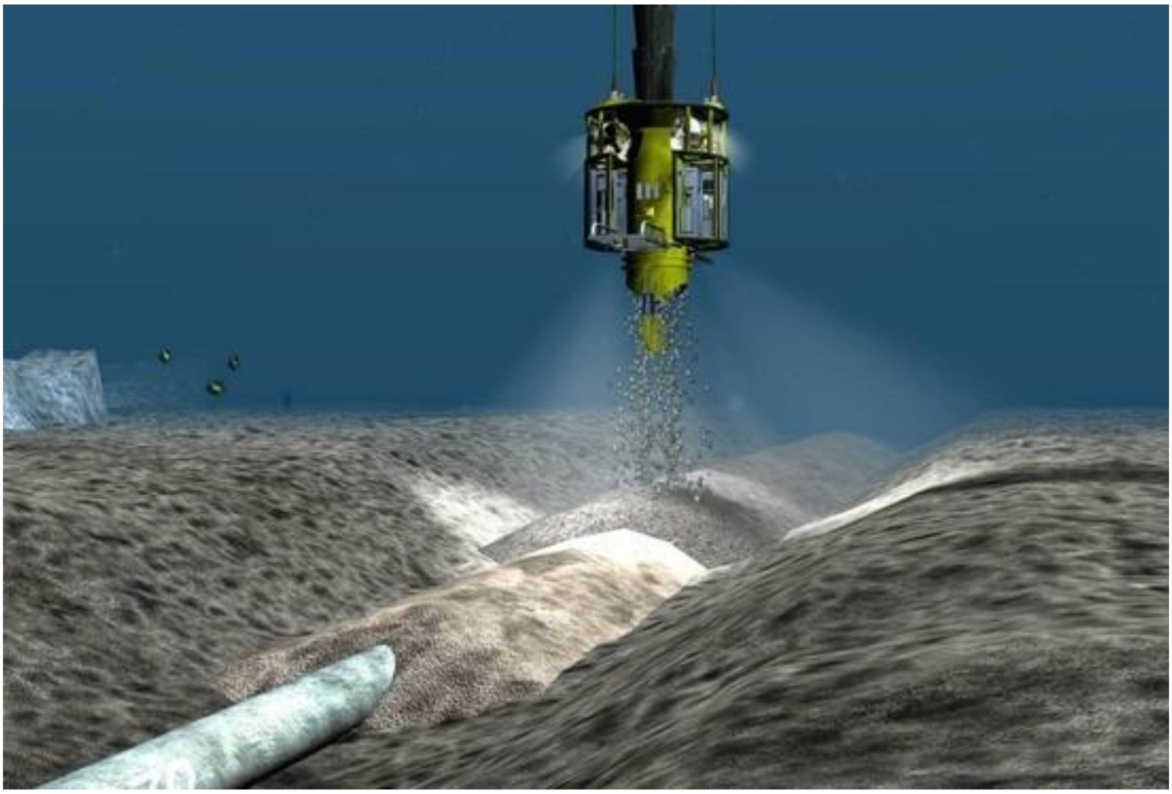


Figure 4.11: Rock protection placement using a Fall Pipe Vessel

Following pipeline trenching operations, Ithaca Energy will liaise with the Scottish Fishermen's Federation (SFF), to ameliorate any safety risks for the fishermen from potential mud berms being left behind.

Rock protection will also be required for both pipelines when crossing the 24" Bruce to Forties Unity condensate pipeline. A pre-lay rock berm will be installed so the new pipelines can safely cross over the top of the existing Bruce to Forties Unity pipeline. Once both pipelines are installed, they will be protected by a 200 m section of rock placement cover, along with 50 m and 75 m transition sections either side guiding the gas lift pipeline and the Fotla production pipeline back into their respective trenches, respectively. Figure 4.12 shows a cross section of the pre- and post-lay rock protection berms at the pipeline crossing location.

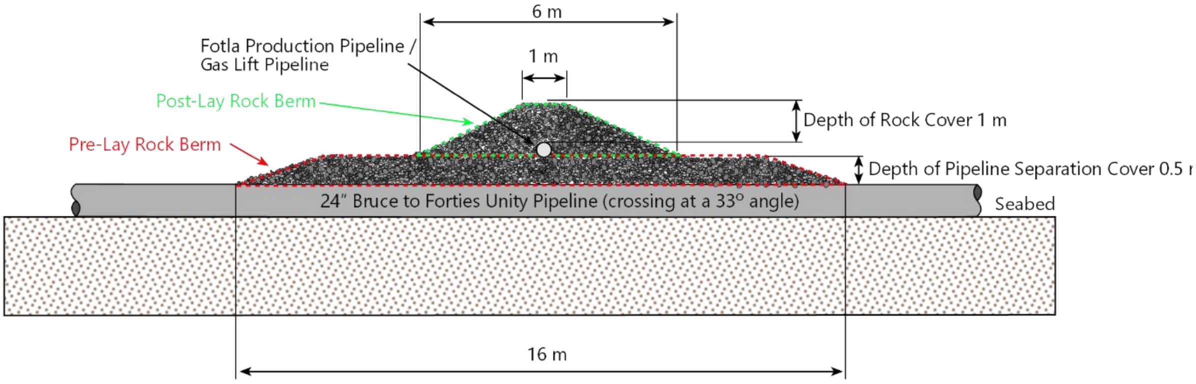


Figure 4.12: Cross section of the rock placement profile at pipeline crossing

The physical extent of the total area of seabed that will be covered by the rock protection material at the pipeline crossing is presented in Figure 4.13 (and detailed in Table 4.11 below). A combined total area of approximately of 6,900 m^2 of seabed will be covered with rock protection material at the crossing, including the associated trench transitions of both pipelines (i.e. 3,600 m^2 for the Fotla production pipeline and 3,300 m^2 for the gas lift line).

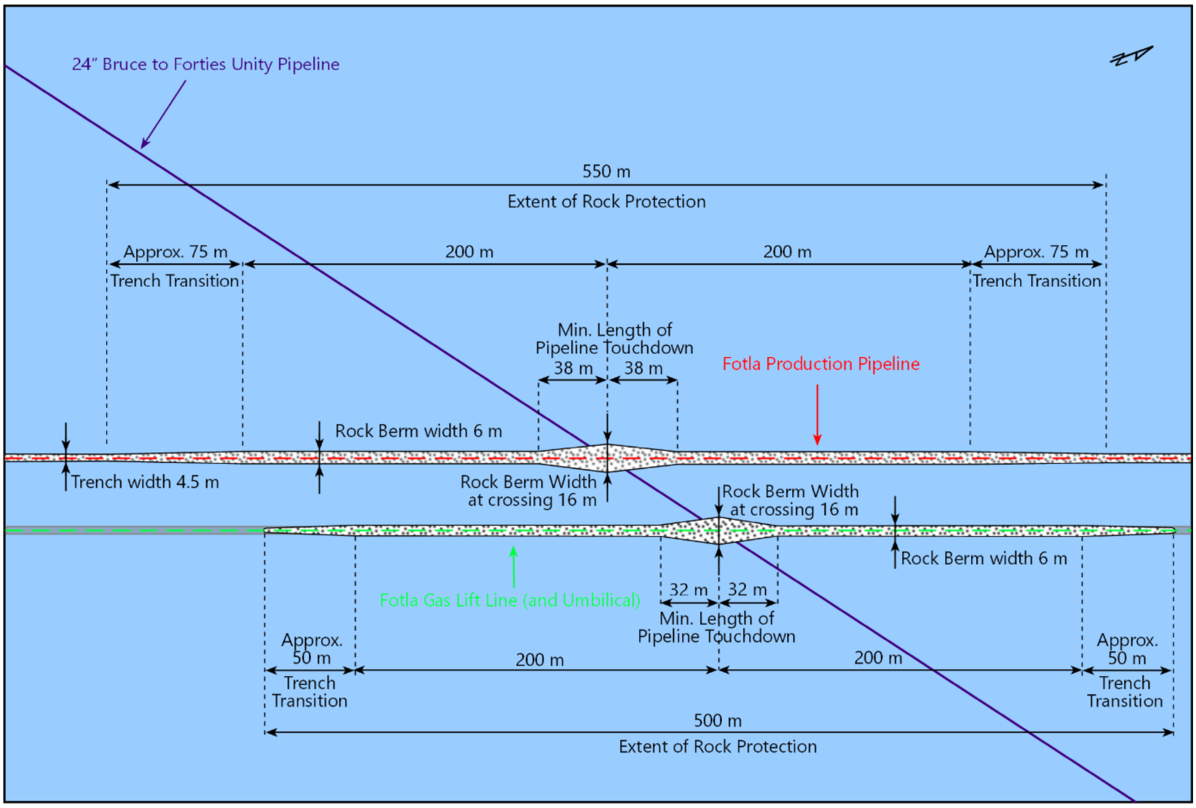


Figure 4.13: Plan view of protective rock placement at the pipeline crossing footprint

All rock protection material to be used is anticipated to comprise rocks of approximately 25 mm and 127 mm (1-5") in diameter.

Table 4.10 shows the area of seabed that will be affected by the installation, trenching and rock placement operations associated with the installation of the Fotla pipelines and umbilical.

Table 4.10: Area of seabed disturbance during pipeline and umbilical installation

Line Type	Start Point (Co-ordinates - ED50 Zone 31)	End Point (Co-ordinates - ED50 Zone 31)	Length [m]	Trench Width [m]	Width of Seabed Disturbance Corridor* [m]	Total Area of Seabed Disturbance [km^2]
Fotla Production Pipeline and Umbilical	386,800 E 6,422,810 N	390,452 E 6,435,790 N	14,400	4.5	25	0.36
Gas Lift Pipeline	386,834 E 6,422,788 N	390,491 E 6,435,801 N	14,400	4.5	25	0.36
Total [km^2]						**0.72**

Notes
* Disturbance corridor width is based on the trenching plough footprint.

Detailed information on the exact quantity of rock placement required is currently unknown. However, Table 4.11 provides a conservative contingent (i.e. 'worst-case') estimate of the amount of rock protection material to be used. The use of rock placement will be minimised, as far as reasonably possible.

Table 4.11 also provides an estimate for the amount of concrete mattresses required to protect the spools and umbilical at the Fotla manifold, SSIV and Britannia Platform locations. The mattresses will be installed on the seabed using a Diving Support Vessel (DSV).

Consents for all pipelay activities, including trenching, backfilling, protective structures and seabed deposits (i.e. concrete mattresses, grout bags and rock protection, where required) will be detailed in the application for a Pipeline Works Authorisation (PWA) and associated Deposit Consent (DepCon), before these operations are undertaken. The pipeline installation will also require a Screening Direction under the EIA Regulations (Section 1.3.1).

Table 4.11: Anticipated quantities of protection features

Protection Item	Total	Area covered (m^2)
Blanket rock placement for the Fotla production and gas pipelines, including trench transitions at the Fotla and Britannia manifolds	116,000 Te	124,670
Rock placement Fotla Production Pipeline crossing and associated trench transition	6,500 Te	3,600
Rock placement Fotla Gas Lift Pipeline crossing and associated trench transition	5,000 Te	3,300
Trench transitions of the Fotla Gas Lift Pipeline at the Fotla and Britannia manifolds	1,500 Te	525
Mattresses 6 m (L) × 3 m (W) × 0.15 m (H)	300 mattresses	5,400
Grout bags	1,500 bags	225
Total [m^2]	--	**137,720**

4.6.6 Pipeline Testing and Commissioning

Once the pipelines are installed, they will be flooded, cleaned and gauge pigged[4] prior to being hydrotested. Following spool piece tie-ins between tree/manifold/pipeline and SSIV riser base structure the production and gas lift systems will be leak tested to ensure system integrity, to test for any leaks and to prove the integrity of the tie-in connections. A leak test is a pressure test that works by completely filling the components with water, removing the air contained within the unit, and pressurising the system. The pressure is then held for a specific time to visually inspect the system for leaks. Dye will be used to aid identification of leaks.

On completion of each testing operation the pressurisation fluid will be discharged to sea. All chemicals to be used in the testing operations, including any dyes, will be detailed in a Chemical Permit (CP-SAT), as part of the pipeline installation consenting process.

4.6.7 Pipeline Maintenance

The existing integrity management strategy for the Greater Britannia Area (GBA) will be updated to include the Fotla facilities and it comprises regular inspections by side-scan sonar, with any anomalies detected in the collected side-scan sonar data being followed up by a visual inspection. Corrosion protection performance and ROV inspections for the Fotla subsea infrastructure will also be included within the inspection scopes, as required.

As described above in Section 4.6.4, no regular operational or maintenance pigging will be required. Nonetheless both pipelines and associated subsea structures (i.e. the manifold and SSIV) will be designed to allow for inline inspection pigging, if required at some stage during the life of field.

4.6.8 Subsea Isolation Valves (SSIVs)

SSIVs for the production and gas lift pipelines will be installed at the Britannia Platform and will be housed in a gravity-based riser base structure. The SSIV riser base structure will also house the Umbilical Termination Assemblies (UTAs) for the riser umbilical and infield umbilical. The Fotla SSIV riser base structure is expected to be of a similar size as the existing structures already in use at Britannia for the Caledonia, Alder and Finlaggan tie-backs, with a footprint of around 9 m × 6 m.

The provisional proposed location for the SSIV riser base structure is provided in Table 4.12 and will be confirmed during FEED and detailed design.

Table 4.12: Proposed location of the riser base SSIV structure

Structure	Co-ordinates (ED50 Zone 31)
Riser Base SSIV Structure	390,463 E 6,435,829 N

[4] A pipeline inspection gauge, commonly referred to as a pig, is a device used to clean and inspect a pipeline.

4.6.9 Britannia Riser Selection and Approaches

The risers and J-tube listed in Table 4.13 have been selected as the preferred options for Fotla, subject to confirmation of suitable integrity. Contingency risers have also been selected if required, but the base case is presented here.

Table 4.13: Riser count and function

Fotla Riser	Location	Selected Riser	Size
Fotla Production	Britannia BLP	Britanna BLP R3 (within Caisson 6)	10"
Fotla Gas Lift	Britanna	Britannia J4 (within Caisson 17)	12"
Fotla J-Tube (umbilical)	Britannia BLP	Britannia BLP J5 (within Caisson 8)	12"

The Britannia approaches layout has been developed to allow for pipeline initiation at either end of the pipeline, whilst minimising spool lengths and crossings. The preferred SSIV location is approximately 75 m clear of the nearest topside structure, which is similar to the Finlaggan and Caledonia SSIV location (approximately 72 m).

The selected production riser for Fotla is the spare 10" riser R3 located in Caisson C6 on the Britannia BLP. The Fotla production pipeline to BLP R3 riser approach requires a spool length of approximately 95 m.

The selected gas lift riser for Fotla is located on the Britannia Platform and is the previous Caledonia gas lift riser (Britannia J4 riser, Caisson 17). The J4 riser is currently connected to the now redundant Caledonia pipeline system. The integrity of the riser is currently unknown but it is expected to be in good condition as it was previously operated with dry lift gas, and the riser itself was specified with a thicker wall than is needed for Fotla. It is proposed that the ex-Caledonia topsides pipework above the riser and the subsea tie-in spools below the riser will be disconnected, removed and replaced with new pipe (following an inspection of the riser which confirms acceptable condition). There is also the possibility of re-using the ex-Caledonia pipework for Fotla if it is found to be still in good condition, thereby reducing construction requirements and associated environmental impacts.

Suitable J-tubes for the umbilical are available at the Britannia BLP as well as suitable deck space for the placement of a Topsides Umbilical Termination Unit (TUTU) adjacent to the top of the available umbilical J-tubes J4 and J5. The selected J-Tube for the riser umbilical pull-in at select / pre-FEED was J4 within caisson 8 on Britannia BLP. This was changed to J5 during host FEED studies. Both are identical in terms of diameter, wall thickness and minimum bend radius, are immediately adjacent to each other and exit subsea on the platform's east face.

4.6.10 Subsea Installation Support Vessels

Various support vessels will be associated with the subsea installation activities. Estimated vessel use and fuel usage during the installation of the subsea infrastructure is provided in Table 4.14.

Table 4.14: Estimated vessel type and fuel usage during the installation of subsea infrastructure

Activity	Vessel	Fuel Type	Consumption Rate (overall average)	Duration†	Total Fuel Consumption (tonnes)
Installation of the Manifold and Riser Base Structures	DP Construction Support Vessel (CSV)	Diesel	20 tonnes / day	8 days	160
Installation of the Umbilical	DP CSV	Diesel	20 tonnes/day	7 days	140
Pipelay Support	Utility / Survey Vessel	Diesel	14 tonnes/day	30 days	420
Rigid Pipeline Installation	Reel Lay Vessel	Diesel	17 tonnes/day	20 days	340
Pipeline Trenching	Trenching Vessel (Plough)	Diesel	18 tonnes/day	20 days	360
Rock Placement	Fall Pipe Vessel	Diesel	20 tonnes/day	19 days	380
Tie-ins, Leak testing and Mattressing	Diving Support Vessel (DSV)	Diesel	20 tonnes/day	50 days	1,000
Guard Vessel*	Guard Vessel	Diesel	4 tonnes/day	30 days	120
Total Diesel Consumption					2,920

Notes:
* Guard Vessel may not be required but had been included to represent a worst-case scenario, in the event that the arrival of the MODU does not align with the anchor laying operations.
† Duration includes mob, demob, transit, and / or working time.

4.7 Host Platform Facilities and Proposed Modifications

4.7.1 Overview

The intention is for the Harbour Energy operated Britannia Platform and Britannia BLP to host the surface facilities required to process fluids from the Fotla field development. The Britannia Platform and BLP are located in UKCS Block 16/26 of the UK central North Sea, 210 km north-east of Aberdeen and approximately 14 km north of the Fotla field. At present, the Britannia Platform and BLP process fluids from a number of fields that make up the GBA, namely the Britannia field itself, as well as from the Brodgar, Callanish, Alder, Enochdhu and Finlaggan subsea tie-back developments (Figure 4.14).

The nominal design capacity of the Britannia Platform export system is as follows:

- Gas export is 21 million Sm^3/day (740 MMScfd); and
- Condensate/Oil export is 10,652 m^3/day (67,000 bpd).

Production from the Britannia Platform began in 1998. Produced gas is exported from the Platform via the Britannia pipeline to the Scottish Area Gas Evacuation (SAGE) facility at St Fergus in the Northeast of Scotland. Ultimately, the gas processed at the St Fergus gas terminal is exported to the National Grid for power generation and to be fed into the National Transmission System (NTS), which supplies the rest of Great Britain. The produced oil and condensate are exported via the Forties Pipeline System (FPS) to the stabilisation and processing plant at Kinneil near Grangemouth. The Kinneil Terminal is where the gas and condensate from the pipeline are separated and treated. The gas is used by the remaining petrochemical plants on the former Grangemouth refinery site, and the stabilised crude oil is sent to the Hound Point terminal in the Firth of Forth, for export to various refineries around the world.

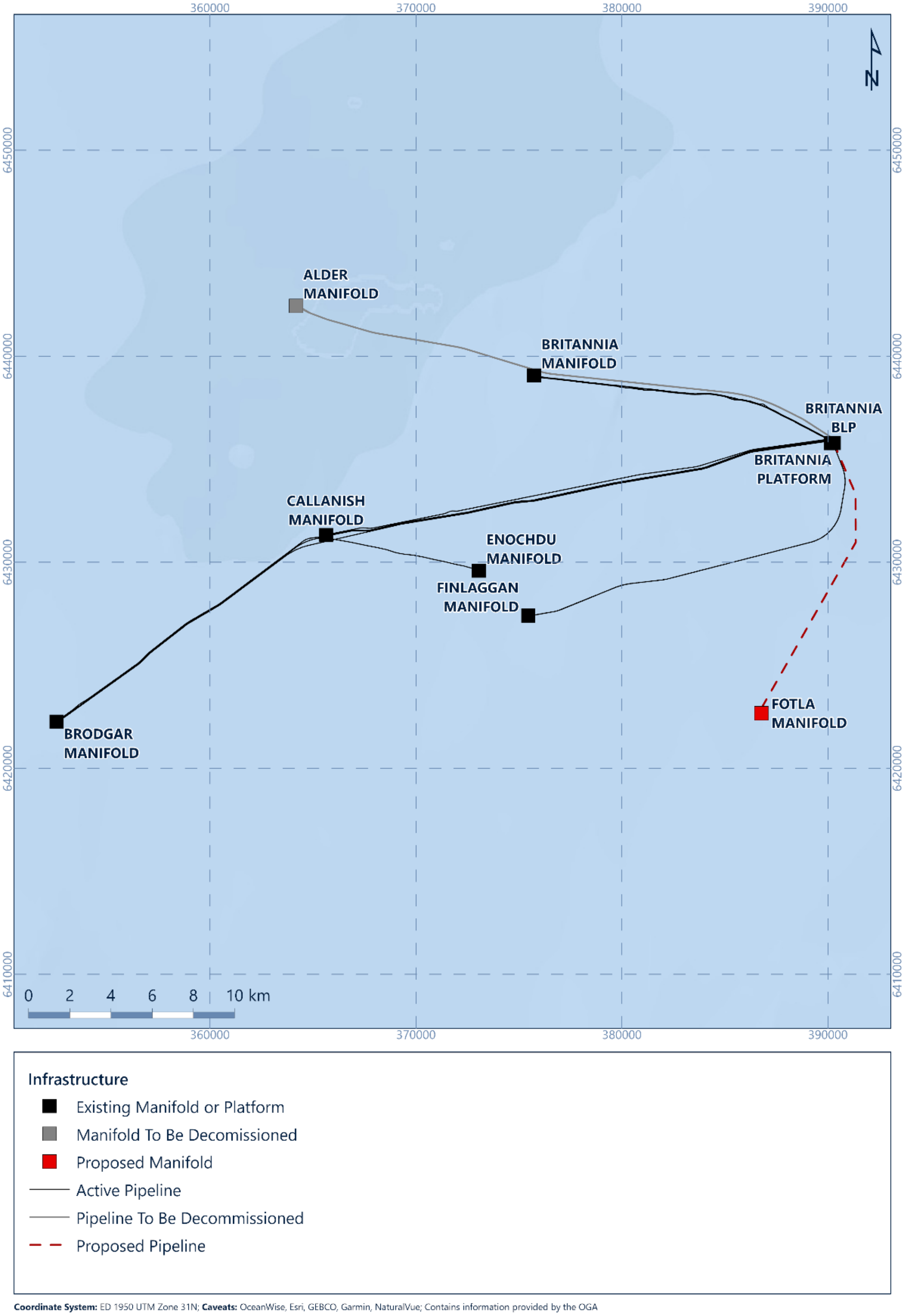


Figure 4.14: The Greater Britannia Area overview

4.7.2 Current Britannia Facilities Description

4.7.2.1 The Britannia Platform

The Britannia Platform receives production fluids directly from the Britannia and Finlaggan gas and condensate fields, which are routed through their individual separators onboard the Platform. The separated produced gas is routed to two dehydration trains and export gas trains before being sent to shore via the SAGE pipeline system.

Gas received from the fields requiring low back pressures is routed through the Long-Term Compression (LTC) module, which comprises a single Booster Compressor train. Currently, gas from the Britannia Separator is routed to LTC.

The Britannia Separators are 2-phase vessels separating the well fluids into gas and total liquids (i.e. condensate and water). The liquid phase is then routed to a single Medium Pressure (MP) Feed Heater, followed by a MP Separator where the condensate is separated out before being routed to the Condensate Export system. The separated water from the MP Separator is treated further by dedicated MP Hydrocyclones and a Produced Water Degassing Drum, prior to disposal overboard. The Finlaggan liquids follow a similar route from the Finlaggan separator through a set of hydrocyclones with treated water routed to the Produced Water Degassing Drum.

The Britannia Platform also houses associated utilities, a flare system and a power generation plant.

4.7.2.2 Britannia Bridge Linked Platform (BLP)

The BLP receives production fluids from Brodgar (gas condensate), Callanish (oil and gas) Enochdhu (oil and gas) and Alder (oil and gas) fields.

The produced well fluids from the Brodgar field are routed to the Brodgar High Pressure (HP) Separator. However, at present the Brodgar HP Separator is operated in Low Pressure (LP) mode with gas routed to the LTC system.

The combined well fluids from the Callanish and Enochdhu fields are routed to the Callanish Separator. The Callanish Separator is operated at HP with gas let down across the separator pressure control valve (PCV) and commingled with Brodgar and Alder gas which are also routed to the LTC system. The Alder fluids are routed through its own separator. The Alder Separator and associated Alder equipment are located on a dedicated Alder module on the BLP.

Condensate from the BLP separators is comingled and routed via a single bridge line to the Britannia MP Separator. Produced water from the Brodgar system is also routed to the Britannia MP Separator via the common condensate bridge line. The Callanish and Alder Separators each have their own set of hydrocyclones and dedicated produced water degassers.

4.7.3 Britannia Topsides Modifications to Accommodate Fotla

Produced fluids from the Fotla field will be processed via the existing topsides facilities currently handling the production from the Alder field. The Alder field will require to have ceased production prior to Fotla coming online. In order to facilitate the Fotla production fluids, the current Alder process facilities will be adapted and upgraded, as follows:

- Alder Separator upgrade (internals upgrades, level settings changes, weir height change inside the separator);
- Hydrocyclones upgrade (new liners to be fitted and operating arrangement to be changed from 2 × 100 % to 2 × 50 %);
- Alder Degasser upgrade (internals upgrade);
- Chemical Injection Pumps upgrades (various pumps replacement and new pumps for subsea and topsides chemicals);
- Repurposed existing Alder Hydraulic Power Unit (HPU),
- New subsea Master Control System (MCS);
- Pipework modifications to provide flexibility in gas routing from the BLP to HP or LP compression on the Britannia Platform;
- Re-establish HP gas route across the bridge to Britannia meet the 30 barg arrival pressure entry specifications for the Britannia gas treatment and compression unit; and
- Re-instatement of the Alder topside inlet facilities.

In addition, a number of existing Alder systems that are currently redundant and mothballed will be re-instated (e.g. pig receiver, inlet heater and produced water treatment system). During the execute stage of the project, these items will be inspected to establish the exact level of refurbishment, upgrading and/or replacement of equipment items will be required.

The produced water will be processed onboard the BLP, before being discharged to sea under normal operating conditions. The discharge of produced water on the UKCS is a permitted activity, which is strictly regulated by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED). As the facilities Operator, Harbour Energy will apply for a permit to discharge Fotla's produced water from the BLP on behalf of Ithaca Energy, as part of its wider annual discharge permit for the Britannia Platform and the BLP. The conditions of the permit will specify the actual discharge limits and thresholds. Presently, the BLP operates under a discharge permit of 30 mg/l for oil in water.

A Best Available Techniques (BAT) / Best Environmental Practice (BEP) Assessment study (NOV, 2024) showed the most effective upgrades to the existing produced water system to meet and improve on the current discharge requirements by replacing the hydrocyclone liners and degasser internals in combination with upgrading the Alder Separator internals. By implementing these three upgrades, the upgraded processing system will be able to maintain an improved average oil in water discharge specification of ≤ 25 mg/l.

In addition, Ithaca Energy will replace the current separator control valve with a low shear control valve instead, as part of the separator and hydrocyclone upgrades. The new low shear control valve will reduce the shearing forces imparted on to the oil droplets and increase the average oil droplet size entering the degasser vessel that in turn aids oil water separation in the degasser, resulting in another small reduction in oil in water content.

The potential implementation of a Mare's Tail Coalescer upstream of the hydrocyclones will also be considered. A Mare's Tail Coalescer is an in-line, low pressure-drop device that coalesces small droplets (sub-10 µm) to enhance the performance of downstream produced water treatment equipment, without the need for deoiling chemicals. The technology can be easily retrofitted into existing installations. However, to confirm compatibility of the technology with the Fotla process stream a field trial is required, as previous applications of Mare's Tail coalescers have identified certain produced fluids and production chemical combinations can prevent it from operating effectively.

4.8 Fotla Production Fluids Processing and Export

4.8.1 Separation of Produced Fluids

The produced Fotla well fluids will arrive onboard the BLP via the production riser. From there the Fotla fluids will pass through a new dedicated Riser Emergency Shutdown Valve (RESDV) before tying into the existing Alder production flowline upstream of the 'Alder' instrumented Over Pressure Protection System (OPPS).

The Fotla production fluids will then pass through the Alder Inlet Heater where they will be heated to aid separation, before passing through the upgraded 3-Phase Alder Separator. Individual oil, water and gas phase meters will be located on the outlets of the Alder Separator in accordance with the Britannia metering and allocation philosophy for all 3rd party fluids. Figure 4.15 provides a simplified overview of the Alder process facilities associated with Fotla.

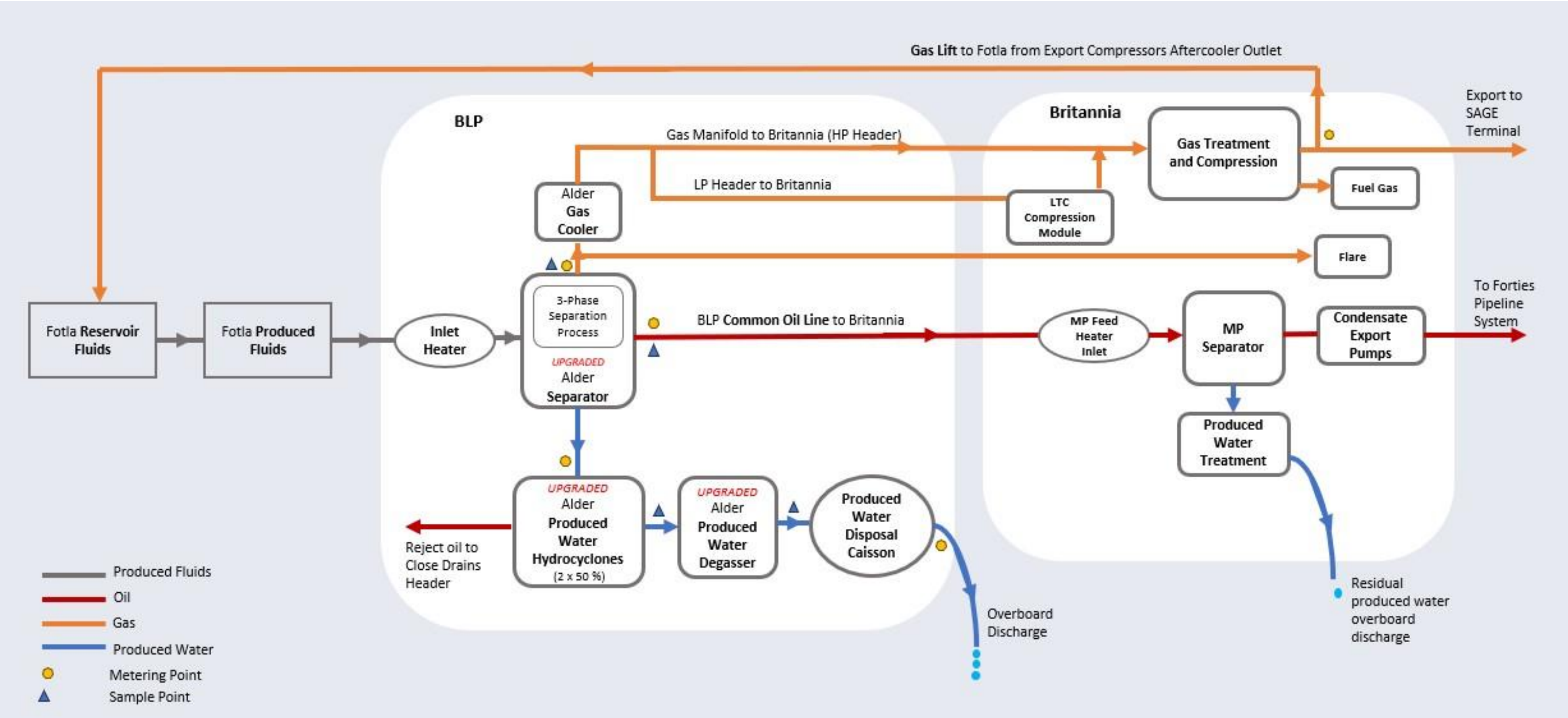


Figure 4.15: Fotla process flow via Alder and Britannia process facilities

4.8.2 Gas Processing

After being metered, the gas from the separator will pass into the Alder Gas Cooler, where it will be cooled down and commingled with Callanish gas, before being routed via the HP gas manifold across the bridge to Britannia for further processing. During start-ups, gas may also be routed via the LP header line to LTC on Britannia to enable the separator to be operated at lower pressure.

Onboard the Britannia Platform, the gas will be cooled down further, dehydrated and compressed for export to the SAGE Terminal.

Gas lift for Fotla will be provided by the Export Compressors. The lift gas will be taken downstream of the Aftercoolers and tied into the existing (and currently redundant) Caledonia gas lift piping and riser system on Britannia. As described in Section 4.6.9 above, the new gas lift line will be tied into the Fotla subsea system at the bottom of the 12" ex-Caledonia gas lift riser into the SSIV riser base structure.

4.8.3 Oil Processing

The produced oil fraction from the Alder Separator will be commingled with BLP oil via a common oil line and routed across the bridge to Britannia to the MP Feed Heater inlet. The existing bypass line of the MP Feed Heater will be adapted and re-used. The modifications of the bypass line will involve the installation of a new isolation valve and changing the position of existing valves, so that the liquids from the BLP can flow through the MP Feed Heater to achieve the required temperature for the Britannia MP Separator. After further de-watering and stabilisation in the MP Separator the oil will be exported via the Condensate Export Pumps for delivery to the Forties Pipeline System.

4.8.4 Produced Water Processing

It is anticipated that the Fotla wells will start producing water early in the production process (see Table 4.3 and Figure 4.4, above). The volume of produced water will gradually increase over time, with the anticipated water cut peaking around 2033 at 1,429 m^3 /day (8,988 bbls/day).

The produced water fraction from the Alder Separator will be routed to the existing Alder Hydrocyclones which will be fitted with upgraded liners. Both sets of Alder Hydrocyclones will be re-used and operated as 2 × 50 % units.

The treated water from the Alder Produced Water Hydrocyclones will be sent onwards to the Alder Produced Water Degasser and discharged overboard via the existing Produced Water Disposal Caisson (C4) on the BLP. After implementation of the planned upgrades (see Section 4.7.3 above), the oil in water content of the produced water from Fotla is anticipated to be ≤ 25 mg/l. Dedicated sampling points will be available to enable regular checking of separation performance, as indicated in Figure 4.15 above.

The reject stream from the Alder Produced Water Hydrocyclones will be routed into the Alder Closed Drains Header. Fluids in the Closed Drains Header flow across the bridge (by gravity) into the LP Flare Drum on the Britannia Platform. The existing reject oil line to the Closed Drains Sump will be retained for drain down to remove reject oil from the line during maintenance, when there will not be sufficient pressure to flow to the Alder Closed Drains Header.

4.8.5 Flaring and Venting

Flaring and venting are controlled processes to dispose of waste gas, essential for emergency and safety purposes on oil and gas installations, and in situations where it may not feasible for the gas to be used, exported or re-injected. Flaring is the burning of gas, and venting is the release of unburned gas (OGA, 2020).

During well clean up and during the commissioning of wells, subsea infrastructure and host facilities, it is expected to up to 2,000 tonnes of hydrocarbons per well (i.e. up to 4,000 tonnes in total for both wells) may be flared off, either from the MODU and/or through the Britannia platforms. These figures represent the worst-case volumes of hydrocarbons which may be flared off.

As all produced fluids from Fotla will be processed at Britannia, any flaring and venting during the production phase of the Fotla development will take place onboard the Britannia platforms. The Britannia Platform has LP and HP flare systems, which are designed for overpressure protection and blowdown for the process and utility systems. The HP Flare system accepts relief from all high-pressure equipment with a design pressure greater than 16 barg, whilst the LP flare system accepts all low-pressure relieving equipment, including the Britannia MP separator.

Both HP and LP flare systems are equipped with horizontal flare knockout drums to minimise liquid carryover to the flare stack. Liquid from the HP flare knockout drum drains to the LP flare knockout drum via an on/off valve. Any liquid collected in the LP flare knockout drum is pumped by the LP flare knockout drum pumps to the Britannia MP separator.

The Fotla field development will be designed to avoid any steady state, operational or routine flaring or venting. Consequently, flaring will be limited to any potential process upsets triggering a plant shutdown, resulting in the requirement for a short period of flaring (approximately 30 minutes).

In addition to the flaring, a certain amount of continuous venting will also take place at the flare from stripping gas, flare purging and vessel blanketing.

Table 4.15 shows historic flaring data from the Britannia Platform (NSTA, 2025a).

Table 4.15: Flaring volumes at the Britannia Platform

Year	Oil and Net Gas Production (mmboe)	Flared Gas	
		(bcf)	(m^3)
2020	18.4	0.48	13.59×10^6
2021	16.85	0.36	10.19×10^6
2022	18.71	0.40	11.33×10^6
2023	15.61	0.35	9.91×10^6

Notes:
Source: NSTA, 2025a.

The effects from Fotla on the current flaring and venting activity of the Britannia Platform will be small and is caused by the following sources:

- Alder Produced Water Degasser Vent (~0.6-0.7 kmol/hr, averaged over life of field based on the Fotla produced water profiles);
- Alder Separator Gas Outlet Sampling Vent (5.9 kmol/hr, for 1 hour each month); and
- Alder Separator to Alder Inlet Heater Sampling Vent (negligible).

Based on the mid-case production profile for Fotla, the 'normal' flaring emissions would rise by 1.3 kton CO_2e per year over a period of 11 years (i.e. ~15 kton in total, over the life of field, or +5.6 % compared to a base case without Fotla). When using Fotla's high-case production profile , the flaring emissions would rise by 1.6 kton CO_2e per year over a period of 15 years, resulting in a total ~26 kton (+6.7 % compared to a base case without Fotla) over the life of field (Kent, 2025).

As the Britannia platform and its associated processing facilities are operated by Harbour Energy, Ithaca Energy has limited control over the current and future net zero measures onboard the platform facilities.

4.8.6 Power Generation

At present, all equipment onboard the Britannia Platform and BLP is powered through three MARS 100 T15000 gas turbine generators, capable of producing 29.4 MW power in total (i.e. 9.8 MW per gas turbine) or 19.6 MW when only two generators are in use, which is the 'normal' use case, with the third generator being there for redundancy.

Table 4.16 shows the power demands of the base case (Britannia without Fotla coming online), Fotla mid-case (Britannia with Fotla producing in line with the mid-case production profile) and Fotla high-case (Britannia with Fotla producing in line the high-case production profile). The table shows that Fotla will have a very small effect on Britannia's overall energy requirements. In fact, the energy requirement will be slightly less under a mid-case production scenario and only increase by < 1 % in case of a high production profile.

The main reason for these very small differences is due to the Export Gas Compressors operating in recycle to achieve the required minimum flow rates to avoid surges. This means these compressors will be running regardless, whether Fotla is added to Britannia or not.

Hence, the additional Fotla gas does not increase the total gas flow through the compressors, but only changes the ratio of recycle flow / forward (export) flow, with a higher proportion of the total gas now being sent forward to the Export Gas Coolers (X-0803A/B) and onwards to export.

In addition, when Fotla replaces the Alder gas, the overall gas composition used for power generation onboard the Britannia platforms will change. The introduction of the Fotla gas will increase the overall molecular weight and the lower heating value[5] (LHV) of the gas used for power generation. This will have a positive effect for the power requirements of the LTC and export compressors, as a lower polytropic head[6] and flow rate will achieve the same required discharge pressure to avoid surge, thus reducing the power consumption.

Table 4.16: Britannia power requirements with and without Fotla and available capacity]

User	Power Demands at Peak Power (kW)			Available Capacity on Britannia (kW)
	Base Case (without Fotla)	Fotla Mid-case Scenario	Fotla High-case Scenario	
Condensate Export Pumps (P-0307A/B/C)	1,366	1,355	1,445	1,550
Condensate Booster Pumps (P-0305A/B/C)	70	70	72	44
Fuel Gas Heater (H-1402A/B)	216	214	215	690
Brodgar Produced Water Pump (P-1343)	13	8	13	22
Suction Scrubber Condensate Pump (P-0512 A/B)	5	4	5	11
Current Base Load - Britannia	9,500	9,500	9,500	-
Total	**11,170**	**11,151**	**11,250**	**19,600 (2×generators)**

4.8.7 Subsea Controls and Chemical Distribution

Power, chemicals and a multiplexed control system for the Fotla field development will be provided via a combined Electro / Hydraulic / Chemical umbilical from Britannia.

The subsea control system comprises a dual redundant open-loop hydraulic system, operating all valves on LP hydraulics with the exception of downhole safety valves, which will operate on HP hydraulics.

Injection chemicals will be supplied from Britannia to the riser base structure, manifold and trees. In order to maintain asset integrity and avoid any flow assurance issues, the following chemical additives are currently anticipated to be injected subsea.

[5] 'Lower heating value' (LHV), also known as 'net calorific value', is defined as the amount of heat released when a fuel is combusted, starting from 25 °C (or another reference state) and with the combustion products returned to 150 °C, excluding the latent heat of vaporization of water.
[6] Lower polytropic head is a measure of the useful work done by a compressor to increase the pressure of a gas.

4.8.7.1 Wax Inhibitor (Subsea Production Manifold)

Due to the length of the pipeline, the arrival temperature of the produced fluids may potentially fall below temperature where wax may start to form and deposit. Therefore, wax inhibitor will be injected at the subsea manifold to avoid potential wax deposition in the subsea system. It is assumed that the injection of wax inhibitor into the Fotla flowline at the subsea manifold will be required throughout the life of field.

4.8.7.2 Scale Inhibitor (Upstream of Production Choke on Subsea Trees)

Significant formation water production is predicted through the life of field, and provision for scale inhibitor injection will be included at each production tree upstream of the production choke. There is no requirement for downhole scale inhibitor injection.

4.8.7.3 Corrosion Inhibitor (Subsea Production Manifold)

The produced water fraction in the production fluids has the potential to cause corrosion of any uninhibited carbon steel sections of the pipeline. Therefore, corrosion inhibitor will be injected downstream of the wells, and upstream of the first carbon steel section of pipework.

4.8.7.4 Hydrate Formation Inhibitor

Methanol injection will be required at the subsea tree, manifold and riser base for hydrate management.

4.9 Decommissioning

The Fotla field development has a projected lifespan of 15 years, after which it will be decommissioned. All decommissioning operations will be undertaken in accordance with UK Government legislation and international agreements in force at the end of field life. At present, the decommissioning of oil and gas installations and infrastructure is controlled through the Petroleum Act 1998, as amended by the Energy Act 2008. The UK's international principal obligations on decommissioning are governed by the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention).

Before cessation of production (CoP), a decommissioning plan will be developed based on industry best practice and guidance in consultation with the relevant statutory authorities. In addition to the decommissioning plan, the (buried) pipelines will also be subject to a Comparative Assessment (CA) to determine their most appropriate decommissioning option.

The ultimate intention is to leave the seabed in and around the development area in a condition that will pose no harm to the marine environment, or other users of the sea.

5. Local Environment

This chapter characterises the marine and coastal environment within the potential zone of influence of the proposed Fotla field development and identifies important and sensitive receptors, including habitats, species and ecosystems, as well as other users of the sea. As the proposed project, and the combustion of the produced hydrocarbons by the end user, will also contribute to the cumulative impacts of global climate change, an overview of the current status, projected trends and effects of global emissions contributing to climate change has been included.

The Fotla field is located in United Kingdom Continental Shelf (UKCS) Block 22/1b and the pipeline route to the Britannia Platform passes through UKCS Blocks 22/1a, 22/1b and 16/26a The Fotla field is located in the Central North Sea (CNS) 176 km east of Peterhead in Scotland (Figure 5.1) and approximately 46 km west of the UK/Norway transboundary line. The Norwegian coastline lies 265 km to the east.

5.1 Data Sources

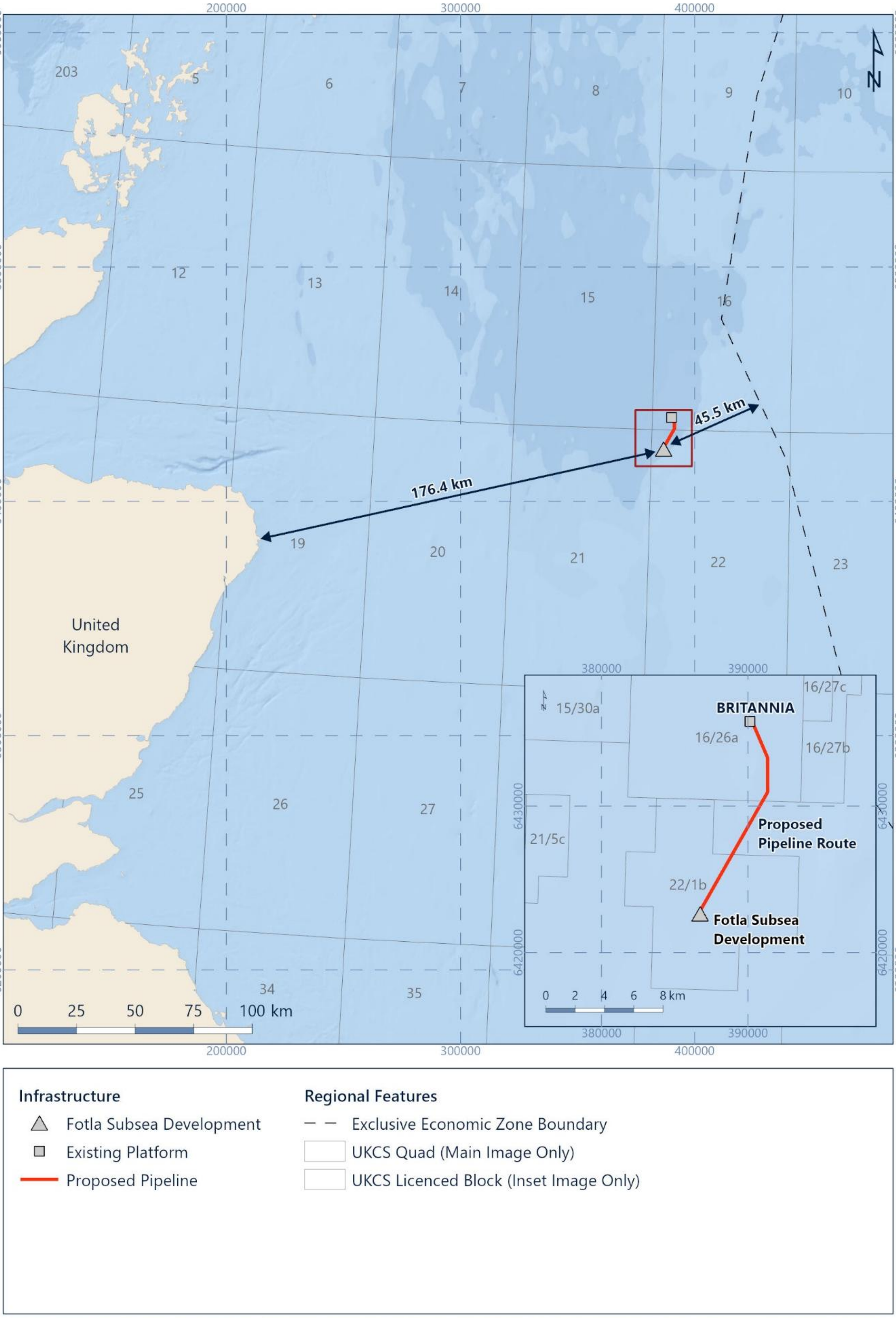
Environmental information derives from publicly available sources including national and regional datasets and published journals. Detailed information on local seabed features, sediment types, benthic habitats and species derive from regional and site-specific surveys as described below.

5.1.1 Site Specific Surveys

A site specific survey of the Fotla field and the proposed pipeline route to Britannia was undertaken in 2023 (Gardline, 2024). Seabed data were obtained using drop down camera, grab sampling, magnetometer, multibeam echosounder (MBES), side scan sonar (SSS) and sub-bottom profiler (SBP). The survey results were reported in an Environmental Baseline Survey (EBS) report and a Habitat Assessment report (Gardline, 2023; Gardline, 2024).

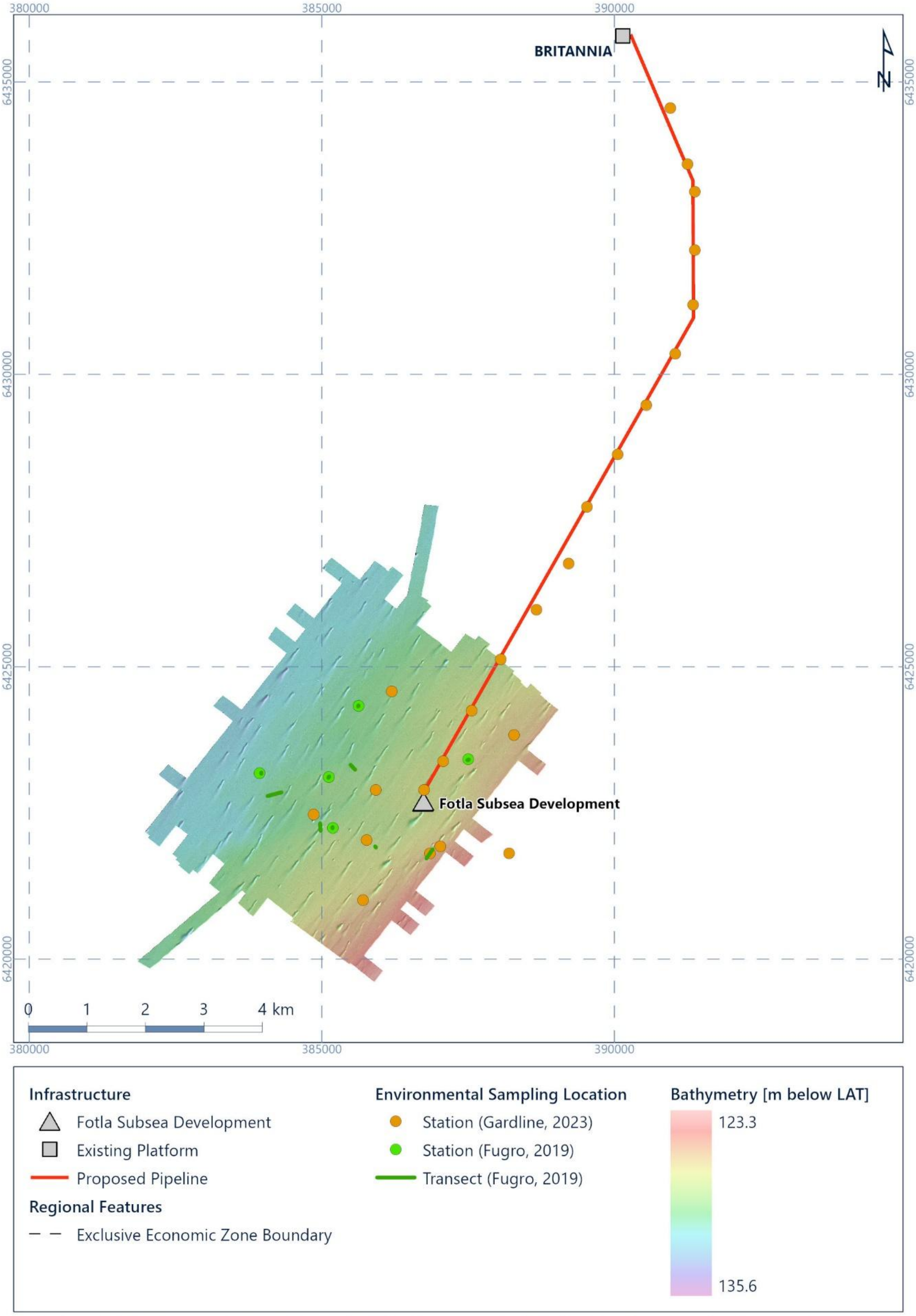
The findings of the site specific survey are supplemented with data collected during a previous similar survey of the Fotla field undertaken in 2019 consisting of drop-down camera, grab sampling, SSS, magnetometer, SBP and MBES (Fugro, 2020).

Figure 5.2 presents the sampling locations from the 2023 and 2019 surveys in relation to the proposed development at the Fotla field and pipeline route.



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** OceanWise, Esri, GEBCO, Garmin, NaturalVue, OceanWise, Esri, Garmin, NaturalVue; Esri, 2024; Contains information provided by the OGA; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12.

Figure 5.1: Location of Fotla field development



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12.

Figure 5.2: Surveys undertaken at the Fotla field and along the pipeline route showing stations sampled, bathymetry (in field) and timing of the survey (Fugro, 2020; Gardline, 2024)

5.1.2 Other Environmental Surveys and Reports

Similar environmental surveys undertaken at adjacent fields are summarised in Table 5.1. These include seabed sampling studies at the Alba field, the observations from which provide a wider, regional environmental context for the Fotla field and the proposed pipeline route.

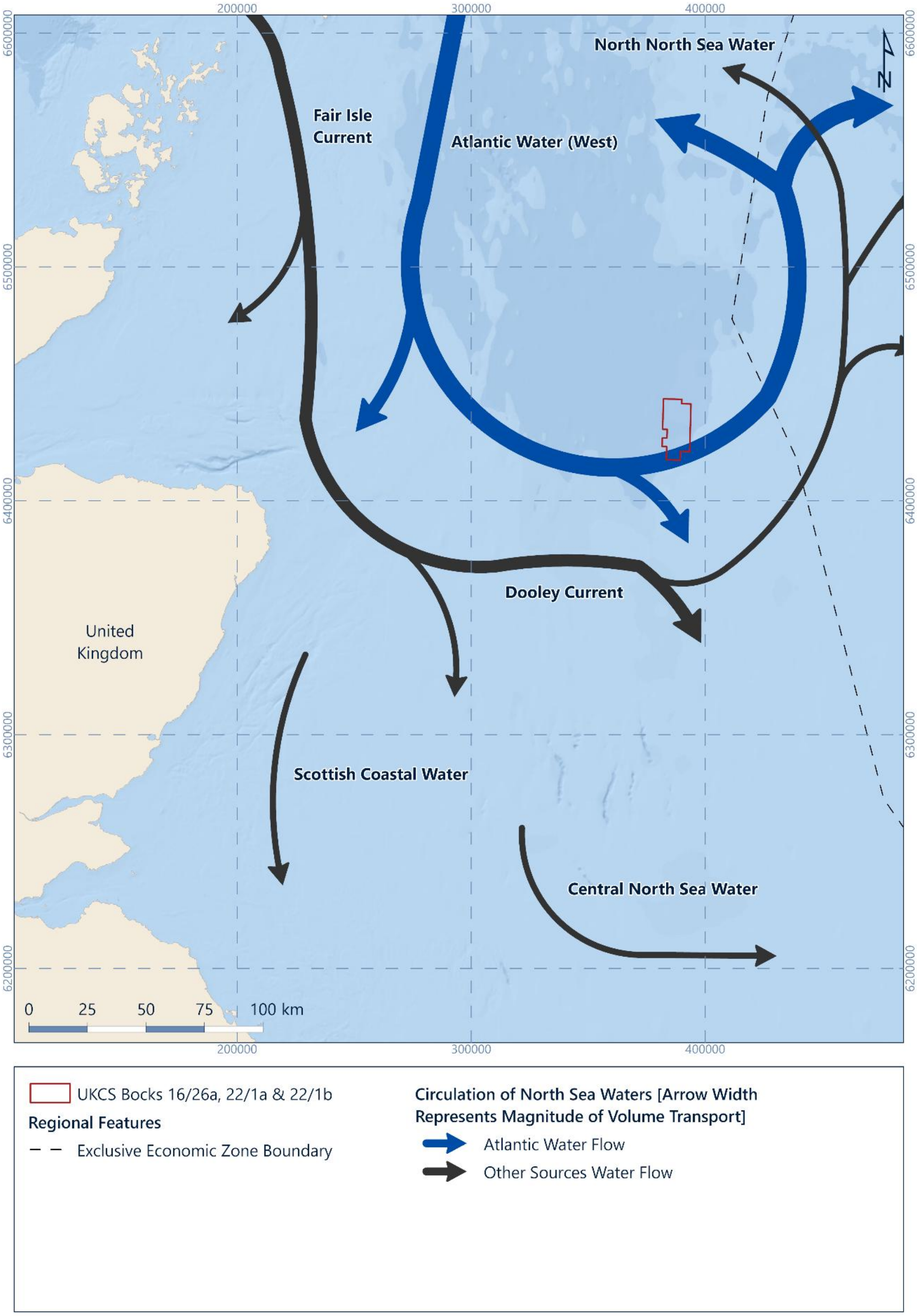
Table 5.1: Other environmental surveys undertaken in the wider region

Report/Year	UKCS Block	Distance to Fotla (km)*	Summary of Results
Alba EBS and HA (Fugro, 2015)	16/26	10	Fine sediments Water depths ranged from 138.5 m to 133.0 m LAT Typical hydrocarbon and metal concentrations for the area OSPAR 'Sea pens and burrowing megafauna communities' habitat'
Notes: EBS = Environmental Baseline Survey HA = Habitat Assessment LAT = Lowest Astronomical Tide OSPAR = Oslo and Paris Conventions			

5.2 Physical Environment

5.2.1 Hydrography

Tidal currents in the offshore waters of the North Sea decrease in velocity with increasing distance northwards. The main water masses in the North Sea are Atlantic Water, Scottish coastal water, northern North Sea water, Norwegian coastal water, CNS water, southern North Sea water, Jutland coastal water and Channel water. The main inflow of water into the North Sea occurs along the western slopes of the Norwegian Trench, with minor inflows from the English Channel and the Baltic Sea. Currents in the North Sea follow an anticlockwise circulation pattern, influenced by major inflows of Atlantic water around the Orkney and Shetland Islands, and balanced by an outflow along the Norwegian coast (DTI, 2001a) (Figure 5.3). The residual current in the region is flowing in a north-easterly direction, at a speed of around 0.23 knots (0.12 m/s) (Hydrographer of the Navy, 2008).



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** OceanWise, Esri, GEBCO, Garmin, NaturalVue, Esri, GEBCO, Garmin, NaturalVue; Esri, 2024; Contains information provided by the OGA; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12; Paramor, O.A.L., Allen, K.A., Aanesen, M., Armstrong, C., Hegland, T., Le Quesne, W., Piet, G.J., Raakær, J., Rogers, S., van Hal, R., van Hoof, L.J.W., van Overzee, H.M.J., and Frid C.L.J. (2009) MEFEPO North Sea Atlas. University of Liverpool. ISBN 0 906370 60 4.

Figure 5.3: Schematic of the circulation patterns of the North Sea. Blue arrows indicate the influx of Atlantic Water. Black arrows indicate water from other sources (Bloomfield et al., 2009)

The wave climate is influenced by wind speed, wind duration and fetch (the distance over which the wind blows uninterrupted over the sea), which are in turn dependent on season and location. The predominant wave direction at the Fotla field is north to north north-west (Fugro, 2023). The North Sea is considered to be frequently rough from October to March. During this time, significant wave height at 58˚N, which includes the proposed Fotla field development, ranges on average between 2.2 m and 3 m.

5.2.1.1 Meteorology

Wind data for the North Sea (Figure 5.4) indicate that wind direction is variable, however, winds tend to dominate from south-south-west and south and north north-west. Predominant wind speeds throughout the year represent moderate to strong breezes (6 m/s to 13 m/s), with the highest frequency of gales (wind speeds greater than 17.5 m/s) occurring in the winter months (November to March) (DTI, 2001a).

Average wind speed across the Fotla field is approximately 8.3 m/s with the wind direction recorded as predominantly from the north-west (Fugro, 2023; Figure 5.4). The greater wind speeds in the area are typically recorded between December to February (Fugro, 2023).

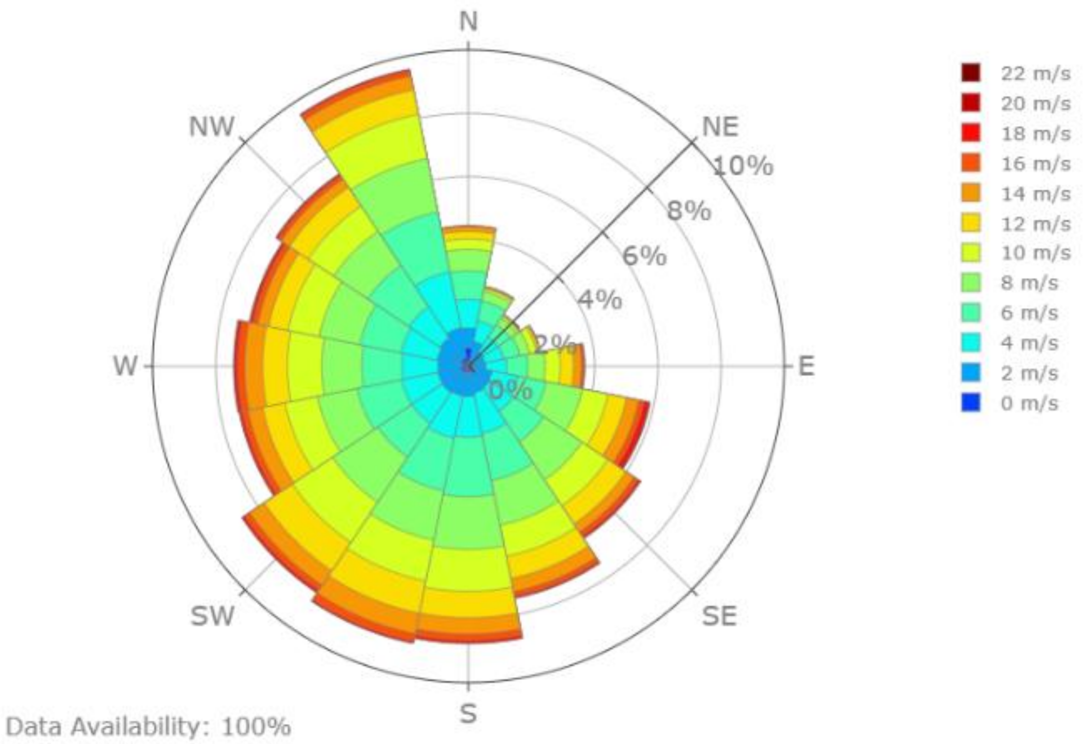


Figure 5.4: Wind rose from an approximate central point of the wider area

Mean annual rainfall is relatively low over much of the CNS, when compared to the Atlantic seaboard and Norwegian coastal waters. Rainfall in the development area is estimated to be between 200 mm and 400 mm per annum (DTI, 2001a). April to June tend to be the driest months, with October to January being wetter (UKHO, 2013).

5.2.1.2 Bathymetry

The bulk of modern seabed sediments in the Central North Sea comprise substrates that are more than 10,000 years old and have been reworked from strata by currents generated by tides and waves. The reworked sediments typically form large areas of seabed sand and gravel (BGS, 2001). Sand and slightly gravelly sand cover much of the bed of the central to northern North Sea and occurs within a wide range of water depths from the shallow coastal zone to 110 m in the north and to below 120 m in isolated deeps in the south and west (Andrews et al., 1990).

In the outer Moray Firth and greater central North Sea lie fine-grained sediments which have their primary distribution within the Fladen and Witch Grounds. These sediments are typical of water depths greater than 120 m (Andrews et al., 1990).

Water depths at the Fotla field vary between approximately 119 m lowest astronomical tide (LAT) and 132 m LAT, whilst water depths along the proposed pipeline route range between 128 m LAT and 137 m LAT (Figure 5.2; Gardline, 2024). Water depths of approximately 136 m LAT were reported at the Britannia platforms (Camm et al., 2020).

5.2.1.3 Water Salinity and Temperature

The temperature of the sea influences the properties of the sea water and the behaviour of discharges and spills to the environment.

Most of the North-East Atlantic (including the North Sea) is well mixed to depths of up to 600 m in the winter and a deep-permanent thermocline in deep oceanic waters. During early spring, a strong vertical temperature gradient develops which separates warm surface water from the cold deeper water (OSPAR, 2010). In late spring a thermocline forms in the water column, separating a warmer and less dense surface layer of water from the rest of the water column, in which winter temperatures remain. The thermocline increases in depth in the months between May and September and is typically between 20 m to 50 m deep during August and September (OSPAR, 2010). During autumn, the variable weather conditions, and seasonal cooling at sea surface result in mixing of the surface and bottom layers and the disruption of the thermocline.

Data from 1971 to 2000 shows that mean surface temperature of the sea around the proposed Fotla field ranges from approximately 5.9 °C in March to approximately 13.7 °C in August (Marine Scotland, 2017c), and that the mean near seabed temperature ranges from approximately 5.9 °C in March to approximately 8.9 °C in November (Marine Scotland, 2017d). Similarly, mean surface temperatures at the Britannia Platform are around 6.0 °C in March and 13.7 °C in August (Marine Scotland, 2017c), whilst mean near-ned temperature range from approximately 6.0 °C in March to 8.9 °C in November (Marine Scotland, 2017d).

Salinity affects the properties of seawater and the species of marine organisms present. Changes and fluctuations in salinity are largely caused by the addition or removal of freshwater from seawater through natural processes such as rainfall and evaporation. The salinity of seawater around an installation has a direct influence on the initial dilution of aqueous effluents. As salinity decreases, the solubility of effluents increases.

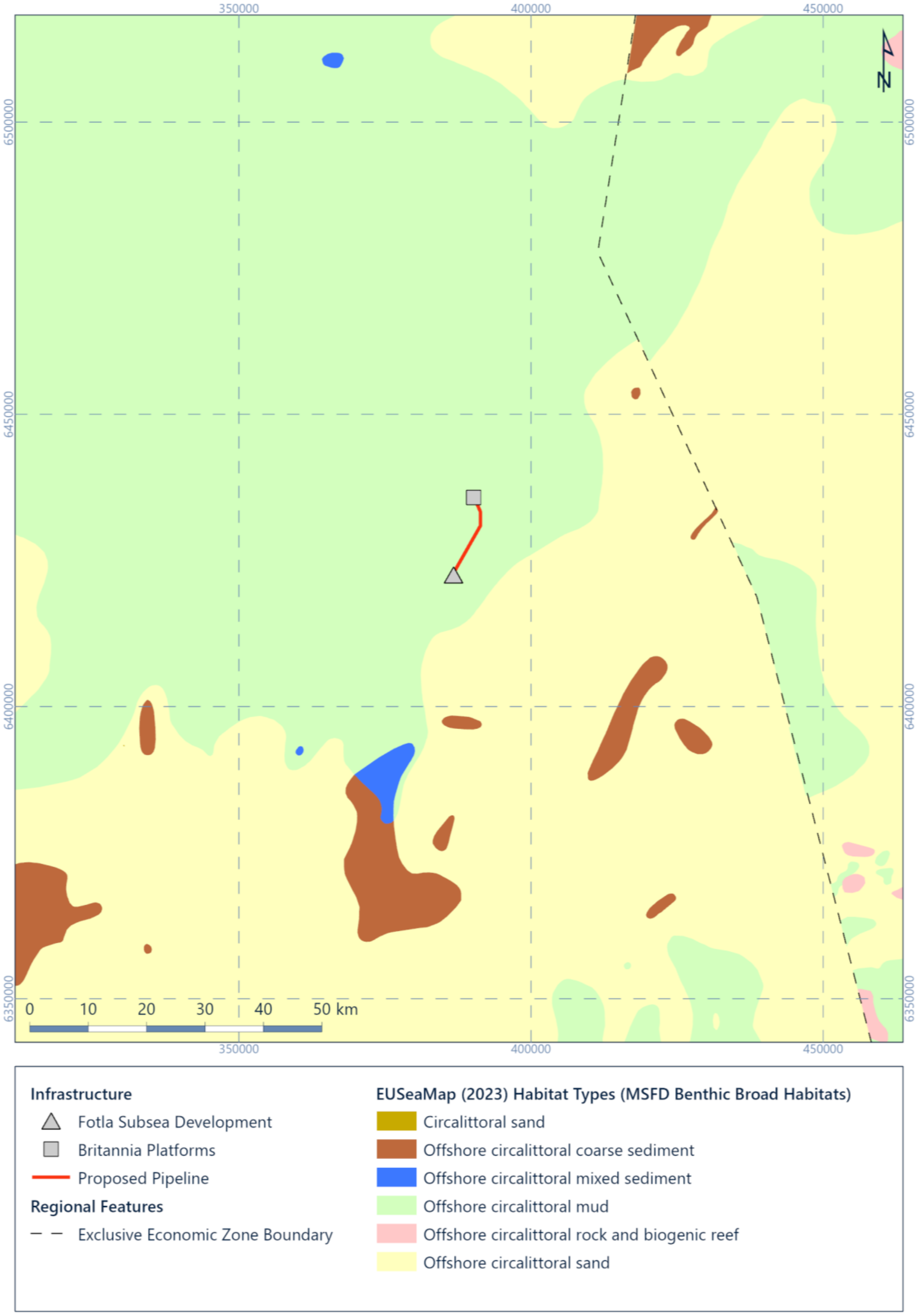
Within the North Sea salinity levels are lowest in the south-eastern sector of the North Sea and increase further north and west, ranging from between 29 ‰ and 35.2 ‰ (Marine Scotland, 2017a).

The annual mean surface and near seabed salinity at the Fotla field is approximately 35 ‰ according to data from 1971 to 2000 (Marine Scotland, 2017a; 2017b). Surface salinity decreases slightly during the period from January to July to approximately 34.89 ‰, and salinity near the seabed fluctuates between 35.16 ‰ in November and 35.07 ‰ in April (Marine Scotland, 2017a). At the Britannia Platform, mean annual surface salinity is approximately 35 ‰ whilst near seabed salinity is around 35.1 ‰ (Marine Scotland, 2017a; 2017b). Similar to the conditions found at the Fotla field, surface salinity decreases slightly from 35.14 ‰ in January to a minimum of 34.88 ‰ in July (Marine Scotland, 2017a). Near the seabed, mean salinity fluctuates between a maximum of 35.17 ‰ in November to an approximate minimum of 35.08 ‰ in March (Marine Scotland, 2017b).

5.2.2 Seabed Sediments

Seabed sediments at the Fotla field, pipeline route, and at the Britannia Platform comprise extremely low strength sandy clay (Gardline, 2024). Particle Size Analysis (PSA) indicated that sediments comprised equal proportions of sand (≥ 63 µm and < 2 mm) and fines (≥ 63 µm). Gravel (≥ 2 mm) was practically absent from all stations.

The sediments observed in 2023 (Gardline, 2024) were similar to previous surveys carried out at Fotla as well as the wider region (Table 5.1). Sediment habitats are classified as MD621: Faunal communities on Atlantic offshore circalittoral mud and MD6218: *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in Atlantic offshore circalittoral sandy mud (Fugro, 2015; 2020; Figure 5.5).



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12; Licensed under CC-BY 4.0 from the European Marine Observation and Data Network (EMODnet) Seabed Habitats initiative (www.emodnet-seabedhabitats.eu), funded by the European Commission.

Figure 5.5: Seabed sediments within and around the proposed Fotla field development

5.2.3 Seabed Features

Four items of debris were identified within the site survey area of the Fotla field development, of which one was interpreted as linear debris and one item of debris had an associated magnetic anomaly. None of these items of debris were located within 100 m of the Fotla subsea development (Gardline, 2024).

A total of 39 magnetic anomalies were identified within the site survey area, of which 31 were associated with the PL815: 24” Bruce to Forties Unity Gas Condensate pipeline. Two magnetic anomalies were associated with Well 22/01B-12, one with Well 22/01A-4 and one was associated with an item of debris identified at seabed. The remaining four magnetic anomalies identified have no visible SSS contact associated with them and as such may represent buried debris (Gardline, 2024).

The SSS data generally showed seabed reflectivity to be homogeneous along the pipeline route, with pockmarks and numerous trawl scars. The largest and deepest trawl scars were identified on the bathymetry and numerous smaller trawl scars were interpreted from the SSS data (Gardline, 2024).

Pockmarks have been previously reported as present within the proposed development area (Fugro, 2020; JNCC, 2018a). The 2023 survey for the Fotla field development (Gardline, 2024) noted that pockmarks were present across the survey site and along the pipeline route. The closest pockmark to the Fotla manifold is 185 m to the south (Gardline, 2024). No methane-derived authigenic carbonate (MDAC) structures are associated with the pockmarks (Gardline, 2024).

Figure 5.6 presents the distribution of seabed features identified from the geophysical survey in the area of interest.

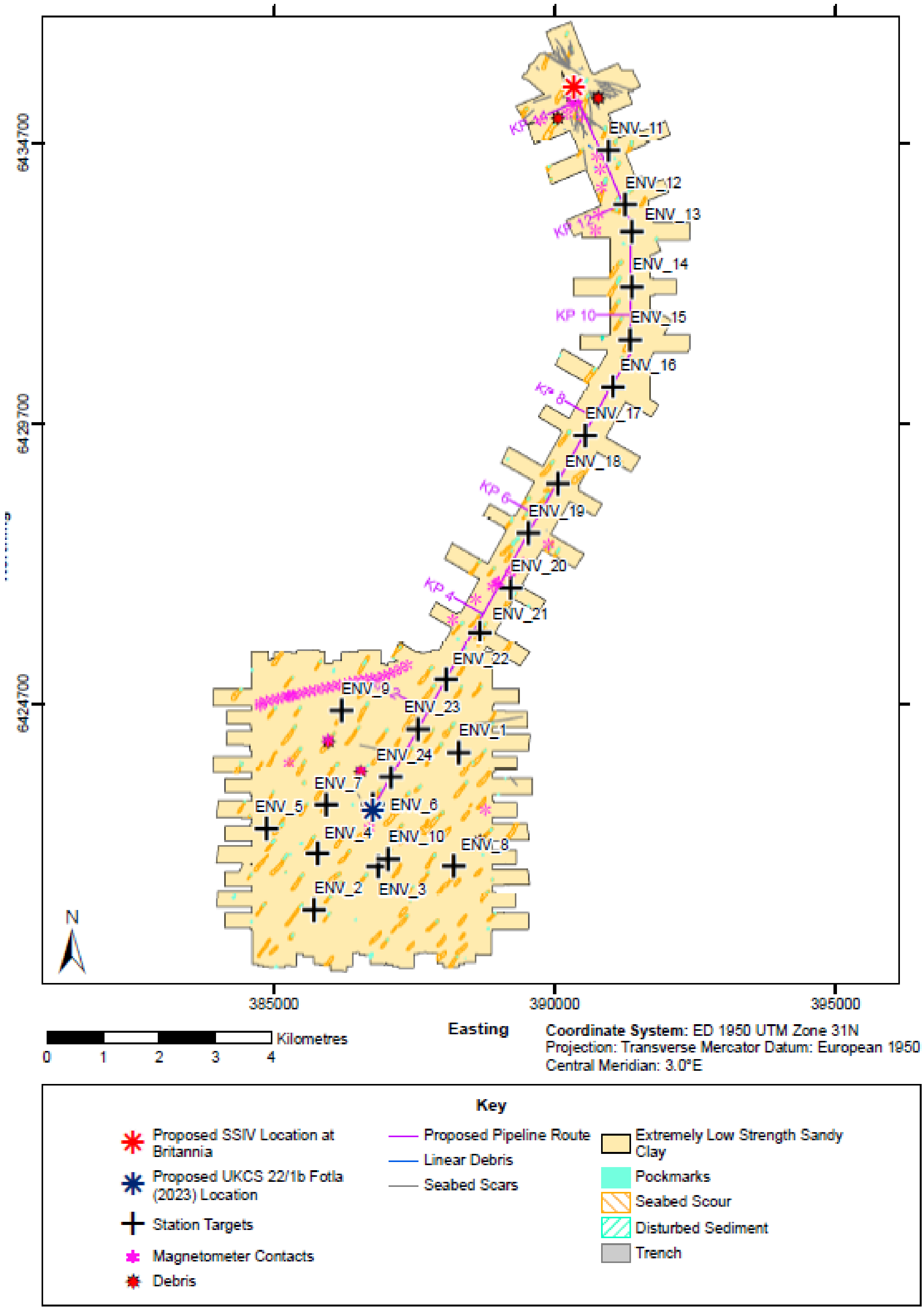


Figure 5.6: Seabed features and side scan sonar mosaic, Fotla field and pipeline route (Gardine, 2024)

5.2.4 Sediment Organic Content, Hydrocarbons and Metals

This section presents a comparison of previously obtained data (from Fotla and Alba) for sediment organic content, hydrocarbons and metal concentrations with background levels for the CNS. The stations sampled in 2023 at Fotla were separated to 'infield' (stations ENV_1 to ENV_10, ENV_23 and ENV_24 as shown in Figure 5.7) and 'pipeline' (stations ENV_11 to ENV_22) to detect potential influence (if any) from nearby infrastructure on marine sediments. It should be noted that during the 2019 survey at Fotla, only five stations were sampled (located in the vicinity of 'infield' stations), and four stations were sampled during the Alba survey (Fugro, 2015). Due to the limited number of stations sampled in 2014 and 2019, any direct comparisons between different surveys should be treated with caution.

5.2.4.1 Nutrients

Total organic matter (TOM) is a primary food source for benthos and plays a role in partitioning of contaminants in sediments (Trannum et al., 2006). Mean TOM content at the Fotla field was comparable between infield and pipeline stations in 2023 (Table 5.2) but were higher than the 95th percentile value recorded for the CNS, as presented by United Kingdom Offshore Operators Association (UKOOA) (2001). The mean TOM values in 2023 (Gardline, 2023) were approximately twice the mean TOM value obtained in 2019 (Fugro, 2020) from the stations sampled in the vicinity of the proposed Fotla wells as well as the Alba field (Fugro, 2015), potentially indicating input of nutrients from nearby infrastructure.

Total organic carbon (TOC) refers to the total amount of carbon present in organic compounds, serving as a key indicator of water quality and organic matter pollution. Mean TOC was broadly comparable between different surveys indicating broadly homogenous conditions at both the proposed well locations and along the pipeline route to Britannia (Table 5.2).

Table 5.2: Sediment nutrient concentrations

Survey	Level	TOM [%]	TOC [%]
Fotla 2023 (Gardline, 2024) Infield*	Minimum	5.90	0.55
	Maximum	9.20	1.13
	Mean	7.67	0.77
	SD	0.88	0.16
Fotla 2023 (Gardline, 2024) Pipeline*	Minimum	5.60	0.76
	Maximum	9.50	1.15
	Mean	7.53	0.93
	SD	1.54	0.14
Fotla 2019 (Fugro, 2020) Pipeline	Minimum	2.90	0.48
	Maximum	4.05	0.62
	Mean	3.25	0.56
	SD	0.48	0.05
Alba 2014 (Fugro, 2015)	Minimum	3.31	0.78
	Maximum	3.72	1.04
	Mean	3.50	0.92
	SD	0.17	0.11
Central North Sea (UKOOA, 2001) †	**Mean**	**1.63**	-
	95th Percentile	**4.48**	-

Notes:
SD = Standard Deviation
TOM = Total organic matter
TOC = Total organic carbon
* = Infield stations sampled in 2023 included ENV_1 to ENV_10, ENV_23 and ENV_24, whereas Pipeline includes all rest of stations.
† = Mean and 95th percentile estimated from data reported at stations greater than 5 km from nearest platform in the central North Sea from 1975 to 1995 (UKOOA, 2001)

Key	Below CNS background mean	Above CNS background mean	Above CNS background 95th percentile

5.2.4.2 Hydrocarbons

Site specific surveys suggest a trend of increasing total hydrocarbon (THC) concentrations over time (Table 5.3; Gardline, 2024; Fugro, 2015; 2020). Mean THC for both infield and pipeline stations sampled in 2023 were nearly five times higher than 2019 values and exceeded the respective mean background UKOOA concentrations for the CNS (UKOOA, 2001). Similar temporal trends for other hydrocarbon parameters, such as unresolved complex mixture (UCM) and total polyaromatic hydrocarbon (PAH) were also observed. Mean total PAH levels were higher than the respective mean background UKOOA concentrations for the CNS but below the 95th percentile (UKOOA, 2001) indicating no significant adverse effect on local benthos (Kjeilen-Eilertsen et al., 2004; UKOOA, 2002; 2005).

Spatial variability of hydrocarbon concentrations was low between all stations sampled in 2023 (Gardline, 2024), indicating a broadly even influence of hydrocarbons across both infield and pipeline stations gas chromatography analysis, indicating hydrocarbon origins to include terrestrial plant sources and highly weathered and biogenic material (McDougall, 2000).

Table 5.3: Sediment hydrocarbon concentrations

Survey	Level	THC	UCM	NPD	Total PAH
Fotla 2023 (Gardline, 2024) Infield*	Minimum	15.1	9.8	0.033	0.190
	Maximum	23.4	19.1	0.089	1.035
	Mean	18.6	14.7	0.053	0.346
	SD	2.21	2.25	0.013	0.220
Fotla 2023 (Gardline, 2024) Pipeline *	Minimum	14.3	11.00	0.050	0.258
	Maximum	26.3	21.8	0.082	0.489
	Mean	19.6	15.8	0.061	0.368
	SD	3.53	3.15	0.009	0.064
Fotla 2019 (Fugro, 2020)	Minimum	2.7	1.8	<0.012	<0.082
	Maximum	4.8	3.3	0.020	0.128
	Mean	3.6	2.5	0.015	0.100
	SD	0.77	0.55	0.003	0.018
Alba 2014 (Fugro, 2015)	Minimum	8.90	6.40	0.055	0.259
	Maximum	16.00	13.10	0.071	0.323
	Mean	11.53	8.85	0.063	0.295
	SD	3.27	3.05	0.007	0.029
Central North Sea (UKOOA, 2001) †	**Mean**	**9.51**	**-**		**0.233**
	95th Percentile	**40.10**	**-**	**-**	**0.736**

Notes:
SD = Standard Deviation
THC = Total hydrocarbon content
UCM = Unresolved complex mixture
NPD = Naphthalene, phenanthrene/anthracene and dibenzothiophene
Total 2 to 6 ring PAH = Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH), including alkyl homologues
Concentrations expressed as µg/g dry weight sediment
* = 'Infield' stations sampled in 2023 included ENV_1 to ENV_10, ENV_23 and ENV_24, whereas 'Pipeline' includes all of the rest of stations
† = Mean and 95th percentile estimated from data reported at stations greater than 5 km from nearest platform in the central North Sea from 1975 to 1995 (UKOOA, 2001).

Key	Below CNS background mean	Above CNS background mean	Above CNS background 95th percentile

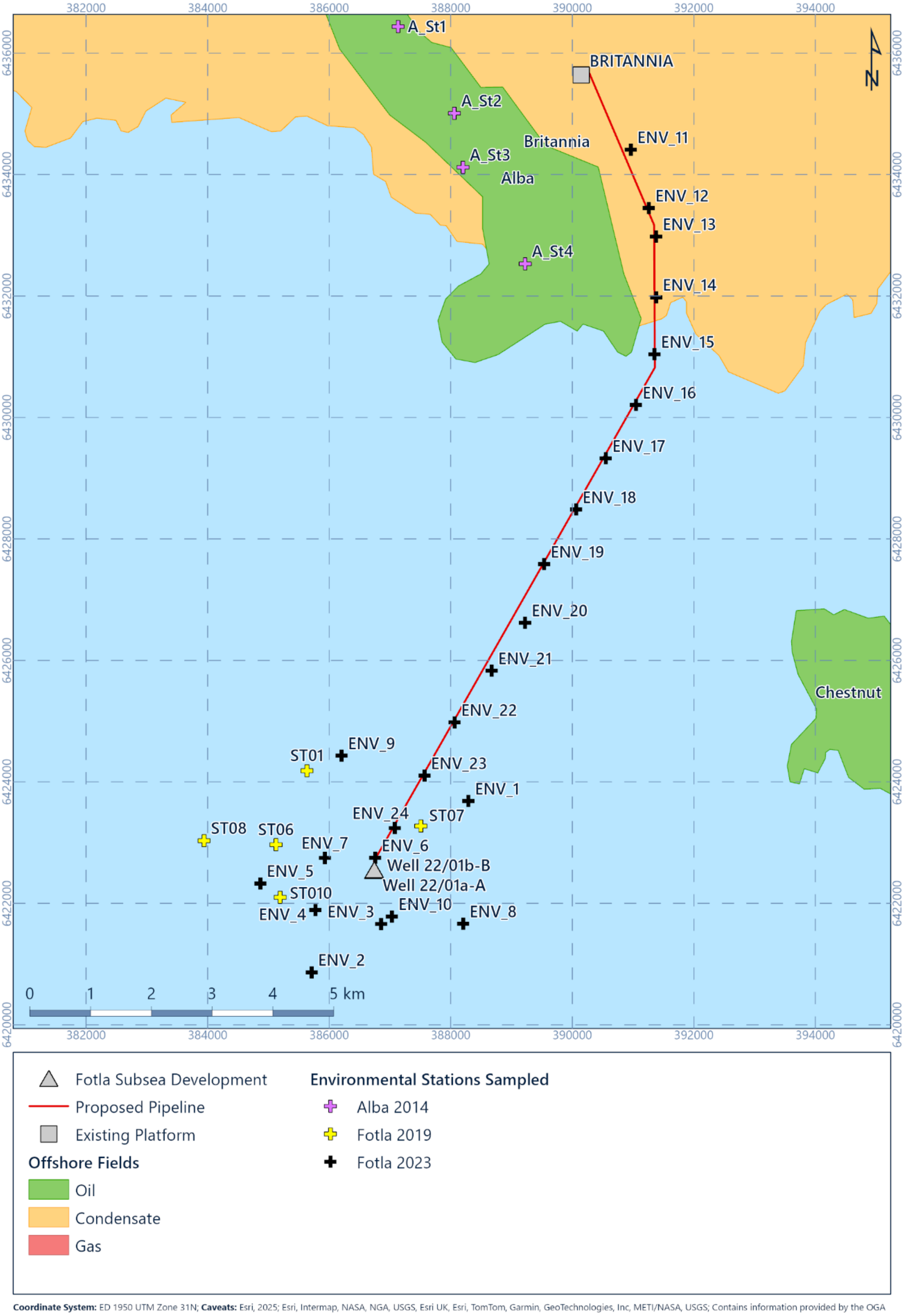


Figure 5.7: Environmental stations previously sampled in 2014, 2019 and 2023 (Fugro, 2015; Fugro, 2020; Gardline, 2023)

5.2.4.3 Heavy Metals

Heavy metal concentrations recorded in 2023 (Table 5.4; Gardline, 2024) are typical of background for sediments near to historic oil and gas exploration infrastructure. No notable differences were observed between infield and pipeline stations at Fotla indicating broadly homogenous heavy metal content in sediments across the area. Most metals except for of aluminium, arsenic, barium (fusion), cadmium, mercury and lithium exceeded their respective CNS background UKOOA mean concentrations (UKOOA, 2001). Mean concentrations for iron exceeded the 95th percentile for the CNS in both infield and pipeline areas. None of the mean metals concentrations exceeded the 'Effects Range Low' (ERL; OSPAR, 2014). Adverse effects on organisms are rarely observed when concentrations are below the ERL value (Long et al., 1995).

Comparison to previously obtained data (Table 5.4) cannot be undertaken due to different methodologies utilised to obtain the results, but nevertheless they are presented against their respective UKOOA levels for the particular extraction method followed. A broadly similar representation was observed to the latest survey results, with most of the metals reported in 2020 (Fugro, 2020) and 2014 (Fugro, 2015) exceeding their mean UKOOA or 95th percentile concentrations but not the ERLs.

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Table 5.4: Sediment metal concentrations from collated survey data

Survey	Level	Al	As	Ba	Ba*	Cd	Cr	Cu	Fe	Hg	Li	Ni	Pb	V	Zn
Fotla 2023 (Gardline, 2024) Infield†	Min	33,200	3.60	443	300	0.05	28.8	4.2	9,530	<0.01	15.9	10.8	12.6	27.4	22.3
	Max	46,300	5.20	665	700	0.10	55.8	7.6	16,100	<0.01	28.3	21.0	17.4	50.5	40.4
	Mean	39,217	4.37	543	583	0.07	38.3	5.6	12,328	-	20.9	14.7	15.2	36.7	29.1
	SD	4,009	0.57	59	111	0.02	7.0	0.9	1,781	-	3.34	2.64	1.41	6.16	4.72
Fotla 2023 (Gardline, 2024) Pipeline†	Min	36,700	4.10	419	500	0.07	41.1	5.40	11,700	<0.01	19.7	14.7	14.1	38.4	27.6
	Max	49,800	6.20	691	800	0.10	56.0	8.00	17,400	<0.01	30.5	21.8	18.7	53.8	40.0
	Mean	44,017	4.85	562	617	0.08	47.5	6.58	14,550	-	24.9	17.8	16.3	45.2	33.5
	SD	3,755	0.59	72	94	0.01	5.4	0.87	1,864	-	3.31	2.37	1.37	4.86	4.22
Central North Sea(UKOOA, 2001)#	**Mean**	-	-	**348.7**		**0.76**	**23.86**	**6.32**	**7,333.82**	**0.17**	-	**11.5**	**12.6**	**21.52**	**21.3**
	95th Percentile	-	-	**720**		**1**	**54**	**18**	**11,960**	**0.58**	-	**21.8**	**26.8**	**41**	**43.4**
Fotla 2019 (Fugro, 2020)‡	Min	8,850	2.64	259	0.08	0.08	20.1	2.64	9130	<0.04	-	9.98	7.32	24.2	19.7
	Max	11,200	3.46	322	0.08	0.08	24.6	3.54	11,000	0.0745	-	12.6	9.02	29.5	24.1
	Mean	10,200	3.04	295	-	0.08	22.4	3.01	9,940	-	-	11.1	8.08	27.2	21.6
	SD	876	0.374	27.2	-	-	1.94	0.412	714	-	-	1.44	0.651	1.91	1.79
Alba 2014 (Fugro, 2015)‡	Min	4,740	2.5	318	-	<0.1	17.1	6.9	-	<0.01	-	17.3	10.6	14.6	30.9
	Max	5,380	3.2	1,460	-	<0.1	20.3	7.6	-	<0.01	-	18.7	11.1	17	34.2
	Mean	5,080	2.9	669	-	-	18.5	7.1	-	-	-	17.8	11.1	15.7	33.1
	SD	263	0.3	531	-	-	1.3	0.4	-	-	-	0.6	0.4	1.1	1.5
Central North Sea (UKOOA, 2001)+	**Mean**	-	-	**178.20**	-	**0.03**	**9.13**	**2.41**	**4,752.22**	**0.03**	-	-	-	**14.9**	**13.48**
	95th Percentile	-	-	**523.20**	-	**0.12**	**31.04**	**6**	**11,160**	**0.12**	-	**19**	**16.7**	**31.3**	**32.59**
CEMP Assessment Criteria	**ERL**	-	-	-	-	**1.2**	**81**	**34**	-	**0.15**	-	-	**47.0**	-	**150**

Survey	Level	Al	As	Ba	Ba*	Cd	Cr	Cu	Fe	Hg	Li	Ni	Pb	V	Zn
(OSPAR, 2014)															

Notes:
Concentrations expressed as µg/g dry weight sediment
Al = Aluminium As= Arsenic Ba = Barium Cd = Cadmium Cr = Chromium Cu = Copper Fe = Iron Hg = Mercury Li = Lithium Ni = Nickel
Pb = Lead V = Vanadium Zn = Zinc
SD = Standard Deviation
ERL = Effect Range Low
* = Obtained by fusion
† = Metals obtained by hydrofluoric acid digestion
‡ = Metals obtained by aqua-regia digestion
# = Mean and 95th percentile estimated from data reported at stations greater than 5 km from nearest platform in the central North Sea from 1975 to 1995 (UKOOA, 2001) for hydrofluoric acid digestion
+ = Mean and 95th percentile estimated from data reported at stations greater than 5 km from nearest platform in the central North Sea from 1975 to 1995 (UKOOA, 2001) for aqua-regia digestion

Key:	Below CNS background mean	Above CNS background mean	Above CNS background 95th percentile	Above ERL

5.3 Biological Environment

5.3.1 Plankton

Plankton consists of microscopic plants (phytoplankton) and animals (zooplankton), including the larval stages of fish and many bottom living animals which drift with the ocean currents. Plankton abundance and distribution is strongly influenced by water depth, tidal mixing, nutrient and light availability, salinity and temperature along with other environmental factors.

