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00

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Document Title

Environmental Statement Supporting the Increase in Consented Production for the Harris and Barra Fields

Information Classification - Restricted

	Originator	Verifier	Authority
Job Title	Environmental Advisor	Environmental Team Lead	HSSE Manager
Name	Nicola Bannigan	Niall Bell	Dave Montague
Signature			
Date	12/09/2017	12/09/2017	12/09/2017

Environmental Statement Details

Section A: Administrative Information

A1 - Project Reference Number

Please confirm the unique ES identification number for the project.

Number: D/4202/2017

A2 - Applicant Contact Details

Company name: Dana Petroleum (E&P) Limited

Contact name: Dr Niall Bell

Contact title: Environmental Team Lead

A3 - ES Contact Details (if different from above)

Company name: As above

Contact name: As above

Contact title: As above

A4 - ES Preparation

Please confirm the key expert staff involved in the preparation of the ES:

Name	Company	Title	Relevant Qualifications/ Experience
Dr Niall Bell	Dana Petroleum (E&P) Limited	Environmental Team Lead	All personnel involved in undertaking the impact assessment hold relevant environmental qualifications from recognised academic institutions and include those holding accreditation from the Institute of Environmental Management and Assessment (IEMA).
Nicola Bannigan	Dana Petroleum (E&P) Limited	Environmental Advisor - Subsea / Drilling	

A5 - Licence Details

a) Please confirm licence(s) covering proposed activity or activities

Licence number(s): P472

b) Please confirm licensees and current equity

Licence Number: P472	
Licensee	**Percentage Equity**
Dana Petroleum (E&P) Limited	64.829%
Cieco	35.171%

Section B: Project Information

B1 - Nature of Project

a) Please specify the name of the project.

Name: Harris & Barra fields (Western Isles Development)

b) Please specify the name of the ES (if different from the project name).

Name: N/A

c) Please provide a brief description of the project.

As the predicted increase in consented production is above the thresholds for which an Environmental Impact Assessment (EIA) must be undertaken, this Environmental Statement (ES) has been submitted in support of the production consent application. The increase is within the limits of the WID ES which was approved in 2012.

B2 - Project Location

a) Please indicate the offshore location(s) of the main project elements (for pipeline projects please provide information for both the start and end locations).

Quadrant number(s):		210	
Block number(s):		24	
Latitude:	61° 12' 52.14" N	Longitude (W / E):	0° 45' 13.11" E
Distance to nearest UK coastline (km):		93	
Which coast?		Scotland	
Distance to nearest international median line (km):		58	
Which line?		UK /Norway	

B3 - Previous Applications

If the project, or an element of the project, was the subject of a previous consent application supported by an ES, please provide details of the original project

Name of project:	Western Isles Development Environmental Statement
Date of submission of ES:	March 2011
Identification number of ES:	D/4104/2011

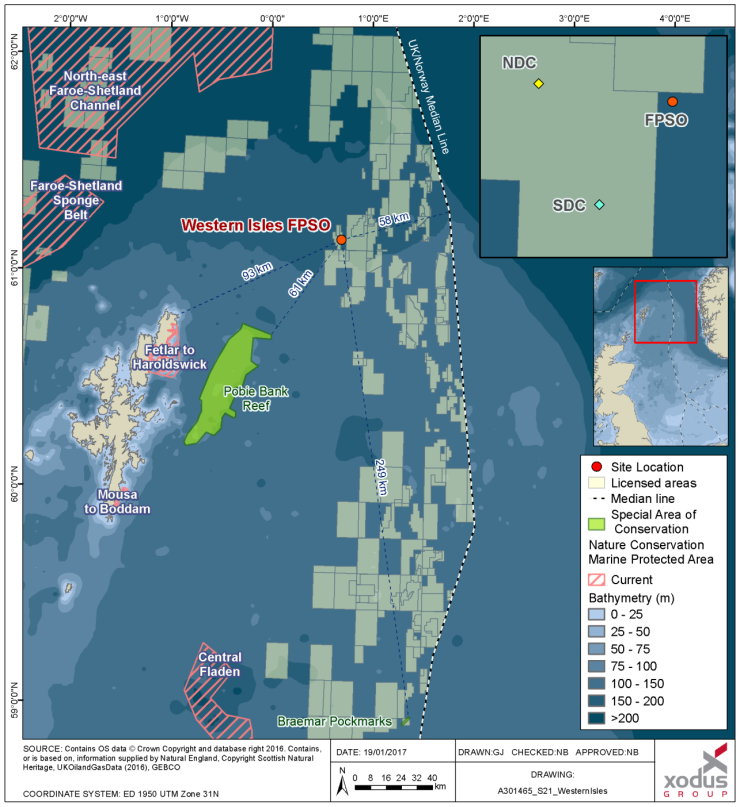
Table of Contents

1 Non-Technical Summary

Introduction

The Western Isles Development (WID) comprises the Harris and Barra fields. The fields are located in the United Kingdom Continental Shelf Block 210/24a in the northern North Sea (Figure 5.1). The Western Isles (WI) Floating Production Storage and Offloading (FPSO) vessel is located 93 km northeast of Shetland and 58 km from the UK/ Norway median line in a water depth of approximately 153 m.

Figure 2.1: Location of the WI FPSO



The fields have been developed across two locations; the Northern and Southern Drill Centres, both of which have eight slots so allowing for up to 16 wells to be developed in total. Both drill centres are connected via pipelines of approximately 3 km length to the WI FPSO.

Dana has drilled fewer wells to date than originally planned, and reviews of the reservoir data indicates that one well at the Harris field will produce more than originally anticipated. Consequently, the distribution of production between the two fields is misaligned and requires to be revised.

Under the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (the EIA Regulations), consent increase applications exceeding the thresholds of 500 tonnes per day of liquid hydrocarbon (oil or condensate) or 0.5 million cubic metres per day of gas must be supported by an Environmental Impact Assessment. The expected increase in oil production

from the Harris field will be above these thresholds and so an Environmental Impact Assessment is required. This Environmental Statement reports the findings of the Environmental Impact Assessment.

Gas production from the Harris field, and both oil and gas from the Barra field will also increase, however, these will be within the threshold requirements for an Increase in Production Subsidiary Application Template. Whilst Dana is preparing this Environmental Statement for the increase in oil production from Harris, an assessment has also been included of the impacts of increasing oil production from Barra and gas production from both fields.

An Environmental Statement (project number D/4104/2011) was approved in 2012 in support of the WI project. This assessed the potential impacts from the maximum capacity of the FPSO. The combined increases in production consents for the Harris and Barra fields will be lower than that assessed in the original ES and consequently, there will be no additional impacts as a result of the increases to the production consents.

Project Description

The following changes are expected as a consequence of increasing production from the Harris and Barra:

- An increase in oil and gas production;
- An increase in the volume of produced water discharged to sea; and
- An increase in the volume of chemicals dosed into the production stream.

It is important to note that there will be no changes to the existing infrastructure or facilities to support the proposed production increases. For clarity, the proposed increase will not result in any changes to the Western Isles operations. In particular:

- There is no requirement for any new infrastructure or facilities to accommodate the production increase;
- There is no requirement for the use of any new chemical products;
- The use of diesel fuel will not increase;
- The use of fuel gas will not increase;
- No change in the oil in water concentration of produced water discharges;
- There is no planned disturbance to the seabed;
- There will be no change to the flaring, venting and power generation systems onboard;
- The overall risk of an accidental release will not increase;
- There is no extension to the life of the field; and
- Vessel presence and noise for routine production operations will not increase.

As detailed above, the increase in oil production from the Harris field is greater than 500 tonnes per day. Gas production from the Harris field, and both oil and gas from the Barra field will also increase, however, these will be less than 0.5 million cubic metres per day for gas and less than 500 tonnes per day of oil.

Constraining production to the currently consent levels would compromise the maximum recovery from the Harris and Barra fields. Any impact to the short-term forecast revenue from the fields would impact on field economics.

Environmental Sensitivities

Information about the environment in the Western Isles Development area and its surroundings was collated to allow assessment of those features that might be affected by the proposed production increases. The key sensitivities are summarised below in Table 2.1.