During spring, an increase in day length and temperature, coupled with the supply of nutrients released during winter mixing of the water column, results in the rapid growth of the phytoplankton population (Drinkwater et al., 2003). This phytoplankton bloom is followed by a similarly rapid increase in the zooplankton population, which prey upon phytoplankton. Zooplankton abundance is typically at its highest between May and September, providing an important source of food for a range of fish species (Johns & Reid, 2001).

The phytoplankton community in the region is dominated by the dinoflagellate genus *Ceratium*, along with *Thalassiosira* spp. and *Chaetoceros* spp diatoms (DECC, 2016), especially from June to October due to the inflow of warm and nutrient rich waters (McQuatters-Gollop et al., 2007).

Zooplankton is dominated by calanoid copepods, with *Paracalanus*, *Pseudocalanus* and larval stages of *Calanus* particularly abundant (DECC, 2016). The larger zooplankton, known as megaplankton, include euphausiids (krill), *Acartia* and decapod larvae Species richness is typically higher in the northern North Sea compared to the southern North Sea and also exhibits greater seasonal variability (Lindley & Batten. 2002).

There has been a significant decline in primary production in the North Sea over the past 25 years the cause of which is liked to warmer sea surface temperatures and reduced riverine nutrient inputs. Coupled with this are changes in zooplankton abundance and fish recruitment within the North Sea (Capuzzo et al., 2018).

5.3.2 Benthos

5.3.2.1 Regional context

Benthos is the term used for the animals, algae and higher plants associated with the seabed, although the latter two are generally limited to depths of less than 50 m by their light requirement. The benthos of soft seabed sediments consists mainly of animals that burrow into the sediment or form tubes in it, and collectively referred to as infauna.

The North Sea region has been the subject of a range of studies seeking to define patterns in the distribution of benthic communities, particularly infauna, and their relationships to key ecological influences such as water depth and seabed sediment type (Greenstreet, 2007). This includes a series of surveys co-ordinated by the International Council for the Exploration of the Sea (ICES) which developed broad classifications of benthic communities e.g., Künitzer et al. (1992). The highest overall abundance and biomass of infaunal invertebrates was observed in the southern North Sea, however, species richness and diversity tended to be higher in the northern and central North Sea (Greenstreet et al., 2007). Classification analyses indicate that the working area falls within a broad area where the fauna is characterised by the presence of the polychaetes such as *Glycinde nordmanni*, *Ophelia borealis*, and *Glycera lapidum* and the *Thyasira* species complex of bivalves (Künitzer et al., 1992).

A subsequent ICES co-ordinated North Sea Benthos Project (NSBP) conducted sampling of infaunal communities throughout the North Sea in 2000, which repeated the studies collated by Künitzer et al. (Rees et al., 2007). Multivariate analysis was used to divide stations into discrete infaunal assemblages. The assemblage of most relevance to the working area was found throughout the northern and central North Sea in fine and muddy sands at depths greater than 50 m. This community was characterised by the polychaete *Paramphinome jeffreysii* and was dominated by polychaete species such as *Myriochele spp* and *Spiophanes spp* and the burrowing brittlestar *Amphiura filiformis*. 'Seapens and burrowing megafauna communities' *P. phosphorea* and *V. maribilis* were observed during the survey and burrows were reported at 'common' abundance across the survey area, but did not form a prominent feature on the seabed. *Nephrops* and sea urchin (*Gracilechinus acutus)* were the most frequently observed taxa. Other less common taxa included sea pen (*Pennatula phosphorea*), hermit crab (*Pagurus bernhardus*), sea mouse (*Aphrodita aculeata*), anemone (*Actiniaria,* including *Hormathia digitata*), shrimp (*Caridea*), and crab (*Lithodes maja*) were observed.

An EBS was conducted along a proposed water injection pipe route between the Alba Northern Platform and the Sadie manifold, UKCS Block 16/26 in 2014 (Fugro, 2015). Seabed sediments comprised mostly mud (~62 - 67 %) and sand (~30 - 37 %) and the habitat 'Seapens and burrowing megafauna in circalittoral fine mud' (SS.SMu.CFiMu.SpnMeg) was identified with epifauna being sparse. The epifauna observed included starfish *Astropecten irregularis*, a hermit crab (*Pagurus prideaux*) with commensal cloak anemone (*Adamsia carciniopados*), sea pens *Virgularia mirabilis* and *Pennatula phosphorea* and the burrowing anemone *Cerianthus lloydii*. Heart urchins (Spatangoida), brittlestars (*Ophiura ophiura*), polychaetes (Nephtyidae and Sabellidae) and crustaceans (Amphipoda) were also observed within sieved grab samples. Infauna at all stations was moderately diverse, with polychaetes dominating and *Paramphinome jeffreysii* being the most abundant and dominant species, followed by the mollusc *Adontorhina similis* and the polychaete *Levinsenia gracilis* (Fugro, 2015).

5.3.2.2 Site specific data

A site hazard investigation, including an EBS at the Fotla area (in the vicinity of the 'infield' stations sampled later on in 2023; Figure 5.7), was undertaken in 2019. The habitat identified was classified as the European Nature Information System (EUNIS) biotope '*Paramphinome jeffreysii, Thyasira spp. and Amphiura filiformis in offshore circalittoral sandy mud*' (A5.376) and sands and fines were reported to almost even quantities (mean of 52.09 %

and 47.91 % respectively). (Fugro, 2020). Characterising species and component biotopes of the Priority Marine Feature (PMF) 'Offshore deep-sea muds' and United Kingdom Biodiversity Action Plan (UKBAP) priority habitat 'Mud habitats in deepwater' were identified. Elements of the PMF 'burrowed mud' and the OSPAR Listed threatened and/or declining species and habitat 'Sea pens and burrowing megafauna communities' were observed which is in agreement with the previous survey at the Alba field. Burrows were reported at 'common' abundance across the survey area, but did not form a prominent feature of the seabed.

The infaunal community of the Fotla area in 2019 was broadly homogeneous. The most abundant and dominant taxa were the polychaetes *Ampharete falcata*, *Paramphinome jeffreysii* and the mollusc *Adontorhina similis*, which are species observed previously in the wider region (Alba field) and typical of soft sediments found in the wider CNS (Fugro, 2020). Juvenile ocean quahog *Arctica islandica* was present in all stations sampled. The ocean quahog has been included on the Convention for the Protection of the Marine Environment and the North-east Atlantic (OSPAR) list of 'Threatened and/or Declining Habitats and Species' (OSPAR, 2023), and as PMF (NatureScot, 2020).

The epibenthic fauna observed during the survey was sparse and included slender sea pens (*Virgularia mirabilis*), Norway lobster (*Nephrops norvegicus*) and urchin (*Gracilechinus acutus*). Less common taxa included the phosphorescent sea pen (*Pennatula phosphorea*), hermit crab (*Pagurus bernhardus*), sea mouse (*Aphrodita aculeata*), anemone (Actiniaria, including *Hormathia digitata*), shrimp (Caridea) and crab (*Lithodes maja*). Pelagic species included krill (Euphausiacea) and fish, specifically haddock (*Melanogrammus aeglefinus*), hagfish (*Myxine glutinosa*), monkfish (*Lophius* sp.), Norway pout (*Trisopterus esmarkii*, which is a PMF) and flatfish (Pleuronectiformes, including *Glyptocephalus cynoglossus*).

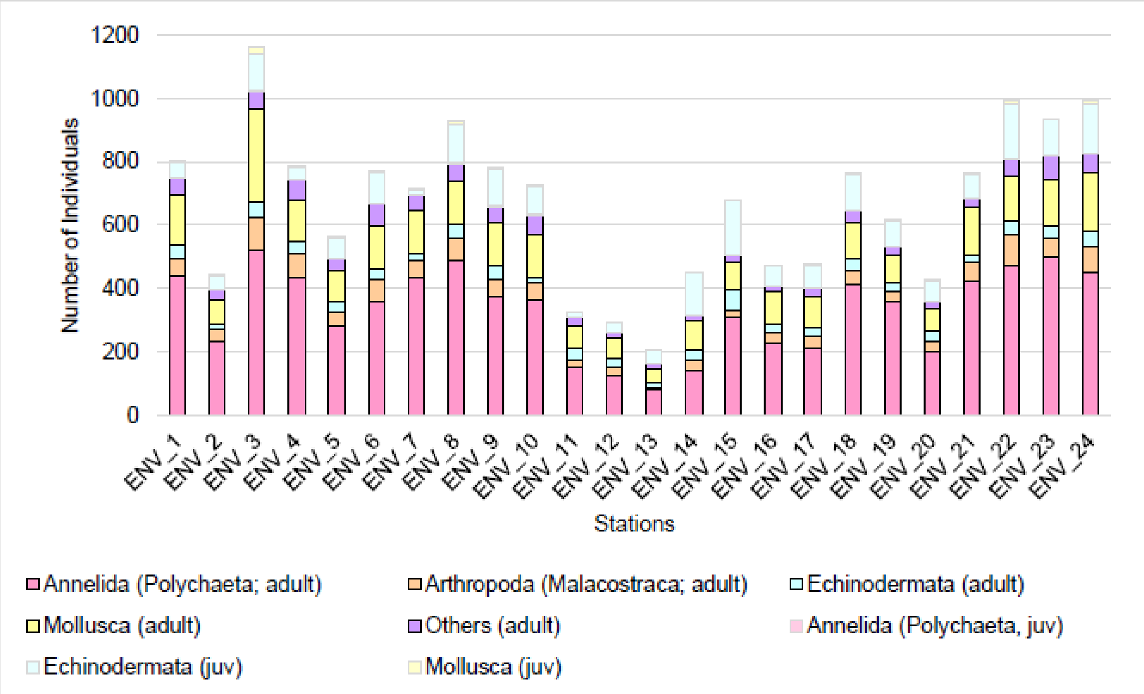
An EBS at Fotla field covering the proposed well locations and the pipeline route to Britannia was carried out in 2023 (Gardline, 2024) and the results were very similar to those observed in 2019 (Fugro, 2020). Sediments comprised sand and mud (mean of 44.7 % and 55.3 % respectively) with biotopes assessed as MD621: Faunal communities on Atlantic offshore circalittoral mud (a classification of higher level to MD6218) and MD6218: *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in Atlantic offshore circalittoral sandy mud due to some differences in the macrofauna. The observed epifauna obtained from photographic data and grab sieved data included sea pens (*Virgularia mirabilis* and Pennatulidae), Echinodermata (Echinoidea, Ophiuroidea), Mollusca (Scaphopoda), Arthropoda (Caridea) (Gardline, 2024). Pelagic species included Chordata (Actinopterygii), hagfish (*Myxine glutinosa*) and flatfish (Pleuronectiformes). Burrows were observed as 'frequent' in the area and the therefore the OSPAR Listed threatened and/or declining species and habitat 'Sea pens and burrowing megafauna communities' was considered present.

In terms of the infauna observed, the macrofauna within the Fotla field area were broadly homogeneous as previously reported (Fugro, 2020). The most abundant and dominant taxa were annelids, followed by molluscs and arthropods. *Paramphinome jeffreysii* accounted for 48 % of the total annelid abundance and 28 % of the overall abundance observed at all stations sampled (Gardline, 2024). The species was the most abundant taxon across all of the stations sampled. Macrofaunal diversity appeared slightly higher in the 'infield' area (in the vicinity of the proposed well locations) compared to the 'pipeline' stations found further north and closer to Britannia infrastructure (Figure 5.8).

Juvenile ocean quahog was also observed at Fotla during the 2023 (Gardline, 2024), similar to the 2019 survey (Fugro, 2020). Ocean quahog is a designated species of the Norwegian Boundary Sediment Plain Nature Conservation Marine Protected Areas (NCMPAs), located approximately 30 km to the east, and the East of Gannet and Montrose Fields NCMPA, located approximately 50 km to the south.

Overall, within the Fotla field a sparse epifaunal community is present with sea pen species and burrows being mostly observed on the seabed. The infauna is dominated by polychaetes, with *Paramphinome jeffreysii* being the most characteristic species. Hagfish (*Myxine glutinosa*) and flatfish (Pleuronectiformes) are some of the most commonly observed pelagic species. The OSPAR Listed habitat 'Sea pens and burrowing megafauna communities', as well as the ocean quahog (PMF and OSPAR listed) are the features of conservation importance.

a) Individuals



b) Taxa

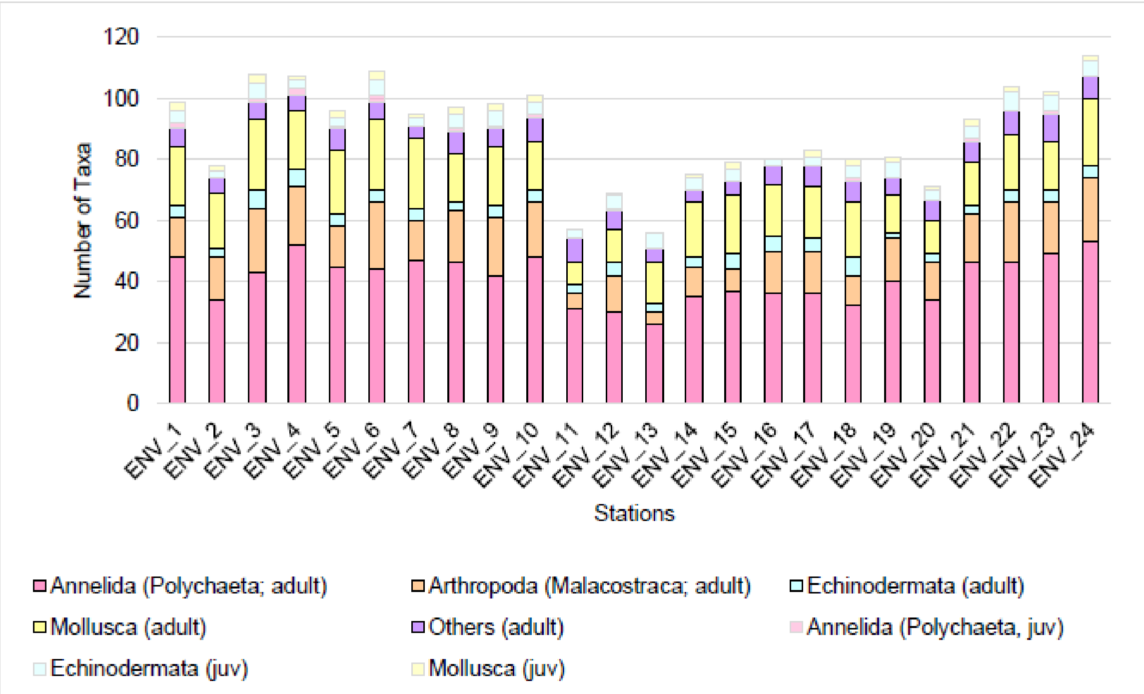


Figure 5.8: Number of Individuals and number of taxa for stations sampled in 2023 (Gardline, 2024)

5.3.3 Fish and Shellfish

Extensive survey programmes have been used to predict the broad distribution of spawning grounds for a range of commercially important fish and shellfish species in UK waters (Coull et al., 1998). For many of these species, this has been supplemented by more recent data collation and reviewed by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) (Ellis et al., 2012) and Marine Scotland (Aires et al., 2014), the latter with specific reference to the distribution of juvenile individuals. Spawning areas are not rigidly fixed, changing with the prevailing environmental conditions. Therefore, the distribution of spawning grounds given here is based on current knowledge but may be subject to change.

The majority of fish species release large numbers of eggs directly into the water column, over a wide area. Fish hatch quickly from their eggs, and many remain in the water column as larvae. The dispersal of fish eggs and larvae is largely dependent upon water circulation patterns. However, as fish develop, they tend to concentrate in localised nursery areas, either within the water column or on the seabed, where feeding opportunities and protection from predators are greatest. Species such as Norway pout and cod (*Gadus morhus*) spawn in the water column were the eggs and larvae are dispersed by currents.

The Fotla field development falls within spawning grounds for cod, *Nephrops* and Norway pout. Cod spawning has been found to be affected by seabed conditions, the species selecting coarse sand and avoiding areas of very high tidal flow (González-Irusta & Wright, 2015). Cod spawning occurs from January to April, with peak spawning occurring between February and March (Ellis et al., 2012). Studies have described cod spawning in vicinity of the Fotla field development as 'recurrent', with a high mean abundance of spawning in the area (González-Irusta & Wright, 2015).

Nephrops spawn throughout the year (Coull et al., 1998; Ellis et al., 2010). A more recent publication reported that *Nephrops* spawn in September and carry their eggs under their tails until they hatch in April and May, whereupon larvae develop in the plankton before settling to the seabed (Barreto et al., 2017). After a relatively short pelagic phase juvenile *Nephrops* settle on the bottom and construct a burrow. *Nephrops* was observed from seabed imagery across eight stations within the Fotla field in 2023 (Gardline, 2024).

Spawning grounds for haddock, herring (*Clupea harengus*), lemon sole (*Microstomus kitt*), mackerel (*Scomber scombrus*), plaice (*Pleuronectes platessa*), sandeel (Ammodytidae) and whiting (*Merlangius merlangus*) are also present in the wider area (Coull et al., 1998; Ellis et al., 2012).

The proposed area for development lies within the nursery grounds of anglerfish (*Lophius piscatorius*), blue whiting (*Micromesistius poutassou*), cod, European hake (*Merluccius merluccius*), herring, ling (*Molva molva*), mackerel (North Sea), *Nephrops*, plaice, sandeels, spotted ray (*Raja montagui*), spurdog (*Squalus acanthias*), and whiting (Coull et al., 1998; Ellis et al., 2010). The proposed area for development lies within a high intensity nursing area for cod. It should, however, be noted that the prevailing water temperature and availability of food can alter the exact position of these areas from year to year.

Data generated by Marine Scotland (Aires et al., 2014) uses species distribution modelling to predict where aggregations of 0-group fish (fish in the first year of their life) may be found based on environmental information and catch records. The data indicates that hake and monkfish have a moderate probability (21 % - 40 %) of being present in the area of the Fotla field development in aggregations of 0-group fish. Other fish species, such as blue whiting, haddock, herring, mackerel, Norway pout, and whiting, have a low probability (1 % -20 %) of forming aggregations of juveniles in the area (Aires et al., 2014).

Figure 5.9 and Table 5.5 summarise the spawning and nursery periods for fish within the region. In addition to this, Table 5.5 summarises the probability for the presence of Year 0 group fish within the area of the Fotla field development. For many species, peak spawning activity occurs between January and April (BEIS, 2022), although several species spawn over a longer period.

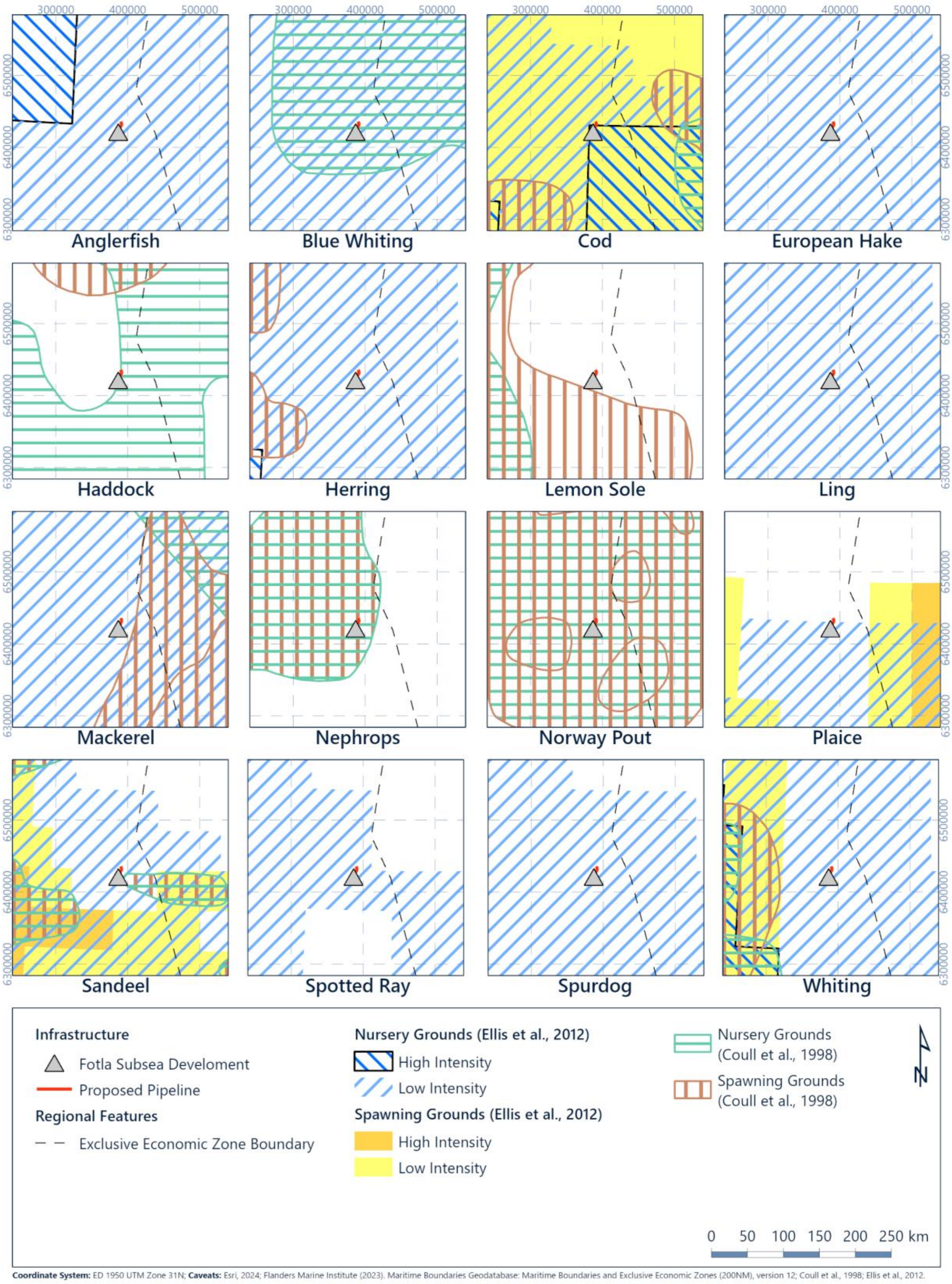


Figure 5.9: Fish spawning and nursing areas in the area of the Fotla field development

Table 5.5: Fish spawning and nursery grounds previously reported in the vicinity of proposed Fotla field development area

Species	J	F	M	A	M	J	J	A	S	O	N	D	Year 0
Anglerfish/ Monkfish	N	N	N	N	N	N	N	N	N	N	N	N	Moderate
	Monkfish are common in coastal waters around Britain and Ireland. Adult monkfish make seasonal migrations to winter deep-water spawning grounds, with spawning occurring at depths of 150 m to 1,100 m during first six months of the year. In general, monkfish eggs are released in a large ribbon of jelly which float on the surface, hatching during February to April.												
Blue whiting	N	N	N	N	N	N	N	N	N	N	N	N	Low
	Blue whiting is a meso-pelagic species, usually found in shoals 30 m to 400 m from the surface in water between 150 m to 3,000 m deep. Blue whiting shoals move to the surface at night. They are widely distributed across the north-east Atlantic. The species is very abundant in deep waters to the north of Orkney in February, and spawning takes place between February and April along the continental slope to the west of Scotland, the shelf edge west of Ireland and Hebrides, at depths of 300 m to 600 m.												
Cod	SN	SN*	SN*	SN	N	N	N	N	N	N	N	N	-
	Cod occur throughout the northern and central areas of the North Sea. Cod spawn all over the North Sea, although there are several areas where spawning is concentrated, particularly in the northern North Sea, the central North Sea around the Dogger Bank and in the southern North Sea and German Bight.												
European hake	N	N	N	N	N	N	N	N	N	N	N	N	Moderate
	Young hake are frequently found in the Northern North Sea and will remain in the North Sea until they are 2 years old. They will then move into deeper waters. From July to October, large mature fish migrate into areas of the northern and central North Sea to spawn at 80 m to 200 m depth. Hake distribution has expanded into the CNS with hake ages 3+ most commonly found in that part of the North Sea during the summer months.												
Haddock	N	N	N	N	N	N	N	N	N	N	N	N	Low
	Haddock occurs mainly in the northern and central areas of the North Sea but can be found as far south as the Humber estuary. At the beginning of the 20th century, they were also abundant in the southern North Sea. Adults occur mainly at depths ranging from 75 m to 200 m. Haddock individuals were observed across multiple stations during the 2023 survey (Gardline, 2024)												
Herring	N	N	N	N	N	N	N	N	N	N	N	N	Low
	Herring are found throughout the shelf waters and spawn in relatively shallow, well oxygenated, water in areas of coarse sediment. Sub-populations of North Sea herring spawn at different times of year in localised areas												
Ling	N	N	N	N	N	N	N	N	N	N	N	N	-
	Ling is widespread, but not abundant, in the deeper waters of the continental shelf. Their main spawning grounds occur in deeper waters to the north and west of the British Isles, between 4–7 years of age and between March and July.												
Mackerel (North Sea)	N	N	N	N	SN	SN	N	N	N	N	N	N	Low
	Two main stocks of mackerel occur in the north-east Atlantic, the western stock and the North Sea stock. The North Sea stock has been at a very low level for years due to high fishing pressure and poor recruitment. North Sea mackerel overwinter in the deep-water to the east and north of the Shetland Islands. In spring, they migrate south to spawn in the North Sea between May and August.												

Species	J	F	M	A	M	J	J	A	S	O	N	D	Year 0
Nephrops	SN	SN	SN	SN*	SN*	SN*	SN	SN	SN	SN	SN	SN	-
	Nephrops are mud burrowing animals and are limited in their distribution by the extent of suitable sediments which range from quite sandy mud to very soft mud. They do not migrate and spend their life in the area in which they settle as larvae. After hatching, the larval stage lasts 6 to 8 weeks, before settlement to the seabed.												
Norway pout	SN	SN*	SN*	SN*	N	N	N	N	N	N	N	N	Low
	Norway pout spawn in the water column between the months of January and May and the eggs and larvae are dispersed by currents.												
Plaice	N	N	N	N	N	N	N	N	N	N	N	N	-
	Plaice live on mixed substrates at depths up to 200 m, with older individuals generally found in deeper water. Plaice is found in greatest abundance in the southern North Sea. Plaice spawn throughout the shallower parts of the southern North Sea, including the Dogger Bank and the Southern Bight, with spawning taking place between December and March. Sandy, shallow bays on the coasts of England act as important nursery grounds for plaice, with juveniles moving further offshore as they mature.												
Sandeel	SN	SN	N	N	N	N	N	N	N	N	SN	SN	-
	Sand eels are a shoaling species which lie buried in the sand at night and hunt during the day. Spawning occurs throughout the North Sea, but especially near sandy sediments. Spawning usually takes place between November and February. Larvae hatch between February and April.												
Spotted ray	N	N	N	N	N	N	N	N	N	N	N	N	-
	Spotted ray live at depths of 100 m to 500 m in soft, sandy substratum, with juveniles often living in shallower areas. Rocky and sandy coastal areas provide nursery grounds for the species with frequent recordings around the entire British coastline, predominantly high in the South towards the English Channel. Spawning takes place between the months of February to July.												
Spurdog	N	N	N	N	N	N	N	N	N	N	N	N	-
	Spurdog or the 'spiny dogfish' is a benthopelagic species found in both inshore and offshore environments of the upper continental shelf. They are a viviparous species with complex seasonal migrations. Juveniles are recorded in high numbers in the Northern and Central North Sea, North-west Scotland, Celtic Sea and the northern Irish Sea.												
Whiting	N	N	N	N	N	N	N	N	N	N	N	N	Low
	Although it is one of the most abundant species in the North Sea, whiting in the North Sea spawns over a period of several months. In the south, the spawning season starts already in January, and in the north eggs and larvae have been observed as late as September. Juveniles can be found throughout the North Sea, particularly off the north-east coast of England.												
Key	S		Spawning ground			N		Nursery area		SN		Spawning and nursery	

Notes:
* = Indicates peak spawning period.
Sources: Bergstad & Hareide, 1996; Coull et al., 1998; DTI, 2001; Ellis et al., 2010: Ellis et al., 2012; Heino & Godoe, 2002; Hufnagl et al., 2013; IFCA, 2021; Institute of Marine Research, 2020; 2022; 2023; Jansen & Gislason, 2011; Marine Scotland, 2015; Regnier et al., 2018; Staby et al., 2018.

There are several fish species designated as European Protected Species (EPS) in the North Sea, but only a few of them can be found in its offshore waters: European sturgeon (*Acipenser sturio*), basking shark (*Cetorhinus maximus*), tope (*Galeorhinus galeus*), porbeagle (*Lamna nasus*), common skate (*Dipturus batis*) and angel shark (*Squatina squatina*). However, these are rarely present in these waters (DTI, 2001). Basking shark, tope, porbeagle, common skate and angel shark are likely to occur only in small numbers throughout the North Sea. The majority of the remaining fish species of conservation importance show a coastal distribution (DTI, 2001).

Spotted ray, Norway pout, ling, sandeels, whiting, cod, mackerel, herring, spurdog, anglerfish and blue whiting have been designated as PMFs (NatureScot, 2020). Cod, spurdog and spotted ray have also been included on the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2023).

The Norway pout, a PMF fish species, was observed within the survey area in 2019 (Fugro, 2020). This species is commonly observed within this area and the wider North Sea region. A monkfish was also observed during that survey. However, it could not be identified to species level from photographic data, therefore the presence of the PMF and UKBAP priority species *Lophius piscatorius* could not be definitively confirmed (Fugro, 2020).

Marine Directorate have not identified any 'period of concern' for drilling activities with respect to fish ecology within UKCS Blocks 22/1 and 16/26 (OPRED, 2022).

5.3.4 Cephalopods

There are several cephalopod species found in the waters around the British Isles. Among the most frequently recorded species within the northern and CNS are long-finned squids (Loliginids), short-finned squids (Ommastrephids), bobtail squids (Sepiolids) and the octopus *Eledone cirrhosa* (BEIS, 2022). Other species may occasionally be encountered in the region.

Cephalopods are short lived molluscs, characterised by rapid growth rates, and are important predators and prey in oceanic and coastal environments. Cephalopods are frequently seen as a major dietary component for many marine mammals and are landed from the area of the proposed Fotla field development (Marine Directorate, 2023). The global cephalopod population has expanded over the past six decades (Doubleday et al., 2017), with fast, adaptive cephalopod species increasing in abundance over a range of habitats (BEIS, 2022).

5.3.5 Elasmobranchs

The most abundant sharks found in UK waters are the lesser and greater spotted dogfish (*Scyliorhinus canicula* and *Scyliorhinus stellaris*), the spurdog and the tope. Dogfish exhibit a wide but patchy distribution in the North Sea (BEIS, 2022).

In the CNS, spurdog and tope shark are commonly observed elasmobranch species (Ellis et al., 2012). Additionally, several elasmobranch species, including spurdog, greater spotted dogfish, smooth-hounds (*Mustelus* sp.), thorny skate (*Amblyraja radiata*), cuckoo ray

(*Leucoraja naevus*), thornback ray (*Raja clavata*) and spotted ray, have been recorded during catches from four research vessel surveys between 1965 and 2005 in the wider region (Daan et al., 2005).

Both the spotted ray and spurdog have been identified as species which have nursery grounds within the proposed development area (Ellis et al., 2012) (see Figure 5.9). The spotted ray is a widespread and relatively abundant skate species which feed on crustaceans, polychaetes and fish. The species spawns between May and July (Ellis et al., 2012).

The spurdog occur on the continental shelf throughout the North Sea and is widespread within UK waters (Ellis, et al., 2012). They feed on crustaceans, cephalopods and fish, with peak spawning taking place between June and July. Spurdog has been designated as PMF (NatureScot, 2020) and it has also been included on the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2023), along with spotted ray and thornback ray.

5.3.6 Marine Mammals

5.3.6.1 Whales, Dolphins, and Porpoises

The regional waters of the CNS support several marine mammal species, whose distribution is governed primarily by water depth and availability of preferred food sources. Harbour porpoise (*Phocoena phocoena*) and white-beaked dolphin (*Lagenorhynchus albirostris*) are the most widespread and frequently encountered marine mammal species in the North Sea, occurring regularly throughout most of the year. Minke whales (*Balaenoptera acutorostrata*) are regularly recorded as a frequent seasonal visitor. Atlantic white sided dolphin (*Lagenorhynchus acutus*), Risso's dolphin (*Grampus griseus*), and killer whale (*Orcinus orca*) are also occasional visitors of the region (BEIS, 2022; Gilles et al., 2023; Hammond et al., 2021; Paxton et al., 2016; Waggitt et al., 2020).

The distribution and abundance of cetaceans in the wider regional context of the proposed Fotla field development area is summarised in Table 5.6 using data obtained during the Small Cetaceans in European Atlantic waters and the North Sea IV (SCANS IV) survey undertaken in the summer of 2022, which was the fourth international population survey of cetaceans in European Atlantic waters (Gilles et al., 2023). During the SCANS IV survey, the surveyed area was divided into 44 Blocks, positioning the Fotla field development in Block NS-G.

Table 5.6: Distribution and abundance of whales, dolphins, and porpoises in the Fotla field development area

Species	Cetacean Distribution and Abundance	Density (animals/km^2)
Harbour porpoise	The harbour porpoise is common in shelf waters of the North Sea. The species is the most abundant cetacean in the whole of the North Sea, but peak sightings vary considerably between sites. This species occurs in very small groups of up to three individuals.	1.0398
White-beaked dolphin	White-beaked dolphins occur only in the North Atlantic and are widely distributed year-round on the UKCS. Their distribution seems to be restricted by temperature, and they are seen particularly in the cooler waters of the western sector of the central and northern North Sea. They are most frequently observed between June and October. White-beaked dolphins are generally found in groups of less than ten individuals, although they have been observed in larger aggregations. They are mainly a pelagic species.	0.1051
Atlantic white sided dolphin	Atlantic white sided dolphins are found only in the North Atlantic, sharing most of their range with the white-beaked dolphin. They tend to occur more frequently in waters to the north and west of the UK and Ireland. This species is rare in the central and north eastern North Sea. White sided dolphins tend to form large groups of tens to hundreds of individuals and are mainly pelagic.	0.0024*
Risso's dolphin	Risso's dolphins are regarded as a pelagic species preferring deeper continental slope waters. However, most sightings around Scotland have occurred over the shelf at water depths up to 100 m. There are few records of Risso's dolphins from the central and southern North Sea with most sightings in the northern North Sea recorded between July and August. Risso's dolphins form groups of up to approximately ten individuals.	0.0094*
Minke whale	Minke whales appear to move into the North Sea at the beginning of May and are present until October. They occur throughout the northern and central North Sea, more frequently found in its western side. Minke whales are found mainly on coastal waters and on the continental shelf in water depths up to 200 m. These whales are generally seen singly or in pairs but can form aggregations of up to fifteen individuals when feeding.	0.0103
Killer whale	In UK waters this species is most common off northern and western Scotland but is rare in the central and southern North Sea. Most sightings offshore have been reported around large fishing vessels targeting pelagic species particularly between Shetland and Norway between November and March. The majority of UK sightings have been of individuals or groups of less than eight animals. Movements are often associated with the seasonal distribution of particular prey species.	-

Notes:
Species density is taken from data gathered during the SCANS IV survey from Block NS-G (Gilles et al., 2023).
Other sources: BEIS, 2022; BODC, 1998; Canning et al., 2008; Hammond et al., 2021; Reid et al., 2003; Waggitt et al., 2019.
*= Species not recorded in Block NS-G. The density for SCANS IV Block NS-E has been used for this species instead.
- = Species not sighted during aerial surveys at a sufficient rate to determine abundance and density estimates in the European Atlantic.

Recent studies, including Paxton et al. (2016), Waggitt et al. (2019) and Gilles et al. (2023), on marine mammal spatio-temporal presence and abundance, confirm the potential presence of harbour porpoise, minke whale, Atlantic white-sided dolphin, Risso's dolphin, white-beaked dolphin, and killer whale within the Fotla field development area, with harbour porpoise being most abundant, followed by white-beaked dolphin and minke whale. All other species are present in much lower numbers.

Cetacean presence and density in the immediate surroundings and within the Fotla field development area have been assessed through species distribution models at 10 km resolution and monthly scale, developed through the collation and standardisation of survey data collected in the North-East Atlantic between 1980 and 2018 (Waggitt et al., 2019), and have been summarised in Table 5.7.

Table 5.7: Density of species of cetaceans within and immediately surrounding the Fotla field development

Species	J	F	M	A	M	J	J	A	S	O	N	D
Harbour porpoise	3	3	3	3	3	2	2	2	2	2	2	3
Killer whale	3	3	3	3	3	3	3	3	3	3	3	3
Minke whale	3	3	3	3	3	3	3	3	3	3	3	3
Risso's dolphin	-	-	-	-	-	3	3	3	3	3	3	-
White-beaked dolphin	2	2	2	2	2	2	2	2	2	2	2	2
Key	-	Not present		3	Low		2	Moderate		1	High	

Notes:
Sources: Waggitt et al., 2019.

All cetaceans that occur in UK waters are protected under the European Commission (EC) Habitats Directive, transposed into UK law by the Conservation (Natural Habitats, &C.) Regulations 1994 (as amended) as well as The Conservation of Offshore Marine Habitats and Species Regulations 2017. Under these regulations, it is an offence to deliberately capture, kill or recklessly disturb any cetaceans. All cetacean species are listed on Annex IV of the Habitats Directive, whereby measures of protection are applied across their entire natural range within the EU and UK. Harbour porpoise is also listed on Annex II of the Habitats Directive, whereby core habitat areas receive protection via a UK Natura 2000 network of Special Areas of Conservation (SAC) and Special Protected Areas (SPA).

All the cetacean species which have been identified within, or in the vicinity of, the proposed Fotla field development area have been designated as PMFs (NatureScot, 2020). Harbour porpoise has also been included on the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2023).

5.3.6.2 Seals

Two species of seal, harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) are resident in Scottish waters. They are typically found in coastal waters shallower than 200 m.

The Fotla field development area lies approximately 197 km East of the Moray Firth Seals Conservation Area and approximately 215 km southeast of the Northern Isles Conservation Area, both designated for harbour and grey seals. The Ythan River mouth is the largest single haul-out site in Scotland (Morris et al., 2021), located on the Aberdeenshire coast and 190 km from the Fotla field and protected under the Protection of Seals (Designated Seal Haul-out Sites) (Scotland) Order 2014.

The grey and harbour seal are listed under Annex II of the EC Habitats Directive and have both been designated as PMFs in Scottish waters (NatureScot, 2020).

5.3.6.2.1 Grey Seal

Approximately 34 % of the world's population of grey seals breeds on the UK coastline. Of these, 70 % breed in Scotland, with main aggregation sites located in the Western Isles, Orkney, and fast-growing colonies in the CNS (SCOS, 2024). They utilise outlying islands and remote coastlines as moulting, pupping and general haul out sites.

Grey seals spend a high proportion of their time ashore during their pupping and moulting seasons (Hammond et al., 2001). Grey seal pups are born from September to late November in northern Scotland and annual moulting typically occurs from December to April (SCOS, 2024).

Satellite tracking has shown that grey seal foraging trips can extend several hundred kilometres offshore, but most foraging tends to occur within 100 km of a haul-out site. Individual seals based at a particular haul-out site will often make repeated trips to the same offshore locations using prominent corridors (Jones et al., 2015; SCOS, 2024). It is estimated that grey seals spent 12 % of their time at distances greater than 50 km from the coast (Jones et al., 2015).

Figure 5.10 shows the estimated at-sea usage of grey seals, obtained from the Sea Mammal Research Unit (SMRU) density maps for grey seal movements (Russell et al., 2017). These maps show the predicted average number of seals in each 5 km × 5 km grid cell at any point in time. As the development site is located beyond the typical foraging range of grey seals, they are not expected to be encountered within or close to the location of the proposed Fotla field development.

5.3.6.2.2 Harbour Seal

The UK is home to approximately 30 % of the European population of harbour seals, 85 % of which is found in Scotland (SCOS, 2024). Main aggregation sites for harbour seals are located on the west coast of Scotland, while smaller concentrations are found on the east coast in the

Firths of Forth and Tay and the Moray Firth. Haul-out, breeding, and moulting sites are typically situated in sheltered estuaries and on sandbanks, as well as rocky areas.

Harbour seals spend a high proportion of time ashore during the pupping and moulting seasons from June to August (SCOS, 2024). During the pupping season hauled-out groups tend to be smaller and more dispersed (Duck, 2007).

Telemetry studies of harbour seals have observed that foraging trips are generally within 40 km to 50 km of haul-out sites. Although longer trips of over 200 km have been observed, these were between haul out sites, rather than to offshore foraging areas (Jones et al., 2013). It is estimated that harbour seals spend only 3 % of their time at greater distances than 50 km form the coast (Jones et al., 2015).

Data analysed in Russel et al., 2017 (Figure 5.10), shows the estimated at-sea usage of harbour and grey seals based on data from SMRU maps for seal movements. This data indicates that both species of seal are unlikely to be recorded in the area of the Fotla field development as the site is located beyond their typical foraging range.

Further studies undertaken by Carter et al. (2025) indicate that, although grey seals may be present within the vicinity of the proposed Fotla field development, the number of individuals which may be present are very low whilst harbour seals have not been recorded in the area (Figure 5.11).

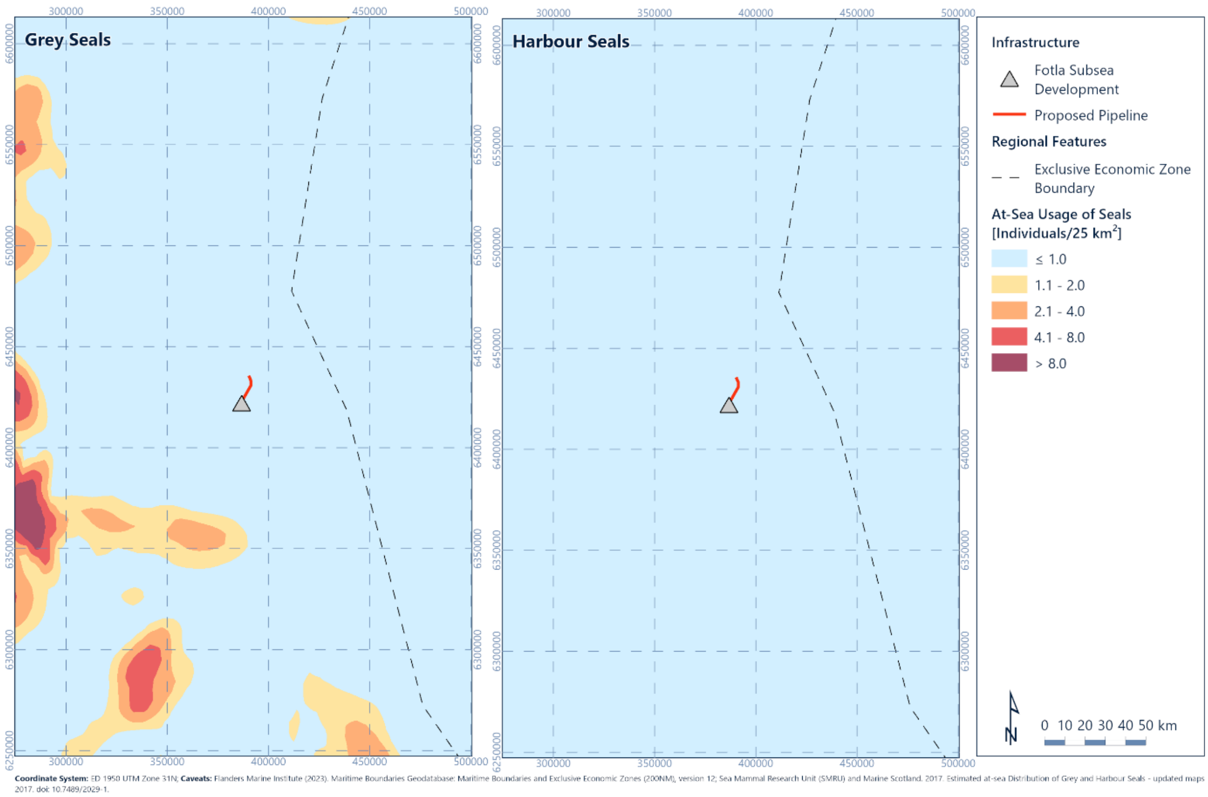


Figure 5.10: At-sea usage of grey and common seals in the vicinity of the proposed Fotla field development (Russell et al., 2017)

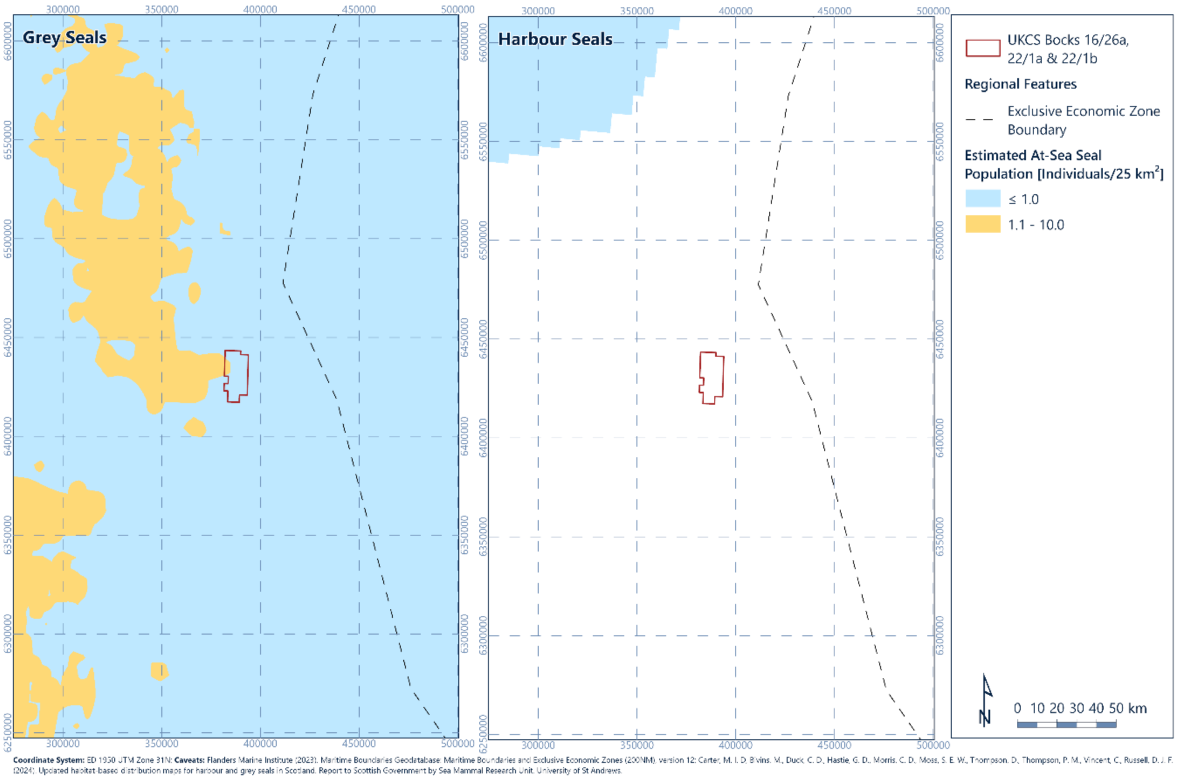


Figure 5.11: At-sea seal population (individuals per 25 km^2) in the vicinity of the proposed Fotla field development (Carter et al., 2025)

5.3.7 Seabirds

The extensive network of cliffs, sheltered bays, coastal wetlands, and estuarine areas, provide breeding and wintering grounds for nationally and internationally important bird species and assemblages (DECC, 2016). Approximately 26 species of seabird regularly breed in the UK and Ireland as do several other waterbird and wader species (DECC, 2016). These birds breed on the coasts of the UK, but frequently feed far offshore. In winter, seabirds become less attached to their nesting sites and travel considerable distances in search of food.

Seabirds are present throughout the year in the CNS, at mostly low to moderate densities found in the proposed development area (Kober et al., 2010; Waggitt et al., 2019). The most common seabird species likely present within the proposed area of development are black-legged kittiwake (*Rissa tridactyla*), northern fulmar (*Fulmarus glacialis*), common guillemot (*Uria aalge*), little auk (*Alle alle*) and northern gannet (*Morus bassanus*) (Kober et al., 2010; Waggitt et al., 2019). Other taxa likely to occur within and around the Fotla field include Atlantic puffin (*Fratercula arctica*), herring gull (*Larus argentatus*), European storm petrel (*Hydrobates pelagicus*), great skua (*Stercorarius skua*) and razorbill (*Alca torda*).

Distribution and abundance of seabird species vary seasonally and annually. Densities of Atlantic puffin, for example, are generally higher in the breeding season (April – July), whereas other species such as the northern fulmar occur at higher densities in the winter season (August - February). Table 5.8 summarises seasonal densities of commonly occurring seabirds within and around the Fotla field development area. No periods of concern for drilling activities with respect to seabirds have been identified within UKCS Blocks 22/1 and 16/26 (OPRED, 2022).

Table 5.8: Important seasons for seabirds likely present within the proposed Fotla field development area

Species	J	F	M	A	M	J	J	A	S	O	N	D
Northern fulmar												
Northern gannet												
European storm petrel												
Great skua												
Herring gull												
Black-legged kittiwake												
Common guillemot								*	*			
Razorbill												
Little auk												
Atlantic puffin												
All species combined					✓	✓	✓	✓				
Key:		Breeding				Wintering				Additional season of interest		

Notes:
Sources: Kober et al., 2010; Waggitt et al. 2019; Wakefield et al., 2017
* = Guillemot chicks are fledging and they leave the colonies accompanied by the male parent. Because adult guillemots moult into their winter plumage after breeding, both juveniles and parents are flightless.

Seabirds are generally not at risk from routine offshore oil and gas production operations (JNCC, 2020). However, they may be vulnerable to pollution from less regular offshore activities such as well testing and flaring, when hydrocarbon dropout to the sea surface can occasionally occur, or from unplanned events such as accidental oil or diesel releases.

Seabird vulnerability within/around the Blocks of interest has been assessed according to the JNCC's Seabird Oil Sensitivity Index (SOSI). The purpose of this index is to identify areas where seabirds are likely to be most sensitive to oil pollution by considering factors making a species more or less sensitive to oil-related impacts.

The SOSI uses seabird survey data collected between 1995 and 2015, in addition to individual species sensitivity index values, combined at each location to create a single measure of seabird sensitivity to oil pollution (Webb et al., 2016). The SOSI combines the seabird survey data with individual seabird species sensitivity index values. These values are based on a number of factors, which are considered to contribute towards the sensitivity of seabirds to oil pollution, and include:

- Habitat flexibility (the ability of a species to locate to alternative feeding grounds);
- Adult survival rate;
- Potential annual productivity; and;

- The proportion of the biogeographical population in the UK (classified following the methods developed by Certain et al., (2015)).

The combined seabird data and species sensitivity index values were then subsequently summed at each location to create a single measure of seabird sensitivity to oil pollution.

Median sensitivity SOSI data for the wider region are shown in Figure 5.12 and Table 5.9. The sensitivity of birds to surface oil pollution is 'low' throughout the year for UKCS Blocks 22/1 and 16/26 with the majority of the surrounding UKCS Blocks also considered to be 'low' sometimes increasing to 'medium' (Webb et al., 2016).

Table 5.9: Seabird sensitivity to surface pollution in the vicinity of the Fotla field development

UKCS Block	J	F	M	A	M	J	J	A	S	O	N	D
15/25	5*	5	5*	5*	5	4	5	5	5	5*	ND	ND
15/30	5*	5	5*	5*	5	5	5	5	5	5*	ND	ND
16/21	5*	5	5*	5*	5	5	5	5	5	5*	ND	ND
16/22	5*	5	5	5*	5	5	5	5	5	5*	ND	ND
16/26	5*	5	5*	5*	5	5	5	5	5	5*	ND	ND
16/27	5*	5	5	4*	4	5	5	5	5	5*	ND	ND
21/5	5*	5	5*	5*	5	5	5	5	5	5*	ND	ND
21/10	5*	5	5	5*	5*	5	5	5	5	5*	ND	ND
22/1	5*	5	5*	5*	5	5	5	5	5	5*	ND	ND
22/2	5*	5	5*	4*	4	5	5	5	5	5*	ND	ND
22/6	5*	5	5	5*	5*	5	5	5	5	5*	ND	ND
22/7	4	5	5	5*	5*	5	5	5	5	5*	ND	4*

Notes:
1 – Extremely High, 2 – Very High, 3 – High, 4 – Medium, 5 – Low and ND – No Data
* - Indicates blocks for which no data was available, and therefore score has been calculated using that of an adjacent month or Block
Source: Webb et al., 2016.

Of the species expected to occur in the area, the European storm petrel is afforded protection by the EC Birds Directive (Annex I), whilst the black-legged kittiwake is included in the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2023).

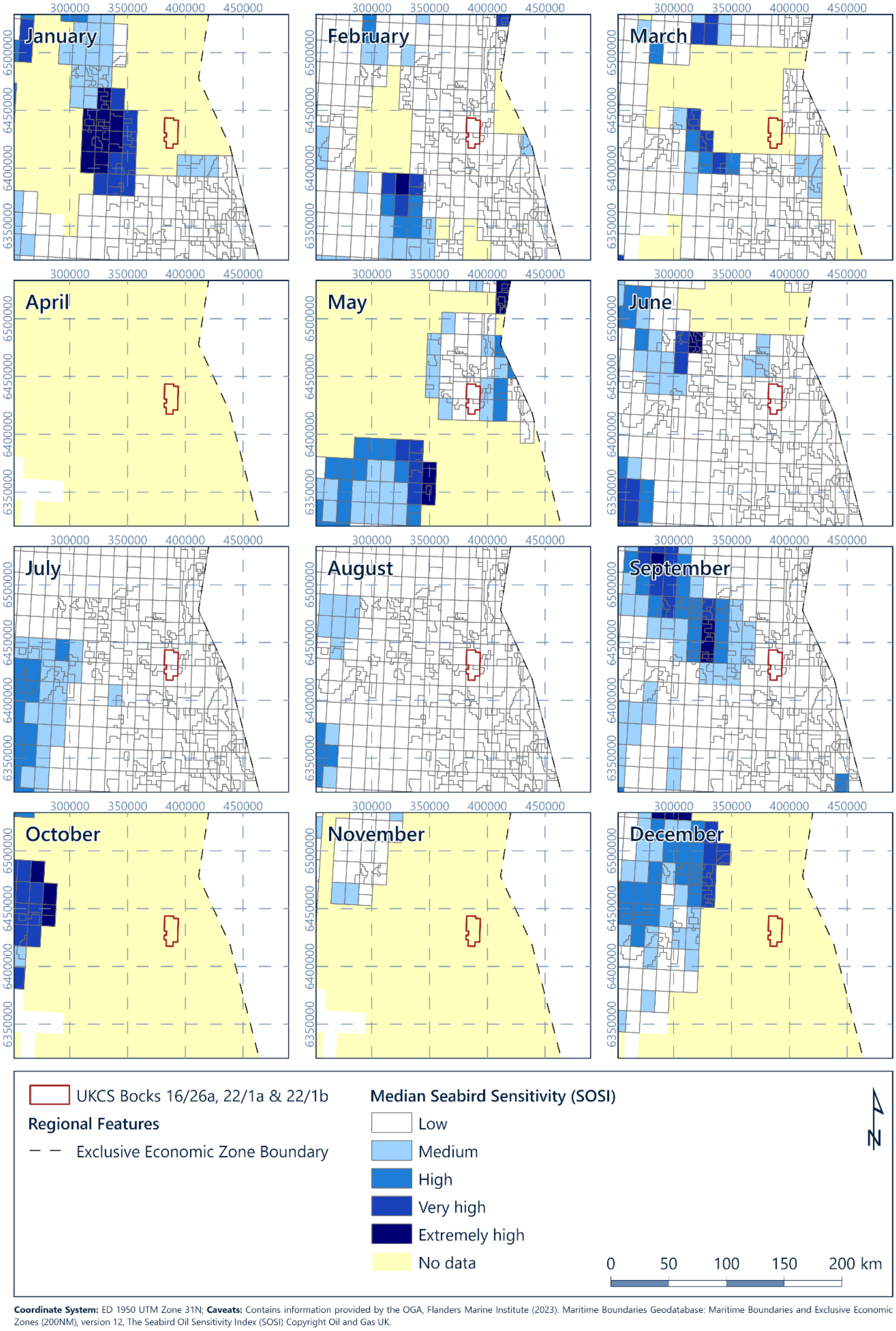


Figure 5.12: Median seabird sensitivity (SOSI) in the Fotla field development area

5.3.8 Coastal Habitats

Oil spill modelling has been conducted to inform the assessment of potential impacts from hydrocarbon spills associated with the proposed Fotla field development (see Section 14). This modelling indicates that under typical climactic conditions, a hydrocarbon spill from an uncontrolled well blow-out could reach the coastlines of Norway, Sweden, and Denmark, but with low to moderate probability (< 45 % with Norway being with most susceptible to oil reaching the shoreline). The characteristics of the coastal habitats encountered in these areas are discussed below.

The coastlines of north-east and east Scotland, Norway, Sweden, and Denmark are characterised by diverse and extensive cliff habitats and rocky shores. These are interspersed with more sheltered areas where sandy beaches are present. Small areas of mud flats and salt marshes are present in estuaries and sheltered inlets. The characteristic coastal habitats encountered in these areas identified are discussed below.

The north-east coast of mainland Scotland, approximately 176 km south-west of the Fotla field, is characterised by diverse and extensive cliff habitats, with headlands, caves, blowholes, and stacks (Dargie, 1996). These cliffs are interspersed with more sheltered areas such as the inner Moray Firth, where sandy beaches are present, backed by extensive sand dune systems, sandy shores and machair. A few small mudflats and saltmarshes are also present along Aberdeenshire (Hill, 1996; Marine Scotland, 2024a). Coastal habitats around Orkney include coastal saltmarshes, dunes and sandy shores, maritime cliffs, coastal shingle and machair (Marine Scotland, 2024a).

The Fotla field is also located around 270 km from the west coast of Norway. This part of the Norwegian coastline is dominated by a network of deep, steep sided fjords, dotted by numerous small, rocky islands and islets. Coastal habitats are therefore characterised by steep cliffs falling straight into deep water with no significant intertidal zone and by rocky shores (Norwegian Environment Agency, 2022). Sand and mud habitats are restricted to sheltered areas away from strong tides. Mudflats and saltmarshes are very limited and are restricted to the inner reaches of the fjords (Marthinsen et al., 1992).

The coastline of north-west Denmark, located approximately 447 km south-east of the Fotla field, supports wetlands habitats found in a series of large inlets and brackish lagoons, interspersed with stretches of sandy beaches (BirdLife International, 2023). The west coast of Sweden is characterised by a number of rocky islands, interspersed with sandy beaches (EMODnet, 2023). The German coastline is dominated by the Wadden Sea is characterised by mudflats, with several islands.

The coastline of south-west Sweden is approximately 600 km away from the Fotla field and some of the coastal habitats include saltmarshes and seagrass beds (UNEP-WCMC, 2024).

5.3.9 Protected Sites and Sensitive Habitats

5.3.9.1 Coastal Conservation

There are numerous protected sites along the Scottish coastline (Figure 5.13). These include internationally designated Ramsar Sites (internationally important wetlands of importance, especially for waterfowl), SPAs and Important Bird Areas (IBAs) (protecting rare and vulnerable species of wild birds), and SACs (EC Directive (92/43/EEC) for the Conservation of Natural Habitats and Wild Flora and Fauna 1992 (The Habitats Directive). There are also numerous nationally designated sites, including Sites of Special Scientific Interest (SSSIs).

The north-east coast of Scotland is of international ornithological significance, particularly as seabird breeding sites, and as such many coastal sites on the islands are designated as SPAs and IBAs (Figure 5.13). The Ythan Estuary and Meikle Loch and the Montrose Basin are also classified as Ramsar sites (Ramsar, 2023). The nearest SPA to the Fotla field development is the Buchan Ness to Collieston coast SPA, located 176 km to the west, which is designated as a SPA for its breeding populations of fulmar, guillemot, herring gull and kittiwake. Inshore waters adjacent to seabird colonies are used heavily by seabirds during the breeding season; this has been reflected in the recent seaward extension to breeding colony SPAs. Several SPAs have recently been extended seaward by up to 2 km to reflect the use of inshore waters by seabirds during the breeding season (SNH, 2023). Some SPAs have also been selected for the presence of rare divers and overwintering waders which are concentrated near to shore or on the shoreline.

There are also several SACs on the north-east coast of Scotland designated for habitats and species (Figure 5.13). Important habitats which are qualifying reasons for the designation of SACs include vegetated sea cliffs at Buchan Ness to Collieston, shifting dunes at Sands of Forvie, estuaries, sandbanks, mudflats, sandflats and common seal of the Firth of Tay and Eden Estuary (JNCC, 2023). A SAC has also been established for bottlenose dolphins in the Moray Firth (JNCC, 2023). The closest SAC is the Moray Firth SAC located approximately 264 km west from the development area, designated for bottlenose dolphins and sandbanks which are slightly covered by sea water all the time.

Numerous SSSIs, the UK's main national nature conservation designation, have also been designated throughout the north-east coast of Scotland. Non-statutory sites include several sites owned or managed by the Royal Society for the Protection of Birds (RSPB), the National Trust for Scotland and the Scottish Wildlife Trust (RSPB, 2023; Scottish Wildlife Trust, 2023).

A number of candidate Emerald Network conservation sites (Council of Europe Areas of Special Conservation Interest) have been designated along the Norwegian coastline closest to the proposed development for vulnerable or rare habitats and species (Norwegian Environment Agency, 2022). There are also three Ramsar sites and four IBAs designated along the south-west coast of Norway and numerous Ramsar sites and IBAs along the coasts of Denmark, Germany, and Sweden (Figure 5.13; Birdlife International, 2023; Ramsar, 2023).

5.3.9.2 Offshore Conservation

Offshore SAC and Sites of Community Importance (SCI) are designated in the UK under the Habitats Directive, implemented in the offshore waters of the UK through the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001. In addition, the Marine (Scotland) Act and the UK Marine and Coastal Act provide the powers for Scottish Ministers to designate NCMPAs in Scottish waters.

The closest offshore SAC to the proposed Fotla field development is the Scanner Pockmark SAC, located approximately 26.3 km to the northwest and is designated for the presence of submarine structures made by leaking gases (JNCC, 2023).

The proposed Fotla field development is also located within a network of NCMPAs, the closest of which is the Norwegian Boundary Sediment Plain NCMPA, which lies approximately 30 km to the east and is designated for the presence of ocean quahog and their supporting habitat of sands and gravels (JNCC, 2023). Ocean quahog has been identified as a PMF, marine habitats and species which are considered of conservation importance in Scottish waters (NatureScot, 2020). They are also included on the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2023).

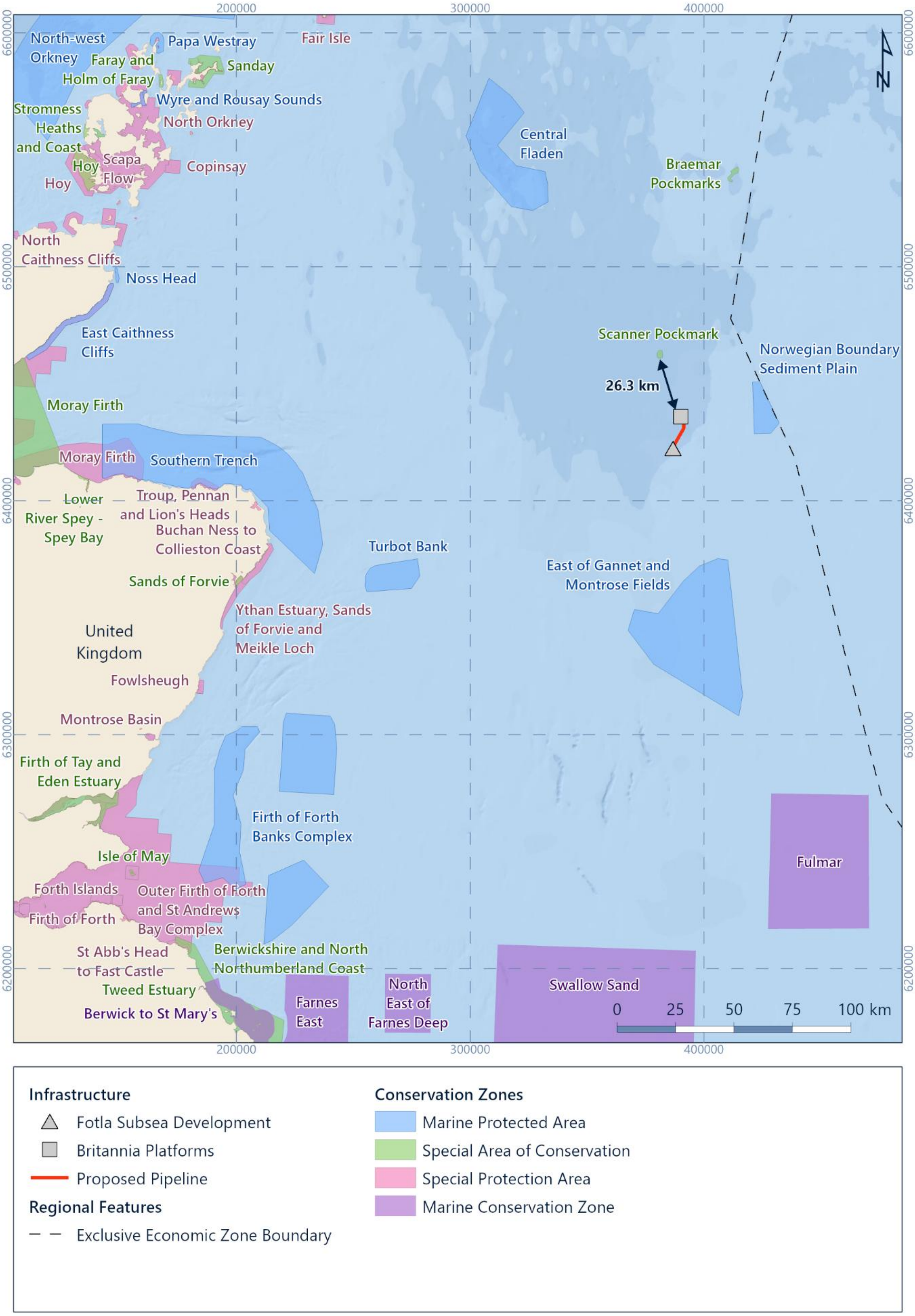
The East of Gannet and Montrose Fields NCMPA, designated for ocean quahog aggregations, offshore subtidal sand and gravels and offshore deep-sea muds, is located approximately 51 km south of the Fotla field development (JNCC, 2024).

The location of these areas in relation to the proposed Fotla field development is shown in Figure 5.13.

Four Marine National Parks are located along the south-eastern coastline of Norway (Figure 5.14), which have been designated to protect the rich fauna, flora, and geological formations (Norwegian National Parks, 2025). The closest of these protected areas is the Jærkysten MPA which is designated for guillemot and black-legged kittiwake (OSPAR, 2018).

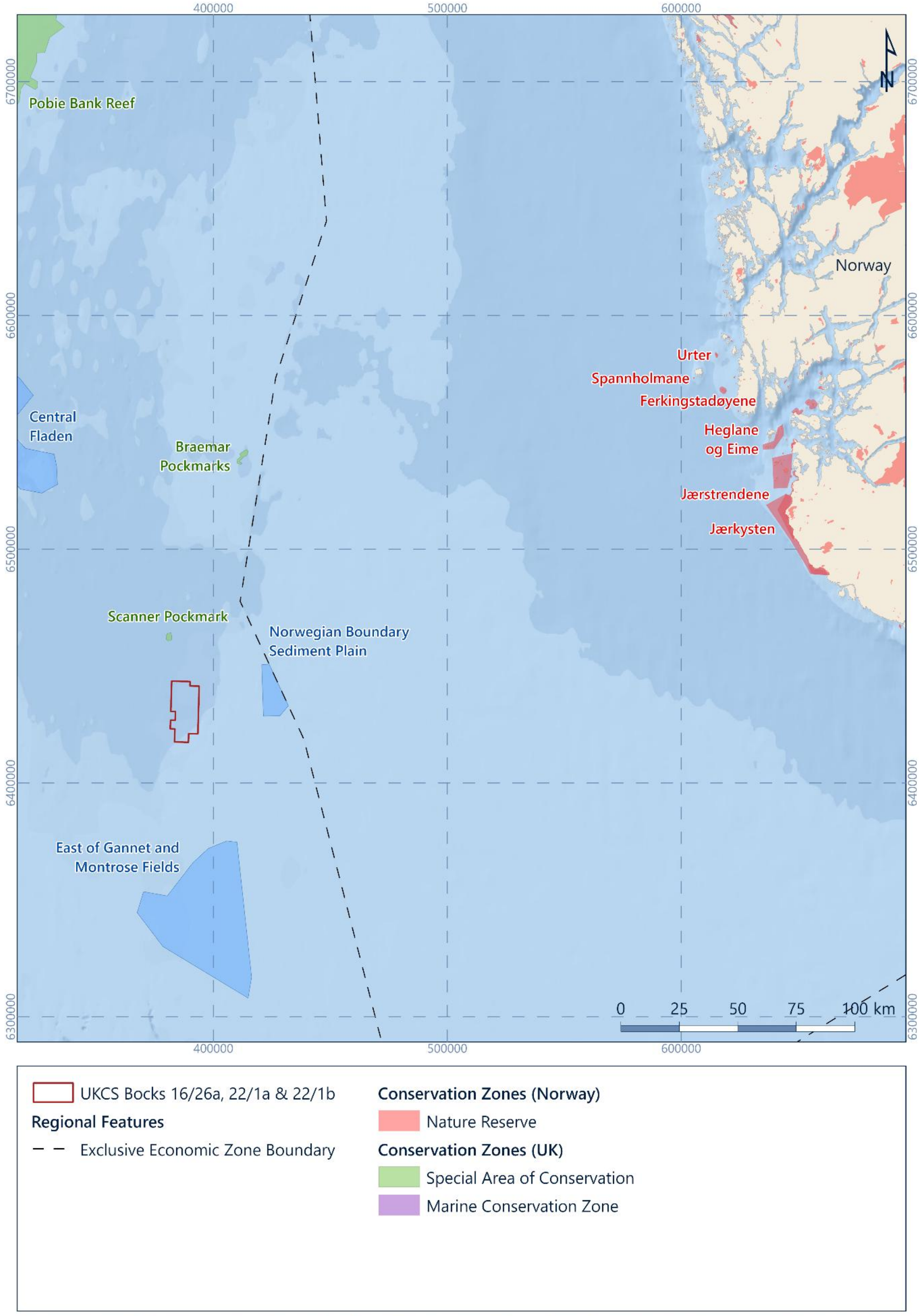
Several protected areas have been designated offshore Denmark under the EC Habitats Directive, including the Skagens Gren og Skagerrak SAC, Store Rev SAC, and the Gule Rev SAC, which have all been designated for the presence of harbour porpoise and reefs among many other protected habitats (BISE, 2025).

Numerous protected areas designated under the EC Habitats Directive are also present along south-western Swedish coastline and in its offshore areas, such as the Bratten SCI which supports reefs, submarine structures made of leaking gases, and many species of coral of conservation importance (BISE, 2025).



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** OceanWise, Esri, GEBCO, Garmin, NaturalVue; Esri, 2024; NatureScot, Contains public sector information licensed under the Open Government Licence v3.0; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2024; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12.

Figure 5.13: UK offshore and coastal conservation areas in relation to the proposed Fotla field development



<bol>Coordinate System:</bol> ED 1950 UTM Zone 31N; <bol>Caveats:</bol> Esri, GEBCO, Garmin, NaturalVue; Esri, 2024; NatureScot, Contains public sector information licensed under the Open Government Licence v3.0; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2024; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12; Contains information from The Norwegian Mapping Authority ©Kartverket, & GEONORGE, 2025.

Figure 5.14: Norwegian protected areas in relation to the proposed Fotla field development

5.4 Socio-Economic Environment

5.4.1 Commercial Fisheries

The North Sea is an important international fishing ground and the Scottish part of the continental shelf is heavily fished by both the UK fleet and foreign vessels (BEIS, 2022). A range of fish species are targeted in the CNS, although overall fisheries landings are higher further north in the North Sea and around the Orkney and Shetland Islands (Marine Scotland, 2024b).

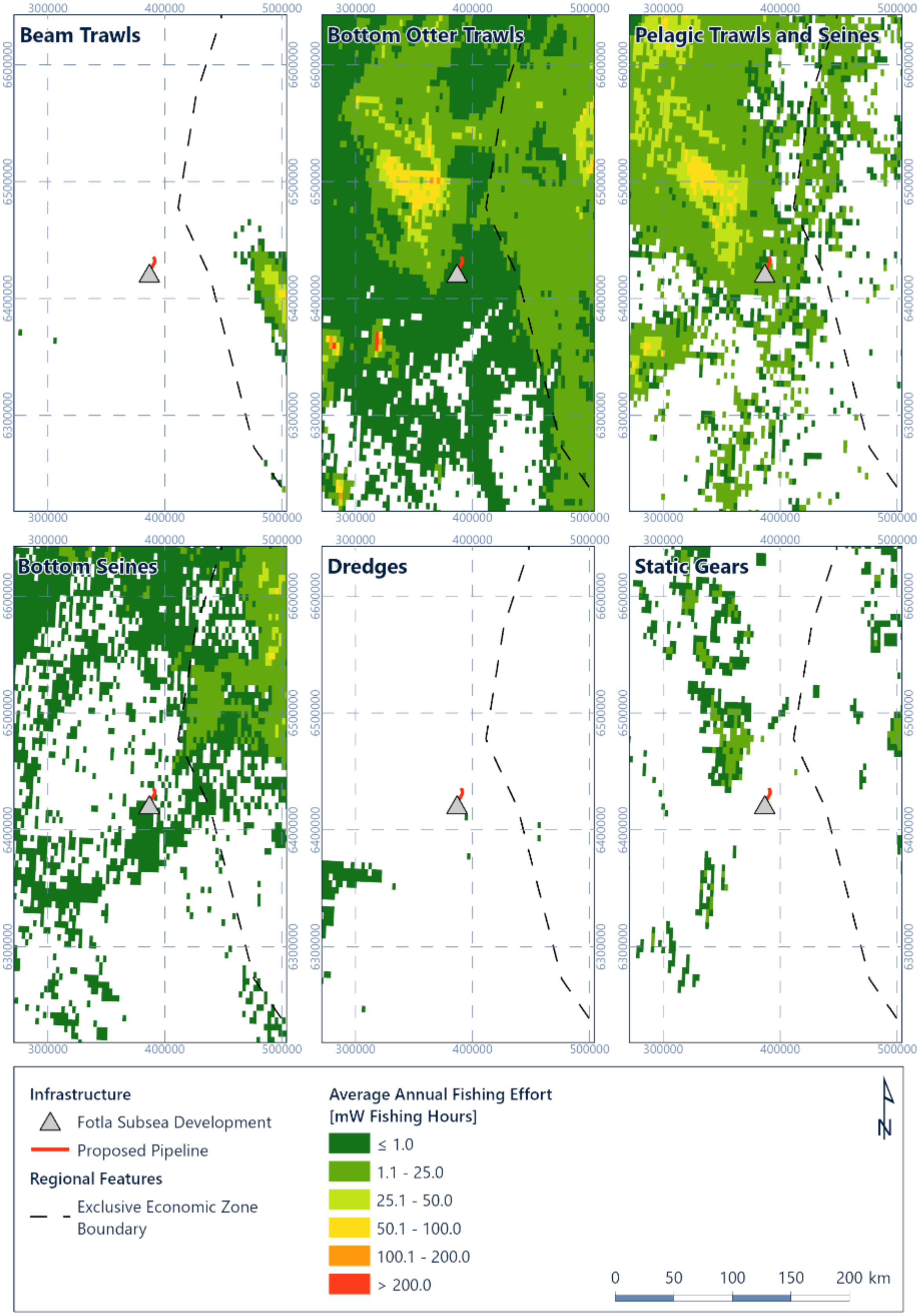
Figure 5.15 shows the main types of fishing activity taking place, indicating fishing activity in and around the Fotla field development area mainly comprises vessels using bottom otter trawls, pelagic trawls and seines and bottom seines. The figure also shows fishing effort in the immediate vicinity of Fotla can be considered low compared to the overall fishing effort in the wider area.

For the purposes of monitoring and analysing fisheries statistics, ICES has divided the north-east Atlantic into several rectangles measuring 30 nm by 30 nm. Each ICES rectangle covers approximately half of one UKCS Offshore oil and gas licencing quadrant, i.e. 15 license Blocks.

The proposed Fotla field development area is located within ICES rectangles 44F1 and 45F1. Fishing effort and landing statistics for the period 2013 to 2023 for these rectangles are summarised in Figure 5.16.

Figure 5.16 shows that demersal fish landings, such as haddock, monkfish and whiting, vary throughout the years but are consistently landed year on year from ICES rectangles 44F1 and 45F1 (Marine Directorate, 2024). Similarly, shellfish landings, principally *Nephrops*, are also consistently landed each year, albeit in smaller quantities than the demersal species (Marine Directorate, 2024).

Contrary, pelagic landings in ICES rectangles 44F1 and 45F1, which mainly comprise herring, vary considerably between years, ranging from zero in some years to very high in others (Marine Directorate, 2024). This variation in temporal and spatial distribution is typical for certain pelagic species such as herring, which live in large mobile shoals.



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12; EMODnet - Human Activities, STECF, and the FAO, 2023.

Figure 5.15: Fishing intensity for different gear types (2018 – 2022) in the Fotla field development area and wider region (EMODnet, 2024)

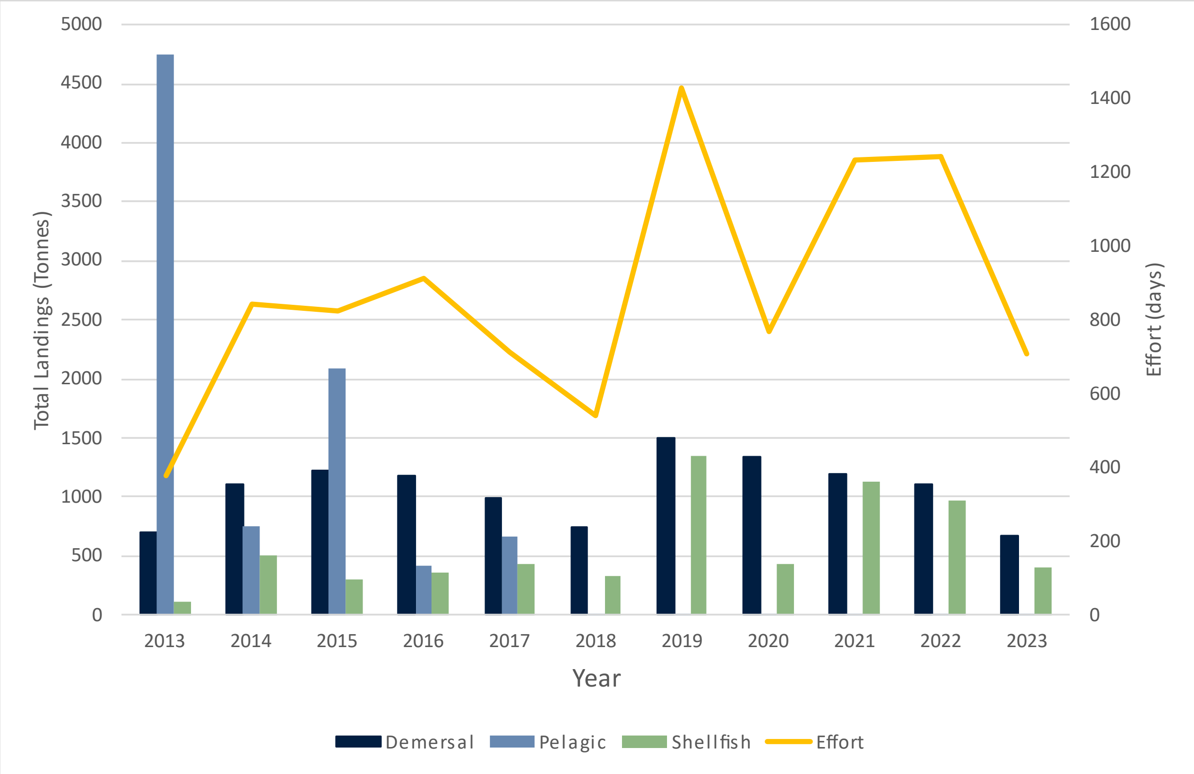


Figure 5.16: Landings and effort from ICES rectangles 44F1 and 45F1 for the period 2013-2023 (Marine Directorate, 2024)

5.4.1.1 Effort

In 2023, fishing effort in Scotland was a total of 95,358 days, whilst total effort registered within ICES rectangles 44F1 and 45F1 amounted to 685 days (Marine Directorate, 2024). Between 2013 and 2023 the highest annual fishing effort, by UK vessels over 10 metres in length, in the vicinity of the proposed field development was 373 days in 2019 for 44F1, which constitutes 0.30 % of the overall annual Scottish fishing effort in days and 1,036 days in 2019 for 45F1, which constitutes 0.82 % of the overall annual Scottish fishing effort in days (Table 5.10; Marine Directorate, 2024). The lowest fishing effort was recorded in 2018 for 44F1 (104 days) and in 2013 for 45F1 (227 days) (Marine Directorate, 2024). According to the Marine Directorate, the fishing effort in the proposed area for development can be considered as low (Marine Scotland, 2024b).

Table 5.10: Annual fishing effort within ICES rectangles 44F1 and 45F1 (Marine Directorate, 2024)

Year	Total Effort between 44F1 and 45F1 [days]	Effort within 44F1 [days]	% of Annual Scottish Total	Effort within 45F1 [days]	% of Annual Scottish Total
2013	352	125	0.07	227	0.12
2014	800	208	0.16	592	0.46
2015	813	250	0.20	563	0.45
2016	904	351	0.27	553	0.42
2017	694	192	0.15	502	0.40
2018	508	104	0.08	404	0.32

Year	Total Effort between 44F1 and 45F1 [days]	Effort within 44F1 [days]	% of Annual Scottish Total	Effort within 45F1 [days]	% of Annual Scottish Total
2019	1,409	373	0.30	1,036	0.82
2020	750	317	0.31	433	0.42
2021	1,201	233	0.22	968	0.92
2022	1,194	165	0.17	1,028	1.09
2023	685	125	0.13	560	0.59

Monthly fishing effort is detailed in Table 5.11. It should be noted that effort and landing data is currently only made publicly available if over five vessels were active in an ICES area and therefore may be (slightly) underrepresenting overall total fishing effort.

Generally, the majority of fishing effort in both rectangles takes place in October and November (Marine Directorate, 2024). Trawling dominates commercial fishing activities in both ICES rectangles 44F1 and 45F1, with the highest effort value of 1,036 days recorded in 2019 in 45F1. Other fishing gear commonly used in the area include seine nets, traps, dredges, and hooks and lines. However, respective effort data for these gear types are not available at this time as data is classified as disclosive (i.e. less than five vessels (> 10 m) undertook fishing activity) (Marine Directorate, 2024).

Table 5.11: Monthly fishing effort within ICES rectangles 44F1 and 45F1 (Marine Directorate, 2024)

ICES Rectangles	Year	Month											
		J	F	M	A	M	J	J	A	S	O	N	D
44F1	2013				12	16		19	25	10	19	14	11
	2014							11	56	49	12	70	10
	2015	6	65		-	-	9	6	34	24	34	52	20
	2016	30	23	-	49		-	-	9	10	83	112	36
	2017	5	-	45	5	-	9	11	62	3	35	17	-
	2018	20		-		-	-	-	24	20	17	24	-
	2019	12	77	19	28	-	39	67	10	45	53	23	-
	2020	31	9	-	29	77	41	18	8	27	44	23	9
	2021	18	-	-	63	9	-	35	19	-	30	59	-
	2022	-	-	9	25	-	58	24	-	23	25	-	-
	2023		-	60	-	-	-	21	43	-	-		
45F1	2013				13	11		15	60	28		98	
	2014	12	6						193	200	8	83	91
	2015	64	107	31		-	-	-	11	8	10	309	22
	2016	15	196	8	22	-	10	-	11	16	21	194	60
	2017		-	213	8		-	-	13	14	194	60	-

ICES Rectangles	Year	Month											
		J	F	M	A	M	J	J	A	S	O	N	D
	2018	-	12	-	4	70	-	8	13	105	120	73	-
	2019	-	275	35	209		45	264	50	47	112	-	
	2020	-	-	208	50	-	10	17	19	9	111	9	-
	2021	4	126	110	111	-		221	43	-	121	230	-
	2022	-	-	20	81	-	290	166	135	196	141	-	-
	2023	-	4	237	6	-		12	222	75	-	3	

< 25 days	25 – 50 days	50 – 100 days	100 – 250 days	250 – 500 days	500 – 750 days	> 750 days	DD	No data

Notes:
'-' represents disclosive data (DD).

5.4.1.2 Landings

In 2023, Scottish vessels landed approximately 545,648 tonnes of fish and shellfish (Marine Directorate, 2024). Approximately 1,078 tonnes of fish were landed from ICES rectangles 44F1 and 45F1, equating to 0.2 % of the total landing made by vessels in Scotland for 2023.

Fishing in ICES rectangle 44F1 and 45F1 occurs year-round and landings are highly variable throughout the year and inter-annually, however highest fish landings between 2013 and 2023 occurred between July and November for both ICES rectangles 44F1 (Table 5.12) and 45F1 (Table 5.13) (Marine Directorate, 2024).

Table 5.12: Monthly fishing landings (tonnes) by UK vessels over 10 metres in length, between 2013 and 2023 in ICES rectangle 44F1 (Marine Directorate, 2024)

Year	44F1 – Fishing Landings [tonnes]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013				15	22		1,960	43	30	110	938	82
2014							34	91	205	126	196	101
2015	35	88	-	-	-	80	30	303	106	158	147	51
2016	79	24	-	47		-	-	31	41	118	239	99
2017	13	-	31	24	-	290	420	152	33	89	133	-
2018	64	-	-	-	-	-	-	41	7	119	-	19
2019	106	114	-	63	-	74	133	68	192	157	213	-
2020	207	-	16	31	122	134	39	54	119	127	134	57
2021	68	-	-	91	11		120	81	-	63	168	47
2022	-	-	-	48		66	22	69	10	107	-	-
2023	-	-	80		-		7	85	-	-	-	

Notes:
'-' represents disclosive data; blank values represent no data.

Table 5.13: Monthly fishing landings (tonnes) by UK Vessels over 10 metres in length, between 2013 and 2023 in ICES rectangle 45F1 (Marine Directorate, 2024)

Year	45F1 – Fishing Landings [tonnes]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013					12		1,353	160	68		112	
2014								233	249	27	99	166
2015	92	125	60			-	-	909	49	44	300	40
2016	22	250	26	19	-	244	-	20	77	40	254	97
2017		-	227	31	-	-	-	15	52	351	124	-
2018	-	18	-	-	106	-	39	28	98	184	156	-
2019	-	346	81	261	-	31	474	123	98	235	-	-
2020	-		292	52	-	47	45	30	38	192	26	-
2021	-	86	331	165	-		305	175	-	183	353	-
2022	26	-	28	125	-	326	280	185	322	255	-	-
2023	-	16	306	30	-		-	335	139	-	-	

Notes:
'-' represents disclosive data; blank values represent no data.

Annual total values of landings for ICES rectangles 44F1 and 45F1 are presented in Table 5.14. The total value of fish caught from 44F1 and 45F1 between 2013 and 2023 is £14,376,840 and £29,288,037 respectively.