Table 2.1: Environmental sensitivities in the Western Isles Development area

Environmental sensitivities	
Plankton	The planktonic assemblage in the northern North Sea in the region of the development is mainly made up of boreal and temperate Atlantic and neritic (coastal water) species. Annually, two density blooms occur in the northern North Sea, one in May and a second in August. The copepod has historically dominated the zooplankton (animal plankton) of the North Sea and is used as an indication of zooplankton abundance. Analysis of data shows a sharper spring increase in copepod biomass in May in the northern North Sea compared to more southerly areas. The increase is likely a reflection of the increased availability of nutrients and food in spring.
Seabed and associated species	Survey work carried out within the area of the WID confirmed that the water depth ranged from 153 m – 159 m. The sediments comprised of fine and medium sands. The diverse seabed was numerically dominated by the polychaetes with molluscs and echinoderms also being numerically important. The species recorded were typical of those found in clean sediments in this area of the North Sea. There was no evidence of any species that are list of threatened and/or declining species, no protected habitats, nor habitats or species listed as priority.
Fish	The WI FPSO is located in an area that is used as a spawning ground by saithe; as spawning and nursery grounds by haddock, Norway pout, and whiting, and as a nursery ground by blue whiting, herring, ling, mackerel, spurdog, anglerfish and European hake. A number of these species are also listed as Scottish Priority Marine Species.
Birds	The WI FPSO is located in an area where seabird vulnerability is extremely high in January and low for the remainder of the year (with no data being available for May). In the survey period 2000-2014, the following species were recorded in the area: northern fulmars, black legged kittiwakes, herring gull, common guillemots and great black-backed gulls.
Cetaceans	The recorded cetacean sightings in the area of the WI FPSO are the harbour porpoise, Atlantic white-sided dolphin and the minke whale. These species are also listed as Scottish Priority Marine Species.
Conservation	The closest offshore conservation site to the WI FPSO that has been designated for conservation importance is the Pobie Bank Reef Special Area of Conservation. This site is located approximately 61 km to the southwest of the WI fields.
Other sea users	The WI FPSO is located within waters which area fished for water column (pelagic) species, and to a less extent bottom dwelling (demersal) and shellfish species. The closest existing oil and gas infrastructure is located 14 km. There are no cables crossing the area, and there are no designated military or submarine exercise areas in the vicinity. The FPSO is on the edge of an RAF development buffer; however the Ministry of Defence has previously been notified of the coordinates of the WI FPSO. The FPSO and seabed infrastructure has in place a life-of-field Consent to Locate and its location has been notified to the UK Hydrographic Office.

Identification of Potential Environmental Impacts

As part of the Environmental Impact Assessment process, the project and the baseline environment (including the sensitivity of receptors) have been defined. The increase in production consents for the Harris and Barra fields are within the limits of the assessment in the original WID ES, and consequently, there will be no further potential impacts beyond those which have previously been assessed, mitigated and approved.

Environmental Management

The management of environmental risks associated with Dana's activities is integral with the business decision making process. Environmental hazards are identified at all stages in the life-cycle of hydrocarbon exploration and production. Risks are assessed and managed via a structured Health, Safety and Environmental Management System (HSE MS).

The Dana HSE MS has been developed and maintained to meet the principal requirements of the ISO 14001:2004 Environmental Standard. The management system was recertified on 20th March 2017. During all audits the system was found to be in compliance with OSPAR Recommendation 2003/5 and regulator required industry standards.

Conclusion

The increased production from the Harris and Barra fields is not expected to result in any significant impacts or any new impact source. There will be no additional impacts to flora and fauna protected under international legislation and no transboundary impacts. In addition, the revised production consents do not contravene any of the Scottish Government's National Marine Plan policies. Existing mitigation measures and Dana's existing environmental management procedures and practises will ensure that any potential impacts are managed and controlled.

2 Glossary

Atmospheric Emissions	Collective term for gases and particulates released to the Earth's atmosphere from combustion and evaporation
Barrels	The traditional unit oil volume, equivalent to approximately 160 litres or approximately 25 imperial gallons
Bathymetry	The measure of water depths in oceans, seas and lakes
Benthic	Adjective pertaining to anything related to the seabed
Benthos	The plant and animal community at the seabed
Block	An area of the UKCS divided measuring 10 minutes of latitude and 12 minutes of longitude
Cetaceans	Collective term for whales, dolphins and porpoises
Environmental Impact Assessment	A systematic review of the environmental effects a proposed project may have on its surrounding environment
Environmental Management System	System established to manage an organisation's processes and resultant environmental impacts
Environmental Statement	Formal document presenting the findings of an EIA process for a proposed project
Flare	A vent where unwanted gas is safely burned(for example because of plant malfunction or maintenance)
Hydrocarbons	Organic compounds of carbon and hydrogen atoms. There are vast numbers of these compounds and they form the basis of all petroleum products. They may exist as gases and liquids. Examples include methane and crude oil
ICES rectangle	A statistical area of the sea that is 0.5° north by 1° west, defined by the International Committee for the Exploration of the Sea
Pinnipeds	Marine mammals that include seals, sea lions and walruses
Plankton	Tiny plants and animals that drift in the surface water of seas and lakes. Of great economic and ecological importance as they are a major component of marine food chains
Produced Water	The water produced along with oil and gas from the reservoir, comprising the formation water but also injection water if used to maintain reservoir pressure. It can contain a range of inorganic and organic compounds
Reservoir	A porous, permeable sedimentary rock formation containing oil or gas that is trapped by layers of less-permeable or impervious rock; a structural trap; or stratigraphic minerals
Special Area of Conservation	A site designated under the Habitats Directive. Sites that have been adopted by the European Commission and formally designated by the government of each country in whose territory the site lies
Venting	The safe discharge to the atmosphere of un-burnt, unwanted gases or hydrocarbons

3 Abbreviations

ASACS	Air Surveillance and Control System in the north of Shetland
BOPD	Barrels Of Oil Per Day
CNS	Central North Sea
EIA	Environmental Impact Assessment
EU	European Union
ES	Environmental Statement
FPSO	Floating Production Storage and Offloading
HP	High Pressure
ICES	International Council for the Exploration of the Sea
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
LP	Low Pressure
MW	Megawatt
NC MPA	Nature Conservation Marine Protected Areas
NDC	North Drill Centre
NMP	National Marine Plan
NNS	Northern North Sea
OSPAR	Oil Pollution Convention
PRA	Production Operations Application
SAC	Special Area of Conservation
SAT	Subsidiary Application Template
SDC	South Drill Centre
SOSI	Seabird Oil Sensitivity Index
SMRU	Sea Mammal Research Unit
SNS	Southern North Sea
UK	United Kingdom
UKBAP	United Kingdom Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
VOC	Volatile Organic Compounds
WI	Western Isles
WID	Western Isles Development

4 Introduction

4.1 Field Development

The Western Isles Development (WID) comprises the Harris and Barra fields. The fields are located in the United Kingdom Continental Shelf (UKCS) Block 210/24a in the northern North Sea (NNS) (Figure 5.1). The Western Isles (WI) Floating Production Storage and Offloading vessel (FPSO) is located 93 km northeast of Shetland and 58 km from the UK/ Norway median line in a water depth of approximately 153 m. The WID is operated by Dana Petroleum (E&P) Limited (hereafter referred to as Dana) with partner Cieco Exploration and Production (UK) Limited.

Due to the nature of the reservoirs, the production and injection wells are clustered around two locations; the Northern Drill Centre (NDC) and the Southern Drill Centre (SDC). Produced oil and gas will be transported to the WI FPSO via pipelines approximately 3 km in length. Periodically oil will be exported from the FPSO by shuttle tanker and excess produced gas (that not used for powering the FPSO) will be exported through a dedicated pipeline to the Tern/ North Cormorant gas pipeline system. The pipeline will also be used for short term transient and restarts throughout field life and for continuous fuel gas import in later field life when the WI reservoir becomes gas deficient.

Both the NDC and SDC are eight slot templates, allowing for up to 16 wells to be developed. The NDC has five production and three water injection slots, the SDC has four production and four water injection slots (Figure 5.2).

An Environmental Statement (ES) (project number D/4104/2011) was approved in 2012 covering the WID.

4.2 Field History

The WID originally composed of four oil accumulations: Harris (previously called East Rinnes), Barra (previously called Melville), Lewis (previously called West Rinnes) and Uist (previously called South East Rinnes). Dana discovered these accumulations during exploration drilling between 2005 and 2009. In 2012 the WID was reduced to two fields (Barra and Harris).

The hydrocarbons are situated inside the Brent reservoir group of the middle Jurassic age. Dana discovered oil within the Barra field in 2005.

Oil was found in the Harris field in 2008. The discovery wells were found to have high standard oil, Brent reservoir sands and potential flow rate of 78,000 bopd. Further discoveries in the Harris area were made in 2009.