Table 5.14: Landing values (£) for fish caught within ICES rectangles 44F1 and 45F1 (Marine Directorate, 2024)

ICES Rectangle	Year	Demersal [£]	Pelagic [£]	Shellfish [£]	Total
44F1	2013	614,513	977,956	79,610	1,672,079
	2014	1,025,453	141,130	346,050	1,512,633
	2015	962,021	65,103	240,844	1,267,968
	2016	824,202		678,098	1,502,300
	2017	672,957	259,409	372,014	1,304,380
	2018	510,986	834	112,610	624,430
	2019	1,116,698	1,078	991,395	2,109,171
	2020	1,202,306	1,676	161,235	1,365,217
	2021	664,520	151	516,088	1,180,759
	2022	393,665	332	901,317	1,295,314
	2023	212,527	205	329,857	624,429
Total		8,199,848	1,447,874	4,729,118	14,376,840
45F1	2013	267,678	436,645	359,781	1,064,104
	2014	543,272	119,962	1,832,176	2,495,410
	2015	620,334	676,413	1,012,362	2,309,109
	2016	1,034,037	189,494	1,045,948	2,269,479
	2017	1,007,938	5	1,238,325	2,246,268

ICES Rectangle	Year	Demersal [£]	Pelagic [£]	Shellfish [£]	Total
	2018	655,897	674	1,013,997	1,670,568
	2019	1,072,806	796	3,166,226	4,239,828
	2020	511,061	674	904,715	1,416,450
	2021	1,142,617	3	3,069,327	4,211,947
	2022	1,094,748	135	4,009,086	5,103,969
	2023	755,250	6	1,505,649	1,670,569
Total		8,705,638	1,424,807	19,157,592	29,288,037

5.4.1.3 Demersal Fisheries

Demersal fisheries target species which live on or near the seabed and generally feed on bottom-living organisms and other fish. Although these fisheries may be directed towards a particular species or species group, demersal fish are often caught together and comprise a mixed fishery. The main demersal species caught within ICES rectangles 44F1 and 45F1 between 2013 and 2023 were haddock, monkfish, gurnards, cod and whiting (Marine Directorate, 2024).

Average demersal landings and sales value typically decrease with distance from shore across the wider area (Marine Directorate, 2024). Landings and values of demersal fish species caught from ICES rectangles 44F1 and 45F1 are generally lower than many of the surrounding ICES rectangles (Figure 5.17). Larger quantities of demersal fish species are landed from ICES rectangles to the west.

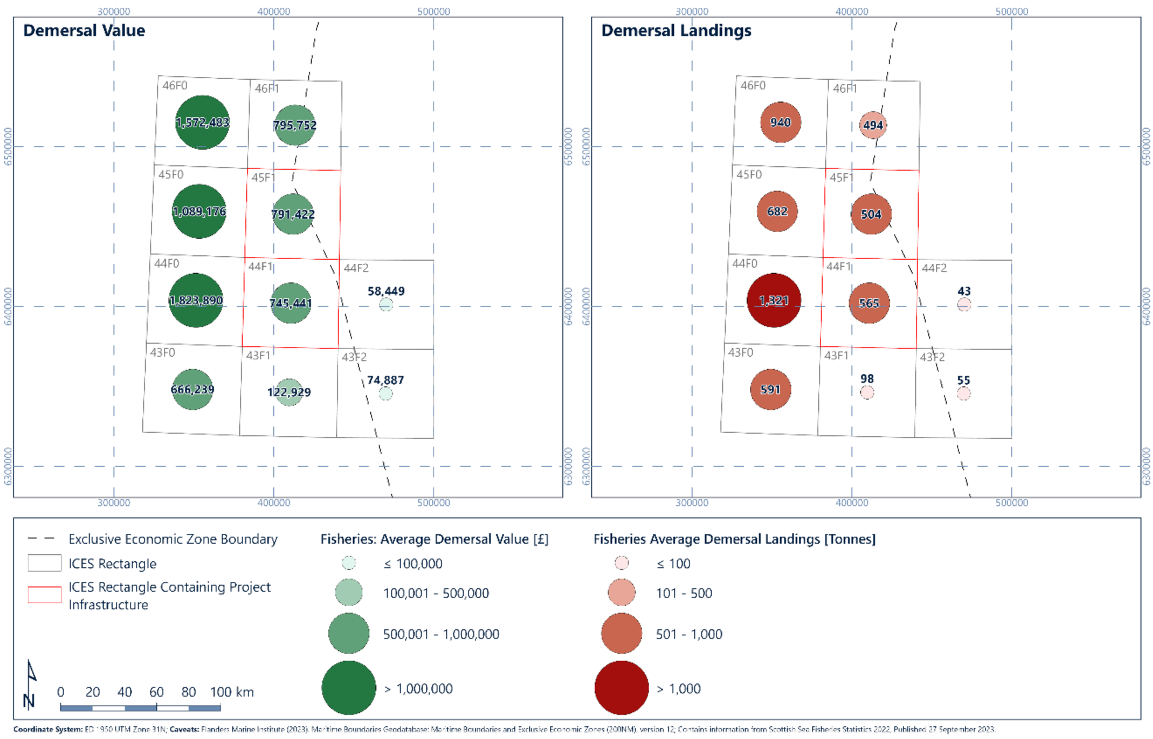


Figure 5.17: Average value (£) and landings (tonnes) of demersal fish species within the area of the proposed Fotla field development and the wider area between 2013 and 2023 (Marine Directorate, 2024)

Total fishing effort by UK vessels of more than 10 m in length using demersal active gear between 2018 and 2022 within rectangles 44F1 and 45F1 was 1,040 days (Marine Scotland, 2024b). Fishing effort across the wider area for demersal active gear is greater in ICES rectangles to the west and lesser in the ICES rectangles immediately to the south of the Fotla field.

5.4.1.4 Pelagic Fisheries

Pelagic fisheries target species which live in the water column. Pelagic fisheries in the North Sea are generally more active in deeper waters, predominantly targeting herring and mackerel. The main pelagic species caught within ICES rectangles 44F1 and 45F1 between 2013 and 2023 were herring and mackerel, although since 2018 the volume of pelagic landings has been comparatively low (Marine Directorate, 2024).

Average pelagic landings and sales value typically decreased with distance from shore across the wider area (Marine Directorate, 2024). Landings and values of pelagic fish species caught from ICES rectangles 44F1 and 45F1 are generally lower than many of the surrounding ICES rectangles (Figure 5.18). Larger quantities of pelagic species are landed from ICES rectangles to the west and northwest.

Fishing effort by UK vessels of more than 10 m in length using pelagic active gear between 2018 and 2022 within rectangles 44F1 and 45F1 could not be completely disclosed for some years for analysis. However, the data does show that pelagic fish were landed, but as previously stated, landings data are currently only made publicly available if over five vessels were active in a particular ICES rectangle (Marine Scotland, 2024b). From the data that are publicly available, it can be seen that fishing effort is low in this area with the majority of effort concentrated in ICEs rectangles immediately west of 44F1 and 45F1.

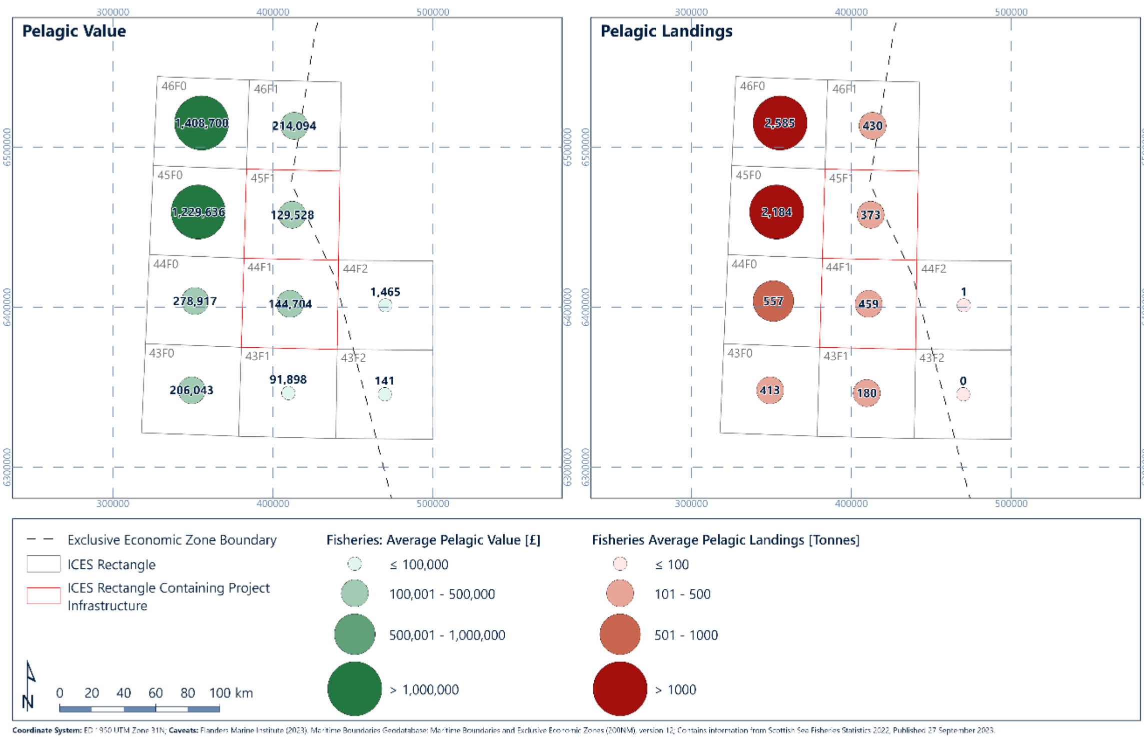


Figure 5.18: Average value (£) and landings (tonnes) of pelagic fish species within the area of the proposed Fotla field development and the wider area between 2013 and 2023 (Marine Directorate, 2024)

5.4.1.5 Shellfish Fisheries

Shellfish fisheries can be broadly divided into offshore and onshore components. Static gears such as creels and pots are used in inshore areas to catch crabs and lobsters, while the offshore component targets *Nephrops* and scallops using trawls. The main shellfish species landed between 2013 and 2023 in ICES rectangles 44F1 and 45F1 was *Nephrops* (Marine Directorate, 2024).

Average shellfish landings are typically low across the wider area and decrease with distance from shore (Marine Directorate, 2024). Larger quantities of shellfish species are landed from ICES rectangles to the west. However, average value, whilst low within ICES rectangle 44F1, the location of the Fotla field, is noted to be high within 45F1, the location of the Britannia Platform where the Fotla field would tie back to (Marine Directorate, 2024) (Figure 5.19).

Fishing effort by UK vessels of more than 10 m in length using passive gear between 2018 and 2022 within rectangles 44F1 and 45F1 could not be completely disclosed for some years for analysis (Marine Scotland, 2024b). From the data that are publicly available, it can be seen that fishing effort using passive gears is low across ICES rectangles 44F1 and 45F1 and the wider area.

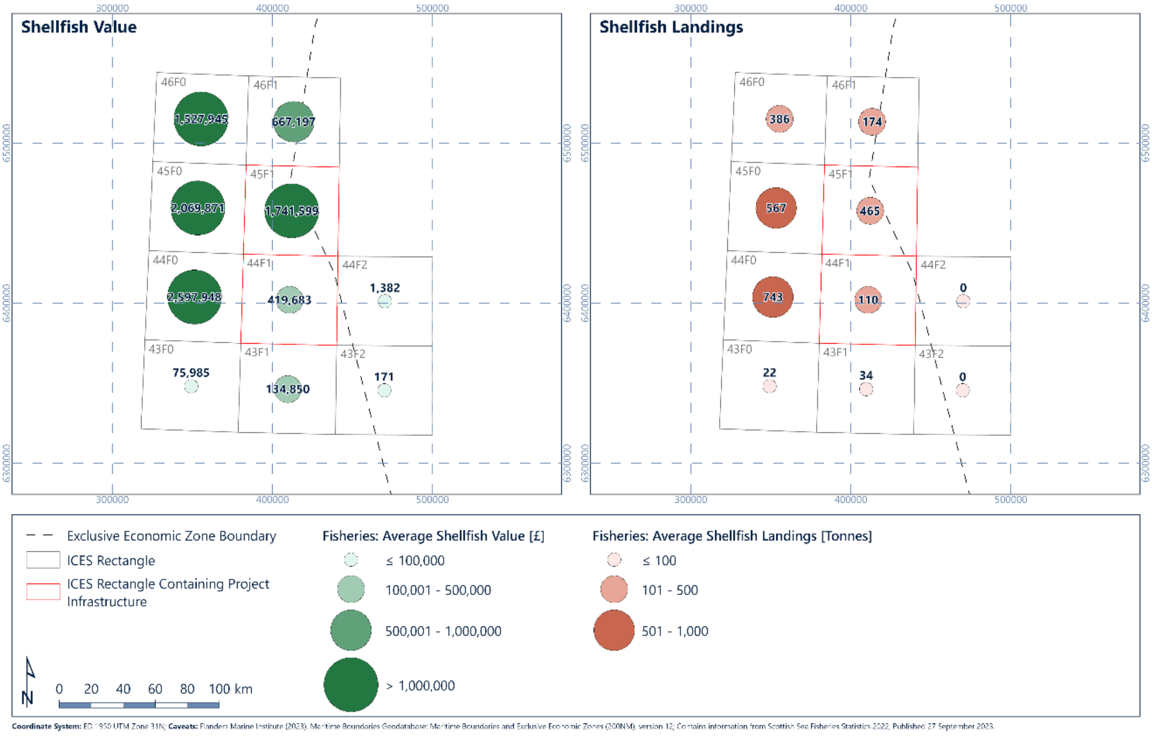


Figure 5.19: Average value (£) and landings (tonnes) of shellfish species within the area of the proposed Fotla field development and the wider area between 2012 and 2022 (Marine Directorate, 2024)

5.4.2 Aquaculture

There are no aquaculture sites within the immediate area of the proposed Fotla field development. The nearest finfish or shellfish farm is approximately 230 km to the west. Shellfish production farms are also present on the south of Norway, but the closest of these sites is at least 310 km from the Fotla field.

5.4.3 Shipping

The highest levels of shipping reported in the CNS from 2012 to 2017 are centred around the ports along the east coast of Scotland (including Aberdeen, Dundee and the Firth of Forth) (Marine Scotland, 2024b). These port approaches, along with nearshore areas of the CNS, experience a moderate to very high shipping density.

Shipping within the area of the proposed Fotla field development is largely dominated by oil industry support and service vessels (Marine Scotland, 2024b). Due to this, Block 22/1 has been designated as an area of moderate shipping density and Block 16/26 as an area of low shipping density (NSTA, 2017).

The average annual shipping route density for all vessels in the development area for the period 2019 to 2024 is reported to be between 50 and over 500 routes per km^2 per year, with the highest density recorded at Britannia (Figure 5.20) (EMODnet, 2023). Data from AIS of shipping traffic between 2012 and 2017, found the average weekly density of tankers, cargo vessels, port service craft, fishing vessels and non-port service craft transiting the development area to be between one and two transits (Marine Scotland, 2024b).

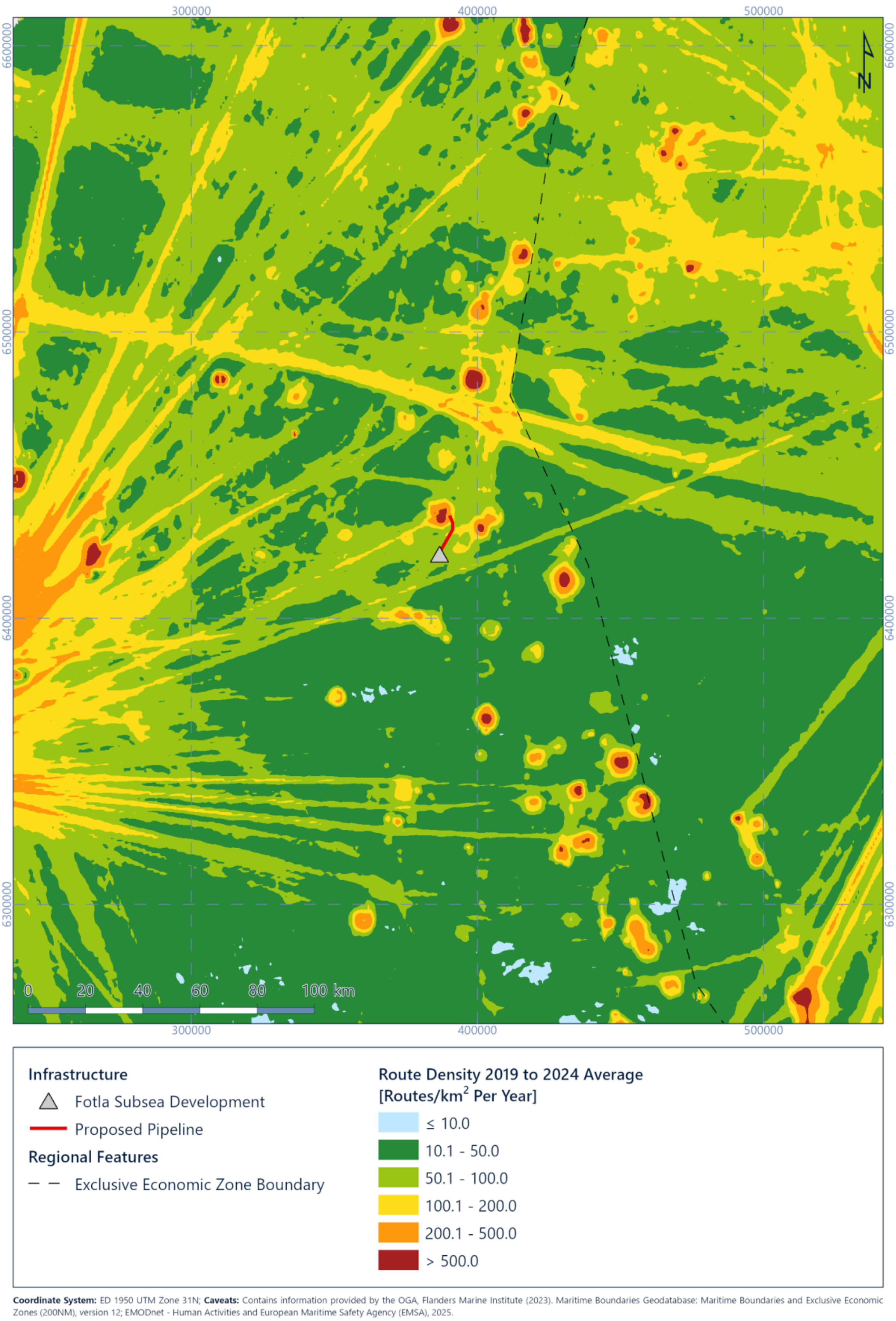


Figure 5.20: Average annual route density (2019 – 2024) in the proposed Fotla field development and wider area (EMODnet, 2023)

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Site specific shipping studies identified 20 shipping routes within 10 nm of the Fotla field development (Figure 5.21) and a corresponding total of 766 vessel movements in one year averaging approximately 2 to 3 vessels per day (Anatec, 2021). The main vessel type operating in the vicinity of the Fotla field development is offshore support vessels of 1,500 to 5,000 dead weight tonnes, accounting for more than half of the total annual vessel movements in the area (Anatec, 2021). The closest shipping routes to the Fotla field development are the America North to Kattegat b route, the Forth to Bomlafjorden route, and the Aberdeen to Andrew Oil Field route, which are primarily used by cargo and offshore support vessels. Of these, the Aberdeen to Andrew Oil Field route is the busiest route, with an estimated 60 vessels per year using it (Anatec, 2021). An updated shipping study will be undertaken as part of any future Consent to Locate application process.

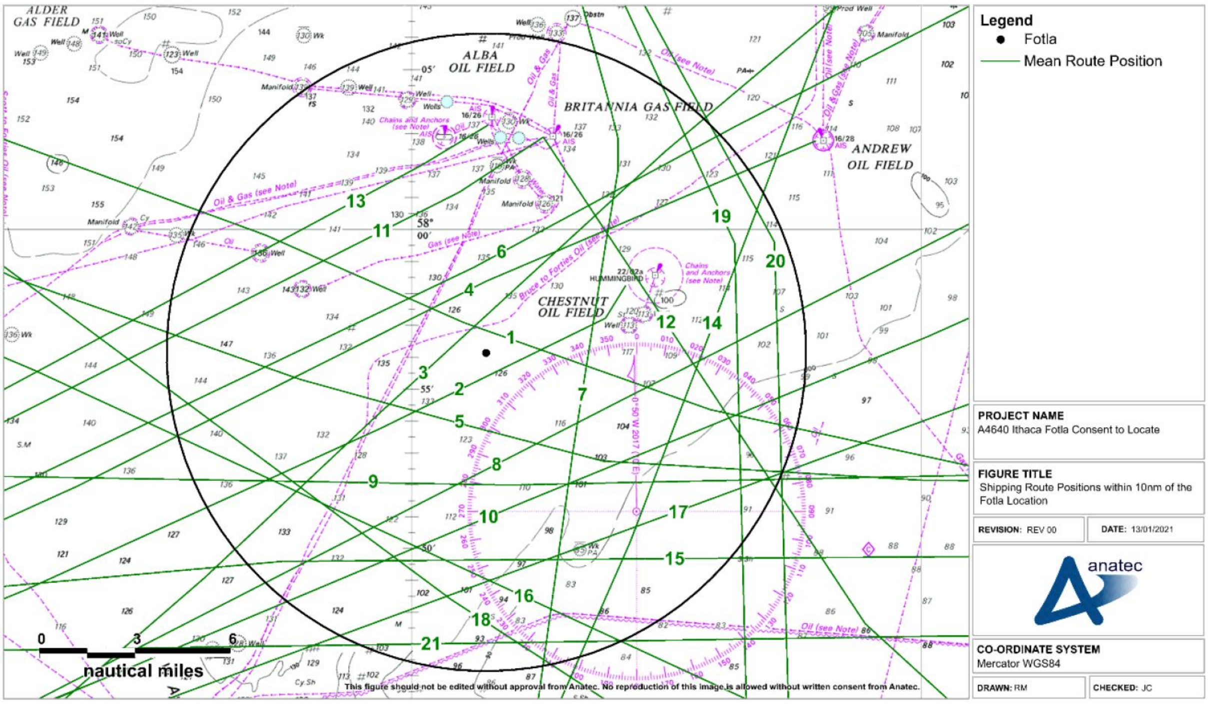


Figure 5.21: Location of shipping routes within 10 nm of the Fotla field development

5.4.4 Oil and Gas

The CNS is an area of intensive oil and gas activity, and the proposed Fotla field development is sited within this extensive zone of operations.

The nearest existing surface infrastructure to the proposed well development area are the Britannia and Britannia Bridge Linked Platform (BLP), located approximately 13.5 km to the north-east (NSTA, 2025d). The Alba Floating Storage Unit (FSU) and Alba Northern Platform are located 13.5 km and 14.2 km to the north of the Fotla field development, respectively. The Alba field facilities are due to be decommissioned between 2028 and 2032 (Ithaca Energy, 2025a).

The Chestnut field and associated subsea infrastructure is located 7.8 km to the north-east of the Fotla wells. The Chestnut field has ceased production and is currently being decommissioned, with the remaining decommissioning of remaining installations and infrastructure programmed for completion by Q2 2028 (Spirit Energy, 2021).

The Bruce to Forties Unity 24" Gas Condensate Pipeline runs north-east to south-west across the northern portion of the Fotla field development, crossing approximately 4.7 km north-west of the Fotla wells location. The proposed route also runs parallel to the Finlaggan 10"/14" PIP Production Pipeline on the approaches to the Britannia platforms. The Brae A to Forties C pipeline also runs west 5.1 km away from the Fotla field development.

Existing oil and gas infrastructure is shown in Figure 5.22.

5.4.5 Submarine Cables

One submarine cable, the Tampnet CNS fibre optic cable, is present approximately 15 km south of the proposed Fotla field development (Figure 5.22).

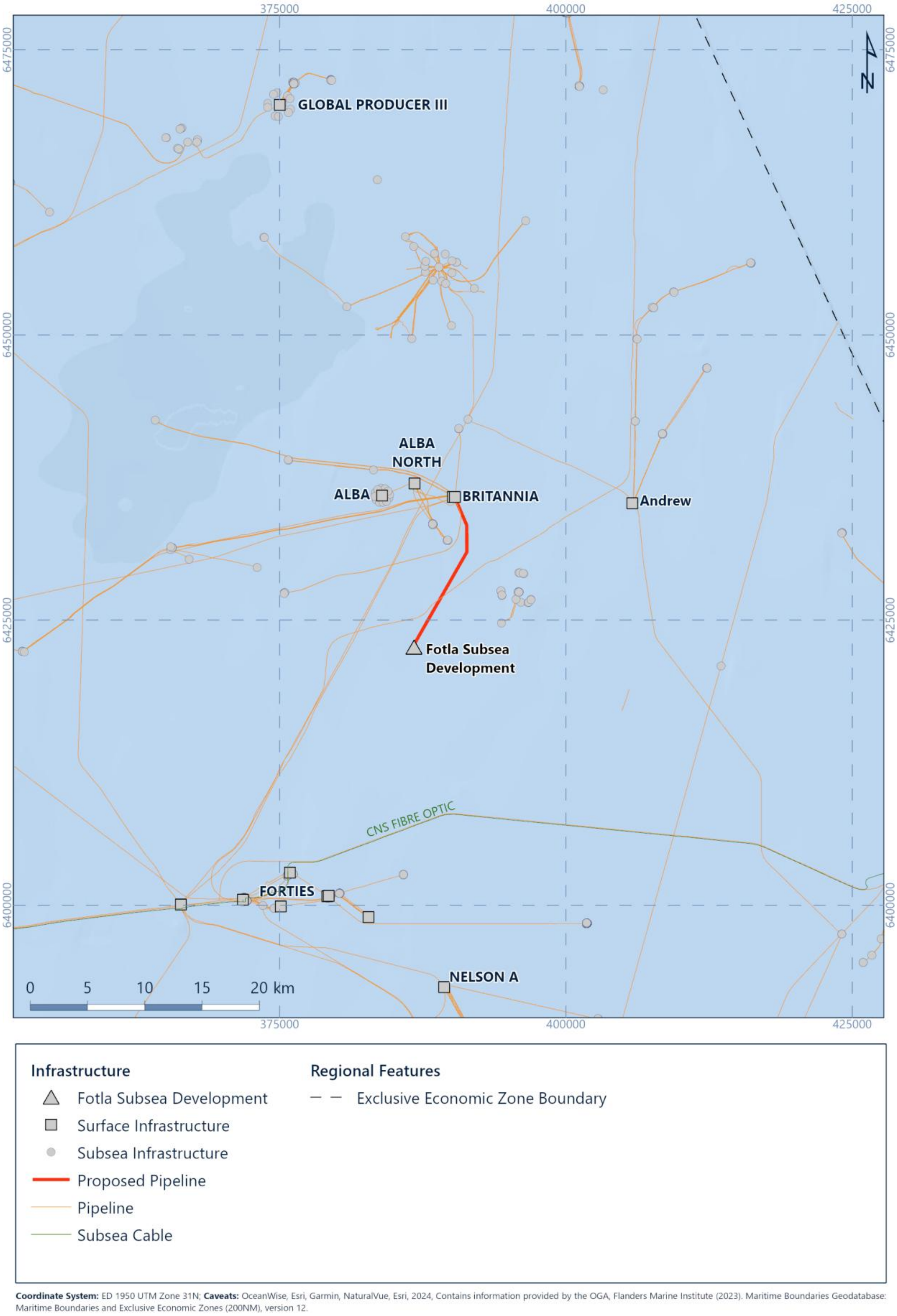


Figure 5.22: Oil and gas infrastructure and telecommunication cables in the vicinity of the Fotla field development

5.4.6 Renewable Energy Installations and Gas Storage/ Carbon Capture and Storage Areas

No operational windfarms are located in the immediate vicinity of Blocks 22/1b, 22/1a and 16/26a.

An Innovation and Targeted Oil & Gas (INTOG) lease area has been awarded to Harbour Energy and is located approximately 9.6 km south-east of the Fotla field development (Crown Estate Scotland, 2023). A further INTOG lease area, awarded to Cerulean Winds, is located approximately 25 km to the east. Both developments are at the early pre-planning stage.

The Campion windfarm, currently in planning, is located approximately 70 km to the south-west of the Fotla subsea development (Marine Scotland, 2024b). The MarramWind windfarm, also in planning, is located approximately 91 km to the north-west of the Fotla field development.

There are no carbon capture and storage (CCS) areas within the vicinity of the proposed Fotla field development. The closest CCS area is the proposed Acorn development, currently in the planning stage, located approximately 80 km to the west of the development area. Two areas for proposed carbon dioxide storage have been leased for development (CS011 and CS012; NSTA, 2025d).

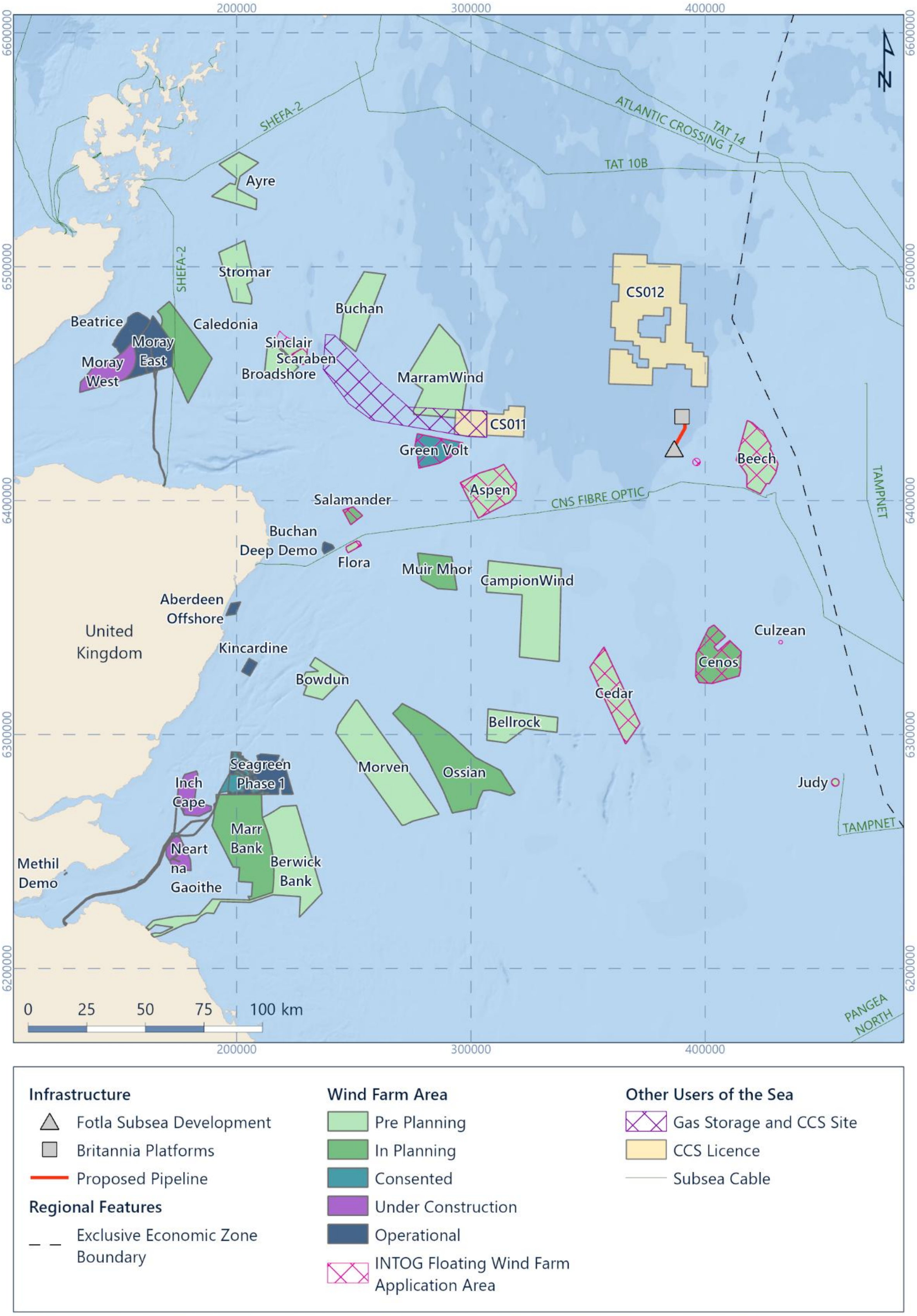
Existing and planned renewable energy installations and gas / carbon capture and storage areas are shown on (Figure 5.23).

5.4.7 Military Activity

No practice and exercise areas (PEXA) are indicated in the vicinity of the development area (Marine Scotland, 2024b). The closest military area is the Moray Firth practice area D809(s) which is located approximately 178 km west of the Fotla field development.

5.4.8 Wrecks and Archaeology

No wrecks have been identified within the Fotla field or along the pipeline route (Marine Scotland, 2024b; EMODnet, 2023). The nearest wreck to the area of the Fotla field development is located 12 km to the southeast whilst marine debris is recorded 9 km to the west (UKHO, 2024).



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** OceanWise, Esri, GEBCO, Garmin, NaturalVue, Esri, 2024, Contains information provided by the OGA; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12; KIS-ORCA 2015 (Reproduced with permission of The Kingfisher Information Service, Seafish, on behalf of Subsea Cables UK); Contains public sector information, licensed under the Open Government Licence v3.0, from Crown Estate Scotland.

Figure 5.23: Renewable energy installations and gas / carbon capture and storage (CCS) areas.

5.5 Climate Change

For most environmental impacts, the location of a project is important when determining a baseline scenario for which the effects of a project would be assessed against. However, as the emissions of greenhouse gases (GHGs) to the atmosphere will contribute to the overall cumulative global effects on climate, the location of the emissions is not relevant. Moreover, global climate change effects are not instantaneous but develop and persist over longer time periods than typically used when assessing environmental impacts. Therefore, a global baseline of GHGs and their effects on climate change over time is provided in this section, using a range of potential climate change scenarios and effects, as developed and framed by the international panel for climate change (IPCC) and other (inter)national government agencies and institutions. As this baseline description extends into the future and therefore cannot be based on actual data, the most current published climate projection data available at the time of writing has been used to inform this section.

5.5.1 The Greenhouse Effect

The greenhouse effect is a natural process where Earth's atmosphere traps the Sun's heat, making the planet warm enough to support life. Sunlight warms the surface of the Earth and infrared radiation expelled into outer space is, ultimately, the way the Earth cools down. If the two are out of balance, then the surface of the Earth can warm up or cool down. Carbon dioxide (CO_2) and other greenhouse gases, such as methane (CH_4) and nitrous oxide (N_2O), can absorb and release infrared radiation and alter that balance (Met Office, 2025). While essential for life, an increase in these gases from human activities can intensify this effect, leading to global warming and climate change. Future warming depends on future GHG emissions, with cumulative net CO_2 dominating (IPCC, 2023). Together, CO_2, CH_4 and N_2O make up over 90 % of the GHGs when expressed in tonnes of carbon dioxide equivalent[1] (CO_2e).

Fossil CO_2 emissions account for approximately 68 % of current GHG emissions. These emissions are primarily driven by the combustion of coal, oil and gas in the energy sector, as well as industrial processes associated with the manufacture of metals, cement and other materials (UNEP, 2024).

Methane accounts for approximately 16 % of the warming effect of long-lived GHGs. Atmospheric methane has a lifetime of about a decade and is ultimately oxidized to CO_2 (Oh et al., 2025; WMO, 2025). 40 % of methane in the atmosphere comes from natural sources, such as wetlands, while human activities, such as rice agriculture, ruminants, fossil fuel exploitation, landfills and biomass burning, account for the remaining 60 % (WMO, 2025).

[1] Carbon dioxide equivalent, or CO_2e, is a standard unit for measuring greenhouse gas emissions. It expresses the global warming potential (GWP) of different greenhouse gases in terms of the amount of CO_2 that would have the same impact over a specific period (usually 100 years). For example, CH_4 has a GWP of 28, meaning one tonne of methane has the same warming effect as 28 tonnes of CO_2, over a period of 100 years. Similarly, the GWP for N_2O is 265.

N_2O accounts for about 7 % of the warming caused by long-lived GHGs. Human-induced sources, such as fertilizer use and biomass burning, account for approximately 40 % of N_2O emissions (WMO, 2025).

5.5.2 Global GHG Emissions - Current Status and Trend

Figure 5.24 shows the amount of greenhouse gases emitted since the start of the industrial revolution, clearly indicating the continual increase of CO_2 emissions with the combustion of fossil fuels becoming the dominating contributor over time (IPCC, 2023).

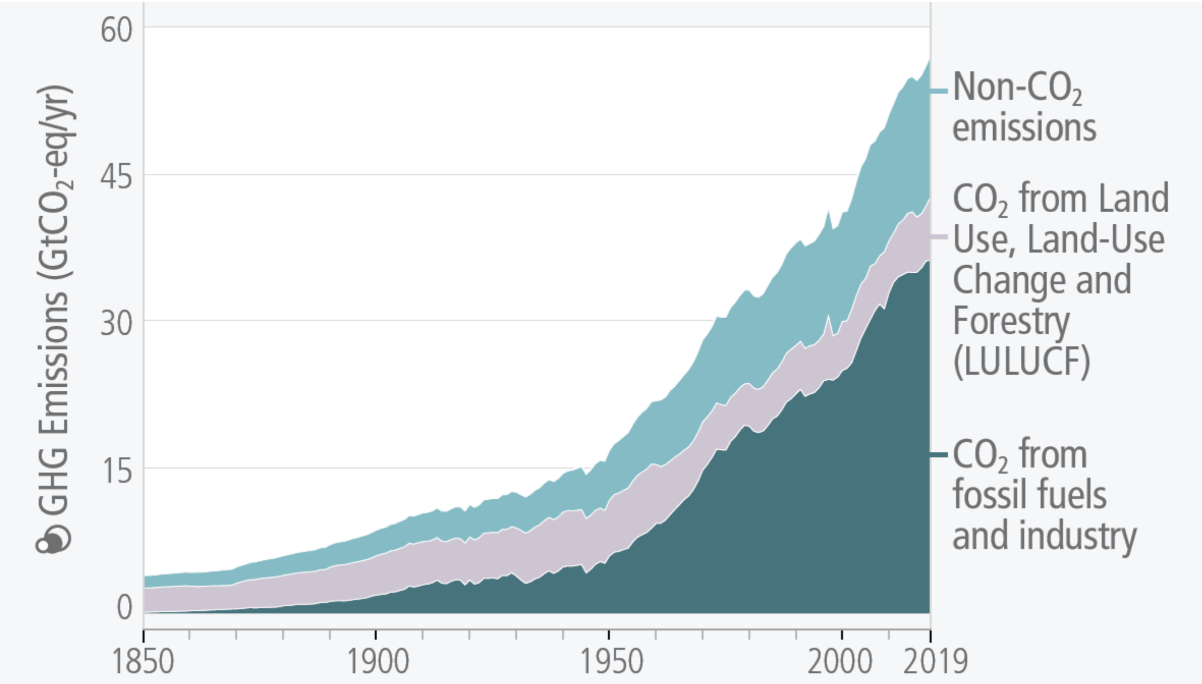


Figure 5.24: Global greenhouse gas emissions (source: IPCC, 2023)

CO_2 concentrations in the atmosphere vary throughout the seasons, largely due to the photosynthetic activity of plants. In the Northern Hemisphere, CO_2 levels peak in late spring and reach a low in late summer to early autumn. This pattern reflects the seasonal uptake of CO_2 by plants during their growing season and the release of CO_2 when photosynthesis slows in winter. The amplitude of these fluctuations is stronger at higher northern latitudes and weaker closer to the equator. In the Southern Hemisphere, where there is less land area, the seasonal CO_2 cycle is much weaker (Scripps, 2025).

However, direct measurements of CO_2 since the 1950s show that the concentrations have clearly increased and currently remains trending upwards (Figure 5.25). Using other sources of information, such as gas bubbles trapped in Antarctic ice, it is possible to measure greenhouse gas concentrations even further back in time. The concentration of CO_2 in the atmosphere has increased by around 46 % since pre-industrial times (Met Office, 2025).

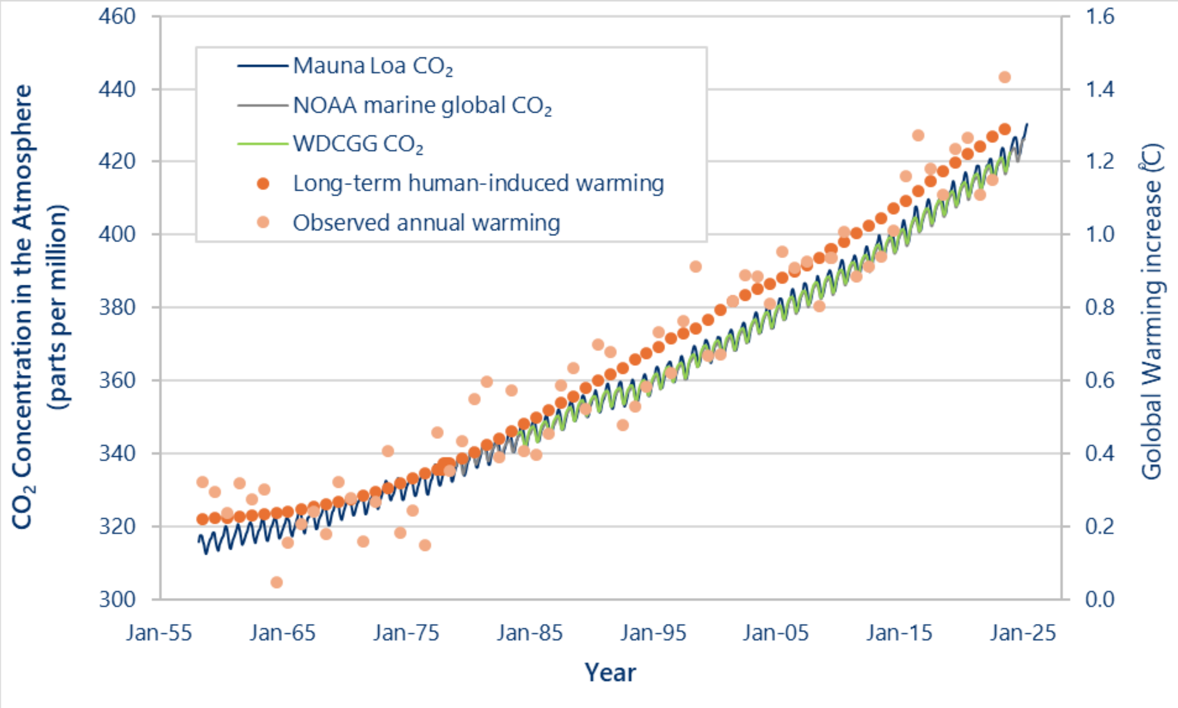


Figure 5.25: Monthly carbon dioxide in the atmosphere (Met Office, 2025) and Global Warming Increase (Smith et al., 2024 in CCC, 2025)

Overall GHG emissions (expressed as total CO_2e) are also continuing to increase, as indicated in Table 5.15.

Table 5.15: Total global GHG emissions

Year	CO_2e (Giga Tonnes)
1990	37.8
2000	41.5
2010	51.0
2020	53.7
2021	55.9
2022	56.3
2023	57.1
Notes Source: UNEP, 2024	

5.5.3 Managing Climate Change Globally – The Paris Agreement

The Paris Agreement is a legally binding international treaty on climate change, which was adopted by 195 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015 and entered into force on 4 November 2016. The overarching goal of the agreement is to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change. In order to achieve the long-term temperature goal, Parties to the

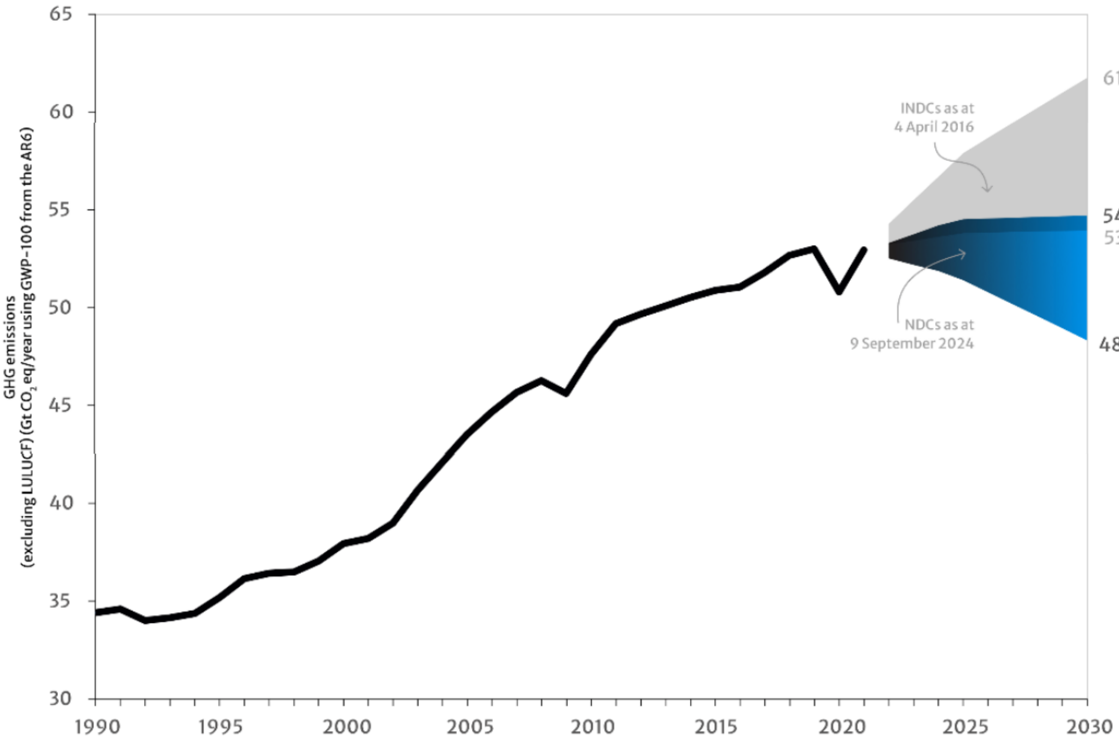
Paris Agreement aim to achieve a balance between anthropogenic emissions by sources and removals by (carbon) sinks of greenhouse gases in the second half of this century. However, in recent years, world leaders have stressed the need to limit global warming to 1.5 °C by the end of this century in response to the Intergovernmental Panel on Climate Change (IPCC) indicating that crossing the 1.5 °C threshold risks unleashing far more severe climate change impacts, including more frequent and severe droughts, heatwaves and rainfall. To limit global warming to 1.5 °C, greenhouse gas emissions must peak before 2025 at the latest and decline 43 % by 2030 (UNFCCC, 2024).

In order to achieve the targets set out in the Paris Agreement, all signatories (including the United Kingdom) have been tasked to outline and communicate their post-2020 climate actions, known as 'nationally determined contributions' (NDCs). Together, these climate actions determine whether the world achieves the long-term goals of the Paris Agreement to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century, by reaching global peaking of GHG emissions as soon as possible and to undertake rapid reductions thereafter in accordance with best available science.

NDCs are submitted every five years to the UNFCCC secretariat and each successive NDC is meant to reflect an increasingly higher degree of ambition compared to the previous version.

The 2024 NDC Synthesis Report (UNFCCC, 2024) shows that, global GHG emissions (without LULUCF[2]) taking into account implementation of the latest NDCs from 9 September 2024 are estimated to be around 51.5 (48.3–54.7) Gt CO_2e in 2030 (Figure 5.26).

[2] These numbers do not include the GHG contribution from land use, land-use change and forestry (LULUCF). For comparison, the global emissions including LULUCF in 2030 are estimated as 55.2 (53.9–56.6) Gt CO_2e considering unconditional elements and 51.7 (50.2–53.1) Gt CO_2e assuming full implementation.



Note: INDCs (Intended Nationally Determined Contributions) were the climate action plans submitted before the Paris Agreement in 2015, while NDCs (Nationally Determined Contributions) are the updated, legally binding versions which were introduced with the Paris Agreement.

Figure 5.26: Projected range and progression of emission levels according to NDCs (Source: UNFCCC, 2024)

The NDCs of 82 % of Parties (including the UK) are unconditional, at least in part, with many including more ambitious conditional elements. The implementation of most conditional elements depends on access to enhanced financial resources, technology transfer and technical cooperation, and capacity-building support; availability of market-based mechanisms; and absorptive capacity of forests and other ecosystems. When also taking into account the conditional NDC elements the reduction could be slightly lower at 49.8 (48.3-51.2) Gt CO_2e by 2030.

5.5.4 Managing Climate Change in the UK

As described in Section 5.5.3, each country that has signed up to the Paris Agreement has been tasked to set out a framework for domestic action to address climate change mitigation and adaptation, which has to be updated periodically and presented through their individual NDCs. In the UK this has been implemented through the Climate Change Act (2008). The Act requires the Government to propose regular (every 5 years), legally binding milestones on the way to achieving Net Zero greenhouse gas emissions, known as carbon budgets. In 2019, the UK committed itself to reach Net Zero greenhouse gas emissions by 2050, with any residual greenhouse gas emissions balanced by removals. The UK's target of Net Zero by 2050 is consistent with IPCC scenarios that limit warming to 1.5°C. NDCs and carbon budgets are set to define a feasible pathway to achieve this that is both ambitious in its pace and deliverable (CCC, 2025).

In order to achieve this ambitious goal, the UK government has set itself interim carbon targets on 5-year intervals, which are developed by the climate change committee (an independent advisory body to the government), before being agreed on by Parliament, turning these carbon budgets into legal obligations. The UK's sixth carbon budget (CB6) was implemented in law in June 2021 for the budget period of 2033 to 2037 and the current proposed seventh carbon budget (CB7) covering the period of 2038 to 2042 is due to be legislated by June 2026.

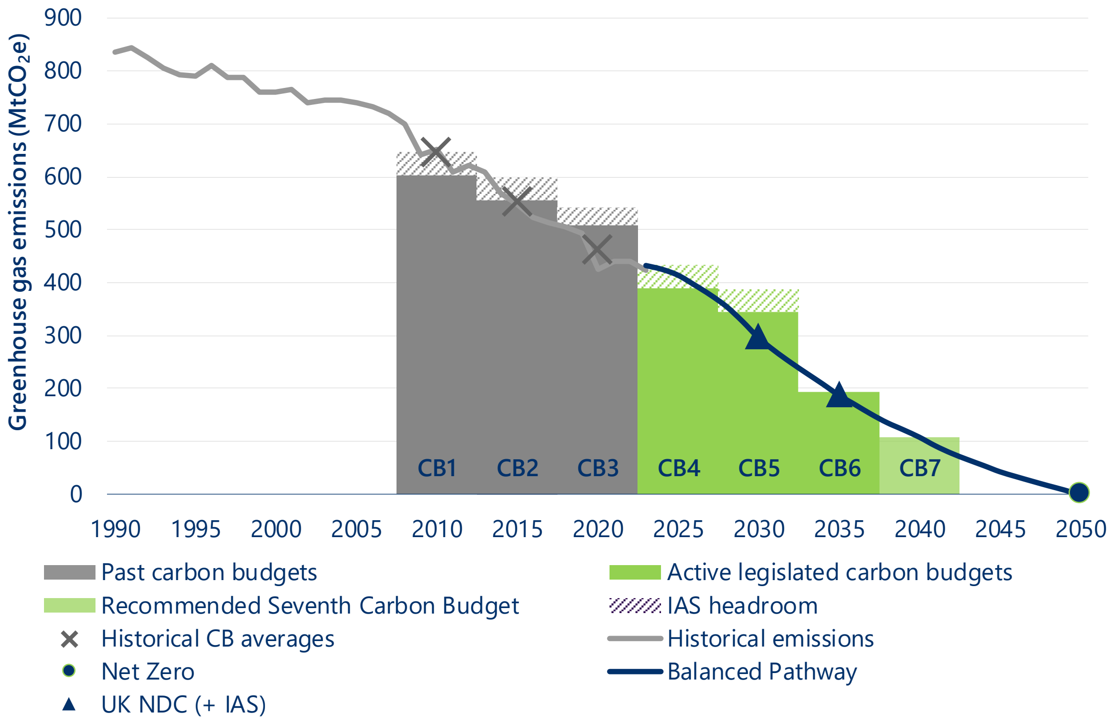
Table 5.16 and Figure 5.27 show the current and proposed UK carbon budgets for the country as a whole. The UK's First, Second, and Third Carbon Budgets, covering the period 2008 to 2022 were set based on the old 2050 target of an 80 % reduction in emissions. The UK has met all three initial targets, with GHG emissions having roughly halved since 1990 (CCC, 2025).

The next three steps on the way to Net Zero are the Fourth, Fifth and Sixth Carbon Budgets, covering the period 2023 to 2037. Whereas the Fourth and Fifth Carbon Budgets were still set based on the previous 80 % reduction target, the current Sixth Budget is set in line with Net Zero and is now also in line with the UK's 2030 and 2025 NDCs. As mentioned above, the seventh carbon budget will be added in 2026.

Table 5.16: UK Carbon Budgets

Carbon Budget	Budget Period	Current Status	UK Budget Allocation [Mt CO_2e]
1	2008-2012	Past Carbon Budget	3,018
2	2013-2017	Past Carbon Budget	2,782
3	2018-2022	Past Carbon Budget	2,544
4	2023-2027	Active Legislated Carbon Budget	1,950
5	2028-2032	Active Legislated Carbon Budget	1,725
6	2033-2037	Active Legislated Carbon Budget	965
7	2038-2042	Proposed Carbon Budget	535

Notes:
Source: CCC, 2025



Notes:
Source: DESNZ (2024a) Provisional UK greenhouse gas emissions national statistics 2023; DESNZ (2024b) Final UK greenhouse gas emissions national statistics: 1990 to 2022; CCC analysis.

(1) The pathway and baseline are modelled using historical data up to 2022 or 2023, depending on the sector. Projected emissions reductions prior to 2025 (shown in a pale shade in this chart) are based on existing trends; additional decarbonisation measures only begin from 2025.
(2) The gap between historical 2023 emissions and the modelling for that year is largely because the analysis assumes that some of the 2021-2023 emissions reduction from buildings was a short-term response to weather and high gas prices and because the shipping modelling is based on an activity-based estimate of emissions.
(3) Emissions from international aviation and shipping (IAS) are included in historical emissions and added to the first five carbon budgets and the two Nationally Determined Contributions (NDC) (in which they are not included).
(4) 'CB' refers to UK carbon budgets: 'CB1' refers to the First Carbon Budget; subsequent numbers refer to subsequent carbon budgets.

Figure 5.27: UK Carbon Budgets

5.5.5 Projected Global GHG Emissions

The level of future global GHG emissions and associated climate change is very hard to predict and historical observations alone are not suitable to forecast how much the climate will change over the coming decades or at the end of the century. The level of climate change over this period will be determined by the amount of greenhouse gases that will be emitted which, in turn, are strongly dependent on how society grows and develops. These growth patterns are influenced by a host of factors, including global cooperation on greenhouse gas reductions, political will, and technological advancements. Even seemingly small changes to any of these factors can result in very different outcomes. Therefore, rather than offering a single set of future climate data, it is considered best practice to provide a range of future climate scenarios that encompass various levels of greenhouse gas emissions (Climate Data Canada, 2025).

To evaluate the most likely range of potential future global warming levels for the Sixth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC AR6), a total of 1,202 modelling scenarios were used, which were split into eight categories (Table 5.17). It should be noted that these categories should not be interpreted as being fixed scenarios. Rather, they are potential storylines that are explored through a large number of individual quantitative scenarios created by climate and economic models. The number of scenarios in each category provides some insight into the current literature, but this does not indicate a higher probability of that category occurring in reality (Riahi et al., 2022).

Table 5.17: Classification of emissions scenarios into global warming levels

Category	Description	SSP	Scenarios modelled
C1: Limit warming to 1.5 °C (> 50 %) with no or limited overshoot	Reach or exceed 1.5 °C during the 21st century with a likelihood of ≤ 67 %, and limit warming to 1.5 °C in 2100 with a likelihood > 50 %. Limited overshoot refers to exceeding 1.5 °C by up to about 0.1 °C and for up to several decades.	SSP1-1.9	97
C2: Return warming to 1.5 °C (> 50 %) after a high overshoot	Exceed warming of 1.5 °C during the 21st century with a likelihood of > 67 %, and limit warming to 1.5 °C in 2100 with a likelihood of > 50 %. High overshoot refers to temporarily exceeding 1.5 °C global warming by 0.1 °C – 0.3 °C for up to several decades.		133
C3: Limit warming to 2 °C (> 67 %)	Limit peak warming to 2 °C throughout the 21st century with a likelihood of > 67 %.	SSP1-2.6	311
C4: Limit warming to 2 °C (> 50 %)	Limit peak warming to 2 °C throughout the 21st century with a likelihood of > 50 %.		159
C5: Limit warming to 2.5 °C (> 50 %)	Limit peak warming to 2.5 °C throughout the 21st century with a likelihood of > 50 %.		212
C6: Limit warming to 3 °C (> 50 %)	Limit peak warming to 3 °C throughout the 21st century with a likelihood of > 50 %.	SSP2-4.5	97
C7: Limit warming to 4 °C (> 50 %)	Limit peak warming to 4 °C throughout the 21st century with a likelihood of > 50 %.	SSP3-7.0	164
C8: Exceed warming of 4 °C (≥ 50 %)	Exceed warming of 4 °C during the 21st century with a likelihood of ≥ 50 %.	SSP5-8.5	29
C1, C2, C3: limit warming to 2 °C (> 67 %) or lower	All scenarios in Categories C1, C2 and C3		541

Notes:
Source: Riahi et al, 2022.

Table 5.17 also shows how the categories relate to the five ‘illustrative’ Shared Socio-economic Pathways (SSPs) used extensively by the IPCC in AR6. These specific SSPs are used to represent five potential futures and are based on broad socioeconomic trends such as population, technological, and economic growth that could shape future society, in combination with a target level of atmospheric greenhouse gas concentrations in 2100.

The five 'illustrative' SSPs used in the IPCC AR6 assessment report (IPCC, 2021) are SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5, whereby SSP1-1.9 represents a low-emissions scenario (based on the implementation of a high level of climate mitigation measures), whilst SSP 5-8.5 represents the highest level of emissions with minimal mitigation.

The five illustrative scenarios are written in a SSPx-y format, where 'x' refers to the particular set of socioeconomic assumptions driving the emissions and other climate forcing inputs used by climate models, and 'y' refers to the approximate level of radiative forcing (in watts per square metre, or W m^{-2}) resulting from that specific scenario in the year 2100 (and therefore, effectively, the amount of warming that could occur by the end of the century).

Of the 1,202 scenarios modelled, 541 scenarios (i.e. the scenarios modelled under categories C1, C2 and C3) would effectively meet the target of limiting global warming to 'well below' 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C as set out in the Paris Agreement.

Figure 5.28 shows these five possible future pathways for yearly global carbon dioxide emissions (left) and their resulting atmospheric carbon dioxide concentrations (right) through the end of the century. For simplicity, the image only shows the mean value predicted by the models for each pathway, not the full range of uncertainty (Lindsey, 2025).

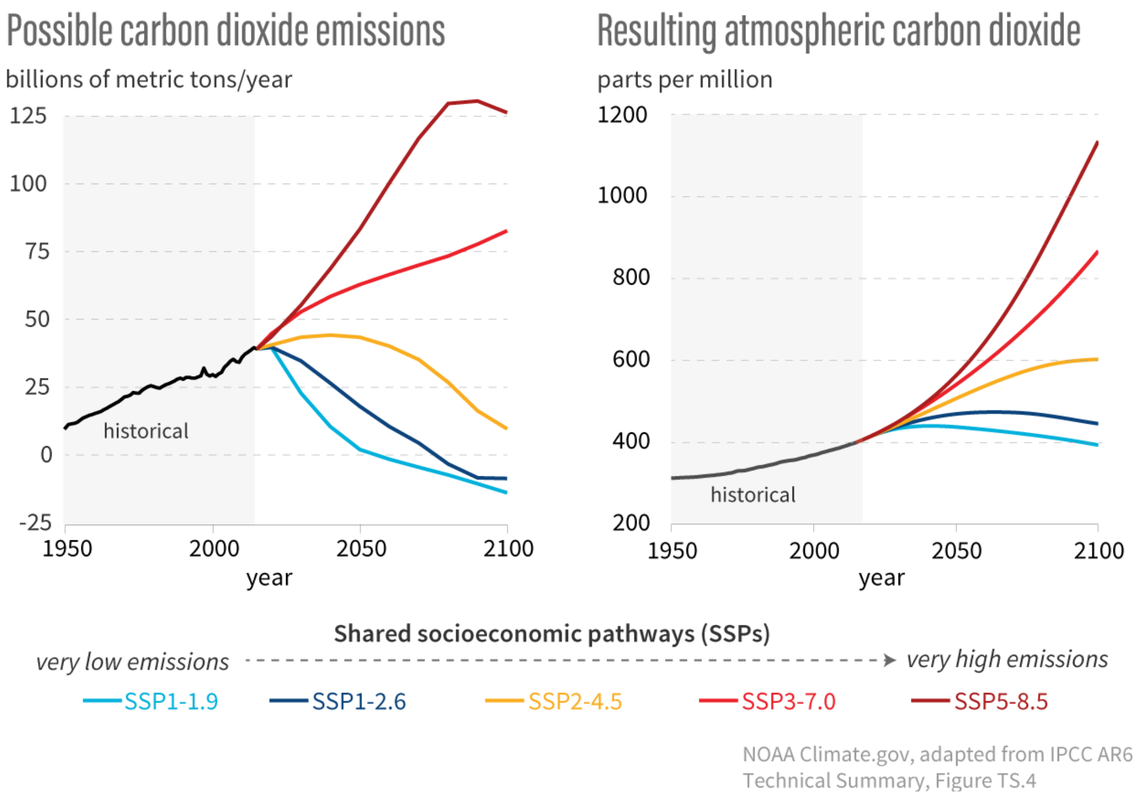


Figure 5.28: Five potential future emission scenarios and resulting atmospheric CO_2 levels

The figures show that global GHG emissions have continued to rise to 2019. The growth of global GHG emissions has however slowed over the past decade, and delivering the current

NDCs to 2030 would turn this into decline. However, the implied global emissions by 2030 exceed pathways consistent with 1.5 °C by a large margin, and are near the upper end of the range of modelled pathways which keep temperatures likely limit warming to 2 °C (with > 65 % probability) (IPCC, 2023).

Predictions beyond 2030 become increasingly more challenging and uncertain, and will largely depend on how successful the implementation of the NDC commitments will be over the next 5 years until 2030, and how much they will improve after that.

Global warming will continue to increase in the near term in nearly all considered scenarios and modelled pathways. Deep, rapid, and sustained GHG emissions reductions, reaching net zero CO_2 emissions and including strong emissions reductions of other GHGs, in particular CH_4, are necessary to limit warming to 1.5 °C (> 50 %) or less than 2 °C (> 67 %) by the end of century (IPCC, 2023).

5.5.6 Global Climate Change Effects

It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred (IPCC, 2023). Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones has been reported in recent years.

Figure 5.29 and Figure 5.30 provide a summary of the impacts of climate change on human and natural systems that have been observed around the world to date.

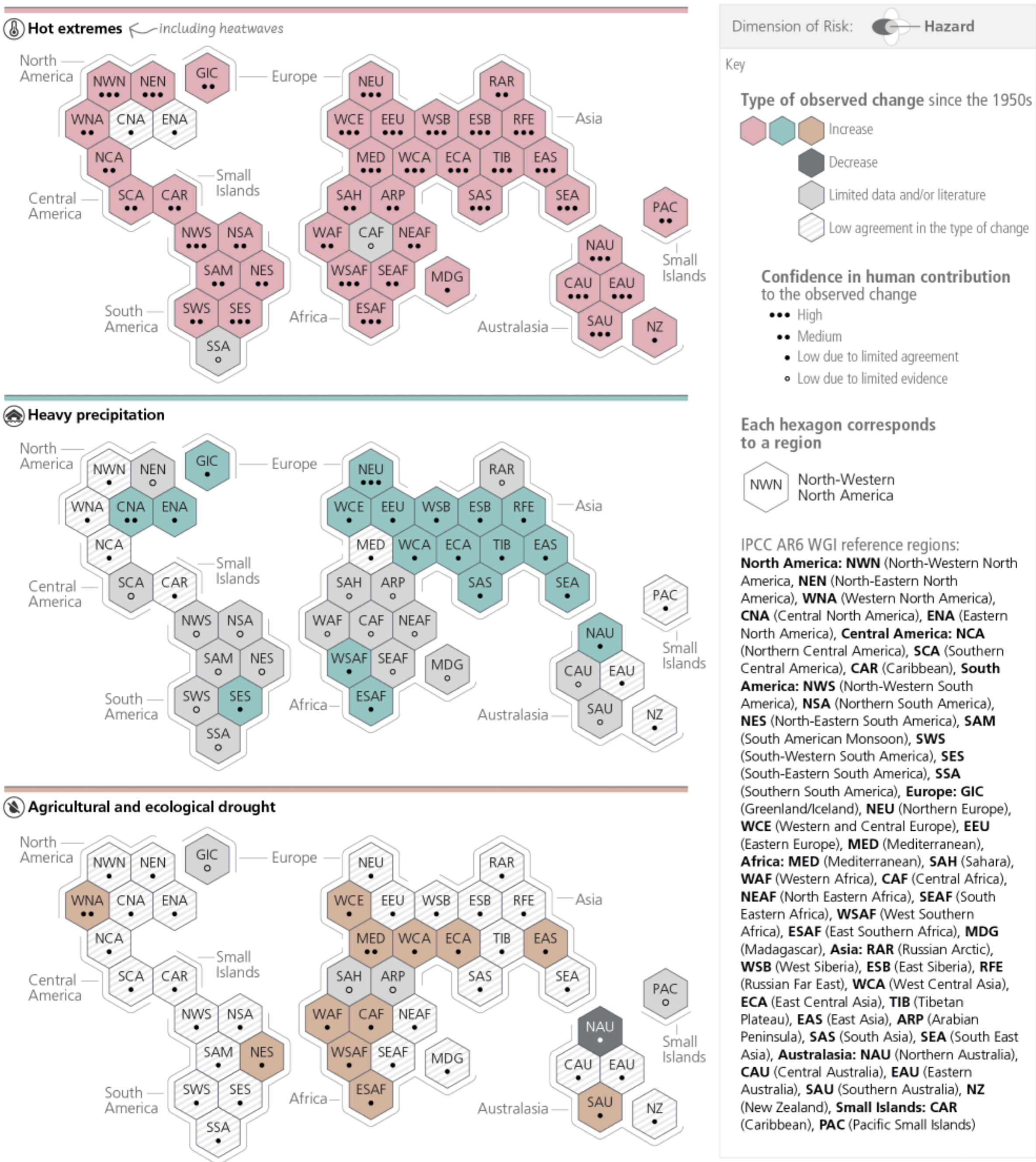


Figure 5.29: Synthesis of observed climate change effects to date around the world (IPCC, 2023)

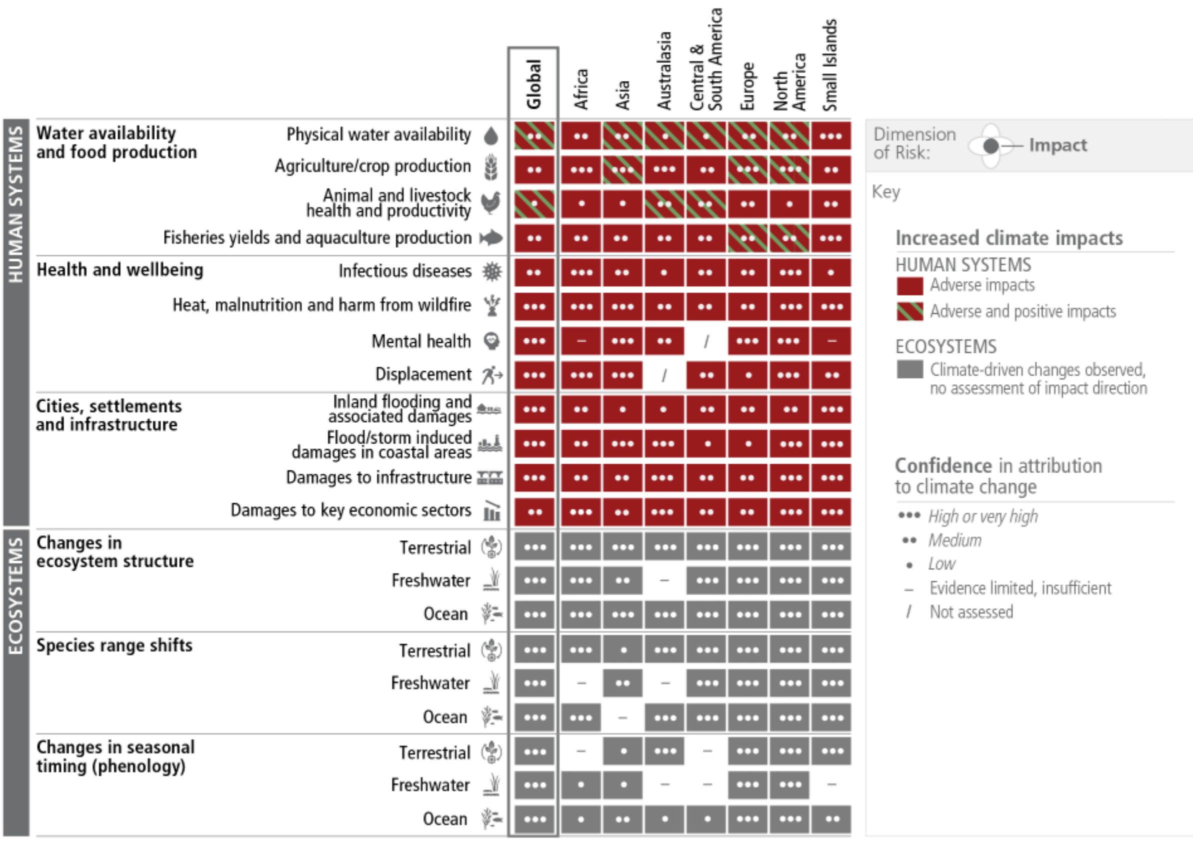


Figure 5.30: Observed impacts and related losses and damages of climate change to date (IPCC, 2023)

As introduced in Section 5.5.5, the 2021 IPCC report on Climate change (IPCC, 2021) has illustrated 5 future scenarios of climate response starting from 2015 which reflect the range of possible development of anthropogenic drivers of climate change until 2100. These different scenarios have been assessed for several chemical, physical, and biological processes affected by the increased concentration of GHGs in the Earth's atmosphere, the most conspicuous being:

- Rising global mean land-surface air temperatures and mean sea-surface temperatures;
- Mean sea level change;
- Changes in the ocean surface pH, also referred to as ocean acidification;
- Changes in land ice mass extent;
- Precipitation level changes; and
- Extreme weather events intensity and frequency changes.

A direct effect of increased GHG and CO_2 emissions in the atmosphere is a change in the global surface temperature, both on land and sea. Increasing global surface temperatures is linked to changes in several other ecological processes and systems, including increasing the species extinction risk, biodiversity loss, melting of ice caps, sea level rise, decreasing the ocean carbon capture capability and more (IPCC, 2021).

According to the modelled scenarios shown in Figure 5.31, global surface temperatures are predicted to continue to rise until the middle of this century in all scenarios. Particularly, after

2050, the low (SSP1-2.6) and very low (SSP1-1.9) scenarios start to flatten out before slowly starting to go down, although surface temperatures are still very likely to be higher than current levels by 1.0 °C to 1.8 °C. Under the intermediate emissions scenario (SSP2-4.5), temperatures are likely to exceed the current levels by 2.1 °C to 3.5 °C. High (SSP3-7.0) and very high (SSP5-8.5) scenarios will see surface temperature continuing to increase, up to 5.7 °C more than current levels (IPCC, 2021).

Land-ocean contrasts are certain to continue to occur under current predictions, with temperatures on land set to increase 1.4 to 1.7 times more than the ocean surface (Lee et al., 2021). As reported by Byrne & O'Gorman (2018), average temperature over land have increased by 42 % more than over the ocean between 1979 and 2016 and this trend is likely to continue in all global surface temperature change scenarios assessed.

Additionally, the Arctic region will experience an increase in surface temperature two times above the rate of global averages under all presented scenarios (Lee et al., 2021). This phenomenon is known as polar amplification and has been observed in parallel to changes in sea ice extent, as well as changes in atmospheric and ocean heat transport and cloud cover (Serreze & Barry, 2011).

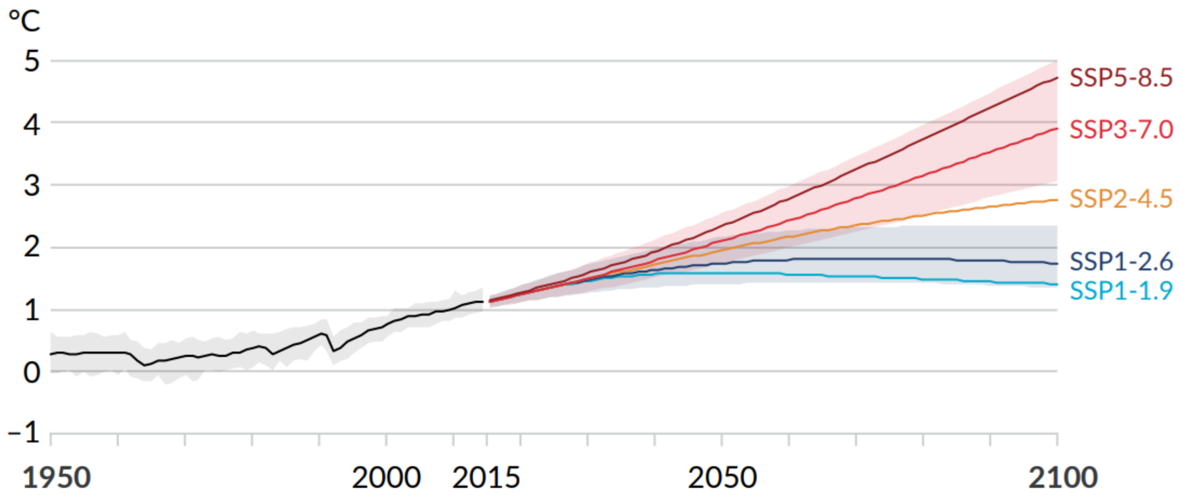


Figure 5.31: Global surface temperature change relative to the period 1850–1900 (Source: IPCC, 2021)

Sea level rise has been linked to the thermal expansion of the ocean due to warming of its waters and melting of ice stored on land as glaciers and ice sheets, which have been exacerbated by global warming driven by human activities (Fox-Kemper et al., 2021). Global mean sea level changes over the 20th century have been primarily affected by the loss of inland ice mass from glacier (52%) and from the Greenland Ice Sheet (29 %), whilst thermal expansion only contributed to 32 % of this change (Fox-Kemper et al., 2021).

Under current predicted scenarios, as shown in Figure 5.32, the global mean sea level will continue to rise throughout this century. In particular, sea level will increase between of 0.28 m (SSP1-1.9) and 1.01 m (SSP5-8.5) under the GHG emissions scenarios assessed (IPCC, 2021). In the longer term, the rise in mean sea level will continue for centuries to millennia and it would take thousands of years under significantly large net negative emissions to reverse this process (Ehlert & Zickfeld, 2018).

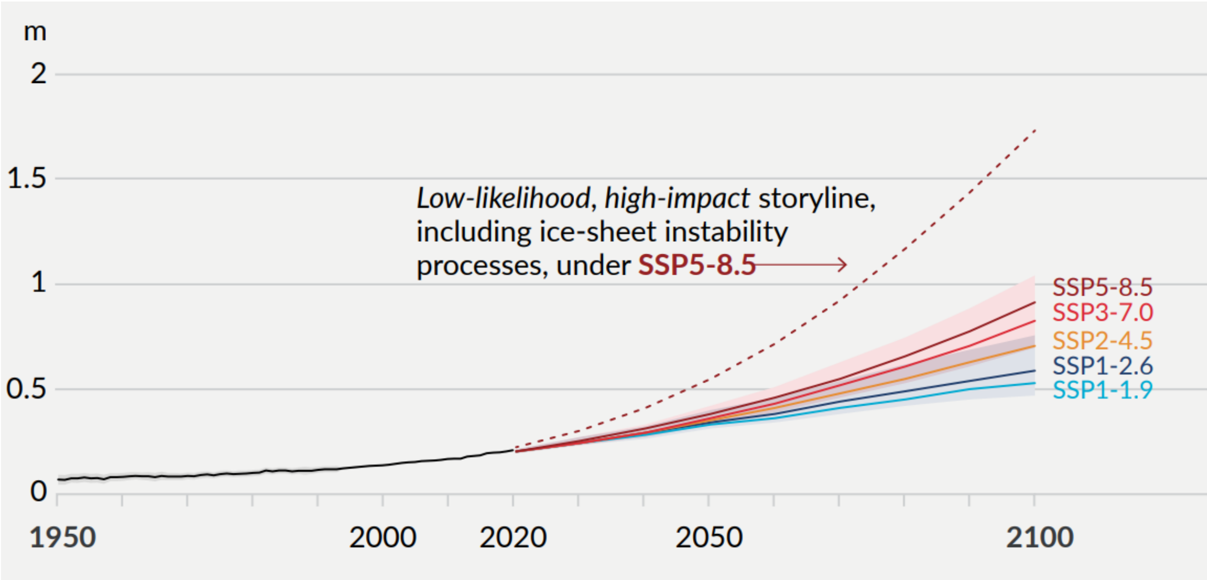


Figure 5.32: Global mean sea level change relative to 1900 (Source: IPCC, 2021)

The global ocean is a natural carbon sink for anthropogenic emissions of CO_2. As increasing CO_2 levels are present in the atmosphere and are absorbed by seawater, the concentration of carbon dioxide in the ocean also increases. The additional uptake of CO_2 through the ocean-atmosphere system triggers a series of chemical reactions causing a decrease in the ocean's pH levels (Gruber et al., 2019). This process is knowns as ocean acidification. Ocean acidification is concurrent to sea temperature rise, decreasing oxygen levels, changes in nutrients availability, and threatens marine organisms by reducing the saturation state of calcium carbonate, which is a component of skeletal structures and shells (Bopp et al., 2013; Gattuso et al., 2015).

Based on the modelled emission scenarios, shown in Figure 5.33, the global ocean surface pH is set to continue decreasing under the intermediate (SSP2-4.5), high (SSP3-7.0), and very high (SSP5-8.5) scenarios through the 21st century. Under the very low (SSP1-1.9) and low (SSP1-2.6) scenarios, pH will decrease before slightly increasing around 2100.

Under the scenarios predicting increasing emissions in the atmosphere, the reduction in pH will result in the ocean carbon sink being less effective, as the proportion of absorbed CO_2 will decrease with increasing CO_2 emissions (Canadell et al., 2021). Moreover, the largest pH decline and decrease in carbonate saturation are expected to be observed in the polar oceans (Jiang et al., 2019).

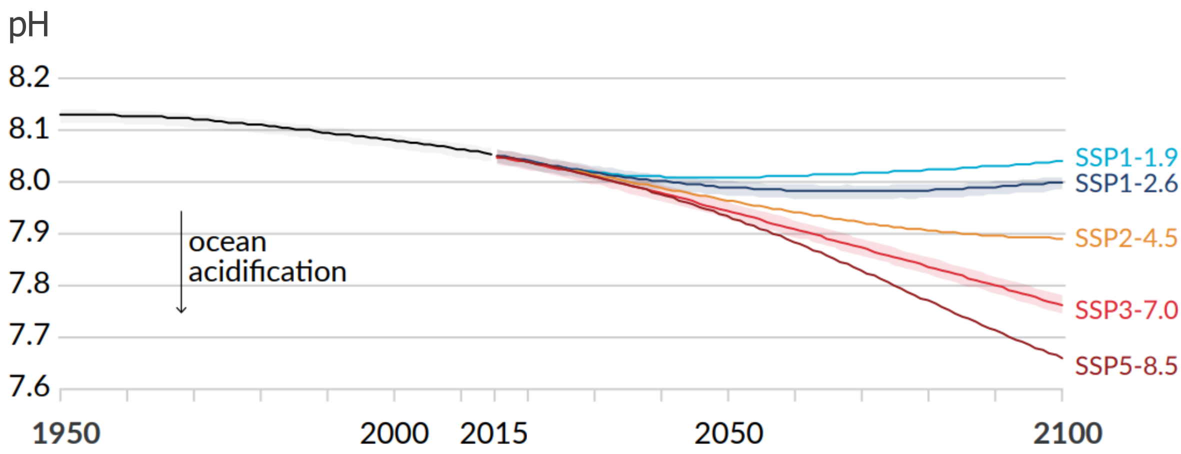


Figure 5.33: Global ocean surface pH (a measure of acidity) (Source: IPCC, 2021)

Climate change directly affects the extent of inland ice mass extent, mainly consisting of Arctic and Antarctic sea ice, Greenland and Antarctic icesheets, glaciers, permafrost and seasonal snow cover around the world. The global increase in temperatures has led to a reduction of ice mass extent globally (Fox-Kemper et al., 2021). The Greenland and Antarctic icesheets have already lost between 4890 Gt (gigatonnes) and 2670 Gt over the period 1992 – 2020, respectively. Glaciers have experienced a loss of 6200 Gt of mass between 1993 and 2019, and increases in permafrost temperatures have been reported over the last four decades. Similarly, the extent of spring snow cover in the Northern Hemisphere has been decreasing since 1978 (Fox-Kemper et al., 2021).

The reduction in snow and ice cover on the planet reduces the amount of sunlight being reflected back into space, thus, trapping more heat in the atmosphere and accelerating global temperature rises. Furthermore, large stores of carbon are thought to be present in the frozen soils and permafrost of the Arctic, and increased decomposition as soils thaw and warm could mean that the Arctic will become a significant source of both atmospheric methane and carbon dioxide (Oh et al, 2025).

According to assessed emission scenarios, as presented in Figure 5.34, the Arctic sea ice area is expected to decrease under all considered scenarios (IPCC, 2021). Additionally, the Arctic will be practically sea ice-free (sea ice area less than 1 million km^2) in September from 2050 under the intermediate (SSP2-4.5), high (SSP3-7.0), and very high (SSP5-8.5) scenarios. Sea ice area is also set to decrease in March when annual coverage will be at its maximum, under all scenarios (IPCC, 2021).

Similarly, polar icesheets, glaciers, and Northern Hemisphere snow cover will continue to lose mass under all scenarios considered for throughout the 21st century (Fox-Kemper et al., 2021). Permafrost is also expected to experience increasing thaw and degradation until 2100 under all scenarios.

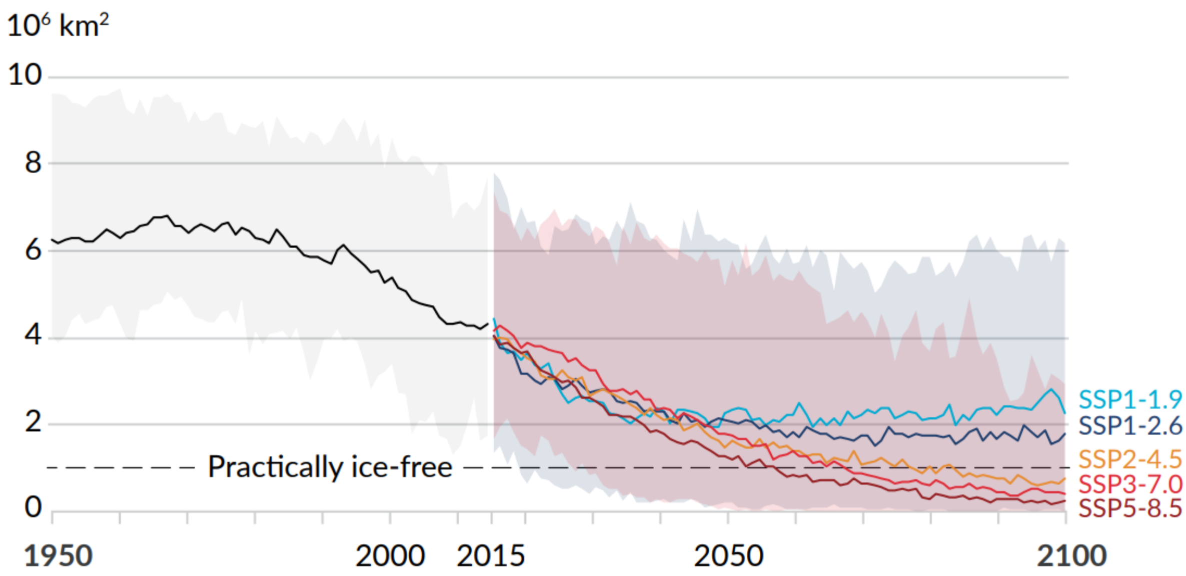


Figure 5.34: September Arctic sea ice area (Source: IPCC, 2021)

Climate changed induced by anthropogenic emissions also affects precipitation, causing increases in frequency and intensity of precipitations over certain parts of the world and decreases in regions. Significant increases in precipitations have been recorded over eastern North America, southern South America, northern Eurasia, and north-west Australia, whilst decreases have been mostly observed across southern Asia and western to equatorial Africa between 1901 and 2019 (Gulev et al., 2021). Increases in precipitations intensity and frequency, particularly of rainfall, can lead to flooding, landslides, and flash flooding (Chan et al., 2016; Gariano & Guzzetti, 2016). Conversely, a decrease in precipitation over certain regions can lead to droughts, impacting agriculture, water resources, and causing plant mortality (Fontes et al., 2018).

Considering the assessed emissions scenarios, the average annual global land precipitation significantly differs both geographically and seasonally. Precipitations are expected to increase over high latitudes and monsoon regions, whilst they are predicted to decrease over the subtropics, including Mediterranean and southern Africa. However, global mean precipitations are projected to increase by approximately 2.0 % under the very low scenario (SSP1-1.9) and 6.5 % under the very high scenario (SSP5-8.5) by the end of the current century (IPCC, 2021).

Climate change and its related effects, such as increasing precipitations and temperature increases, will also exacerbate extreme weather events, including tropical cyclones, tornadoes and other severe local storms, floods, heatwaves, droughts, wildfires and cold events (Seneviratne et al., 2021). These can be short-term events, such as tropical cyclones, or events that can extend over several months or years such as droughts. Some extreme events bring substantial loss of life or population displacement, others may have limited casualties but major economic impacts (WMO, 2020). These extreme weather events are expected to increase in frequency and intensity with increasing global warming levels.

Projected changes in the frequency of occurrence and intensity of some of these extreme weather events in relation to additional increments of global warming are summarised in Table 5.18.

Table 5.18: Projected changes in extremes frequency and intensity with every additional increment of global warming

	1850-1900	Present	Future global warming levels		
		1°C	1.5°C	2°C	4°C
Hot temperature extremes over land (10-year and 50-year events)					
Frequency per 10 years	1×	2.8×	4.1×	5.6×	9.4×
Intensity Increase	--	+1.2 °C hotter	+1.9 °C hotter	+2.6 °C hotter	+5.1 °C hotter
Frequency per 50 years	1×	4.8×	8.6×	13.9×	39.2×
Intensity Increase	--	+1.2 °C hotter	+2.0 °C hotter	+2.7 °C hotter	+5.3 °C hotter
Heavy precipitation over land (10-year event)					
Frequency per 10 years	1×	1.3×	1.5×	1.7×	2.7×
Intensity Increase	--	+6.7 % wetter	+10.5 % wetter	+14 % wetter	+30.2 % wetter
Agricultural & ecological droughts in drying regions (10-year event)					
Frequency per 10 years	1×	1.7×	2.0×	2.4×	4.1×
Intensity Increase	--	+0.3 sd drier	+0.5 sd drier	+0.6 sd drier	+1.0 sd drier
Notes: Source: IPCC (2021).					

5.5.7 Climate Change Effects in the UK

The changes in the UK climate that are currently already observed are projected to continue and intensify. In the second half of the century, the amount of change that occurs will depend strongly on how successful the measures to reduce greenhouse gas emissions globally are.

Table 5.19 shows the projected changes in some climate variables for England (ENG), Northern Ireland (NI), Scotland (SCO) and Wales (WAL), based on the 2018 UK probabilistic climate projections. These values quoted in the table represent a central (median) estimate of 30-year average change in each variable from a 1981-2000 baseline. Two emissions scenarios (Representative Concentration Pathways, or RCPs) are used, with RCP2.6 being roughly equivalent to a global warming +2 °C above pre-industrial scenario by 2100 and RCP6.0 being roughly equivalent to a global warming +4 °C above preindustrial levels by 2100. The exception is Sea Level Rise, where the RCP8.5 scenario is used, as for marine projections this is closer to a +4 °C global warming scenario. The full likely range of change (i.e. 10 - 90th percentile) in each average variable is not shown here but is available from the full UKCP18 database. It is important to note that because these projections show average changes for a 30-year period and only the central estimate, changes in individual years would show a much greater range of change and could be significantly higher (or lower).

Table 5.19: Climate change effects in the UK

Climate change Effect	Country	2050s RCP2.6 (50th percentile)*	2050s RCP6.0 (50th percentile)*	2080s RCP2.6 (50th percentile)*	2080s RCP6.0 (50th percentile)*
Annual Temperature	ENG	+1.3 °C	+1.2 °C	+1.4 °C	+2.4 °C
	NI	+1.1 °C	+1.2 °C	+1.2 °C	+2.1 °C
	SCO	+1.1 °C	+1.0 °C	+1.1 °C	+2.0 °C
	WAL	+1.2 °C	+1.1 °C	+1.3 °C	+2.3 °C
Summer Rainfall	ENG	-15 %	-14 %	-15 %	-22 %
	NI	-11 %	-11 %	-10 %	-15 %
	SCO	-7 %	-6 %	-12 %	-16 %
	WAL	-15 %	-15 %	-18 %	-26 %
Winter Rainfall	ENG	+6 %	+6 %	+8 %	+13 %
	NI	+3 %	+3 %	+7 %	+10 %
	SCO	+7 %	+7 %	+7 %	+13 %
	WAL	+6 %	+5 %	+7 %	+13 %
Sea level rise**	ENG	+23 cm	+29 cm	+45 cm	+78 cm
	NI	+14 cm	+16 cm	+27 cm	+58 cm
	SCO	+12 cm	+18 cm	+23 cm	+54 cm
	WAL	+22 cm	+28 cm	+43 cm	+76 cm

Notes:
Sources: Climate Northern Ireland, 2021; Netherwood, 2021; Sniffer, 2021; Sustainability West Midlands, 2021.

* RCP values refer to the 'Representative Concentration Pathways' and are analogous to the 'y' values used in the SSPx-y scenarios used in AR6, i.e. they are scenarios for the future that project greenhouse gas concentrations and their resulting impact on the climate, expressed in watts per square metre (w/m^2). RCP2.6 (50th percentile) refers to a climate change scenario with a central estimate for low-emission futures, where greenhouse gas emissions are assumed to peak and then decline significantly, leading to a warming of around 2.6 w/m^2 above pre-industrial levels with global temperature rises expected to remain below 2 °C. RCP6.0 represents a medium-range greenhouse gas emissions pathway projecting a global temperature rise of approximately 3 to 4 °C by 2100 above pre-industrial levels. This scenario assumes that greenhouse gas emissions peak around 2080 and then decline, stabilizing at a radiative forcing level of 6.0 w/m^2 after 2100 and projects a global temperature rise of approximately 3–4 °C by 2100 above pre-industrial levels.
** As sea level rises will be very location specific around the UK shores, only one representative location from each of the four countries has been selected to represent each of the four nations, namely: Belfast, Cardiff, Edinburgh and London.

Annual average temperatures are projected to rise. Risks associated with rising temperatures, such as extreme heatwave events causing impacts on people's health and wellbeing, are likely to become more prevalent, with their magnitude depending on the degree of change that is experienced. Although temperatures are projected to increase in both summer and winter, warming is expected to be greatest in summer. Summer rainfall is projected to decrease, although extreme downpours will be heavier despite the overall drying trend.

The change in expected rainfall is projected to lead to an increase in flooding of infrastructure, businesses and homes. Conversely, as overall summer rainfall is projected to decrease, periods of water scarcity are likely to become more prevalent under these scenarios, leading to possible implications in agriculture and industry, for example.

Winters are projected to become wetter, both in terms of total amount of rainfall and the number of wet days.

Sea level rises will be very location specific, and the examples provided in the table for Belfast, Cardiff, Edinburgh and London should just be seen as 'typical' examples for each of the four nations. Such rises would lead to an increase in likelihood of associated risks, such as flooding of coastal communities.

5.6 Summary

Table 5.20 provides a summary of the key environmental sensitivities identified throughout this chapter for the proposed Fotla field development.

Table 5.20: Seasonal variation of key environmental sensitivities

Receptors	Environmental Sensitivity											
	J	F	M	A	M	J	J	A	S	O	N	D
Benthos												
	Sediments at Fotla comprise sand and mud with biotopes assessed as MD621: Faunal communities on Atlantic offshore circalittoral mud (a classification of higher level to MD6218) and MD6218: *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in Atlantic offshore circalittoral sandy mud. The OSPAR Listed habitat 'Sea pens and burrowing megafauna communities', as well as the ocean quahog (PMF and OSPAR listed) are the features of conservation importance. A sparse epifaunal community is present in the area, with sea pens, urchins, starfish and burrows being some of the most commonly observed epifauna on the seabed. The infauna is dominated by polychaetes, with *Paramphinome jeffreysii* being the most dominant and abundant species. Hagfish (*Myxine glutinosa*) and flatfish (Pleuronectiformes) are some of the most commonly observed fish species. June to October is considered a comparatively sensitive period for benthos at Fotla, due to the spawning of ocean quahog.											
Fish and shellfish												
	The proposed Fotla field development area lies within, or close to, known spawning grounds for cod, Norway pout, *Nephrops*, lemon sole and sand eels. The majority of species exhibit peak spawning activity between January and April, although several species spawn over a longer period. The Fotla field lies in a year-round nursery area for anglerfish, blue whiting, cod, European hake, herring, ling, mackerel (North Sea), *Nephrops*, plaice, sand eels, spotted ray, spurdog, and whiting.											
Marine mammals												
	Six species of cetacean have been recorded in the vicinity of the development, including Harbour porpoise, Killer whale, Minke whale, Risso's dolphin, White-beaked dolphin and Atlantic white-sided dolphin. Common and grey seals are unlikely to be found within the proposed Fotla field development area (≤ individuals per 25 km^2 or ≤ 0.01 % of the UK and Ireland population).											
Seabirds											n/d	n/d

Receptors	Environmental Sensitivity											
	J	F	M	A	M	J	J	A	S	O	N	D
	Seabirds are present throughout the year including black-legged kittiwake, northern fulmar, common guillemot, little auk and northern gannet. Most species likely present in the proposed development area breed along the coast between May and August. The sensitivity of birds to surface oil pollution is 'low' or 'medium' throughout the year (no data for November and December) in UKCS Blocks 22/1 and 16/26 and adjacent Blocks.											
Other users of the sea												
	The proposed Fotla field is situated in an area of extensive oil and gas activity. The area is also widely used by the fishing and shipping industries. The commercial fishery within the area (ICES Rectangles 44F1 and 45F1) shows that most of the fishing effort takes place in October and November for both rectangles, whilst landings are highly variable but are highest between July and November for both ICES rectangles 44F1 and 45F1. The shellfish fishery in the area is very lucrative with *Nephrops* being the most landed species. Shipping density is low to moderate in the proposed area.											
Climate Change												
	The atmospheric concentration of GHGs is classed as being of high sensitivity to all further emissions.											
Key:		Low		Moderate		High		Very High				

6. Identification of Potential Impacts

This section describes the scoping methods used to identify the environmental interactions and concerns associated with the proposed Fotla field development that could potentially cause a significant environmental impact. The following three scoping methods were used:

- Environmental issue identification (ENVID) workshops with members of the Ithaca Energy project team and environmental consultants from Fugro;
- Informal scoping consultation with the regulator and statutory consultees; and
- Consideration of national policies and guidance, including:
  - The Scottish National Marine Plan (NMP) policies, relating to the potential impacts from oil and gas activity; and
  - Assessment of the sensitive features of the local environment and corresponding relevant pressures from the proposed Fotla field development, based on the Feature Activity Sensitivity Tool (FEAST).

The purpose of these scoping activities was to identify the main environmental concerns at an early stage of the project, so that they could be addressed and mitigated against during the Environmental Impact Assessment (EIA) process.

6.1 The ENVID Workshops

An ENVID workshop is a scoping exercise during which members of the project team identify all potential interactions of the proposed development activities with the environment and score their potential environmental impacts in a transparent and auditable manner. Three separate ENVID workshops were organised, each of which were attended by members of the Ithaca Energy project team and environmental consultants from Fugro. During the ENVIDs, all anticipated operations and activities of the proposed Fotla field development which may interact with the environment were identified and categorised as follows:

- Subsea infrastructure and pipeline installation and operation;
- Drilling and completion operations; and
- Platform topsides installation and operation.

These operations and activities are termed 'environmental aspects'. The source and pathway of each environmental aspect was defined, and all potential receptors that may be affected by that particular aspect were identified. The effects of each environmental aspect were then scored for each individual environmental aspect, using the minimum scoping thresholds outlined in Table 6.1 to determine whether their impact would require further detailed assessment and appropriate mitigation in the Environmental Statement (ES).

Table 6.1: ENVID workshop scoping matrix

Scoping Thresholds for Detailed Assessment in the ES	To Be Scoped In
Detectable/measurable change to habitats and biological communities exceeding natural variability.	
An impact affecting any locally, nationally or internationally protected features.	
An environmental effect lasting more than a few days/weeks.	
An impact affecting behaviour or causing a nuisance to other users of the sea or the general public.	
An impact extending beyond the immediate footprint of the development.	✓
Impact is acknowledged to contribute to cumulative effects.	
Potential to cause risk to reputation of the company or commercial success.	
Noticeable change in landscape character causing changes to the view or other landscape characteristics.	
Usage of finite resources that may affect short-term availability and local market price.	

All aspects deemed to require further assessment and management measures to control them were scored as 'Y' for 'Yes', are therefore 'scoped in' to be assessed further as part of the EIA process. Where a potential interaction was identified, but the associated impacts were deemed to be insignificant, this was scored as 'N' for 'No'. Such interactions will not require further detailed assessment in the ES, i.e. these aspects are 'scoped out' of the EIA. The full results of the ENVID workshops undertaken are presented in Appendix 4. Environmental aspects 'scoped in' for further detailed assessment in the ES are summarised in Table 6.2.

Table 6.2: Summary of project environmental aspects scoped in for assessment

Environmental Impact	Aspects Scoped in for Further Assessment in the ES	ES Section
Discharge of oil-based mud (OBM) contaminated drill cuttings after thermal treatment (i.e. < 1 % oil left on cuttings)	Biological Receptors	8
Discharge of water-based mud (WBM), drilling chemicals, drill cuttings and excess cement	Biological Receptors	8
Installation of seabed infrastructure	Biological Receptors	9
Installation, presence and removal of anchor chains from the Mobile Offshore Drilling Unit (MODU)	Biological Receptors and Other Users of the Sea	9
Use of rock protection, laying of concrete mattresses, grout bags etc. to protect pipelines or other seabed infrastructure	Biological Receptors	9

Environmental Impact	Aspects Scoped in for Further Assessment in the ES	ES Section
Ongoing presence of pipelines / subsea infrastructure on the seabed during the lifetime of the development	Biological Receptors and Other Users of the Sea	9
Physical presence of installation, construction and support vessels during subsea infrastructure installation operations	Other Users of the Sea	9
Physical presence of the drilling rig and support vessels at the sea surface	Other Users of the Sea	9
Trenching and installation of pipelines on the seabed	Biological Receptors	9
Atmospheric emissions from power combustion emissions during installation, commissioning and routine operations	Atmosphere	10
Flaring during well clean up and commissioning of subsea infrastructure and host platform facilities	Atmosphere	10
Increased energy demand due to modifications to, and subsequent operation of, the host platform topsides resulting in increased atmospheric emissions	Atmosphere	10
Increases in produced water discharges from the host platform facilities due to the addition of the Fotla field development	Biological Receptors	11
Use and discharge of chemicals during testing and commissioning of infield pipelines and other infrastructure (assumed to be discharged via Britannia)	Biological Receptors	11
Noise from installation and support vessels and vibration of equipment (below sea level)	Biological Receptors	12
Operational noise and vibration from the MODU and support vessels	Biological Receptors	12
Piling to fix infrastructure to the seabed	Biological Receptors	12
Dropped objects	Biological Receptors and Other Users of the Sea	14
Large oil spill, requiring mobilisation of all available internal and external oil spill response resources. Oil Spill has potential to reach the shore. (e.g. well blowout or loss of entire fuel inventory of a vessel)	Biological Receptors, Sensitive Receptors, Other Users of the Sea and Society	14
Loss of installation vessel, support vessel or helicopter, resulting in an unrecoverable wreck on the seabed (ignoring any potential associated spill effects, as these are already covered in the categories above)	Biological Receptors and Other Users of the Sea	14
Medium oil or chemical spill, requiring offshore intervention but will not reach the shore (e.g. Spillage of OBM / diesel / base oil transfer), a production pipeline leak, a fuel spill from the installation or supply vessels or the loss of an installation or support vessel (e.g. due to a collision resulting in hydrocarbon release, loss of stability or fire / explosion)	Biological Receptors, Sensitive Receptors and Other Users of the Sea	14
Small oil or chemical spill which will disperse naturally within a few hours to days (e.g. hydraulic fluid, lubes, helicopter fuel, etc)	Biological Receptors	14

6.2 Informal Stakeholder Consultation

In addition to completing three ENVID workshops, Ithaca Energy has undertaken informal consultation on the proposed Fotla field development with the following organisations:

- Offshore Petroleum Regulator for Environment and Decommissioning (OPRED);
- Marine Directorate (formerly Marine Scotland);
- The Joint Nature Conservation Committee (JNCC); and
- The Scottish Fishermen's Federation (SFF).

An early engagement meeting with the OPRED was held in August 2023 to introduce the project and highlight potential environmental sensitivities identified from an initial review of available data.

6.2.1 Early Consultation Document

An Early Consultation Document (ECD) was prepared describing the proposed Fotla field development, the environmental baseline conditions at the site and recommendations for the impacts to be 'scoped in' for further detailed assessment following the ENVIDs. The ECD was issued to the OPRED, Marine Directorate, JNCC and SFF in June 2024 for informal feedback by way of any comments or concerns they might have, in relation to the proposed Fotla field development, the quality of the environmental baseline information provided and the impact recommendations. A follow up scoping meeting was held with the OPRED in July 2024 which considered the consultation responses received. Responses were received from the majority of consultees with the exception of the Marine Directorate. A summary of the consultee comments relating directly to impacts that are *potentially significant* are summarised in Table 6.3.

Table 6.3: Consultee comments to be considered in the ES

OPRED Comments	Relevant ES Section
Estimates of drill cuttings discharges should include a re-spud and sidetrack for each well. The sidetrack should be based on the section of the well which generates the largest volume of drill cuttings for the modelling. The impact assessment of discharge of drill cuttings should consider potential cumulative impacts	4.5 and 8
Trenching and rock dumping of pipelines should be justified and include consideration of any sensitive habitats along the pipeline routes setting out the potential to reroute the pipeline to avoid/minimise the impact on any such habitats	3, 4 and 9
The additional power demand on the selected host platform facilities should be determined along with any associated changes in atmospheric emissions	10
"Scope 3" emissions, indirect emissions which occur in the upstream and downstream activities of an organisation, associated with the project required to be included in the assessment of atmospheric emissions. The assessment of emissions should be calculated on a worst-case scenario	10
The ES should set out opportunities to reduce emissions to align with Net Zero targets	3
The potential impacts from the discharge of produced water should be considered in the ES	11
Marine mammals should be considered in any assessment of underwater noise impacts which may arise from piling of the subsea infrastructure	12
Management of waste for the development requires to be considered in the ES	13
Options for removal of any seabed protection material (i.e. rock protection material, concrete mattresses, etc) should be considered in the ES	4.6.5
JNCC Comments	**Relevant ES Section**
Where acoustic surveys have indicated the presence of pockmarks and/or Methane-Derived Authigenic Carbonate (MDAC) the data should be ground truthed, if possible, by Remotely Operated Vehicle (ROV) surveys to provide evidence that MDAC is not present	5.2.3
JNCC would advise to avoid the Oslo and Paris Convention (OSPAR) Threatened and Declining Habitat 'Sea-pen and burrowing megafauna communities' as much as practicably possible while conducting activities	4
JNCC would suggest that developers do not undertake any systematic survey for *A. islandica* unless agreed with the regulator or consultees. JNCC would advise to avoid the above-mentioned habitats as much as practicably possible while conducting activities	5.3.2
JNCC's preference would be for the pipelines to be buried with a minimum quantity of rock used. If sufficient burial depth can be achieved, we do not see a need to add extra hard substrate deposits to a mainly sedimentary environment. If rock dump is required along the entire length of the pipelines, we would request justification for the rock dump and request that the mitigation hierarchy is followed to minimise impacts to benthic habitats and Priority Marine Features (PMF)	3.5
JNCC encourages the operator to continue working to minimise the amount of hard substrate material used. The use of fall pipe vessel is recommended rather than using vessel-side discharge methods. JNCC expects detailed commentary on stabilisation operations to be included, to understand the potential nature conservation impacts and expected fate of deposit after end of production, i.e. will it be left in situ or recovered	4.6.5
JNCC expects to see detailed drill cuttings dispersion modelling that identifies the thickness/radius of the dispersion, and the possible impact that might have on the surrounding benthic environment	8

JNCC prefers that the WBM from the reservoir section is treated in the same way as the Low Toxicity Oil Based Mud (LTOBM)	4.5
JNCC requests applicants to provide more detail on previous environmental surveys undertaken, including a map detailing site locations in relation to proposed activities and sampling occurred at each location (e.g. drop-down video transects, number of grab samples etc)	5.1.1
Data for the Seabird Oil Sensitivity Index (SOSI) should be included for Blocks where activity will occur and any surrounding blocks. Information should be presented in a table format.	5.3.7
JNCC advises undertaking marine mammal mitigation for piled events, following of the JNCC (2010) guidelines	12
SFF Comments	**Relevant ES Section**
Consideration to eliminate safety risk for the fishermen from mud berms being left behind following pipeline trenching operations	5 and 9
Consideration to avoid use of concrete mattresses and rock bags. If inevitable, it is recommended that any such mattresses being installed in open water and are rock-dumped.	4.6.5
Impacts on commercial fisheries should be considered and use of 10-year landings data	5.4.1 and 9
Consideration of impacts on spawning and nursery sites for fish in the area of the Fotla field development and potential loss of fish stocks	5.3.3 and 9
Consideration of disruptions to the fishing industry due to the presence of subsea infrastructure and to propose embedded mitigations related to decommissioning	9

6.2.2 Near Final Draft Version of the ES

A Near Final Draft version of the ES was issued to OPRED for a preliminary review. The feedback received was used to update the Final version of the ES for submission to OPRED.

6.3 National Policies and Guidance

6.3.1 Scottish National Marine Plan Requirements

The Scottish National Marine Plan (NMP) has established policies relating to potential impacts from oil and gas activity. These policies have been taken into full consideration during the EIA process. A summary of the general and oil and gas specific policies and objectives relevant to the proposed Fotla field development are presented below. In addition to the NMP, the principles of best available technology (BAT) and best environmental practice (BEP) is considered and adhered to throughout project planning, design, engineering and execution (Section 3.6.1).

The NMP also requires operators to have adequate risk reduction measures and sufficient emergency response and contingency strategies in place that are compatible with the National Contingency Plan and the Offshore Safety Directive. Furthermore, it requires that any future decommissioning operations will be undertaken in line with standard practice, and as allowed by international obligations.

The proposed Fotla field development has been assessed against the following general Marine Plan objectives and policies: GEN 1, 2, 3 ,4, 5, 6, 9, 10, 11, 12, 13, 14, 18, 19, 20 and 21.

6.3.1.1 GEN 1 – General Planning Principle

Development and use of the marine environment should be consistent with the NMP, ensuring all activities are undertaken in a sustainable manner that protects and enhances Scotland's natural and historic marine environment. Ithaca Energy will ensure that the project will be undertaken in accordance with this policy and any potential impacts associated with the proposed Fotla field development will be kept to a minimum, as part of the avoid, reduce, mitigate hierarchy discussed in Section 7 and applied throughout this ES.

6.3.1.2 GEN 2 – Economic Benefit

The economic benefit of the development should be considered carefully and appropriately, as sustainable development and use of the marine environment can provide economic growth, skill development, employment and opportunities for investment. The proposed Fotla field development will sustain jobs and provide tax revenue to the Scottish economy and therefore is considered to comply with this objective.

6.3.1.3 GEN 3 – Social Benefit

Sustainable development and use which provides social benefits is encouraged when consistent with the objectives and policies of the NMP. The proposed Fotla field development is in line with sustainable development as it will prolong the life of the Britannia facilities and associated workforce. In addition, the drilling and installation of the new infrastructure will sustain industry opportunities.

6.3.1.4 GEN 4 – Coexistence

Coexistence with other development sectors and activities is encouraged in planning and decision-making processes. Where conflict over space or resource exists or arises, marine planning should encourage initiatives between sectors to resolve conflict and take account of agreements where this is applicable. Ithaca Energy will ensure that the Fotla field development will be undertaken in accordance with this policy and any potential impacts on other sea users associated with the proposed Fotla field development will be kept to a minimum as discussed in Section 9 of the ES which concerns Physical Presence impacts.

6.3.1.5 GEN 5 – Climate Change

Marine planners and decision makers must act in a way best calculated to mitigate and adapt to climate change. Developers and users of the marine environment should seek to facilitate a transition to a low carbon economy through mitigation and adaptation and consider ways to reduce emissions of carbon and other greenhouse gasses. Ithaca Energy will ensure that the Fotla field development will be undertaken in accordance with this policy and any potential impacts associated with the proposed Fotla field development will be kept to a minimum, as discussed in Section 10 of the ES which concerns Atmospheric Emissions. Section 2 of the ES, Net Zero Action Plan, discusses Ithaca Energy's greenhouse gas (GHG) emissions strategy, policy and targets and how these are embedded in the Company's management systems.

6.3.1.6 GEN 6 – Historic Environment

Development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance. There are no known wrecks or heritage sites within the Fotla field development area, as discussed in Section 5 of the ES which details the Local Environment.

6.3.1.7 GEN 9 – Natural Heritage

Development and use of the marine environment must:

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

The Fotla field development is not situated within or in close proximity to a conservation site (Section 5). The closest conservation area to the proposed Fotla field development is the Scanner Pockmark Special Area of Conservation (SAC), located approximately 26.3 km to the northwest However, certain protected species/habitats may be present within or make use of the wider project areas, and these are described in Section 5. Ithaca Energy will ensure that the Fotla field development will be developed in accordance with this policy and any potential impacts to these protected species will be kept to a minimum, as discussed in Sections 8 and 9 of the ES, Drilling Impacts and Physical Presence respectively.

6.3.1.8 GEN 10 – Invasive Non-Native Species

Opportunities to reduce the introduction of invasive non-native species to a minimum, or proactively improve the practice of existing activity, should be taken when decisions are being made. All vessels, including the MODU, used during the proposed drilling and installation phases, will follow International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004 requirements.

6.3.1.9 GEN 11 – Marine Litter

Developers, users and those accessing the marine environment must take measures to address marine litter where appropriate. Ithaca Energy will ensure that construction and operational activities will be undertaken, in accordance with this policy.

6.3.1.10 GEN 12 – Water Quality and Resource

Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives apply. Ithaca Energy will ensure that construction and development activities associated with the Fotla field development will be undertaken in accordance with this policy.

6.3.1.11 GEN 13 – Noise

Developments and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects. Ithaca Energy will ensure that any potential impacts from underwater noise associated with the Fotla field development will be kept to a minimum as discussed in Section 12 of the ES, Underwater Noise.

6.3.1.12 GEN 18 – Engagement

Early and effective engagement should be undertaken with the general public and all interested stakeholders to facilitate planning and consenting processes. The proposed Fotla field development has been subject to stakeholder engagement, as discussed in Section 6 of the ES, Identification of Potential Impacts. The ES will also be subject to public consultation.

6.3.1.13 GEN 19 – Sound Evidence

Decision making in the marine environment will be based on sound scientific and socio-economic evidence, drawn from a wide range of sources including the scientific community, stakeholders and users of the marine area. Ithaca Energy ensures the use of sound scientific and socio-economic evidence, as demonstrated throughout this ES.

6.3.1.14 GEN 20 – Adaptive Management

Adaptive management practices should be used to take account of new data and information in decision making. Ithaca Energy will ensure the continued use of the most up-to-date data and research, to inform proportionate and optimal management of field activities and operations.

6.3.1.15 GEN 21 – Cumulative Impacts

Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation. Ithaca Energy will ensure that the development and operation of the Fotla field development will be undertaken in accordance with this policy. Cumulative impacts, associated with the proposed Fotla field development, will be minimised as part of the mitigation hierarchy discussed in Section 7, Impact Assessment Methodology.

6.3.2 Oil and Gas Policies

In addition to the General Policies stated in Section 6.3.1, the Scottish NMP sets out six policies in relation to oil and gas developments in Scottish offshore waters. These are described in the following sections.

6.3.2.1 Oil & Gas 1

The Scottish Government proposes to work with the (historical) Department of Energy and Climate Change (DECC) (now the Department for Energy Security and Net Zero (DESNZ)), the

Oil and Gas Authority (OGA) and the industry to maximise and prolong oil and gas exploration and production whilst ensuring that any environmental risks associated with these activities are regulated. Any activity should be undertaken in line with the principles of Best Available Technology (BAT) and Best Environmental Practice. Consideration should be giving to key environmental risks including impacts from noise, oil and chemical contamination and habitat change. The ES considers each of these in dedicated impact sections where the level of significance of impacts are assessed and, where appropriate, mitigation to reduce or eliminate the impact is proposed.

6.3.2.2 Oil & Gas 2

If the re-use of oil and gas infrastructure is not feasible then decommissioning should take place in line with standard practice, and as allowed by international obligations. The re-use or removal of decommissioned assets from the seabed is encouraged where practicable and in accordance with relevant regulatory process. Reuse of existing infrastructure is proposed as part of the Fotla field development and is discussed in Sections 3 (Option Selection) and 4 (Project Description) of the ES.

6.3.2.3 Oil & Gas 3

Where marine and coastal infrastructure is required for oil and gas developments, including for storage, any such development should utilise the minimum space required for the activity and take into account environmental and socio-economic constraints. The proposed Fotla field development will tie back to an existing asset therefore minimising the project footprint. Ithaca Energy have undertaken a concept select process (Section 3 of the ES) which considers environmental and socio-economic reasons for the proposed development.

6.3.2.4 Oil & Gas 4

All oil and gas platforms will be subject to 9 nautical mile consultation zones in line with Civil Aviation Authority guidance.

6.3.2.5 Oil & Gas 5

Consenting and licensing authorities should have regard to the potential risks, both now and under future climates, to oil and gas operations in Scottish waters, and be satisfied that installations are appropriately sited and designed to take account of current and future conditions.

6.3.2.6 Oil & Gas 6

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

6.3.3 Feature Activity Sensitivity Tool (FeAST)

The Marine Scotland FeAST has been developed to determine potential management requirements for Nature Conservation Marine Protected Areas (NCMPAs) (FeAST, 2023; 2024). The Fotla field development is not within or in close proximity to a NCMPA. Therefore, the FEAST tool has not been directly used within this EIA. However, Ithaca Energy recognise that certain protected species may be present within, or make use, of the wider project area and as such, FEAST has been used as an indirect reference tool within the EIA.

6.4 Potential Concerns Identified for Further Assessment

Potentially significant concerns associated with the proposed Fotla field development were identified at the early planning stage, by taking into account a combination of the results from the ENVID workshops, the issues raised during the informal consultation process and the national policies and guidance (Sections 6.1, 6.2 and 6.2.2).

These concerns have driven the environmental considerations throughout the project. Additionally, they have helped guide mitigation measures incorporated into the project planning to eliminate, or reduce, the potential environmental impacts. Each concern that has been scoped in for further assessment is fully addressed in the subsequent sections of the ES.

The key concerns relating to the proposed Fotla field development are addressed under the following headings:

- Drilling Impacts (Section 8);
- Physical Presence Impacts (Section 9);
- Atmospheric Emissions (Section 10);
- Marine Discharges Impacts (Section 11);
- Underwater Noise Impacts (Section 12);
- Waste Management (Section 13); and
- Accidental Events Impacts (Section 14).

In line with the requirements of the Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020, potential cumulative and transboundary impacts have also been assessed. Cumulative impacts are those that arise from activities, or events, which individually may not be significant, but when combined with impacts arising from different sources, and which overlap spatially and / or temporally, may be potentially significant. Transboundary impacts comprise potentially significant environmental impacts on the seabed, water column and/or atmosphere, and which extend beyond the boundaries of the United Kingdom Continental Shelf (UKCS).

7. Impact Assessment Methodology

7.1 Introduction

The assessment methodology used in this Environmental Statement (ES) is based on a 'concerns based' approach, which means that the emphasis has been placed on assessing those environmental aspects (i.e. activities and processes) that have been identified during the scoping phase as potential key issues or concerns in Section 6.

The assessment methodology follows common legislative requirements and has drawn on a multitude of corporate, national and international EIA guidance documents and best practice publications. Each concern is dealt with in the same manner, which involves outlining the concern, describing and quantifying the impacts and effects from the proposed activity, recognising any gaps in understanding and explaining how these are dealt with, and defining measures that have been taken to mitigate the impact.

The impact assessment methodology used in this Environmental Impact Assessment (EIA) follows a two stepped approach. The first step comprises a Source-Pathway Receptor (SPR) analysis to quantify each impact and establish the possible pathway(s) that it can affect one or multiple receptors and consequently result in an environmental effect on that/those given receptor(s).

During the second step of the assessment the indicated effects will be systematically assessed, based on their significance.

The terms 'Impact' and 'Effect' are frequently used interchangeably in many published documents. However, when following this assessment method it is important to distinguish between these two terms.

'Impacts' are defined here as measurable changes to the baseline environment conditions, as a direct result of project activities (e.g. xx km^2 loss of habitat, or xx mg/l increase in a substance concentration).

Subsequently, 'Effects' are defined as the consequences of those impacts upon receptors of concern, that are subject to assessments of significance. An environmental effect can be any change to the environment, or its use. Effects can be positive (beneficial) or negative (adverse) and can result directly, or indirectly, from project activities or events. An overview of the Environmental Impact Methodology is provided in Figure 7.1. and is explained in more detail in the remainder of this section.

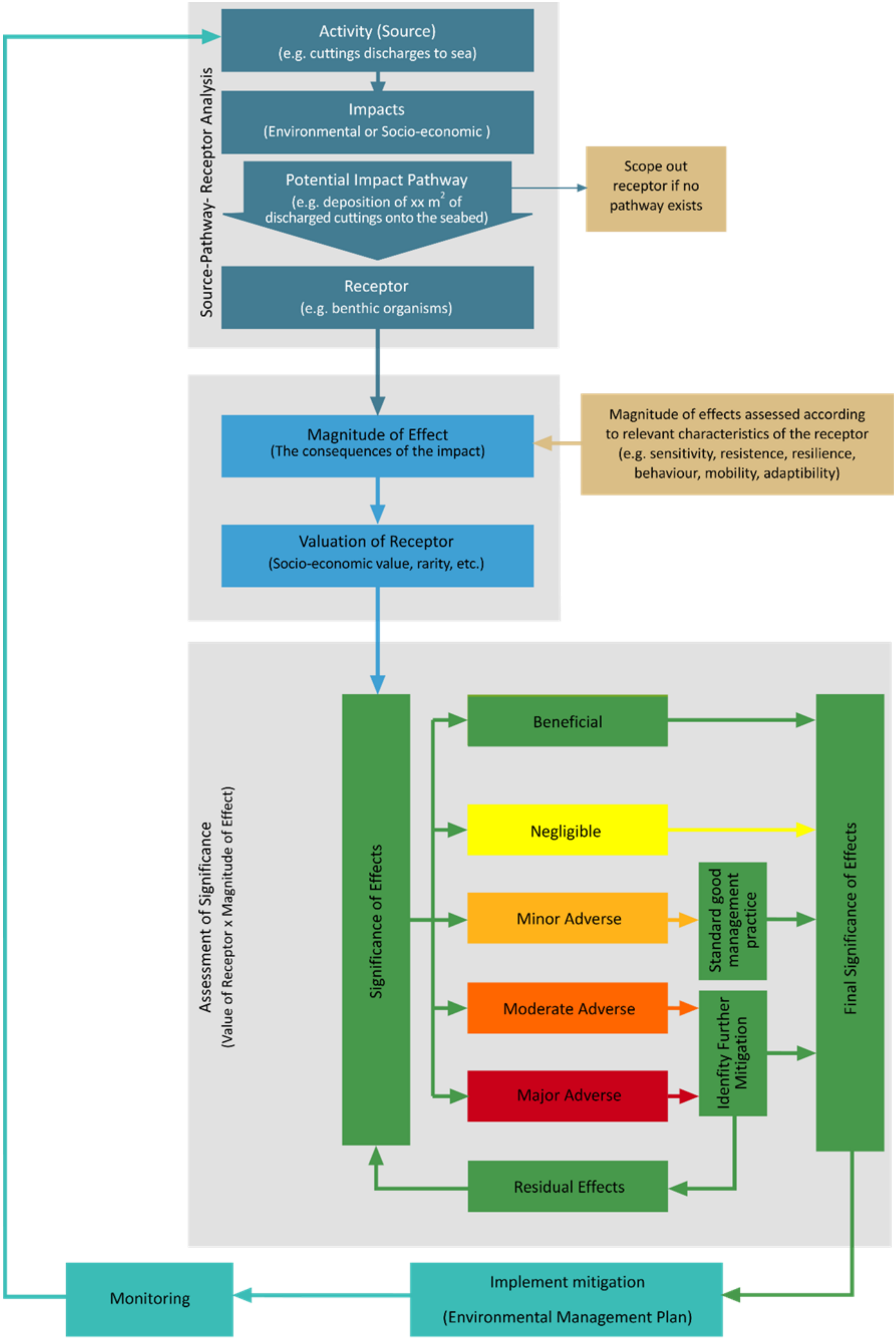


Figure 7.1: Environmental Impact Assessment (EIA) methodology

7.2 Source-Pathway-Receptor Analysis

Determining which receptors may be affected by a specific activity relies on SPR analysis for the identification of the impact and consequential effects. SPR analysis considers all potential routes and mechanisms for impacts to affect any potential receptors, along predicted pathways. It forms the first part of the assessment process, establishing and quantifying the impact(s) of a certain activity.

The term ‘source’ describes the origin of the impact (i.e. the operational activity resulting in an impact), e.g. the generation of drill cuttings onboard the mobile drilling unit (MODU).

Pathways are processes or series of interactions (i.e. the impacts) that result in an environmental effect upon a final receptor. Hence, the ‘pathway’ is the means (e.g. the discharge and subsequent deposition of xx m^2 of discharged cuttings onto the seabed) by which the source reaches the affected ‘receptor’ (e.g. benthic organisms). Pathways may be physical, chemical, ecological or socio-economic processes or interactions.

A receptor is a specific component of the baseline environment or socio-economic domain that will be, or is likely to be, affected by the impacts of the project. This could be a single entity such as a species or community, or a conceptual grouping such as a population or subset of an ecosystem. A receptor may be affected only by the proposed project, or by the proposed project and other relevant projects cumulatively. If no likely pathway can be demonstrated, then potential receptors can be scoped out, regardless of their intrinsic sensitivity or value.

7.3 Assessment of Effects and Their Significance

Once the impact pathway(s) has/have been established and subsequently quantified, the environmental effect of the impact is determined by assessing the magnitude of the effect against its significance. This is achieved by multiplying the Magnitude of the Effect (Table 7.1) and Value of the Receptor (Table 7.2) to produce an aspect significance score (Table 7.3) which is reported in the ES, along with any mitigation measures identified during the EIA process. By using this predetermined scoring system, the reader can readily follow how the assessment conclusions are derived, ensuring a fully transparent and repeatable impact assessment process.

7.3.1 Characterising and Assessing the Magnitude of Effects

The magnitude of the potential environmental effects for each receptor is assessed using the categories described in Table 7.1 below, taking into consideration the SPR analysis described in Section 7.2 above and the ecological sensitivity of the receptor being assessed, but independently of its value or designated status.

Ecological sensitivity is the relative change of a system, or population, in relation to the level of disturbance or perturbation (Miller et al., 2010). The sensitivity of socio-economic and socio ecological systems may be defined in a similar manner (Holling, 2001).

The magnitude of ecological effects is the product of the project-specific impacts and the receptor specific characteristics, that make those receptors sensitive or responsive to the relevant impacts. Therefore, when establishing the Magnitude of Effect value, the resilience of the affected receptor should be taken into account.

Although this approach works well for assessing most impacts, it cannot readily be applied to the assessment of greenhouse gases (GHG) emission impacts, as these contribute to cumulative global effects, rather than affecting a discrete localised area. In other words, there is no greater local climate change effect from a localised impact of GHG emission sources (or vice versa) (IEMA, 2022). Therefore, it is not possible to assess the global climate change effect of any individual project or development, directly. Instead, the EIA should address the impacts of GHG in the context of industry-wide, national and internationally agreed climate change reduction targets, so that the relative severity of the environmental effects can be weighed in the context of legislation and policies (national and international) developed to manage human-induced climate change.

A project's carbon footprint can then be used to determine whether it supports or undermines a trajectory towards net zero. With regard to the Fotla field development, the context in this case refers to national and international climate change pathways, as outlined in Table 7.1.

Table 7.1: Magnitude of effect value and description

Magnitude of Effect	Magnitude of Effect Description
Beneficial	a) A change that improves the quality of the environment e.g. by increasing species diversity, extending habitat or improving water quality. This may also include halting or slowing an existing decline in the quality of the environment. e) Improvements in the quality of life, economic opportunities, and social conditions for individuals, communities, or regions. i) A project that causes GHG emissions to be avoided or removed from the atmosphere by actively reversing (rather than only reduce) the risk of severe climate change.
Negligible	a) Minor change to an ecological system or population which is unlikely to be noticed or measurable against background variation b) Receptor species or habitat is tolerant to high impact levels c) An environmental effect not likely to last more than a few days d) Effects that are only detectable at source e) No implications to other users of the sea or local communities f) No risk to reputation of the company or commercial success g) No discernible change in the existing view or other landscape characteristics h) Usage of renewable or non-supply-limited resources with no measurable effect on current or future supply i) A project that achieves emissions mitigation that goes substantially beyond the national reduction trajectory, or substantially beyond existing and emerging national and international policies compatible with that trajectory, and has minimal residual emissions.

Minor	a) A detectable change to an ecological system or population which is within scope of existing variability b) Receptor species or habitat is tolerant to moderate impact levels c) A transient environmental effect not lasting more than a few weeks d) Unlikely to contribute to cumulative effects e) May affect behaviour, but not a nuisance to other users of the sea or general public f) Transient issues regarding external relationships but with no long-term reputational consequences g) Virtually imperceptible change in landscape receptors causing very minor changes to the view or other landscape characteristics over a wide area or minor changes over a limited area h) Usage of finite resources with no measurable effect on current supply and not affecting market price i) A project with GHG impacts that are fully consistent with applicable existing and emerging national and international policy requirements and good practice design standards for projects or developments of this type.
Moderate	a) Change in habitats and biological communities within the footprint of the development b) Receptor species or habitat is tolerant to low impact levels c) Short-term change in habitats and biological communities with good recovery potential within 2 years d) Similar scale of effect to existing variability but may have cumulative implications e) May cause measurable nuisance to some other users of the sea or local communities f) Risk of undermining reputation of the company within industry or with regulators g) Moderate change in localised areas causing minor changes to the existing view or other landscape characteristics over a wide area or noticeable change over a limited area h) Usage of finite resources that may affect short-term availability and local market price i) A project with GHG impacts that are partially mitigated and may partially meet the applicable existing and emerging national and international policy requirements but is not fully compatible with the UK's net zero trajectory, or accepted aligned practice or area based transition targets, such as the revised OGA strategy.
Major	a) Change in habitats and biological communities extending beyond the immediate footprint of the development b) Receptor species or habitat has little to no resilience to this type of impact c) Change in habitats and biological communities leading to medium term (> 2 years) damage, but with a likelihood of recovery within 10 years d) Cumulative implications are understood to occur in relation to activities of this type e) Financial loss or safety implications to other users of the sea or local communities f) Undermining the reputation of the company with serious commercial implications g) Notable change in landscape characteristics over an extensive area ranging to a very intensive change over a more limited area h) Reduction in stock resource, affecting national availability and market price

	i) A project that follows a 'business-as-usual' or 'do minimum' approach, which is only compliant with existing legislation and is not aligned the UK's and global climate change targets and objectives.
Severe	a) Wide scale change to the offshore environment or effects on coastal receptors b) Receptor species or habitat is extremely sensitive to this impact, even at low exposure levels c) Change in the natural environment, leading to long term (> 10 years) damage and poor potential for recovery to baseline conditions d) Will make a significant contribution to national or global issues, individually or cumulatively e) Long-term economic loss or strategic business changes for other users of the sea or local communities f) Damage to company reputation of sufficient gravity, to incur irreparable damage to the business g) Extensive long lasting (> 10 years) to permanent change in landscape characteristics over an extensive area h) Reduction in stock resource, affecting global availability and market price i) A project that locks in GHG emissions and does not contribute to any of the UK's and global climate change targets and objectives.
Notes Source: Fugro, 2025a	

7.3.2 Value of Receptors

The next stage of the assessment is to determine the nature conservation, socio-economic or heritage value of the affected receptor, following the selected examples provided in Table 7.2.

It should be noted that the receptor value associated with the impacts assessment of climate change impacts is treated slightly different here, compared to all other impacts assessed in the ES. The atmospheric concentration of GHGs (anthropogenic and otherwise) and resulting effect on climate change is affected by all carbon emission sources and sinks globally. Therefore, all GHG emission impacts and resulting effects are global, rather than affecting one localised area and the approach to cumulative effects assessment for GHGs differs from that used for the other EIA impacts (IEMA, 2022). In line with the guidance provided in the supplementary guidance for assessing the effects of downstream scope 3 emissions on climate from offshore oil and gas projects (DESNZ, 2025) and the Institute of Environmental Management and Assessment (IEMA) guide: Assessing greenhouse gas emissions and evaluating their significance (IEMA, 2022), the receptor value for all cumulative GHG emissions is classed as being 'high' with regard to any further emissions. Hence, for all Fotla related emissions the receptor value is classed as 'high', as indicated in Table 7.2.

Table 7.2: Environmental and socio-economic receptor value

	Receptor Category	Selected Examples
Negligible	Natural environment (marine, coastal, terrestrial)	a) No sites or species of conservation interest b) Not capable of supporting any threatened species or conservation interest c) A poor habitat with low biodiversity and productivity
	Socio-economic Other users of the sea,	d) No commercially exploitable fisheries present e) Areas of very low shipping intensity f) Areas of no discernible anthropogenic use or socio-economic benefits
	Landscape	g) Poor quality landscape, not representative of a wider type within the local area and capable of accommodating high levels of change/improvement/enhancement, with few or no views (visual amenity)
	Society	h) Renewable or non-supply-limited resource, readily available at point of use
Low	Natural Environment (marine, coastal, terrestrial)	a) No sites or species of conservation interest b) No resident or regularly occurring threatened species or habitat present c) A natural and diverse habitat supporting widespread and common species
	Other Users	d) Areas of low intensity fishing, not essential for supporting local communities e) Areas of low shipping intensity f) Areas of low intensity anthropogenic use
	Landscape	g) Undesignated landscape of defined character type, but of low quality. Capable of tolerating moderate levels of change/improvement/enhancement. Views lack distinctive characteristics and/or are of low quality (visual amenity)
	Society	h) Reusable or recyclable resource, abundantly available on world market.
Medium	Natural environment (marine, coastal, terrestrial)	a) Sites or species protected on a local level, or of acknowledged conservation value b) The presence of a locally threatened species or habitat c) Species and habitats of importance for the conservation of biodiversity at a local level
	Other Users	d) Areas used by local fisheries, but with nearby alternatives e) Areas of moderate-high commercial shipping intensity f) Multiple other stakeholder interest or extensive use for a single purpose
	Landscape	g) Locally designated or recognised landscape with some distinctive character and features in reasonable condition. Capable of tolerating low levels of change without affecting key characteristics and elements (e.g. Local Green Space). Partial or interrupted views (visual amenity)
	Society	h) Non-reusable finite resource presently plentiful/abundantly available on world market
High	Natural environment (marine, coastal, terrestrial)	a) Nationally designated site or protected species b) A nationally threatened species or habitat essential for maintaining such species

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	Receptor Category	Selected Examples
		c) Species and habitats of principal importance for the conservation of biodiversity at a national level
	Other Users	d) An area of regional importance for fisheries or of local importance but with no nearby alternatives e) Major shipping activity located in a restricted area f) Extensive use by multiple other industries
	Landscape	g) Nationally designated or recognised landscape of high quality and distinctive character, with a strong sense of place, and susceptible to change which would permanently alter key characteristics and elements of the landscape (National Parks and Areas of Outstanding Natural Beauty (AONBs)). Partial or interrupted views (visual amenity)
	Society	h) Finite resource with restricted availability on the world market
	Climate Change	i) Any emission contributing to global climate change
Very High	Natural environment (marine, coastal, terrestrial)	a) Internationally designated site or protected species b) A regularly occurring, globally threatened species or habitat essential for maintaining such species c) Species and habitats essential to conserve biodiversity at an international level
	Other Users	d) A major fishing area contributing at a national level e) An internationally defined shipping lane f) Any areas licensed for use by other industries
	Landscape	g) Internationally designated or recognised landscape of exceptional quality and distinctive intact character with a large number of features and strong sense of place, and uninterrupted views (visual amenity)
	Society	h) Rare, finite and non-reusable resource only scarcely available on the world market

Notes
Source: Fugro, 2025a; IEMA, 2022

7.3.3 Determining Significance of Effects Categories

The significance of each effect is determined by scoring the value of the receptor against the magnitude of the predicted effect as set out in (Table 7.3). This methodology is applied individually with respect to the specific ecology, socio-economic or heritage characteristics of each receptor.

Table 7.3: Determining significance of adverse effects

Magnitude of Effect	Nature Conservation Value, Socio-economic Value or Heritage and Cultural Value				
	Negligible	Low	Medium	High	Very High
Beneficial	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
Negligible	Negligible	Negligible	Negligible	Negligible	Minor adverse
Minor	Negligible	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Moderate	Minor adverse	Minor adverse	Moderate adverse	Moderate adverse	Moderate adverse
Major	Minor adverse	Moderate adverse	Moderate adverse	Major adverse	Major adverse
Severe	Moderate adverse	Major adverse	Major adverse	Major adverse	Major adverse

Notes
Source: Fugro, 2025

The level of effect significance is used to determine the use and level of mitigation measures. Where a potential effect is assessed as 'moderate adverse' or 'major adverse', then this should be considered "significant" in EIA terms. So far as practicable, mitigation measures (including offsetting) which reduce the potential magnitude or significance of effects, or the likelihood of significant effects, should be identified. Minor adverse effects would not usually require any action beyond standard good management practices.

The outcome of the significance matrix (Table 7.3) determines the 'significance' of each impact that is assessed, indicating whether the impact is acceptable or requires further mitigation measures to be implemented. Significance categories are defined in Table 7.4 and are generally consistent for all ES topics, with the exception of climate change impacts, which have their own dedicated effect categories, as indicated in the table.

Additional mitigation recommendations should be explored as part of the EIA process for 'moderate adverse' or 'major adverse' effects. Effects are re-assessed as described above, until either the effect significance is reduced to acceptable levels ('Minor adverse' or 'Negligible'), or no more mitigation can be applied. Residual effect significance is estimated, from which consenting decisions can be made.

As explained in Section 7.3.2, the receptor value for global climate change impacts (in this case the atmospheric concentration of GHGs) is being classed as 'high' for all additional emissions, making all global cumulative GHG sources, regardless of size or location, relevant to the effects on climate change. Therefore, the only dynamic values for assessing climate change impacts are the magnitude of effect values described in 7.3.1. The magnitude of effect categories provide context, enabling the produced emissions to be evaluated against national and international planning balances. The project's carbon footprint can then be used to determine whether it supports or undermines a trajectory towards net zero.

The effect significance categories for climate change in Table 7.4 below define significance depending on the project's whole life GHG emissions and how these align with the UK's and global net zero compatible climate trajectories.

Table 7.4: Effect significance categories

Category	Description of effects – general impacts	Description of effects - climate change
Beneficial	Effects that improve the baseline condition of the receptor. Positive change in social and economic conditions.	A project that causes GHG emissions to be avoided or removed from the atmosphere. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.
Negligible	An effect that is found to be not significant in the context of the stakeholder and/or regulator objectives, or legislative requirements.	A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory, and has minimal residual emissions. This project is playing a part in achieving the rate of transition required by (inter-)nationally set policy commitments.
Minor adverse	An effect considered sufficiently small (with or without mitigation) to be within accepted standards. No further action is required if it can be controlled by adopting normal good working practices.	A project with GHG impacts that are fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects or developments of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
Moderate adverse	A significant effect that exceeds accepted limits and thresholds but is less serious than a 'major' adverse effect. Moderate adverse effects may include a reduction in the integrity or quality of a protected site or habitat, or a reduction in a local population of a protected species. Predicted moderate adverse effects require mitigation recommendations.	The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's and global trajectories towards net zero.
Major adverse	A serious effect of the highest significance, where an acceptable limit or threshold is likely to be exceeded, that would result in a breach of statutory objectives or law. Major adverse effects would include a major, or permanent loss of a significant part of a protected habitat or local population of a protected species. Predicted major adverse	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's and global trajectories towards net zero.

Category	Description of effects – general impacts	Description of effects - climate change
	effects require mitigation recommendations.	
Notes Source: Fugro, 2025; IEMA, 2022		

For the avoidance of doubt, in this instance a 'minor adverse' or 'negligible' non-significant effect conclusion does not necessarily refer to the magnitude of GHG emissions being carbon neutral (i.e. zero on balance), but refers to the likelihood of avoiding severe climate change, aligning project emissions with a science-based 1.5 °C compatible trajectory, limiting climate change to <2 °C by 2100 and being in line with achieving the UK's net zero target by 2050. A project's impact can shift from a 'significant' moderate or major adverse effect to a 'non-significant' negligible or minor adverse effect by incorporating mitigation measures that substantially improve on business-as-usual and meet or exceed the science-based emissions trajectory of ongoing, but declining, emissions towards net zero. A 'minor adverse' effect or better is therefore a high bar and indicates exemplary performance where a project meets or exceeds measures to achieve net zero earlier than 2050 (IEMA, 2022).

At the end of each impact section in the ES, a conclusion on the level of the significance of effects will be drawn, based on the methodology described in this section.

7.3.4 Frequency, Duration and Likelihood of occurrence

Most impacts identified during scoping relate to planned activities, resulting in impacts and associated effects for which the frequency and duration of the activity and the scale and duration of the resulting effects can be readily predicted. However, for unplanned / accidental events the frequency, timing and duration and the scale and duration of any consequential effects may vary considerably. For example, some potential effects may be very improbable, but may be extremely serious should they occur, resulting in major adverse effects on some receptors. Therefore, as the final step of the assessment, it is also important to consider the likelihood that a potential effect could occur as predicted.

For unplanned/accidental events, where it may not be possible to reduce the magnitude of potential impacts or effects, the overall environmental risk may be decreased by reducing the likelihood of an adverse event occurring, through adequately designed-in mitigation measures (Gormley et al., 2011).

Hence, after assessing the initial potential worst-case effect, the overall residual environmental risk of any unplanned / accidental event will be determined by also taking into account the likelihood of that event happening, including all its preventive measures in place using the criteria listed in Table 7.5.

Table 7.5: Likelihood of an unplanned/accidental event

Likelihood	Definition
Extremely Remote	The event has never occurred in the industry but is theoretically possible.

Likelihood	Definition
Remote	The event has occurred previously in the industry but is not anticipated to occur given current practices and mitigation procedures in place.
Unlikely	The event may occur during the lifetime of multiple, similar projects but is not expected to occur within the lifetime of one single project.
Possible	The event may occur during lifetime of the project.
Likely	The event is considered likely to occur at least once during lifetime of the project.
Certain	The activity/event is planned to occur.

The likelihood of the event should then be used to determine to overall final EIA significance, based on the significance criteria outlined in Table 7.6 to determine whether an effect would be classified as significant or not.

Table 7.6: Determining final effect significance

		Effect Significance Categories			
		Negligible	Minor adverse	Moderate adverse	Major Adverse
Likelihood	Certain	Not Significant	Not Significant	Significant	Significant
	Likely	Not Significant	Not Significant	Significant	Significant
	Possible	Not Significant	Not Significant	Significant	Significant
	Unlikely	Not Significant	Not Significant	Significant	Significant
	Remote	Not Significant	Not Significant	Not Significant	Not Significant
	Extremely Remote	Not Significant	Not Significant	Not Significant	Not Significant

7.4 Assessing Multiple Options

The Fotla field development is currently in the Front End Engineering and Design (FEED) phase of the project life cycle, which means that not all project and engineering details are finalised at this point in time. Where multiple options and/or project solutions are still under consideration, each option/solution has been described in the project description of the ES (Section 4). In any instances where the predicted environmental impacts between two remaining options differ noticeably, the 'environmental worst-case option', i.e. the option or solution resulting in the largest anticipated environmental effect, will be assessed in the relevant impact assessment section(s) of the ES.

In the event that two options result in multiple impacts with contradictory 'worst-case' effects, then the activity resulting in that specific worst-case effect will be assessed independent of the results of its other impact(s). For example, Option 1 results in a large seabed footprint, but has low atmospheric emissions and Option 2 results in a small seabed footprint, but generates significantly more atmospheric emissions. In this case the ES will assess the seabed impacts from Option 1 and the atmospheric emissions from Option 2. This will ensure that the impact assessment in the ES always represents the 'environmental worst-case' impacts and effects associated with the proposed Fotla field development.

7.5 In-Combination, Cumulative and Transboundary Impacts

In line with the requirements of The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020, the EIA also considers the cumulation of the impacts assessed during the EIA with the impacts of other existing or approved projects. Cumulative impact effects can be described as the combined environmental effects of the proposed project or development with other past, present, or future projects and activities. These impacts can arise from the accumulation of individual, sometimes minor, effects from multiple actions that, together, may result in an overall significant effect.

An in-combination effect may occur when a single receptor is impacted by multiple impacts from a project. An example of this may be a benthic organism being impacted by the drilling and physical presence impacts. Cumulative effects may occur when the effects of a proposed project combine with others from other developments. An example here could be the discharge of cuttings from multiple projects undertaking drilling operations at a similar time.

Transboundary effects comprise any potential environmental effect on the seabed, water column and/or atmosphere, which extend beyond the boundaries of the United Kingdom Continental Shelf (UKCS).

The potential for in-combination, cumulative and transboundary effects from the Fotla field development have been assessed in the respective assessment sections of the ES (Sections 8 - 14).

7.6 Mitigation and Monitoring

The concept of mitigation is a central component of impact assessment and environmental management theory and practice and can be described as taking measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (IEMA, 2024).

The avoid, reduce, mitigate hierarchy (as presented by Department for Environment, Food and Rural Affairs (Defra) (2021)) was followed to minimise any impacts from the proposed development on the marine environment and other users. All impacts identified during the scoping phase were reviewed and fed back the project engineering team to identify and optimise the FEED, as well as infrastructure installation methods.

Mitigation may include design changes, alteration of proposed methods, or other activities in addition to the core project-related activities, aiming to reduce or ameliorate impacts. Mitigation is often used as a catch-all term that also includes avoidance, minimisation, restoration and offsets or compensatory measures.

Mitigation measures are predominantly applied at source, to reduce or remove impacts, with the intention of a corresponding reduction in residual effects upon the receptors in question, to acceptable levels. However, mitigation may also be applied directly at the receptor-level, with the intention of reducing effects, without any influence on the source or the impact.

Classifying mitigation measures into one of three key types helps to achieve a more proportionate Environmental Statement, as it allows for some mitigation measures to be taken-as-read in assessing effects (i.e. these mitigations are embedded intrinsically into the project design as set out in the project description). IEMA has defined three mitigation categories (IEMA, 2024):

1. Primary (Inherent) mitigation;
2. Secondary (foreseeable) mitigation, and;
3. Tertiary (inexorable) mitigation.

Primary mitigation is an inherent part of the project design and are actioned at the top of the mitigation hierarchy. They are best applied early, as they become more difficult to accommodate as the design progresses and stabilises. They become a fundamental part of the design seeking consent and are described in detail in the project description of the ES.

Secondary mitigation requires further activity in order to achieve the anticipated outcome. Typically, these will be described within the chapters of the Environmental Statement, but often they are secured through planning conditions, requirements and/or management plans. Secondary mitigation is a flexible form of mitigation that can be proposed at any point during the EIA process, including during the decision-making process. They tend to operate in the middle of the mitigation hierarchy, focusing on reducing the significance or likelihood of adverse effects. While they are integrated into the application for consent, this form of mitigation also requires additional action post-consent, beyond the core function of the development, to be implemented. Therefore, they carry a greater risk of non-implementation or ineffective application post-consent than primary or tertiary mitigation and are best managed through an Environmental Management Plan (EMP).

Tertiary mitigation measures will be required regardless of any EIA assessment and comprise actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects and therefore does not need to be presented in extensive detail in the EIA. However, it is good practise to mention them, so they be captured in the commitments register and subsequent EMP. Tertiary mitigation is the least flexible form of mitigation, it either exists, or it doesn't. It can be identified at any point during the design and EIA process. The EIA coordinator must be confident that any tertiary mitigation identified is very likely (> 90 %) to occur without further specific activity being undertaken within the EIA process.

Countries with a mature oil and gas industry and well-developed regulatory framework, such as the UK, have incorporated comprehensive mitigation and monitoring requirements within their permitting and consenting regime. These mitigation and monitoring measures are further informed and/or augmented with good industry practice guidance from organisations and institutions such as Oslo and Paris Convention (OSPAR), Offshore Energies UK and the International Association of Oil and Gas Producers (IOGP).

All mitigation and monitoring recommendations described within the ES are based upon the realistic worst-case scenarios, ensuring that all measures described are adequate to ameliorate the range of predicted effects. Mitigation and monitoring recommendations may be revised during the determination of application.

During the procurement process, all major third-party contractors will be audited to ensure they have suitable management systems in place.

Environmental mitigation and monitoring requirements stated throughout the ES will be taken forward in an EMP. A Commitments Register, summarising these mitigation measures, has been included in Appendix 4.

8. Drilling Impacts

This section assesses the potential impacts arising from the drilling activities of the proposed Fotla field, as described in Section 4.5. This assessment has been informed by the outcomes of the Environmental Issues Identification (ENVID) exercise (Appendix 3), informal statutory consultation, and National Marine Plan (NMP) policies and statutory guidance as explained in Section 6 (Identification of Impacts). Both the Joint Nature Conservation Committee (JNCC) and the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) requested information on the impacts of drill cuttings when consulted on the Early Consultation Document.

The potential impacts arising from the proposed drilling operations at the Fotla field assessed in this section are focused on the:

- Effects of drill cuttings and excess cement discharges onto the seabed on benthos, fish and shellfish; and
- Effects of drilling discharge plumes on plankton, fish and shellfish in the water column.

8.1 Description and Quantification of Discharges

8.1.1 Muds and Cuttings

A detailed description of the drilling process and well engineering design is provided in Section 4.5.

Drill cuttings consist of the chips of crushed rock broken off by the drill bit, as it extends the wellbore. Drill cuttings therefore vary in nature, depending on the characteristics of the rock layers present and the drill bit used, but generally range in size between very fine clay sized particles (<2 µm) to coarse gravels (>30 mm) (Neff, 2005).

The mud system for the two tophole well sections will consist of seawater with high viscosity bentonite and barite sweeps to clean out the boreholes. The tophole well sections will be drilled as an open hole, before the Blowout Preventer (BOP) and marine riser are installed, resulting in all drill cuttings and associated drilling fluids from these two tophole sections to be deposited on the seabed in the immediate vicinity of the wellbore. It is estimated that collectively, a total of approximately 1,748 tonnes of cuttings and drilling muds will be discharged to sea during the drilling operations for the two wells (Table 8.1).

Table 8.1: Estimated cuttings volumes for the two production wells combined

Section	Mud System	Discharge Point	Section Length (m)	Drilling Muds (Te)	Cuttings Generated (Te)
42" × 36" × 26"	WBM	Seabed	73	97	140
26"	WBM	Seabed	443	303	334
Total for one production wells discharged to seabed				**400**	**474**
Total for two production wells discharged to seabed				**800**	**948**

The deeper 17½, 12¼" and 8½ sections will be drilled using low toxicity oil-based muds (LTOBM). As discussed in section 3.4.5, the drill cuttings from the deeper well sections that are drilled with LTOBM will be either skipped and shipped to shore for appropriate treatment and disposal, or thermally treated onboard the Mobile Offshore Drilling Unit (MODU) before being discharged to sea. The latter represents the worst-case scenario with regard to local environmental impacts of the two options.

Therefore, for the purposes of the assessment it is assumed that all LTOBM contaminated cuttings will be thermally treated offshore and disposed of to sea, resulting in an additional 4,242 tonnes of mud and cuttings being discharged in the water column (Table 8.2). A 12¼" contingency sidetrack has been added as this represents the largest potential cuttings volume and therefore represents the absolute worst-case discharge scenario if a contingency sidetrack was to be required in any part of the well. However, in reality, such emergency sidetracks are very rare and, if required, would be more likely to occur somewhere in the 8½" section instead which would result in a reduced quantity of cuttings being discharged.

Table 8.2: Estimated LTOBM cuttings volumes for the two production wells combined

Section	Mud System	Discharge Point	Section Length (m)	Drilling Muds [Tonnes]	Cuttings Generated [Tonnes]
17½"	LTOBM	Surface	701	109	311
12¼" (Appraisal Section)	LTOBM	Surface	1,333	123	352
12¼" (Mainbore)	LTOBM	Surface	1,416	131	374
12¼" (Contingency sidetrack)	LTOBM	Surface	1,416	134	374
8½" (Mainbore & Sidetrack)	LTOBM	Surface	1,456	67	146
Total treated LTOBM cuttings for one production well				**564**	**1,557**
Total treated LTOBM cuttings for two production wells combined				**1,128**	**3,114**

8.1.2 Cement

The well casings used to prevent the wells from collapsing will be cemented in place to provide hydraulic isolation and structural integrity to the wells. The cementing design will take into account the actual formations encountered throughout the well, incorporate optimised cement placement techniques and will also consider the future abandonment requirements.

The two tophole sections of both wells will be cemented in place completely, all the way back up to the seabed. To ensure cement returns to seabed for wellbore safety reasons, an excess of up to 300 % cement has been planned for. Therefore, it is expected that some cement will be discharged onto the seabed during these operations.

Consequently, it is anticipated that up to 492 m^3 of cement slurry may be discharged for the two wells, as a worst-case estimate. This is based on the entire amount of 300 % excess cement reaching the seabed, in the very unlikely event that the holes are exactly in gauge (i.e.

there is no wash-out of the wellbore) and the full amount of 300 % excess cement would be pumped. In reality this amount is expected to be significantly lower, as there will inevitably be a certain amount of washout of the borehole and the cement returns will be monitored and the cementing pumps will be stopped immediately, once cement is observed back the seabed. As explained in Section 4.5.6, subsequent casing strings will not be cemented up to the surface, so it is highly unlikely that any cement will return to the rig from these deeper well sections.

8.2 Drill Cuttings Modelling

Numerical modelling study was undertaken to determine the spatial extent of the dispersion of the discharged cuttings and associated drilling fluids through the water column and their ultimate deposition on the seabed, using SINTEF's Dose-Related Risk and Effect Assessment Model (DREAM) (Xodus, 2025a).

The study modelled the discharge of cuttings from two fully drilled production wells with seven vertical sections each, and two "respud wells" with only the first two upper sections completed. The quantities of cuttings for the "respud wells" would be the same as those described in Table 8.1. This was considered to represent the "worst-case scenario" for the volume of cuttings which would be generated by the drilling operations. The respective well locations are detailed in Table 8.3.

Table 8.3: Fotla production well and respud well locations

Well Information	Location			
	Northings (m)	Eastings (m)	Lat (° ' ")	Long (° ' ")
P1 Well	6,422,704	386,726	57° 55′ 49.26″	1° 5′ 14.28″
P2 Well	6,422,720	386,736	57° 55′ 49.78″	1° 5′ 14.86″
Respud Well 1	6,422,718	386,713	57° 55' 49.70"	1° 5' 13.47"
Respud Well 2	6,422,734	386,723	57° 55' 50.22"	1° 5' 14.05"

The cuttings from the first two well sections will be continuously discharged to the seabed, while those from the remaining five sections will be thermally treated and discharged from the drilling rig in batches to sea.

The results of the modelling study indicate that the discharges will result in a cuttings pile around each well with a maximum thickness of 2.57 m. This rapidly decreases with increasing distance from the well site such that within 140 m, the thickness decreases to less than 10 mm. The total area of deposition of this thickness is 0.015394 km^2 (Xodus, 2025a). Figure 8.1 shows the deposition footprint of the dispersed cuttings and drilling muds.

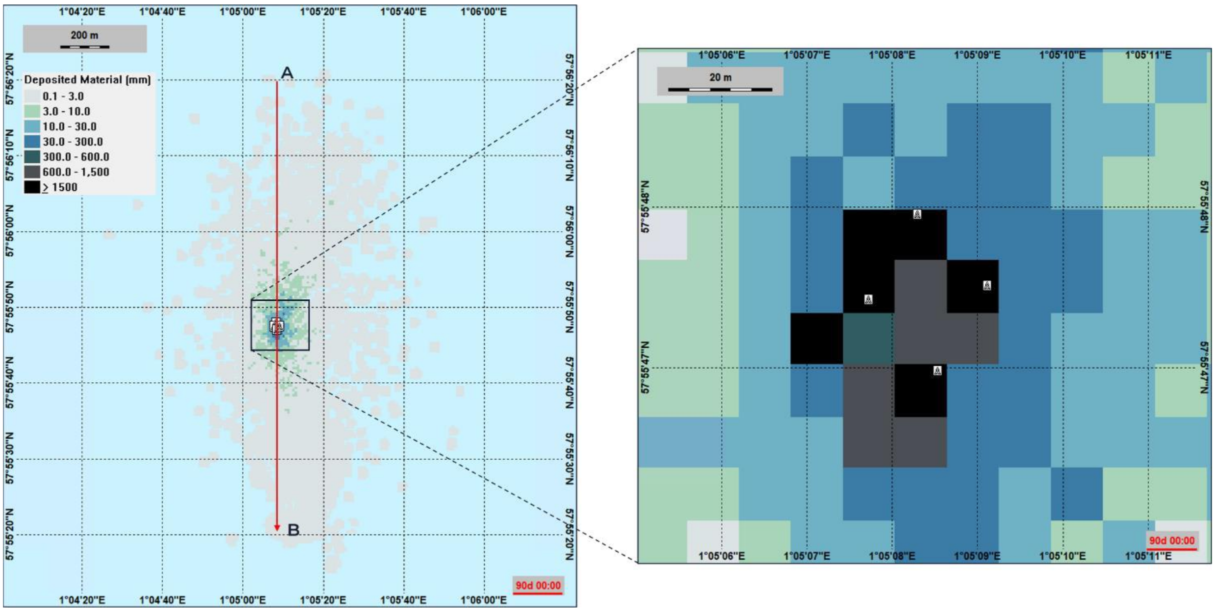

Figure 8.1: Modelled cuttings accumulation on the seabed

The results of the modelling study predicts that some interspersed patches between 1-10 mm deposition thickness may occur in the area up to approximately 600 m north of the wells and up to 500 m to the south (see Figure 8.1). Based on the model predictions, the total area of seabed over which deposition will occur will be 918,200 m^2 (0.9182 km^2) (Table 8.4).

Table 8.4: Area of sediment thickness categories around discharge locations (Xodus, 2025a)

Sediment thickness (mm)	Area (m^2)
0.1 – 3.0	866,900
3.0 – 10.0	51,300
10.0 – 30.0	11,200
30.0 – 300.0	2,700
300.0 – 600.0	100
600.0 – 1,500	600
≥ 1,500	600

8.3 Impacts from Cuttings and Mud Discharges

The discharge of drill cuttings may cause biological effects on benthic species and plankton both during suspension in the water column and after sedimentation. The following assesses the impacts on these receptor groups.

8.3.1 Seabed Impacts on Benthos, Fish and Shellfish

The primary impact identified with regard to drill cuttings and mud discharges is the direct smothering effect of burial by material discharged as they settle on the seabed (Gates & Jones, 2012; Jones et al., 2012; Neff, 2005; OSPAR, 2007). Sedimentation near oil and gas installations can be very high, because drill cuttings typically settle on the seabed, when discharged directly to sea (Ellis et al., 2012). Other impacts observed are changes in sediment grain size, increased organic enrichment and potential chemical impacts (IOGP, 2021).

Most of the chemical additives used during the drilling, cementing and well completion operations are highly water soluble, of low persistence, low toxicity and have a low likelihood to be incorporated into the tissues of marine organisms and are therefore classified as PLONOR (Pose Little or No Risk to the Environment) by the OSPAR Commission. Typically, modern WBMs contain fresh or salt water as the base fluid, and a weighting agent such as barite ($BaSO_4$). Clays or organic polymers are incorporated to create a homogeneous fluid. These weighting agents may naturally contain elevated levels of barium and other metals, which will typically be higher than those found in natural unpolluted seabed sediments.

However, the metals and metal salts associated with barite, clay, and cuttings particles are not readily bio-accumulated by animals living in close association with cuttings piles and the metals are not passed efficiently through marine food chains (Leuterman et al., 1997; Neff, 1987, 2010).

Field studies of organisms around drill cuttings piles have observed that upon intake by ingestion or adhesion to epithelial surfaces, the majority of metals remain bound to cuttings grains in an insoluble form and are not bioavailable. Jenkins et al. (1989) found that around 97 % of the barium content remained in granular form and were not assimilated into the study species' tissues. The acute toxicity of WBM is considered to be low (Neff, 1987) and in general, any toxic effects of WBM associated with cuttings discharge have been deemed to be negligible (Neff, 2005, 2010; OSPAR, 2007).

The discharge of cuttings contaminated with LTOBM on the United Kingdom Continental Shelf (UKCS) is strictly regulated. The discharge of cuttings contaminated with low toxicity oil-based drilling fluids that have been treated to meet the oil on cuttings standard (i.e. <1 % organic-phase fluids concentration by weight of dry cuttings) are controlled under the Offshore Chemicals Regulations 2002.

A comprehensive sampling analyses and environmental risk assessment study by Aquateam COWI (2014) concluded that the environmental risks associated with the discharge of thermal treated oil-based mud (OBM) cuttings correspond to those seen with discharges of WBM cuttings. These results align well with Minton et al. (1993), who found that thermally processed cuttings had no greater environmental effects than their controls, comprising clean sand, shale, barite and clay to simulate uncontaminated cuttings. The discharge of WBM cuttings and thermally treated LTOBM cuttings may cause some smothering in the near vicinity of the well location, resulting in localised and transient impacts (Marappan et al., 2022).

The levels of oil, Polycyclic Aromatic Hydrocarbons (PAH) and metals in treated OBM cuttings are expected to lie at the same level as for WBM cuttings. Environmental impacts will be limited to areas with the highest sedimentation of cuttings and the chemical pollution is expected to have a negligible effect on both water-phase and bottom-dwelling organisms. No effects are expected in the water column (Aquateam COWI, 2014).

The main difference between WBM and thermally cleaned OBM cuttings is their difference in particle size, with the thermal treated OBM cuttings generally comprising of smaller particles than WBM cuttings. Thermal treated OBM cuttings will therefore tend to be deposited in lesser amounts over a wider area (i.e. resulting in a lower overall deposition thickness) compared to WBM cuttings (Aquateam COWI, 2014; Minton et al., 1993).

Given the similarities in scale and effects of discharged WBM cuttings and thermally treated LTOBM cuttings, as illustrated by the studies quoted above, the remainder of this impact section will make no further distinction between them and their impacts.

Sensitivity to cuttings discharges varies between different benthic groups, depending on their physiology and ecology, with sessile species in particular more likely to be affected than more mobile species. For example, many burrowing organisms, which feed on subsurface sediments, are capable of burrowing up through deposited sediment ranging from 10 mm to 600 mm in thickness to live at the new sediment surface (e.g. Kukert & Smith, 1992; Maurer et al., 1979). Consequently, burrowing megafauna, such as ocean quahogs, shrimp and *Nephrops* are quite tolerant to sedimentation (Hill & Sabatini, 2008). Not all species are this tolerant though. Bakke et al. (2013), for example, state that WBM cuttings deposits affecting benthos are at least 3 mm thick or more, based on a review of multiple studies.

An Oslo and Paris Convention (OSPAR) review of environmental monitoring results from the United Kingdom, the Netherlands and Norway concluded that disturbance of the seabed fauna by cuttings and WBM discharges typically only occurs within 50 m from single well locations. Any biological effects beyond this distance tend to be very subtle or undetectable, although the presence of discharged drilling materials on the seabed is often detectable chemically at longer distances, up to several hundreds of metres from a well location (OSPAR, 2007).

Although there are no studies available into the specific effects of cement discharges, it is anticipated that the primary effects of cement discharges will also arise from the physical smothering of organisms within the area of cement deposition. Furthermore, as cementing operations and associated discharges are an intrinsic part of the drilling process, it can be assumed that any field studies on the impacts of drill cuttings (including the ones quoted above) inherently also include the effects of the associated cement discharges.

In addition to the smothering effects described above, increased concentrations of suspended particles in the water near the seabed may also cause damage to feeding and respiratory organs, causing metabolic stress and reducing growth, as well as affecting reproductive and survival rates. Studies by Cranford et al. (1999) and Bechmann et al. (2006) have demonstrated these effects in scallops and other bivalves, for example. A study by Trannum et al. (2010) observed a significant reduction in number of taxa, abundance, biomass and diversity of macrofauna with increasing layer thickness of drill cuttings

(3-24 mm), which was not observed for the natural sediment particles, clearly affecting the fauna through mechanisms other than sedimentation. The authors postulated that physical factors such as sediment texture, i.e. shape and stickiness of drill cuttings particles, a lower content of nutrients and toxicity should not be ruled out as potential impact factors, but they also indicated an organic phase present in the WBM increasing the risk of oxygen depletion as a potential cause of increased mortality of benthic organisms in the affected area.

The accumulation of cuttings, drilling mud particles and cement at the Fotla field is, therefore, likely to mainly affect the local benthic community, by burying animals and, to a lesser degree, impairing the feeding and respiration activities of others. However, these impacts will be highly localised as shown by cuttings dispersion modelling. Near-bed current velocities and sediment mobility in the central North Sea are generally sufficient to gradually disperse the accumulated cuttings material to the wider environment over time (Bakke et al., 2013; DTI, 2001a; Henry et al., 2017; OSPAR, 2007).

The Fotla field development lies in an area that hosts the OSPAR habitat and Priority Marine Feature (PMF) 'sea pen and burrowing megafauna' habitat (Gardline, 2023), as well as the OSPAR listed and PMF ocean quahog (*Arctica islandica*). Associated species with the afore mentioned habitat, including sea pen species including *Virgularia mirabilis* and *Pennatula phosphorea*, as well as burrowing megafauna, such as *Nephrops,* were recorded during the environmental surveys for the Fotla field development. However, sea pen species and ocean quahogs are not considered particularly sensitive to heavy smothering. The Feature Activity Sensitivity Tool (FeAST) tool quotes that both sea pens and quahogs are tolerant to siltation rate changes of up to 30 cm of fine material added to the seabed in a single discrete event (FeAST, 2023; Hill et al., 2023; Tyler-Walters & Sabatini, 2017).

The drill cuttings dispersion modelling results presented in Figure 8.1 above show cuttings deposition of more than 30 cm is limited to nearly 30 m from the well locations. Given the close distance between the wells, the cuttings depositions are expected to overlap with each other considerably. The modelling results show a steep decline from the areas with a deposition thickness of >30 cm to areas where deposition is between 10 and 30 cm deep or less. Therefore, the overall cuttings deposition over 30 cm thickness for all wells combined is not expected to exceed a total area 0.004 km^2 (Table 8.4).

For the purposes of this assessment, it is assumed that all benthos in the areas covered > 30 cm of cuttings deposits will be lost over a medium to long time period (i.e several to ten or more years). Beyond this immediate area of impact, the thickness of the deposited cuttings decreases rapidly to < 10 mm and becomes patchier. At greater distances from the wells the severity of the effects will diminish until they become indistinguishable from natural background levels. As a conservative estimate, it is assumed that some ecological effects on sensitive receptors may extend to this area. These effects will be much more subtle however, and any ecological effects in this area are expected to start recovering soon after discharges cease.

Therefore, the magnitude of effect from the discharge of drill cuttings, muds and excess cement to benthos is judged to be '**Moderate**' for most smaller (and sessile) benthic species. The receptor value is classed as '**Low**', resulting in a '**Minor adverse**' effect. The magnitude of effect from the discharge of drill cuttings, muds and excess cement to fish and shellfish is judged as '**Minor**' due to their ability to avoid the source of disturbance. The receptor value is classed as '**Low**' resulting in a '**Minor adverse**' effect.

Conversely, the receptor value of the local sea pens and ocean quahog in the area is classed as '**Very High**', as both the 'sea pen and burrowing megafauna' habitat and the ocean quahog are listed as threatened and/ or declining by OSPAR (OSPAR, 2023). However, due to their tolerance to sedimentation, the magnitude of the effect can be considered to be '**Minor**', resulting in an overall '**Minor adverse**' effect significance.

8.3.2 Water Column Impacts on Plankton, Benthos, Fish and Shellfish

The discharge of cuttings into the water column will form a plume which will gradually sink through the water column before settling onto the seabed.

As part of the drill cuttings modelling, overall 'Environmental Impact Factors' (EIFs) were calculated, which represent the relative risk to biota in the water column (and the benthos), based on the contributions of each constituent in the discharge, taking into consideration several factors, including toxicity, sedimentation potential, sediment grain size change and oxygen depletion. The EIF is a useful tool to use to understand how much each constituent of the discharge contributes to the overall expected environmental impact (Xodus, 2025a).

Figure 8.2 shows the development of the EIF in terms of impacts affecting the water column over the drilling period. The graph shows that for the drilling of the first two sections of the well, a continuous discharge of cuttings will take place, leading to elevated EIF. From the third well section onwards, the cuttings are discharged in batches from the surface, allowing the EIF to return to 0 between discharges of the different well sections. The EIF finally returns to 0 after 78 days and 6 hours, which is 7 hours after the end of the cuttings treatment and subsequent discharge from the last section of the well. It should be noted, that the 1 % oil dispersed on cuttings is the theoretical maximum amount of dispersed oil on cuttings that is allowed to be discharged under the regulations. In practice, the fraction of oil on cuttings is significantly lower.

Aquateam COWI (2014) quotes an average oil content of cuttings treated offshore on the UKCS to be 0.4 g/kg dm, or 0.04 % and that the water maintains an average oil-in-water concentration of about 12 mg/l. The modelling results for the remaining oil content on the cuttings should therefore be considered as very conservative.

The contribution to the EIA of the cuttings particles themselves and the metals associated with the barite have a negligible impact of the EIF, and do not appear in the graph.

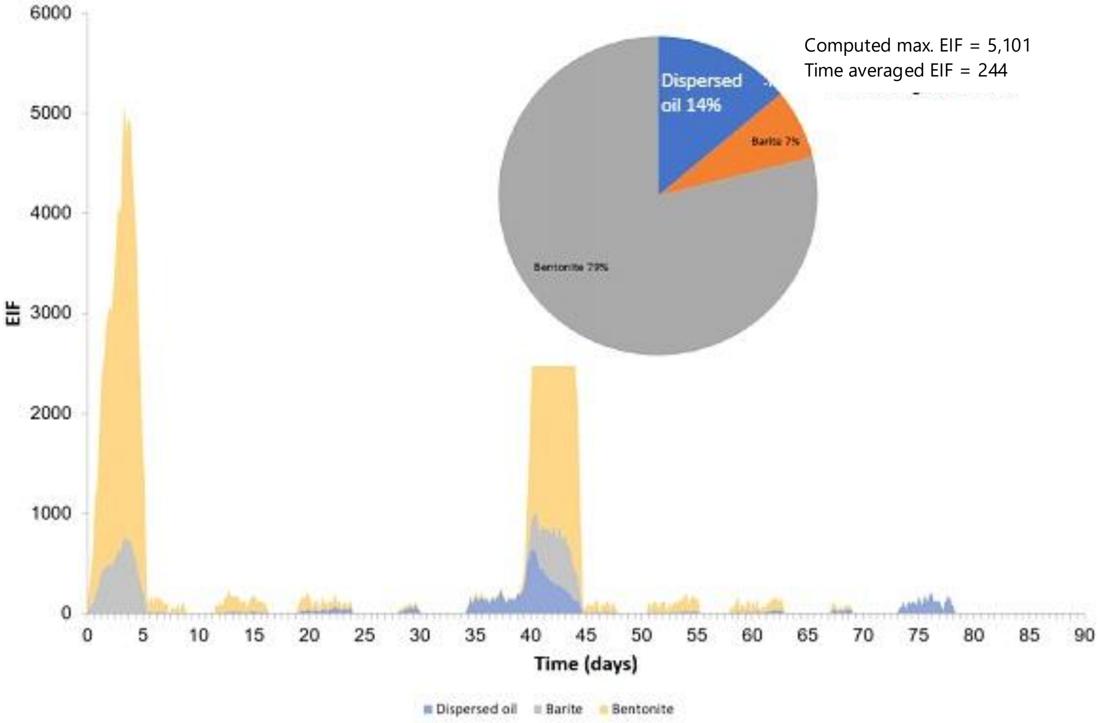

Figure 8.2: Development of the water column EIF over the duration of the drilling period

The magnitude of effects of WBM drilling chemicals and excess cement discharges into the marine environment on plankton, fish and shellfish is judged to be '**Minor**' given the limited spatial and temporal extent. The rapid dilution and dispersion of discharge plume, as well the low overall toxicity of the cuttings and drilling fluids will limit any potential impacts. The ultimate effect on the plankton, which has been deemed the most sensitive of the receptors assessed, will be within the scope of existing variability. The receptor value based on the local communities present is classed as '**Low**' for most species, resulting in a '**Minor adverse**' effect. Conversely, the receptor value of the local sea pens and ocean quahogs in the area is classed as '**Very High**', as the 'sea pen and burrowing megafauna' habitat and ocean quahogs are listed as threatened and/ or declining by OSPAR. However, as the discharge will be short in duration and these species are expected to be relatively resilient to the effects of the discharge plume, the magnitude of the effect is considered to be '**Minor**', resulting in an overall '**Minor adverse**' effect significance.

8.4 In-Combination, Cumulative and Transboundary Impacts

The central North Sea is an area of intensive oil and gas activity, with several developments located in the wider region surrounding the proposed Fotla field development. The nearest producing fields include the Britannia and Britannia Bridge Linked Platform located 13.5 km to the north-east (NSTA, 2025d), the Alba Northern Platform located 14.2 km to the north and the Chestnut field subsea infrastructure located 7.8 km to the north-east. A review of submitted drilling permit applications (DESNZ, 2025) indicates that there are no drilling operations proposed or ongoing within the immediate area of the Fotla wells which may give rise to cumulative effects. Therefore, it is not expected that there will be any physical overlap between the drill cuttings, mud and cement discharges at Fotla with any other cuttings piles from the surrounding oil fields.

With respect to drilling discharges, no potentially significant in-combination effects were identified which would justify further assessment, beyond the individual effects that have already been considered in this section, as this would not alter the conclusions reached.

At its nearest point, the UK/Norway median line is situated approximately 46 km east of the proposed Fotla field development. As no measurable effects from the drilling discharges are expected beyond a few hundred metres from well locations, no transboundary impacts are anticipated.

8.5 Mitigation

To mitigate the potential impacts of drilling discharges, the following mitigation measures have been implemented or are proposed:

- An environmental baseline survey with seabed sampling, as well as a habitat survey has been undertaken at the Fotla field development location and along the proposed pipeline route;
- Drilling operations will be permitted though the UK Energy Portal Environmental Tracking System (PETS), which includes Chemical Permit (CP-SAT) for the use and discharge of all chemicals offshore;
- Wherever practicable and technically feasible, chemicals with the lowest CEFAS ranking scores (i.e. OCNS E, Gold rated and without substitution warnings) will be prioritised over those that have substitution warnings;
- The actual mud and chemical usage will be monitored during drilling operations and subsequently reported to Environmental and Emissions Monitoring System (EEMS), which is maintained by the OPRED;
- Cement discharges discharged onto the seabed during installation of the top section casing will be minimised by visual monitoring of the operation by a Remotely Operated Vehicle (ROV). Once returns are observed, pumping will be stopped in order to minimise discharged volume; and
- Project design has and will further consider the minimisation of produced volumes of drill cuttings, mud and excess cement, as well as the chemical volumes discharged, according to Section 2.

8.6 Conclusion

The effects of cuttings discharges, drilling fluids and cement on the benthic environment are closely related to the total quantity discharged and the oceanic energy regime encountered at the discharge site, particularly the currents close to the seabed itself (Neff, 2005).

The drilling discharges from the proposed Fotla wells have the potential to cause a localised impact to the benthic environment, primarily through direct physical changes to the seabed.

This is expected to affect benthic communities in the immediate vicinity of the wells, where the benthos within 30 m of the well locations is expected to be lost over a medium to long time period (i.e several to ten or more years) with more subtle effects extending up to a few hundred metres from the two well locations. Any effects on the benthos at distances over 30 m from the well locations are expected to start recovering soon after discharges cease. Impacts on the water column will be very limited and short in duration returning to zero risk within 7 hours after drilling discharges are stopped (Xodus, 2025a).

Therefore, the physical and chemical impacts from release of cuttings discharges, drilling fluids and cement in the marine environment are considered of '**Minor adverse**' significance.

9 Physical Presence Impacts

This section assesses the potential impacts arising from the physical presence of the proposed Fotla field infrastructure (as defined in Section 4: Project Description) on seabed habitats, species and other users of the sea. This assessment has been informed by an Environmental Baseline Survey (EBS) report and Habitat Assessment (HA) reports (Gardline, 2023; Gardline, 2024), the outcomes of the Environmental Issues Identification (ENVID) exercises (Appendix 3), informal statutory consultation, and National Marine Plan (NMP) policies and statutory guidance as explained in Section 6 (Identification of Impacts).

The following potential impacts and effects were identified during scoping and will therefore be assessed in the section of the Environmental Statement (ES):

- Installation of seabed infrastructure impacting biological receptors;
- Installation, presence and removal of anchor chains from the Mobile Offshore Drilling Unit (MODU);
- Laying of concrete mattresses, grout bags etc. to protect pipelines or other infrastructure;
- Ongoing presence of pipelines / subsea infrastructure on the seabed during the lifetime of the development;
- Physical presence of installation, construction and support vessels during subsea infrastructure installation operations;
- Physical presence of the drilling rig and support vessels at the sea surface;
- Trenching and installation of pipelines on the seabed; and
- Use of rock protection for pipelines or other infrastructure.

In addition to these impacts the following issues raised during the early consultation process will also be addressed:

- Trenching and rock dumping of pipelines should be justified and include consideration of any sensitive habitats along the pipeline routes setting out the potential to reroute the pipeline to avoid/minimise the impact on any such habitats (Offshore Petroleum Regulator for Environment and Decommissioning (OPRED));
- Consideration to eliminate safety risk for the fishermen from mud berms being left behind following pipeline trenching operations (Scottish Fishermen's Federation (SFF)); and
- Consideration of disruptions to the fishing industry due to the presence of subsea infrastructure and to propose embedded mitigations related to decommissioning (SFF).

The sections below are split into a description of the physical extent of each impact, followed by separate impact assessments on seabed and associated seabed communities and impacts on other users of the sea, as appropriate.

9.1 Extent of Areas Impacted by the Physical Presence of the Fotla Field Development

The activities described above will result in a number of temporary and/or permanent impacts (for the duration for the Fotla field development).

9.1.1 Temporary Seabed Disturbances

Temporary seabed disturbances are expected to occur due to the movement of anchor lines of the MODU, placement of the MODU anchors, trenching/backfilling of the production pipeline/umbilical and gas lift pipeline. These disturbances will be temporary, lasting for the duration of the subsea construction activities and drilling phase only.

The MODU to be used for drilling operations is still to be determined but is anticipated to be an anchored semi-submersible drilling rig, which will be secured to the seabed by 8 anchors (see Section 4: Project Description). Based on previous operational experience on the UKCS, each anchor line is expected to extend to approximately 1,450 m from the MODU with up to 750 m of each anchor line resting on the seabed. As a worst-case estimate, it is assumed that there is a potential for seabed disturbance along a 10 m wide corridor along the length of the line on the seabed, due to dragging during installation and removal activities and due to swell movement during adverse weather conditions. This would result in temporary seabed disturbances over an area of 7,500 m^2 (0.0075 km^2) per anchor chain or 60,000 m^2 (0.06 km^2) in total for all 8 mooring lines. In addition, an area of 800 m^2 (0.0008 km^2) of seabed will be disturbed by the placement of the anchors, assuming a footprint of 10 m × 10 m for each anchor.

The installation of the pipelines and umbilical will also result in temporary seabed disturbance. The production pipeline (and umbilical) and the gas lift pipeline will be installed in separate trenches (see Section 4: Project Description), using a trenching plough. A seabed disturbance corridor of 25 m has been estimated for each trench, based on the size of a typical trenching plough for these pipeline diameters and type of seabed. Two trenches are required over a distance of 14.4 km each. The total area of temporary disturbance area will be 780,800 m^2 (0.7808 km^2).

Table 9.1 outlines the total area of temporary seabed disturbance, due to the physical presence of the MODU and subsea infrastructure installation.

Table 9.1: Estimated worst-case footprint of temporary seabed disturbance

Activity	Footprint of Activity [m^2]	Number of Activities	Impact Footprint	
			[m^2]	[km^2]
MODU mooring lines	7,500	8	60,000	0.06
MODU mooring anchors	100	8	800	0.0008
Installation of production pipeline and umbilical	360,000	1	360,000	0.36

Activity	Footprint of Activity [m²]	Number of Activities	Impact Footprint	
			[m²]	[km²]
Installation of gas lift pipeline	360,000	1	360,000	0.36
Total			**780,800**	**0.7808**

The pipeline trenching operations and subsequent installation of rock protection will result in temporary local sediment plumes in the overlying water column, which will be dispersed via tidal currents and deposited over adjacent seabed areas. The extent of the plume dispersal and deposition from these activities is difficult to determine and will depend on the nature of the tidal currents at the time of sediment suspension and the grain size properties of the sediment in question. Heavier sand and gravel particles are expected to settle back to the seafloor very quickly (within seconds) and close to the point of disturbance, but finer silt and clay particles may remain suspended for longer periods of time (minutes and hours) and dispersed over a wider seabed area. These effects will be temporary, lasting for the duration of the trenching, backfilling and rock placement operations only.

9.1.2 Permanent Seabed Disturbances

The subsea infrastructure (including any protection material) placed on the seabed as part of the Fotla field development will replace the original soft sediment habitat with hard substratum instead, therefore resulting in a permanent reduction of natural soft sediment seabed habitat available. Table 9.2 summarises the planned seabed infrastructure and anticipated maximum area of permanent habitat reduction.

As described in Section 4.6.5, as a worst-case scenario the blanket placement of 0.6 m of rock material over the entire length (14.4 km) of both the production and gas lift pipeline has been considered in the ES. Rock protection will also be required at the crossing of the 24" Bruce to Forties Unity condensate pipeline. Concrete mattresses will be installed to protect the spools and umbilical at the Fotla manifold, Subsea Isolation Valve (SSIV) and Britannia platform locations, as well as grout bags protecting the ends of flowlines and umbilical. Table 9.2 provides an estimate of the amount of infrastructure protection associated with the Fotla field development.

Table 9.2: Area of permanent habitat reduction due to the physical presence of the Fotla field subsea infrastructure

Item	Item Footprint [m²]	Impact Footprint	
		[m²]	[km²]
Drill Centre Manifold	102	102	0.000102
Xmas trees*	25 m² (×2)	50	0.00005
Blanket rock placement for production pipeline, including trench transitions at the Fotla and Britannia manifolds	-	124,670	0.12467
Rock placement Fotla Production Pipeline crossing and associated trench transition	-	3,600	0.0036

Item	Item Footprint [m²]	Impact Footprint	
		[m²]	[km²]
Rock placement Fotla Gas Lift Pipeline crossing and associated trench transition	-	3,300	0.0033
Trench transitions of the Fotla Gas Lift Pipeline at the Fotla and Britannia manifolds	-	525	0.000525
Contingent rock placement (for gas lift pipeline)	-	1,200	0.0012
Concrete mattresses	18 m² (×300)	5,400	0.00540
Grout bags	0.15 m² (×1,500)	225	0.000225
Total		**139072**	**0.139072**

Notes:
* = Xmas tree dimensions are not known at present, hence a 5 m x 5 m was used which is indicative of similar infrastructure utilised previously in the North Sea.