Figure 5.1: Location of the WI FPSO

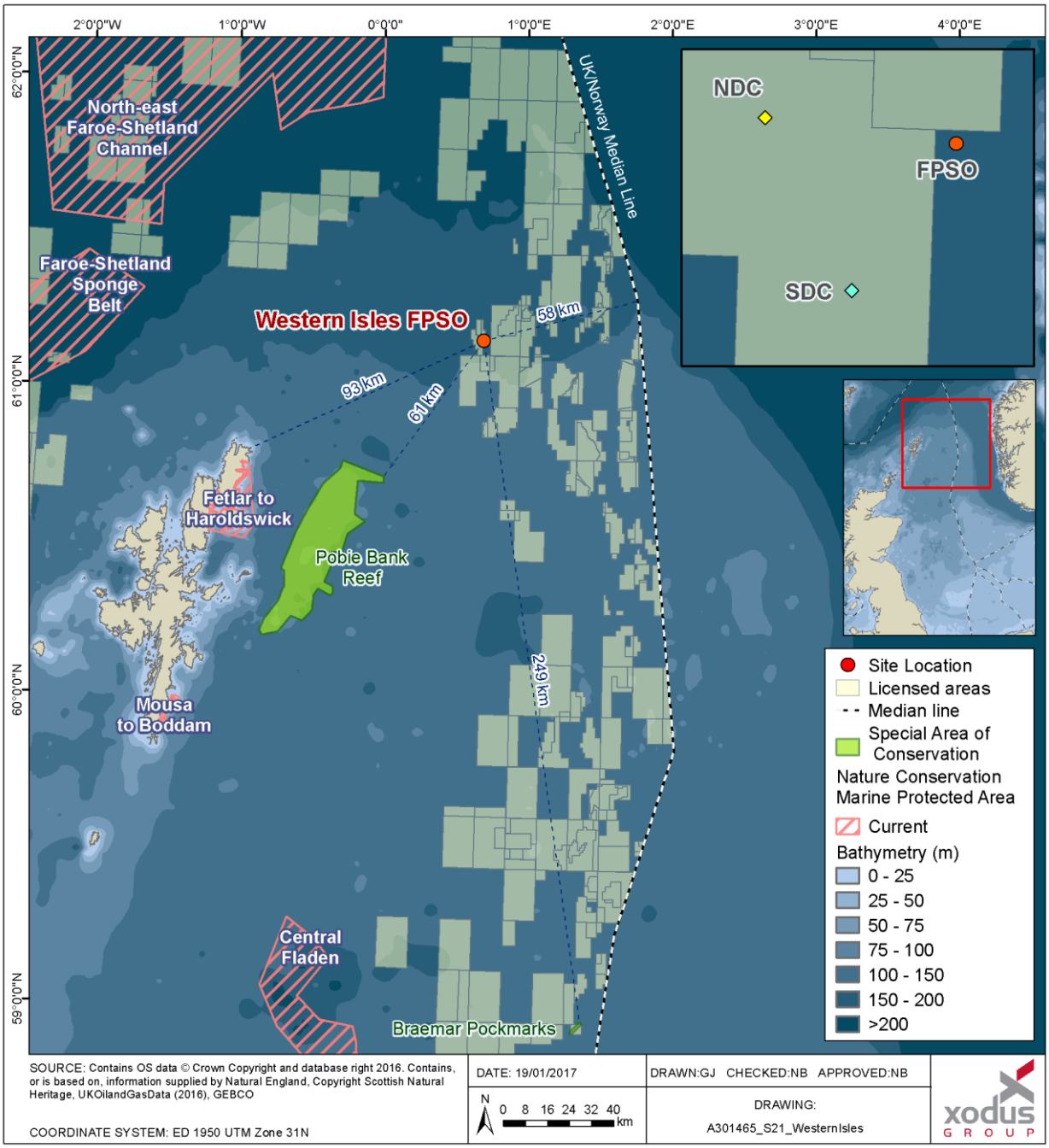
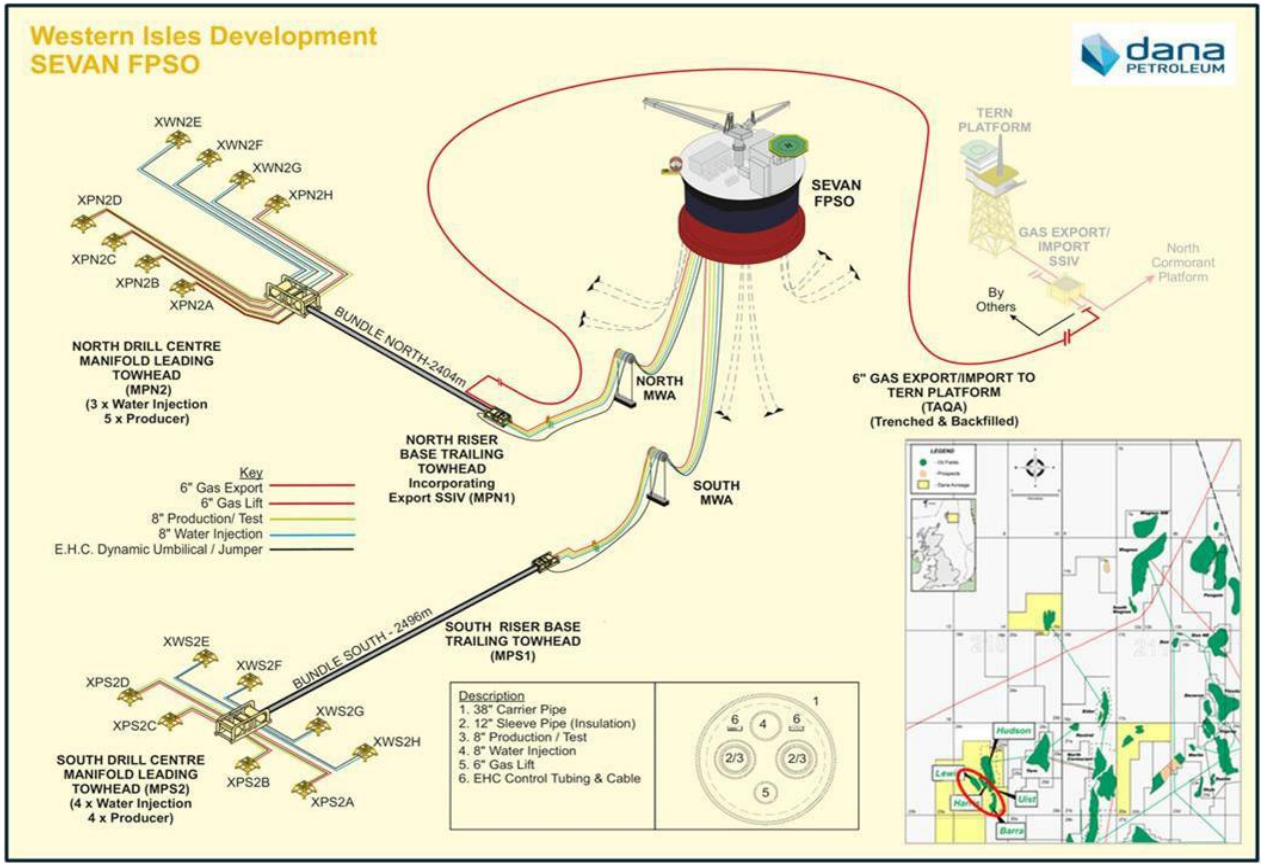


Figure 5.2: WID layout



4.3 Purpose & Scope of the Environmental Impact Assessment

This ES describes the outcome of the Environmental Impact Assessment (EIA) in support of an application to increase the production consents for oil and gas from the Barra and Harris fields. The production consents are being amended because the original consents were for flow rates that were lower than will be achieved although this increase will still be lower than those assessed in the approved WID ES in 2012.

The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended), require that any increase in consented production that exceeds 500 tonnes per day of liquid hydrocarbons (e.g. oil, condensate) or 0.5 million cubic metres per day of gas must be supported by a full Environmental Impact Assessment (EIA) and submission of a statutory ES.

The production consent for the Harris field will be increased by more than 500 tonnes oil per day of oil. Gas production from Harris and both oil and gas production from the Barra will also increase, but within the threshold of an Increase in Production Subsidiary Application Template (SAT). To reduce administrative burden, Dana has included all increases to the Bara and Harris production consents within this one ES. The production consent increases are provided in detail in Section 6.2.2.

Whilst the production consents for Barra and Harris are being increased, these will remain within the production capacity of the FPSO that was assessed in the original WID ES. Consequently there will no change to the potential environmental impact that was assessed in the original ES.

In addition, the original WID ES showed production commencing in 2013. This ES also realigns the date of first oil to 2017 to match the production consents.

5 Project Description

It is important in any EIA process that a clear description is provided of the project being assessed. In the case of an increase in production, it is first necessary to understand the reason for and context of the proposed production increase, including consideration of any potential alternatives (described in Section 6.2.3.). Following this, it is then necessary to understand the facilities through which the hydrocarbons are processed and highlight any changes that might be required to these facilities as a result of the proposed production increase. The processing facilities used to treat the hydrocarbons are described in Section 6.3.

5.1 Reservoirs

As detailed in Section 5.2, the WID consists of the Harris and Barra fields. Production will come specifically from the Broom, Rannoch, Etive and Lower Ness Formations

Water injection support, which is required from start-up, is essential for maintenance of reservoir pressure and optimal sweep efficiency. Formation water is expected to break through after 2 months and seawater breakthrough is expected after 2 years.

The fluid type to be produced is an under saturated oil, with the solution gas-oil ratio varying with depth across the different panels. The fluid density decreases with depth from 30 to 35 API, which have no H_2S and very low CO_2. However, H_2S development is possible during field life, with the risk of reservoir souring. Each well is designed with artificial lift in the form of gas lift.

5.2 Production Overview

5.2.1 Background to Production Increase

As detailed in Section 5.1, both the NDC and SDC eight slot manifolds although to date four wells have been drilled at the Harris field and one at the Barra field.

Dana has drilled fewer wells than originally planned at the Barra field and review of subsurface data indicates that one of those at Harris is liable to produce more than originally anticipated. Consequently, the distribution of production between the two is misaligned and requires to be revised and to incorporate the greater anticipated flow rates.

5.2.2 Production profiles

Tables 6.1 and 6.2 show the current and revised consent figures for the two fields. The 2017 production averaged over period 1st October to 31st December (92 days) and the 2018 production averaged over period 1st January to 17th March (76 days).

Table 6.1: Current and revised production for Barra field

Barra	Current permitted (km3/day)		Revised permit (km3/day)		Increase in permit (km3/day)		Change (te & m3)	
Year	Oil	Gas	Oil	Gas	Oil	Gas	Oil (te)	Gas (m^3)
2017	0.444	23.6	0.791	34.0	0.347	-23.253	298.42	Decrease
2018	2.746	145.8	0.791	191.2	-1.955	45.4	Decrease	45,400

Table 6.2: Current and revised production for Harris field

Harris	Current permitted (km^3/day)		Revised permit (km^3/day)		Increase in permit (km^3/day)		Change (te & m^3)	
Year	Oil	Gas	Oil	Gas	Oil	Gas	Oil (te)	Gas (m^3)
2017	0.64	34	5.72	285.4	5.08	251.4	4,368.80	251,400
2018	3.588	191.2	5.72	285.2	2.132	94	1,833.52	94,000

5.2.3 Alternatives to Production Increase

Constraining production to the currently consent levels would compromise the maximum recovery from the Harris and Barra fields. Any impact to the short-term forecast revenue from the fields would impact on field economics.

5.3 Facilities Description

5.3.1 Overview

No changes will be required to any part of the existing WI infrastructure or facilities to support the proposed production increases. The infrastructure capacity will remain as constructed at approximately 40,000bopd.

However, the following sections provide a summary of the existing facilities that will support production from the Harris and Barra fields to help understand the how the existing capacity will not be exceeded and consequently that there can be no additional no impact beyond that assessed in the approved WID ES from 2012.

5.3.2 Process Facilities

5.3.2.1 Oil Separation and Stabilisation

Well fluids arrive at the FPSO from the two subsea drill centres (NDC and SDC) via four production pipelines. Each drill centre has two 8" production flowlines. From the production manifold, production fluids are routed to the topsides module (P20) via a single production header. A test header is also provided which is configured to allow testing from either of the production flowlines. Should the normal production route via the production header be unavailable for any reason the option exists to use the test header for continuous production.

The crude oil separation system is designed to stabilise crude oil through the 1st stage separator and the 2nd stage separator.

The 1st stage separator receives the reservoir fluids from the production header via the inlet heaters. The fluids are heated to 60°C in passing through the two 100% capacity inlet heaters. The off-gas produced is routed to the High Pressure (HP) compression system. Separated oil from the 1st stage separator is heated to 75°C passing through the two 60% capacity interstage heaters to the 2nd stage separator. The off-gas produced is routed to the Low Pressure (LP) compression system.

The oil from the 2nd stage separator is pumped to the electrostatic coalescer and removes any remaining water to the required tanker loading specification. The separated water is recycled to the 2nd stage separator and the treated stabilised oil is forwarded to the cargo loading header via the crude coolers.

In addition to the 1st stage separator, there is also a parallel test separator. A separate test manifold is provided within module P10 with connections to each of the inlet four pipelines. The primary function of the test separator is for well tests. In addition to well tests, the test separator will also be used for well clean up following scale squeeze, and full metering of all process streams oil, water and gas (temperature and pressure compensated) is provided on both the test separator and the 1st stage separator.

5.3.2.2 Produced Water System

5.3.2.2.1 Produced Water Hydrocyclones

The water separated in the 1st stage separator is routed to the produced water hydrocyclones under interface level control. After treatment, the produced water is routed to the produced water treatment package which is the compact flotation units.

Produced water from the 1st stage separator and, if selected, from the produced water booster pumps are routed to two 100% produced water hydrocyclones. The main function of the produced water booster pumps is to raise the pressure of the LP produced water from the 2nd stage separator to allow it to be routed into the 1st stage separator upstream of the inlet heater.

Produced water from the test separator is routed to the test hydrocyclone. The control is the same as described for the produced water hydrocyclones. The produced water flow through the hydrocyclone is determined by level control from the test separator. The reject oil stream is routed to the interstage heaters, and back through the 2nd stage separator. In certain, unusual circumstances it may be necessary to divert water to the clean or dirty slops. However, this could cause production issues and is not the normal or preferred route. The produced water is combined with produced water hydrocyclones produced water stream and routed to the produced water treatment package.

5.3.2.2.2 Produced Water Treatment Package (Compact Flotation Units)

The produced water treatment package consists of two compact flotation units. Oil rich water is routed to the oil side of the produced water degasser and the cleaned produced water is routed to the water side.

The compact flotation units comprise of a vertical pressure vessel with feed water entering towards the top of the vessel via a distributor to split the flow evenly and liberate gas from the produced water. The feed water floods an internal annular weir in the top of the vessel and overflows to the flotation compartment below through a number of vertical flotation tubes. These tubes incorporate an eductor which draws gas from the vessel headspace as the water discharges through the tube. The gas and water comingle in the tube at the outlet of the eductor and exit to the flotation compartment beneath.

Gas bubbles mix with oily water within the tubes, and on entering the flotation compartment, coalesce and rise to the surface due to their natural buoyancy. As the gas bubbles rise and coalesce, they attach to suspended oil and solids particles causing their accelerated rise to the surface. The arrangement of the tubes is such that the discharging gas and water cause the body of water to rotate. This aids concentration of the floated oil and gas phases towards the centre of the compartment.

Due to the flotation effect and rotating water mass, the floated oil collects at the surface towards the centre, where it is removed by a floating skimmer. The skimmed oil exiting the compact flotation units is directed to the oil side of the degasser. The water stream leaves the compact flotation units at the bottom of the units and is routed to the water side of the degasser.

A high level trip is provided to prevent overfilling. The oily water is pumped by the produced water skimming pumps under on/off level control to the interstage heaters, and back through the 2nd stage separator.

5.3.2.2.3 Produced Water Degasser

The produced water degasser separates entrained gas from the produced water. From the produced water degasser the produced water is normally routed overboard. Any fluids above the regulatory limit will be routed to the interstage heaters, and back through the 2nd stage separator. In certain, unusual circumstances it may be necessary to divert water to the clean or dirty slops. However, this could cause production issues and is not the normal or preferred route.

5.3.2.3 Changes to Produced Water as a Result of Production Increase at Harris & Barra

The produced water discharge volumes are set to increase in line with the increased production at the Harris and Barra fields. However, this increase will remain within the capacity of the infrastructure that was assessed in the original WID ES.

5.3.3 Gas

Upon arrival the fluids will enter a 1st stage separator where the oil, produced water and gas are separated. The gas is routed to the high pressure compression system and the water to the produced water treatment system (as detailed in Section 6.3.2.2). The remaining fluids are reduced in pressure and proceed to the 2nd stage separator where the remaining gas is removed. Following the 2nd stage separator the gas will either be used for fuel or exported to the Tern platform.

5.3.3.1 Changes to Produced Gas as a Result of Production Increase at Harris & Barra

The produced gas volumes are set to increase in line with the increased production at the Harris and Barra fields. However, this increase will remain within the capacity of the infrastructure that was assessed in the original WID ES from 2012.

5.3.4 Chemical Injection

The following section details the related flow assurance issue and the requirement for chemical and non-chemical treatments.