9.2 Potential Effects on Seabed and Benthic Communities

The habitats and species affected by the proposed infrastructure during construction and operation of the Fotla field will include:

- Faunal communities on Atlantic offshore circalittoral mud (MD621);
- *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in Atlantic offshore circalittoral sandy mud (MD6218);
- Sea pen and burrowing megafauna communities; and
- Ocean quahogs (*Arctica islandica*).

These habitats and species are all commonly found across the North Sea (Hill et al., 2023; OSPAR, 2010; Tyler-Walters & Sabatini, 2017). The 'sea pen and burrowing megafauna communities' and 'ocean quahogs' are both habitats/species of national and international conservation importance, as indicated by their inclusion on the Oslo and Paris Convention (OSPAR) List of Threatened and/or Declining Species and Habitats, as well as being listed as Priority Marine Features (PMFs) in Scotland's seas.

9.2.1 Temporary Effects from Seabed Disturbance and Plumes

Seabed disturbance from the activities mentioned in Section 9.1.1 may include compaction and abrasion of local habitats and species resulting in temporary displacement effects. Sediment dwelling species at, or close to, the seabed may be disturbed, whereas deeper burrowing animals may be relatively unaffected, depending on the depth of penetration of the anchors and chains. Sessile epifauna coming into direct contact with the equipment are more likely to be damaged or killed, to their lack of mobility. Sea pen species (e.g. *Virgularia mirabilis*) can retract into their burrows when disturbed and therefore may be more robust to physical disturbance and displacement effects (Tuck et al., 2000; Wilding & Wilson, 2009), compared to softer bodied species, such as polychaete worms. In contrast, ocean quahogs are sensitive to abrasion (MarLIN, 2025). Mobile species such as *Nephrops* and fish will be able to move away and avoid the source of disturbance. Any displacement effects will be temporary and short-lived lasting for the duration of the drilling and completion operations only.

Recovery characteristics of disturbed seabed sediments will be dependent on a number of factors, including the nature of the seabed and the communities present, the severity of the original impact and local and regional hydrodynamic conditions. Studies have shown that initial re-colonisation takes place rapidly following a disturbance event, with certain species returning almost immediately to the disturbed site (BERR, 2008). The Department for Business, Enterprise and Regulatory Reform[1] (BERR, 2008) also highlights that in general, recovery is relatively rapid where seabed disturbances are more frequent and opportunistic species are more likely to dominate the community. In contrast, the recovery of complex communities indicative of more stable sediment habitats, such as the 'sea pen and burrowing megafauna' habitat, occurs over longer timescales. Similarly, ocean quahog recruitment can take more than ten years (Gilkinson et al., 2015) and so recovery of ocean quahog is therefore expected to occur over a long period of time compared to other benthic communities.

In conclusion, the effects of temporary seabed disturbance from the anchors, anchor lines and during pipeline installation will be highly localised and reversible and insignificant in size within the context of the wider region. Effect magnitude is thus judged to be '**Minor**'. However, the 'sea pen and burrowing megafauna communities' habitat present in the area of Fotla field development, as well as ocean quahog, are OSPAR (and PMF) listed hence of international importance, thus are considered to be of '**Very High**' value. The effects are therefore assessed to be '**Minor adverse**'.

Raised sediment plumes will be dispersed within water currents and re-deposited on to the seafloor over adjacent areas. Significant deposition of sediment plumes can smother or bury seabed communities, causing damage to sensitive respiratory organs, or preventing feeding resulting in the loss of sensitive species within affected areas (Carreiro-Silva et al., 2022; Christiansen et al., 2020). Sediment dwelling species, on the other hand, will be largely tolerant to the effects of light sediment deposition and are expected to be able to relocate to preferred feeding depths if buried under natural sediments. Mobile fauna is expected to be able to move away from temporary adverse areas of raised sediment plumes. The trenching tool will be continually moving along the trench route. In addition, the tool will aim to minimise any sediment loss from the trench, as this will be required for backfilling and burial of the gas lift pipeline.

Any plumes generated during rock placement will also be temporary and a fall-pipe vessel will be used to minimise the formation of plumes. Any fine sediments that are deposited over adjacent seabed areas will be rapidly re-mobilised, due to water current movements, or periods of increased bottom current velocities and will be eventually diluted and dispersed

[1] The Department for Business, Enterprise and Regulatory Reform (BERR) has since been replaced by the Department for Business and Trade (DBT), the Department for Energy Security and Net Zero (DESNZ) and the Department for Science, Innovation and Technology (DSIT).

out of the area. Effects of deposition of sediment plumes are therefore expected to be temporary and short-lived.

Local seabed communities at the Fotla field area are dominated by sediment dwelling species and are expected to be naturally tolerant to temporary and short-lived light sediment accumulation. Burrowing species (including ocean quahogs) are unlikely to be significantly affected by temporary deposition of sediment and are expected to relocate to preferred feeding depths and retain connection to the sediment / water interface if buried.

Sessile organisms, such as sea pens, are unable to escape plumes, hence they are more susceptible to smothering from dispersed sediment in the water column impacting their feeding capabilities and leading to an increase in the energetic cost of cleaning sediment from the polyps (Weaver et al., 2022). However, the two sea pen species *Virgularia mirabillis* and *Pennatula phosphorea,* have high resilience to smothering and siltation rate changes and were assessed as not sensitive to smothering effects up to a depth of 30 cm above the substratum (FeAST, 2024; Hill et al., 2023; Tyler-Walters & Sabatini, 2017).

The effects of the deposition of raised sediment plumes, will be localised, limited to the immediate area of sediment disturbance and adjacent areas within the influence of the plume, and will be very short-lived lasting for the duration of the activity only, after which recovery to pre-construction conditions are forecast to occur. The 'sea pen and burrowing megafauna' habitat and ocean quahog are receptors of '**Very High**' value. As shown above, the *Virgularia mirabillis* and *Pennatula phosphorea* and ocean quahogs are quite resilient to over sedimentation and the magnitude of effect is thus considered '**Minor**'. Therefore, effect significance is thus judged to be '**Minor adverse**', hence not significant.

9.2.2 Permanent Effects from Placement of Subsea Infrastructure and Protection Material

Burrowing species living directly underneath the placed infrastructure will be affected by the placement of subsea infrastructure, pipelines and associated protection materials on the seafloor. These animals may be prevented from accessing the sediment - water interface, limiting feeding, oxygenation of deep burrows and the dispersal of larvae, or will be killed directly. The extent of the effect will be highly localised and will be limited to the direct footprint of the seabed infrastructure and permanent, lasting for the duration of the proposed Fotla field development. In contrast, the new (albeit) artificial habitat may subsequently be colonised by attaching and encrusting species (e.g. Actiniaria) or used as refuge for mobile epibenthos (e.g. starfish and fish). Mobile fauna, such as fish and crabs are expected to be able to largely avoid getting trapped beneath any of the infrastructure during the installation activities.

Furthermore, the top of the blanket rock placement along the trenched production and gas lift pipelines and umbilical will be below the seabed height, hence it is expected that the trench will be gradually filled back in by adjacent soft sediments over time, returning to (near-)background conditions. For example, a review of seabed recovery following offshore wind farm construction (English et al., 2017) showed that seabed impacts from the placement of spud cans of construction vessels and from cable laying may take months to years to be infilled. Seabed habitats in lower energy environments, such as at the Fotla field development location, may take a number of years to recover compared to those in higher energy and more mobile sediment areas.

Therefore, the permanent effects of placement of subsea infrastructure, pipelines, umbilical and protection material will be highly localised and limited to the footprint of the installed infrastructure and protection material, for the duration of the Fotla field development. Upon decommissioning of the subsea infrastructure these effects will be (largely) reversible, depending on the outcome of a comparative assessment for the pipeline decommissioning options (see Section 4.9.2).

Therefore, the magnitude of the effect can be described as a detectable change to an ecological system or population which, due to the small scale of the impacts is within scope of existing variability within the context of the wider region. The effect magnitude is therefore judged to be '**Minor**'. Due to the presence of the sea pen and burrowing megafauna communities habitat and ocean quahog in the Fotla field development area, the receptor value is judged to be of '**Very High**' value. Therefore, effect significance is judged to be '**Minor adverse**', hence not significant.

9.3 Effects on Other Users of the Sea

9.3.1 Impacts on Commercial Fisheries

Fishing vessels will be temporarily displaced from a safety zone of 500 m radius centred on the MODU during the drilling and completion of the two Fotla wells (180 days) and subsequent Fotla subsea development infrastructure for the duration of the proposed development (approximately 15 years). This will displace all other users of the sea, including all types of fishing activity from a sea area of 0.785 km^2. However, demersal fishing with bottom gears will be displaced from a greater area than this, due to the physical presence of the anchor spread of the MODU. Given that the anchor lines will be 1,450 m long then demersal trawling may be temporary displaced from an area of 6.6 km^2 around the MODU for the duration of drilling the two wells. This equates to roughly 0.2 % of the area of an International Council for the Exploration of the Sea (ICES) statistical rectangle (approximately 3,087 km^2). All type of fishing will be able to return to fishing outwith the 500 m safety exclusion zone following the MODU removal. This 0.785 km^2 (i.e. approximately 0.025 % of an ICES statistical rectangle) will remain in place permanently, for the duration of the Fotla field development (15 years).

Fishing will also be temporarily displaced from areas around trenching/backfilling/rock placement activities during the installation of the pipelines and umbilical. However, these activities will be temporary, taking place over a 6 month period (as described in Table 4.4.).

Beyond the areas of displacement, commercial fishing is expected to remain unaffected although the displacement itself may result in some local increases in cumulative fishing effort in adjacent waters that are already exploited. This may lead to reduced catch per unit effort (CPUE) within the immediate surrounding area but is unlikely to result in significant reductions in CPUE over the wider region, where the characteristic offshore fisheries activities take place.

Commercial fishing within the area is considered to be moderately important regionally, with approximately 1,078 tonnes of fish being landed in ICES rectangles 44F1 and 45F1 in 2023, equating to 0.2 % of the total landing made by vessels in Scotland for 2023 (Section 5.4.1). Pelagic landings were variable between different years, likely influenced by food availability. The landings from shellfish fisheries within the ICES rectangle 44F1 and 45F1 in 2023 was valued at £1.84 million, which was almost double the value of demersal landings for the same year. However, fish landing data from other ICES rectangles in the wider region (e.g. 44F0, 45F0 and 46F0) indicated higher levels of shellfish landings compared to those reported within the Fotla field development. Based on these arguments, the receptor value is therefore regarded as '**Medium**'. Effects will remain localised to the immediate area of displacement and are reversible on completion of the construction operations and the decommissioning and removal of the MODU. Effect magnitude is judged to be '**Minor**' on a '**Medium**' value receptor. Consequently, the effect significance is considered to be '**Minor adverse**'.

9.3.2 Impacts on Shipping and Navigation

Vessel traffic will be temporarily excluded from an area with a radius of 500 m around the MODU during drilling and completion operations. Similarly, the vessels involved with the installation and commissioning of the pipelines will form a temporary obstruction to other sea users, for the duration of these operations.

As discussed in Section 5.4.3, a shipping traffic study carried out by Anatec, identified 20 shipping routes within 10 nm of the Fotla field development (Anatec, 2021). This equates to an average of 2 to 3 vessels per day travelling through this area. UKCS Block 22/1 has been designated as an area of moderate shipping density and Block 16/26 as an area of low shipping density (NSTA, 2017). The Fotla field is situated in an area of low average annual shipping density however the Britannia field typically experiences high shipping density (Figure 5.20) due to vessel traffic associated with operations at the Britannia Platform.

Receptor value is thus considered to be '**Medium**'. However, the Fotla field development lies in an area of open sea, so any passing vessels will have with ample space to navigate around it. Effects on shipping and navigation are forecast to be highly localised and fully reversible on completion of the drilling and construction activities. Effect magnitude is thus considered to be '**Minor**' on a '**Medium**' value receptor, resulting in a '**Minor adverse**' effect significance.

9.4 Mitigation Measures

The following mitigation measures are proposed to manage and minimise the risk of physical potential impacts of the physical presence of infrastructure, construction vessels and equipment occurring.

- An updated Vessel Traffic Study and, if required, Collision Risk Assessment will be undertaken to support any future Consent to Locate application for the MODU;
- All construction vessels will be highly visible and display the appropriate light or daytime signals to warn other sea users of the presence and their activities;
- Vessel use will be optimised by minimising the number of vessels required and length of time vessels are on site;
- Following pipeline trenching operations, Ithaca Energy will liaise with the SFF, to ameliorate any safety risks for the fishermen from potential mud berms being left behind;
- Prior to the MODU moving onto location, a Notice to Mariners will be issued and Navtex and NAVAREA warnings will be posted. In addition, the Aberdeen Coastguard Operations Centre (CGOC) and Northern Lighthouse Board (NLB) will be notified. This will ensure that all vessels, including fishing vessels, are aware of all planned operations at the Fotla field;
- The Seafish Kingfisher Information Service will be notified of the exact location of the MODU, pipelay vessel and subsea infrastructure, allowing their inclusion in their fortnightly bulletin to fishing vessels;
- The Hydrographic Office will be notified as to the location of the Fotla wells, manifold and pipelines, so that these can be marked on navigational charts;
- A 500 m safety exclusion zone will be imposed around the MODU during the drilling of the wells, which will be enforced by a dedicated Emergency Response and Rescue Vessel (ERRV);
- A 500 m safety exclusion zone will remain in place around the Fotla manifold and Xmas trees for the duration of the development (i.e. approximately 15 years);
- The MODU, construction vessels and any other vessels operating in the area, will be equipped with the appropriate navigational aids and aviation obstruction lights system, and;
- The use of subsea infrastructure stabilisation features (mattresses, grout bags and rock material) will be minimised through project design and will be installed in accordance with industry best practice (e.g. by using a fall pipe when placing rock protection).

9.5 In-Combination, Cumulative and Transboundary Impacts

The Fotla field development is planned within a region with multiple oil and gas developments. The nearest surface oil and gas infrastructure includes the Britannia Platform and Britannia Bridge Linked Platform (BLP) (13.5 km to the north-east), the Alba Northern Platform (14.2 km to the north) and the Chestnut field subsea infrastructure (7.8 km to the north-east).

The proposed development will reduce the area of available natural seabed habitat by approximately 137,720 m^2 (0.138 km^2), as a result of the placement of infrastructure on the sea floor. This area is considered to be very small within the context of the wider region and consequently, significant cumulative effects of habitat reduction are not forecast. Effects will be largely reversed on decommissioning.

The Fotla field development will contribute to the cumulative reduction in area of accessible fishing grounds within the wider region. However, the reduction of fishing grounds is considered to be small within the context of the available fishing ground at this geographic scale. An exclusion zone will only be put in place around the wells and Fotla manifold and Ithaca Energy will engage with the SFF to discuss options to ameliorate the potential mud berms generated during pipeline trenching to avoid any potential snagging risks to fishing. Consequently, any significant cumulative increase in fisheries pressure, across the wider region, as a result of displaced fishing effort, is not expected. Any displacement will be temporary for a period of approximately 15 years and will be reversible on decommissioning.

No cumulative impact on shipping and navigation is expected in the wider region. Drilling operations and installation of subsea infrastructure by the MODU and installation vessels, respectively, will lead to temporary vessel displacement and will cease following completion.

With respect to the physical presence of the proposed Fotla field development, no potentially significant in-combination effects were identified which would justify further assessment, beyond the individual effects that have already been considered in this section, as this would not alter the conclusions reached.

The proposed Fotla field lies approximately 46 km west of the United Kingdom (UK)/Norway transboundary line at its nearest point. Effects of physical presence are anticipated to be localised and no transboundary effects related to physical impacts have been identified.

9.6 Conclusion

Predicted effects (temporary and permanent) deriving from the Fotla field development on the seabed and benthic communities, as well as on other users of the sea, are assessed to be '**Minor adverse**'.

Mitigation measures have been proposed to maintain safe distance separations between other users of the sea during construction and throughout the operational life of the Fotla field and to ensure that all relevant stakeholders are notified as to the intended activities. An ERRV will be available throughout drilling operations, to ensure other vessel users maintain a safe distance from the MODU. During drilling and installation operations, radio navigation warnings will be issued, and the rig and vessels will be appropriately marked and lit.

Hence, none of the physical presence impacts assessed in this section (including cumulative or transboundary effects) are expected to result in any significant impacts.

10. Atmospheric Emissions

This section assesses the impacts on air pollution and cumulative global climate impacts of atmospheric emissions generated and associated with the Fotla field development.

The scope of this assessment has been informed by the outcomes of the Environmental Issues Identification (ENVID) exercises (Appendix 3), informal stakeholder consultation, and National Marine Plan (NMP) policies and statutory guidance, as explained in Section 6 (Identification of Impacts). The following impacts were identified for further assessment:

- Atmospheric emissions during installation, commissioning and routine operations;
- Flaring during well clean up and commissioning of subsea infrastructure and host platform facilities;
- Increased energy demand due to modifications to, and subsequent operation of, the host platform topsides resulting in increased atmospheric emissions; and
- Greenhouse gas (GHG) emissions associated with the transportation, distribution and processing (refining) and end user combustion of hydrocarbons produced from the proposed Fotla field development (Scope 3, Category 9, 10 and 11 emissions, as explained below).

The assessment will include all relevant 'Scope 1', 'Scope 2' and 'Scope 3' emissions, as defined in the 2015 revision of the GHG Protocol (GHG Protocol, 2015) and interpretated in the Department for Energy Security & Net Zero's EIA guidance on the assessment of Scope 3 emissions on climate (DESNZ, 2025), as follows:

- Scope 1 GHG emissions are direct emissions from operations that are owned or controlled by the reporting company (i.e. in this case Ithaca Energy);
- Scope 2 emissions are indirect emissions from the generation of purchased or acquired electricity, steam, heating, or cooling consumed by the reporting company; and
- Scope 3 GHG emissions are all indirect emissions (not included in Scope 2) that occur in the value chain.

Emissions directly associated with the Fotla development (i.e. the Scope 1 emissions) will take place at the Britannia platforms where the processing of the produced hydrocarbons will take place, including any potential flaring during the well clean-ups and during certain commissioning activities, such as process start-up.

As all required electricity, steam, heating and cooling will be generated onboard the Britannia platforms as part of the production process, there will be no Scope 2 emissions associated with the Fotla development.

All emissions associated with the MODU, support and installation vessels and helicopters, as well as those generated during the transportation, processing (refining) and distribution of the produced hydrocarbons and from their use by the end user are classed as Scope 3 emissions. Although none of these are owned by or under direct control of Ithaca Energy, they have been included for the purposes of the Environmental Impact Assessment (EIA) in order to provide a complete and holistic assessment of the potential cumulative impacts that may result as a consequence of the Fotla field development.

Scope 3 emissions comprise a wide range of upstream and downstream emission categories as listed in Table 10.1. For the purposes of this EIA, Scope 3 categories 4, 6, 9, 10 and 11 have been included in the assessment, as these are considered to cover the pertinent emissions with regard to the proposed Fotla development. The upstream Scope 3 categories 4 and 6 cover the vessel and helicopter usage, whereas the downstream Scope 3 categories 9 and 10 cover the transportation, distribution and processing (refining) taking place before the produced hydrocarbons reach the end user. Downstream Scope 3, category 11 covers the emissions associated with the ultimate combustion of the sold hydrocarbons by the end users that will be produced over the life of the Fotla field development. It is assumed that ultimately all sold hydrocarbons (i.e. 100 %) will be combusted.

Table 10.1: List of Scope 3 categories (adapted from GHG Protocol, 2011)

Upstream / Downstream	Scope 3 Categories
Upstream	1) Purchased goods and services Extraction, production, and transportation of goods and services purchased or acquired by the reporting company not otherwise included in Categories 2 – 8.
Upstream	2) Capital goods Extraction, production, and transportation of capital goods purchased or acquired by the reporting company.
Upstream	3) Fuel- and energy-related activities (not included in Scope 1 or Scope 2) Extraction, production, and transportation of capital goods purchased or acquired by the reporting company, including: a. Upstream emissions of purchased fuels (extraction, production, and transportation of fuels consumed by the reporting company); b. Upstream emissions of purchased electricity (extraction, production, and transportation of fuels consumed in the generation of electricity, steam, heating, and cooling consumed by the reporting company); c. Transmission and distribution (T&D) losses (generation of electricity, steam, heating and cooling that is consumed (i.e., lost) in a T&D system) – reported by end user; d. Generation of purchased electricity that is sold to end users (generation of electricity, steam, heating, and cooling that is purchased by the reporting company and sold to end users) - reported by utility company or energy retailer only.
Upstream	4) Upstream transportation and distribution ▪ Transportation and distribution of products purchased by the reporting company between a company’s tier 1 suppliers and its own operations (in vehicles and facilities not owned or controlled by the reporting company); ▪ Transportation and distribution services purchased by the reporting company, including inbound logistics, outbound logistics (e.g., of sold products), and transportation and distribution between a company’s own facilities (in vehicles and facilities not owned or controlled by the reporting company).
Upstream	5) Waste generated in operations

Upstream / Downstream	Scope 3 Categories
	Disposal and treatment of waste generated in the reporting company's operations (in facilities not owned or controlled by the reporting company).
Upstream	6) Business travel
	Transportation of employees for business-related activities (in vehicles not owned or operated by the reporting company).
Upstream	7) Employee commuting
	Transportation of employees between their homes and their worksites (in vehicles not owned or operated by the reporting company).
Upstream	8) Upstream leased assets
	Operation of assets leased by the reporting company (lessee) and not included in Scope 1 and Scope 2 – reported by lessee.
Downstream	9) Downstream transportation and distribution
	Transportation and distribution of products sold by the reporting company between the reporting company's operations and the end consumer (if not paid for by the reporting company), including retail and storage (in vehicles and facilities not owned or controlled by the reporting company).
Downstream	10) Processing of sold products
	Processing of intermediate products sold by downstream companies (e.g. refineries).
Downstream	11) Use of sold products
	End use of goods and services sold by the reporting company. The direct use-phase emissions of sold products over their expected lifetime (i.e., the Scope 1 and Scope 2 emissions of end users that occur from the use of: products that directly consume energy (fuels or electricity) during use; fuels and feedstocks; and GHGs and products that contain or form GHGs that are emitted during use..
Downstream	12) End-of-life treatment of sold products
	Waste disposal and treatment of products sold by the reporting company at the end of their life.
Downstream	13) Downstream leased assets
	Operation of assets owned by the reporting company (lessor) and leased to other entities, not included in Scope 1 and Scope 2 – reported by lessor.
Downstream	14) Franchises
	Operation of franchises, not included in Scope 1 and Scope 2 – reported by franchisor.
Downstream	15) Investments
	Operation of investments (including equity and debt investments and project finance), not included in Scope 1 or Scope 2.

During the drilling, installation and operation of the Fotla field development atmospheric emissions will be generated by releasing carbon dioxide (CO_2), nitrogen oxides (NO_x), sulphur dioxide (SO_2) and volatile organic compounds (VOCs) into the atmosphere. The emissions produced during these operations are known to contribute to a number of environmental processes and impacts, including global warming, acidification (acid rain), the formation of low-level ozone (also referred to as tropospheric ozone), and local air pollution (Lee et al., 2022).

The most commonly used general indicator for global climate change is the global warming potential (GWP), expressed in tonnes of CO_2 equivalents (CO_2e). All gaseous substances that contribute towards global warming (referred to as 'greenhouse gases') have a GWP factor that allows the conversion of individual emissions into CO_2 equivalents. As such, GWP can be used to estimate the potential future impacts of gaseous emissions upon the climate system.

GWP is a measure of the relative radiative effect of a given gas compared to that of CO_2, integrated over a chosen time horizon (often a 100-year time period). Simply stated, the GWP of a specific gas is a measure of its climate change impact relative to carbon dioxide (AEA, 2007).

Greenhouse gases can be divided into 'direct' and 'indirect' greenhouse gases[1]. Direct greenhouse gases contribute directly to climate change owing to their positive radiative forcing effect, as described above. The GHG protocol recognises six direct greenhouse gases that are reported under the United Nations Framework Convention on Climate Change (UNFCCC), namely CO_2, CH_4 (methane) and N_2O (nitrous oxide) and the so-called 'F-gasses' comprising hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6). Regarding the Fotla field development, only the first three (CO_2, CH_4 and N_2O) are relevant to the combustion emissions assessed here.

Indirect greenhouse gases, like carbon monoxide (CO) and NO_x, do not trap heat themselves but can react in the atmosphere to form warming gases, such as tropospheric ozone. They can also affect the concentration of hydroxyl (OH) radicals, which are crucial for breaking down other greenhouse gases like CH_4. Their role in climate change is complex because they also have a strong impact on air quality and can lead to cooling effects in certain parts of the atmosphere.

Other combustion emissions, such as SO_2 and small particulate matter (PM) do not contribute to climate change, but do contribute to local and regional air pollution.

Table 10.2 summarises the GWP factor of each of the combustion gases associated with the Fotla field development, as well as their 100-yrear GWP factor. The GWP factors of the direct greenhouse are used for the emission calculations in the remainder of this section, as per the GHG protocol.

[1] Please note that the terms '**direct**' and '**indirect**' in the context of **greenhouse gases**, as described here have a different meaning than when used in the context of S**cope 1 ,2 and 3 emissions**, where they refer to whether the emissions are under direct control of the reporting company (i.e. in this case Ithaca Energy) or not.

Table 10.2: Environmental effects and GWP of atmospheric emissions

Gaseous emission	Environmental Effect	100-Year GWP Factor*
Direct Greenhouse Gases		
Carbon dioxide (CO_2)	Direct greenhouse gas contributing to climate change, meaning that it inhibits the radiation of heat into space, increasing temperatures at the Earth's surface.	1
Methane (CH_4)	Direct greenhouse gas contributing to climate change.	25
Nitrous oxide (N_2O)	Direct greenhouse gas contributing to climate change.	298
Indirect Greenhouse Gases		
Carbon monoxide (CO)	Direct effects upon human health (asphyxiant). May contribute indirectly to climate change.	East Asia: 1.8 (±0.6) [a] EU + North Africa: 1.6 (±0.5) [a] North America: 1.8 (±0.6) [a] South Asia: 1.8 (±0.6) [a] Global: 2 to 3.3[b] Global: 2.2 (±0.6)[c] Global: 3.3 (±0.8)[c] Global: 5.3 (±2.3)[c]
Oxides of nitrogen (NO_x)	Nitrogen dioxide (NO_2) has direct effects upon human health and vegetation and has the potential to cause respiratory illness and irritation of the mucous membranes. NO_x acts as a precursor to low-level ozone formation. While short-lived, ozone is a very potent greenhouse gas that can contribute significantly to climate warming and is a major component of smog, affecting air quality and human health. NO_x contributes to acid deposition (wet and dry) which impacts both freshwater and terrestrial ecosystems.	East Asia: -5.3 (±11.5) [a] EU + North Africa: -15.6 (±5.8) [a] North America: -8.2 (±10.3) [a] South Asia: -25.3 (±29.0) [a] Mid-latitude: -18 to +1.6 [b] Tropical: -28 to -10 [b] Global: -11[d] Global: -31 (±10)[c] Global: -95 (±31)[c] Global: -159 (±79)[c]
Volatile organic compounds (VOC)	VOCs include non-methane hydrocarbons (NMHC) and oxygenated NMHC (e.g. alcohols, aldehydes and organic acids), have short atmospheric lifetimes (fractions of a day to months) and small direct impact on radiative forcing. VOC influence climate through their production of organic aerosols and their involvement in photochemistry, i.e. production of ozone (O_3) in the presence of NO_x and light. Generally, fossil VOC sources have already been accounted for as the release of fossil C in the CO_2 budgets and therefore are not counted as a source of CO_2.	East Asia: 5.0 (±2.1) [e] EU + North Africa: 5.6 (±2.8) [e] North America: 5.0 (±3.0) [e] South Asia: 8.8 (±1.9) [e] Global: 4.5[f]
Other		
Sulphur dioxide (SO_2)	SO_2 has direct health effects - causes respiratory illness. SO_2 contributes to acid	-

Gaseous emission	Environmental Effect	100-Year GWP Factor*
	deposition (wet and dry) which impacts both freshwater and terrestrial ecosystems.	
Particulate matter (PM)	The environmental effect of particulate matter is mainly determined by the size (and shape) of the particles. Particles emitted from modern diesel engines (commonly referred to as Diesel Particulate Matter, or DPM) are typically in the size range of 100 nanometres (0.1 µm) and can penetrate the deepest part of the lungs. In addition, these soot particles also carry carcinogenic components. In high concentrations particulate matter can also affect plant growth.	-

Notes:
* = GWPs are from Myhre et al (2013) and refer to the 100-year horizon values.

Sources referred to in Myhre et al (2013):
a: Fry et al. (2012) (updated by including stratospheric H_2O) and Collins et al. (2013)
b: Fuglestvedt et al. (2010), with the VOC values based on Collins et al. (2002).
c: Shindell et al. (2009). Three values are given: First, without aerosols, second, direct aerosol effect included, third, direct and indirect aerosol effects included. Uncertainty ranges from Shindell et al. (2009) are given for 95 % confidence levels.
d: Fuglestvedt et al. (2010); based on Wild et al. (2001).
e: Fry et al. (2012) (updated by including stratospheric H_2O) and Collins et al. (2013).
f: Fuglestvedt et al. (2010) based on Collins et al. (2002).

10.1 Quantification of Fotla Atmospheric Emissions

Atmospheric emissions contribute to a variety of environmental effects and associated impacts, including local air pollution and climate change.

10.1.1 Data Sources and Uncertainty

As all operations associated with the Fotla field development will take place in the future, there are currently no direct monitoring data available to inform this assessment. Therefore, the quantification of emissions in this Section of the ES are based on generic emission factors from sectoral guidelines and other relevant literature as indicated and referenced throughout this section. Where available, representative proxies have been used, as appropriate.

The calculations are based on the fuel consumption estimates presented in Section 4 (Project Description), namely from Table 4.8 for the drilling operations and Table 4.14 for the installation of the subsea infrastructure.

10.1.2 Estimation of Vessel Emissions During Drilling Operations

It is estimated that the MODU will consume 20 tonnes of marine diesel per day, based on general industry figures for an anchored semi-submersible drilling rig. With a total operational time of approximately 203 days on location, this will amount to approximately 4,060 tonnes of marine diesel being used for power generation during drilling and completion operations.

In addition to the fuel used by the MODU itself, all support vessels (tugs, anchor handling vessels, supply vessels, standby vessel and helicopters) will also consume fuel and produce exhaust emissions as detailed in Table 4.8 in Section 4 (Project Description). Table 10.3 below provides the predicted emissions from these sources, based on their total fuel consumption.

Table 10.3: Estimated emissions during drilling and well completions

		MODU	AHVs	Tugs	Supply vessels	Standby / support vessel	Helicopter	Total
Fuel consumption (tonnes)		4,060	256	300	700	1,224	61	**6,540**
Emissions (tonnes)	CO_2	12,992	819	960	2,240	3,917	195	**21,123**
	CO	63.7	2.0	2.4	5.6	9.8	0.3	**84**
	NO_x	241.2	15.1	17.7	41.3	72.2	0.8	**388**
	N_2O	0.89	0.06	0.07	0.15	0.27	0.01	**1**
	SO_2	16.2	2.6	3.0	7.0	12.2	0.1	**41**
	CH_4	0.73	0.07	0.08	0.19	0.33	0.01	**1**
	VOC	8.12	0.61	0.72	1.68	2.94	0.05	**14**
GWP (tonnes of CO_2e)		13,211	839	983	2,294	4,012	197	**21,536**

10.1.3 Flaring during Well Clean-up and Commissioning

The base case for cleaning up the Fotla wells after drilling and completion is to send all well fluids through the pipeline to the process facilities at Britannia. This means most of the hydrocarbons extracted from the produced fluids during clean-up will be separated out and exported or used as fuel gas, with only a small fraction being flared off through the Britannia flare system. However, clean-up via the MODU is included in the EIA to capture a 'worst-case' scenario, should clean-up to the MODU be required instead (see Section 4.8.5). The exact well clean-up method will be confirmed as part of full analysis of detailed start-up procedures and the initial start-up programme. Therefore, based on a worst-case estimate, a maximum of 2,000 tonnes of hydrocarbons will be flared off per well (i.e. up to 4,000 tonnes in total) with the well clean-up operations taking less than 96 hours per well. Flaring associated with clean-up through the Britannia facilities would be significantly less than this. Table 10.4 sets out the maximum estimated emissions during the combined well clean-up operations for both production wells.

Table 10.4: Estimated emissions during well-cleanup and commissioning

		Oil	Gas	Total
Amount (tonnes)		3,271.7	728.3	**4,000**
Emissions (tonnes)	CO_2	9,946	1,937	11,883
	CO	55.9	4.6	61
	NO_x	11.5	0.8	12
	N_2O	0.25	0.06	0.3
	SO_2	0.04	0.01	0.1
	CH_4	77.7	31.1	109
	VOC	77.7	3.5	81
GWP (tonnes of CO_2e)		12,188	2,824	**15,012**

10.1.4 Estimation of Emissions During Subsea Installation

A number of different vessels will be involved during the installation of the subsea infrastructure in the Fotla field and the associated pipeline to Britannia, as listed in Table 10.5.

Table 10.5: Estimated emissions during subsea installation

		DP Construction Support Vessel (CSV)	Utility / Survey Vessel	Reel Lay Vessel	Trenching Vessel (Plough)	Fall Pipe Vessel	Diving Support Vessel (DSV)	Guard Vessel	Totals
Fuel consumption (tonnes)		300	420	340	360	380	1,000	120	**2,920**
Emissions (tonnes)	CO_2	960	1,344	1,088	1,152	1,216	3,200	384	9,344
	CO	2.4	3.4	2.7	2.9	3.0	8.0	1.0	23
	NO_x	17.7	24.8	20.1	21.2	22.4	59.0	7.1	172
	N_2O	0.07	0.09	0.07	0.08	0.08	0.22	0.03	1
	SO_2	3.0	4.2	3.4	3.6	3.8	10.0	1.2	29
	CH_4	0.08	0.11	0.09	0.10	0.10	0.27	0.03	1
	VOC	0.72	1.01	0.82	0.86	0.91	2.40	0.29	7
GWP (tonnes of CO_2e)		**983**	**1,377**	**1,114**	**1,180**	**1,246**	**3,278**	**393**	**9,571**

10.1.5 Estimation of Operational Emissions During the Production Phase of the Fotla field

The operational emissions during the production phase of the Fotla field development have been modelled to predict the effect on the Britannia and BLP emissions with and without the

Fotla field (Kent, 2025). As part of this study a benchmarking exercise was carried out to compare actual Britannia and BLP emissions data and Harbour Energy predictions to the Kent estimations, which found good correlation (within 2 %) between the two.

Table 10.6 shows the predicted CO_2e emissions at Britannia under baseline conditions (i.e. without Fotla), compared to the emissions of Britannia including Fotla for the mid-case and high-case production forecasts. Based on the mid-case forecast, the overall CO_2e emissions at Britannia are forecast to increase by 16.5 kton CO_2e over an 11 year long period, whereas under high-case conditions the increase will be 24 kton CO_2e over a 16 -year long period, i.e. <1 % under both scenarios.

Table 10.6: Annual Emissions during the production phase of the Fotla field development

Year	Britannia Baseline (kton CO_2e)	Britannia + Fotla mid-case (kton CO_2e)	Fotlamid-case contribution (kt CO_2e)	Britannia + Fotla high-case (kton CO_2e)	Fotla high-case contribution (kt CO_2e)
2027	74	74	0.3	74	0.37
2028	295	302	7.1	304	8.76
2029	295	296	1.5	297	2.18
2030	295	296	1.3	297	1.91
2031	295	296	1.2	297	1.72
2032	295	296	1.2	297	1.62
2033	295	296	1.0	296	1.38
2034	294	295	0.8	296	1.27
2035	294	295	0.8	296	1.25
2036	294	295	0.7	295	0.90
2037	294	295	0.6	295	0.81
2038	294	-	-	295	0.91
2039	295	-	-	295	0.38
2040	295	-	-	295	0.29
2041	294	-	-	294	0.29
2042	221	-	-	221	0
Total	**3,021* / 4,420****	**3,038**	**16.5**	**4,444**	**24.0**

Notes:

* Total for mid-case scenario over the period 2027-2037 (estimated life of field for mid-case scenario)

** Total for high-case scenario over the period 2027-2042 (estimated life of field for high-case scenario)

10.1.6 Estimation of Downstream Combustion Emissions of Produced Hydrocarbons (Scope 3, Category 9, 10 and 11 emissions)

In addition to the upstream emissions discussed above, the impact assessment also looks at the emissions downstream from the point where the Fotla hydrocarbons leaving the Britannia Platform for export. These estimates include the CO_2e generated from the transportation, distribution and processing (refining) and the ultimate combustion of produced Fotla hydrocarbons by the end user and are based on the UK Government GHG Conversion Factors for Company Reporting (DESNZ, 2025). The estimates for downstream transportation, distribution and processing (refining) Scope 3, categories 9 and 10 emissions have been calculated by deducting the Fotla contribution to the Britannia CO_2e emissions from the overall 'Well to Tank' values, as the upstream Fotla emissions are already covered in Table 10.6 above.

For the combustion of the produced Fotla hydrocarbons by the end user (Category 11 emissions) the conversion factor for 'fuel oil' has been used as a representative proxy for the produced Fotla oil and 'natural gas (100 % mineral blend)' as a proxy for the produced Fotla gas. These conversion factors are essentially independent of application as they assume that all fuel is fully oxidised and combusted. They are based on an activity-weighted average of all the different CH_4 and N_2O conversion factors from the UK's greenhouse gas inventory for 2023, to allow for the variety of potential end users (DESNZ, 2025).

Table 10.7 presents the downstream Scope 3 emissions (categories, 9, 10 and 11) for the high-case and mid-case production scenarios.

Table 10.7: Fotla Downstream Scope 3 Emissions

Year	Mid-case			High-case		
	Category 9, 10 (kton CO_2e)	Category 11 (kton CO_2e)	Total (kton CO_2e)	Category 9, 10 (kton CO_2e)	Category 11 (kton CO_2e)	Total (kton CO_2e)
2027	31	152	184	26	125	151
2028	464	2,408	2,879	451	2,386	2,846
2029	198	1,044	1,244	331	1,826	2,159
2030	147	779	926	274	1,540	1,816
2031	126	675	802	217	1,230	1,448
2032	109	596	706	183	1,045	1,230
2033	95	526	622	156	892	1,049
2034	84	471	556	137	788	926
2035	75	427	503	117	677	796
2036	47	272	320	52	297	351
2037	11	65	76	37	210	249
2038	0	0	0	32	179	212
2039	0	0	0	28	155	183
2040	0	0	0	25	136	162

Year	Mid-case			High-case		
	Category 9, 10 (kton CO_2e)	Category 11 (kton CO_2e)	Total (kton CO_2e)	Category 9, 10 (kton CO_2e)	Category 11 (kton CO_2e)	Total (kton CO_2e)
2041	0	0	0	23	124	147
2042	0	0	0	12	63	75
Total	**1,404**	**7,414**	**8,817**	**2,124**	**11,675**	**13,799**

The table shows that the more likely mid-case production profile would result in 36 % less downstream Scope 3 emissions compared to the high-case production profile.

It should be noted that these calculations are based on a wide range of assumptions, based on the best estimates currently available. The Scope 3 category 8, 9 and 10 estimates should therefore be considered to provide an indication of scale only for the purpose of putting them into context in relation to current global carbon emissions, national emission reduction targets and projected potential climate change trajectories.

10.1.7 Summary of all Emissions Combined over the Fotla Life of Field

Table 10.8 combines all emissions presented Table 10.3 to Table 10.7, thereby summarising all emissions over the life of field.

Table 10.8: Summary of all Fotla CO_2e emissions combined over life of field

Year	Upstream				Downstream		Total
	Drilling and Completion (kton CO_2e)	Well Clean-up and Commissioning (kton CO_2e)	Subsea Installation (kton CO_2e)	Production (kton CO_2e)	Transportation, distribution and processing (refining) (kton CO_2e)	End User Combustion Emissions (kton CO_2e)	Total (kton CO_2e)
2027	21.5	15.0	9.2	0.4	26	125	197
2028	--	--	--	8.8	451	2,386	2,854
2029	--	--	--	2.2	331	1,826	2,161
2030	--	--	--	1.9	274	1,540	1,818
2031	--	--	--	1.7	217	1,230	1,451
2032	--	--	--	1.6	183	1,045	1,232
2033	--	--	--	1.4	156	892	1,050
2034	--	--	--	1.3	137	788	927
2035	--	--	--	1.3	117	677	796
2036	--	--	--	0.9	52	297	351
2037	--	--	--	0.8	37	210	249

Year	Upstream				Downstream		Total
	Drilling and Completion (kton CO_2e)	Well Clean-up and Commissioning (kton CO_2e)	Subsea Installation (kton CO_2e)	Production (kton CO_2e)	Transportation, distribution and processing (refining) (kton CO_2e)	End User Combustion Emissions (kton CO_2e)	Total (kton CO_2e)
2038	--	--	--	0.9	32	179	213
2039	--	--	--	0.4	28	155	184
2040	--	--	--	0.3	25	136	161
2041	--	--	--	0.3	23	124	147
2042	--	--	--	0.0	12	63	75
Total	**22**	**15**	**8**	**24**	**2,124**	**11,675**	**13,867**

10.2 Putting the Fotla Emissions into Context

In this section the Fotla emissions are put into context with regard to their contribution to industry-wide, national and international emission and carbon budgets and net zero targets, in order to evaluate to what extent the Fotla field development aligns with these targets and objectives, as per the DESNZ (2025) and IEMA (2022) guidance documents.

10.2.1 NSTA Targets for the Oil and Gas Industry

The emissions listed in Sections 10.1.2 to 10.1.7 above can be put into context by comparing them with the current emissions from the UK's oil and gas industry and to see how the high-case Fotla production profile fits in with the North Sea Transition Authority (NSTA) targets for the UK oil and gas industry, as described in the Oil and Gas Authority (OGA) Strategy and the North Sea Transition Deal (NSTD).

In 2024, GHG emissions from oil and gas production in the UK, which includes emissions from offshore oil and gas fields, onshore processing terminals and oil and gas exploration activity, totalled an estimated 11.8 Mt CO_2e (Figure 10.1). Of this, 81 % originated from offshore facilities which extract and initially process oil and gas. Emissions from the production of oil and gas in the UK declined by 7 % between 2023 and 2024, a fifth consecutive year of reductions (NSTA, 2025b).

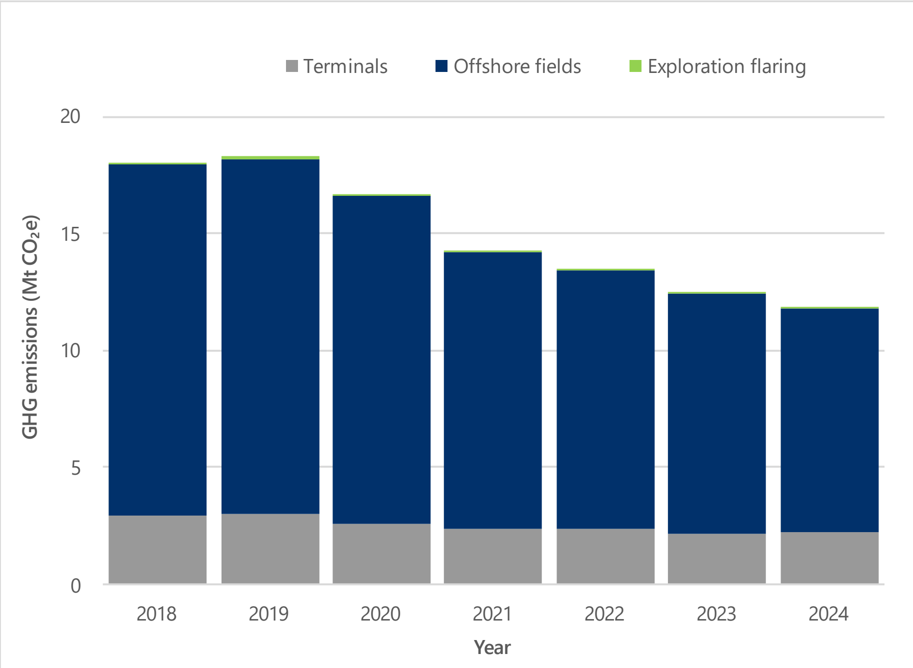

Figure 10.1: Emissions from UK oil and gas production (Source: NSTA, 2025b)

When comparing Fotla's annual upstream[2] emissions using the total of 9.58 Mt CO_2e for all offshore fields in 2024 as a baseline (NSTA 2025b), it shows Fotla would contribute 0.49 % to this total in 2027, including all emissions from drilling, flaring during well clean-up and commissioning, installation of subsea infrastructure and the initial production from October 2027 onwards. From 2028 onwards, this drops down to 0.09 % and gradually decreases to around 0.003 % by the end of 2041 going into the final months of production in 2042, when they will reduce to zero by September that year, when production finishes.

If the transportation, distribution and processing (refining) emissions are included as well, the combined Fotla emissions can be compared to the overall UK oil and gas production of 11.8 kt/CO_2e in 2024 (See Figure 10.1 above). The Fotla GHG contribution would then increase to 0.61 % in 2027 and 3.95 % in 2028, before gradually reducing over the life of field to 0.10 % in 2042. However, it should be noted that most, it not all, of the Fotla oil is expected to be processed (refined) abroad and the emission comparison against a UK only benchmark used in this instance should therefore be viewed as a very conservative estimation.

The OGA strategy sets out a Central Obligation which commits all parties involved to undertake the steps necessary to:

a. secure that the maximum value of economically recoverable petroleum is recovered from the strata beneath relevant UK waters; and, in doing so,
b. take appropriate steps to assist the Secretary of State in meeting the net zero target, including by reducing as far as reasonable in the circumstances greenhouse gas

[2] The term 'upstream' in this context means all emissions associated with Fotla, until the produced hydrocarbons leave the Britannia Platform.

emissions from sources such as flaring and venting and power generation, and supporting carbon capture and storage projects (OGA, 2021).

Government forecasts show that oil and gas will remain an important part of our energy mix for the foreseeable future, including under Net Zero (NSTA, 2025c). Presently, the projected oil and gas requirements for the UK in 2050 are 14.5 million tonnes of oil equivalent (Mtoe) for oil and 9.2 Mtoe for gas (NSTA, 2024). Figure 10.2 and Figure 10.3 show the trajectory of the amount of oil and gas that the UK as a country is projected to require between 2024 and 2050, including the provision in there for new oil developments and the contribution that Fotla will make to this. Both figures show that the projected oil and gas production from the Fotla development fits in well within the anticipated production targets, taking up only a small part within the amount allocated for new developments.

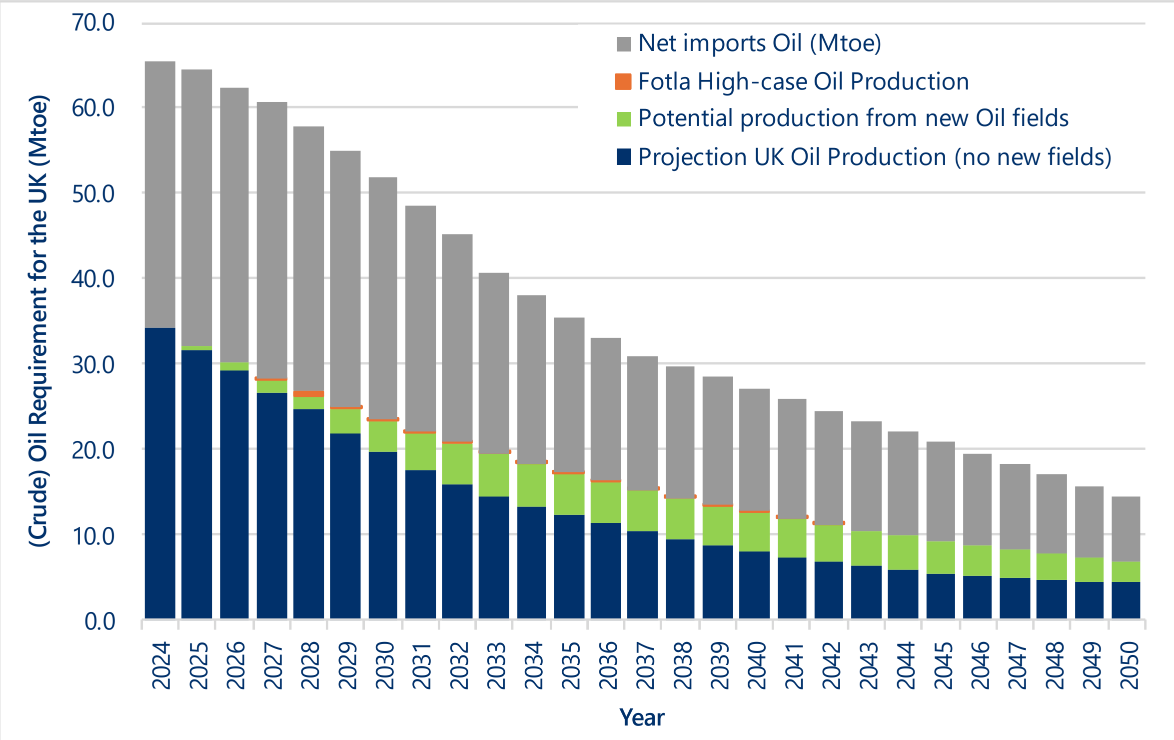

Figure 10.2: Projected oil requirements for the UK (NSTA, 2024)

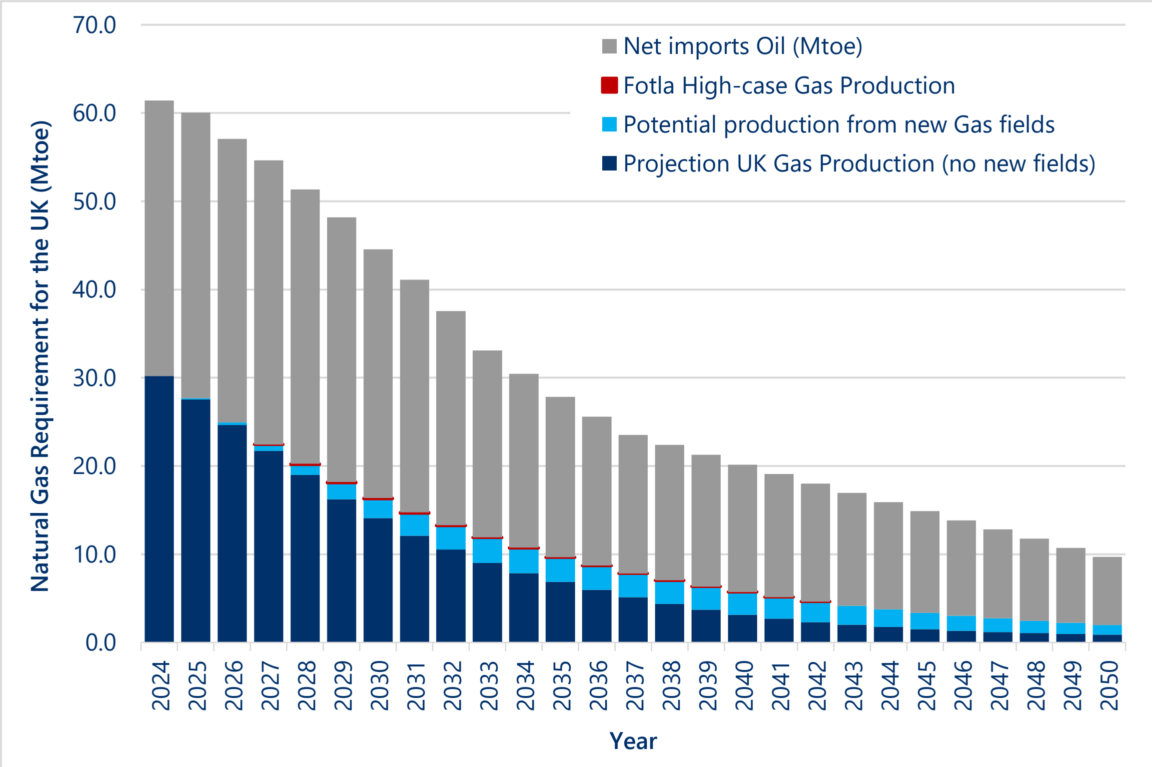

Figure 10.3: Projected gas requirements for the UK (NSTA, 2024)

The NSTD is an agreement between the UK government and the oil and gas industry which includes upstream emissions reduction targets of 10 % by 2025, 25 % by 2027 and 50 % by 2030 in support of the UK's pathway to net-zero by 2050, all against a 2018 baseline (NSTA, 2021; NSTA, 2022). The UK upstream oil and gas sector has set itself additional targets, starting from a 50 % reduction in 2030 to 90 % in 2040 (against a 2018 baseline) and to become a net zero basin by 2050 (OGUK, 2020). The UK oil and gas industry is currently on track to meet, and is forecasted to slightly exceed, the NSTD targets up to 2030. Upstream oil and gas emissions are projected to continue to reduce beyond 2030, with the reduction rates depending on the amount of additional mitigation that will be implemented (Figure 10.4).

The 'business as usual' projection (dark blue line) represents a continuation of the current trend in the UK's oil and gas industry, which follows a gradually declining trajectory based on the cessation of production (CoP) of installations over the next few decades. The dark blue line provides a reference point against which the potential impact of future abatement measures can be assessed in relation to the NSTD and industry targets and is not intended to represent the most likely emissions pathway, as the NSTA both anticipates and requires continued abatement efforts (NSTA, 2025b).

The lime green, light blue and orange lines present pathways based on a range of additional measures, including the implementation of zero routine flaring and venting from 2030 onwards, in combination with 3 different electrification scenarios (based on high, mid and low range electrification, respectively).

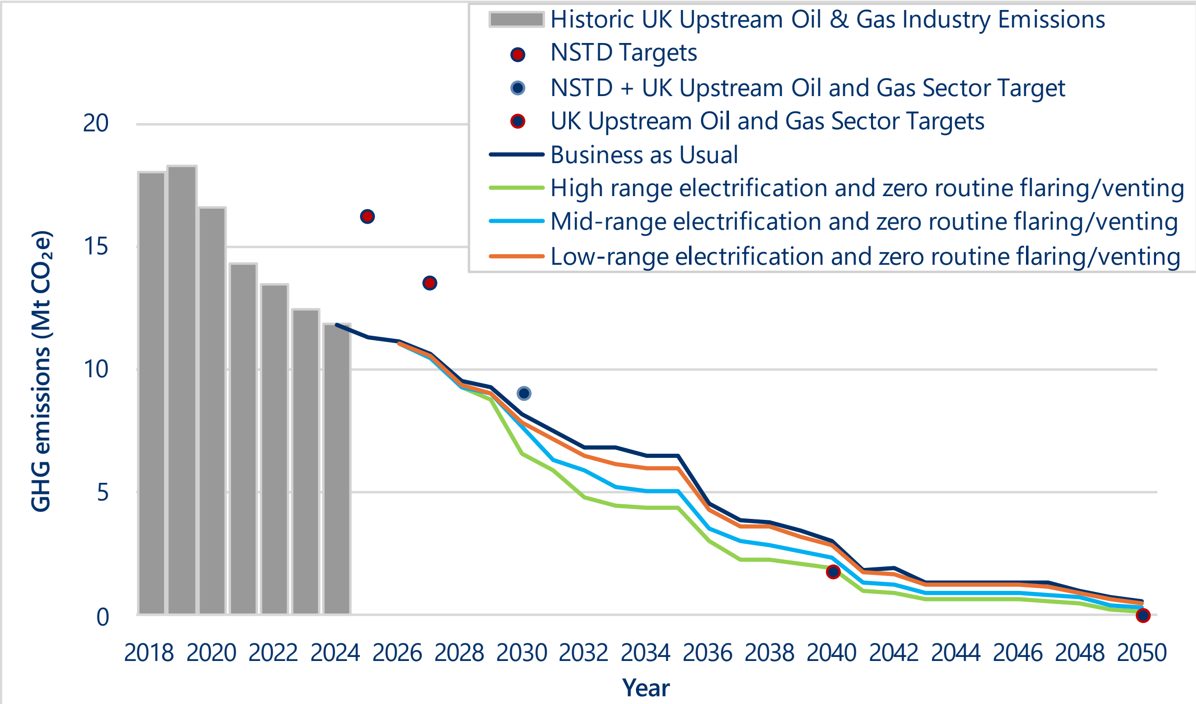

Figure 10.4: Current trend and projected upstream CO_2 emissions from the UK upstream oil & gas industry

10.2.2 UK Carbon Budgets

As described in the Local Environment chapter of the ES (Section 5.5.4), the UK as a country has set itself legally binding carbon targets to reach net zero by 2050, under the Climate Change Act (2008). The Act requires the Government to set periodic carbon budgets every 5 years, known as 'nationally determined contributions' (NDCs), to ensure the UK reaches Net Zero by 2050. In 2019, the UK committed itself to reach Net Zero greenhouse gas emissions by 2050, with any residual greenhouse gas emissions balanced by removals. To date, targets have been set for the period up to 2042 (see Table 5.17). In order to meet these targets, the UK's climate change committee (CCC) has set out a strategy known as 'the Balanced Pathway', on which the NDCs are based.

At peak production in 2028, Fotla's contribution to the Britannia emissions will be 8,800 tonnes of CO_2e (Table 10.6). Over the life of field, the annual contribution of Fotla to the overall emissions at Britannia is around 1,600 tonnes of CO_2e per year on average. The overall upstream oil and gas emissions in the UK were 11.8 million tonnes of CO_2e. Therefore, using 2024 as a baseline year, Fotla's emissions in relation to the whole UK oil and gas upstream sector will contribute 0.01 % on average per year and 0.07 % during peak production in 2028.

As explained in Section 4.7.1, the produced Fotla export gas will be fed into the National Transmission System, where it will be used for power generation by the National Grid, to supply heating and hot water to homes and businesses, and to fuel industrial processes in Great Britain. The produced Fotla oil will be exported to the global market for refining and further processing, and hence no estimation can be made of how much of the oil will ultimately be used domestically.

The overall Fotla emissions (including its combined Scope 1 and Scope 3, Category 4, 6, 9, 10 and 11 emissions) will contribute a very small part of the projected annual UK target carbon budgets set, remaining well in line with the Balanced Pathway strategy towards Net Zero by 2050, as shown in Table 10.9. The highest contribution will be from the downstream gas emissions, which in fact is already part of the energy transition, by contributing to the electricity generation through the use of gas fired power stations, since the last coal fired power station in the UK was closed in September 2024, for example.

Table 10.9: Fotla emissions in relation to UK Carbon Budgets

Year	UK's Balanced Pathway towards Net Zero in 2050	Fotla upstream emissions (Scope 1 and Scope 3, Category 4 and 6 emissions)		Fotla Oil downstream emissions (Scope 3, Category 9,10 and 11 emissions		Fotla Gas downstream emissions (Scope 3, Category 9,10, and 11 emissions)	
	Amount [kton CO_2e]	Amount [kton CO_2e]	Fraction of UK Carbon budget	Amount [kton CO_2e]	Fraction of UK Carbon budget*	Amount [kton CO_2e]	Fraction of UK Carbon budget
2027	376,889	46.2	0.0123 %	119	<0.032 %	53	0.014 %
2028	355,012	8.8	0.0025 %	1,483	<0.418 %	1,622	0.457 %
2029	326,860	2.2	0.0007 %	748	<0.229 %	1,544	0.472 %
2030	295,757	1.9	0.0006 %	526	<0.178 %	1,383	0.468 %
2031	271,054	1.7	0.0006 %	387	<0.143 %	1,130	0.417 %
2032	249,041	1.6	0.0006 %	306	<0.123 %	978	0.393 %
2033	228,398	1.4	0.0006 %	247	<0.108 %	845	0.370 %
2034	208,153	1.3	0.0006 %	205	<0.099 %	757	0.364 %
2035	186,996	1.3	0.0007 %	173	<0.093 %	653	0.349 %
2036	169,338	0.9	0.0005 %	102	<0.060 %	266	0.157 %
2037	151,338	0.8	0.0005 %	84	<0.055 %	179	0.119 %
2038	135,119	0.9	0.0007 %	77	<0.057 %	148	0.110 %
2039	121,774	0.4	0.0003 %	71	<0.058 %	125	0.103 %
2040	107,703	0.3	0.0003 %	66	<0.061 %	107	0.099 %
2041	91,287	0.3	0.0003 %	61	<0.067 %	97	0.106 %
2042	77,283	0.0	0.0000 %	32	<0.041 %	49	0.063 %

Notes:

* Whereas the Fotla emissions and the Scope 3 category 9, 10 and 11 for the produced Fotla gas will be almost exclusively used for the UK market and thus will ultimately count directly towards to the UK's carbon budget, the produced Fotla oil will be exported for refining and further processing. Thus it can be assumed that most of the produced oil end products will end up on the global market and hence no meaningful estimate can be made of how much of it will ultimately be processed and used domestically. Therefore, the fraction of the carbon budget for Scope 3 category 9, 10 and 11 oil emissions has been included only to put them into context, as the actual fraction ultimately counting towards the UK's carbon budget will be significantly lower.

10.2.3 Global CO_2 Targets

Lastly, Fotla's combined emissions are considered in respect of global emissions targets set out in the Paris Agreement[3]. As shown in Table 10.8, the annual combined upstream and downstream emissions comprising all Scope 1 and all Scope 3, Category 4, 6, 9, 10 and 11 emissions, vary between 75 kt CO_2e and 2,854 kt CO_2e per year over the Life of Field of the Fotla field development. As referred to in the previous section above, each party (i.e. country) signed up to the Paris Agreement has to submit the periodic NDCs. By combining all NDCs together, these climate actions determine whether the world achieves the long-term goals of the Paris Agreement to achieve a balance between anthropogenic emissions by sources and removals by (carbon) sinks of GHGs in the second half of this century by reaching global peaking of GHG emissions as soon as possible and to undertake rapid reductions thereafter in accordance with best available science. As shown in Figure 5.26, the 2024 NDC Synthesis Report (UNFCCC, 2024) shows that, based on the current unconditional NDC commitments made by all contracting Parties being fully implemented, GHG emissions are estimated to rise over the next few years to be 51.5 (48.3–54.7) Gt CO_2e by 2030[4], before stabilising or slightly reducing. When also taking into account all conditional NDC elements these will be slightly lower at 49.8 (48.3-51.2) Gt CO_2e by 2030, before stabilising or slightly reducing beyond 2030.

Figure 10.5 shows how the current NDCs up to 2030 relate to the Intergovernmental Panel on Climate Change (IPCC) AR6 SS Pathways, described in Section 5.5.5. The figure shows that the newest NDCs are gradually starting to move towards the SSP1-2.6 pathway, although additional and sustained future commitments from all parties signed up to the Paris Agreement will still be required to reach the blue pathway limiting global warming to 2 ºC or the even lower turquoise pathway of 1.5 ºC with no or limited overshoot as characterised by SSP-1.9.

Bearing in mind that: 1) Oil and gas will remain an important part of the planet's energy mix during the energy transition and even after reaching Net Zero in 2050 or later; and 2) Under the high-case production scenario, Fotla is expected to only produce hydrocarbons until 2042, the efficient exploitation opportunity offered by the Fotla field development is fully in line with a Net Zero trajectory and will not put at risk the global energy transition.

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[3] The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 195 Parties (including the UK) at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016.

[4] These numbers do not include the GHG contribution from land use, land-use change and forestry (LULUCF). For comparison, the global emissions including LULUCF in 2030 are estimated as 55.2 (53.9–56.6) Gt CO_2e considering unconditional elements and 51.7 (50.2–53.1) Gt CO_2e assuming full implementation.

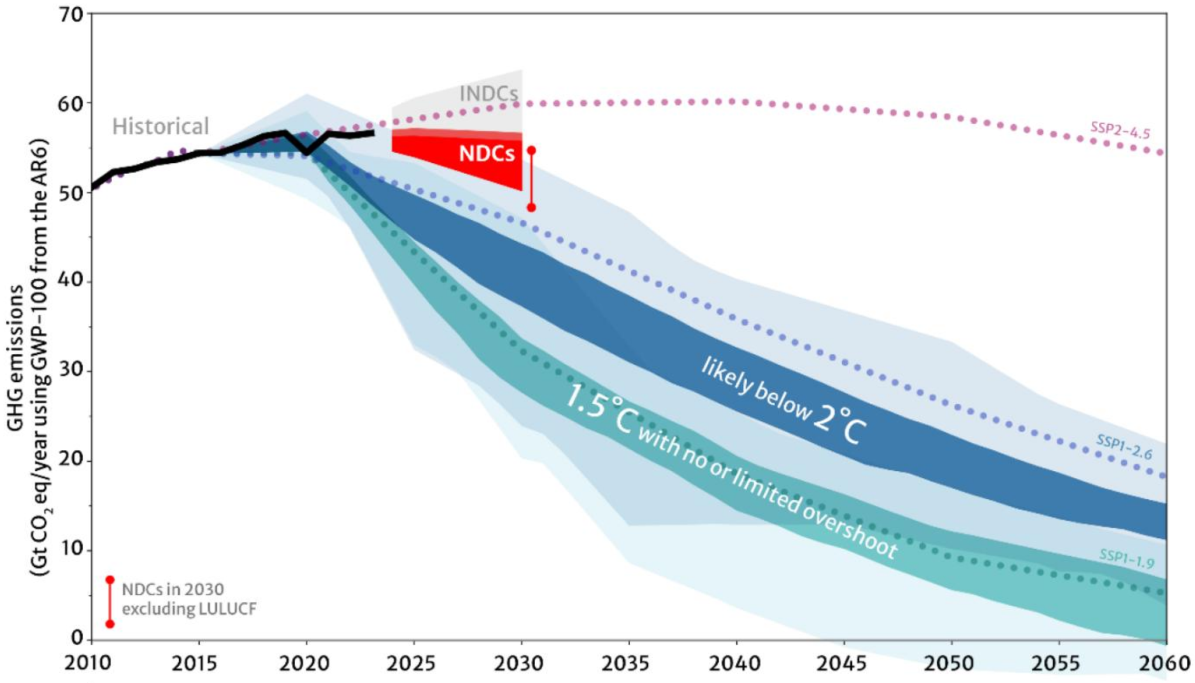


Figure 10.5: Comparison of current global NDCs in relation to the IFCC AR6 SSP pathways (UNFCCC, 2024)

10.3 Assessment of Localised and Regional Air Pollution Impacts

Combustion emissions have the potential to reduce local air quality through the introduction of contaminants such as NO_X, VOCs and particulates which contribute to regional acid gas loads and may result in local low-level ozone and photochemical smog formation. SO_2 and NO_2 are known to be involved in acid deposition and the human health effects of particulates are still poorly understood but appear to have a considerable impact (BEIS, 2022, DECC, 2016).

However, the MODU and vessels used during the drilling and construction phases are built and operated to meet regulated air quality standards that preclude impacts to the health of crews, whilst other environmental receptors present in the immediate vicinity of the operations (e.g. flora and fauna) tend to be sparsely distributed and/or mobile in their distribution.

The nearest manned oil and gas installations to the Fotla subsea development are the Britannia platforms and the Alba North platforms, situated at 13.5 km and 14.2 km distance, respectively. Therefore, it is not expected that changes to air quality will be noticeable and/or measurable at these receptor locations during the drilling and installation operations at Fotla.

During the production phase the contribution of Fotla to the overall emissions at the Britannia platforms will be minimal (<1 %) throughout the life of field (see Section 10.1.5 above), and therefore no noticeable and/or measurable change in local and regional air pollution impacts are expected.

All Fotla related local and regional air pollution emissions will only form a small contribution to overall UK atmospheric emissions, and any potential local and regional pollution effects are further mitigated by their long distance from shore (and other receptors) allowing for significant dispersal, so effects on coastal and terrestrial air quality are unlikely to be significant (DECC, 2016).

Therefore, the magnitude of effect of localised and regional air pollution has been classed as '**Negligible**'. Consequently, regardless the receptor level that may be affected, the resulting overall effect will be '**Negligible**' to '**Minor adverse**' and thus can be considered as not significant.

10.4 Cumulative Global Climate Change Impacts

As described in Section 7.3.1 of the impact assessment methodology, the assessment of GHG emission impacts differs from the other impacts assessed in this Environmental Statement (ES), as they contribute to cumulative global effects, rather than having a direct impact affecting a discrete localised area that can be directly attributed to a specific emission source. The atmospheric concentration of GHGs and resulting effect on climate change is affected by all carbon emission sources and carbon sinks globally, anthropogenic and otherwise (IEMA, 2022).

The crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a science-based 1.5 °C compatible trajectory and achieving net zero by 2050, in line with internationally agreed and UK government and industry specific targets (IEMA, 2022). For the oil and gas industry the latter are set out in the NSTD, as described in Sections 5.5.3 and 5.5.4.

The cumulative impact of the Fotla GHG emissions can therefore be determined by assessing how the Fotla emissions relate to and fit in with the global-reduction pathways described in Section 5.5.5. By contextualising the Fotla emissions in this way, the assessment becomes inherently cumulative, as these pathways take into account a wide range of existing and planned projects and other activities. Furthermore, with IPCC's Shared Socio-economic Pathways SSP1-1.9 and SSP1-2.6 effectively meeting the Paris agreement target of limiting global warming to 'well below' 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C they can be used as benchmarks for determining the significance of the effect.

Therefore, the impact assessment is based on how these GHG emissions contribute and fit in with the IPCC climate change commitment towards net zero in line with these Paris Agreement targets as set out in the DESNZ (2025) guidance and the Institute of Environmental Management & Assessment's guidance document on assessing greenhouse gases and evaluating their significance (IEMA, 2022).

Based on this guidance, the receptor value for all cumulative GHG emissions should be classed as being of '**High sensitivity**' to any further emissions. Consequently, the outcome of the impacts assessment will depend solely on the magnitude of effects described in Section 7.3.1.

When reviewing the Fotla against industry specific, UK national and international emission reduction and global warming reduction targets, as detailed in Section 10.2, it can be concluded that the Fotla emissions are fully aligned with the NSTA and UK carbon budgets and net zero targets and the objectives agreed in the Paris (climate) Agreement. The magnitude of effect can therefore be classed as being '**Minor**'.

Consequently, the overall cumulative effect on global climate change is considered as '**Minor adverse**' and therefore may be considered as not significant. The GHG impacts associated with the Fotla field development are fully consistent with applicable existing and emerging policy requirements and good practice design standards for this type of development. The minor adverse effects are fully in line with measures necessary to achieve the UK's (as well as the global) trajectory towards net zero.

10.5 Mitigation Measures

During the drilling and subsea installation activities the use of vessels will be optimised in order to minimise the number of vessel trips and their length of time present at the Fotla field.

Once the Fotla wells are drilled and completed, they will be shut in, so that they can be cleaned up once they are connected to the Britannia Platform, where the fluids will be processed through the production stream, minimising flaring during well clean-up.

Using existing Britannia processing facilities significantly reduces the overall carbon footprint of the Fotla project, compared to constructing and operating a dedicated new installation at the Fotla location. The additional Fotla fluids will increase efficiency of the Britannia processing equipment. The higher molecular weight of the Fotla gas will reduce the polytropic head of the fuel and export gas, i.e. less energy is required to achieve the same discharge pressures for the Long-Term Compression (LTC) and export compressors. In addition, higher molecular weight of the Fotla gas will also increase the lower heating value (also known as calorific value) of the fuel gas for the gas turbines and power generation. Lastly, adding the Fotla hydrocarbons to the processing streams on Britannia will reduce the recycling rates of the condensate booster and export pumps required to meet minimum flow requirements. This means the overall increase in emissions at Britannia will be less than 1 % over the life of field, compared to a Britannia only base case scenario without Fotla.

Ithaca Energy's Net Zero targets are fully supportive of national and industry targets, by contributing to achieving:

1) The UK's NDC targets as set out in 'the Balanced Pathway' (CCC, 2025).

2) The NSTA targets for the UK oil and gas industry, as described in the OGA Strategy and the NSTD, including the upstream emissions reduction targets of 10 % by 2025, 25 % by 2027 and 50 % by 2030 in support of the UK's pathway to net-zero by 2050, all against a 2018 baseline (NSTA, 2021; NSTA, 2022); and
3) The UK upstream oil and gas sector emission targets of 50 % reduction in exploration and production emissions by 2030 and 90 % reduction in 2040, against a 2018 baseline in order to becoming a Net Zero basin by 2050 (OGUK, 2020).

In order to reduce Fotla's Scope 1 emissions during the production phase, Ithaca Energy will be largely dependent on how Harbour Energy manages the energy supply and associated combustion emissions and process emissions onboard the Britannia complex. Ithaca Energy will monitor, support and assist Harbour Energy in any planned, existing or future initiatives aimed at improving the emissions footprint of the Britannia complex, where possible.

10.6 Conclusions

Atmospheric emissions will be produced during drilling, installation and commissioning operations, as a result of power generation onboard the MODU, support & installation vessels, helicopters. During the production phase, the Fotla development will add a small amount (<1 %) to the existing overall emissions at Britannia platforms over its life of field. In addition, emissions will be generated during the transportation, distribution and processing (refining) of the produced Fotla hydrocarbons and ultimately also during the combustion of the processed/refined oil and gas products by the end user. All these emissions will contribute to local, regional and global environmental effects.

At local and regional levels, air pollution impacts are mitigated by Health and Safety measures in place to control emissions, the dispersive nature of the offshore environment and the lack of sensitive receptors in the area. As such, any local and regional air pollution effects are expected to be 'Negligible' to 'Minor adverse', and therefore not significant.

It is recognised that, cumulatively, the emissions associated with the Fotla field development will also contribute to global climate change. However, as global climate change impacts resulting from individual projects and/or activities (including the proposed Fotla field development) cannot be assessed in isolation, cumulative global climate change impacts of individual projects are therefore assessed on whether and how that project will contribute to or put at risk the achievement of industry, national and international climate change reduction targets, in line with DESNZ and IEMA guidance (DESNZ, 2025; IEMA, 2022). With respect to the Fotla field development the relevant national targets include those set out in the North Sea Transition Deal (NSTA, 2021; NSTA, 2022) and the UK upstream oil and gas sector targets for emissions (OGUK, 2020) and the advice for the seventh carbon budget (CCC, 2025). These national targets, in turn, feed into the global emissions targets set out in the Paris Agreement, making the overarching aim to keep global warming to well below 2 °C by 2100 and to pursue efforts to limit it to 1.5 °C above pre-industrial levels. Therefore, it is ultimately this Paris Agreement target that sets the benchmark for the effects on climate change assessed here.

The contribution of the proposed Fotla field development and its associated emissions is comparable to similar operations, and small in comparison to emissions at an industry wide level. Moreover, the proposed Fotla field development and its associated emissions are in line with and do not put at risk the UK's current energy transition trajectory towards Net Zero by 2050, as followed by the government through its Balanced Pathway strategy, as well as with the objectives agreed in the Paris (climate) Agreement.

Therefore, in this context, the effects of the overall contribution of all combined Fotla emissions generated during the drilling, installation, commissioning and operational life of field of the Fotla development (Scope 1 and Scope 3, Category 4 and 6 emissions), as well as those generated during the transportation, distribution and processing (Scope 3, Category 9 and 10 emissions) and end user combustion (Scope 3, Category 11 emissions) of the produced hydrocarbons on global climate change have been assessed as being '**Minor adverse**' and fully in line with UK policy and the measures necessary to achieve the UK's (as well as the global) trajectory towards net zero and thus can be considered to be not significant.

11. Marine Discharges Impacts

This section assesses the potential impacts of marine discharges, other than those associated with the drilling of the wells (which are addressed in Section 8). The scope of this assessment has been informed by the outcomes of the Environmental Issues Identification (ENVID) exercises (Appendix 3), informal stakeholder consultation, and National Marine Plan (NMP) policies and statutory guidance as explained in Section 6 (Identification of Impacts).

During scoping the following impacts were identified for further assessment:

- Use and discharge of chemicals during testing and commissioning of infield pipelines and other infrastructure; and
- Increase in produced water discharges from the host platform facilities due to the addition of the Fotla field development.

11.1 Quantification of Discharges Containing Oil and Chemical Additives into the Marine Environment

11.1.1 Use and Discharge of Chemicals during Testing and Commissioning

Once the pipelines, associated pipework and connections have been installed, the newly installed production and gas lift systems will need to be tested to ensure their integrity and to confirm that there are no leaks or other issues. A leak test is a pressure test that works by filling the components with (sea)water to remove any air, before pressurising the system. The pressure is then held for a specific time to visually inspect the system for leaks. To aid the identification of any leaks, a coloured dye is added to the hydrotest water, along with small amounts of corrosion inhibitor, oxygen scavenger and biocide to prevent any potential corrosion and biofouling from occurring inside the pipeline system.

On completion of each testing operation the hydrotest water will be routed into the produced water system onboard the host platform, where it effectively becomes part of the produced water treatment process, undergoing treatment before ultimately being discharged to sea. Therefore, the impact assessment for produced water below also includes the effects from the hydrotest water discharges. All chemical additives to be used in the testing and commissioning operations, including any dyes, will be detailed in a chemical permit (CP-SAT) as part of the pipeline installation consenting process.

11.1.2 Increase in Produced Water Discharges

Produced water can be defined as water from the formation which is produced together with oil and gas (Bakke et al., 2013). Produced water may contain residues of reservoir hydrocarbons as well as chemicals added during the production process[1], along with dissolved organic and inorganic compounds that were present in the geological formation (Durell et al. 2006 and Neff, 2002). These organic and inorganic compounds typically

[1] The production process may on certain occasions also be used to process other distinct discharge streams, such as the hydrotest water described in Section 11.1.1, for example.

comprise hazardous substances that occur naturally in the reservoir, such as heavy metals, aromatic hydrocarbons and alkyl phenols. As a result, the overall chemical composition of produced water can be very complex and may vary over time, depending for instance on the maturity of the oil or gas field (Roex et al., 2012).

It is anticipated that the Fotla field development wells will start producing water early in the production process from 2028 onwards (see Table 4.3 and Figure 4.4). The volume of produced water will gradually increase over time, with the anticipated water cut peaking around 2032 at 1,429 m^3/day (8,988 bbls/day).

The produced water from the Fotla field will be processed onboard the Britannia Bridge Linked Platform (BLP), before being discharged to sea under normal operating conditions.

The BLP processing facilities are currently being used for the Alder subsea development. The Alder field will be required to have ceased production prior to the Fotla field coming online. In order to facilitate the Fotla production fluids, the current Alder process facilities will be adapted and upgraded, as described in Section 4.7.

The discharge of produced water on the United Kingdom Continental Shelf (UKCS) is controlled under the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (OPPC Regulations) and is only allowed under an oil discharge permit, issued by Offshore Petroleum Regulator for Environment and Decommissioning (OPRED). Each permit includes specific conditions which must be met in order to minimise any impact on the environment.

Presently, the BLP operates under a discharge permit of 30 mg/l for oil in water. Upon implementation of the proposed refurbishment, the upgraded processing system for fluids from the Fotla field will be able to maintain an average oil in water discharge specification of ≤ 25 mg/l. As the facilities Operator, Harbour Energy will apply for a permit to discharge Fotla's produced water from the BLP on behalf of Ithaca Energy, as part of its wider annual discharge permit, covering the combined produced water discharges from the Britannia Platform and the BLP.

11.1.3 Produced Water Modelling

To support the assessment of potential environmental impacts, numerical modelling was undertaken to quantify the effect of the new produced water discharges from Fotla on the current produced water discharges at Britannia and the BLP. The produced water discharges were modelled using the SINTEF Marine Environmental Modelling Workbench Dose related Risks and Effects Assessment Model (DREAM) software (version 15.2.0).

As mentioned above, the produced water discharges on the UKCS are regulated under the OPPC Regulations which implement a number of Oslo and Paris Convention (OSPAR) Recommendations on oily discharges, including OSPAR Recommendation 2012/5 for a risk-based approach (RBA) to the 'Management of Produced Water Discharges from Offshore Installations' and involves periodically conducting an environmental risk assessment for all produced water discharges from offshore installations into the marine environment (BEIS, 2020). The RBA is an approach which characterises risk given a) exposure resulting from a produced water discharge and b) the sensitivity of the receiving environment to this exposure. Where RBA identifies that the resultant risk exceeds an agreed threshold, the assessment can be further refined and/or measures can be taken which avoid or mitigate the risk (IOGP, 2020).

The output of the DREAM model is a dynamic representation of the produced water plume in the receiving environment expressed as the Environmental Impact Factor (EIF), which is one of the main risk parameters informing the RBA described above.

EIF is a risk-based management tool that was developed to quantify and document the environmental risks from produced water discharges and provides an objective quantitative measure of risk that has proven to be a very useful decision support tool for environmental management. The EIF represents a volume of recipient water containing concentrations of one or more substances to a level exceeding a generic threshold for ecotoxicological effects (Smit et al., 2011). The EIF is not a direct measure of environmental impact however, but rather a relative measure of potential risk, based on the conservative assumption that the most sensitive species are always present in the modelled domain (Xodus, 2025b).

A beneficial feature of the EIF approach is that the method enables the quantification of the contribution of the various individual compounds in the discharge to the overall environmental risk. This enables the identification of the highest risk contributors in the discharge providing the opportunity to select the most effective environmental risk mitigation measures, as a priority. These can for instance be the selection of additional effluent treatment technologies or the substitution of harmful compounds from added production chemicals (Xodus, 2025b).

A RBA assessment for the Britannia facility was undertaken in 2019, which has then been re-run on the latest version of the DREAM model (15.2.0), so that it can be used as a baseline for the current assessment.

The modelling study for Fotla, undertaken by Xodus (2025b), considered the following three produced water discharges:

- Britannia (511 m^3/day);
- BLP (3,769 m^3/day); and
- Fotla (1,421 m^3/day).

This allows for a direct comparison to be made between the EIFs of the 2019 RBA baseline (Britannia + BLP) based on the discharge rate of 4,280 m^3/day and the new scenario, with the inclusion of Fotla to the Britannia and BLP discharge streams increasing the discharge rate to 5,701 m^3/day.

The modelling further assumes that the three discharge caissons all release their respective produced water discharges in a vertical downwards direction, at 14 m Lowest Astronomical

Tide (LAT). The model was run for 110 days to ensure the discharge plume reached a stable state in the water column, in line with OPRED guidance (BEIS, 2020).

The modelling results show the discharge plumes will disperse quickly with increasing distance from the discharge point in line with the local tidal currents. Figure 11.1 shows that the plume size, dimensions and direction vary considerably over the 110-day simulation period, due to the range of metocean conditions encountered over this time period.

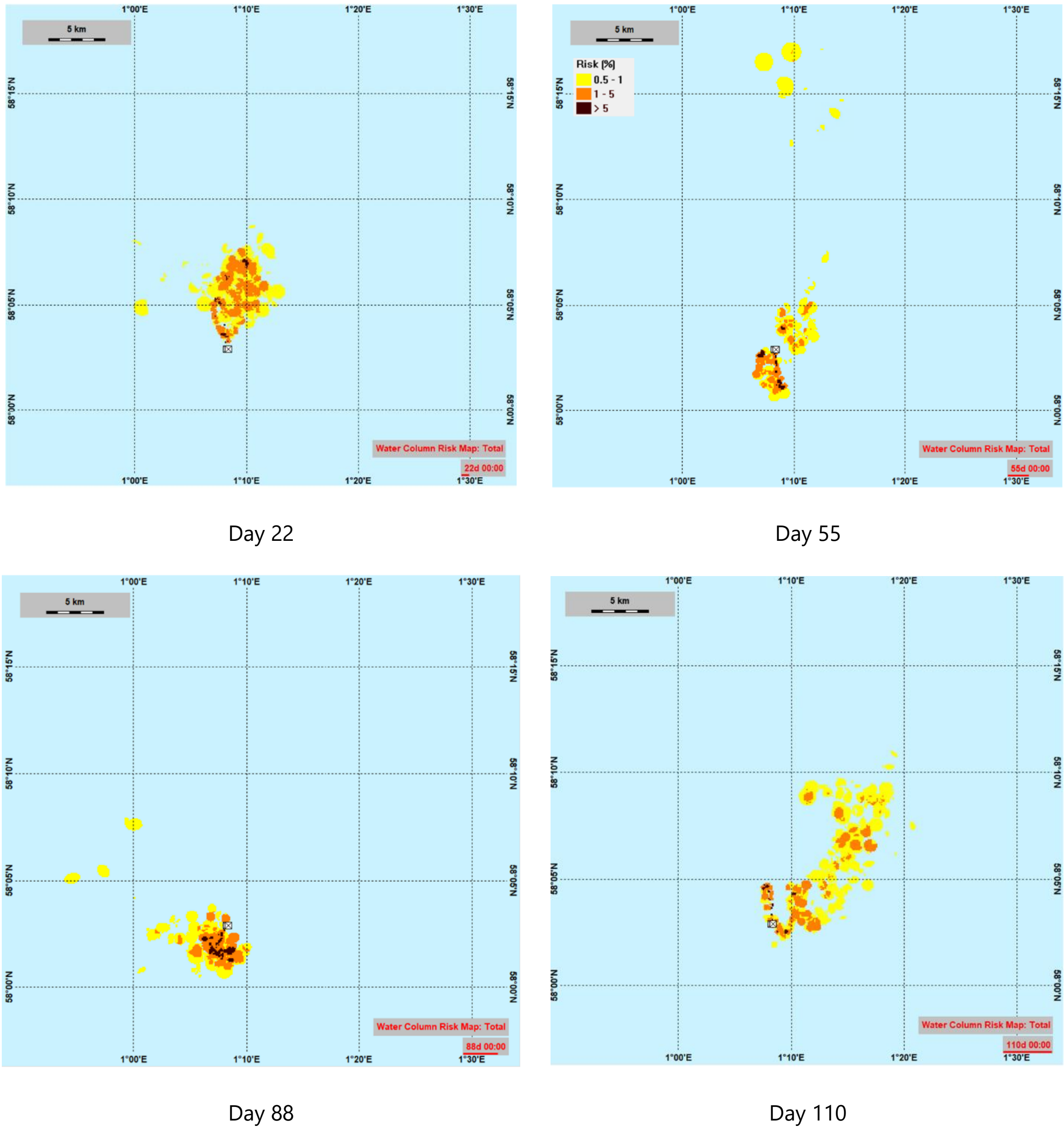


Figure 11.1: Temporal development of discharge plume showing the maximum EIF in the water column

Figure 11.2 shows a NW-SE cross section representing the maximum EIF Risk levels reached at any point in time during the entire 110-day modelling period (i.e. the spatial extent of the risk levels will be much lower at any single point in time). However, by looking at them all combined instead, a clear pattern emerges, showing a distinct vertical split between the Britannia and Fotla discharges which disperse in the top part (28 m) of the water column, compared to the BLP discharge which mainly disperses in the bottom part (below 42 m) of the water column.

The BLP discharge, being more dense than ambient seawater and with a flow rate of 3,769 m^3/day, is sufficient to propel the discharge downward, resulting in impacts at the seabed.

The produced water discharges from Britannia Platform (551 m^3/day) initially travel downwards due to the discharge caisson facing vertically downward. However, the plum is predicted to return to the surface due to flows having less downward momentum and being less dense than seawater.

The Fotla produced water discharge plume (1,421 m^3/day) initially travels downward and reaches deeper than the Britannia produced water, due to its greater downward momentum and higher density. However, the density is similar to seawater and therefore the plume does not continue to descend further through the water column.

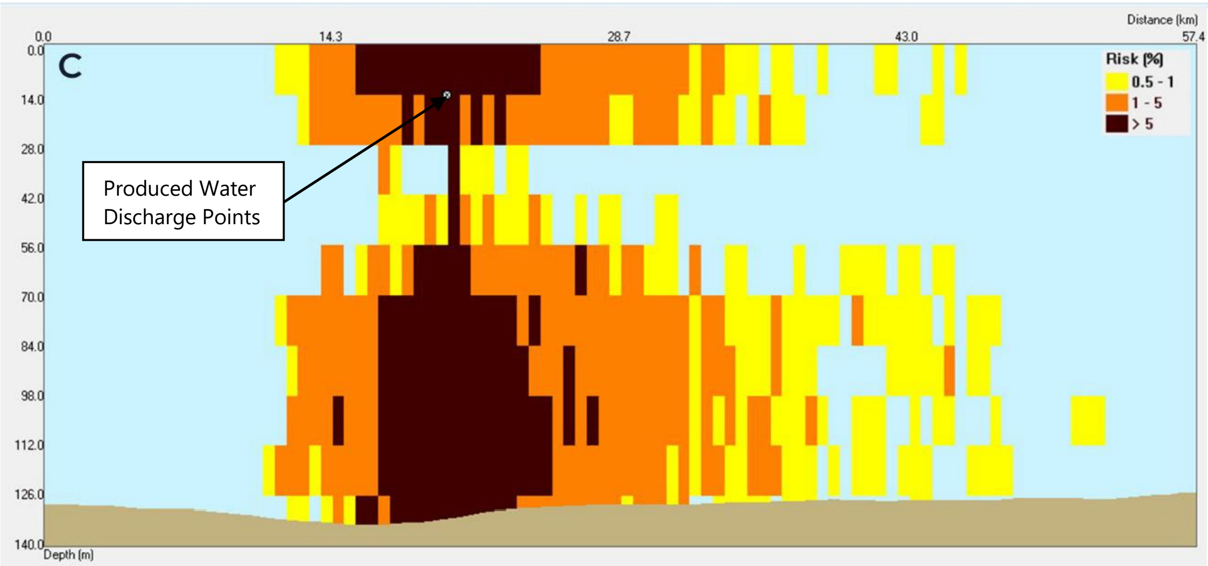


Figure 11.2: NW-SE Cross section showing maximum EIF risk levels at any point in time over the entire 110 day modelling period (Xodus, 2025b) – Combined Fotla, BLP and Britannia discharges

The individual EIF values for Britannia, BLP and Fotla can also be used to compare how the addition of the Fotla produced water discharges will change existing produced water discharges. When comparing the EIF values for the produced water discharges it shows that the maximum momentary EIF increases by 16.0 % from 491.4 to 569.8, compared to a 33.2 % increase in overall produced water volume[2] (Table 11.1). For the time averaged EIF, this

[2] The modelling used a Fotla produced water rate of 1,421 m^3/day. Although this is not strictly the highest anticipated produced water rate over the life of field (which is 1,429 m^3/day, as per Table 4.3), it does correspond to what is considered to be the worst-case discharge scenario, based on the combination of produced hydrocarbons and produced water rates. The combination of the oil and water rates used for the modelling is anticipated to result in the highest anticipated concentrations of oil in water, as well as chemical additives used (and ultimately discharged) in the production process.

difference is less distinct (time averaged EIF increase: 28.6 % / produced water rate increase: 33.2 %).