5.3.4.1 Process Treatments

The following chemical types are required for the process treatment on the WI FPSO:

- Foaming
- Separation
- Scale
- Corrosion
- Wax
- Hydrates
- Hydrogen Sulphide

5.3.4.2 Seawater Uplift & Water Injection System

The following chemical types are required for seawater uplift and the water injection system on the WI FPSO:

- Biofouling
- Oxygen Scavenging
- Scale
- Particulate Removal
- Foaming
- Bacteria Control

5.3.4.3 Utility Chemicals

The following chemical types are required for utility on the WI FPSO:

- Heating and Cooling Medium System
- Hydraulic Fluid
- Cleaning Chemicals

- Biocide
- Carrier Solvent

5.3.4.4 Changes to Chemical Use as a Result of Production Increase at Harris & Barra

The types of chemicals used to treat produced fluids from the Harris and Barra fields are not anticipated to change as a result of the production increase; i.e. no new chemicals will be required. However, there will be a requirement to increase some volumes of process related chemicals to be in line with the proposed production increase.

At the time of writing the WID ES that was approved in 2012, the exact details of the chemical usage and discharge were not known. The WID ES stated that this information would be provided within a PON15D (now a Production Operations Application (PRA)). This has been undertaken and the chemicals have been subject to an impact assessment as part of the approved production chemical permit (PRA/228 CP/1282). Any changes to chemical volumes will required a variation to the current chemical permit.

5.3.5 Power Generation

The FPSO power demand of 20.2 MW for the production, gas lift, injection and offloading demand of the WID is provided by three dual fuel Siemens SGT-100 turbine engines operating in a three x 50% configuration (two machines on duty, one on stand-by). Normal load scenario will require a power demand of approximately 18.5 MW and the low load scenario approximately 16.6 MW.

5.3.5.1 Flaring

The WI FPSO has been designed to operate without routine flaring. Flaring will occur only during process upsets where emergency blow-downs would be required for the assurance of platform safety. The flare has a ballistic ignition system and no pilot light.

However, short-term flaring will occur during the commissioning phase. This will take place over a few weeks only and is covered under existing GHG permit (Permit Number: DTI9997, ETSWAP Reference: UK-D-IN-13455).

HP, LP and relief systems gases will be sent to flare only during process upsets or special operations. The flare systems comprise of a flare header and liquid knock-out drums connected to a multi nozzle flare trip. The flare systems are interconnected with the hydrocarbon cargo gas blanketing/vapour recovery systems. This allows gas to be used in the cargo gas blanketing system to reduce Volatile Organic Compounds (VOC) emissions arising from offloading operations.

5.3.5.2 Venting

VOC emissions arise from the storage of hydrocarbons as well as during offloading operations and are vented from the WI FPSO.

The release of VOC emissions during offloading operations is reduced by the use of inert gases to blanket the storage tanks. The inert gas is obtained from exhaust emissions arising from power generation. The WI FPSO has also been fitted with a VOC Recovery System, which directly absorbs VOC in a side stream of the loading oil. Venting will only occur on first oil start up date when oil reaches topsides.

5.3.5.3 Changes to Power Generation as a Result of Production Increase at Harris & Barra

As described in Section 6.3.5.1, the WI FPSO has been designed to operate with zero flaring during normal production (although a small amount will also be flared during the first few weeks of the commissioning phase). This position will not change as a result of the proposed production consents increase and the FPSO will continue to be operated as a zero flare installation.

At the time of writing the WID ES in 2012, the precise types of turbines for power demand had not been finalised. The ES stated that a Best Available Technique (BAT) assessment would be undertaken prior to combustion equipment final selection. This has been undertaken and it forms part of the approved PPC Permit SAT (PRA/228 PPC/90).

The original WID ES included predicted annual volumes of VOC emissions from the FPSO. There will be no additional VOC emissions as a result of the increases in production consent for the Harris and Barra fields.

5.3.6 Operation Life

The WI field life is currently predicted to come to an end in 2031. Whilst there will be no increase in the length of field life as a result of the increases to the Barra and Harris production consents, the projected date of cessation has been re-aligned from 2013 as shown in the approved WID ES to account for the delay in first oil.

6 Environmental Description

6.1 Introduction

Dana conducted a comprehensive baseline seabed survey of the WID area in 2010 and a subsequent but more limited survey in 2012 (Gardline, 2010a, 2010b and 2012). The surveys utilised a variety of seabed samplers and imaging technology, *viz*: single and multi-beam echo sounders, side scan sonar, pinger, mini airgun, 2D high resolution seismic equipment, seabed cameras and grab samplers. The data generated were used to provide a comprehensive assessment of the seabed conditions around the locations of the drill centres, the FPSO and pipeline corridors. Data from these reports has been used to provide the seabed description below.

6.2 Physical Environment

6.2.1 Weather & Sea Conditions

The general anti-clockwise movement of water through the North Sea and around the NNS region originate from the influx of Atlantic water, via the Fair Isle Channel and around the north of Shetland, and the main outflow northwards along the Norwegian coast. Against this background, the direction of residual tidal movement in the NNS is generally to the south or east (DTI, 2001). Tidal current velocities in the region range between 1.0 and 4.0 knots (0.51 to 2.06 m/s) during mean spring tides (BODC, 1998).

Historical meteorological data for the NNS region (covering 1854 - 1994) show that winds are dominated by those from the south southwest and south, although they can occur from any direction. Average wind speeds throughout the year equate to moderate to strong breezes (6 – 13 m/s), with the highest frequency of gales (>17.5 m/s) occurring during winter months (November - March). The NNS has a higher relative frequency of strong winds and gales, particularly from the south, compared with the central North Sea (CNS) and southern North Sea (SNS) (DTI, 2001).

The average wave height in the NNS region follows a gradient increasing from the southern point in the Fladen/Witch Ground to the northern area of the East Shetland Basin. In the south the mean wave height ranges from 2.11 - 2.40 m whilst in the north it ranges from 3.31 - 3.60 m (NMPI, 2017). The wave energy at seabed to range from low (i.e. less than 0.21 N/m^2) to moderate (i.e. 0.21 – 1.2 N/m^2) for most of the NNS region, increasing to high (more than 12 N/m^2) close to shore (McBreen *et al*., 2011).

6.2.2 Bathymetry & Seabed Conditions

The water depth ranged from 153 m (LAT) at the FPSO location, to approximately 158 m at the NDC and 159 m at the SDC. The seabed in the NDC and SDC locations is broadly undulating and deepens towards the east and south. The maximum gradient observed in the survey area was approximately 3° on the edge of a broad depression in the southwest although gradients are generally <1°.

Sediments were poorly and very poorly sorted fine and medium sands, with particle size distribution skewed towards the fine end of the distribution spectrum. There were areas of numerous gravelly sand clay outcrops with cobbles (Figure 7.1 and Figure 7.2).

Analysis of sediment samples collected during the surveys confirmed that the seabed in the development area contained hydrocarbons of the type and concentration typical of normal background conditions in this area. Similarly, the concentration ranges of metals examined was representative of background conditions and were low and uniform across the development area.

A habitat assessment was conducted using a variety of seabed imagery techniques mentioned previously, the aim of which was to check for potentially important seabed habitats which could be impacted by the proposed operations. This included investigation of any potentially sensitive habitats that would be protected under the Offshore Petroleum Activities (Conservation of natural habitats & c) Regulations 1999, which implement the EC Habitats Directive 92/43/EEC, such as potential Annex I habitats including 'submarine structures made by leaking gas', commonly known as pockmarks, and potential reef (biogenic or stony) habitats, and those listed as priority species and habitats in the UK Biodiversity Action Plan (UKBAP, 2011).

The survey confirmed that there was no evidence in the development area of any potential Annex 1 habitats nor any evidence of threatened /declining species or habitats (OSPAR, 2008) nor listed as priority species and habitats in the UKBAP (UKBAP, 2011).

Figure 7.1 Seabed features of the sediment from the WID survey (Gardline, 2012)

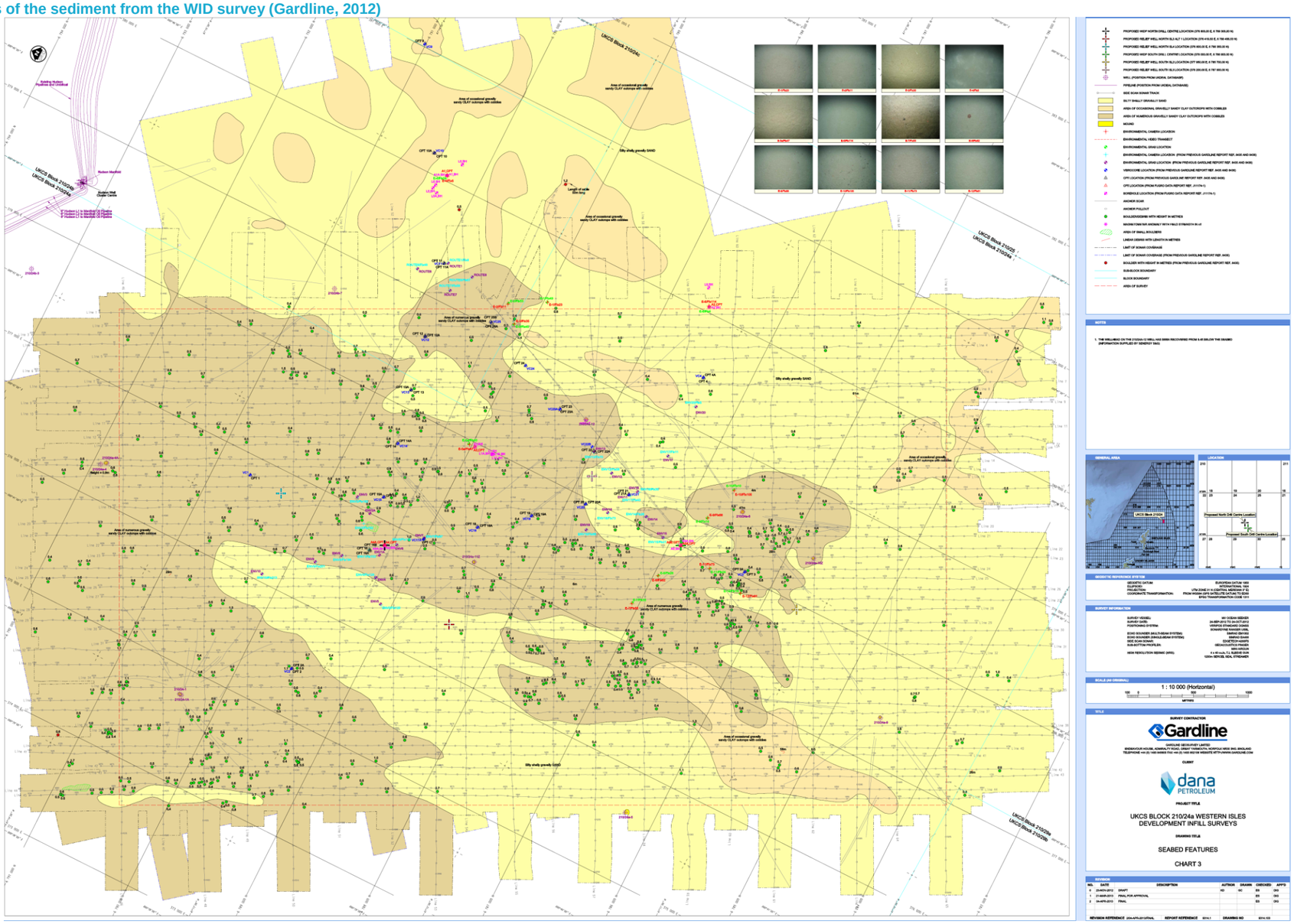


Figure 7.2: Example seabed photographs taken at WID (Gardline, 2012)

Fix: 73 **E:** 377931 **N:** 6786574 **Depth:** 157

Fix: 76 **E:** 377938 **N:** 6786575 **Depth:** 158

Station: E-11
Sediment Description:
Fix73: Sand with shell hash.

Fix76: Sand with shell hash.

Fauna Description:
Fix73: Arthropoda (Paguridae), Cnidaria (*Caryophyllia smithii*).

Fix76: Cnidaria (*Caryophyllia smithii*, *Flabellum alabastrum*), Mollusca (*Turritella communis*) .

Fix: 23 **E:** 377931 **N:** 6786571 **Depth:** 154

Fix: 23 **E:** 377931 **N:** 6786571 **Retention:** MFC

Station: E-11
Sediment Description:
Grab: Sand with shell hash.

Sieve: Sand with shell hash.

Fauna Description:
Grab: No visible fauna.

Sieve: No visible fauna.

6.3 Biological Environment

6.3.1 Plankton

The planktonic assemblage in the NNS in the region of the development is mainly made up of boreal and temperate Atlantic and neritic (coastal water) species. The phytoplankton (plant plankton) in the area is dominated by the dinoflagellates *Ceratium* spp. and the diatoms *Chaetoceros* spp. and *Rhizosolenia* spp. Phytoplankton densities fluctuate during the year, with sunlight intensity and nutrient availability driving its abundance and productivity together with water column stratification (Johns and Reid, 2001). Annually, two density blooms occur in the NNS: one in May and a second in August (SAHFOS, 2015).

The copepod (*Calanus finmarchicus*) has historically dominated the zooplankton (animal plankton) of the North Sea and is used as an indication of zooplankton abundance. Analysis of data provided by the Continuous Plankton Reader (CPR) surveys in the 10 year period between 1997 and 2007 shows a sharper spring increase in *C. finmarchicus* biomass in May in the NNS compared to more southerly areas. This peak in numbers is 70% greater than seen in the CNS and 88% greater than the SNS over the same period (SAHFOS, 2015). The increase is likely a reflection of the increased availability of nutrients and food (including phytoplankton) in spring.

The overall abundance of *C. finmarchicus* has declined over the last 60 years, probably because of changes in seawater temperature and salinity (Beare *et al*., 2002). FRS (2004) notes a decline of up to 50% from the 1960s to the 1990s of *C. finmarchicus* and of its main omnivorous predators such as herring (*Clupea harengus)*. *C. finmarchicus* has largely been replaced by boreal and temperate Atlantic and neritic species, and in particular, a relative increase in the populations of *C. helgolandicus* has occurred (DECC, 2009; Edwards *et al*., 2010; Baxter *et al*., 2011).

Planktonic assemblages exist in large water bodies and are transported simultaneously with tides and currents as they flow around the North Sea.

6.3.2 Benthos

Seabed sediment samples were also collected across the development area for analysis of macrobenthic infauna (invertebrates living within the sediment matrix). Such animals are generally sessile (are fixed in one place), are variably sensitive to contamination, and consequently how individual species and their wider taxonomic grouping contribute to the structure of the overall community acts as a measure of seabed disturbance. Macrobenthos were collected using Day grabs with invertebrates being retained on a 0.5mm mesh.

Indices of diversity, which are calculated from the numbers of each species recorded, were high and uniform across the development area as were indices of how evenly numbers were spread between species. In conjunction, this information suggests a healthy and non-disturbed seabed community.

As with most soft sediment areas in the North Sea, the development area was numerically dominated by polychaete worms (which contributed 50% of the species recorded). The crustaceans accounted for 20% and the molluscs 18%.

The diverse area was numerically dominated by the polychaetes *Euchone* sp; *Galathowenia fusiformis; Pterolysippe vanelli; Minuspio cirrifera; Aonides paucibranciata; Glycera lapidum; Mugga wahrbergi;* the mollusc *Axinulus* and the echinoderm *Spatangoida* (juv).

These species are typical of clean sediments of the types recorded in this area of the North Sea. There was no evidence of any species that are on the OSPAR (2008) list of threatened and/or declining species, or listed as priority species and habitats in the UK Biodiversity Action Plan (UKBAP, 2011).

6.3.3 Fish

A number of commercially important fish species can be found in the vicinity of the WI FPSO. Fish populations may be vulnerable to impacts from offshore installations such as hydrocarbon pollution and exposure to aqueous effluents, especially during the egg and juvenile stages of their lifecycles (Bakke *et al*., 2013). The WI FPSO is located in international council for the exploration of the sea (ICES) rectangle 51F0 which is within ICES area IVa. The WI FPSO lies within the spawning grounds of saithe (*Pollachius virens*); spawning and nursery grounds of haddock (*Melanogrammus aeglefinus*), Norway pout (*Trisopterus esmarkii*) and whiting (*Merlangius merlangus*). The site also falls within the nursery grounds of blue whiting (*Micromesistius poutassou*), herring (*Clupea harengus*), ling (*Molva spp*), mackerel (*Scomber scombrus*), spurdog (*Squalus acanthias*), anglerfish (*Lophius Piscatorius*) and European hake (*Merluccius merluccius*) (Coull *et al*, 1998; Ellis *et al*., 2012). Information on spawning and nursery periods for different species is detailed in Table 7.1. The following species listed above are also listed as Scottish Priority Marine Species; Norway pout, blue whiting, herring, whiting, ling, anglerfish and mackerel (SNH, 2014).