Table 11.1: EIF comparison table

EIF Type	Britannia only	BLP Only	2019 RBA (Britannia+BLP)	Fotla Only	2019 RBA (Britannia+BLP) and Fotla combined
Maximum Momentary EIF	77.0	477.4	491.4	85.4	569.8
Time Averaged EIF	21.0	140.6	159.6	31.1	205.7

The EIF values also allows which components in the discharges contribute the most to the risk factors, as illustrated in Figure 11.3. These can by split out into two groups, the chemical compounds that occur naturally in the produced water (referred to 'naturally occurring substances', or 'NOS') and the chemical additives added during the production process. NOS make up just under 40 % of the maximum momentary EIF, with Dibenzothiophene (10.79 %), Dibenzo(a-h)anthracene (7.36 %) and Chrysene (5.09 %) making the largest contributions of the NOS. Dispersed oil contributed 3.19 % to the overall EIF and heavy metals made only minor contributions. The contribution of dispersed oil in the combined Britannia, BLP and Fotla discharges (3.19 %) is only marginally higher than the dispersed oil contribution from Britannia and the BLP in the 2019 RBA (3.18 %).

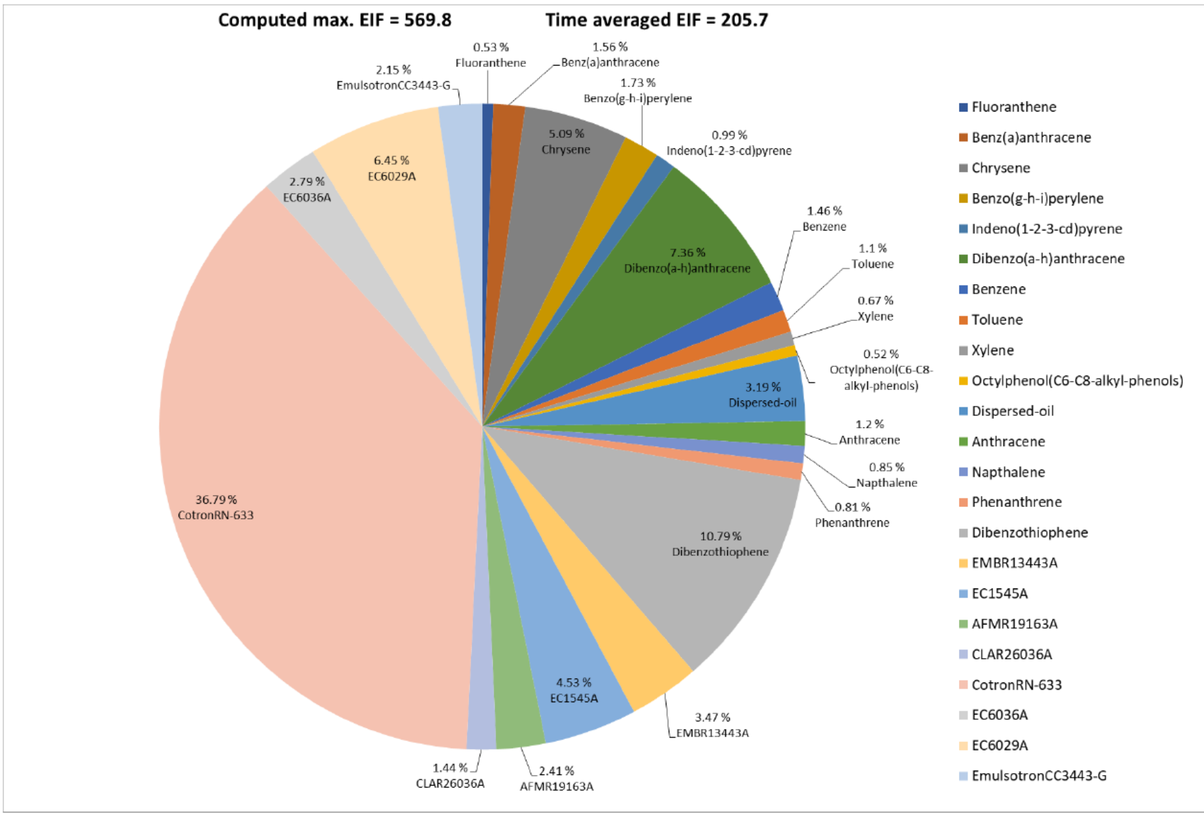


Figure 11.3: Relative contribution of substances to maximum momentary EIF (>0.5 %)

The chemical additives used during the production process make up just over 60 % of the overall EIF. The highest contributing chemical additive is the corrosion inhibitor Cortron RN-633 (36.79 %), which is applied to the Britannia and BLP streams but is not planned to be used for Fotla.

The modelling undertaken included information on certain chemicals which may be used at the Fotla field during production operations. Table 11.2 presents the example chemicals used in the produced water modelling. The chemicals detailed in Table 11.2 are either currently in use at Britannia, have proven effective during previous use, or have been recommended by the chemical supplier. These chemicals were selected based on a review of the production chemistry of the Fotla field development and represent a best estimate for chemical use at the time the modelling was undertaken. The quantities of the respective chemical were based on the maximum concentrations for design purposes and the latest Fotla production forecast. The corrosion inhibitor EC1545A was included as its chemical properties are considered to be appropriate for the Fotla field development (Xodus, 2025b).

Table 11.2: Chemical use calculation for Fotla

Chemical	SG	Dosage (ppm)	Application Stream	Daily Use (kg)
EMBR13443A	0.889	50	Total fluids	88.1
AFMR19163A	1.02	25	Oil	14.3
SCAL16662A	1.198	50	Produced water	85.1
PARA16793A	0.889	300	Oil	149.6
ASPH13019A	0.93	50	Oil	26.1
EC1545A	1.1	50	Total fluids	109
CLAR26036A	1.09	25	Produced water	38.7

Table 11.3 presents the relative contribution of the chemical additives in predicted produced water discharges from Britannia, BLP and Fotla combined and how they compare with the produced water discharged in the 2019 RBA for Britannia and the BLP, used as a baseline for comparison.

Table 11.3: Contribution of individual chemical additives to the overall EIF

Chemical Additive*	Contribution to Overall EIF (%)	
	2019 RBA (Britannia+BLP)	2019 RBA (Britannia+BLP) and Fotla combined
Corton RN-633 (Corrosion Inhibitor)	44.48	36.79
EC6029A (Dispersant Polymer)	7.73	6.45
EC1545A (Corrosion Inhibitor)* †	5.16	4.53
EMBR13443A (Demulsifier)*	-	3.47
EC6036A (Deoiler)	3.34	2.79
AFMR19163A (Antifoam)*	-	2.41
Emulsotron CC3443-G (Demulsifier)	2.60	2.15
CLAR26036A (Deoiler)*	-	1.44

Chemical Additive*	Contribution to Overall EIF (%)	
	2019 RBA (Britannia+BLP)	2019 RBA (Britannia+BLP) and Fotla combined
FX2443 (Scale Inhibitor)	0.17	0.14
SCAL1662A (Scale Inhibitor)*	-	0.04
Clearton MRD 208SW (Deoiler)	0.03	0.03
ASPH13019A (Asphaltene Inhibitor)*	-	0.01
PARA16793A (Wax Inhibitor)*	-	0.00
Total Contribution of all Chemical Additives combined	63.51	**60.25**

Notes:
* = Chemical additives are included in the Fotla Produced water stream
† = Additive is used in all three produced water streams. As Fotla only contributes around 6% to the total discharge amount of this chemical additive (BLP contributes 81 % and Britannia 13 %), it can be assumed that Fotla's contribution to this risk percentage will be relatively minor.
Sources: Xodus, 2025b

The table shows that the contribution of chemical additives to the overall EIF will reduce slightly from 63.51 % to 60.25 %, when Fotla is added. Fotla's produced water will contribute < 11.9 % of the 60.25 %.

A similar comparison can be made for the NOS contribution, which will increase from its 2019 baseline of 36.49 % to 39.75 % when Fotla comes online. As mentioned above, the contribution of dispersed oil will only increase slightly from 3.18 % to 3.19 %.

Overall, it can therefore be concluded that the addition of Fotla to the existing produced water discharges at Britannia and BLP will only have a relatively small effect on the chemical composition and any associated ecotoxicological effects and that the increases in the overall Maximum Momentary EIF from 491.4 to 569.8 and from 59.6 to 205.7 for the Time Averaged EIF are mainly related to the increase in overall volume of produced water being discharged.

11.2 Effects of Marine Discharges on Local Ecology (Plankton, Benthos, Fish and Shellfish)

The effects of marine discharges may cause biological effects on plankton, benthos, and fish and shellfish due to the release of chemical into the water column, which could also reach the seabed.

11.2.1 Effects on Plankton

Plankton is often particularly susceptible to chemical pollution, such as produced water and hydrotest water discharges, due to its small size and inability to avoid the discharge plume. The Research Council of Norway (2012) discusses that produced water effects on zooplankton can include gene modification and effect processes such as nutrient absorption, shell replacement and the storage of fat, protein and amino acid metabolism.

Neff et al. (2002) note that the exposure to produced water discharges resulted in subtle effects on marine planktonic communities in controlled studies. However, these controlled studies do not account for the degradation of the produced water chemicals in well mixed marine environments (Neff et al., 2002) and it is therefore possible that effects on plankton are very limited or negligible in open sea receiving waters. This was also reported by Bakke et al. (2013), noting that long term ecological impact from operational discharges can be considered as low.

In addition, most phyto- and zooplankton have (very) short life spans, are naturally predated at high rates, and have (very) high reproduction rates. Hence, populations undergo large fluctuations over short periods of time as part of their natural life cycle. The modelling results in Figure 11.1 above also show a broad variety in the daily plume dispersion. Therefore, local impacts on plankton are generally quick to recover. No protected planktonic species are known to be present in the affected area. Research Council of Norway (2012) noted that ecological effects of discharges of produced water are not probable.

As the resulting effects of the increase in produced water discharges are predicted to remain well within the scope of natural variability, the magnitude of effect can be considered '**Minor**', As no specific conservation concerns have been identified, plankton has been considered as a receptor of '**Low**' value. Consequently, the effect significance is assessed as '**Minor adverse**', and therefore not significant.

11.2.2 Effects on Benthos

Bakke et al. (2013) found that produced water may cause toxic effects on individual organisms close to discharge sites and that effects of the discharges on populations and communities have not yet been verified and are unlikely. The produced water modelling showed that the Fotla produced water, after initially travel downwards, remains in the top half of the water column (Figure 11.2) and therefore will have very limited to no contribution to bottom part of the combined discharge plume, which is caused by the existing BLP produced water discharge. Hence, the impact magnitude from the additional Fotla produced water discharges on benthic species is considered to be '**Negligible**'. With the presence of the 'sea pen and burrowing megafauna' habitat and ocean quahogs in the area, the receptor value is classed as '**Very High**', resulting in a significance score of '**Minor adverse**' indicating this impact is not significant.

11.2.3 Effects on Fish and Shellfish

A comprehensive study on the effects of produced water discharges by the Research Council of Norway (2012) states that produced water discharges, and particularly alkyl phenols, have the potential to cause harm to the reproductive success of fish within a few kilometres of the discharge sites, although extensive and long-term reproductive effects of produced water on fish are not very probable. Additionally, studies have shown that fish will actively avoid environments contaminated with Polycyclic Aromatic Hydrocarbons (PAH) or oil above certain thresholds and may avoid produced water plumes from offshore installations (Beyer et al., 2020).

Laboratory studies on captive fish also show other effects including alteration in fish enzyme activity, liver oxidative metabolism and cell death, deoxyribonucleic acid (DNA) damage, impaired immunity and gene modification which can affect overall fish health if exposed for prolonged periods of time (Gagnon, 2011; Hamoutene et al., 2011; Research Council of Norway, 2012).

The Fotla field falls within spawning grounds for cod, *Nephrops* and Norway pout and nursery grounds of anglerfish, blue whiting, cod, European hake, herring, ling, mackerel (North Sea), *Nephrops*, plaice, sandeels, spotted ray, spurdog, and whiting (Coull et al., 1998; Ellis et al., 2010).

Norway pout, ling, sandeels, whiting, cod, mackerel, herring, spurdog, anglerfish and blue whiting have been designated as PMFs (NatureScot, 2020). Cod is included in the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2023). The Norway pout, a PMF fish species, was observed within the survey area in 2019 (Fugro, 2020).

When assessing the effect magnitude, it has been taken into account that fish are highly mobile species and thus any prolonged exposure is very unlikely. The increase in produced water discharges is considered as having a '**Low**' magnitude of effect. Based on the presence of OSPAR listed and PMF species in the area the receptor value is classed as '**Very High**'. Consequently, the effect significance is '**Minor adverse**', and therefore not significant.

11.3 Mitigation

Produced water discharges on the UKCS are highly regulated and controlled and in order to minimise the potential effects of the produced water discharges, a wide array of industry standard practices will be adhered to, including:

- All chemicals used and/or discharged will subject to a permit (CP-SAT). Chemical risk assessments will be undertaken as part of the environmental permitting process which will be submitted to the OPRED to obtain approval prior to use and discharge of any chemicals;
- The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Ranked List will be used to evaluate the selection of all chemical additives and, where possible, the most environmentally friendly options, including chemicals that pose little or no risk (PLONOR) to the environment will be selected; and
- All discharges will be monitored and reported on the Environmental and Emissions Monitoring System (EEMS), which is the environmental database of the UK oil and gas industry and is maintained by OPRED (Department of Energy Security and Net Zero (DESNZ)).

In addition, the existing Alder produced water system on the BLP will be upgraded to achieve a ≤ 25 mg/l oil-in-water discharge limit by implementing the following measures:

- Upgrade Alder Separator (internals upgrades, level settings changes, weir height change inside the separator);
- Upgrade Hydrocyclones (new liners to be fitted and operating arrangement to be changed from 2 × 100 % to 2 × 50 %); and
- Upgrade Alder Degasser (internals upgrade).

The current separator control valve with be replaced with a low shear control valve instead, as part of the separator and hydrocyclone upgrades. Additional measures, such installing a Mare’s Tail Coalescer upstream of the hydrocyclones will also be considered but will require field trials first in order to confirm whether the Fotla produced water stream will be amenable to this type of treatment.

11.4 In-combination, Cumulative and Transboundary Impacts

Numerous oil and gas developments are present in the wider Fotla region (Section 5.4.4). The Britannia Platform and BLP currently process fluids (including produced water and its disposal) from a number of fields that make up the Greater Britannia Area (GBA), namely the Britannia field itself, as well as from the Brodgar, Callanish, Alder (to be decommissioned), Enochdhu and Finlaggan subsea tie-back developments. The additional produced water generated from the Fotla field will add to the overall amount of produced water discharged into the region.

The closest surface platform to Britannia and the BLP is the Alba Northern Platform located 3.7 km to the west of the BLP. Given this close distance between the platforms, there may be some interaction between their produced discharge plumes, under certain metocean conditions. In addition, the Alba Northern Platform is due to be decommissioned between 2028 and 2032 (Ithaca Energy, 2025a), so any cumulative impacts will be limited in duration.

However, the distance separation between the discharges is large enough to allow for adequate dispersion and dilution of any oil or chemical compounds between the discharge plumes, so no significant mixing of produced water discharges is anticipated and no significant cumulative or synergistic impacts are forecast.

With respect to produced water discharges, no potentially significant in-combination effects were identified which would justify further assessment, beyond the individual effects that have already been considered in this section, as this would not alter the conclusions reached.

Given the 46 km distance to the UK/Norway transboundary lie, no significant transboundary effects are expected.

11.5 Conclusions

The produced water modelling for the proposed Fotla field development shows that plumes will be rapidly diluted with increasing distance from the discharge point in line with the local tidal currents. Fotla's produced water, discharged from the BLP, will disperse in the top part of the water column where it will mix with the Britannia discharges. The contribution of Fotla to the produced water discharge plume from the BLP will be negligible. Minor local impacts are forecasted in the local vicinity of the discharge point, but overall no significant effects are expected on the plankton, benthos, fish and shellfish.

Although some limited interaction between the Britannia, BLP, Fotla and the nearby Alba Northern Platform produced water discharge plumes cannot be ruled out, no significant impacts are expected, due to the distance (3.7 km) between the discharges and the dispersive nature of the local environment. Given the distance to the nearest transboundary line (46 km), no transboundary impacts are forecasted.

12. Underwater Noise Impacts

12.1 Introduction

The following issues and concerns regarding underwater noise generation were raised during the Environmental Issues Identification (ENVID) workshop, informal consultation, and/or are referred to in national policies and guidance, as outlined in Section 6, "Identification of Impacts".

- **Installation and support vessels**: The ENVID identified underwater noise from installation of subsea equipment as having a potential significant effect on the marine environment, namely on marine mammals and fish. The impact piling necessary to fix the Fotla manifold to the seabed is the dominant source of acoustic emissions during the equipment installation phase. This issue was also raised by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) during the early consultation. Other installation activities with potential to contribute to noise levels in the area are the trenching, pipe laying, and rock placement operations involved in the pipeline installation campaign. The sound levels produced by the specialised vessels used for trenching ('plough'), pipe laying ('reel lay vessel'), and rock placement ('fall pipe vessel') are expected to be comparable to those from larger support vessels; and
- **Operational noise and vibration from the MODU and support vessels**: The ENVID also identified the operational noise of the anchored Mobile Offshore Drilling Unit (MODU) employed to drill the two wells of the Fotla field as an activity to be scoped in for assessment. The support vessels participating in the drilling campaign were also identified as acoustic emitters capable of producing sound levels above ambient noise.

Consequently, the potential piling operations associated with the installation of the Fotla manifold anchor piles, and the drilling operations from the MODU have been identified for further assessment in this section.

12.2 Quantification of Noise

The development of the Fotla field involves various activities that have the potential to generate underwater noise. These include the use of pile driving for the installation of the Fotla manifold, drilling of the two wells by the anchored MODU, trenching for the installation of the production and gas lift pipelines, rock placement for pipeline protection, and any associated vessel operations.

These activities produce both impulsive and continuous sounds, each with distinct temporal and spectral characteristics that affect marine animals differently. Impulsive sounds, such as those from impact piling, are short transitory signals characterised by rapid changes in sound pressure and a broadband spectrum with high-frequency content, often causing more immediate and severe impacts. In contrast, continuous sounds, such as those from drilling, trenching, and vessel operations, are stable over time and cover a wide range of frequencies, which may include tonal (narrowband) components.

12.2.1 Ambient Noise

The ocean's soundscape is highly variable. Ambient or background noise in the ocean consists of a broad range of individual sound sources, both natural and manmade (Hildebrand, 2009).

The dominant source of naturally occurring noise is associated with surface waves generated by the wind. This noise occurs across a range of frequencies from 1 Hz (hertz) to 100 kHz (kilohertz) (NRC, 2003). Other natural sounds in the sea include currents, rain, ice-breaking, echolocation and communication sounds generated by cetaceans, and other natural sources such as tectonic activity. Table 12.1 displays some of the different types of sounds found naturally in the marine environment.

Table 12.1: Examples of natural sounds in the marine environment (NRC, 2003)

Sound Source	Dominant Frequency Range	Sound Pressure Power Spectral Density Level (dB re 1 μPa^2/Hz)	Noise Characteristics
Wind	1 kHz to 25 kHz	100 Hz to 200 Hz 65 dB (force 3)	Greatest levels at higher wind speeds, noise is continuous on a scale of hours to days
Rain	Broad spectrum	0 dB (no rain) 80 dB (heavy rainstorm)	Flat frequency spectra (white noise)
Earthquakes	5 Hz to 15 Hz	0 dB (no earthquake) 200 dB to 240 dB (at 10 km from earthquake of ML 4 to 6, broadband)	Short term transitory events on a scale of minutes, noise levels may be high
Baleen whales	16 Hz to a few hundred Hz	128 dB to 190 dB re μPa @ 1 m	Communication (low frequency moans, grunts, down sweeps)
	2 kHz to 25 kHz	151 dB re μPa @ 1 m	Communication (clicks)
Toothed whales	100 Hz to 20 kHz	Up to 180 dB re μPa @ 1 m	Communication
	6 kHz to 325 kHz	120 to 228 dB re μPa @ 1 m	Echolocation

In addition to naturally occurring sounds, anthropogenic noise is generated by shipping activity, offshore construction (e.g., pile driving, dredging), oil and gas exploration (e.g., seismic airgun arrays), geophysical surveys (e.g., echosounders, sub-bottom profilers), and naval exercises (e.g., mid-frequency active sonar, explosions). Of these, shipping is the dominant source of continuous ambient sound in the world's oceans, covering frequencies from five to a few hundred hertz (NRC, 2003). All vessels generate noise as a consequence of their operation and the mechanisms of sound radiation are common to most of them. In particular, propeller cavitation produces the majority of the broadband sound as well as dominant tones at the propeller blade rate (Richardson et al., 1995). The propulsion engines and auxiliary machinery also contribute to the overall sound levels. Even though the mechanisms of noise radiation are shared by most vessels, the spectral characteristics and overall sound levels are highly dependent on the dimensions, speed, general condition, and age of the vessel.

Anthropogenic noise levels in the oceans have increased significantly over the last few decades (Andrew et al., 2002; Studds & Wright, 2007) giving marine animals little time to adapt to these changes in an evolutionary sense. This is particularly true for commercial shipping, which had led to an approximate increase of low-frequency ambient noise levels of 3.3 dB per decade during the period between 1950 and 2007 (Frisk, 2012), with similar trends observed for the last two decades (Jalkanen et al., 2022).

Table 12.2 shows various anthropogenic sources and received levels of sound in the marine environment.

Table 12.2: Sound sources from various maritime activities

Activity	Dominant Frequency Range (kHz)	Average Source Level (dB)	Estimated Received Level (dB) at Different Ranges			
			0.1 km	1 km	10 km	100 km
High resolution geophysical survey; pingers, side scan, fathometer	10 – 200	< 230	190	169	144	69
Low resolution geophysical seismic survey; seismic air gun	0.008 – 0.2	248	210	144	118	102
			208	187	162	87
Production drilling	0.25	163	123	102	77	2
Jack-up drilling rig	0.005 – 1.2	85 – 127	45 – 87	24 – 66	<41	0
Semi-submersible rig	0.016 – 0.2	167 – 171	127 – 131	106 – 110	81 – 85	6 – 10
Drill ship	0.01 – 10	179 – 191	139 – 151	118 – 130	93 – 105	18 – 30
Large merchant vessel	0.005 – 0.9	160 – 190	120 – 150	99 – 129	74 – 104	<29
Military vessel	Not known	190 – 203	150 – 163	129 – 142	104 – 117	29 – 42
Super tanker	0.02 – 0.1	187 – 232	147 – 192	126 – 171	101 – 146	26 – 71

Notes:
Sources: Adapted from: Evans & Nice, 1996; Richardson et al., 1995

Figure 12.1 represents ambient noise as a function of frequency. The ambient noise spectrum normally lies between the two thick black lines (Harland et al., 2005; NRC, 2003; Wenz, 1962). The red line depicts the power spectrum of ambient noise in shallow waters with usual vessel traffic and sea state 1. These conditions are representative of the study area and correspond to a broadband sound pressure level ($L_{p,rms}$) of 103.9 dB re 1µPa calculated over the frequency range of 10 Hz to 100 kHz.

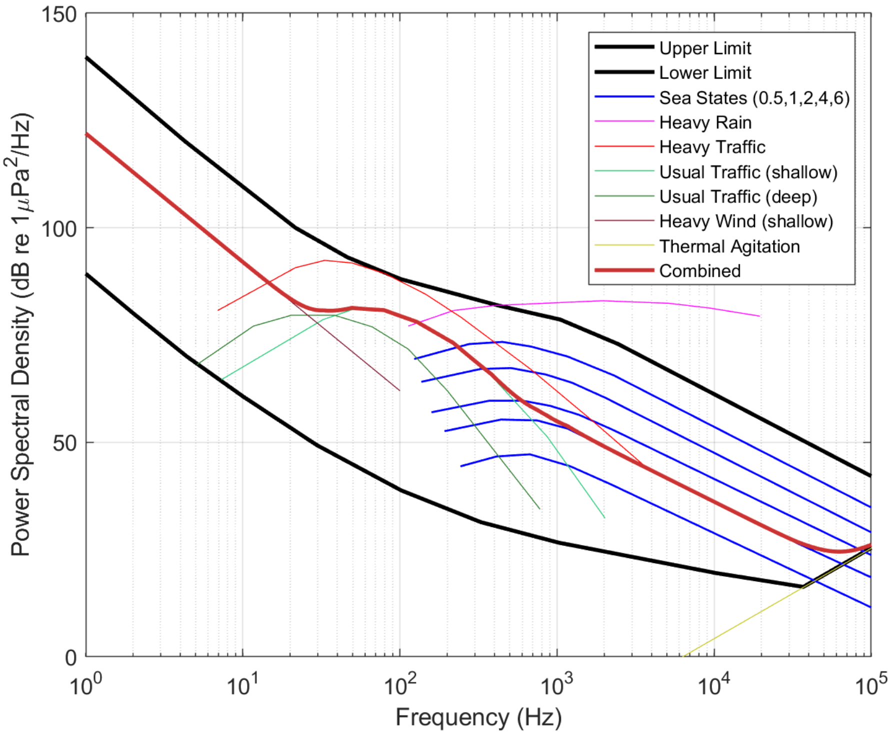


Figure 12.1: Ambient noise power spectral density in the open ocean. Adapted from NRC (2003).

At the lower frequencies, shipping noise dominates, while at the higher frequencies noise from waves and precipitation is more prevalent. The frequency at which the change occurs is a complex function of local bathymetry, propagation conditions, shipping levels, and weather conditions.

12.2.2 Acoustic Characteristics of Activities in the Fotla Field

This section discusses the various sources of noise involved in the development of the Fotla field and presents, where available, their typical source levels, frequency content, and operational parameters (Section 12.2.2), along with their attenuation (Section 12.2.3) and sound levels (Section 12.2.4) in the area.

12.2.2.1 Impact Pile Driving

Pile driving operations are required for the installation of the four anchor piles for the Fotla manifold. Each pile is 914 mm (36 in) in diameter, 31.8 mm thick (1.25 in) and 25 m long. The field operations will last approximately eight days, including mobilisation, transit, installation of the Fotla manifold and subsea isolation valve (SSIV), and demobilisation.

The underwater sound pressure levels generated during piling operations depend on many factors, including the size (length and diameter) and material of the pile, hammer properties (e.g., excitation mechanism, strike energy, ram weight), connection between hammer and pile (e.g., size and material of cushions), environmental conditions (e.g., water depth and seabed geology), and operational factors (e.g., penetration depth, pile direction) (Jiménez-Arranz et al., 2020b). These variables and the complex interaction between the hammer, the pile, and the seabed make the estimation of acoustic levels from marine pile driving particularly challenging.

Numerical models such as those from Reinhall & Dahl (2011), Zampolli et al. (2013), Lippert & Estorff (2014), and Fricke & Rolfes (2015) provide the most accurate simulations of acoustic emissions from impact pile driving. However, they require detailed knowledge of a large number of input parameters that are presently not available for the proposed Fotla piling operations.

A recent empirical model proposed by Pein et al. (2022; 2024) for simulating sound levels from marine impact pile driving largely simplifies the modelling workflow, enabling realistic underwater acoustic simulations of impact piling by applying scaling laws derived from numerical simulations to estimate the sound exposure level at a reference range, in combination with the damped cylindrical spreading (DCS) model (Lippert et al., 2018) to estimate the sound levels at any desired range.

Using representative proxies, the model calculated that the proposed piling operations will generate a broadband sound exposure level at one meter $SL_{E,p}$ (or 'source level') of 187.0 dB re 1µPa^{2}s m^2 for a single piling blow. To further inform the modelling, a representative normalised one-third octave band frequency spectrum was obtained as the average of several impact piling spectra measured at various distances from the source (Bellmann et al., 2020; Robinson et al., 2012). The spectral maximum of impact pile driving noise is in the frequency range of 60 Hz to 500 Hz, which overlaps with the hearing ranges of certain cetaceans and pinnipeds.

12.2.2.2 Drilling

Underwater sounds from a MODU mainly originate from vibrations of equipment onboard that transmit through the structure and into the water. Some of the acoustic energy radiated into the water is generated by the drill string and from the interaction of the drill bit with the seabed (Austin et al., 2018). Underwater sounds emitted by a MODU concentrate at low frequencies (10 Hz to 1 kHz), with strong tonal components associated with rotation rates from onboard machinery such as generators, engines, pumps, and motors. Vessels with large surface areas in contact with the water tend to produce higher sound levels (Richardson et al., 1995).

The broadband sound pressure source levels from three MODUs (two hull-based vessels, and a self-propelled drill ship) were measured by Austin et al. (2018), with values ranging from 168.6 dB to 174.9 dB re 1µPa m. Jiménez-Arranz et al. (2019) reported a similar broadband source level of 167.3 dB re 1µPa m from a moored sixth-generation MODU during drilling.

Measurements of the sound spectrum from three exploratory drilling units reported by Austin et al. (2018) have been selected for the underwater noise modelling simulations. The vessel size, onboard machinery, and environment of these measurements are considered representative of those expected for the drilling operations in the Fotla field. The average spectrum of the three semi-submersibles, with a broadband source level of 172.0 dB re 1µPa m, which has been used for the simulations.

12.2.2.3 Trenching, Pipe Laying, and Rock Placement

The pipeline installation campaign in the Fotla field involves various activities with potential to generate underwater noise. These include trenching, pipe laying, rock dumping, and support vessel operations.

Johansson and Andersson (2012) measured a broadband source level of 182.7 dB re 1µPa m during the trenching operations for the Nordstream pipeline, using the *Far Samson* installation vessel. This value is consistent with typical source levels observed for commercial vessels, the majority of which range between 178 and 188 dB re 1µPa m (Jiménez-Arranz et al., 2020a).

The sound levels emitted by the pipe laying vessel are comparable to those from trenching, with spectral levels likely similar to those from a passing cargo vessel travelling at typical speeds of 18.5 to 38 km/h (10 to 20 kt). The power spectral density (PSD) of sound pressure source levels produced by a 211 m bulker navigating at a speed of 25.7 km/h (13.9 kt) were simulated using the JOMOPANS-ECHO model (MacGillivrai & de Jong, 2021). The length and speed chosen for the model correspond to the average values observed by MacGillivrai & de Jong (2021) for 360 bulkers and a total 850 measurements. The broadband sound pressure source level $SL_{p,rms}$ of the simulated spectrum was 185.0 dB re 1µPa^{2}s m^2.

The spectrum of these vessels is characterised by a peak energy at 40 Hz, typical of large commercial vessels, where the slow-turning engines and propellers, along with large hulls and drafts, contribute to the radiation of dominant low frequency components, with the acoustic energy concentrated below 100 Hz (Malme et al., 1989; Richardson et al., 1995). The broadband source level is 2.3 dB higher than that of trenching. Thus, this spectrum will be adopted as a worse-case scenario for the acoustic emissions from trenching and pipe laying vessels and will be used for the sound field simulations of these two activities.

Rock placement and mattress installation are not expected to produce significant levels of noise on their contact with the seabed, with noise generation being primarily associated with the vessels themselves.

12.2.2.4 Support Vessels

Several support vessels will be involved during the drilling and pipe installation campaigns, as described in Section 4: Project Description.

The overall sound levels and spectral characteristics of the larger support vessels, such as the Construction Support Vessel (CSV) and Diving Support Vessel (DSV) used in the pipe laying campaign, are expected to be similar to those depicted for a cargo vessel at typical transit speeds. Given the uncertainty regarding the dimensions and dominant speed of the support vessels participating in the drilling and pipe laying campaigns for the Fotla field development, the simulated source level spectrum from the cargo vessel discussed in Section 12.2.2.3 will be assumed as a worst-case scenario for the acoustic output of all individual support vessels.

Therefore, the source level spectrum of the cargo vessel at a typical navigation speed will be used to simulate the sound field and impact ranges associated with drilling, pipelay, trenching, and support vessel operations (see Section 12.2.4.4).

12.2.3 Underwater Sound Attenuation

As a sound wave propagates underwater, its energy spreads over a larger area, effectively reducing the sound pressure at any point in its wavefront. In a homogenous, infinite body of water and far enough from the acoustic source, a spherical wavefront will form, resulting in an attenuation of 6 decibels per doubled distance. This type of geometrical attenuation is termed *spherical spreading* and is represented by the formula $20 \log r$, where r is the source-to-receiver distance and 20 is the spherical spreading factor.

In practice, the propagation loss that occurs as the sound wave travels between source and receiver is far more complex. In a real environment, the sound wave interacts with the sea surface and the seabed, propagating through layers of varying composition and following a complex path controlled by the effects of refraction, reflection, and diffusion. This multipath propagation phenomenon is dominated by refraction patterns shaped by local water properties and weather conditions, resulting in considerable temporal and spatial variability that is often difficult to quantify.

This section discusses the methods used to calculate realistic propagation losses based on the properties of the environment and operational considerations from the acoustic source.

12.2.3.1 Propagation Model

A logarithmic formula, such as that defining spherical spreading, is often not sufficient to describe the range-dependence of sound propagation losses underwater, but it can be further improved by accounting for a linear term to compensate for (some of) the factors described above, as in:

$$PL = A \log r + B(r - 1)$$

where PL is the propagation loss in dB (decibels), A is the geometric spreading factor and B is the linear attenuation factor, in dB/m (decibels per meter). B encompasses the effects from volume attenuation in water, scattering by organisms suspended in the water column, as well as absorption and scattering from the seabed and sea surface.

A similar approach is adopted by the DCS method proposed by Lippert et al. (2018) for the prediction of propagation losses from impact pile driving. This solution uses a geometric spreading factor A of 10, corresponding to *cylindrical spreading*, and a linear attenuation factor B that depends on the water depth, the grazing angle of emission φ of the Mach wave[1], and the seabed reflection coefficient at that angle of incidence. This method is used to estimate the propagation losses from the piling noise associated with the installation of the Fotla manifold.

As a distributed sound source that often covers the entirety of the water column, impact pile driving represents a special acoustic modelling case. For localised sources such as vessels, the main mechanism of acoustic radiation is in the water, allowing for a simpler modelling approach. For vessels and vessel-based operations such as drilling, trenching, and pipe laying, a wide-angle range dependent parabolic equation model for elastic, horizontally stratified seabeds (RAMS) was used (Collins, 1992; 1993a; 1993b). The model was run at two source depths: 3 m below the water surface for support vessels, and 2 m above the seabed (or 128 m deep) for seabed-interacting sources such as drilling, trenching, and pipe laying.

12.2.3.2 Propagation Losses

This sub-section discusses the range-dependent propagation losses for various operations including piling, drilling, trenching, pipe laying, and vessel activities. It also presents the best-fit two-parameter equations used for the sound field simulations discussed in Section 12.2.4.

For the impact pile driving scenario, the propagation loss curve is calculated using the DCS model for waters 130 m deep with a semi-infinite homogeneous silty seabed. The reflection coefficient $|R|$ at the Mach cone angle ($\varphi = 17.4°$), necessary for calculating the linear attenuation factor B, is 0.627. The propagation loss is given by the equation

$$PL(r) = 10\log r + 5 \cdot 10^{-3}(r-1)$$

For drilling, trenching, pipe laying, and support vessels, the propagation losses were computed using the RAMS model for four central one-octave frequencies from 63 Hz to 500 Hz. The source was placed at 3 m below the sea surface and at 2 m above the seabed (128 m depth) to assess differences in attenuation between near-surface and near-seabed sound radiation mechanisms. The propagation losses for each source depth z_s were averaged over all receiver depths and frequencies. The two resulting broadband propagation loss curves proved to be significantly similar. The results from the shallow source depth ($z_s = 3\ \mathrm{m}$) were fitted with a regression equation of the form $PL(r) = A\log r - B(r-1)$ using constrained non-linear optimisation. The fitted curve produced the propagation loss equation

$$PL(r) = 19.3\log r + 7.1 \cdot 10^{-3}(r-1)$$

The choice of source depth ($z_s = 3\ \mathrm{m}$) was made based on the assumption that for both specialised and support vessels, the majority of acoustic energy will originate from onboard machinery and propeller cavitation.

[1] The Mach wave is produced by the compressional deformation that propagates along the pile after the impact of the hammer (Reinhall & Dahl, 2011).

12.2.4 Underwater Noise Generated by Activities in the Fotla Field

12.2.4.1 Overview of Sound Level Metrics

The received sound levels RL at a given frequency f and distance r from the source can be conveniently calculated as the difference between the source level SL and the range-dependent propagation losses PL, using the following simple formula

$$RL(r,f) = SL(f) - PL(r,f)$$

The source level spectrum $SL(f)$ and the propagation loss curves $PL(r,f)$ for the various sound sources under evaluation were presented in sections 12.2.2 and 12.2.3. The propagation losses are considered constant for all frequencies of interest; hence they are assumed to be independent of frequency and can be defined as $PL(r)$. The source levels were presented as one-third octave band spectra.

The advantage of working with separate frequencies is that a *weighting function* can be applied to the sound levels to account for the varying sensitivities that marine mammals have at different frequencies (Southall et al., 2019; NMFS, 2024). For a given auditory weighting function $W(f)$, the 'weighted' (or filtered) broadband received levels can be calculated as

$$RL_w(r) = 10 \log \left(\sum_n 10^{\frac{RL_n(r)W(f)}{10}} \right)$$

The 'unweighted' received levels can be calculated with the formula above by assuming a constant hearing sensitivity for all frequencies ($W(f) = 1$).

Sound levels may be expressed as different acoustic metrics. For instance, RL and SL can refer to sound pressure level $L_{p,rms}$ (or SPL), peak sound pressure level $L_{p,pk}$ (or SPL_{pk}), and sound exposure level $L_{E,p}$ (or SEL).

The root-mean square (RMS) sound pressure p_{rms} is the square root of the squared instantaneous sound pressure $p(t)$ averaged over a specified interval T and is expressed in pascals (Pa) (ISO, 2017). The sound pressure level $L_{p,rms}$ is the decibel representation of p_{rms}. The sound pressure level $L_{p,rms}$ is used as a measure of the amplitude of continuous acoustic signals and is expressed in decibels referred to one micro pascal (dB re 1µPa).

The peak sound pressure p_{pk} is the greatest absolute value of the instantaneous sound pressure $p(t)$ during a specified time interval and is expressed in pascals (Pa) (ISO, 2017). The peak sound pressure level $L_{p,pk}$ (or SPL_{pk}) is the decibel representation of p_{pk} and is expressed in decibels referred to one micro pascal (dB re 1µPa). Due to the broadband nature of $L_{p,pk}$, auditory weighting is not applied to it. The 'unweighted' peak sound pressure level is often referred to as $L_{p,pk,flat}$ (NMFS, 2024). This metric is well suited for characterising large instantaneous amplitudes from impulsive signals. For impact pile driving, the range-dependent peak sound pressure level $L_{p,pk}(r)$ was obtained from the (single-strike) 'unweighted' sound exposure level $L_{E,p}(r)$ using the method described by Lippert et al. (2015).

The sound exposure E_p is the integral over a specified time interval T of the squared instantaneous sound pressure $p(t)$ and is expressed in pascal-squared second (Pa^2s) (ISO, 2017). The sound exposure level $L_{E,p}$ is the decibel representation of the sound exposure and is expressed in decibels referred to one micro pascal-squared second (dB re $1\mu Pa^2s$). The *single-strike* sound exposure level $L_{E,p}$ (SEL_{ss}) is a term commonly used to emphasise that the sound exposure was calculated over the duration of a single sound event. This terminology is used to distinguish it from the *cumulative* sound exposure level $L_{E,p,T}$ (SEL_{cum}), which indicates that the energy is accumulated over a long period T or a number of individual sound events. There is no mathematical difference between the two. Noise impact guidelines for marine mammals and fish recommend a 24-hour integration period and auditory weighting for the cumulative sound exposure level, denoted by $L_{E,p,w,24h}$ (NMFS, 2024; Popper et al., 2014). The cumulative sound exposure level is better suited than $L_{p,rms}$ for the assessment of noise impacts, due to the correlation of the accumulated acoustic energy with hearing fatigue.

The peak sound pressure level $L_{p,pk}$ and the 24-hour 'weighted' cumulative sound exposure level $L_{E,p,w,24h}$ are the primary metrics used in noise impact assessments for marine mammals according to the latest guidelines (Southall et al., 2019; NMFS, 2024). For fish, the 'unweighted' cumulative sound exposure $L_{E,p,T}$ is used instead of $L_{E,p,w,24h}$, as a standardised auditory weighting function does not currently exist due to the complexity and variability of fish hearing. Currently, $L_{p,rms}$ is only used as an unweighted metric for the noise impact assessment of fish from continuous sources such as vessels or sonar (Popper et al., 2014).

The behaviour of the marine animal plays a key role in the accumulation of the sound exposure. For instance, if the animal remains static at a distance from the source, the overall cumulative sound exposure will be higher compared to that of an (fleeing) animal swimming away from the sound source. If the animal swims away from the source at a speed v and the source emits pulses every Δt seconds, the 'weighted' cumulative exposure will be given by

$$L_{E,p,w,24h}(r) = 10\log\left(\sum_i 10^{\frac{SL_{E,p,w} - PL_n(r + iv\Delta t)}{10}}\right)$$

where $i = 0,1,2, \dots M$ is the index of each sound event in the sequence (0 is the first and M the last), $v\Delta t$ is the distance covered by the animal between each pulse, and r is the departing distance. Since propagation losses increase with range, this second, more realistic, scenario will result in lower cumulative sound exposure. This equation was used to calculate the 'weighted' cumulative sound exposure level for each marine mammal functional hearing group (FHG), taking account of the hearing ranges of these specific animal groups. For a fleeing response scenario, the marine mammal is assumed to swim away from the source at a speed of 2 m/s, to then stop once it reaches a 'safe distance'. This 'safe distance' is assumed to coincide with the range at which the sound pressure level from the source and the background noise are equal. The broadband sound pressure level for the ambient noise expected during the development of the Fotla field is 103.9 dB re 1µPa, as discussed in Section 12.2.1. Estimations of impact ranges for fish consider no fleeing response ($v = 0\ \mathrm{m/s}$).

Figure 12.2, Figure 12.3 and Figure 12.4 in the sections below present the sound levels with range $L_{E,p}(r)$, $L_{p,rms}(r)$, $L_{p,pk}(r)$, and $L_{E,p,24h}(r)$ for the noise-generating activities identified in the Fotla field. The reader should be aware that, although the mentioned metrics may be displayed in the same figure, a direct relation between level and impact cannot be established through comparison (i.e., a metric with a higher sound level does not necessarily have a higher associated risk). It should also be noted that the cumulative sound exposure levels shown in these figures are 'unweighted'. The 24-hour 'weighted' cumulative sound exposure level $L_{E,p,w,24h}$ for the fleeing response ($v = 2\ \mathrm{m/s}$) was used to calculate impact ranges for each marine mammal FHG (Table 12.6), according to the latest guidelines (Southall et al., 2019; NMFS, 2024).

12.2.4.2 Pile Driving

Impact pile driving is required for the installation of the Fotla manifold in the Fotla field. The manifold will be anchored to the seabed using four small diameter piles driven by impact piling. Each hammer blow is expected to generate a sound exposure source level $SL_{E,p}$ of 187.0 dB re 1µPa^{2}s m^2 (see Section 12.2.2).

A total blow count of 1,500 pile strikes was assumed based on results for piles of similar length, thickness, diameter, and material, driven in a fine-grained sediment consisting of sand, silt, and clay (Afshani et al., 2012). With a blow rate of 1 strike per second, this results in a 25-minute piling sequence for a single pile. Each blow in the sequence was conservatively assigned the maximum hammer energy of 200 kJ. In practice, however, lower hammer energies are typically applied in certain parts of the piling sequence, particularly during the initial 'soft start' phase. It is important to note that should piling operations be paused for more than 10 minutes, the soft-start procedure should be repeated before resuming (JNCC, 2010).

Figure 12.2 presents the range-dependent 'unweighted' sound levels from the installation of the Fotla manifold with impact piling for the metrics $L_{E,p}$ (light grey), $L_{p,pk}$ (grey), and $L_{E,p,24h}$ for a static marine mammal (green) and a marine mammal fleeing at a speed of 2 m/s (light green). The 'safety distance' is reached at 8 km. The cumulative sound exposure is calculated for 1,500 hammer blows at 1 blow per second.

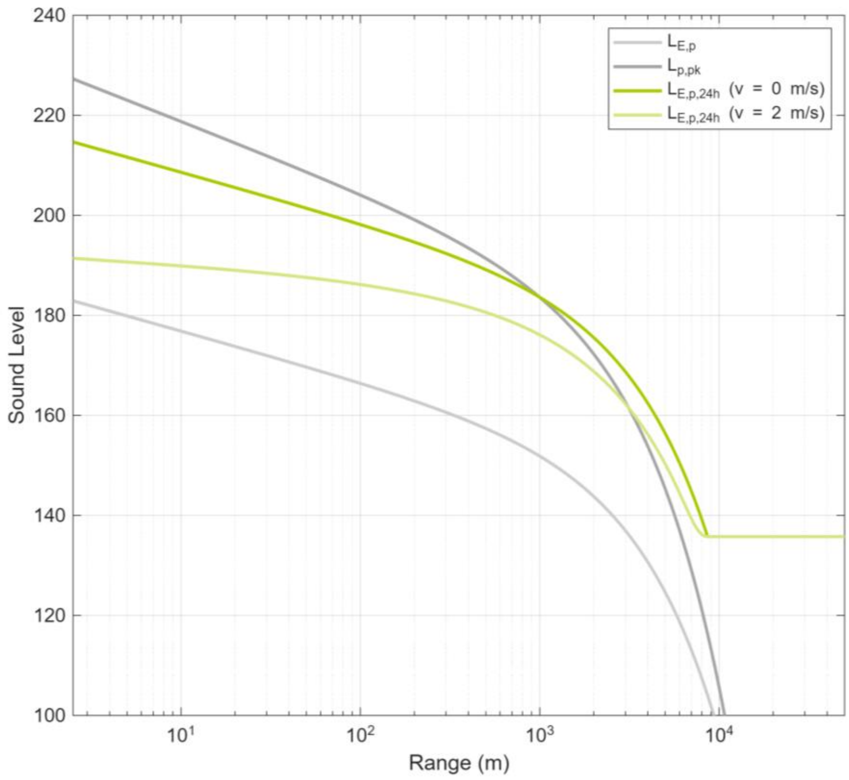


Figure 12.2: Sound levels with range from impact pile driving during the installation of the Fotla manifold

12.2.4.3 Drilling

Two wells are planned to be drilled in the Fotla field using an anchored sixth-generation MODU. The majority of the noise is expected to be generated by the drill sting, the interaction between the drill bit and the seabed, and the vibrations from the machinery onboard. The operations are expected to generate a broadband sound pressure source level $SL_{p,rms}$ of 172 dB re 1µPa (see Section 12.2.2.2).

Figure 12.3 illustrates the range-dependent 'unweighted' sound levels from drilling operations for the metrics $L_{p,rms}$ (light grey), and $L_{E,p,24h}$ for a static marine mammal (green) and a marine mammal fleeing at a speed of 2 m/s (light green). The 'safety distance' is reached at 4 km. The drilling operations are assumed to continue uninterrupted for the entirety of the 24-hour cumulative period.

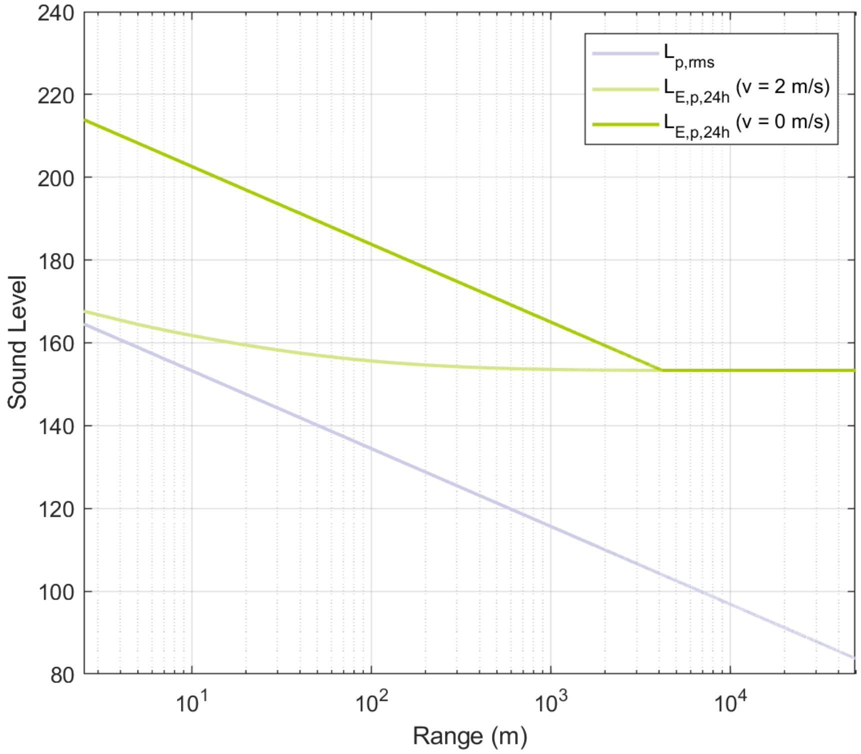


Figure 12.3: Sound levels with range from the drilling of a well in the Fotla field

12.2.4.4 Trenching, Pipe Laying, and Rock Placement

The pipeline installation campaign for the Fotla field development involves trenching, pipe laying, and rock placement. Among these activities, trenching and pipe laying are expected to produce higher sound levels. The operations of these individual specialised vessels will generate a maximum broadband sound pressure source level $SL_{p,rms}$ of 185 dB re 1µPa (see Section 12.2.2.3).

Figure 12.4 shows the range-dependent 'unweighted' sound levels during trenching and pipe laying operations for the metrics $L_{p,rms}$ (light grey) and $L_{E,p,24h}$ for a static marine mammal (green) and a marine mammal fleeing at a speed of 2 m/s (light green). These results are based on sound pressure levels produced by a 211 m long bulker travelling at a nominal speed of 13.9 kt (see Section 12.2.2.3). The operations from these individual activities are assumed to continue uninterrupted for the entirety of the 24-hour cumulative period.

The sound levels produced by the bulker represent the worst-case emissions from any large vessel participating in the drilling and pipeline installation campaigns.

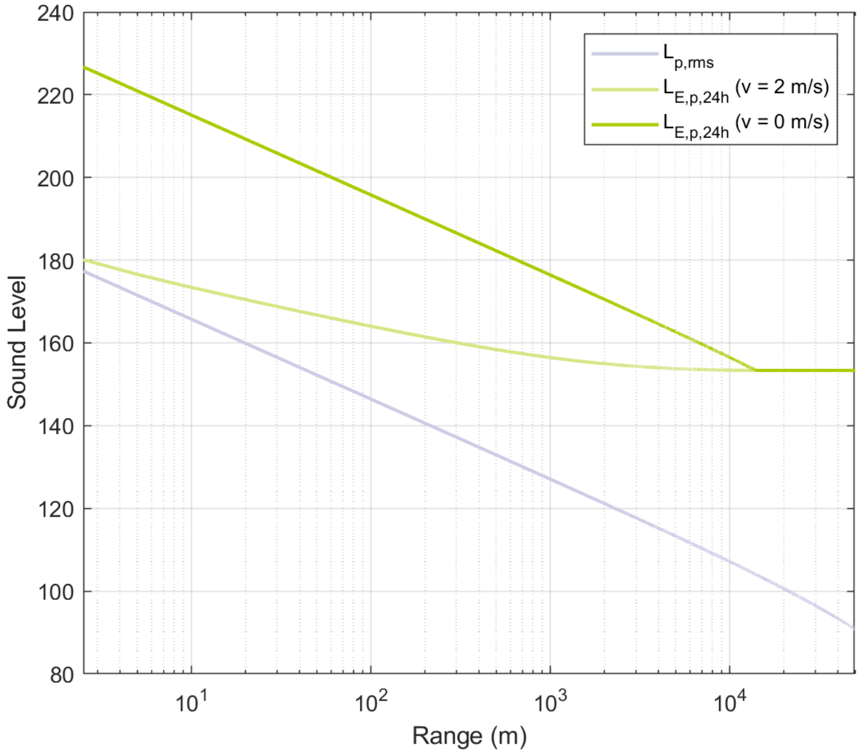


Figure 12.4 Sound levels with range from trenching and pipe laying for the installation of the oil and gas pipelines in the Fotla field.

12.3 Impacts from Underwater Noise

Sound is particularly efficient at propagating through water, and many marine animals have evolved to use hearing as their primary sense. Cetaceans in particular are heavily dependent on sound for foraging, communication, reproduction, navigation, and predator avoidance (Weilgart, 2007; Hildebrand, 2009).

The ocean is a naturally noisy environment, and cetaceans have evolved ears that function well within this context. Anatomical and behavioural studies suggest that whales and dolphins may be more resistant than many land mammals to transitory physiological effects such as Temporary Threshold Shift (TTS). However, these data also show that they are subject to disease and aging processes and are therefore not immune to hearing loss. Increasing ambient noise via human activities is a potential candidate for exacerbating or accelerating such losses (Ketten, 2004).

The introduction of additional noise into the marine environment could potentially interfere with the animals' ability to interact with other individuals and the environment. This increase in noise could therefore cause short term behavioural changes and, in more extreme cases, cause auditory damage. In addition, underwater sound may also cause behavioural changes in other animals such as fish and diving seabirds.

This section presents the potential impacts from underwater sound produced by the piling, drilling, and pipeline installation campaigns taking place during the development of the Fotla field. The assessment focuses on marine mammals and fish which are the receptors believed to be most at risk from noise impacts.

The impact ranges presented for marine mammals (Section 12.3.1.2) and fish (Section 12.3.2.2) were obtained by comparing the modelled range-dependent sound level curves to the thresholds associated with each combination of impact level, functional hearing group, source type, and acoustic metric.

For the 24-hour 'weighted' cumulative sound exposure $L_{E,p,w,24h}$, a fleeing response was assumed for the marine mammal, which will swim away from the source at speed of 2 m/s. This metric was used in combination with the peak sound pressure level $L_{p,pk}$ as a dual impact criteria for marine mammals, following National Oceanic and Atmospheric Administration's (NOAA) latest technical guidance (NMFS, 2024). For the assessment of noise impact on fish, the 'unweighted' cumulative sound exposure $L_{E,p,24h}$ was used along with $L_{p,pk}$ for impact piling, in accordance with the latest guidelines of noise impact on fish and sea turtles (Popper et al., 2014). No fleeing response was assumed for the calculations of impact ranges from fish. The sound pressure level $L_{p,rms}$ was only applied for impact range estimation from continuous sources on fish (i.e., drilling, trenching, pipe laying, and vessel noise).

12.3.1 Impacts of Noise on Marine Mammals

12.3.1.1 Marine Mammals and Noise

Marine mammals use sound in various important contexts, such as in social interactions, foraging, and response to predators (Southall et al., 2007). Hearing is the primary sensory system for marine mammals, which is clearly shown by the development level of their ear and neural auditory centre (Ketten, 2004). As the sea has never been a silent place, the ears of marine mammals, and those of whales and dolphins in particular, have evolved to function well within this context of ambient noise. However, little information exists to describe how marine mammals respond physically and behaviourally to intense sounds and to long term increases in ambient noise levels (NRC, 2003).

The hearing sensitivity of marine mammals varies significantly between species. In order to assess the impacts of sound, these animals can be classified into FHG (NMFS, 2024; 2018; 2016; Southall et al., 2019; 2007). This classification considers that not all marine mammal species have identical hearing, or susceptibility to temporary and permanent noise-induced hearing loss. Outside their generalised hearing range, animals may be able to detect loud sounds, but the risk of auditory impacts is considered highly unlikely or very low.

As discussed in Section 5: Local Environment, harbour porpoise (*Phocoena Phocoena*) and white-beaked dolphin (*Lagenorhynchus albirostris*) are the most widespread marine mammal species in the North Sea. Minke whales (*Balaenoptera acutorostrata*) are a frequent seasonal visitor, while Atlantic white-sided dolphin (*Lagenorhynchus acutus*) and Risso's dolphin (*Grampus griseus*) are occasional visitors. Harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) reside in Scottish waters but are unlikely to be found near or within the Fotla field development area.

Table 12.3: Functional hearing groups for marine mammals potentially present in the Fotla field development area

Functional Hearing Group	Nominal Hearing Range*	Species Potentially Present in the Area
Low-frequency cetaceans	7 Hz to 36 kHz	Minke whale
High-frequency cetaceans	150 Hz to 160 kHz	Atlantic white-sided dolphin; White-beaked dolphin; Risso's dolphin;
Very high-frequency cetaceans	200 Hz to 165 kHz	Harbour porpoise
Phocid pinnipeds in water	40 Hz to 90 kHz	Unlikely presence of grey seals and harbour seals

Notes:
* Generalised hearing range based on a ~65 dB threshold applied to the composite audiogram of each functional hearing group. Based on analysis and data from NMFS (2018) and Southall et al. (2007; 2021).
Sources: NMFS,2024; DECC, 2016; Reid et al., 2003; Pollock et al., 2000

According to this hearing group classification, harbour porpoises are regarded as 'very high-frequency cetaceans', and white-beaked dolphins and Atlantic white-sided dolphins are classified as 'high-frequency cetaceans'. This classification is based on the fact that odontocetes have highly advanced echolocation systems that use intermediate to very high frequencies. They also produce social sounds in a lower-frequency band, including generally low to intermediate frequencies (1 kHz to tens of kHz). Consequently, their functional hearing is expected to cover this whole range; however, their hearing sensitivity typically peaks at, or near, the frequency where echolocation signals are strongest (Southall et al., 2019).

All mysticetes (i.e. the large baleen whales) are categorised as 'low-frequency cetaceans'. No direct measurements of hearing exist for these animals and theories regarding their sensory capabilities are consequently speculative. In these species, hearing sensitivity has been estimated from behavioural responses (or lack thereof) to sounds at various frequencies, common vocalisation frequencies, ambient noise levels at the frequencies they use most, body size, and cochlear morphology. At present, the lower and upper frequencies for functional hearing in mysticetes, collectively, are estimated to be 7 Hz and 36 kHz (NMFS, 2024).

Pinnipeds (seals, sea lions, and walruses) also produce a variety of sounds, generally over a lower and more restricted bandwidth (from 100 Hz to several tens of kHz). These sounds are primarily used in critical social and reproductive interactions (Southall et al., 2007). Most pinniped species have peak sensitivities between 1 and 20 kHz (NRC, 2003). Harbour seals are most sensitive to sounds between 6 kHz to 12 kHz (Wolski et al., 2003), although their sensitivity for hearing and response thresholds lies at much lower frequencies. Kastak and Shusterman (1998) measured the underwater sound detection threshold of a harbour seal, which ranged between 101.9 dB and 62.8 dB for frequencies between 75 Hz and 6,400 Hz respectively. The audiograms of harbour and grey seals are very similar (Thompson, 1998), suggesting their reactions to anthropogenic underwater sound are likely similar. Grey and harbour seals are phocids. In water, their hearing range spans from 40 Hz to 90 kHz, one octave broader than that of 'otariid pinnipeds in water'.

Research indicates that marine mammals can react differently to the introduction of additional noise into the marine environment. Reactions may vary depending on sound source level, propagation conditions and ambient noise, in addition to species, age, sex, habitat, individual variation, and previous habituation to noise (Richardson et al., 1995). It should also be noted that marine mammals react differently to stationary noise, compared to sudden bursts of noise and noises that appear to be coming towards them.

12.3.1.2 PTS and TTS Impact Ranges for Marine Mammals

Table 12.4 shows the Permanent Threshold Shift (PTS) and TTS impact ranges (or 'isopleths') for all marine mammal functional hearing groups for the main identified noise producing activities. For impulsive sources such as percussive pile driving, the impact range is taken as the worst of the dual criteria ($L_{p,pk}$, $L_{E,p,w,24h}$) for the selected impact level (PTS, TTS) and is highlighted in green. Impact ranges lower than the model's resolution (< 2.5 m) are considered *null impacts* and are greyed out.

The individual sources involved in the drilling and pipeline installation campaigns do not incur permanent (PTS) or temporary (TTS) threshold shift for marine mammals. Therefore, the risk of physiological impact from drilling, trenching, pipe laying, and support vessel operation on marine mammals is considered 'negligible'.

The underwater sounds generated during the piling operations required for the installation of the Fotla manifold produce intermittent, impulsive sounds which are considerably more intense than the continuous signals emitted by most industrial acoustic sources in the ocean. Impact piling can result in various degrees of physiological impact, in particular for low frequency cetaceans which may experience PTS at distances closer than 73 m and TTS at ranges of up to 1.6 km. Very high frequency cetaceans can be affected by PTS up to distances of 134 m from the source, with a moderate impact range of 297 m for TTS. Phocid pinnipeds must get closer to the source to experience physiological impacts, with a 5 m radius isopleth for PTS and 112 m for TTS. High frequency cetaceans are unlikely to be affected by physiological effects from noise, with only a 4 m impact range for TTS.

Table 12.4: PTS and TTS noise impact ranges (in meters) for marine mammals as a result of exposure to sounds from impact piling, drilling, pipe installation, and vessel activity in the Fotla field

Source	Impact Level	Acoustic Metric	LF	HF	VHF	PW
Impact Pile Driving	PTS	$L_{p,pk}$	6	<2.5	134	5
		$L_{E,p,w,24h}$	73	<2.5	<2.5	<2.5
	TTS	$L_{p,pk}$	16	4	297	13
		$L_{E,p,w,24h}$	1,600	<2.5	239	112
Drilling	PTS	$L_{E,p,w,24h}$	<2.5	<2.5	<2.5	<2.5
	TTS	$L_{E,p,w,24h}$	<2.5	<2.5	<2.5	<2.5
Trenching, Pipe Laying, Vessels	PTS	$L_{E,p,w,24h}$	<2.5	<2.5	<2.5	<2.5
	TTS	$L_{E,p,w,24h}$	<2.5	<2.5	<2.5	<2.5

Notes:
The last four columns represent the marine mammal functional hearing groups (FHG) that may be present in the wider Fotla area → Low frequency cetaceans (LF), high frequency cetaceans (HF), very high frequency cetaceans (VHF) and phocid pinnipeds in water (PW).
$L_{p,pk}$ is the peak sound pressure level in dB re 1µPa, and $L_{E,p,w,24h}$ is the 24-hour weighted cumulative sound exposure level in dB re 1µPa^{2}s.
Cells highlighted in green indicate the dual metric impact range (i.e., the highest of the two metrics).
Cells greyed out indicate a *null impact* (i.e., no PTS or TTS for the specific source and FHG).

Piling operations will be undertaken following the Joint Nature Conservation Committee (JNCC) Protocol for minimising risk of injury to marine mammals from piling noise (JNCC, 2010b). This mitigation protocol will ensure that no marine mammal within 500 m from the activity is exposed to physiological effects from noise. The only exception will be the low frequency cetacean group, for which an individual could be affected by TTS if located closer than 1.6 km from the source when piling starts, if there would be no appropriate mitigation measures in place.

Adopting a 'soft start' piling period will encourage a flee response, producing low intensity sounds that will result in lower cumulative exposure. The major contribution to the cumulative sound exposure comes from the first few blows; subsequent blows will have an increasingly lower contribution to the accumulated energy. The 'soft start' will effectively shift the onset range, making it less likely for an individual to experience physiological impact from noise.

For instance, a typical 'soft start' will increase the strike energy from 10 % to 85 % of the maximum planned for the main piling sequence. By assuming a piling rate of one blow every 2 seconds (i.e., 0.5 blows/s) and a strike energy of 80 kJ (i.e., 40 % of full energy of 200 kJ), the TTS impact range for the low frequency cetacean for the $L_{E,p,w,24h}$ metric will be reduced from 1.6 km to 686 m. Within that range, an appropriate monitoring and mitigation plan consistent with the JNCC protocol with a 700 m mitigation zone will drastically reduce any chance of impact on this group from percussive piling.

Therefore, considering the above assessment, it is deemed unlikely that the piling operations would cause any physiological injury (PTS or TTS) to marine mammals in the area, provided the proposed mitigation measures outlined above are followed. Hence, marine mammals are not expected to experience PTS or TTS onset as a result of the proposed piling, drilling, trenching, pipe laying, and vessel operations in the Fotla field.

12.3.1.3 Behavioural Disturbance of Cetaceans

Although it is unlikely that any piling operations will cause injury, they may very well evoke some behavioural responses from any marine mammals in the vicinity of such operations.

There is limited information available on the behavioural effects of the larger baleen whale species to piling operations. However, as sound levels and dominant frequencies of piling sound are in many ways quite similar to the sound generated during offshore geophysical (i.e. seismic) surveys, the following examples have been used as a proxy to describe some of the anticipated effects and spatial extent.

Baleen whales have hearing sensitivity ranges between 10 Hz and 10 kHz, with greatest sensitivities usually below 1 kHz (Southall et al., 2007; Evans, 1998). This hearing range overlaps the low frequency sounds produced by the planned piling operations, which may mask long distance communication between whales and prevent the detection of other faint sounds (Evans & Nice, 1996).

Most studies on low-frequency cetaceans report behavioural responses to ‘pulsed sound’, such as that produced by piling operations or seismic surveys, at received sound levels around 140 to 160 dB re 1 µPa, and sometimes even higher (e.g. Southall et al., 2007; Richardson et al., 1995). These responses typically consist of subtle effects on surfacing and respiration patterns. Sound levels of 150 dB to 180 dB will generally evoke behavioural avoidance reactions (Richardson et al., 1995). Two acoustic thresholds for the onset of behavioural disturbance (or ‘Level B harassment’) for marine mammals were set in the US National Marine Fisheries Service guidance (NMFS, 2005) based on the sound pressure level metric $L_{p,rms}$: 160 dB re 1 µPa for impulsive noise and 120 dB re 1 µPa for continuous noise. Using the propagation loss curve predicted with the DCS model for impact piling (see Section 12.2.3.2), and considering that the broadband ‘unweighted’ sound pressure source level $SL_{p,rms}$ is 187.0 dB re 1µPa, the range of avoidance behaviour for baleen whales from a single pulse is expected to occur at 338 m from the source (see Figure 12.2). This short range for the onset of disturbance is consistent with the comparatively low acoustic energy produced by small diameter piles as those used for the Fotla manifold.

Nonetheless, applying a single threshold for species and individuals, each capable of responding differently depending on context, is questionable. This concern is reflected in the ongoing difficulty in reaching consensus on a suitable methodology for assessing behavioural disturbance.

Assuming the 160 dB re 1µPa threshold is valid and that behavioural disturbance occurs within an estimated range of 338 m, piling blows are unlikely to trigger a fleeing response in baleen whales beyond this distance. However, the calculations indicate a risk of TTS from high cumulative exposure even beyond 338 m. The occurrence of TTS without behavioural disturbance is counterintuitive and emphasises the need for caution when relying on a single behavioural threshold. While the estimated 338 m range for impulsive sounds-induced behavioural disturbance may be applicable to other functional hearing groups, low-frequency cetaceans are expected to exhibit behavioural reactions above the range of 1.6 km associated with TTS.

When considering continuous sounds, for which a behavioural threshold of 120 dB re 1µPa is recommended, disturbance is expected to occur at significantly greater ranges. For instance, a large support vessel may elicit behavioural responses at distances of up to 2.4 km (see Figure 12.4). This range will be adopted as a worst-case scenario across all marine mammal groups and for all sound sources, whether continuous or impulsive.

Similar levels of avoidance can be expected for cetaceans in the other functional hearing groups. For example, Graham et al. (2019) found ≥ 50 % chance of harbour porpoises responding to piling noise at distances up to 7.4 km at the Beatrice Offshore Wind Farm in the Moray Firth for pile diameters of 2.2 m. A lower range of behavioural disturbance should be expected for the smaller diameter piles in the Fotla manifold (0.61 m).

As described above, the proposed piling operations are not expected to cause any injury to cetaceans, and only a certain level of avoidance responses are expected within 2.4 km. The following assessment will estimate the number of animals and percentage of the local population which may experience behavioural disturbance as a result of the piling activity.

Table 12.5 identifies the cetacean species that have been recorded in the area of the proposed Fotla field development and therefore may be present in the wider area during the piling operations. It also specifies the number of individuals per species that can be expected to be present within a radius of 2.4 km from the Fotla manifold piling operations to represent the area in which potential 'disturbance' effects could be expected to occur, based on potential temporary avoidance of that area. Abundance data has been used from the Small Cetacean Abundance in the North Sea (SCANS) IV surveys (Gilles et al., 2023). Further information on the cetacean species is presented in Section 5.3.6 of this ES.

Table 12.5: Numbers of cetaceans present within 2.4 km from the proposed piling operations

Cetacean Species	Density (Animals/km^2)	Estimated Abundance in SCANS IV Block NS-G	Disturbance Zone (2.4 km)	
			Number of Individuals Affected	% of Population Affected
Harbour porpoise	1.0398	51,646	18.82	0.036
White-beaked dolphin	0.1051	5,218	1.90	0.036
Atlantic white-sided dolphin *	0.0024	3,504	0.04	0.001

Cetacean Species	Density (Animals/km^2)	Estimated Abundance in SCANS IV Block NS-G	Disturbance Zone (2.4 km)	
			Number of Individuals Affected	% of Population Affected
Risso's dolphin *	0.0094	13,854	0.17	0.001
Minke whale	0.0103	510	0.19	0.037

Notes:
* = Species not recorded in Block NS-G. The density and abundance for SCANS IV Block NS-E has been used for this species instead. This is a conservative value, as the absence of data indicates very low probability of presence in Block NS-G.
Source: Gilles et al (2023)

Table 12.5 shows that harbour porpoises are the most abundant species in SCANS IV Block NS-G, which overlaps with the Fotla field development, with a potential of up to 18.82 animals affected. The second most affected species is the white beaked dolphin, with 1.90 animals affected. However, it should be noted that the abundance data in Table 12.5 is based on the mean values over a wide area (49,671 km^2) and does not take account of the fact both species mentioned above live in larger pods, which means that in reality their distribution will be much more clustered. It should also be noted that both species are classed as the more abundant cetacean species living in the water surrounding the UK. Moreover, it is expected that any effects will be of short duration and not all animals present in the area would respond equally to the piling noise, with only a certain fraction of the animals present responding with a complete avoidance reaction. Any affected individuals temporarily leaving the area are also be expected to move back shortly after the piling operations have finished.

SCANS IV data is unavailable for Risso's dolphins and Atlantic white-sided dolphins within Block NS-G, however data is available for Block NS-E (approximately 24 km northwest of the Fotla field development). They are unlikely to be present in any significant numbers in the area of the planned operations but, if individuals are present, they may show some behavioural response to the piling operations, in a similar way as all other species.

Risso's dolphins are mainly distributed off western and northern coasts of Britain and Ireland and along the continental shelf. They are known to use only a portion of UK waters which is highly variable both seasonally and inter-annually. Greatest numbers of Risso's dolphins have been observed from western Scotland with the waters around the Hebrides forming an obvious concentration (JNCC, 2010b). Risso's dolphins are not as common as other dolphin species around Scotland. As discussed in Section 5.3.6, there have been few records of the species within the central North Sea, with most sightings occurring in the northern North Sea between June and August. Atlantic white-sided dolphins are more commonly sighted in the waters to the north and west of UK and Ireland. They are rarely found in the central and north-eastern regions of the North Sea.

Behavioural reactions of any of the cetacean species to underwater sound produced by the piling operations are expected to be limited to within a few km. The strongest anticipated response would be the temporary avoidance of certain individuals within a 2.4 km radius. It is believed that the relatively small area, in which this temporary avoidance behaviour may occur, can be easily avoided by any individual, without causing a serious degree of nuisance to the animals involved or the larger population as a whole.

In conclusion, by applying the proposed mitigation measures outlined in the JNCC Guidelines for piling operations (JNCC, 2010b) and bearing in mind the short overall duration of the piling operations, the magnitude of effect can be classed as '**Minor**'. As internationally protected species, all cetaceans qualify as having a '**Very High**' receptor value. Hence, the environmental effect of the proposed Fotla manifold piling operations at Fotla will result in a '**Minor adverse**' effect and consequently can be considered as not significant.

12.3.1.4 Behavioural Disturbance of Pinnipeds

Very few studies have been conducted on the effects of impulsive noise on pinnipeds, even though they are known to have good underwater hearing and their feeding grounds often overlap with areas subject to manmade high intensity underwater noise activities.

Russell et al. (2017) found that seal usage (abundance) was significantly reduced up to 25 km from piling operations at a wind farm location in the southern North Sea. Within 25 km of the centre of the wind farm, there was a 19 % to 83 % decrease in usage of the area compared to during breaks in piling. This amounted to significant displacement starting from predicted sound pressure peak-to-peak received levels $L_{p,pk-pk}$ between 166 and 178 dB re 1 μPa (p-p). Within 2 hours of cessation of pile driving, seals were distributed as per the non-piling scenario.

By converting the peak-to-peak values quoted in Russell et al. (2016) to peak values $L_{p,pk}$ (i.e. 160 and 172 dB re 1 μPa (0-p)), they can be compared with the range-dependent peak sound pressure level curve for impact piling. The expected disturbance ranges of seals during the proposed Fotla manifold piling operations are between 2,024 m and 3,294 m from the pile.

In conclusion, the predicted magnitude of effect for piling can be classed as '**Minor**' when bearing in mind the following three points:

- Piling operations will be short in duration (< 1 day of active piling in total over an 8 day period);
- Seals are unlikely to be present in the area and any seal(s) affected is/are expected to return to the area quickly (within a few hours) after piling operations have ceased; and
- Ithaca Energy will be following the JNCC Piling Guidelines (JNCC, 2010b).

Both the grey and common seal are listed under Annexes II and IV of the EU Habitats Directive (JNCC, 2019) and thus qualify as internationally protected species, giving them a '**Very High**' receptor value. Consequently, the predicted environmental effect of the proposed Fotla manifold piling operations will result in a '**Minor adverse**' effect (i.e. not significant).

12.3.2 Impacts of Noise on Fish

12.3.2.1 Fish and Noise

The inner ear of fish, including elasmobranchs (sharks, skates and rays), is very similar to that of terrestrial vertebrates, and hearing is understood to be present in virtually all fish (NRC, 2003). Most species of fish are able to detect sounds from below 50 Hz (some as low as 10 Hz or 15 Hz) to upward of 1,000 Hz. Moreover, a number of fish species have auditory adaptations that enhance sound detection and enable them to detect sounds of 1 kHz and above, giving them better sensitivity than non-specialist species at lower frequencies (NRC, 2003; Popper, 2003). Many species of fish use sound to find prey, to avoid predators, and for social interactions. In addition, the sensory systems used by fish to detect sounds are very similar to those of marine (and terrestrial) mammals and, as a consequence, sounds that damage or affect marine mammals could in other ways have similar consequences for fish (Popper, 2003). Some fish species, such as herring, have swim bladders which may be susceptible to damage by high underwater noise levels, making these species comparatively more sensitive.

12.3.2.2 Injury and Auditory Thresholds for Fish

As presented in Section 5.3, the proposed operations will overlap with spawning and nursing times of some fish species. This section assesses the potential effect of the proposed piling, drilling, trenching, pipe laying, and vessel activities on fish.

Popper et al. (2014) developed an interim technical guidance for assessing the impact of underwater noise on fish and sea turtles. The guidelines provide received level thresholds related to four levels of impact: mortality or potential mortal injury (PMI), recoverable injury (RI), TTS, and behavioural disturbance. These thresholds are available for specific types of impulsive and continuous sources and various hearing groups, including sea turtles and four fish categories: fish without swim bladder (FNSB) only sensitive to particle velocity, fish with swim bladder primarily sensitive to particle velocity (FSBV), fish with swim bladder primarily sensitive to sound pressure (FSBP), and fish eggs and larvae (FEL). Impulsive sources use a dual impact criteria that includes peak sound pressure level $L_{p,pk}$ and 'unweighted' cumulative sound exposure level $L_{E,p,24h}$. For continuous sources, the sound pressure level $L_{p,rms}$ is used instead. These thresholds were used to estimate the impact ranges associated with the proposed activities in the Fotla field for the various categories of fish and impact levels.

Table 12.6 summarises the impact ranges for fish from piling, drilling, trenching, pipe laying, and support vessel operations. Percussive piling presents the highest risk to physical and physiological impact on fish from all the evaluated sources. Piling will induce potential mortal injury within 64 m of the pile for pressure-sensitive species (FSBP, FSBV), as well as eggs and larvae (FEL). The PMI is related to the $L_{p,pk}$ metric and is therefore attributed to the sudden increase in sound pressure. The PMI impact range for FNSB is 25 m, less than half the value for pressure-sensitive groups. TTS onset from cumulative exposure will occur for all species of adult and juvenile fish within 761 m from the pile.

The continuous underwater sound sources present a comparatively lower risk to fish. Drilling can result in TTS for the FSBP group only within 6 m from the sound source, with negligible risk for RI. For the other categories of fish, there is only a 'moderate' risk for TTS within tens of metres from the source, with 'low' risk for longer distances. For the other continuous sources (trenching, pipe laying, support vessels), the RI impact range for the FSBP category is only 6 m, with TTS onset occurring within 25 m from the source. For the other fish categories, TTS is considered 'moderate' within tens of metres from the source, with the risk for RI likely to be 'low'. The risk of mortality (PMI) is considered 'low' at any distance from a continuous source.

Table 12.6 PMI, RI, and TTS noise impact ranges (in meters) for fish as a result of exposure to sounds from impact piling, drilling, pipe installation, and vessel activity in the Fotla field.

Source	Impact Level	Acoustic Metric	FNSB	FSBV	FSBP	FEL
Impact Pile Driving	PMI	$L_{p,pk}$	25	64	64	64
		$L_{E,p,24h}$	<2.5	7	14	7
	RI	$L_{p,pk}$	25	64	64	NA
		$L_{E,p,24h}$	<2.5	35	35	NA
	TTS	$L_{E,p,24h}$	761	761	761	NA
Drilling	RI	$L_{p,rms}$	NA	NA	<2.5	NA
	TTS	$L_{p,rms}$	NA	NA	6	NA
Trenching, Pipe Laying, Vessels	RI	$L_{p,rms}$	NA	NA	6	NA
	TTS	$L_{p,rms}$	NA	NA	25	NA

Notes:
The last four columns represent the fish functional hearing groups (FHG) that may be present in the wider Fotla area → Fish without swim bladder sensitive to particle velocity (FNSB), fish with swim bladder *mainly* sensitive to particle velocity (FSBV), fish with swim bladder *mainly* sensitive to sound pressure (FSBP), and fish eggs and larvae (FEL).
$L_{p,pk}$ is the peak sound pressure level in dB re 1µPa, $L_{E,p,w,24h}$ is the 24-hour weighted cumulative sound exposure level in dB re 1µPa^{2}s, and $L_{p,rms}$ is the root mean square sound pressure level in dB re 1µPa.
Cells highlighted in green indicate the worst-case impact range (i.e., the highest of the two metrics for dual impact criteria).
Cells greyed out indicate a *null impact* (i.e., no PMI, RI, or TTS for the specific source and FHG).

Given the limited spatial extent of the anticipated physical injury impacts (PMI, RI) as well as other physical and physiological impacts, in combination that fish have the capability to temporarily avoid areas of adverse noise further reducing the zone of exposure for TTS (see Section 12.3.2.3), the magnitude of effect can be considered as '**Minor**'. The receptor value of the fish species present in the Fotla area can be considered as '**Medium**'. Consequently, the resulting predicted effect of the proposed piling, drilling, trenching, pipe laying, and vessel operations is '**Minor adverse**', and therefore not significant.

12.3.2.3 Behavioural Disturbance of Fish

The effect of piling operations on fish is strongly related to their life cycle stage. Adult and juvenile fish are rarely affected by piling operations (Harding et al., 2016; Ruggerone et al., 2008; Knudsen et al., 1992), because they are able to detect and physically avoid the area, but fish eggs and larvae may be more vulnerable. Fish can detect impulsive sound sources over large distances (up to 30 km), yet they seldom react to the sound before it is above a certain threshold. Alarm responses in adult or juvenile fish can be expected at distances of 1 km to 5 km from the piling operations, depending upon their auditory thresholds and the level of sound transmission loss (Nakken, 1992). Furthermore, if fish are disturbed by sound, evidence suggests they will return to an area within hours or days once the activity causing the disturbance has ceased (Slabbekoorn et al., 2010; Popper & Hawkins, 2019).

The limited period over which the piling will take place and the ability of fish to temporarily avoid areas of adverse noise led to considering the magnitude of effect of behavioural disturbance from noise as '**Minor**'. The receptor value of the fish species present in the Fotla is judged to be '**Medium**'. Consequently, the resulting predicted effect significance of behavioural disturbance from the proposed piling operations is '**Minor adverse**', and therefore not significant.

12.4 In-combination, Cumulative and Transboundary Impacts

Noise is transmitted through water very efficiently and may be detectable over many kilometres from its source. This has led to concern that increasing anthropogenic activity in the sea, and consequent increasing noise levels, may have effects on marine mammals through disturbance of their communication, mating, nursing, and foraging activities, as well as a permanent or temporary alteration of their hearing response. The potential outcomes of having multiple noise sources in the sea include more frequent masking, behavioural disruptions and short-term displacement. Prolonged or repeated disturbance is generally considered to be of more concern than isolated short-term disturbance, although some prolonged or repeated disturbance could potentially be mitigated by a certain level of habituation.

The long term, synergistic and cumulative impact of sound sources is not known, and the introduction of additional low frequency noise into the marine environment from Fotla manifold anchor piling, drilling, trenching, pipe laying, and vessel operations should be considered to have the potential to contribute to the overall cumulative effect of anthropogenic generated underwater noise. However, the risks in this instance are considered to be low as piling noise will be transitory, with the installation of the Fotla manifold anchor piles and SSIV riser lasting 8 days. Operational noise from specialised and support vessels will be low and intermittent, with sound level values comparable to those from widespread marine vessel activities and commercial shipping.

With regard to potential transboundary effects, the proposed piling operations will be undertaken over 46 km west of the UK/Norway transboundary line. Although underwater sound produced during the planned piling may have the potential to travel into Norwegian waters, at these distances the sound levels will have attenuated to such a low level, that no observable effects would be expected to occur.

Therefore, no significant cumulative and/or transboundary impacts from noise generated during the proposed piling, drilling, trenching, pipe laying, and support vessel operations associated with the proposed Fotla field development. No potentially significant in-combination effects were identified which would justify further assessment, beyond the individual effects that have already been considered in this section, as this would not alter the conclusions reached.

12.5 Mitigation Measures

The piling activities associated with the installation of the Fotla manifold will produce high, impulsive sound levels taking place over a limited period of 8 days. Therefore, any noise associated with the operations will be transitory.

The planned piling operations will be conducted in accordance with the JNCC Protocol for minimising risk of injury to marine mammals from piling noise (JNCC 2010b) at all times. This will include the use of a trained and dedicated marine mammal observer (MMO) to undertake marine mammal monitoring duties before any piling operations commence ('pre-piling search'), including breaks in piling activity. If visibility is poor during the piling operations, a Passive Acoustic Monitoring (PAM) system may be used. A mitigation zone of 500 m will be put in place for the piling operations.

A 'soft start' procedure will also be applied during piling operations and after any interruptions over ten minutes in duration. During a typical soft start, the strike energy and blow rate will be gradually increased over a period of 20 minutes, from 10 % to 85 % of the full strike energy envisaged for the main piling phase. An average piling rate of one blow every two seconds (< 0.5 blows/s) during the soft-start will be sufficient to reduce TTS impact ranges for the most sensitive marine mammals to distances within the mitigation zone (< 500 m). This will allow any marine mammal in the area, and specifically low frequency cetaceans, to move away from the source to avoid any potential TTS thresholds being breached as a result of cumulative exposure. The hammer energy, blow rate, and duration of the soft start sequence will be selected to meet operational requirements while minimising cumulative acoustic radiation and providing effective deterrence.

12.6 Conclusions

Anthropogenic noise from shipping and existing oil and gas operations is currently believed to be the main source of anthropogenic background noise in the area of the proposed Fotla field. During the scoping phase of this ES, the piling operations associated with the installation of the Fotla manifold anchor piles, along with operations related to the pipeline installation campaign (trenching, pipe laying, rock placement) and activity from specialised and support vessels, were identified for further assessment.

No physiological effects on marine mammals were predicted for noise from continuous sources such as drilling, trenching, pipe laying, and support vessel activities.

Ithaca Energy will adopt the measures outlined in Section 12.5, to avoid any potential temporary (TTS) or permanent (PTS) impact thresholds being breached as a result of impact pile driving. The implementation of a ‘soft start’ during piling will limit any PTS and TTS impact to ranges (particularly those for baleen whales) to be within the 500 m mitigation zone. With these proposed mitigation in place, no physiological effects are expected from the piling operations either.

Ongoing operations in the area may cause some level of temporary avoidance responses however, as well as other, more subtle, behavioural reactions in cetaceans within 2.4 km, with similar ranges estimated for pinnipeds (1.65 and 2.88 km).

In conclusion, the underwater noise generated during the drilling and installation operations of the Fotla field development will not result in any significant impacts.

Any cumulative underwater noise effects will be limited to the drilling and installation phase only, and therefore will be transient and minimal in magnitude. Consequently, no significant cumulative effects are anticipated. Given the distance to the nearest transboundary line (46 km), no transboundary impacts are forecasted.

13. Waste Management

13.1 Introduction

The management of waste produced offshore on the UK Continental Shelf (UKCS) is regulated through a framework of international and national legislation. Waste from offshore vessels and facilities is primarily regulated by the Merchant Shipping (Prevention of Pollution by Sewage and Garbage of Ships) Regulations 2008. These Regulations implement both the revised Annex IV of MARPOL 73/78 – Regulations for the Prevention of Pollution by Sewage from Ships, and the Annex V of MARPOL 73/78 (including amendments) – Regulations for the prevention of Pollution by Garbage from Ships. These Regulations prohibit the disposal of any garbage (including plastics) and galley waste (except for ground food waste to < 25 mm and treated sewage) from any offshore installations or vessels. Once transported onshore, waste management is regulated by the Environment Protection Act 1990, which sets out Duty of Care requirements for the containment, transfer, handling, and recording of all onshore waste through appropriately licensed carriers holding a Waste Carrier Registration.

All wastes associated with the Fotla field development will be managed in accordance with Ithaca Energy's Waste Management Procedure and via the existing waste management contracts. This procedure establishes the controls required to manage the hazards associated with the transportation and disposal of waste from offshore sites as well as the processes and verification activities necessary to ensure legal obligations are satisfied.

Waste handling onboard the mobile offshore drilling unit (MODU) and any associated support vessels will be the responsibility of the MODU/vessel contractors. However, Ithaca Energy will ensure that the collection, handling, and disposal of all waste generated by the Fotla field development is achieved, in compliance with current environmental legislation and Ithaca Energy's procedures.

Waste management onboard the Britannia platforms is covered under Harbour Energy's own waste management procedures and managed by their appointed waste contractors.

13.2 The Waste Hierarchy

Ithaca Energy is committed to reducing waste production and to managing all produced waste by adhering to the waste hierarchy as presented in Figure 13.1. The waste hierarchy ranks waste management options according to the best environmental outcome, taking into consideration the lifecycle of the material. The lifecycle of a material is an environmental assessment of all the stages of a product's life from-cradle-to-grave (i.e. from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling). Waste will only be disposed of if it cannot be prevented (also referred to as reduced), re-used, recycled or recovered.

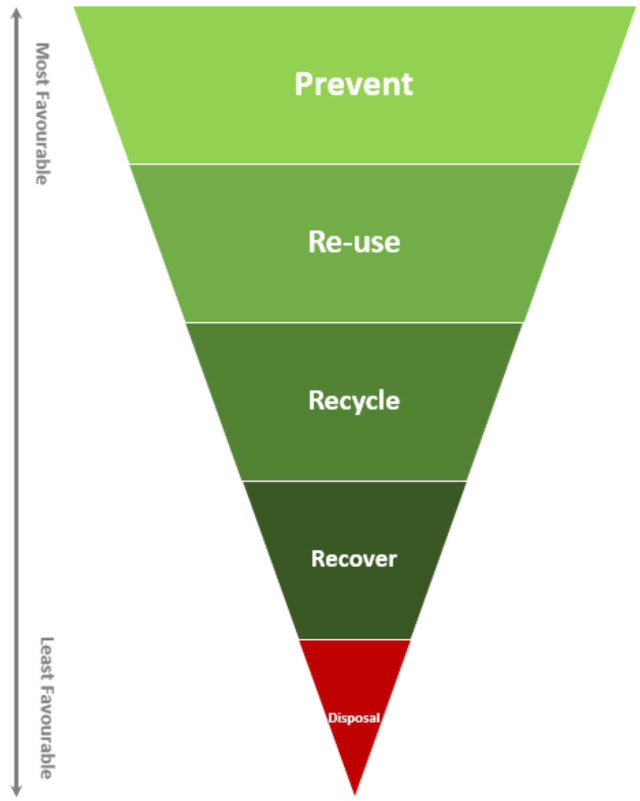


Figure 13.1: Waste hierarchy

In its simplest form, the waste hierarchy gives top priority to preventing (or reducing) waste. When waste is created, it gives priority to preparing it for reuse, then recycling, then other recovery, and last of all disposal (i.e. landfill). For example, one tonne of food waste in landfill produces 450 kg CO_2eq (equivalents), whereas preventing one tonne of food waste saves 3,590 kg CO_2eq. The benefits of selecting options higher up the hierarchy also extend beyond carbon savings and include reduced water consumption, protection of important raw materials, creation of jobs, and other economic opportunities (Scottish Government, 2017).

13.3 Waste Disposal Management

The eventual disposal of any waste is intrinsically related to its nature. All waste produced as part of the development will be minimised through appropriate procurement controls and will be properly segregated for recycling, disposal, and treatment. Bulk wastes generated offshore will be segregated by type, and periodically transported to shore for disposal or recycling in an auditable manner through authorised waste contractors.

The amount and disposal routes of all atmospheric emissions, liquid discharges, and solid wastes will be recorded in the UK Environmental Emissions Monitoring System (EEMS) according to the following categories:

- Group I: Special waste, such as oils, paints, adhesives, solvents, surplus chemicals, etc., and these are mainly recycled;
- Group II: General waste, including non-hazardous workover / completion / drilling fluids, brines, galley waste, accommodation waste, compactor waste, and much of this has to

go to landfill. Segregated materials such as scrap metal, plastics, aluminium cans, paper / cardboard, glass, cooking oil, and clean wood are recycled;

- Group III: Other waste, including asbestos, clinical materials, and explosives;
- Group IV: Backloaded cuttings, such as oil-based mud (OBM) or synthetic based mud (SBM) cuttings backloaded for treatment, as well as water based mud (WBM) drill cuttings backloaded for disposal onshore. In this group are also included any solid material (e.g. powder or stabilised products) generated by the treatment process, oil recovered from the backloaded cuttings through the treatment process, and water separated from the oil and solids through the cuttings treatment process; and
- Group V: Naturally occurring radioactive material (NORM) from mineral scales which build up in processing equipment and pipework (generally from production installations only).

Any onshore waste disposal will be undertaken at appropriate licensed sites through suitably licensed waste disposal contractors.

13.3.1 Waste Sources and Management

Ithaca Energy is responsible for ensuring that waste is transferred to disposal contractors in possession of a Waste Carrier Registration. All controlled waste being transferred onshore is required to have a completed Transfer Note, whilst special waste requires a Consignment Note. These Notes provide details on the type and quantity of waste that is being transferred, the parties involved in the transfer of waste, the category of authorised person in receipt of the waste, licence numbers, and time, place and date of transfer.

13.3.1.1 Vessel Waste

Waste will be generated onboard all vessels associated with the proposed activities including the MODU, support vessels and subsea installation vessels. All wastes will be managed in compliance with the framework of Regulations discussed above and in line with individual vessel specific Waste Management Plans (WMPs). Generally. waste will be segregated and stored in suitable, labelled containers on the vessels and will be discharged in line with MARPOL 73/78 requirements or transferred to shore in skips and / or containers where it will be disposed of appropriately.

Offshore vessels of 400 gt and above, and every ship certified to carry 15 or more persons, must have a Garbage Management Plan (GMP) (per guidance in Merchant Shipping Notice No.1807) and Garbage Record Book. Solid domestic waste will normally be compacted with a garbage compactor, placed in disposal bags and returned to the mainland in waste skips. Open skips will be netted and lidded skips will be used for drill cuttings (if required). Separate storage areas will be provided for solid and liquid waste that can be reused. Waste storage areas will be well ventilated and bunded with drainage to appropriate storage or treatment areas. Hazardous waste containers will be covered to reduce rainwater contact in the containment structure. Furthermore, segregation of recyclable materials will be implemented to avoid contamination and consequent reduction of the quality of recycled products.

13.3.1.2 Drilling Waste

Drilling rigs generate various waste products during routine operations (e.g. drill cuttings, excess cement, used drilling fluids and chemicals), in addition to waste generated from the everyday running of the MODU (e.g. general waste, food waste and sewage). Wastes will be minimised by use of appropriate procurement controls, and all wastes will be segregated for recycling, disposal, and / or treatment. The appointed waste management contractor will supply monthly reports of waste sent to shore and will complete Controlled Waste Transfer Notes as required, and records of monthly disposals will be maintained. Waste Management Duty of Care audits will also be carried out.

Oily waste will be generated on the MODU by a variety of sources, including waste engine and hydraulic oil. All waste oil will be held in designated storage tanks onboard the MODU. The volumes of waste oils kept onboard will be kept to minimum before being transferred to shore, keeping the possibility of spillages to a minimum. No sludge or waste oil will be discharged to sea.

13.3.1.3 Installation and Commissioning Waste

Several waste streams are expected to arise during installation and commissioning including scrap metal, wooden crates, etc. All wastes will be segregated in accordance with Ithaca Energy's Waste Management Procedure and Controlled Waste Transfer Notes will be completed.

13.3.1.4 Production Waste

The Britannia installations comply with Harbour Energy's waste management procedures. Controlled Waste Transfer Notes will continue to be completed as required and records on monthly waste disposal activities will be maintained. The proposed Fotla field development is not expected to result in a change to the current waste streams occurring at the Britannia installations.

13.3.1.5 Decommissioning Waste

Any waste generated during the decommissioning stage and the most appropriate disposal option(s) will be identified and discussed in a dedicated WMP. Where possible, materials will be sold for reuse or recycled in accordance with the waste hierarchy. All recovered waste will be brought to shore to a licenced decommissioning facility. It is expected that the majority of the recovered materials will be reused or recycled.

13.4 Mitigation Measures and Best Practice

The management of offshore waste generated on the UKCS is strictly regulated, ensuring a high level of mitigation from the outset, and as described above. Ithaca Energy ensures successful implementation of the mitigation and industry best practice measures regarding waste management as follows:

- Application of the Waste Hierarchy to all produced waste;
- Compliance with Ithaca Energy's WMP and use of a GMP for the management of waste produced from vessels;
- Compliance with Ithaca Energy's Waste Management Procedures for waste produced during the proposed development activities;
- Compliance with Harbour Energy's Waste Management Procedures for the management of waste produced on Britannia installations;
- Segregation, transfer onshore and disposal of waste through licensed contractors and sites; and
- Reporting of all waste generated offshore will be recorded in the UK EEMS.

13.5 Conclusion

Several different waste streams will be generated throughout the development's lifespan. Waste management will be undertaken in compliance with current environmental legislation and the company's own waste procedures which includes the waste hierarchy, as described above. The management of offshore waste generated on the UKCS is strictly regulated and the UK has well-established infrastructure in place to manage this waste effectively. Therefore, no significant impacts (including in combination, cumulative or transboundary impacts) are anticipated as a result of the Fotla field development.

14. Accidental Events

14.1 Sources of Hydrocarbon Spill

The risk of an accidental hydrocarbon spillage to sea is often one of the main environmental concerns associated with drilling and production activities. Spilled oil at sea can have a number of environmental and economic impacts, the most conspicuous of which relate to seabirds and coastal areas. The severity of the impact of an accidental spill event depends on many factors, including the volume and type of hydrocarbon spilled, the sea and weather conditions at the time of the spill, the sensitivity of receptors and the efficiency of the ensuing oil spill response.

The following accidental events associated with the proposed development were identified as having the potential to cause an oil spill:

- Uncontrolled well blow-out; and
- A fuel oil spillage (diesel release) from an installation vessel, support vessel, supply vessel, the Mobile Offshore Drilling Unit (MODU) or a helicopter.

A crude oil spill from either a well blow-out, or diesel release from the MODU, have been identified as the two worst-case oil spill scenarios and could potentially result in a Major Environmental Incident (MEI).

14.1.1 Potential Crude Oil Spillages - Uncontrolled Well Blow-out

During drilling operations, a well blow-out would theoretically represent the largest potential source of a large hydrocarbon spill. For a blow-out to occur, the primary well control element, the hydrostatic pressure exerted by the drilling mud, would have to be overcome by the inflowing hydrocarbons. The secondary well control measure, the blow-out preventer (BOP), would also have to fail closing off the well. The actual flow rate and duration of any such event, and hence the severity of the incident, are dependent upon the pressure and geology of the well, which vary with each well.

The flow rate encountered during an uncontrolled blow-out event may be very different from that expected during production, as there may be no equipment, or other measures in place to restrict the flow. To consider the worst-case scenario, it was assumed that there would be no physical restriction to the flow inside the well, such as drill string, or tubing, obstructing the wellbore, chemical build-up coating in the wellbore, or damaged wellhead and well control equipment on top of the well.

14.1.2 Potential Diesel (Fuel Oil) Spillages

Diesel will be the main power source for the MODU and vessels utilised in support of the Fotla field development, such as Anchor Handling Vessels (AHV) and support vessels. The largest volume of diesel will be stored in fuel oil tanks on the MODU. The worst-case diesel spill scenario is considered to be the complete loss of the diesel inventory from all of the fuel tanks on the MODU.

Smaller diesel spills can result from equipment failures, such as the rupture of pipes, or open valves. Small spills most frequently occur during bunkering operations and are generally caused by hose failures (Section 14.2.3). Diesel will be transferred from a supply vessel to the MODU as needed during the drilling operations, via a flexible hose. No other vessels will require bunkering, whilst infield. As the hose is suspended between the two vessels, there is the potential for a direct diesel release to sea, if the hose or any of its connections are damaged during the bunkering operations.

14.1.3 Other Potential Sources of Oil

As detailed in Sections 1 (Introduction) and 4 (Project Description) of this Environmental Statement (ES), the specific MODU which will be used to drill the two production wells the Fotla field has not been confirmed and a final decision concerning MODU selection will be taken at a later stage in the project's development. For the purposes of this assessment, information and a generalised inventory of hydrocarbons for a representative semi-submersible MODU previously on hire to Ithaca and is presented here.

The fuel storage capacity of the representative MODU including pontoons and surface fuels is estimated to be 3,468 m^3. Ithaca Energy plans to use low toxicity oil-base muds (LTOBM) to drill the lower sections of the two wells. As described in Section 4.5.5 (Table 4.7) the LTOBM contaminated cuttings may either be contained and shipped onshore for appropriate treatment and disposal or may be thermally treated offshore and disposed to sea, depending on the availability of a suitable drilling unit at the time of drilling.

If the LTOBM are to be contained on the MODU they will be stored in dedicated mud tanks. Based on other MODU inventories, it can be assumed that the overall volume of LTOBM held onboard the MODU will total approximately 500 m^3. Lubricating and hydraulic oils are stored separately in tanks or sealed drums. Storage tanks for lubricating oil range in size, but each will normally contain a maximum of 15 m^3, while hydraulic oils are stored in smaller 2 m^3 tanks. Additional oils may be transported and stored in sealed 0.025 m^3 or 0.21 m^3 drums, or 1 m^3 tote tanks. Approximately 12 m^3 of aviation fuel will also be held on the MODU. All oils will be stored in dedicated, bunded storage areas, with oil spill kits located nearby. Therefore, the possibility of a spillage to sea from any of these sources is considered to be very small.

Waste oil will be generated onboard the MODU from a variety of sources, including waste engine, gear and hydraulic oil. These waste oils will be held in designated storage tanks and their volumes kept to a minimum before being transferred to shore on regular intervals for appropriate treatment and disposal.

The quantities of LTOBM, lubricating, hydraulic and waste oil stored onboard the MODU will be very small in comparison to the main fuel supply. The probability of any spillages from any of these sources is considered to be minimal, as the containers are relatively small, sealed and stored in bunded areas. Therefore, the risk to the environment from these oils is regarded as negligible and is not considered further within this section.

14.2 Likelihood of a Hydrocarbon Spill

14.2.1 Mobile Operated Drilling Unit (MODU) Release

Historical data, covering the period between January 1990 and December 2024 indicates that the possibility of a large hydrocarbon spill from a MODU operating on the United Kingdom Continental Shelf (UKCS) is very low. As shown in Figure 14.1 (Fugro, 2025b), most spillages from MODUs are attributable to release of hydraulic/lube oils (241), crude oils (236) and Oil Based Muds (OBM)/Base oils (236). However, these are typically very small spillages. There have been 19 spills over 25 tonnes between 1990 and 2024 (Fugro, 2025b).

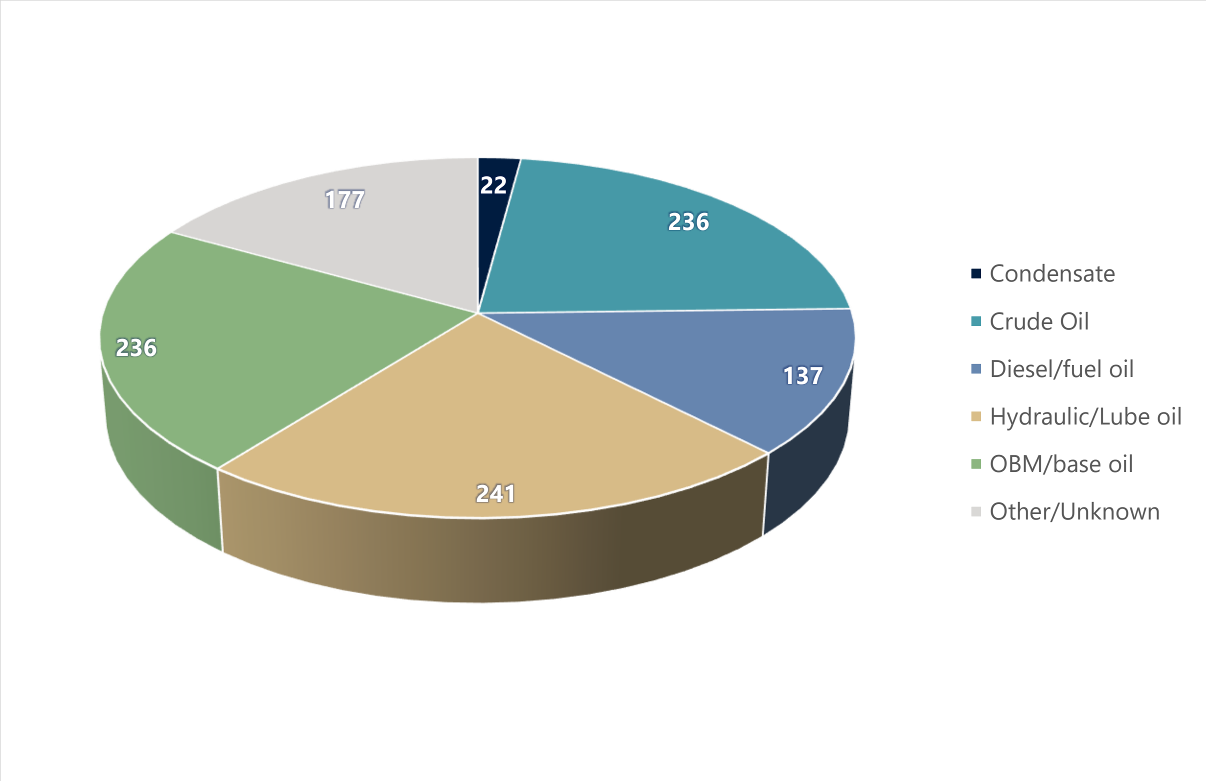


Figure 14.1: Number of oil spills on the UKCS from MODUs between 1990 and 2024 (Fugro, 2025b)

14.2.2 Uncontrolled Well Blow-out

The likelihood of an uncontrolled well blow-out event occurring is very low. Well blow-outs resulting in the uncontrolled release of hydrocarbons have happened too infrequently on the UKCS for a meaningful analysis of the historic frequency to be carried out. However, the International Association of Oil and Gas Producers (IOGP) has released international well blow-out frequency data based upon historical datasets compiled by SINTEF (worldwide; 1980 to 2014) and Lloyds Register (North Sea; 1980 to 2014 and USA Gulf of Mexico; 1980 to 2011). The frequency data indicate that, overall, the possibility of a blow-out and well release occurring during offshore drilling operations is very low (IOGP, 2019). The frequency of occurrence of a blow-out for the average exploration well on the UKCS at normal pressure is

1.4×10^{-4}, or one blow-out for every 7 142 wells. The frequency of occurrence for any release of reservoir oil is 1.2×10^{-3}, or one release for every 833 wells.

The IOGP data includes releases of all sizes, and therefore does not present an analysis of what proportion of such incidents result in significant oil pollution events. However, only a very small proportion of blow-outs would be expected to result in a significant release. It should also be noted that the majority of the data was collected prior to the Gulf of Mexico Macondo event in 2010, and that significant improvements in offshore safety and blow-out prevention have since been implemented across the industry as a result of this event. Therefore, these frequency estimates should be viewed as conservative.

The following paragraphs give a brief overview on historic well control events on the UKCS.

Prior to 1990, only two significant uncontrolled blow-outs occurred in the North Sea. These events occurred during drilling operations on the West Vanguard semi-submersible on the Norwegian continental shelf and on the Ocean Odyssey semi-submersible on the UKCS, during 1985 and 1988 respectively (DTI, 2007). Both blow-outs involved gas and did not result in hydrocarbon spills to sea. In addition, lessons learnt from these events resulted in major legislative and operational changes for offshore drilling on the UKCS to prevent such events from happening again.

Between 1990 and 2007, a total of 343 well control incidents were recorded from MODUs (both drilling and production). These incidents included several issues of varying severity, but only 17 resulted in loss of well control. This translates to 0.00004 incidents per rig day. Furthermore, none of the 17 recorded incidents resulted in an uncontrolled well blow-out with a crude oil spill of any size (OGUK, 2009).

The most recent well control incident in the North Sea involved a gas and condensate blow-out from Well 22/30c-G4, located close to the Elgin Platform, in March 2012. This incident resulted in the temporary cessation of production from the Elgin/Franklin area.

The worst-case scenario, an uncontrolled well blow-out, will only occur as a result of a major accident, such as hydrostatic pressure exerted by the drilling mud. The probability of such an event occurring is very low.

14.2.3 Diesel Spill

Diesel spills from mobile drilling units have accounted for 137 oil spill incidents (13 %) on the UKCS from MODUs from 1990 to 2024 (Fugro, 2025b) (Figure 14.1). Diesel will be the main fuel used for power generation during the proposed drilling operations. Historical oil spill data indicate that the probability of a diesel spill is 0.0002 spills per day. When extrapolating this probability to the Fotla field, this equates to a probability of 4.7 % of a diesel spill occurring from the MODU during the drilling operations (Fugro, 2025b; HSEx, 2007).

Spill records indicate that most diesel spills occur during bunkering operations and that they are mostly caused by hose failures. Therefore, the volumes of diesel spilled tend to be relatively small. For example, of the 137 recorded diesel spills, 128 (93 %) were less than 1 tonne (Fugrob, 2025). If a diesel spill of this size were to occur, it is likely that only onsite response personnel and equipment would be required to control the incident, due to the tendency of diesel to evaporate and disperse relatively quickly from the sea surface (see Section 14.3). Only 9 of the recorded diesel spills were greater than 1 tonne.

14.3 The Fate and Behaviour of a Hydrocarbon Spill at Sea

Oil characteristics, spill location and the wave, wind and current conditions all govern the fate of spilled hydrocarbons. The behaviour of hydrocarbons when released from the sea surface and from the seabed are described in the following section. During the proposed drilling operations, it is expected that the most likely release point for reservoir hydrocarbons (crude oil) would be at the seabed. Meanwhile, the most likely release point for a spill of diesel from the MODU storage tanks would be at the sea surface.

The fate of hydrocarbons spilled at sea is relatively well understood. As soon as oil is released, the weathering process begins, and the oil begins to move across the sea surface. Oil characteristics, spill location and wave and wind conditions govern the fate of the spilled oil. These processes are described in Section 14.3.1 below.

14.3.1 Oil Spill Movement

14.3.1.1 Spreading

Due to the influence of gravity, oil starts to spread out over the sea surface as soon as it is spilled. Oil slicks can spread very quickly to cover extensive areas of the sea surface, the speed of which depends mainly on the viscosity of the oil. Lighter oils spread out more quickly than heavier crudes. Although a spill will spread quickly in the first few days, the processes of evaporation and dispersion quickly remove the lighter, more volatile and water soluble, fractions of a slick from the sea surface. Then, as only the heavier, more viscous fractions are left, slick spreading will slow down.

Initially an oil spill will spread out as a single slick, covering an increasingly larger area while the slick becomes correspondingly thinner. However, as the slick spreads further, it will start to break up into smaller breakaway slicks due to the wind and water movement. Wind and wave conditions in the central North Sea (CNS) can be regarded as dynamic, due to a combination of the relatively high wind speeds and increased water movement, created by a combination of the wind speed and tidal movements across the region. As such, it is expected that a large oil slick in this area would tend to break up quickly into smaller patches.

14.3.1.2 Direction of Movement

Wind and surface current speed and direction are the main parameters influencing the movement of an oil slick. Any oil slick will travel roughly at the same speed and direction as the surface water current, while the prevailing wind drives a slick downwind at 3 % to 4 % of the wind speed.

Currents in the CNS circulate in an anticlockwise direction, with cold Atlantic waters flowing to the south-east and warmer North Sea waters flowing to the North (Section 5.2.1). In the area around the Fotla field, currents predominantly move to the north-east, suggesting that any slick occurring in the surface waters would move with the dominant current in this direction.

Offshore winds in the area are very variable, but they mostly originate from the north-west and south to south west (Section 5.2.1.1). Under these conditions it would be expected that a slick occurring on the sea surface would typically move to the north-east and east.

14.3.2 The Weathering Process

When oil is released into the marine environment it undergoes a number of physico-chemical changes, some of which assist in the degradation of the spill, while others may cause it to persist. These changes are dependent upon the type and volume of oil spilled, and the prevailing weather and sea conditions. An overview of the main processes influencing the fate and behaviour of spilled oil at sea is given in Figure 14.2. Evaporation and dispersion are the two main mechanisms that act to remove oil from the sea surface.

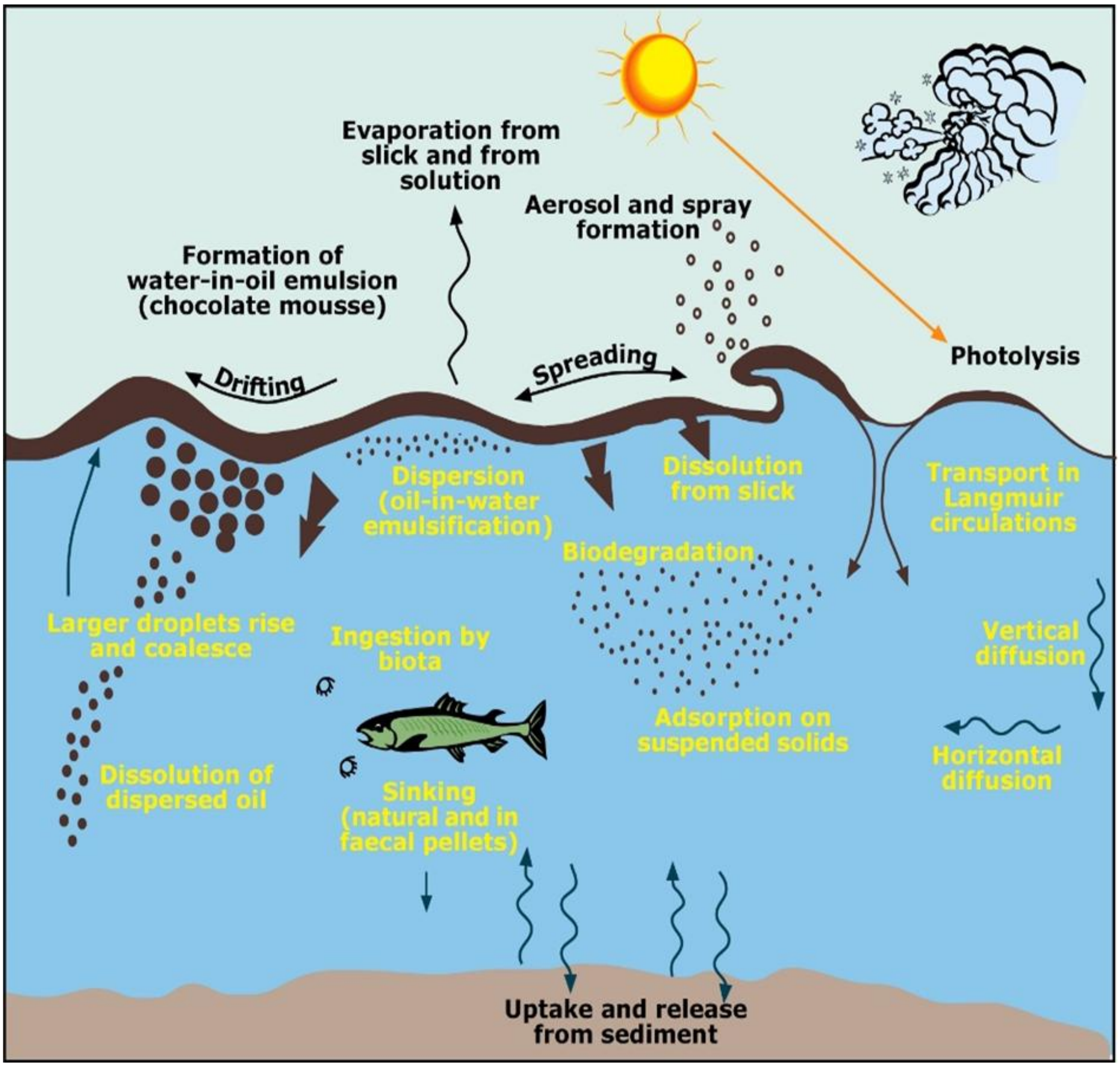


Figure 14.2: Fate and behaviour of spilled oil at sea

14.3.2.1 Evaporation

Following a hydrocarbon spill, evaporation is the initial predominant mechanism of reducing the mass of oil, as the light fractions (including aromatic compounds such benzene and toluene) evaporate quickly. Evaporation can cause considerable changes in the density, viscosity and volume of the spill. If the spilled oil contains a high percentage of light hydrocarbon fractions, a large part of it will evaporate relatively quickly in comparison to heavier oil.

Diesel displays very high evaporative losses upon exposure to air. Under ideal environmental conditions, i.e. a warm, sunny day with only moderate wind, a large proportion of the spill volume may be lost by evaporation in the first few hours after release. The evaporation process will be enhanced by warm temperatures and moderate winds.

14.3.2.2 Dispersion

After the light fractions have evaporated from the slick, natural dispersion becomes the dominant mechanism in reducing slick volume. The speed at which oil disperses is largely dependent upon the nature of the oil and the sea state. Lighter and less viscous oils tend to have more water-soluble components, allowing them to mix and remain suspended within the water column.

The process of dispersion is dependent upon waves and turbulence at the sea surface, which can cause a slick to break up into fragments and droplets of varying sizes. This turbulence mixes these droplets into the upper levels of the water column, where some of the smaller droplets will remain suspended, while the larger ones will tend to rise back to the surface. Therefore, rough seas will break up a slick and disperse the oil at a faster rate than calm seas. There have been incidences of large oil spills being broken up and dispersed into the water column during large storm events, with little visible effect on the surrounding environment. As oil droplets are dispersed into the water column, the oil has a greater surface area which encourages the natural processes of dissolution, biodegradation and sedimentation.

Water movement at the sea surface is affected by wind speed. The CNS is an active environment, with relatively high average wind speeds. Predominant wind speeds throughout the year represent moderate to strong breezes (6 m/s to 13 m/s) (Fugro, 2023), with the highest frequency of gales (wind speeds greater than 17.5 m/s) occurring in the winter months (November to March) (DTI, 2001a).

Water movement and wave size is also related to fetch, the distance over which the wind can blow without being interrupted. The enclosed environment of the North Sea therefore limits the size of waves here to a certain extent.

14.3.2.3 Emulsification

The immiscible components of an oil spill may either emulsify and disperse as small droplets in the water column (an oil-water emulsion; Rhein, 2007) or aggregate into tight water-in-oil emulsions, often referred to as 'chocolate mousse'. The rate at which this happens, and the type of emulsion formed, is dependent upon the oil type, sea state and the thickness of the oil slick. Large, thick oil slicks tend to form water-in-oil emulsions, while smaller thinner slicks tend to form oil-in-water emulsions that usually disappear by natural dispersion. In practice, usually only one of the two processes will dominate.

When a water-in-oil emulsion (chocolate mousse) is formed, the overall volume of the slick increases significantly, as it may contain up to 70 % or 80 % water (Stout & Wang, 2016). This chocolate mousse will form a thick layer on the sea surface reducing slick spreading and inhibiting natural dispersion. The formation of this thick layer causes the surface area available to weathering and degradation processes to diminish, which can make 'chocolate mousses' difficult to break up using dispersants. In their emulsified form, and with their drastically increased volume, they can also cause difficulties for mechanical recovery devices. A water-in-oil emulsion is therefore very unlikely to occur in diesel spills, for example.

14.4 Oil Spill Modelling

The amount of time a hydrocarbon spill remains on the sea surface before becoming insignificant, and the extent to which it spreads from the point of release, may dictate the severity of any impacts on the marine life, particularly seabirds. Whether it reaches the shore is also a major consideration, due to the sensitivity of the nearest coastline of northeast Scotland (Peterhead), and the additional clean up resources required. Modelling was conducted to provide information on whether a spill might beach, and if so, how much time this would take. In view of this, the end points for the oil spill risk assessment are considered to be:

- Probability of oil reaching a shoreline, or crossing a median line to reach international waters; and
- Minimum time taken for oil to reach a shoreline, or crossing a median line to reach international waters.

Stochastic oil spill modelling has been conducted to assess these two criteria. Stochastic oil spill modelling is based on actual statistical wind speed and direction frequency data and provides a probability range of sea surface oil and beaching, representative of the prevailing conditions.

As discussed in Section 14.1, the two scenarios which may result in a large release of hydrocarbons to sea are:

- Spillage of hydrocarbons in the event of an uncontrolled well blow-out; and
- Rupture of fuel oil tanks on the MODU leading to a loss of inventory.

All modelling has been undertaken using SINTEF's Oil Spill Contingency and Response (OSCAR) model (version 14.1.0) for both the well blow-out and MODU release scenarios (OSRL, 2024). Oil spill modelling for both scenarios was undertaken for all four seasons i.e. winter (December to February), spring (March to May), summer (June to August) and autumn

(September to November). As drilling and production operations are proposed to take place throughout the year this provides a range of risk profiles throughout the year.

14.4.1 Uncontrolled Well Blow-out

The parameters used in modelling an uncontrolled well blow-out at the Fotla field are detailed in Table 14.1. The results of the well blow-out modelling scenario are provided in Table 14.2 and Table 14.3. Minimum arrival time of surface oiling is shown in Figure 14.3 and the probability of surface oiling in Figure 14.4. It should be noted that surface oiling is shown with a thickness threshold of 0.3 µm (equal to 0.0003 mm), in accordance with the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED's) oil spill modelling requirements. Potential impacts relating to the modelling results are described in Section 14.5.

According to OSRL (2024), the fastest oil to shore (UK coastline) resulting from an uncontrolled well blow-out occurs during spring and within 23 days, 6 hours.

Table 14.1: Summary of stochastic setup for spill scenarios associated with the Fotla field development

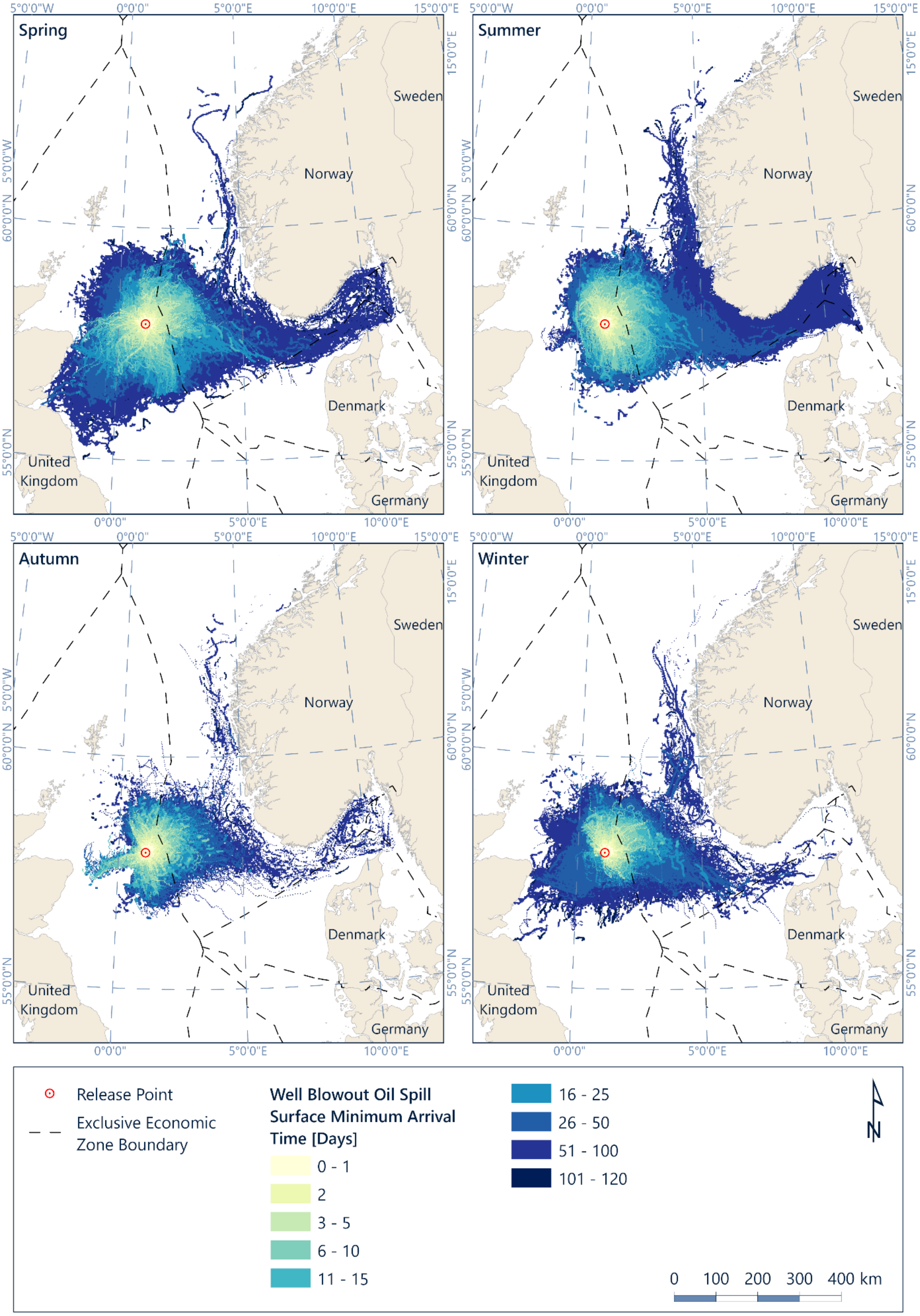
Scenario Reference	Scenario 1 (S01)	Scenario 2 (S02)
Description	Well blow-out	Diesel Release
Location	57° 55′ 49.52″ N 001° 05′ 14.51″ E ED50	
Timeframe	Winter – Dec to Feb Spring – Mar to May Summer – Jun to Aug Autumn – Sep to Nov	
Depth of Release	128 m	0 m (surface)
Release Rate	4 300 m^3/day	3 500 m^3/day
Duration of Release	90 days	1 hour
Total Volume Released	387,000 m^3	3,500 m^3
Total Mass Released	327 452.6 MT	3 040.5 MT
Total Run Duration	105 days	15 days
Diameter of Release Hole	0.708 m	n/a
Gas to Oil ratio (GOR)	1 226 sm^3/m^3	n/a
Gas Density	0.95 kg/sm^3	n/a
Oil Temperature	80 C	n/a
Total Number of Trajectories	240	
Time Between Trajectories	1 day, 3 hours	
Nearest Shoreline	~176 km, Peterhead, UK	

Table 14.2: Statistical Analysis – Surface

Oil Spill Modelling Summary				
Spill Scenario/Description	S01		Well Blow-out	
Median Crossing				
Identified Median Line	Probability and Shortest Time to Reach Median Line			
	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov
Denmark	32 % 36 days, 21 hrs	45 % 23 days, 15 hrs	70 % 43 days, 21 hrs	26 % 50 days, 21 hrs
Joint Regime Area Sweden / Norway	0 % n/a	6 % 69 days, 6 hrs	13 % 67 days, 6 hrs	1 % 69 days, 18 hrs
Norway	100 % 1 day, 15 hrs	100 % 1 day, 12 hrs	100 % 1 day, 15 hrs	100 % 1 day, 9 hrs
Sweden	1 % 96 days, 21 hrs	20 % 64 days, 0 hrs	44 % 53 days, 15 hrs	14 % 59 days, 9 hrs
UK	100 % Spill originates in UK waters			

Table 14.3: Statistical Analysis – Shoreline

Oil Spill Modelling Summary				
Spill Scenario/Description	S01		Well Blow-out	
Landfall				
Identified Shoreline	Probability and Shortest Time to Reach Shoreline			
	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov
Denmark	3 % 76 days, 11 hrs	7 % 60 days, 15 hrs	5 % 63 days, 14 hrs	< 1 % 91 days, 0 hrs
Norway	2 % 88 day, 17 hrs	14 % 70 day, 1 hrs	45 % 53 days, 15 hrs	6 % 65 days, 8 hrs
Sweden	0 % n/a	1 % 66 days, 22 hrs	3 % 67 days, 13 hrs	< 1 % 73 days, 4 hrs
UK	10 % 50 days, 2 hrs	9 % 23 days, 6 hrs	0 % n/a	0 % n/a
Maximum Volume Beached				
Mass of oil onshore	47 MT	48 MT	116 MT	26 MT
Volume of oil onshore	58 m^3	59 m^3	144 m^3	32 m^3
Water content	80 %	80 %	80 %	80 %
Volume of emulsion onshore	291 m^3	297 m^3	719 m^3	161 m^3



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** Esri, 2024; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12.

Figure 14.3: Well blow-out modelling: minimum arrival time of surface oil (OSRL, 2024)

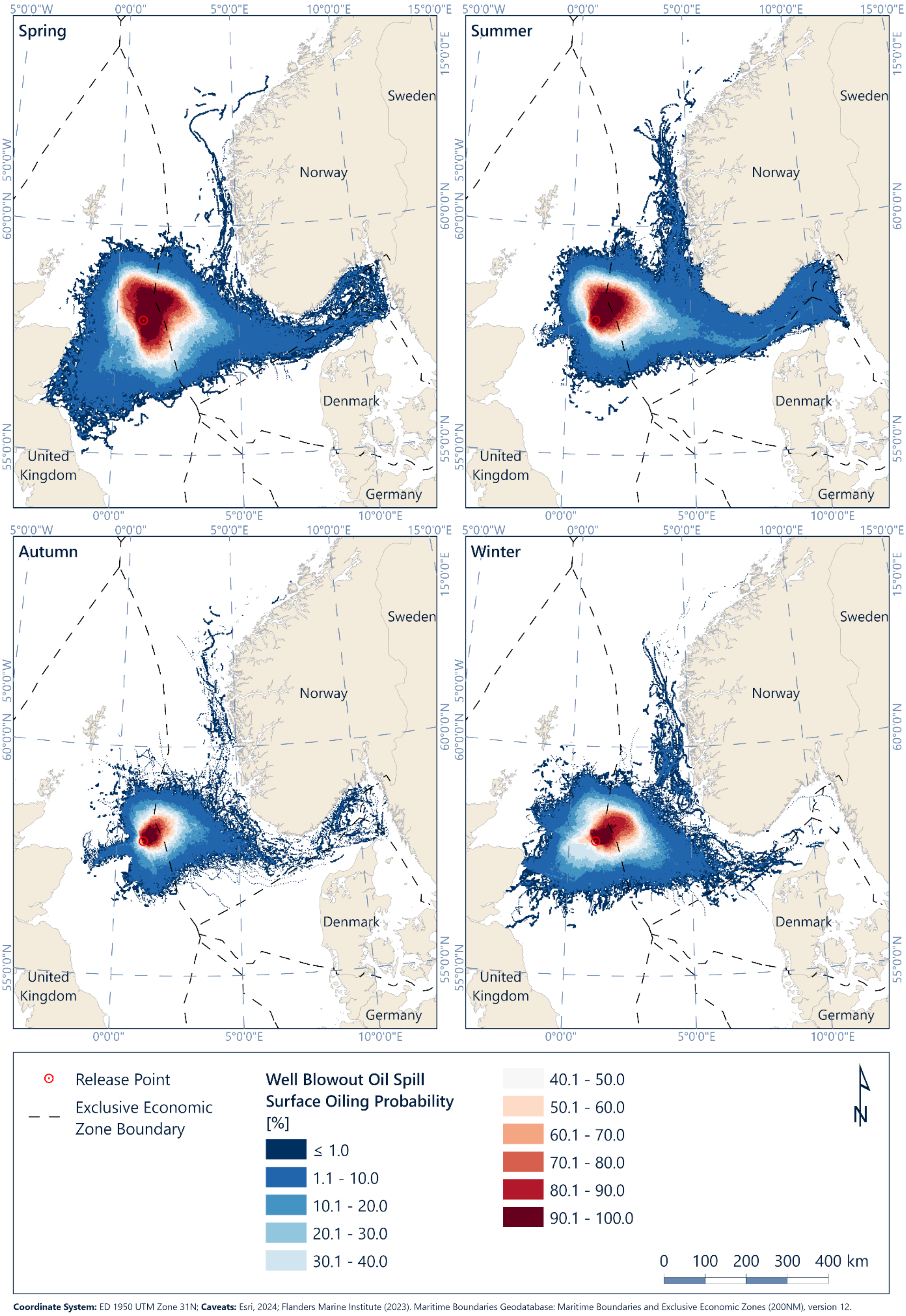


Figure 14.4: Well blow-out modelling: probability plot (OSRL, 2024)

14.4.2 Diesel Release from MODU

The parameters used in the modelling of a diesel release from the MODU are detailed in Table 14.1. The results of the diesel release modelling scenario are provided in Table 14.4 and

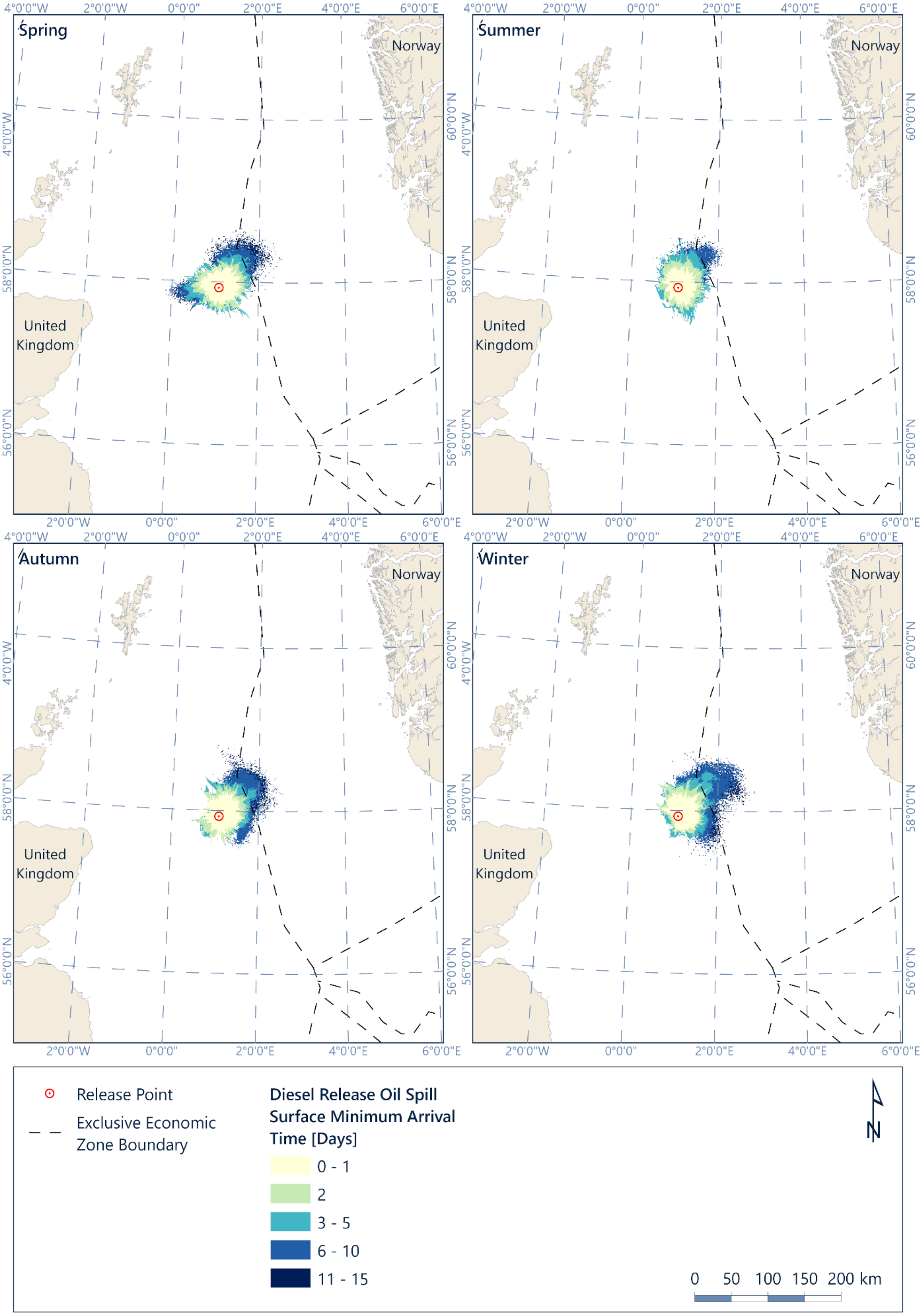
Table 14.5. Minimum arrival time of surface oiling is shown in Figure 14.5 and the probability of surface oiling in Figure 14.6.

Table 14.4: Statistical Analysis – Surface

Oil Spill Modelling Summary				
Spill Scenario/Description	S02		Diesel Release	
Median Crossing				
Identified Median Line	Probability and Shortest Time to Reach Median Line			
	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov
Norway	58 % 1 day, 6 hrs	42 % 2 days, 12 hrs	22 % 1 day, 8 hrs	52 % 1 day, 15 hrs
UK	100 % Spill originates in UK waters			

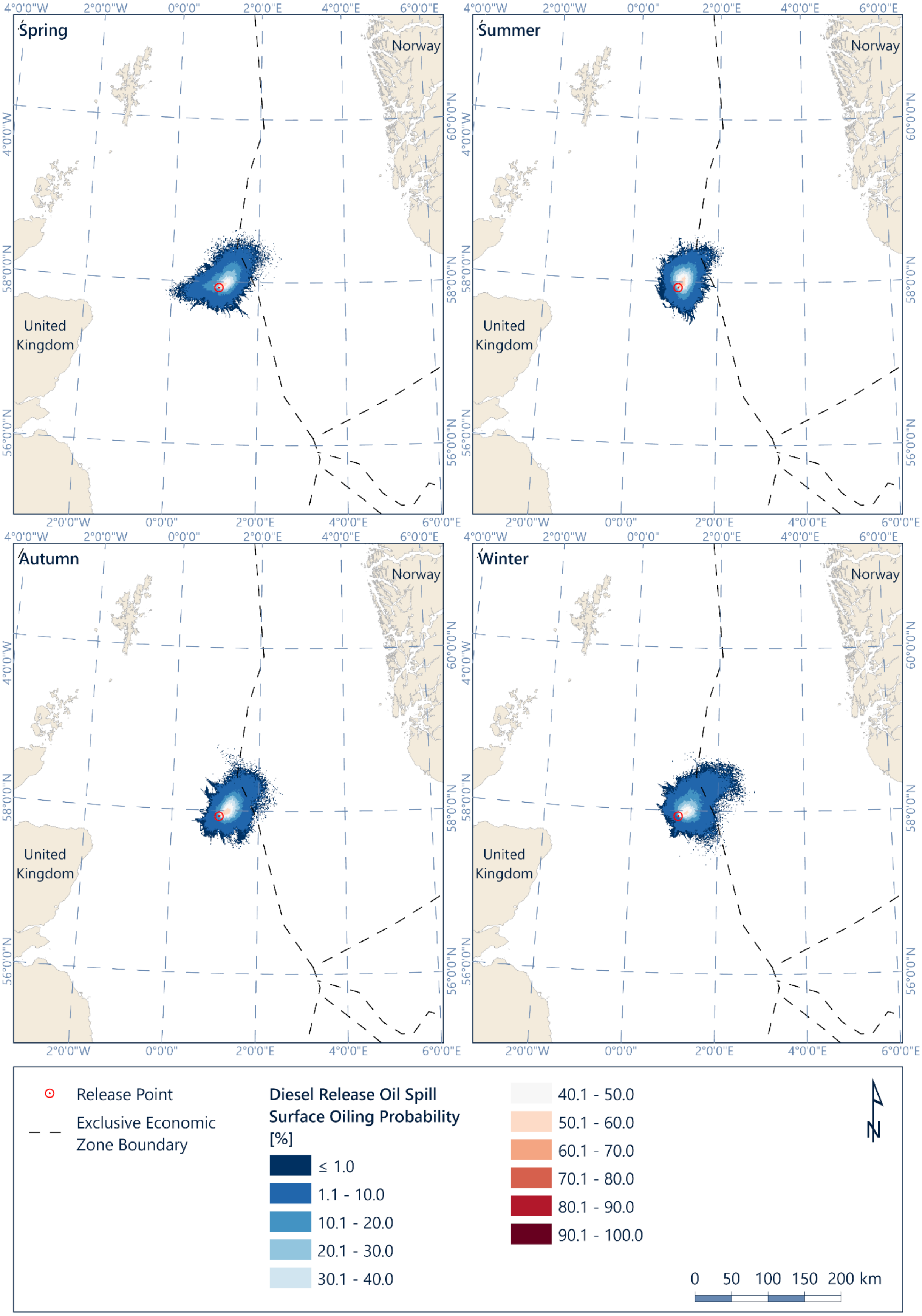
Table 14.5: Statistical Analysis – Shoreline

Oil Spill Modelling Summary				
Spill Scenario/Description	S02		Diesel Release	
Landfall				
Identified Shoreline	Probability and Shortest Time to Reach Shoreline			
	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov
	0 % No shoreline oiling occurs			



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** Esri, 2024; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12.

Figure 14.5: Diesel release modelling: minimum arrival time of surface oil (OSRL, 2024)



Coordinate System: ED 1950 UTM Zone 31N; **Caveats:** Esri, 2024; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12.

Figure 14.6: Diesel release modelling: probability (OSRL, 2024)

14.4.3 Fate of Oil

In addition to the stochastic modelling detailed above, both scenarios were investigated further as deterministic (or trajectory) models which simulate a single spill scenario under specific conditions on a particular date. Trajectory results are generated simulating a single spill scenario under specific conditions on a particular day. A total of 120 trajectories were modelled per season (480 trajectories for all four seasons) with each trajectory beginning on a different start date with a range of wind and current conditions. The worst-case trajectories were selected, from these pools of trajectories that make up the stochastic models to investigate the fate and behaviour of oil during the course of the simulation in more detail. The worst-case trajectories are defined as those that:

- Result in the most oil ashore; and
- Result in the fastest oil ashore.

Worst-case trajectories allow further investigation into the oil fates and behaviour. Mass balance can be scrutinised, and the probability and likelihood of oil impact better understood.

The modelling results showed that with Scenario 1, uncontrolled well blow-out, there would be potential for sea surface and shoreline oiling. No shoreline oiling was predicted for Scenario 2, diesel release from the MODU.

14.4.3.1 Well blow-out

Worst-case trajectories were selected, in case of an uncontrolled well blow-out and these included:

- The trajectory that results in the most oil ashore;
- The trajectory that results in the fastest oil ashore; and
- The trajectory that results in the fastest oil to neighbouring maritime boundary.

The deterministic model showed that much of the oil is predicted to persist in the water column for approximately 50 days after the blow-out (Figure 14.7). Thereafter, it is predicted that quantities of oil would begin to settle on or within the sediment. Volumes of oil which will evaporate are predicted to continuously increase up until 90 days after release at which point the volume of oil which evaporates will remain consistent. A quarter of the total volume of oil released, is expected to biodegrade after 100 days and a very small amount (also consisting of 80 % water; Table 14.7) to end up on the shoreline.

The trajectories selected for the well blow-out are given in Table 14.6 and the main results are summarised in Table 14.7.

Table 14.6: Worst-case trajectories following the well blow-out

Season	Worst-Case	Trajectory Number	Simulation Start Date [UTC]
Summer (Jun-Aug)	Most Oil Ashore	200	15-Jul-2013 20:00
Spring (Mar-May)	Fastest Oil to Shore	177	19-Mar-2013 09:00
Autumn (Sep-Nov)	Fastest Oil to Neighbouring Maritime Boundary	14	15-Sep-2012 18:00

Worst-case trajectories allow further investigation into the oil fates and behaviour. Mass balance can be scrutinised, and probability and likelihood of oil impact better understood.

Table 14.7: Key results from the well blow-out

Trajectory 200/240	Most Oil Ashore
Release Location	Fotla Well, North Sea UK
Maximum Mass of Oil Ashore	116 MT
Maximum Volume of Oil Ashore	144 m^3
Water Content	80 %
Volume of Emulsion Ashore	719 m^3
Most Oil Ashore Time	104 days, 0 hrs
Trajectory 177/240	**Fastest Oil to Shore**
Release Location	Fotla Well, North Sea UK
First Shoreline Impact	23 days, 6 hrs
Side of impact	Whinnyfold, Scotland, UK
Trajectory 14/240	**Fastest Oil to Neighbouring Maritime Boundary**
Release Location	Fotla Well, North Sea UK
Time of Impact	1 day, 9 hrs
Maritime Boundary Crossed	Norway

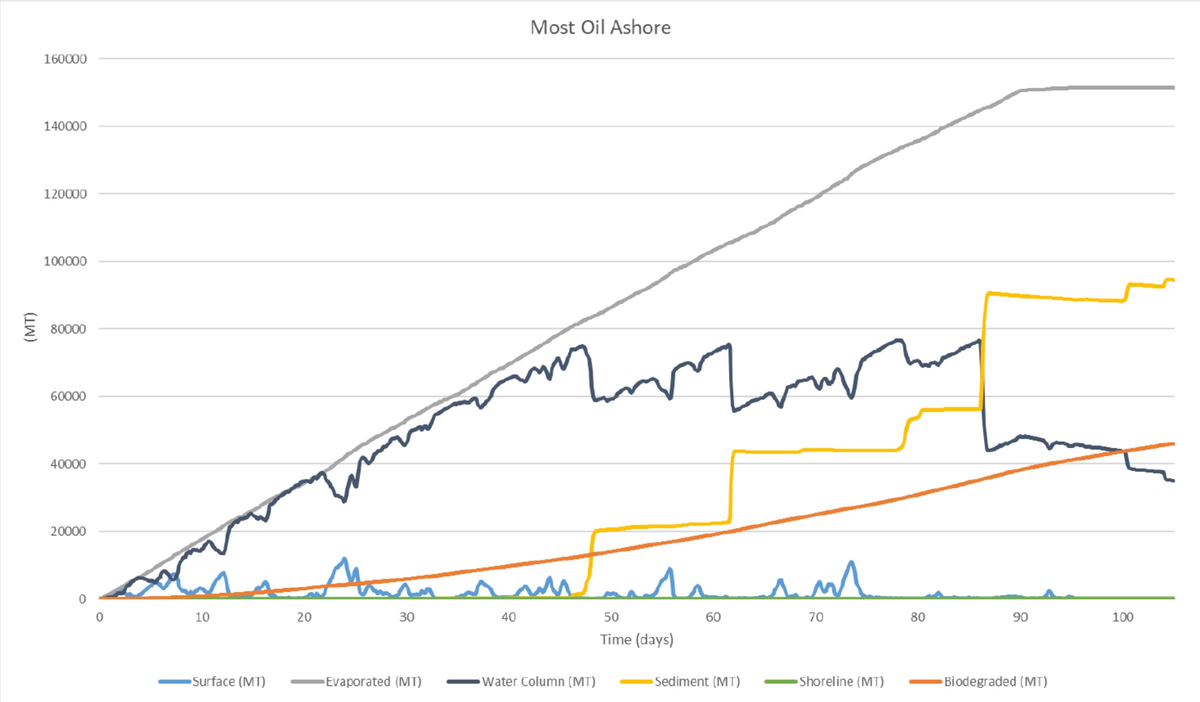


Figure 14.7: Mass balance of oil from Scenario 1 (well blow-out) throughout the simulation (OSRL, 2024)

14.4.3.2 Diesel Release from MODU

Due to the diesel release scenario not resulting in any shoreline oiling, the worst-case trajectory was the one that results in the fastest oil to neighbouring maritime boundary.

During the winter season, the model showed that oil will cross the Norwegian boundary after 1 day and 6 hours and most of it will be in the water column and on the sea surface (Figure 14.8).

The trajectory selected is shown in Table 14.8 and the main results are summarised in Table 14.9.

Table 14.8: Worst-case trajectory following diesel release from MODU

Season	Worst-Case	Trajectory Number	Simulation Start Date [UTC]
Winter (Dec-Feb)	Fastest Oil to Neighbouring Maritime Boundary	10	11-Dec-2011 05:00

Table 14.9: Key results from the diesel release from MODU

Trajectory 10/120	Fastest oil to neighbouring maritime boundary
Release Location	Fotla Well, North Sea UK
Time of Impact	1 day, 6 hrs

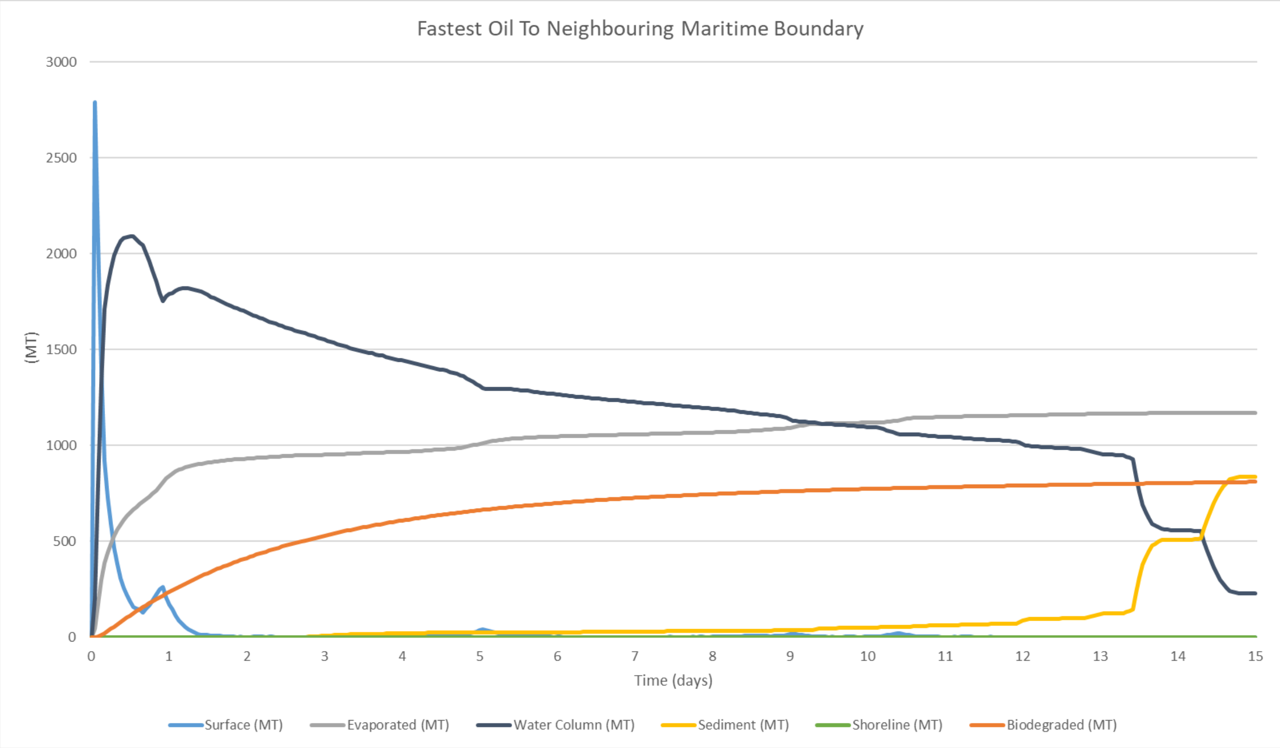


Figure 14.8: Mass balance plot (Scenario 2) – Fastest oil to neighbouring maritime boundary

14.5 Potential Environmental Impacts

14.5.1 Impact on Marine Life

The risk of accidental hydrocarbon spillage to the marine environment is one of the main environmental concerns associated with oil-industry activities. Although the effects of oil spills are well understood, the effects of each individual spill are unique, and some assumptions have been made regarding predicting the effects of a large crude oil spill at the proposed Fotla field. The assessment of the effects of a release of hydrocarbons on the receptors in this section is based on the methodology described in Sections 6 and 7 of this ES.

14.5.1.1 Plankton

Oil, particularly diesel, is toxic to a wide range of planktonic organisms (Quigg et al., 2021; Siron et al., 1993). Oil slicks can inhibit light penetration which is essential for phytoplankton growth and photosynthesis whilst those living near the sea surface are particularly at risk, as water-soluble components leach from floating oil (Quigg et al., 2021). However, the extent of any effect is largely dependent on the structure of their communities. Some studies have shown the phytoplankton growth responses vary, in response to exposure to contaminants, such as crude oil with some, finding growth increases and others find growth decreases (Quigg et al., 2021; Tang et al., 2019; Varela et al., 2006). Evidence of toxicity of both crude oil and dispersants within phytoplankton has been reported in plankton communities in the Gulf of Mexico (Ozhan & Bargu, 2014) following the Deepwater Horizon spill (Buskey et al., 2016). Zooplankton at the surface are considered to be particularly sensitive to oil spills due to their proximity to high concentrations of dissolved hydrocarbon and to the additional toxicity of photo-degraded hydrocarbon products at this boundary (Bellas et al., 2013), and direct ingestion of dispersed oil droplets has been also reported on zooplankton species (Lee et al., 2012).

Although oil spills may kill individuals, the effects on whole plankton communities generally appear to be short-term. Following an oil spill incident, plankton biomass may fall dramatically, due either to animal deaths or avoidance of the area leading to community shifts (Severin & Erdner, 2019). Taxon specific responses are complex and will ultimately vary according to the specific plankton species and depend on factors such as oil type and concentration as well as environmental influences (Severin & Erdner, 2019). However, some studies note that after only a few weeks, some populations may be expected to return to previous levels through a combination of high reproductive rates and immigration from outside the affected area (NSTF, 1993).

The magnitude of effect of an oil spill (either due to a well blow-our or diesel release) on plankton species, a receptor of '**Low**' value due to large, widespread populations, is considered to be '**Major**' and therefore overall effect significance is '**Moderate adverse**'. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be '**Not Significant**'.

14.5.1.2 Benthos - Shallow Coastal Communities

It is generally assumed those animals associated with the seabed will remain unaffected by a surface slick as the floating oil moves above them. In addition, as shown in Figure 14.7, oil from a well blow-out is projected to settle on the sediments at least 45 days after a release, by which point response measures would already be undertaken to control the release. Limited impact is expected from a potential diesel release due to the smaller area of spreading (OSRL, 2024).

A fraction of the water-soluble components of a slick may, however, dissolve into the water column, assisted by rough seas or agitation of the sea surface, where these could potentially be harmful to benthic organisms. However, if the spilled oil drifts inshore, the benthic communities of the shallow coastal areas may be affected. The benthic species response to hydrocarbon exposure varies depending on life history, feeding behaviour and the ability to metabolise toxins. Community-level changes in the biomass, density, and diversity of protistan, meio-/macro-/mega- faunal assemblages have been recorded in numerous studies (Currie & Isaacs, 2005; Gray et al., 1990; Jones et al., 2007; Lanzen et al., 2016; Netto et al., 2009; Santos et al., 2009). Parameters such as local bathymetry and sediment types would significantly influence the distribution of oil contamination at the seabed.

It should be noted that any oil that reaches these shallow areas will have travelled a considerable distance through the water column and across the sea surface and will therefore have been affected by the range of degradation processes described in Section 14.3. These mechanisms will have contributed to decreases in the toxicity of the oil (ITOPF, 2014a; USEPA,

1999) and the primary effect of the oil deposition on benthic communities is likely to be smothering (ITOPF, 2014b). As the oil will also have become widely dispersed by this point, the physical effects of smothering on benthos are expected to be limited.

If an oil spill was to occur (in case of a well blow-out) and oil settles on the seabed it is considered that the magnitude of effect would be '**Major**' on receptors of '**Very High**' value (e.g. sandbanks, mudflats which are designated features for Special Areas of Conservation (SACs)) and therefore overall effect significance is '**Major adverse**'. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be '**Not Significant**'.

14.5.1.3 Benthos - Deepwater Communities

As described above, the buoyancy of the produced oil will carry hydrocarbons straight up to the sea surface in the event of a subsea spill. In offshore areas such as the Fotla field, impacts on the benthos from a release of oil are likely to be very minimal, due to the water depth (between 119 m and 132 m lowest astronomical tide (LAT)). Therefore, it is expected to be unlikely for the crude oil to reach the surrounding benthic communities. However, the worst-case deterministic model (Section 14.4) showed the potential for some of the oil to remain in the water column.

It is unknown how exactly a subsea oil spill would affect the benthos. Assessing the effects of toxic contamination on biotopes is extremely difficult because varying quantities of different contaminants can have very different effects on marine organisms. However, reported effects from large oil spills, such as the Ekofisk blow-out in 1977 and the Braer oil spill in 1993, were limited to some chemical contamination of seabed sediments at the latter, with neither spill appearing to have resulted in any acute biological effects (Kingston et al., 1995).

The seabed in the area across the Fotla field area is classed as the European Nature Information System (EUNIS) biotype complex MD621: Faunal communities on Atlantic offshore circalittoral mud and MD6218: *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in Atlantic offshore circalittoral sandy mud (Section 5.2.2). Species present include *Nephrops*, sea pens and anemones (Gardline, 2024).

The 'sea pen and burrowing megafauna communities' habitat as defined by OSPAR (2010) is likely present in the area of interest (Gardline, 2024). Suspension and filter feeders, such as sea pens, gather their food directly from the seawater and would, therefore, take in any oil present within the surrounding water leaving them more vulnerable to the toxic effects of oil dispersed in the water column.

The aforementioned OSPAR habitat is a component biotope of the 'burrowed mud' habitat which is a priority marine feature (PMF). High levels of nutrients or organic material (oil components) in this habitat can cause the mud to become very low in oxygen, to the point that the typical communities can no longer survive.

As described in Section 5.3.2, seabed surveys at the Fotla field in 2023 and 2019 did not identify the presence of adult Ocean quahogs (*A. islandica*) however juveniles were recorded in both surveys (Gardline, 2024; Fugro, 2020). This species is considered under OSPAR to be a threatened and/or declining species and it is also a PMF, therefore recognised to be of conservation significance. Ocean quahogs are filter feeders and therefore potentially vulnerable to ingesting oil during feeding due to the potential presence of oil in the sediment or water column however they are considered to be tolerant of deoxygenation, nutrient and organic enrichment (JNCC, 2018b; Tyler-Walters & Sabatini, 2017).

Consequently, if an oil spill was to occur (from either a well blow-out or diesel release) and oil settles on the seabed it is considered that the magnitude of effect would be '**Major**' on receptors of '**Very High**' value and therefore overall effect significance is '**Major adverse**'. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be '**Not Significant**'.

14.5.1.4 Fish

Offshore fish populations remain relatively unaffected by oil pollution, as oil concentrations below the surface slick are generally low (Claireaux et al., 2018; Clark, 2001; NOAA, 2021). There is also evidence that fish are able to detect and avoid oil-contaminated waters (IPIECA, 2000). This avoidance may, however, cause disruption to migration or spawning patterns.

Rather than impacting the fish directly, heavily contaminated sediments may have an adverse effect on local populations of demersal fish species, due to the impact it has lower down the food chain. However, as described in the benthos section above, heavy contamination of the sediments is not expected (Section 14.4.3).

Few studies have demonstrated increased mortality in fish species as a result of oil spills (Langangen et al., 2017). However, fish eggs and larvae are more vulnerable to oil pollution than adult fish as, in many fish species, these stages float to the surface where contact with spilt oil is more likely. Therefore, fish stocks may be vulnerable to spills that occur close to spawning or nursery grounds as fish eggs and larvae are susceptible to toxic oil compounds which can kill or cause sub lethal effects (Carpenter, 2019; Langangen et al., 2017).

The Fotla field falls within spawning grounds for cod, *Nephrops* and Norway pout (see Figure 5.9 in Section 5.3.3) and the species are designated PMFs. Cod is also OSPAR listed. Spawning grounds for haddock, herring, lemon sole, mackerel, plaice, sandeel and whiting are also present in the wider area (Coull et al., 1998; Ellis et al., 2012). However, as the majority of these species have extensive spawning grounds and produce large numbers of pelagic young, there is unlikely to be any significant, long-lasting effect on numbers in the adult populations. Certain fish stocks may be more affected than others, particularly if the spill is very large, coincides with spawning periods, or enters the grounds of species with restricted spawning areas.

The magnitude of effect of an oil spill (either from well blow-out or diesel release) on fish species is considered to be **'Major'** on receptors of '**High**' and '**Very High**' value, due to the presence of spawning grounds of designated PMF and OSPAR listed species in the area, and therefore overall effect significance is **'Major adverse'**. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be **'Not Significant'**.

14.5.1.5 Shellfish

If oil reaches the seabed, shellfish species that cannot swim away from oiled sediments are susceptible to its effects. Mortalities may occur if shellfish become smothered by settling oil. Only low levels of oil in seawater may cause tainting in shellfish, which may be commercially damaging to shellfish fisheries. This is more common in filter feeding shellfish, principally bivalves, as they would take up fine oil droplets from the water column. It is extremely unlikely that hydrocarbons released from a subsea blow-out would remain near the seabed in significant concentrations to have such an effect, but that might not be the case for a diesel release as presented in Figure 14.8. The inshore waters around north-east Scotland do, however, support commercially important shellfish fisheries, which may be at risk if a spill reaches these waters.

The proposed development lies within a reported spawning ground for *Nephrops* which is a PMF (Section 5.3.3). Landings data for shellfish species within rectangles 44F1 and 45F1 from 2013 to 2023 show an increase in shellfish landings being recorded since 2019 compared to previous years and being almost equal to demersal landings which have been the most consistent type of resource landed (see Section 5.4.1; Marine Directorate, 2024). However, the quantities of shellfish species landed from ICES rectangles 44F1 and 45F1 are typically low particularly when compared to the wider area (Section 5.4.1.5 and Figure 5.19).

Therefore, the magnitude of effect of an oil spill on shellfish species (either from well blow-out or diesel release), is considered to be **'Major'** on a receptor of '**High**' value, due to their conservation status (PMF), and therefore overall effect significance is **'Major adverse'**. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be **'Not Significant'**.

14.5.1.6 Marine Mammals

Several cetacean species are known to occur in the vicinity of the Fotla field (see Section 5.3.6), the most widespread and frequently recorded are harbour porpoise and white-beaked dolphin observed throughout most of the year. Other species in the wider CNS include killer whales, minke whales, Risso's dolphins and Atlantic white sided dolphins.

Whales, dolphins and porpoises are not considered to be affected by an oil spill in similar ways as birds, fish and otters. Oil is unlikely to adhere to their skin, due to its slickness and is not expected to accumulate in or around the eyes, mouth, blow hole or other potentially sensitive areas (Helm et al., 2015).

Furthermore, these marine species do not consume large quantities of seawater, do not groom themselves and are unlikely to consume oil-contaminated prey, therefore they are unlikely to ingest significant quantities of oil (Helm et al., 2015).

The greatest risk to most cetaceans from an oil spill is likely to occur if they come into contact with an oil spill when they surface to breathe and inhale oil and/or toxic petroleum vapours (de Lima et al., 2023). This may impact on the individuals' respiratory system (Frasier et al., 2019; Helm et al., 2015; Schwacke et al., 2013), as when concentrated vapours are inhaled, mucous membranes may become inflamed, lungs can become congested, and pneumonia may ensue. Inhaled fumes from oil may accumulate in blood and other tissues, leading to possible liver damage, reproductive impairment and neurological disorders (Helm et al., 2015). Ingestion of oil contaminated prey or foraging in areas affected by an oil spill is one direct way in which cetaceans will come into contact with oil components. Some cetaceans, particularly odontocetes (toothed whales), employ suction feeding to capture prey which may also see an animal ingest oil in the water column (de Lima et al., 2023) whilst mysticetes (baleen whales), which feed using baleen plates in their mouths, may clog these plates when taking in oil contaminated water (de Lima et al., 2023).

Previous studies have shown that some species of cetacean may be able to detect and avoid oil spills, but this was dependent on oil thickness and colour (Aichinger Dias et al., 2017). The mechanisms used to avoid oil spills have not been confirmed however it is believed that echolocation or taste may play a role (de Lima et al., 2023). Studies undertaken after the Deep-Water Horizon spill in the Gulf of Mexico noted that cetaceans present in the area that came into direct contact with oil did not show any avoidance of a slick (Aichinger Dias et al., 2017).

A thick layer of blubber protects cetaceans and adult seals from the cold and these animals are less vulnerable to the physical impacts of oil lowering their resistance to the cold (Helm et al., 2015) however contact of oils with the skin may lead to prolonged coating of the body which can hamper the ability to swim (de Lima et al., 2023). Seal pups however are at risk from hypothermia if their fur becomes oiled and loses its thermal properties, as they do not have sufficient blubber underneath their fur to keep them warm (Helm et al., 2015). Unlike cetaceans, the mucous membranes, eyes and ears in seals are likely to be negatively affected by exposure to an oil slick (Helm et al., 2015). When seals are exposed to oil at sea they may ingest it leading to the oil being absorbed into the blood and transferring to muscles, liver and fat (de Lima et al., 2023).

Both grey and common seals are known to breed on the coastline of north-east Scotland (Section 5.3.6.2). These marine mammals may be at risk if a slick reaches coastal areas.

The magnitude of effect of an oil spill on marine mammals, it is considered to be '**Major**' on a receptor of '**Very High**' value, due to their internationally and nationally protected status

(European Protected Species (EPS), PMFs, OSPAR (harbour porpoise), Annex II and Annex IV species), and therefore overall effect significance is '**Major adverse**'. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be '**Not Significant**'.

14.5.1.7 Seabirds

Seabirds are particularly susceptible to oil pollution on the sea surface (Munilla et al., 2011; Votier et al., 2005), especially during large oil spills. The effects of oil pollution on diving seabirds such as seaducks (Anatidae), divers (Gaviidae), cormorants (Phalacracoracidae), grebes (Podicepididae) and auks (Alcidae) are likely to be more pronounced than aerial species such as gulls (Laridae) (Webb et al., 2016).

After exposure to oil, birds may experience negative effects on their reproductive success as well as their cardiovascular and respiratory systems, cellular damage and heightened metabolic cost through increased foraging time (Michael et al., 2022; Takeshita et al., 2021; Troisi et al., 2016). Ingested oil may also result in pathological changes in the intestinal tract, lungs, liver and kidneys leading to a range of negative impacts on survivability (Alonso-Alvarez et al., 2007; Troisi et al., 2016). Exposure to oil may also affect long-term reproductive success (Michael et al., 2022).

Even thin sheens of oil may adhere to feathers comprising their structure and potentially affecting thermoregulation (Michael et al., 2022). Seabirds that survive with oil contaminated feathers may be able to remove traces of oil by preening. There is little information on the extent and speed with which full functionality is restored, however, some wild gulls and terns have been shown to remove visible oil within 10 weeks (King et al., 2021).

Despite considerable effort to rescue, clean and reintroduce seabirds which have been impacted by an oil spill, post release survival is low with successful rehabilitation requiring high quality facilities and veterinary skills (Troisi et al., 2016; Heubeck et al., 2003).

The aerial habits of the fulmar and gulls, together with their large populations and widespread distribution, reduce vulnerability of these species. Gannets, skuas and auk species are considered to be most vulnerable to oil pollution due to a combination of heavy reliance on the marine environment, low breeding output with a long period of immaturity before breeding, and the regional presence of a large percentage of the biogeographical population (DTI, 2003).

Of these species the conservation status of the Atlantic Puffin is classified as 'Endangered' on the International Union for Conservation of Nature (IUCN) Red List for Birds due to the rapid declines recorded in its European populations. The Atlantic Puffin is vulnerable to oil spills from direct mortality and as a result of successive years of breeding failure, due to ecosystem degradation, leading to reduced numbers of prey species (e.g. herring and sandeels) (BirdLife International, 2021). Therefore, the impacts from a large spill from a well blow-out could potentially affect the ability of regional populations to propagate and hence recover within a short time. This could have significant adverse effects on the already declining European Atlantic Puffin populations to reach favourable conservation status.

The European storm petrel (*Hydrobates pelagicus*) is also of conservation importance classified as 'Least Concern' on the IUCN Red List for Birds and its population trends are currently unknown in Europe (BirdLife International, 2015). European storm petrels feed on the sea surface, where the oil remains are found, hence they are prone to swallowing oily substances since they form part of their natural food (Boersma, 1986, Nevitt & Haberman, 2003). Azkona et al. (2006) suggested that the birds returned to pre-spill abundance and reproduction levels in 2 years after the wreck.

The sensitivity of seabird to oil pollution is 'low' throughout the year for UKCS Blocks 22/1 and 16/26 with the majority of the surrounding UKCS Blocks also considered to be 'low' sometimes increasing to 'medium' (Webb et al., 2016; Section 5.3.7).

The magnitude of effect of an oil spill on seabirds given the wide area (Figure 14.4) that would be impacted by a well blow-out as a worst-case scenario, is considered to be **'Major'** on a receptor of **'Very High'** value, due to their internationally and nationally protected status (e.g. black legged kittiwake is OSPAR listed), and therefore overall effect significance is **'Major adverse'**. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be **'Not Significant'**.

14.5.2 Impact on Coastal and Inshore Habitats

Oil spill modelling has shown that the shorelines of the UK, Denmark, Norway and Sweden have the potential to receive oil on their shores in the unlikely event of a spill from the Fotla field (Table 14.3 and Figure 14.4).The probability of shoreline oiling is less than 10 % for the majority of countries and seasons modelled however higher probabilities are predicted for Norwegian shorelines in spring (14 %) and summer (45 %) (Table 14.3). The shortest time to reach the shoreline was predicted to occur in spring affecting UK shorelines (23 days, 6 hours). These coastlines support a range of different habitat types, and are important for nature conservation, with numerous sites designated under national and international legislation (Section 5.3.10).

14.5.2.1 Rocky Shores

Rocky shores can vary in structure, ranging from exposed vertical walls to flat bedrock, or stable boulder fields to aggregations of cobbles. These shores may support a variety of sessile animal and plant communities which live attached to the rock surface, as well as a range of associated mobile invertebrates and fish. More exposed rocky shores are typically dominated by sessile animals and smaller, more robust seaweeds. Sheltered shores are characterised by large brown kelps.

Rocky shores are generally high energy beaches and while oil may have an impact on the animals and plants which live on them it is often quickly removed by wave action and water movement. The vulnerability of rocky shore habitats to oiling is dependent on the type of rocky shore and its exposure. The action of the waves may start to remove the oil from an exposed vertical wall almost immediately, but the oil may remain for longer in more sheltered, kelp dominated areas.

Many of the animals and small seaweeds found on rocky shores would be killed by exposure to fresh and light oils, but much of the crude oil potentially reaching the shore from a large release from the proposed Fotla field would have been at sea for several days (a minimum of 23 days (Table 14.3)) and therefore lost some degree of its toxic constituents through the oil weathering process (Keramea et al., 2021). Various shoreline species have been observed to survive shoreline oiling and continue feeding in oiled areas, suggesting that the toxic impacts would be minimal (Clark, 2001). However, even if the beached oil is relatively non-toxic, heavily weathered oil may still cause damage due to its physical properties. Large amounts of stranded oil may impact upon shoreline animals by smothering them. Those animal species that are large enough to protrude above the oil or can move away quickly may survive, but smaller species would be killed by inhibition of their feeding and respiration mechanisms. Many of the larger brown seaweeds which dominate the more sheltered rocky shores secrete mucus which would prevent oil adhering to them (IPIECA, 2016). However, if oil does adhere to the seaweed fronds, instead of killing the seaweeds directly, the oil will increase their overall weight potentially resulting in them being pulled from the rocks by the wave action.

The rate of recovery and the form it takes will depend upon the type of rocky shore and the animals and plants that live on it. The general experience of oil spills on rocky shores is that substantial recovery can be achieved within 2 to 4 years (Park et al., 2022), but biological factors may intervene and cause a prolonged change. Rocky shores are high energy, highly productive environments, where the physical and biological factors exerted upon them lead to intense competition between the species which live there. The physical factors, such as desiccation, extremes of temperature, and changes in salinity, can cause mortalities in rocky shore communities, while the severe winter storms can pull many animals and plants from the shore each year (Little & Kitching, 1996). As a result, these communities have the capability to regenerate quickly in order to take advantage of the newly available space.

Oil spill modelling indicates that, under the majority of meteorological circumstances, a large oil slick from the Fotla field will drift eastwards and north-eastwards, and the coastlines of western Norway will be at the greatest risk of oil impacting on the shoreline (OSRL, 2024 (Table 14.3)). These shores are all dominated by steep sea cliffs and high energy rocky shores (Section 5.3.8). Therefore, it is considered that these areas could recover relatively quickly from a beaching oil spill.

14.5.2.2 Sedimentary Shores

The fate of oil stranded on sedimentary shores depends on the nature of the substratum (IPIECA, 2016; 2008). Due to the increased sediment movement and relatively large gaps between the particles, beached heavy oil can penetrate further into the more mobile shingle or coarse sand shores. These coarse sediment shores tend to be less productive than sheltered mudflats, where waterlogged sediments, rich in organic matter, can accommodate huge numbers of invertebrates. Gaps between the shingle or sand grains allow the water to drain away quickly between the tides and the movement of the sediment itself is very abrasive, meaning few animals can survive in it. If the beaching of an oil spill becomes inevitable, sandy beaches have in the past been considered as sacrificial areas. A spill may be directed towards a sandy beach to protect other, more sensitive, shorelines. Soft sediment areas are rare on the coast of Norway, with sandy beaches making up a very small proportion of the total coastline (Section 5.3.8).

In contrast, oil does not readily penetrate the sediments in areas of firm waterlogged mud or fine sand and tends to be carried away with the next tide (Clark, 2001). However, there is a concern over oil beaching on sheltered mudflats or associated sensitive areas of saltmarsh and these are often priority areas for protection following oil spills because these are generally highly productive areas, with high numbers of invertebrates living within the sediments which may provide a valuable food source for juvenile fish and birds (Little, 2000). Recovery times tend to be longer in these sheltered areas, due to the reduced bacterial degradation and persistence of the oil, particularly if it penetrates into the sediment (IPIECA, 2016; 2008). The process of cleaning the sediments and vegetation can be very difficult in these areas and could potentially exacerbate any damage to the habitat. In the most sheltered of intertidal areas, where very fine sediments accumulate, saltmarshes may be found. A few small mudflats and saltmarshes are present along Aberdeenshire (Hill, 1996; Marine Scotland, 2024a), but the likelihood of oil reaching the Scottish coast is low (10 % or less) as predicted by the oil spill modelling (OSRL, 2024).

The magnitude of effect of an oil spill on coastal and inshore habitats given the wide area (Figure 14.4) that would be impacted by a well blow-out as a worst-case scenario, is considered to be '**Major**' on a receptor of '**Very High**' value due to numerous sites designated under national and international legislation, and therefore overall effect significance is '**Major adverse**'. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be '**Not Significant**'.

14.5.3 Impact on Offshore Protected Areas

The Fotla field is located in the CNS and a number of offshore protected areas would potentially be affected by an uncontrolled well blow-out (Figure 14.9 and Figure 14.10).

Impacts from a release of hydrocarbons on offshore protected areas are considered in Section 14.6.

14.5.4 Impact on Other Users of the Sea

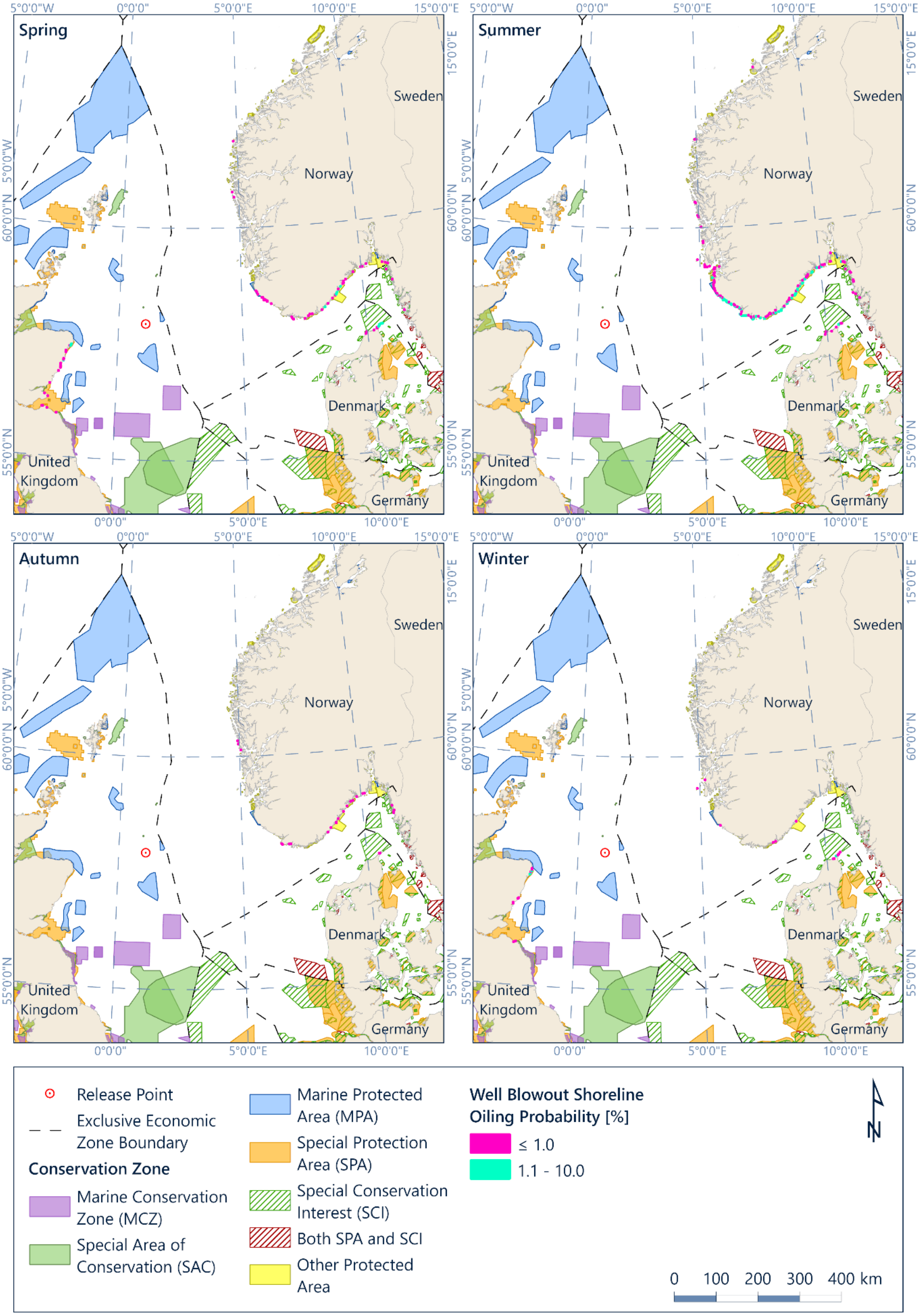
14.5.4.1 Commercial Fisheries

The effects of oil spills on commercial fish and shellfish, and the indirect impacts on their habitats, are described above in Section 14.5. Fish and shellfish exposed to oil may become tainted, which could prevent an entire catch from being sold (Clark, 2001). There is evidence that fish are able to detect and avoid oil-contaminated waters (IPIECA, 2000), therefore tainting is more a concern for immobile shellfish which cannot swim away. This is more common in filter feeding shellfish, such as scallops, as they could take up fine oil droplets from the water column. *Nephrops* are the principal species of shellfish taken from the area in notable quantities, overlapping with the proposed Fotla field. In the event of a spill (if required), temporary fishing exclusion zones can be established to prevent fishing activity for a period of time (DTI, 2001b).

If fishing in the area of an oil spill, nets may become fouled with floating oil. This not only causes damage to the nets themselves but contact with fouled fishing gear may also contaminate subsequent catches. Average landings of demersal fish species from International Council for the Exploration of the Sea (ICES) rectangles 44F1 and 45F1, where the Fotla field is located, are broadly comparable to, or smaller than, quantities landed from the surrounding area (Figure 5.17). Pelagic fisheries are also present, but are notably lower to the wider region on average (Figure 5.18). Landings of shellfish species are very low in 44F1 but broadly similar for 45F1 when compared to the wider region.

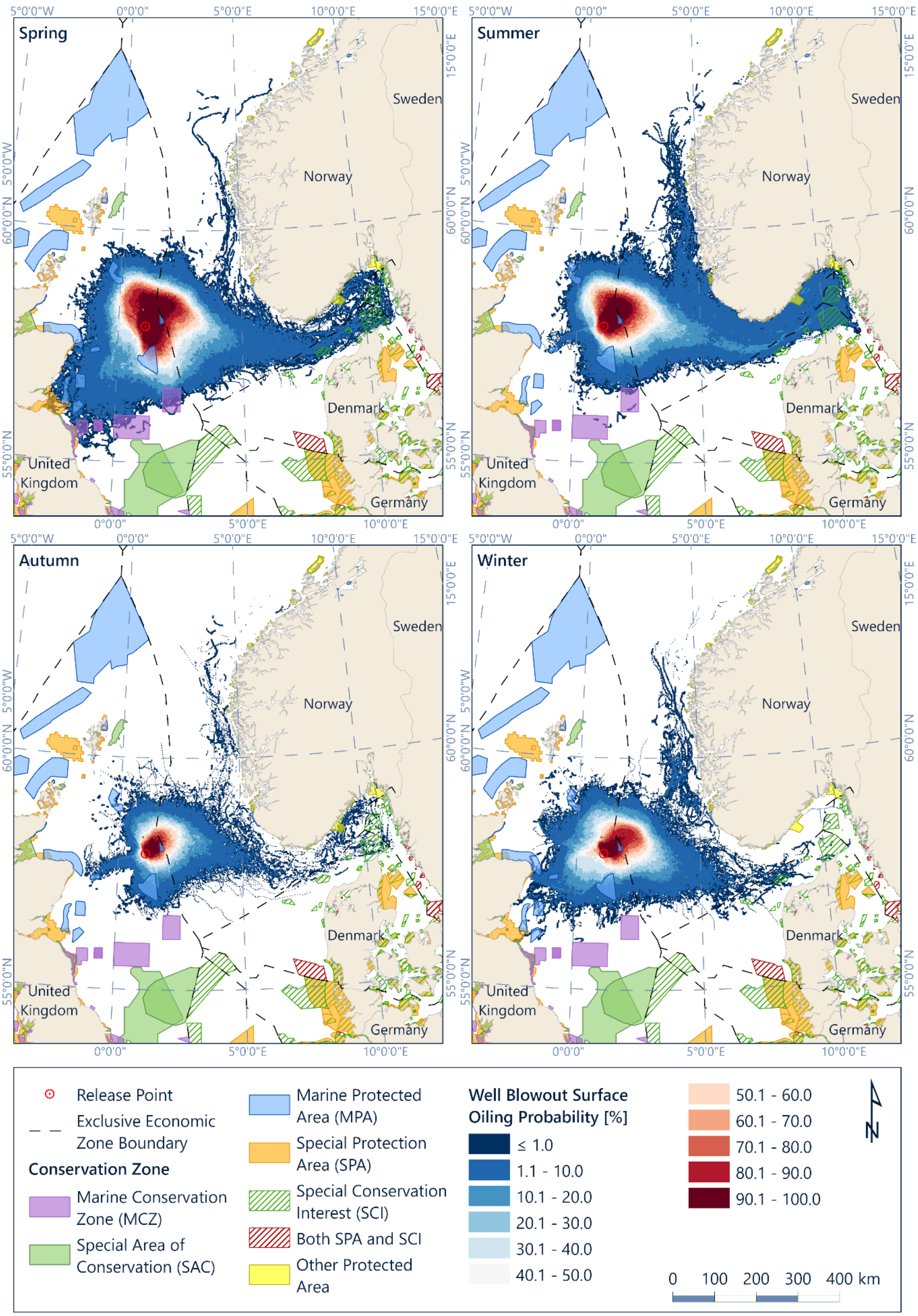
For all species groups, nets could potentially become tainted in the unlikely event of a large oil spill occurring. Major spills may also result in loss of fishing opportunities with boats unable or unwilling to fish, due to the risk of fouling, causing a temporary financial loss to commercial fishermen.