Fisheries sensitivity maps produced by Aires *et al* (2014) for Marine Scotland Science detail aggregations of fish species in the first year of their life. The sensitivity maps found the probability of cod, haddock, whiting, Norway pout, herring, mackerel, horse mackerel (*Trachurus trachurus*), sprat (*Sprattus sprattus*), blue whiting, plaice (*Pleuronectes platessa*), sole (*True Soles*), European hake and anglerfish aggregations in the area of the WI FPSO location as low.

In general, areas used for spawning are regarded as more sensitive than nursery areas. The spawning and nursery areas for fish are rarely fixed in one location (CEFAS, 2001), therefore operations are not expected to adversely affect fish spawning or nursery grounds.

Table 7.1: Fish spawning and nursery areas in the vicinity of the WI FPSO (Coull *et al*., 1998, Ellis *et al*., 2012)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Norway Pout	N	N	N	N	N	N	N	N	N	N	N	N
Blue whiting	N	N	N	N	N	N	N	N	N	N	N	N
Spurdog	N	N	N	N	N	N	N	N	N	N	N	N
Herring	N	N	N	N	N	N	N	N	N	N	N	N
Whiting	N	N	N	N	N	N	N	N	N	N	N	N
Ling	N	N	N	N	N	N	N	N	N	N	N	N
European Hake	N	N	N	N	N	N	N	N	N	N	N	N
Anglerfish	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel	N	N	N	N	N	N	N	N	N	N	N	N
Haddock	N	N	N	N	N	N	N	N	N	N	N	N
Saithe												

	Peak Spawning		Spawning	N	Nursery

6.3.4 Seabirds

The northeast coast of Scotland and adjacent offshore waters are internationally important for their seabird populations. The most abundant seabird species found in the WI area are northern fulmar (*Fulmarus glacialis*), northern gannet (*Morus bassanus*), black-legged kittiwake (*Rissa tridactyla*), herring gull (*Larus argentatus*) and common guillemot (*Uria aalge*) (DECC, 2009). Northern gannets and Atlantic puffins (*Fratercula arctica*) are present in summer months, whilst herring gulls, glaucous gull (*Larus hyperboreus*) and great black-backed gulls (*Larus marinus*) are known to use the area in winter (DECC, 2009). These seabird species use a variety of coastal habitats for breeding, with some species only coming ashore to form colonies during the breeding season (April to June inclusive). The WI FPSO is located approximately 93 km from the nearest UK coast and is therefore remote from sensitive seabird breeding areas on the coast.

The JNCC has released the latest analysed trends in abundance, productivity, demographic parameters and diet of breeding seabirds, from the Seabird Monitoring Programme (JNCC, 2015). The new data provides at-a-glance UK population trends as a percentage of change in breeding numbers from complete censuses. From the years 2000-2014, the following population trends for species known to use the area have been recorded: northern fulmars (-18%), black legged kittiwakes (-47%), herring gull (-17%) common guillemots (+22%) and great black-backed gulls (-6%).

In the unlikely event of an oil spill, birds are vulnerable to oiling from surface pollution, which could cause direct toxicity through ingestion, and hypothermia as a result of the birds' inability to waterproof their feathers (JNCC, 1999). After the breeding season ends in June, large numbers of moulting auks (common guillemot, razorbill (*Alca torda*) and Atlantic puffin) disperse from their coastal colonies into

offshore waters from July onwards resulting in peak numbers of seabirds during the summer. At this time, birds are particularly vulnerable to oil pollution as the adults are rendered flightless due to moulting and the juveniles are not able to fly, therefore they spend a lot of time on the water's surface, significantly increasing their vulnerability to oil spill. In addition to auks, black-legged kittiwake, northern gannet, and northern fulmar, are present in sizable numbers during the post breeding season.

The Seabird Oil Sensitivity Index (SOSI) (Webb *et al*, 2016) identifies sea areas where seabirds are likely to be most sensitive to oil pollution. It is an updated version of the Oil Vulnerability Index (JNCC, 1999) as it uses survey data collected between 1995 and 2015 and includes an improved method to calculate a single measure of seabird sensitivity to oil pollution.

The survey area covers the UKCS and beyond, and seabird data were collected using boat-based, visual aerial, and digital video aerial survey techniques. These data were combined with individual species sensitivity index values and summed at each location to create a single measure of seabird sensitivity to oil pollution (Webb *et al*, 2016). The vulnerability of seabirds to surface oil pollution in the region of the WI FPSO is presented in Table 7.2.

Table 7.2: Seabird vulnerability to oiling in the vicinity of Block 210/24a (Webb *et al*, 2016)

Block	J	F	M	A	M	J	J	A	S	O	N	D
210/18	1	5	5	5*	5	5*	5	5	5	5*	N	1*
210/19	1	5	5	5*	5*	5*	5	5	5	5*	N	1*
210/20	3	5	5	5*	N	5*	5	5	5	5*	4*	4
210/23	1	5	5	5*	N	5*	5	5	5	5*	5*	5
210/24	1	5	5	5*	N	5*	5	5	5	5*	5*	5
210/25	5	5	5	5*	N	5*	5	5	5	5*	5*	5
210/28	1	5	5	5*	N	5*	5	5	5	5*	5*	5
210/29	2	5	5	5*	3*	3	5	5	5	5*	5*	5
210/30	5	5	5	5*	5*	5	5	5	5	5*	5*	5

	Extremely high		Very high		High
	Medium		Low		No data

* = In light of coverage gaps, an indirect assessment of SOSI has been made

Seabird vulnerability is extremely high in January and low for the remainder of the year with no data for May (Webb *et al*, 2016).

6.3.5 Marine Mammals

6.3.5.1 Cetaceans

A total of 19 species of cetacean have been recorded in North Sea waters (Sea Around Us, 2008). Cetaceans regularly recorded in the North Sea include Atlantic white-sided dolphin (*Lagenorhynchus acutus*), bottlenose dolphin (*Tursiops truncatus*) (primarily in inshore waters), harbour porpoise (*Phocoena phocoena*), killer whale (*Orcinus orca*), minke whale (*Balaenoptera acutorostrata*) and white-beaked dolphin (*Lagenorhynchus albirostris*) (Reid *et al.*, 2003). Risso's dolphin (*Grampus griseus*) and some large baleen whales are also occasionally sighted. Spatially and temporally, harbour porpoises, white-beaked dolphins and minke whales are the most regularly sighted cetacean species in the North Sea (Reid *et al*., 2003).

The NNS is described as supporting a rich diversity and density of marine mammals and is considered to be one of the most important areas for these animals in northwest European waters (DECC, 2009). Evidence suggests that harbour porpoise and white-beaked dolphins are widespread and numerous throughout shelf waters, whilst minke whales, Atlantic white-sided dolphin and killer whales are also widely distributed in shelf waters during summer months. Deep water species (e.g. sperm whales (*Physeter macrocephalus*), long-finned pilot whales) occur in deeper waters within the NNS (DECC, 2009).

The recorded cetacean sightings in the general area of the WI FPSO are the harbour porpoise, Atlantic white-sided dolphin and minke whale (BODC, 1998). These three species are also listed as Scottish Priority Marine Species (SNH, 2014). Information on cetacean sightings is detailed in Table 7.3. Based on the available information, Block 210/24a is not considered to be significant for feeding, breeding, nursery or migrating cetaceans.

Table 7.3: Cetacean occurrence in the vicinity of the WI FPSO (BODC, 1998; Reid *et al.*, 2003)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Harbour porpoise												
Minke whale												
Atlantic white-sided dolphin												

Key (Number of individuals sighted per hour of effort)

	High	Medium	Low	Very Low	No sighting

6.3.5.2 Pinnipeds

Grey and harbour seals are resident in UK waters and are listed under Annex II of the EU Habitats Directive Approximately 38% of the world's grey seals breed in the UK and 88% of these breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney, while approximately 30% of harbour seals are found in the UK. However, this proportion has declined from approximately 40% in 2002 (Special Committee on Seals, 2013). Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles (Special Committee on Seals, 2013).

Grey and harbour seals will feed both in inshore and offshore waters depending on the distribution of their prey, which changes both seasonally and yearly. Both species tend to be concentrated close to shore, particularly during the pupping and moulting season. Seal tracking studies from the Moray Firth have indicated that the foraging movements of harbour seals are generally restricted to within a 40–50 km range of their haul-out sites (Special Committee on Seals, 2013). The movements of grey seals can involve larger distances than those of the harbour seal, and trips of several hundred kilometres from one haul-out to another have been recorded (SMRU, 2011). Since the WI FPSO is located approximately 93 km offshore, grey seals may be encountered from time to time but it is not likely that they use the area with any regularity or in great numbers. This is confirmed by the latest grey and harbour seal density maps published by the Sea Mammal Research Unit (SMRU), which reports the presence of grey and harbour seals in the area as between zero and one per 25 km^2 (Jones *et al*., 2013).