The magnitude of effect of an oil spill on commercial fisheries, due to the importance of the area for fishing, is considered to be '**Major**' on a receptor of '**Medium**' value due to areas used by local fisheries but with nearby alternatives, and therefore overall effect significance is '**Moderate adverse**'. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be '**Not Significant**'.



<bol>Coordinate System:</bol> ED 1950 UTM Zone 31N; <bol>Caveats:</bol> Esri, 2024; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2024; NatureScot, Contains public sector information licensed under the Open Government Licence v3.0; EMODnet Human Activities & Cogea, 2024; The Norwegian Environment Agency, 2024.

Figure 14.9: Shoreline oiling probability and protected areas (blowout scenario)



<bol>Coordinate System:</bol> ED 1950 UTM Zone 31N; <bol>Caveats:</bol> Esri, 2024; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM), version 12; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2024; NatureScot, Contains public sector information licensed under the Open Government Licence v3.0; EMODnet Human Activities & Cogea, 2024; The Norwegian Environment Agency, 2024.

Figure 14.10: Surface oiling probability and protected areas (blowout scenario)

14.5.4.2 Aquaculture

Numerous fish and shellfish farms are distributed across the coast of Norway and Orkney (Section 5.4.2) and, therefore, aquaculture is an important contributor to the economies of these areas. Tainting is of concern for all caged fish and shellfish farms, as the animals are unable to swim away. If a large surface spill can reach these islands the many mariculture farms, which cultivate fish and shellfish may be at risk from tainting and fouling, potentially leaving their stock unmarketable and their sites liable to closure (Andrews et al., 2021).

Although all oils can cause taint, lighter oils are generally more potent (Clark, 2001). Any large oil spill from the proposed Fotla field would have undergone the weathering processes described above (Section 14.3.2) and, therefore, will have lost many of its lighter fractions by the time it reaches the inshore areas where aquaculture sites are typically located. Although this would not completely prevent the impact of the oil with regard to tainting, it may limit the severity.

Oil spill modelling in the case of an uncontrolled well blow-out predicts that the oil has a 45 % probability of reaching the Norwegian coastline (Table 14.3) however it would take approximately 53 days for the oil to arrive.

Therefore, the magnitude of effect of an oil spill (well blow-out) on aquaculture sites, is considered to be '**Major**' on a receptor of '**Medium**' value, and therefore overall effect significance is '**Moderate adverse**'. The likelihood of this occurring however is considered to be '**Remote**', due to the perceived frequency of such an incident occurring as discussed in Section 14.2, and therefore final effect significance is judged to be '**Not Significant**'.

14.5.5 In-combination, Cumulative and Transboundary Impacts

If a spill was to occur, any released oil may have the potential to act 'in-combination' with other aspects of the Fotla field development and impact on some receptors leading to a combined effect. However, with respect to an accidental release of hydrocarbons, no potentially significant in-combination effects were identified which would justify further assessment, beyond the individual effects that have already been considered in this section, as this would not alter the conclusions reached.

In terms of cumulative impacts, if another installation was to experience an accidental release of hydrocarbons, the cumulative effects are considered to be '**Major**' on receptors judged to be of '**Very High**' value and effect significance would be '**Major adverse**'. However, as discussed in Section 14.2, given there is limited potential for an accidental release of hydrocarbons from the Fotla field development and any other existing installation to occur, no cumulative impacts are therefore considered likely. The likelihood of multiple accidental events occurring on the UKCS is considered to be '**Remote**'. In the event of an accidental release of hydrocarbons the responses measures detailed in the OPEP and / or TOOPEP for the respective installation would be implemented and residual effect significance is judged to be '**Not Significant**.

The greatest potential for transboundary impacts is considered to arise from an uncontrolled well blow out as this would see a large volume of hydrocarbons released to the marine environment. Modelling of this release of hydrocarbons predicts that the oil may reach the median lines of the Denmark, Sweden and Norway (Section 14.4.1 and Table 14.2) with varying degrees of probability. If an accidental release of hydrocarbons was to occur, Ithaca Energy has appropriate procedures in place to liaise with regulatory authorities in the UK and other European countries to respond to a release in line with any existing agreements for dealing with international releases of hydrocarbons (e.g. the Bonn Agreement).

14.6 Potential For a Major Environmental Incident

The Offshore Safety Directive (2013/30/EU) came into force via UK Regulations on 19 July 2015. These Regulations require that a Safety Case defining Major Accident Hazards (MAH) with the potential to cause Major Accidents (MA) must be in place to cover all relevant offshore operations. The potential for MAs to cause a Major Environmental Incident (MEI) must also be defined in the Safety Case. For the proposed Fotla field, two scenarios with the potential to cause a MEI have been identified:

- Spillage of hydrocarbons in the event of an uncontrolled well blow-out (Scenario 1); and
- Diesel release from the MODU (Scenario 2).

The modelling results for Scenario 1 (Section 14.4.1) showed that there would be potential for sea surface and shoreline oiling, whereas for Scenario 2 (Section 14.4.2) there would be potential for sea surface oiling only. Of these two scenarios, the oil spill modelling results showed that the uncontrolled well blow-out would be expected to result in a greater extent of sea surface and shoreline oiling and therefore this scenario has been used as the basis for the MEI Assessment.

14.6.1 Major Environmental Incident (MEI) Assessment Methodology

The Offshore Safety Directive defines a MEI as an incident which results, or is likely to result, in significant adverse effects on the environment (Article 2[37]). Environmental vulnerability to oil spills is dependent on both the size of the spill and also the sensitivity of receptors. There is no standard quantitative method of determining the environmental impact likely to be associated with an oil spill, and so a qualitative approach based on the "Impact Scales and Gradation of Oil Spill Ecological Hazards and Consequences in the Marine Environments" classification guide by Patin (2004) has been used for this MEI assessment.

Table 14.10 shows the consequence assessment methodology defined by Patin (2004). These criteria have been used to consider the potential impact of a worst-case scenario oil spill from the Fotla field development on protected sites, including Special Protected areas (SPAs), SACs and Nature Conservation Marine Protected Areas (NCMPAs) and others, which have been designated for the protection of habitats and species.

The oil spill modelling shows that there is potential for oil to reach the waters of Norway, Denmark, Sweden, as well as the UK (Table 14.2). In the event of an incident that could impact the waters of an adjacent State, Ithaca Energy would liaise with the relevant national authorities to assess the scale of any potential impacts.

Table 14.10: Consequence Assessment Methodology based on Patin (2004)

A. Spatial Scale (Area)	
Spatial Scale	Area Under Impact
Point	Less than 100 m^2
Local	Range from 100 m^2 to 1 km^2
Confined	Range from 1 km^2 to 100 km^2
Sub-regional	More than 100 km^2
Regional	Spread over shelf area

B. Temporal Scale	
Temporal Scale	Longevity
Short term	Several minutes to several days
Temporary	Several days to one season
Long-term	One season to 1 year
Chronic	More than 1 year

C. Reversibility of Changes	
Reversibility of Changes	Longevity of Disturbance
Reversible (acute stress)	Acute disturbances in the state of environment and stresses in biota that can be eliminated either naturally or artificially within a short time span (several days to one season)
Slightly reversible	Disturbances in the state of environment and stresses in biota that can be eliminated either naturally or artificially within a relatively short time span (one season to 3 years)
Irreversible (chronic stress)	Prolonged disturbances in the state of environment and stresses in biota that exist longer than 3 years

D. Consequence Assessment – General Assessment	
General Assessment	Disruption
Insignificant	Minimal changes that are either absent or not discernible.
Slight	Slight disturbances to the environment and short-term stresses in biota are discernible (below minimum reaction threshold 0.1 % of natural population reaction).
Moderate	Moderate disturbances to the environment and stresses in biota are observed (changes up to 1 % of natural population reaction are feasible).
Severe	Severe disturbances to the environment and stresses in biota are observed (up to 10 % of natural population).

D. Consequence Assessment – General Assessment	
General Assessment	Disruption
Catastrophic	Catastrophic disturbances to the environment and stresses in biota are observed (up to 50 % of natural population). Changes are irreversible and stable structural and functional degradation of a system is evident.

The oil spill modelling results show that the majority of crude oil would be expected to move eastwards and north-eastwards, with Norway predicted to have the greatest probability (up to 45 % in summer) of oil reaching the shoreline (OSRL, 2024) (Section 14.3).

As shown by the modelling (Section 14.4), in the event of an uncontrolled well blow-out as a worst-case scenario, a proportion of the oil released may remain in the water column or sediment. Therefore, conservation areas designated for the protection of benthic habitats/species may be affected in the event of a spill from the proposed Fotla field development and have been included in the assessment.

As an initial step in the assessment, thresholds have been applied in terms of the minimum arrival time and maximum probability of oiling. The modelling results provide an absolute worst-case scenario with the assumption that there would be no intervention in the slick. In practice, oil spill response resources would be mobilised immediately if a spill occurred, and oil spill response efforts would prioritise the protection of sensitive habitats and species.

Consequently, in order to represent a realistic worst-case scenario for the assessment, it is assumed that sites at which oil would be expected to take three weeks (21 days) or more to reach, or with a probability of less than 5 % for any oiling, would be very unlikely to be subject to significant adverse effects that could constitute a MEI, due to the implementation of response measures and the low probability of oil reaching the site. Therefore, only sites with an expected minimum arrival time for oiling of 20 days or less, and a probability of more than 5 %, have been assessed according to the consequence assessment methodology detailed above.

After reviewing protected sites against the criteria detailed above, Table 14.11 lists the those that have been shown by the modelling to have the potential to be affected by a large oil spill from the proposed Fotla field development. The potential impact of surface, shoreline or sediment oiling on the habitats and species of the protected sites listed in Table 14.11 has been considered in the assessment.

The modelling results show that the probability and shortest time to reach a particular sensitivity differs between the two scenarios. Therefore, Table 14.11 presents the shortest minimum arrival time and maximum probability extracted from the modelling results for both scenarios for sites screened into the assessment based on the criteria described above.

Table 14.11: Protected sites which may be impacted by a large oil spill from the proposed Fotla field development

Name	Designation	Location	Season	Minimum Arrival Time*	Maximum Probability	Qualifying Features (SAC: Only marine and intertidal habitats are listed; SPA: individual species of international importance refers to relevant biogeographic area for each species; MPA/MCZ: Geodiversity Features not listed)
Norwegian Boundary Sediment Plain	NCMPA	Offshore	Winter	1 day, 3 hrs	100 %	Ocean quahog (*Arctica islandica*) aggregations Offshore subtidal sands and gravel
Scanner Pockmark	SAC	Offshore	Spring	2 days, 0 hrs	100 %	Annex I Habitats: submarine structures made by leaking gases
East of Gannet & Montrose Fields	NCMPA	Offshore	Spring	3 days, 9 hrs	100 %	UK BAP Offshore deep-sea muds Ocean quahog (*Arctica islandica*)
Braemar Pockmarks	SAC	Offshore	Summer	8 days, 12 hrs	22 %	Annex I Habitats: submarine structures made by leaking gases
Fulmar	MCZ	Offshore	Spring	11 days, 0 hrs	34 %	Subtidal sand, Subtidal mud, Subtidal mixed sediments and Ocean quahog (*Arctica islandica*)
Turbot Bank	NCMPA	Offshore	Spring	11 days, 18 hrs	14 %	Sandeels
Firth of Forth Banks Complex	NCMPA	Offshore	Spring	13 days, 21 hrs	17 %	Ocean quahog (*Arctica islandica*) aggregations, Offshore subtidal sands and gravel and Shelf Banks and Mounds

Notes:
NCMPA = Nature Conservation Marine Protected Areas   SAC = Special Areas of Conservation   SPA = Special Protection Area   MCZ = Marine Conservation Zone
* = Protected sites are sorted based on the minimum arrival time for ooil .

14.6.2 Sediment Oiling

A number of the protected sites listed in Table 14.11 have been designated for offshore benthic habitats and the species associated with these habitats, with the potential to be affected by sediment oiling.

Two SACs have been designated for the presence of Annex I habitats:

- Submarine structures made by leaking gases (Braemar Pockmarks and Scanner Pockmark).

Three NCMPAs and one MCZ have been designated for the following habitats:

- Subtidal sand (Fulmar MCZ);
- Subtidal mud (Fulmar MCZ);
- Subtidal mixed sediments (Fulmar MCZ);
- Offshore deep-sea muds (East of Gannet & Montrose Fields NCMPA);
- Offshore subtidal sands and gravel (Norwegian Boundary Sediment Plain and Firth of Forth Banks Complex NCMPAs); and
- Shelf Banks and Mounds (Firth of Forth Banks Complex NCMPA).

In addition, the Norwegian Boundary Sediment Plain NCMPA, East of Gannet & Montrose Fields NCMPA, Firth of Forth Banks Complex NCMPA, Turbot Bank NCMPA and Fulmar MCZ have been designated for the following species:

- Ocean quahogs (Norwegian Boundary Sediment Plain NCMPA, East of Gannet & Montrose Fields NCMPA, Firth of Forth Banks Complex NCMPA and Fulmar MCZ); and
- Sandeels (Turbot Bank NCMPA).

The potential impacts from a release of hydrocarbons on benthic habitats and their associated species is considered in Sections 14.5.1.2 and 14.5.1.3. The deterministic oil spill modelling carried out for the Fotla field development provided a mass balance for the fate of oil, which indicated that released hydrocarbons would begin to settle on the seabed after nearly 50 days (Figure 14.7).

The Feature Activity Sensitivity Tool (FeAST) was used to consider the sensitivity of marine features and their sensitivity to the impacts of a release of hydrocarbons. It does not take into account the intensity, frequency or cumulative impacts from activities taking place at specific locations.

Using the FeAST, medium to high sensitivity is reported for the PMF burrowed mud (associated with sea-pen and burrowing megafauna communities) deriving from organic enrichment and hydrocarbon and Polycyclic Aromatic Hydrocarbons (PAH) contamination, respectively (FeAST, 2024).

The sensitivity of burrowed mud habitats on sediment oiling has been considered as high (FeAST, 2024), due to organic material causing the mud to become very low in oxygen. A number of studies have previously indicated an initial mortality of marine invertebrates (especially crustaceans) and a slow recovery from then onwards (5-15 years; Birchenough & Frid, 2009), as well as a slight change in the communities with the presence of opportunistic species (Dauvin & Gentil, 1990; Gesteira et al., 2003; Suchanek, 1993). However, an oil spill would have to be dispersed deep into the water column to affect the feature and this is unlikely based on the oil modelling results to occur (Section 14.4.3, Figure 14.7) and given that an immediate response to limit oil dispersion would be undertaken.

Medium sensitivity to organic enrichment is considered (FeAST, 2024), given that organic enrichment has several adverse consequences which are detrimental to burrowing megafauna and sea pens (considered present within the Fotla field) (FeAST, 2024). Hypoxia, excess turbidity, physical burial, the presence of toxins are some of the effects of organic enrichment on the seabed which are unfavourable to burrow maintenance (Hughes, 1998).

No sensitivity is reported for subtidal sands and gravels to organic enrichment (Tillin et al., 2010), but no assessment exists on the impact of hydrocarbon and PAH contamination (FeAST, 2024). Subtidal sands and gravels is a widespread habitat across the North Sea and, as previously mentioned, a release of hydrocarbons would not be expected to begin impacting the seabed until nearly 50 days after the release commences by which point containment measures to mitigate impacts would be underway.

The FeAST notes that Ocean quahog is not sensitive to organic enrichment (FeAST, 2024) and is tolerant of, or indifferent to, organic enrichment (Borja et al., 2000; Gittenberger & van Loon 2011). However, no assessment exists on the impact of hydrocarbon and PAH contamination (FeAST, 2024).

The FeAST notes that phytoplankton enrichment of sediment has been implicated in local declines of sandeels (FeAST, 2024). Sandeels depend on clean sandy bottomed substrates for their preferred habitat but can migrate to avoid contaminated substrates (Velando et al., 2005). The mass balance plot predicts that released hydrocarbons will take nearly 50 days before beginning to impact on the sediment (Figure 14.7). Any significant adverse effects would not occur until this time by which point some containment measures would be implemented in an effort to mitigate any hydrocarbon release.

Potential impacts from organic enrichment on Pockmarks and 'Shelf Banks and Mounds' are not considered relevant (FeAST, 2024).

Using the environmental consequence from Table 14.10 (Patin, 2004), the assessment of this scenario is summarised in Table 14.12.

Table 14.12: Environmental Consequence Assessment for sediment oiling

Scale	Assessment	Justification
Spatial	Sub-regional	Maximum extent of spill
Temporal	Chronic	Expected recovery to soft sediment habitats to take more than 1 year
Reversibility	Slightly reversible	The disturbance to the environment would be removed within 1 year
General	Moderate	Change expected in no more than 1% of the population

In summary, sediment oiling has the potential to cause a measurable significant adverse effect to burrowed mud (associated with offshore deep-sea muds (and sea pen and burrowing megafauna communities present in Fotla field), but no effects to subtidal sands and gravels, ocean quahog and sandeels.

14.6.3 MEI Assessment Conclusions

Consideration is given in Section 14.5 to the impacts of an uncontrolled well blow-out on the favourable conservation status of marine life and relevant protected areas. It was concluded that an uncontrolled well blow-out at the Fotla field location could lead to significant impacts that could affect the favourable conservation status of marine life and offshore protected areas. Therefore, such an event is considered to qualify as a MEI as defined in the SCR 2015.

It should be noted however, in the event of an actual oil spill, the affected area(s) will be much more localised and will depend on the volume of oil spilled and local metocean conditions at the time. Moreover, mitigation measures will be put in place to minimise the footprint of the oil spill as outlined in Section 14.7.

14.7 Mitigation Measures

14.7.1 Preventative Measures

Ithaca Energy's commitments to ensuring protection of the environment are set out in the corporate Health, Safety, and Environmental (HSE) Policy Statement. Ithaca Energy follows the International Standards Organisation (ISO) 14001 standard and has an externally verified Environmental Management System (EMS). The Company's EMS covers activities including exploration, drilling and production and will be applied to the proposed Fotla field development. The EMS governs those aspects of the operations that can be controlled, such as discharges, and establishes a subsequent auditing process.

The activities associated with the proposed development are also covered in a project specific HSE plan which ensures that the project is managed in such a way that Ithaca Energy's HSE Policy Statement is adhered to throughout all phases of the proposed project. Particular emphasis will be paid to having a robust design, quality equipment, quality construction and operational best practices.

In order to prevent an oil spill occurring, stringent safety and operational procedures will be followed at all times.

14.7.1.1 Training, Experience and Suitability of Equipment

Ithaca Energy is aware of the risk of a release of hydrocarbons at the proposed Fotla field. Before offshore operations commence, Ithaca Energy and their appointed Installation/Well Operator will fully assess the competence and experience of all contractors as well as the suitability of all equipment to operate in the CNS area. All offshore personnel will be appropriately trained, experienced and certified to carry out their specific duties. The crew of the MODU will also undergo environmental awareness and safety training.

14.7.1.2 Well Design

All wells in the UK are subject to well examination schemes as per the Offshore Safety Directive 2015. The purpose is to provide assurance that the well is designed and constructed properly and is maintained adequately. This provides a scheme of quality control and quality assurance and incorporates current industry guidance. It is essential for the examination to demonstrate that the pressure boundary of the well is controlled throughout the well's life cycle and that the pressure containment equipment that forms part of the well is suitable for this purpose.

Examination of planned well programmes and operations must be carried out by an independent and competent person. Independent examination ensures that 'Good Oilfield Practice' and company standards are incorporated during drilling and well intervention operations. This contributes to risk reduction and prevention of loss of containment through application of the 'as low as reasonably practicable' (ALARP) principle.

The Fotla wells have been designed to minimise the potential for well control issues. A thorough and formal peer-review approach will be used, to review all critical elements of the well design and the execution of drilling the well. Furthermore, the well design will be independently reviewed by a Well Examiner, as is required for all wells in the UK. The Well Examiner will also monitor the actual construction and any modifications to the well.

Any change, or deviation, to the drilling programme, the subsurface parameters for the well design, or the well construction itself, will be subject to a formal management of change process.

14.7.1.3 Well Control

The MODU will be equipped with a BOP which is rated for pressures beyond the maximum pressure anticipated for the wells being drilled.

The function of the BOP will be to prevent uncontrolled flow from the wells to the surface during drilling by positively closing in the well in the event of an uncontrolled release from the reservoir into the well bore. The BOP is made up of a series of hydraulically operated rams that can be closed in an emergency from the drill floor, or from a safe location elsewhere on the rig.

The integrity of the BOP will be tested prior to usage and periodically during the drilling. Inspection and testing of the BOP will be undertaken in line with the Installation/Well operator, Ithaca Energy procedures and UK legislation.

In the event of any well control issues the Ithaca Energy Well Incident Response Plan will be activated and used as a guide in the event of a well control emergency during operations involving a MODU. The Well Incident Response Plan provides a contingency plan and guidance for the application of equipment and procedures to various well control scenarios. These range from routine well control operations to situations involving the total loss of well control.

The available response options will include, but are not limited to, well control specialists and engineering support; specialist equipment and services; intervention procedures; well kill procedures; relief well planning and execution; Remotely Operated Vehicle (ROV) intervention; capping stack deployment; hydrocarbon containment and subsea dispersant resources. A well control event may not require all of the responses listed.

The Oil Spill Prevention and Response Advisory Group (OSPRAG) capping device is available for use on the Fotla wells if it is determined to be a suitable and effective response to the incident at the time. In addition to well capping the drilling of a relief well may be required (Section 14.7.2).

The suitability of a capping device strategy will be significantly dependent on the circumstances of the incident and scenario encountered. In the unlikely event of a blow out from a subsea well where the primary blowout prevention equipment has failed, a well capping device may be required. Ithaca Energy has access to the OSPRAG Capping device in the event it is required.

14.7.1.4 Other Safety Measures

All equipment used on the MODU will have safety measures built in, to minimise the risk of any hydrocarbon spillage (e.g. open and closed drain systems). A number of spill kits will be available to deal with (smaller) spillages. All supply vessels will operate via Dynamic Positioning (DP), to reduce likelihood of collision and therefore potential tank rupturing.

14.7.1.5 Flowline Maintenance and Control

The flowline and umbilicals associated with the Fotla field will be subject to a rigorous inspection and maintenance regime, to ensure they are kept in optimum condition through the life of the field. Periodic flowline surveys, comprising ROV inspections, and an inspection repair and maintenance plan will be in place. Inspection intervals will be reviewed following receipt of inspection information and, where appropriate, future intervals are adjusted.

14.7.2 Action to Stop a Subsea Spill During Drilling with the MODU

14.7.2.1 Initial Actions

The initial response to a subsea spill will be to use the ROV to identify the source of the leak. However, if at any time the safety of the MODU becomes compromised, the first priority will be to close the BOP, disconnect the MODU from the well, and move off location. While the BOP is designed as fail safe closed, ROV and acoustic overrides are available should this not work correctly. This will allow the BOP to be closed within 24 hours, even if the MODU has to move off location first. Once at a safe distance from the well location, the ROV can be deployed to verify the BOP is properly closed, and no more oil is being spilled.

A second rig or intervention vessel would be mobilised to the location with the intention of placing a second BOP or a capping device on the flowing well or by drilling a relief well and re-establishing well control. As a member of OSRL, Ithaca Energy will have access to the OSPRAG well capping device to contain the well (Section 14.7.1.3).

If primary and secondary well control is lost by way of a blowout and oil flows uncontrollably from the well a relief well may be required to stop the flow of oil and bring the well back under control. A suitable rig would be sourced from the UK market. An inventory is maintained by Ithaca Energy and their contractors to ensure that stocks of all materials required for a relief well are available at short notice. Ithaca Energy has insurance provisions in place to cover well control/re-drill situations as well as legal liabilities, and the Company is a member of Offshore Pollution Liability Association Limited (OPOL) which provides rapid compensation to parties directly affected by an oil spill.

In a situation where the MODU is not disconnected from the well, and depending on the stage of operations a blow-out occurs, there may be various other methods available to control the flow of hydrocarbons to the surface. These include varying the pump rate and the use of various chemicals, such as weighting material (barite or calcium carbonate) and cement. Therefore, a contingency stock of cement and barite will be kept onboard the MODU. Although the time required to kill the well will be dependent on how and why it has failed, a standard well kill operation takes between 12 and 48 hours. Once control of the well has been regained, the well can be fully abandoned with cement plugs.

14.7.3 Oil Spill Response

If a well control incident were to occur, it would be a priority to avoid spilled hydrocarbons impacting the coastline and, therefore, Ithaca Energy would employ all available and suitable oil spill response techniques in the event of a spillage moving towards the shore.

14.7.3.1 Oil Pollution Emergency Plan

Oil Pollution Emergency Plans (OPEPs) will be required for the Fotla field development. OPEPs must conform to the Merchant Shipping (Oil Pollution, Preparedness, Response and

Co-operation Convention) (Amendment) Regulations 2015 and the Offshore Installations (Emergency Pollution Control) Regulations 2002.

Ithaca Energy must ensure that any MODU working in the Fotla field has an approved Non Production Installation Oil Pollution Emergency Plan (NPI OPEP) in place. Ithaca Energy must also have in place an approved Temporary Operations Oil Pollution Emergency Plan (TOOPEP) to cover the planned drilling operations.

During production operations, Ithaca will have a Fotla Field (Tier 1) OPEP in place. A copy of this OPEP will be held on the Britannia platforms. In addition, Ithaca has in place an Onshore OPEP detailing Tier 2/3 response arrangements.

The respective OPEPs set out the specific oil spill response requirements for the Fotla field development, taking into account the location, the prevailing meteorological conditions and the environmental sensitivities of the area. The OPEPs will be designed to assist the decision-making process during a hydrocarbon spill, indicate what resources are required to combat the spill, steps to minimise any further discharges and mitigate its effects.

14.7.3.2 Training, Exercises and Experience – Offshore Personnel

Specific members of the MODU and standby vessel crew will have undertaken appropriate OPEP level oil spill response training. The Offshore Installation Manager (OIM) and the Installation/well Operator offshore representative will have undertaken the OPRED course for On-Scene Commander (OPEP Level 1).

As a minimum, the TOOPEP and a Field OPEP will be distributed to personnel with designated duties in the event that an oil spill response is required, and to the regulatory authorities and statutory consultees. On receipt of the TOOPEP and Field OPEP, personnel will undergo awareness training in oil spill response prior to the commencement of drilling operations.

During the proposed drilling operations, the MODU will regularly undertake training exercises, including vessel-based oil spill response exercises for the crew and an OPEP Exercise while on site, to ensure that offshore personnel are familiar with the OPEPs and their responsibilities during a response.

14.7.3.3 Training, Exercises and Experience – Onshore Personnel

External oil spill response training will be organised for key onshore personnel, in line with the OPRED requirements and the internal requirements of environmental training and continual improvement in Ithaca Energy’s Management System. Relevant Ithaca Energy Duty Managers will, as a minimum, have undertaken the OPRED course, Corporate Management oil spill response awareness (OPEP Level 2). Ithaca Energy is a member of OSRL, and a response advisor with OPEP Level 4 training would also be provided by OSRL.

Desktop exercises will be undertaken prior to commencement of operations to test the effectiveness of the TOOPEP and Field OPEP. Ithaca Energy will conduct these oil spill response exercises to ensure that all personnel are aware of their roles in an actual oil spill incident. The exercises will also familiarise personnel with the lines of communication between the MODU, offshore, the Installation/Well Operator and Ithaca Energy representatives onshore. The exercises will include familiarisation of the roles and responsibilities of the various interested parties, and the chosen response strategies. If necessary, the TOOPEP and/or Field OPEP will be updated to reflect any changes required as a result of these exercises.

14.7.3.4 UK Mutual Aid Framework Agreement

Ithaca Energy is a signatory to the UK Mutual Aid Framework Agreement (MAFA) which facilitates mutual aid of personnel between UK operators in the event of a sustained incident response. This initiative will allow for the potential sharing of specialist expertise and support between participating members.

14.7.4 Oil Spill Response Strategies

The most appropriate response to a hydrocarbon spill from the planned drilling operations will be determined by oil type, logistics and prevailing physical conditions. A precise response strategy, which may employ one or more of the response options described below, can only be decided at the time of the spill. Oil spill response personnel must be prepared to adapt their actions as the spill develops, as changes in both the prevailing conditions and the oil properties dictate.

In general, there are four groups of response strategies which could be deployed in the event of an oil spill:

- Natural dispersion and monitoring;
- Application of chemical dispersants;
- Containment and recovery (surface and subsea); and
- Shoreline protection and clean-up.

14.7.4.1 Natural Dispersion and Monitoring

In the early stages of an incident, a standby vessel will be on site for monitoring and surveillance of the slick. Aerial surveillance may also be undertaken by helicopter or aircraft depending on the size of the spill. Manual predictions and oil spill modelling software to estimate the movement of the oil will be employed using real time parameters to assist with the predictions.

14.7.4.2 Application of Chemical Dispersants

Chemical dispersants will be considered to aid natural dispersion of a large oil spill, or when sensitive receptors such as flocks of seabirds are at risk. The decision to use chemical dispersants will assess its positive benefits, against any resulting impacts in the water column.

14.7.4.3 Containment and Recovery

Booms may be used to contain a large slick on the sea surface, concentrating the oil for recovery by skimmers. The effectiveness of both booms and skimmers will be assessed for their suitability.

14.7.4.4 Shoreline Protection and Clean-up

In the event of a spill, the first priority should be to prevent spilled hydrocarbons from reaching coastal areas. If spillage is projected to reach the shoreline with the use of manual and software predictions, coastal sensitivities will be identified. OSRLs Geographic Information System (GIS) facility (which maps coastal sensitivities around the UK) will supplement local authority plans, strategy documents, maps, and other available resources. Broad-scale surveys, from vehicles, inshore vessels or helicopters, will be mobilised to gain an overview of the shoreline types and main sensitivities along the potentially affected stretch of coast, and consideration will be given to carrying out more detailed surveys of particularly environmentally sensitive or commercial important areas of shoreline prior to any oil beaching. The strategy for shoreline clean-up ultimately will be directed by the affected local authorities. Appropriately trained personnel and clean-up equipment will be made available to assist any clean-up operations, through OSRL.

14.7.5 Liability and Insurance

Ithaca Energy will ensure that it has sufficient finances and insurance in place to cover the cost of responding to a large oil spill (including the use of a well capping device and drilling a relief well, if required). Ithaca Energy is a member of the Offshore Pollution Liability Association Limited (OPOL). OPOL is a voluntary oil pollution compensation scheme to which all offshore operators currently active on the UKCS are party to. OPOL is accepted as representing the committed response of the oil industry in dealing with compensation claims arising from offshore oil pollution incidents from exploration and production facilities. At present the OPOL Limit of Liability is US $250 million per incident.

Based on an oil spill modelling study undertaken on behalf of the OSPRAG, the current occurrence limit should be sufficient to cover the third-party pollution compensation and remediation costs associated with the majority of spill scenarios, with only a small number of wells on the UKCS having the potential to exceed the OPOL Limit (OGUK, 2012).

While OPOL provides for third party clean-up and compensation costs to a predetermined limit, there may be additional extra expenses that the Ithaca Energy, as the Licence Operator, may have to cover in the event of a blow-out. Ithaca Energy will ensure that sufficient finance or insurance/indemnity provision is available to cover the drilling of relief wells (if required).

14.8 Catastrophic Loss of the MODU, Support Vessel, Helicopter

Under extreme circumstances, the MODU, a support vessel or a helicopter may sink. This could be caused by a variety of reasons, such as a serious blow-out situation, shallow gas release, a collision with another vessel, a freak weather event or other natural disaster, a catastrophic error during ballasting of the MODU. These events are extremely rare and happen so infrequently that no reliable statistics could be obtained to quantify them.

A suite of mitigation measures would be implemented to prevent such an event from occurring including the mitigation measures described in Section 14.7, as well as the following:

- The MODU will be inspected for sea worthiness and the Well Operator/Installation Operator audited prior to operations commencing;
- Personnel will be appropriately trained, experienced and certified;
- The competence and experience of all contractors will be assessed before they are contracted;
- All supply vessels will operate via DP, to reduce the likelihood of a collision;
- A digital site survey for drilling hazards has been carried out to confirm that there is no shallow gas in the area;
- A 500 m exclusion zone will be enforced around the MODU for general shipping in the area;
- A standby vessel will be on site through the life of the field to enforce the 500 m exclusion zone;
- The MODU and associated vessels will display appropriate marking and lighting;
- The suitability of supply, other support vessels and the helicopter will be assessed before they are contracted;
- The standby vessel will be equipped with radar and communication equipment so that any vessel in the area can be detected and contacted, if required; and
- The United Kingdom Hydrographic Office (UKHO) will be kept informed of drilling activities.

In the event of diesel release from the MODU, a support vessel or helicopter, it would be unlikely that the MODU, vessel or helicopter would be salvageable and, therefore, it would most probably remain on the seabed as a wreck. Attempts would be made to salvage any remaining hydrocarbons and other potentially harmful products onboard although it should be noted that, in practice, these types of operations may cause pollution incidents themselves. The potential impact of the release of oil to the marine environment is described above in Section 14.5.

The wreck of the MODU, vessel or helicopter would be marked on navigational charts to prevent the snagging of fishing nets and other towed equipment. In general, the presence of wrecks on the seabed is not considered to have any long lasting negative environmental effects. Therefore, given the remote chance of such an event happening due to appropriate mitigation measures in place, and minimal negative long-term environmental impacts, the residual impact of a diesel release from the MODU, support vessel or helicopter is considered to be insignificant.

14.9 Resilience to Natural Disasters and Climate Change

The potential for natural disasters such as earthquakes and tsunamis are very low as these events are themselves rare however they cannot be discounted (Long, 2015). Nonetheless, the infrastructure of the proposed development must be able to withstand the rigours of the North Sea environment.

As a result of climate change, more extreme weather events have been recorded in recent years, this is in conjunction with rising sea levels. The effects of climate change may affect storminess, storm tracks as well as wind and wave heights (Bricheno et al., 2025). Modelling studies predict that, with respect to the UK, there may be a weakening of storm tracks during the summer months but an increase in winter storms both in terms of frequency and intensity (Bricheno., et al 2025). The effects of climate change must therefore be considered when embarking on operations such as the Fotla field.

To this end, the above sea and subsea infrastructure used at the Fotla field will be structurally sound, designed to withstand a number of different loads and extreme weather events. Safety procedures will also be implemented, such as making the operations/installations safe or potentially shutting down operations, if such extreme weather events are experienced. This is in combination with emergency procedures described in TOOPEP and OPEP.

14.10 Conclusions

The risk of a large-scale hydrocarbon spill during drilling operations or during the subsequent production phase of the proposed Fotla field is very low. Historic spill data shows that large (crude) oil spills from oil and gas developments on the UKCS are very rare, and the overall volume spilled each year continues to reduce gradually over time. There has never been an oil spill as a result of a well blow-out on the UKCS. Between 1990 and 2024, a total of 8 spills greater than 25 tonnes have been recorded from oil and gas developments on the UKCS. Historic data suggest small spills of less than 1 tonne represent the most likely spill scenarios.

Oil spill modelling shows that a large spill, such as an uncontrolled well blow-out, would, under the majority of meteorological circumstances, drift eastwards and north-eastwards from the Fotla field. A large spill may have the potential to reach the shorelines of the UK, Denmark, Norway and Sweden however this probability is less than 10 % for most of the countries and seasons modelled. These conclusions are based on modelling results that assume no intervention in the event of a spill whereas, in practice, response resources would be mobilised immediately if a spill occurred. It would be a priority for Ithaca Energy to attempt to ensure no spilled oil would impact the coastline and, therefore, all appropriate spill response techniques would be employed in the event of a spillage moving towards the shore.

It should be noted that these potential impacts would only occur under extreme circumstances in the event of a very large oil spill, as modelled in this assessment. Although it is recognised that a well blow-out could result in a major impact on some receptors, with the application of the mitigation measures identified, the likelihood of such an event occurring at the Fotla field is considered unlikely to occur.

Throughout the life of field, the focus will be on the prevention of oil spills. Stringent safety and operational procedures will be adhered to throughout the operations. A robust well design has been developed to minimise the potential for well control issues, and all critical elements of this design and the execution operations have been both peer and independently reviewed.

Ithaca Energy will ensure that the Installation Operator and Well Operator will have a detailed operation specific OPEPs in place, to ensure that immediate and appropriate action is taken in the event of any hydrocarbon spillage, minimising any impact to the marine environment. A contract with OSRL is in place, allowing the rapid deployment of oil spill response equipment and personnel in the event of a large oil spill incident. Specific response equipment would be available including booms, to contain surface spills at sea or protect sensitive shorelines. Ultimately, the type and size of spill, along with the metocean conditions at the time of the spill, will dictate which of these resources is most suitable for the spill event. Additional shore clean-up equipment is also available.

With the preventative steps and mitigation measures in place to avert an oil spill incident from occurring, and the oil spill contingency planning and response resources available to Ithaca Energy in the event of a large oil spill event, the likelihood of such an event is '**Remote**' and the residual effect of a release of oil from the proposed Fotla field is judged to be '**Not Significant**' and therefore not significant.

15. Conclusions

Ithaca Energy proposes to construct the Fotla field development located in United Kingdom Continental Shelf (UKCS) Block 22/1b, approximately 176 km east of Peterhead and 46 km west of the UK/Norway transboundary line comprising up to two production wells which will be drilled and tied back to the Britannia platforms, operated by Harbour Energy, located 13.5 km to the north in UKCS Block 16/26a. The pipeline route from the Fotla field to Britannia will pass through UKCS Blocks 16/26a, 22/1a and 22/1a.

An Environmental Impact Assessment (EIA) of the potential environmental effects arising from the proposals was undertaken and reported in the Environmental Statement (ES) which also identifies measures proposed to remove or minimise identified significant effects. The findings of the ES are summarised below.

15.1 Drilling Impacts

The discharge of cuttings, fluids and cement has the potential to cause localised effects on the benthic environment, primarily through direct physical changes to the seabed, as well as in the water column.

The OSPAR habitat and Scottish Priority Marine Feature (PMF) 'sea pens and burrowing megafauna' as well as ocean quahog (OSPAR listed and PMF), are present at the Fotla field development. However, any adverse effects on the conservation features are expected to take place as a worst-case scenario up to 30 m from the point of discharge and will last for the duration of the activity. Sea pens and ocean quahogs are tolerant to smothering and siltation rate changes and any chemicals released in the water column during drilling, cementing and well completion operations are highly water soluble, of low persistence and of low toxicity. Therefore, the effect from the physico-chemical impacts due to drilling operations for the Fotla production wells is considered insignificant.

15.2 Physical Presence Impacts

The physical presence of infrastructure, construction vessels and equipment has the potential to displace vessels using the area including fishing and general shipping traffic. However, the location of the field lies in an area of open sea and outside of major shipping routes. Also, the scale of the infrastructure is judged to be very small within the context of the wider region such that it is highly unlikely to represent a significant barrier to vessel movement. Consequently, significant adverse effects on other users of the sea due to the physical presence of the development are not anticipated.

The physical presence of infrastructure on the seabed will result in a permanent reduction in the total area of natural seabed habitat within the infrastructure footprint for the duration of the development. However, the habitat and species present in the locale are well represented across the wider area such that overall diversity at the regional level is not affected. Consequently, no significant effects on benthic ecology are anticipated.

Mitigation measures have been proposed for the safety of other users of the sea during construction and operation and include notification of stakeholders as to intended activities and notices to other vessels to maintain a safe distance from the MODU. Radio navigation warnings will be issued, and the rig and vessels will be appropriately marked and lit.

No significant cumulative or transboundary effects are forecast, due to the construction and operation of the Fotla field development.

15.3 Atmospheric Emissions

Atmospheric emissions will be produced during all phases of the Fotla field development. During the production phase, the Fotla development will add a small amount (<1 %) to the existing overall emissions at Britannia platforms over its life of field. In addition, emissions will be generated during the transportation, distribution and processing (refining) of the produced Fotla hydrocarbons and ultimately also during the combustion of the processed/refined oil and gas products by the end user. All these emissions will contribute to local, regional and global environmental effects.

At local and regional levels, air pollution impacts are mitigated by Health and Safety measures in place to control emissions, the dispersive nature of the offshore environment and the lack of sensitive receptors in the area. As such, any local and regional air pollution effects are expected to be 'Negligible' to 'Minor adverse', and therefore not significant.

Emissions will also contribute cumulatively to global environmental issues, including climate change. With regard to these cumulative impacts, the contribution of the proposed Fotla field development and its associated emissions is comparable to similar operations, and small in comparison to emissions at an industry wide level. Moreover, the proposed Fotla field development and its associated emissions are in line with, and do not put at risk, the current energy transition trajectory towards Net Zero by 2050, as followed by the UK government through its Balanced Pathway strategy as well as with the objectives agreed in the Paris (climate) Agreement. These targets are implemented in the UK by law and put into practise through nationally determined contributions, the North Sea Transition Deal, and industry guidance.

Therefore, in this context, the significance of the likely effects of the overall contribution of all combined Fotla emissions generated during the drilling, installation, commissioning and operational life of field of the Fotla development (Scope 1 and Scope 3, Category 4 and 6 emissions), as well as those generated during the transportation, distribution and processing (Scope 3, Category 9 and 10 emissions) and end user combustion (Scope 3, Category 11 emissions) of the produced hydrocarbons on global climate change have been assessed as being '**Minor adverse**' and fully in line with the measures necessary to achieve the UK's (as well as the global) trajectory towards net zero and therefore can be considered to be not significant.

15.4 Marine Discharges

The flow rate of produced water will increase due to the inclusion of fluids produced from the Fotla field which will be discharged via the Britannia and BLP. This is expected to increase the risk profile of the discharges with respect to water quality effects and effects on marine life.

However, as demonstrated by the specific produced water modelling, the plumes of discharged produced water will be rapidly diluted in open sea environment in line with the local tidal currents and the produced water will stay near the sea surface. Plankton at sea surface will likely be moderately impacted locally around the point of discharge, but no significant adverse effects on plankton populations over the wider area, fish and shellfish populations, and benthic communities are anticipated.

No cumulative impacts with other discharges in the region or transboundary impacts are expected.

15.5 Underwater Noise Impacts

Anthropogenic noise from marine activities during the drilling and installation of the Fotla field development can result in physiological effects and disruption of marine mammals and fish in the area. The installation of the Fotla manifold by impact piling, drilling of the two wells, and operations related to the pipeline installation campaign, including vessel activities, were identified for further assessment.

The underwater sound field model showed that piling operations can cause temporary and permanent auditory effects on marine mammals within short distances from the driven pile. With the proposed mitigation protocol in place, distances at which physiological impact occurs will remain within a defined 500 m exclusion zone, which will be monitored for the presence of marine mammals and mitigated accordingly. No physiological effects are expected from continuous sources such as drilling and vessel operation at any distance.

Behavioural disruption of marine mammals is expected to occur within 2.4 km of the marine activities. However, displacement is likely to be temporary, with marine mammals returning to the area shortly after the piling operations are completed. With the mitigation protocol in place, no significant effects are predicted for marine mammals as a result of noise emissions.

The piling activities are also expected to cause temporary disruption and auditory effects on fish a few hundred meters from the pile, with recoverable injuries occurring within only a few meters. Continuous sounds such as those produced by drilling, trenching, and vessel operation are only capable of causing temporary effects on fish within the immediate vicinity of the noise source. Due to the limited spatial extent of these effects, the ability of fish to avoid areas of intense sound, and the low receptor value of species present in the area, no significant effects on fish are predicted to arise from noise emissions.

No significant cumulative and/or transboundary effects from noise are expected as a result of activities associated with the Fotla field development.

15.6 Waste Management

Several different waste streams will be generated throughout the lifespan of the Fotla field development, which require appropriate management procedures to be in place to ensure correct disposal.

Waste management will be undertaken in compliance with current environmental legislation and Ithaca Energy's own waste procedures, including the waste hierarchy. The management of offshore waste generated on the UK Continental Shelf (UKCS) is strictly regulated and the UK has well-established infrastructure in place to manage this waste effectively. No significant impacts are anticipated, and significant cumulative or transboundary impacts are not expected as a result of the Fotla field development.

15.7 Accidental Events

The likelihood of a large-scale hydrocarbon spill during drilling operations or during the subsequent production phase of the proposed Fotla field development is very low.

Oil spill modelling undertaken to inform the assessment shows that a large spill would have the potential to reach the coasts of the UK, Denmark, Norway and Sweden, but with < 10 % probability for most of the countries and seasons modelled. Were there to be an accidental release of hydrocarbons from the Fotla well(s), it was concluded that the effect significance would range between 'moderate adverse' and 'major adverse'. However, these conclusions assume no intervention whereas, in practice, oil spill response resources would be mobilised immediately if a spill occurred.

Throughout the life of field, the focus will be on the prevention of oil spills. Stringent safety and operational procedures will be adhered to throughout the operations. With the preventative steps and mitigation measures in place to avert an oil spill incident from occurring, and the oil spill contingency planning and response resources available to Ithaca Energy in the event of a large oil spill event, the residual effect of a release of oil from the proposed Fotla field development is considered not significant. In addition, no significant in-combination, cumulative and/or transboundary effects were identified during the assessment process.

15.8 Overall Conclusions

The ES has considered the worst-case impact of the proposed Fotla field development and is therefore a conservative consideration of the potential effects on the environment. Overall, it is considered that the environmental impacts of the proposed Fotla field development, when undertaken in conjunction with the mitigation measures identified in the ES, will not incur any significant long-lasting environmental effects.

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A.1 Summary of Legislation

The main environmental legislation relevant to the proposed Fotla field development.

Topic	Legislation
Consenting	
Environmental Statement	The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020; The Offshore Chemicals Regulations 2002 (as amended); The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended); The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended); The Offshore Marine Conservation (Natural Habitats &c) Regulations 2007 (as amended); The Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019; Petroleum Act 1998 (as amended); The Energy Act 2008 (as amended); Marine and Coastal Access Act 2009; Scottish National Marine Plan (NMP); The Climate Change Act 2008; The Climate Change (Scotland) Act 2009; UK Energy White Paper 2020; North Sea Transition Deal; British Energy Security Strategy; Shipping (Oil Pollution Preparedness, Response and Cooperation Convention) Regulations 1998; Offshore Chemical Regulations 2002, as amended; The Offshore Installations (Offshore Safety Directive (Safety Cases etc.) Regulations 2015.
Well Consent	The Petroleum Act 1998 (as amended). The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020; Well Operations Notification System (WONS); Offshore Petroleum Licensing (Offshore Safety Directive) Regulations 2015 (2015 licensing regulations); Drilling Operations Application (DRA) and Chemical Permit Subsidiary Application Template(SAT).
Well Test Consent	The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020; Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005, as amended;

Topic	Legislation
	Petroleum Licensing (Exploration & Production) (Seaward and Landward) Regulations 2004;
Consent to Locate	Marine and Coastal Access Act 2009; Marine Scotland Act 2010; The Energy Act 2008 (as amended)
Pipeline Consent	Petroleum Act 1998 (as amended); The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020; Pipeline Safety Regulations 1996, as amended; Marine and Coastal Access Act 2009; Marine Scotland Act 2010. Pipeline Operations MAT (PLA), Chemical Permit SAT (CP), EIA Direction for Pipeline Operations SAT (PL), and EIA Direction for Deposits SAT (PL).
Production Consent	Petroleum Act 1998 (as amended); The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020; Offshore Petroleum Licensing (Offshore Safety Directive) Regulations 2015 (2015 licensing regulations); Production Operations MAT (PRA) and EIA Direction for Commencement of Production SAT (PR).
Produced Water	Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005, as amended; Production Operations MAT (PRA) and Oil Discharge Permit (Life) SAT (OLP).
Routine Drilling Operations and Routine Installation Operations	
Sewage from Drilling Rig	MARPOL 73/78 Annex IV Prevention of Pollution by Sewage from Ships; Annex V of MARPOL 73/78 (including amendments) - Regulations for the Prevention of Pollution by Garbage from Ships Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008; Food and Environment Protection Act 1985 (FEPA); Deposits in the Sea (Exemption) Order 1985; Convention on the Protection of the Marine Environment of the North East Atlantic 1992 (OSPAR Convention).
Oil Contaminated Discharges	Offshore Chemical Regulations 2002, as amended; Offshore Petroleum Activities (Oil Pollution Prevention and Control) (OPPC) Regulations 2005, as amended; Food and Environment Protection Act 1985 (FEPA); Convention on the Protection of the Marine Environment of the North East Atlantic 1992 (OSPAR Convention); OSPAR Decision 2000/3 on the Use of Organic-phase Drilling Fluids (OPF) and the Discharge of OPF-Contaminated Cuttings;

Topic	Legislation
	OSPAR Recommendation 2006/5 on a Management Regime for Offshore Cuttings Piles.
Water Based Mud (WBM) Cuttings	Offshore Chemical Regulations 2002, as amended; Offshore Petroleum Activities (Oil Pollution Prevention and Control) (OPPC) Regulations 2005, as amended; Food and Environment Protection Act 1985 (FEPA); Deposits in the Sea (Exemptions) Order 1985; OSPAR Recommendation 2006/5 on a Management Regime for Offshore Cuttings Piles.
Chemical Use	The Offshore Chemicals Regulations 2002, as amended; The REACH Enforcement Regulations 2008, as amended; Convention on the Protection of the Marine Environment of the North East Atlantic 1992 (OSPAR Convention); OSPAR Recommendation 2006/3 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that are, or which contain Substances Identified as Candidates for Substitution; OSPAR Recommendation 2005/2 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Contain Added Substances, Listed in the OSPAR 2004 List of Chemicals for Priority Action; OSPAR Recommendation 2000/2 on a harmonised mandatory control system for the use and reduction of the discharge of offshore chemicals as amended by OSPAR Decision 2005/1; Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005, as amended (OPPC); Food and Environment Protection Act 1985 (FEPA); Deposits in the Sea (Exemptions) Order 1985.
Rig Drainage Water	Offshore Petroleum Activities (Oil Pollution Prevention and Control) (OPPC) Regulations 2005, as amended; Convention on the Protection of the Marine Environment of the North East Atlantic 1992 (OSPAR Convention); PARCOM Recommendation 86/1 of a 40 mg/l Emission Standard for Platforms; Merchant Shipping (Prevention of Oil Pollution) Regulations 1996, as amended; Merchant Shipping Act 1995; International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78; Merchant Shipping (Prevention of Oil Pollution) (Amendment) Regulations 1994.
Atmospheric Emissions	
Turbine/Combustion Emissions	MARPOL 73/78 Annex VI Prevention of Air Pollution from Ships; The Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008, as amended; Offshore Combustion Installations (Prevention and Control of Pollution) Regulations 2001, as amended;

Topic	Legislation
	The Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013; Climate Change Act 2008; National Emission Ceilings Regulations 2002; Pollution Prevention and Control Act 1999.
Halocarbons (halons, CFCs)	Ozone Depleting Substances Regulations 2015; Fluorinated Greenhouse Gases Regulations 2015; MARPOL 73/78 Annex VI Prevention of Air Pollution from Ships; The Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008, as amended.
Flaring and Venting	Energy Act 1976; Energy Act 2016 Petroleum Act 1998 (as amended); Petroleum Licensing (Exploration & Production) (Seaward and Landward) Regulations 2004; The Petroleum (Current Model Clauses) Order 1999; Climate Change Act 2008; National Emission Ceilings Regulations 2002; Waste and Emissions Trading Act 2003.
Chemical Transport	
Bulked Chemicals	Environmental Protection Act 1990; Merchant Shipping (Dangerous or Noxious Liquid Substances in Bulk) Regulations 1996, as amended.
Dangerous Goods	Environmental Protection Act 1990; Controlled Waste Regulations 1992, as amended; The Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations 1997; The Environmental Protection (Duty of Care) (Scotland) Regulations 2014; The Waste (Scotland) Regulations 2011.
Hazardous Chemicals	Environmental Protection Act 1990; Controlled Waste Regulations 1992, as amended; Chemicals (Hazard Information and Packaging for Supply) Regulations 2009; The Environmental Protection (Duty of Care) (Scotland) Regulations 2014; The Waste (Scotland) Regulations 2011, as amended.

Topic	Legislation
Wildlife Protection (Offshore)	
Habitats and Species	Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (Offshore Marine Regulations, OMR), as amended; The Conservation of Habitats and Species Regulation 2010, as amended; The Conservation of Offshore Marine Habitats and Species Regulations 2017; The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001; The UK Marine and Coastal Access Act 2009; The Marine (Scotland) Act 2010;
Cetaceans	The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001, as amended; Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas 1991 (ASCOBANS); Wildlife and Countryside Act (1981); Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (Offshore Marine Regulations, OMR), as amended.
Waste Handling	
Transfer of Oil Contaminated Wastes	Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005, as amended.; Merchant Shipping (Prevention of Oil Pollution) Regulations 1996; Prevention of Pollution (Reception Facilities) Order 1984; Merchant Shipping and Maritime Security Act 1997.
Garbage	Food and Environment Protection Act 1985, as amended; Deposits in the Sea (Exemptions) Order 1985; Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008.
Transfer of waste/garbage from installations	Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008; Food and Environment Protection Act 1985, as amended; Deposits in the Sea (Exemptions) Order 1985; Environmental Protection (Duty of Care) Regulations 1991; Waste Management Licensing (Scotland) Regulations 2011; Waste (Scotland) Act 2011.
Transfer of special waste	Environmental Protection Act 1990; Controlled Waste Regulations 1992, as amended; Special Waste Regulations 1996, as amended; The Special Waste Amendment (Scotland) Regulations 2004;

Topic	Legislation
	The Environmental Protection (Duty of Care) (Scotland) Regulations 2014; The Waste (Scotland) Regulations 2011, as amended.
Radioactive waste	Radioactive Substances Act 1993 (RSA 93), as amended; Radioactive Substances (Phosphatic Substances, Rare Earths etc.) Exemptions Order 1962; Radioactive Substances (Substances of Low Activity) Exemption Order 1986, as amended; Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations 1997.
Support Vessels	
Machinery Space Drainage from Shipping	The Merchant Shipping (Prevention of Oil Pollution) Regulations 1996, as amended; Merchant Shipping Act 1995; International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78.
Sewage from Vessels	MARPOL 73/78 Annex IV Regulations for the Prevention of Pollution by Sewage from Ships; Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008; Deposits in the Sea (Exemption) Order 1985; Food and Environment Protection Act 1985, as amended.
Garbage from Vessels	Food and Environment Protection Act 1985, as amended; Deposits in the Sea (Exemption) Order 1985; Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008.
Atmospheric Emissions from Vessels	The Merchant Shipping (Prevention of Air Pollution from Ships) Order 2006; MARPOL 73/78 Annex VI - Prevention of Air Pollution from Ships, the regulations in this annex set limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibit deliberate emissions of ozone depleting substances; The Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008.
Accidental Events (Installations)	
Spills, Release or Possible Escape of Oil, Noxious Substance or Marine Pollutant	Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998, as amended; Merchant Shipping (Oil Pollution, Preparedness, Response and Co-operation Convention) (Amendment) Regulations 2015; Merchant Shipping (Reporting of Pollution Incidents) Regulations 1987; Merchant Shipping (Reporting Requirements for Ships Carrying Dangerous Polluting Goods) Regulations 1995; Petroleum Operations Notice no 1. Offshore Installations (Emergency Pollution Control) Regulations 2002
Decommissioning	

Topic	Legislation
Well Suspension and Abandonment	Petroleum Act 1998(as amended); Energy Act 2008; The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005, as amended; Offshore Chemicals Regulations 2002; Offshore Chemicals (Amendment) Regulations 2011; Marine and Coastal Access Act 2009 (MCAA); Marine Scotland Act 2010; Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001, as amended; The Offshore Petroleum Activities (Conservation of Habitats) (Amendment) Regulations 2007; Petroleum (Production) (Seaward Areas) Regulations 1988, as amended; Offshore Installations and Wells (Design and Construction etc) Regulations 1996; Food and Environment Protection Act 1985; Well intervention Permit via the UK Oil Portal, FEPA licence may be required, or a Marine Licence for deposits on the seabed. A MCAA licence via the UK Oil Portal.

A.2 Production Profiles for the Fotla Field

Production Profiles for two production wells:

- High-Case - reflects the highest anticipated volume of hydrocarbon production (at least P_{10}).
- Mid-Case - reflects the best estimated volume of hydrocarbon production.
- Low-Case - reflects the smallest expected volume of hydrocarbon production.

Year	High-Case Scenario						Mid-Case Scenario						Lowest-Case Scenario					
	Oil Rate		Water Rate		Gas Rate		Oil Rate		Water Rate		Gas Rate		Oil Rate		Water Rate		Gas Rate	
	bbls/day	m^3/day	bbls/day	m^3/day	MMscf/day	m^3/day	bbls/day	m^3/day	bbls/day	m^3/day	MMscf/day	m^3/day	bbls/day	m^3/day	bbls/day	m^3/day	MMscf/day	m^3/day
2027	3,163	503	2	0	4.1	114,889	3,163	503	8	1	4.6	129,897	3,163	503	25	4	5.1	144,165
2028	9,917	1,577	3,187	507	43.2	1,221,874	8,912	1,417	5,839	928	38.9	1,101,156	5,425	862	8,320	1,323	23.4	661,743
2029	5,013	797	7,057	1,122	44.8	1,269,129	3,313	527	8,964	1,425	20.1	570,223	2,111	336	8,964	1,425	9.4	267,443
2030	3,529	561	8,940	1,421	41.0	1,159,616	2,406	383	8,964	1,425	15.4	435,287	1,528	243	8,964	1,425	8.5	239,314
2031	2,596	413	8,964	1,425	33.7	954,649	1,925	306	8,964	1,425	14.3	403,515	1,240	197	8,964	1,425	8.2	233,036
2032	2,044	325	8,988	1,429	29.3	828,542	1,483	236	8,988	1,429	13.7	388,027	1,024	163	8,988	1,429	8.1	228,739
2033	1,659	264	8,964	1,425	25.4	720,134	1,165	185	8,964	1,425	13.0	366,741	834	133	8,964	1,425	7.6	215,233
2034	1,376	219	8,964	1,425	22.9	648,220	935	149	8,964	1,425	12.2	345,048	701	111	8,964	1,425	7.2	203,567
2035	1,161	185	8,897	1,415	19.7	559,058	765	122	8,560	1,361	11.5	324,817	602	96	8,964	1,425	6.8	193,289
2036	684	109	8,040	1,278	8.0	225,276	435	69	3,441	547	7.7	217,085	532	85	8,988	1,429	6.4	182,070
2037	561	89	8,002	1,272	5.3	151,075	194	31	1,541	245	2.6	73,396	166	26	3,030	482	2.1	58,783
2038	516	82	8,003	1,272	4.4	124,462	0	0	0	0	0.0	0	0	0	0	0	0.0	0
2039	476	76	7,934	1,261	3.7	104,330	0	0	0	0	0.0	0	0	0	0	0	0.0	0
2040	442	70	7,834	1,246	3.1	88,957	0	0	0	0	0.0	0	0	0	0	0	0.0	0
2041	409	65	7,657	1,217	2.7	76,367	0	0	0	0	0.0	0	0	0	0	0	0.0	0
2042	287	46	5,610	892	1.8	50,527	0	0	0	0	0.0	0	0	0	0	0	0.0	0

A.3 ENVID Matrices

Table 1: Fotla field development drilling and completion ENVID matrix

Fotla Drilling and Completion																				
No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
1	Installation, presence and removal of anchors and anchor lines (semi-sub)	Disturbance to seabed.	Biological Receptors and Other Users of the Sea			N	Y	Y	N	N	N	N	Y	N	N	N				Yes
2	Physical presence of the drilling rig and support vessels at the sea surface	Physical presence of the rig (potential navigation hazard).	Other Users of the Sea										Y	Y	N	N				Yes
3	Operational noise and vibration from the MODU and support vessels	Generation of underwater noise from the MODU and support vessels.	Biological receptors			N	N	Y	N	Y										Yes
Atmospheric Emissions																				
4	Atmospheric emissions during routine operations	Combustion emissions (CO_2, CO, SO_x, NO_x etc.) from the drilling rig and its associated support vessels affecting local air quality and contributing to global climate change.	Atmosphere	Y	Y															Yes
5	Flaring from well clean-up and commissioning of subsea infrastructure and host platform facilities	Combustion emissions (CO_2, CO, SO_x, NO_x etc.) from the drilling rig and its associated support vessels affecting local air quality and contributing to global climate change.	Atmosphere	Y	Y															Yes
Discharges to Sea																				
6	Discharge of WBM, drilling chemicals and excess cement	Discharge of WBM, brines, chemicals (including those used for drilling and completion operations and those used on the rig (e.g. rig wash)) and excess cement into the marine environment.	Biological receptors			Y	Y	Y	N	N										Yes
7	Discharge of drill cuttings	Discharge of cuttings on the seabed.	Biological receptors			N	Y	Y	N	N										Yes
8	Discharge of OBM contaminated cuttings after thermal treatment	Discharge of OBM drill cuttings containing < 1 % oil (i.e. cleaned by a cuttings removal system).	Biological receptors			N	Y	Y	N	N										Yes

Fotla Drilling and Completion																				
No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
9	Well clean up via host platform	All fluids will be processed onboard the host facilities and be discharged to sea.	Biological Receptors			N	N	N	N	N										No
10	Oily water discharge from drilling rig and support vessels	Discharges of non-drilling related general oily discharges such as deck wash, bilge waters, etc.	Biological receptors			N	N	N	N	N										No
11	Drilling rig/support and supply vessels - discharge of domestic sewage	Sewage has high biological oxygen demand (BOD) resulting from organic and other nutrient matter in the detergents and human wastes.	Biological receptors			N	N	N	N	N										No
12	Drilling rig/support and supply vessels - release of food waste to sea	Waste has high BOD resulting from organic and other nutrient matter. Positive impact of nutrients provided for fish.	Biological receptors			N	N	N	N	N										No
13	Discharge of ballast water from drilling rig	Potential to introduce alien species.	Biological receptors			N	N	N	N	N										No
Well-Logging																				
14	Logging while drilling	Generation of electromagnetic fields, acoustic waves, microwaves, etc.	Biological receptors			N	N	N	N	N										No
15	Logging while drilling	Use of radioactive sources.	Resource use														N			No
Other Impacts																				
16	Lighting during operations	Artificial light is emitted from the drilling rig.	Biological receptors			N	N	N	N	N										No
17	Fuel use during installation operations.	Use of diesel for power generation.	Societal														N	N	N	No
18	Onboard non-renewable consumables during installation operations.	The use of various consumables on board CSV, including stationary and electrical equipment, has environmental impacts both upstream and downstream. Use of refrigerants.	Societal														N	N	N	No
19	General operational waste generated onboard the installation vessels	Effects associated with onshore disposal are dependent on the nature of the site or process. Landfills - land take, nuisance, emissions (methane), possible leachate, limitations on future land use. Treatment plants - nuisance,	Societal														N	N	N	No

Fotla Drilling and Completion																				
No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
		atmospheric emissions, potential for contamination of sites.																		
20	General operational waste - Hazardous	Effects associated with onshore disposal are dependent on the nature of the site or process. Landfills - land take, nuisance, emissions (methane), possible leachate, limitations on future land use. Treatment plants - nuisance, atmospheric emissions, potential for contamination of sites.	Societal														N	N	N	No
Emergency / Accidental Events																				
21	Large oil spill, requiring mobilisation of all available internal and external oil spill response resources (e.g. well blowout or loss of entire fuel inventory of a vessel)	Potential water borne pollution with consequential impacts on marine flora and fauna covering a large area, including the potential to reach coastlines (and) affecting designated sites.	Biological Receptors, Sensitive Features and Other Users of the Sea			Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Yes
22	Medium oil or chemical spill, requiring some intervention (e.g. Spillage of OBM / diesel / base oil transfer during bunkering operations or from storage tanks/containers	Potential water borne pollution with consequential impacts on marine flora and fauna covering a large area, including the potential to reach coastlines (and) affecting designated sites.	Biological Receptors, Sensitive Features and Other Users of the Sea			Y	N	Y	Y	Y	N	N	Y	N	N	N				Yes
23	Small oil or chemical spill which will disperse within a few hours to days (e.g. hydraulic fluid, lubes, helifuels etc)	Potential water borne pollution affecting local marine flora and fauna over a small area, with no potential to reach any coastlines (and/or) affecting designated sites.	Biological Receptors, Sensitive Features and Other Users of the Sea			Y	N	N	Y	N	N	N	N	N	N	N				Yes
24	Dropped objects	1) Dropped objects causing disturbance or damage to the seabed (e.g. loss of habitat and/or smothering of benthic organisms). 2) Dropped objects may pose a risk to subsea infrastructure or a hazard to other users of the sea.	Biological receptors and Other Users of the Sea			N	Y	Y	N	N			N	N	N	N				Yes

Fotla Drilling and Completion																				
No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
25	Loss of vessels	Catastrophic loss of rig, vessels or helicopter, resulting in an unrecoverable wreck on the seabed (potential oil spills are already assessed above).	Biological Receptors and Other Users of the Sea			N	Y	Y	N	N			Y	N	N	N				Yes

Table 2: Fotla field development subsea and pipeline installation ENVID matrix

Fotla Development: Subsea and Pipeline Installation																				
No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
General Operations																				
Installation of Fotla production and gas lift pipelines, umbilical and manifold																				
1	Presence of installation, construction and support vessels.	Physical presence of vessels on sea surface.	Other users of the sea										Y	Y	N	Y				Yes
2	Fuel use during installation operations.	Use of diesel for power generation.	Societal														N	N	N	No
3	Onboard non-renewable consumables during installation operations.	The use of various consumables on board CSV, including stationary and electrical equipment, has environmental impacts both upstream and downstream. Use of refrigerants.	Societal														N	N	N	No
4	Trenching and laying of infield pipelines and umbilical (including any backfilling).	Laying of pipelines and umbilical on the seabed.	Biological receptors			N	Y	Y	N	N										Yes
5	Positioning of infrastructure on the seabed.	Installation of manifold / SSIV on seabed.	Biological receptors			N	Y	Y	N	N										Yes
6	Piling to fix infrastructure to the seabed.	Installation of manifold and riser base structures on seabed.	Biological receptors			N	N	Y	N	Y										Yes

Fotla Development: Subsea and Pipeline Installation

No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
7	Rock dumping protection of production pipeline or other infrastructure.	Laying of pipelines and umbilicals on the seabed.	Biological receptors			N	Y	Y	N	N										Yes
8	Laying of concrete mattresses, grout bags etc for protection of infrastructure.	Laying of pipelines and umbilicals on the seabed.	Biological receptors			N	Y	Y	N	N										Yes
9	Use of finite resources.	Use of steel, pipes etc for project infrastructure.	Societal														N	N	N	No
10	Installation and support vessels - General noise and vibration of equipment whilst operating (below sea level).	Production of sound below sea level (e.g. from thrusters).	Biological receptors			N	N	Y	N	Y										Yes
11	Installation and support vessels. General noise and vibration of equipment whilst operating (on sea surface).	Production of sounds on the sea surface (including transfer routes).	Biological receptors			N	N	N	N	N										No
12	Lighting during operations.	Artificial light is emitted from vessels.	Biological receptors			N	N	N	N	N										No
Production Operations																				
13	Ongoing presence of pipelines / subsea infrastructure on the seabed.	Physical presence of infrastructure on the seabed.	Biological Receptors and Other Users of the Sea			N	Y	Y	N	N			Y	N	N	N				Yes
Discharges and Emissions																				
Subsea and Pipeline Installations																				
14	Use and discharge of chemicals during testing and commissioning of infield pipelines and other infrastructure (assumed to be discharged via Britannia).	Discharge of chemicals, including those used during riser connections and commissioning, domestic chemicals, fire protection system, laboratory into the marine environment.	Biological receptors			Y	Y	Y	N	N										Yes

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Fotla Development: Subsea and Pipeline Installation																				
No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
15	Atmospheric emissions during installation and commissioning.	Power generation during installation and operation of the CSV contribute to atmospheric emissions of greenhouse gases.	Atmosphere	Y	Y															Yes
16	Installation and support vessels - Discharge of domestic sewage.	Sewage has high BOD resulting from organic and other nutrient matter in the detergents and human wastes	Biological receptors			N	N	N	N	N										No
17	Installation and support vessels - Release of food waste to sea.	Waste has high BOD resulting from organic and other nutrient matter. Positive impact of nutrients provided for fish	Biological receptors			N	N	N	N	N										No
18	Discharge of ballast water from installation vessels.	Potential to introduce alien species.	Biological receptors			N	N	N	N	N										No
Waste																				
19	General operational waste generated onboard the installation vessels.	Effects associated with onshore disposal are dependent on the nature of the site or process. Landfills - land take, nuisance, emissions (methane), possible leachate, limitations on future land use. Treatment plants - nuisance, atmospheric emissions, potential for contamination of sites.	Societal														N	N	N	No
20	General operational waste – Hazardous.	Effects associated with onshore disposal are dependent on the nature of the site or process. Landfills - land take, nuisance, emissions (methane), possible leachate, limitations on future land use. Treatment plants - nuisance, atmospheric emissions, potential for contamination of sites.	Societal														N	N	N	No
Emergencies / Accidental Events																				
Large Release																				
21	Spill of hydrocarbons due to loss of production pipeline leak (pipeline inventory).	Water quality will be reduced and become deoxygenated. Fish will avoid contaminated areas, and could potentially reduce their foraging areas. Contaminated	Biological Receptors, Sensitive Features and Other Users of the Sea			Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N				Yes

Fotla Development: Subsea and Pipeline Installation																				
No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
		deposits could cause fatality / disturbance to benthic dwelling species. Oil could beach along coastlines effecting designated sites.																		
22	Installation vessels / support and supply vessels - Fuel oil spillage (e.g. vessel collision).	Potential water borne pollution with consequential impacts on marine fauna.	Biological Receptors, Sensitive Features and Other Users of the Sea			Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N				Yes
Small Release																				
23	Chemical spills during installation operations.	Water quality will be reduced. Fish will avoid contaminated areas, and could potentially reduce their foraging areas. Contaminated deposits could cause fatality/ disturbance to benthic dwelling species.	Biological Receptors, Sensitive Features and Other Users of the Sea			Y	N	Y	Y	Y	N	N	N	N	N	N				Yes
24	Small release of hydraulic fluid, lubes, helifuels etc.	Fluid leak into marine environment.	Biological Receptors, Sensitive Features and Other Users of the Sea			Y	N	Y	Y	Y	N	N	N	N	N	N				Yes
Other Accidental Events																				
25	Dropped objects.	Dropped objects may pose a risk to subsea infrastructure or a hazard to other users of the sea.	Other users of the sea										Y	N	N	Y				Yes
26	Loss of installation vessels or support vessels.	Collision, loss of stability or fire / explosion resulting in loss of vessel posing a risk to subsea infrastructure or a hazard to other users of the sea.	Biological Receptors and Other Users of the Sea			N	Y	Y	N	N			Y	N	N	Y				Yes

Table 3: Fotla field development topsides modifications and operations ENVID matrix

Fotla Development: Topsides Modifications and Operations																				
No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
Topside Modifications																				
General Operations																				
1	Temporary presence of vessels transporting personnel, equipment and waste to / from the host platform.	Temporary exclusion of fishing operations due to presence of additional vessels travelling to / from the host platform	Other Users of the Sea										N	N		N				No
2	Modifications to plant / equipment on the host platform	Modifications to plant and equipment on the host platform may consume raw materials some of which may be finite in their abundance.	Society														N			No
Discharge and Emissions																				
3	Testing of modified equipment.	Increased discharges from the platform e.g. produced water discharges during testing of upgraded plant / equipment	Biological receptors, Other Users of the Sea			N	N	N	N	N										No
4	Discharge of oily fluids during testing and commissioning of infrastructure (assumed to be discharged via Britannia)	Testing and commissioning of pipelines, umbilical and facilities may result in discharges containing oil.	Biological receptors			N	N	N	N	N										No
Waste																				
5	Topsides Modifications	Generation of waste streams that may require treatment and disposal onshore	Society															Y		Yes
Topsides Operation																				
General Operations																				
6	Presence of service / transport vessels	Presence of additional or larger vessels leading to temporary exclusion of fishing operations from the area	Other Users of the Sea										N	N						No
7	Ongoing presence of the host platform	After modifications, the host platform will remain on location	Other Users of the Sea										N	N						No

Fotla Development: Topsides Modifications and Operations																				
No.	Description of Aspect		Environmental Issues	Atmosphere		Biological Receptors					Sensitive Features		Other Users of the Sea				Societal			Scoped In for Further Assessment
	Operational Activity (source)	Impact (pathway)		Local air pollution	Global warming potential	Plankton	Benthos	Fish/Shellfish	Seabirds	Marine Mammals	Offshore Conservation Areas	Inshore Conservation Areas	Commercial Fisheries	Shipping	Military activity	Infrastructure	Resource use	General public	Recreation	
		presenting a physical barrier to receptors																		
Discharges and Emissions																				
8	Increase in energy consumption onboard the host platform	Increased energy demand will result in additional combustion emissions leading to increases in GWP from GHG	Atmosphere	Y	Y															Yes
9	Increase in discharge of produced water	Increase in discharge of produced water from the host platform due to Fotla coming online	Biological receptors			Y	N	Y	N	N										Yes
Waste																				
10	Topside operations	Generation of waste streams that may require treatment and disposal onshore	Societal																	No
Emergencies / Accidental Events – Small Release																				
11	Minor chemical / hydrocarbon release associated with Fotla infrastructure / equipment onboard the host platform e.g. from drains.	Oils and / or chemicals used in the topside modifications and / or their operation may result in a small release of oil or chemicals to the marine environment	Biological receptors, Sensitive features and Other Users of the Sea			N	N	N	N	N	N	N	N	N	N	N				No
12	Fire	A (large) fire from an installation / support vessel will have a negative impact on local air quality and put additional pressure on resources on board. In addition, the use of fire extinguishing systems may lead to emissions of greenhouse gases and/or uncontrolled discharges to sea containing hazardous substances.	Atmosphere	N	N															

A.4 Commitments Register

The following table summarises the mitigation commitments made in each of the impact sections of this Environmental Statement (ES) (Sections 8 to 14). These commitments will inform the planning stages for the Fotla field and where relevant, they will also form the basis of the Environmental Management Plan (EMP), which will be prepared closer to the start of the operations.

Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
Drilling Discharges					
Drilling discharges effecting nature conservation features	An environmental baseline survey with seabed sampling, and a habitat survey has been undertaken at the Fotla development location, as well as along the proposed pipeline route.		✓		
Deposition of drill cutting and associated muds directly to the seabed	Details on all drill cuttings discharged to sea or skipped and shipped to shore for appropriate treatment and disposal, will be reported to the regulator.		✓	✓	
	Drilling operations will be permitted though the UK Portal Environmental Tracking System (PETS), which includes Chemical Permit (CP-SAT) for the use and discharge of all chemicals offshore.	✓	✓		
	Project design has and will further consider the minimisation of produced volumes of drill cuttings, mud and excess cement, as well as the chemical volumes discharged.		✓		
	The actual mud and chemical usage will be monitored during drilling operations and subsequently reported to Environmental and Emissions Monitoring System (EEMS), which is maintained by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED).	✓		✓	
Introduction of WBM drilling chemicals and excess cement discharges into the marine environment	All chemicals that will be used and discharged are regulated under the Offshore Chemicals Regulations 2002 (as amended) and have been assessed and approved for use (and discharge) on the United Kingdom Continental Shelf (UKCS) by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS).	✓	✓	✓	
	Wherever practicable and technically feasible, chemicals with the lowest CEFAS ranking scores (i.e. OCNS E, Gold rated and without substitution warnings) will be prioritised over those that do have warnings.		✓		
	Cement discharged onto the seabed during installation of the top section casing will be minimised by visual monitoring of the operation by a Remotely Operated Vehicle (ROV). Once returns are observed, pumping will be stopped in order to minimise discharged volume.	✓		✓	

Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
Physical Presence					
Presence of protective material for project infrastructure on the seabed	The use of subsea infrastructure stabilisation features (mattresses, grout bags and rock material) will be minimised through project design and will be installed in accordance with industry best practice (i.e. fall pipe when placing rock protection) and Scottish Fishermen's Federation (SFF) recommendations.	✓	✓	✓	
Potential for MODU, CSV or other vessels to be a navigation hazard for shipping and other users	Vessel use will be optimised by minimising the number of vessels required and length of time vessels are on site.	✓		✓	✓
	Following pipeline trenching operations, Ithaca Energy will liaise with the Scottish Fishermen's Federation (SFF), to ameliorate any safety risks for the fishermen from mud berms being left behind.				✓
	Prior to the Mobile Offshore Drilling Unit (MODU) moving onto location, a Notice to Mariners will be issued and Navtex and NAVAREA warnings will be posted. In addition, the Aberdeen Coastguard Operations Centre (CGOC) and Northern Lighthouse Board (NLB) will be notified. This will ensure that all vessels, including fishing vessels, are aware of all planned operations at the Fotla field.	✓	✓	✓	
	The Seafish Kingfisher Information Service will be notified of the exact location of the MODU, pipelay vessel and subsea infrastructure, allowing their inclusion in their fortnightly bulletin to fishing vessels.	✓	✓	✓	
	The Hydrographic Office will be notified as to the location of the Fotla wells, manifold and pipelines, so that these can be marked on navigational charts.	✓	✓		
	A 500 m safety exclusion zone will remain in place around the Fotla manifold and Xmas trees for the duration of the development (i.e. approximately 15 years). The exclusion zone will be enforced by a dedicated Emergency Response and Rescue Vessel (ERRV) which will be on location whilst the MODU is present.	✓	✓	✓	✓

Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
	The MODU, construction vessels and any other vessels operating in the area, will be equipped with the appropriate navigational aids and aviation obstruction lights system.	✓	✓	✓	
	An updated Vessel Traffic Study will be undertaken to inform any future Consent to Locate application for the development location.	✓	✓		
Atmospheric Emissions					
Emissions to the atmosphere during drilling and installation operations	All equipment onboard the MODU, installation and other vessels used during drilling, installation and commissioning phases will be well maintained according to a strict maintenance regime, including regular monitoring and inspections.			✓	
Emissions Reporting	Atmospheric emissions from the MODU and from Britannia will be reported under EEMS.	✓		✓	✓
Net Zero Targets	Comply with the North Sea Transition Deal and industry Net Zero targets, including a 50 % reduction in 2030 to 90 % in 2040 (against a 2018 baseline) and to become a net zero basin by 2050	✓		✓	✓
	Provide all necessary support to Harbour Energy for any planned, existing or future initiatives aimed at improving the emissions footprint of the Britannia complex, as required.		✓		✓
Marine Discharges					
Discharges containing oil and chemical additives into the marine environment	Only chemicals with chemical permit (CP-SAT) will be used.	✓	✓		✓
	Where possible, the most environmentally friendly options, including chemicals that pose little or no risk (PLONOR) to the environment will be selected.	✓	✓		✓
	Chemical risk assessments will be undertaken as part of the environmental permitting process.	✓	✓		
	All discharges must be monitored and reported.	✓			✓
	Produced water from the reservoir will be treated reducing oil content to ≤ 25 mg/l or less.		✓		✓

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Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
Underwater Noise					
Underwater noise	Piling operations will be undertaken using a 'soft start' procedure as per the JNCC Protocol for minimising risk of injury to marine mammals from piling noise (JNCC 2010b). The power of the hammer is gradually ramped up to allow marine mammals to move away from the area before full power is reached.	✓		✓	
	Use of a trained Marine Mammal Observer (MMO) to undertake cetacean monitoring duties before any piling operations commence	✓		✓	
	A mitigation zone of 500 m will be in place for the Fotla manifold anchor piling operations.	✓		✓	
	A Passive Acoustic Monitoring (PAM) system may be used during times of poor visibility to monitor for the presence of marine mammals.	✓		✓	
Waste Management					
Legislation	The appropriate environmental legislation and Ithaca Energy's Waste Hierarchy.	✓	✓	✓	✓
Segregation of waste	The MODU will have waste storage and segregation facilities, including laydown areas for skips and deck space for other waste storage receptacles. Waste will be segregated into hazardous and non-hazardous waste types.	✓	✓	✓	✓
Other waste generated by the development	Other waste will be returned to shore for appropriate treatment and disposal, with recycling encouraged.	✓	✓	✓	✓
Documented waste	Every offshore installation and vessel must have a Garbage Management Plan (per guidance in Merchant Shipping Notice No.1807) and Garbage Record Book. The amount and disposal route of any waste will be recorded in the UK EEMS.	✓	✓	✓	✓

Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
Accidental Events - Preventative Measures					
Training, experience and suitability of equipment	Ithaca Energy and their appointed Installation/Well Operator will fully assess the competence and experience of all contractors as well as the suitability of all equipment to operate in the central North Sea (CNS) area.	✓	✓	✓	✓
	All offshore personnel will be appropriately trained, experienced and certified to carry out their specific duties.	✓	✓	✓	✓
	The crew of the MODU will also undergo environmental awareness and safety training.	✓	✓	✓	✓
Well design	The wells will be designed to minimise the potential for well control problems.	✓	✓		
	An independent, thorough and formal peer-review approach will be used to review all critical elements of the well design and the execution of drilling the well. The design of the wells will be independently reviewed by a Well Examiner, who will also monitor the actual construction and any modifications to the wells.	✓	✓		
	Any deviation to the drilling programme, well designs or construction, will be subject to a formal management of change process.	✓	✓	✓	
Well control	A Blow Out Preventer (BOP) will be put in place to prevent the uncontrolled release of hydrocarbons from the well.	✓		✓	
	The BOP is made up of a series of hydraulically operated rams that can be closed in an emergency from the drill floor, or from a safe location elsewhere on the rig.	✓		✓	
	The integrity of the BOP will be tested prior to usage and periodically during the drilling. Inspection and testing of the BOP will be undertaken in line with the Installation/Well operator, Ithaca Energy procedures and UK legislation.	✓		✓	

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Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
Other safety measures	All equipment used on the MODU will have safety measures built in to minimise the risk of any hydrocarbon spillage. Spill kits will be available. All supply vessels will operate via Dynamic Positioning (DP).		✓	✓	✓
Flowline Maintenance and Control	Flowlines and umbilicals will be inspected and maintained, to ensure they are kept in optimum condition. Periodic flowline surveys, comprising ROV inspections, and an inspection repair and maintenance plan will be in place.				✓
Accidental Events - Action to Stop a Subsea Spill During Drilling with the MODU					
Initial actions	Use the ROV to identify the source of a leak from subsea leak.			✓	
	If at any time the safety of the MODU becomes compromised, the first priority will be to close the BOP, disconnect the MODU from the well, and move off location.			✓	
	If BOP fail, ROV and acoustic overrides are available, allowing the BOP to be closed within 24 hours, even if the MODU has to move off location first. Once at a safe distance from the well location, the ROV can be deployed to verify the BOP is properly closed, and no more oil is being spilled. If that fails too, a second rig or intervention vessel would be mobilised to the location with the intention of placing a second BOP or a capping device on the flowing well or by drilling a relief well and re-establishing well control.			✓	
	Other methods are available to control the flow of hydrocarbons to the surface, including varying the pump rate and the use of various chemicals, such as weighting material (barite or calcium carbonate) and cement. Therefore, a contingency stock of cement and barite will be kept onboard the MODU. After the well is killed, it can be fully abandoned with cement plugs.			✓	

Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
Accidental Events - Oil Spill Response					
Temporary Operations OPEP (TOOPEP) and Field Oil Pollution Emergency Plan (OPEP)	A TOOPEP and Field OPEP will be in place for drilling and production operations respectively, conforming to the Merchant Shipping (Oil Pollution, Preparedness, Response and Co-operation Convention) (Amendment) Regulations 2015 and the Offshore Installations (Emergency Pollution Control) Regulations 2002. The TOOPEP/Field OPEP will fully consider the specific oil spill response requirements for Fotla field, taking into account the location, meteorological conditions and the environmental sensitivities of the area.	✓	✓	✓	✓
Training, exercises and experience for offshore personnel	Specific members of the MODU and standby vessel crew will have undertaken appropriate OPEP level oil spill response training. The Offshore Installation Manager (OIM) and the Installation/well Operator offshore representative will have undertaken the OPRED course for On-Scene Commander (OPEP Level 1).		✓	✓	✓
	The TOOPEP and Field OPEP will be distributed to offshore personnel with designated duties in the event that an oil spill response is required, and to the regulatory authorities and statutory consultees. On receipt of the TOOPEP and Field OPEP, personnel will undergo awareness training in oil spill response prior to the commencement of drilling operations.	✓	✓	✓	✓
	During the proposed drilling and production operations, the MODU specific members will regularly undertake training exercises, including vessel-based oil spill response exercises for the crew and an Offshore TOOPEP Exercise while on site, to ensure familiarity with its requirements.	✓		✓	✓
Training, exercises and experience for onshore personnel	Relevant Ithaca Energy Duty Managers will, as a minimum, have undertaken the OPRED course, Corporate Management oil spill response awareness (OPEP Level 2). Ithaca Energy is a member of OSRL, and a response advisor with OPEP Level 4 training would also be provided by OSRL.	✓	✓	✓	✓

Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
	Desktop exercises will be undertaken prior to commencement of operations to test the effectiveness of the TOOPEP and Field OPEP.	✓	✓		
	If necessary, the TOOPEP and/or Field OPEP will be updated to reflect any changes required as a result of desktop exercises.	✓	✓	✓	✓
Accidental Events - Oil Spill Response Strategies					
Natural dispersion and monitoring	In the early stages of an incident, a standby vessel will be on site for monitoring and surveillance of the slick.			✓	✓
	In the short term, aerial surveillance may also be undertaken by the helicopter contractor.			✓	✓
	For larger ongoing spills, aircraft may be mobilised to undertake aerial surveillance.			✓	✓
	Manual predictions can be used to estimate the movement of the oil on the sea surface and Oil spill modelling software would also be employed to gain a more accurate indication of oil spill movement, using real time parameters to assist the predictions.			✓	✓
Chemical dispersants	Ithaca Energy will consider applying chemical dispersants, to aid natural dispersion of a large oil spill, or when sensitive receptors such as flocks of seabirds are at risk. Therefore, the decision to use chemical dispersants will assess its positive benefits, against any resulting impacts in the water column.	✓		✓	✓
Containment and Recovery	Booms may be used to contain a large slick on the sea surface, concentrating the oil for recovery by skimmers. The effectiveness of both booms and skimmers will be assessed.	✓		✓	✓
Shoreline protection and clean-up	In the event of a spill, the first priority should be to prevent spilled hydrocarbons from reaching coastal areas. If spillage is projected to reach the shoreline with the use of manual and software predictions, coastal sensitivities will be identified.	✓		✓	✓

Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
	OSRL Geographic Information System (GIS) facility (which maps coastal sensitivities around the UK) will supplement local authority plans, strategy documents, maps, and other available resources.	✓		✓	✓
	Broad-scale surveys, from vehicles, inshore vessels or helicopters, will be mobilised to gain an overview of the shoreline types and main sensitivities along the potentially affected stretch of coast, and consideration will be given to carrying out more detailed surveys of particularly environmentally sensitive or commercial important areas of shoreline prior to any oil beaching.	✓		✓	✓
	The strategy for shoreline clean-up ultimately will be directed by the affected local authorities. Appropriately trained personnel and clean-up equipment will be made available to assist any clean-up operations, through OSRL.	✓	✓	✓	✓
Accidental Events - Liability and Insurance					
Liability and insurance	Ithaca Energy will ensure that it has sufficient finances and insurance in place to cover the cost of responding to a large oil spill (including the use of a well capping device and drilling a relief well, if required).	✓	✓	✓	✓
Accidental Events - Catastrophic Loss of the MODU, Vessel or Helicopter					
Loss of the MODU, Vessel or Helicopter	The MODU will be inspected for sea worthiness and the Well Operator/Installation Operator audited prior to operations commencing.	✓	✓		
	Personnel will be appropriately trained, experienced and certified and the competence and experience of all contractors will be assessed before they are contracted.	✓	✓	✓	
	All supply vessels will operate via DP, to reduce the likelihood of a collision.			✓	✓
	A digital site survey for drilling hazards has been carried out to confirm that there is no shallow gas in the area.	✓	✓		
	A 500 m exclusion zone will be enforced around the MODU for general shipping in the area.	✓		✓	✓

Impact	Mitigation	Regulatory Commitment	Stage of Operations		
			Planning/ Preparation	Installation/ Drilling	Production
	A standby vessel (ERRV) will be on site during drilling operations to enforce the 500 m exclusion zone and be equipped with radar and communication equipment so that any vessel in the area can be detected and contacted, if required.	✓		✓	
	The MODU and associated vessels will use appropriate marking and lighting.	✓		✓	✓
	The suitability of supply, other support vessels and the helicopter will be assessed before they are contracted.		✓		
	The United Kingdom Hydrographic Office (UKHO) will be kept informed of drilling activities.	✓		✓	
Accidental Events - Natural Disasters					
Vulnerability of projects to risks of major accidents	The above sea and subsea infrastructure used at the Fotla field will be structurally sound, designed to withstand a number of different loads. Safety procedures will also be implemented, such as making the operations/installations safe or potentially shutting down operations, if such extreme weather events are experienced. This is in combination with emergency procedures described in TOOPEP and Field OPEP.	✓		✓	✓