6.4 Conservation

6.4.1 Offshore Conservation

The closest offshore conservation site to the WI FPSO designated for conservation importance is the Pobie Bank Reef Special Area of Conservation (SAC). This site is located approximately 61 km to the southwest of the WI FPSO (Figure 5.1). Due to the distance of the SAC from the WI FPSO, the Pobie Bank Reef is unlikely to be affected by operations at the WI FPSO. Pobie Bank Reef is designated for the presence of stony and bedrock reef, an Annex I Habitat. This reef is a habitat for an extensive community of encrusting and robust sponges and bryozoans (JNCC, 2014).

As detailed in Sections 7.2.2 and 7.3.2 there was no indication from the acoustic data, seabed imagery or grab sampling observations of the presence of any Annex I habitats within the survey area, such as submarine structures caused by leaking gas and reef habitats (biogenic or stony); those on the OSPAR (2008) list of threatened and/or declining species and habitats, or those listed as priority species and habitats in the UK Biodiversity Action Plan (UKBAP, 2011) (Gardline, 2010 and 2012). As stated in Section 8.3.3, the following fish, shellfish and cetacean species are also listed as Scottish Priority Marine features; Norway pout, blue whiting, herring, whiting, ling, anglerfish, mackerel, harbour porpoise, Atlantic white-sided dolphin and minke whale (SNH, 2014).

The closest Nature Conservation Marine Protected Areas (NC MPA) is the Fetlar to Haroldswick, which is located 97 km to the southwest and the North-East Faroe-Shetland Channel, located 96 km to the northwest (Figure 5.1). These are all located at a significant distance from the WI FPSO and are therefore not expected to be impacted by operations.

Four Annex II species occur in UK waters: harbour and grey seals, bottlenose dolphin and harbour porpoise. Given the WI FPSO offshore location, it is unlikely that harbour or grey seals will be found in significant numbers as discussed in Section 7.3.5.2. Bottlenose dolphins are also not likely to be observed in the region with any regularity as the resident population on the east coast of Scotland typically remains close to the coast. The only species likely to be observed in Block 210/24a with any regularity is the harbour porpoise, which is considered the most common cetacean in UK waters.

6.4.2 National Marine Plan

The National Marine Plan (NMP) covers the management of both Scottish inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles). The aim on the NMP is to help ensure the sustainable development of the marine area through informing and guiding regulation, management, use and protection of the Marine Plan areas. Production operations from the WI FPSO as described in this permit have been assessed against the Marine Plan objectives and policies, specifically GEN 1 (General planning and principle).

Assessment of compliance against relevant policies has already been achieved through the impact assessment. Operations from the WI FPSO do not contradict any of the Marine Plan objectives and policies. Dana will ensure they comply with all the new policies that have been introduced, with particular attention being made to the following policies.

GEN 1- General planning and principle

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

GEN 4- Co-existence

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

GEN 5- Climate change

Marine planners and decision makers should seek to facilitate a transition to a low carbon economy. They should consider ways to reduce emissions of carbon and other greenhouse gasses.
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 Priority Marine Features;
- Protect and, where appropriate, enhance the health of the marine area.

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.

GEN 14- Air quality

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

GEN 21- Cumulative impacts

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

6.4.3 Onshore Conservation

Given its distance from the nearest coastline (93 km), potential impacts to sites of onshore conservation are not predicted and are therefore not considered further in this document.

6.5 Socio-Economic Environment

6.5.1 Fisheries

The North Sea has important fishing grounds and is fished throughout by both UK and international fishing fleets, targeting both demersal and pelagic fish stocks (CEFAS, 2001). The WI FPSO is located in ICES rectangle 51F0. According to Scottish Government 2015 statistics ICES rectangle 51F0 was targeted for demersal, pelagic and to a lesser extent shellfish species in 2015. Table 7.4 lists the live weight and value of fish and shellfish landings into Scotland from ICES rectangle 51F0 in 2015 (Scottish Government, 2016).

Table 7.4: Landings from ICES rectangle 51F0 in 2015 (Scottish Government, 2016)

Species type	2015	
	Live-weight (tonnes)	Value (£)
Demersal	333	499,665
Pelagic	2,944	1,912,829
Shellfish	0.26	539
Total	**3,277**	**2,413,033**

The data indicates that in 2015 landings were dominated by pelagic fish species. Pelagic landings contributed to 90% of the landed weight and 79% of the landed value. Demersal landings accounted for 10% of the landed weight and 21% of the landed value while shellfish contributed to <1% for landed weight and value (Scottish Government, 2016).

Logbooks submitted by fishermen allow the seasonal pattern of fishing effort to be examined, as shown in Table 7.5. Fishing occurs most of the year in ICES rectangle 51F0. For all gears combined, effort increased in May and August in 2015 although it was relatively low throughout the year. Fishing effort in May and June accounted for 41% of the total number of days fished, with the rest of the year contributing to 59% of fishing effort for 2015 (Scottish Government, 2016).

Table 7.5: Number of days fished per month (all gears) in ICES rectangle 51F0, 2015 (Scottish Government, 2016)

Year	J	F	M	A	M	J	J	A	S	O	N	D	Total
2015	-	D	D	D	21	9	8	14	D	7	-	-	85

Note: Monthly fishing effort by UK vessels landing into Scotland: green = 0 – 100 days fished, yellow = 101 – 200, orange =201-300, red = ≥301.D = Disclosive[1]. *Source*: Scottish Government, 2016

Trawls and seine nets were the only gear types used in 2015 in ICES rectangle 51F0. Trawls accounted for 96% of the gear type used in 2015 with seine nets accounting for 4%.

6.5.2 Other activities

Other activities are summarised below:

- The WI FPSO is located in the NNS in an area of extensive oil development (Oil and Gas Authority, 2016). The Western Isles FPSO is not expected to have any impact on the oil and gas activities in the area due to the distance (14 km) of the nearest installation from the site.

- The North Sea contains some of the world's busiest shipping routes, with significant traffic generated by vessels trading between ports at either side of the North Sea and the Baltic. North Sea oil and gas fields also generate moderate vessel traffic in the form of support vessels (DECC, 2009). A detailed study of shipping routes was undertaken by Anatec (2017) for the WI NDC and SDC sites. The study identified shipping routes which passed within a ten nautical mile radius of the NDC and SDC locations. Approximately, 620 ships per year pass within 10 nautical miles of the FPSO location, which corresponds to an average of 2 vessels per day. The survey identified that the majority of passing vessels are offshore vessels, with the remainder consisting of tankers, ferries and cargo vessels.

- There are no designated military or submarine exercise areas in the vicinity of Block 210/24a (DECC, 2014). However, the WI FPSO is on the edge of an RAF 74 km development buffer around a military Air Surveillance and Control System in the north of Shetland (ASACS). The Ministry of Defence have been notified of the FPSO location to ensure there is no significant impact on any military activities.

- There are no cables in the immediate vicinity of the WI FPSO (KIS-ORCA, 2017).

[1] Fewer than five vessels of more than 10 m in length undertook fishing activity in this year and, to ensure anonymity, the Scottish Government does not release details of effort.

7 Identification of Potential Environmental Impacts

7.1 Introduction

The EIA process requires an understanding of the proposed project and the environment upon which there may be an impact. Fundamental to the process is the systematic identification of issues that could impact the environment, including other users of the environment. Once identified these issues have to be assessed to define the level of potential impact they present to the environment, so that if necessary, measures can be taken to remove or reduce such effects through mitigation.

7.2 Consultation

Consultation via e-mail correspondence with BEIS has focused on establishing the requirement for and scope of the EIA and statutory ES under the Offshore Petroleum Production and Pipe-lines (Assessment of Environmental Effects) Regulations 1999 (as amended).

7.3 Environmental Issues Identification

Having defined the project (Sections 6 and 7) and the baseline environment including the sensitivity of receptors (Section 8), it is then necessary to identify and assess the possible effects. The increase in production consents for the Harris and Barra fields are within the limits on which was assessed in the original WID ES. Consequently, the increase in production cannot generate an impact beyond that which has already been assessed (Table 8.1). As a result, the significance criteria has not been included within this ES.

Table 8.1: Impacts scoped out of EIA

Potential Impact	Reason for scoping out of EIA		
	Harris Field	Barra Field	Changes from the original WID ES
Seabed disturbance, including to benthos and seabed spawning fish species	There will be no new seabed infrastructure or any other form of seabed disturbance as a result of the proposed production increase. Therefore no impacts are anticipated for the Harris field.	There will be no new seabed infrastructure or any other form of seabed disturbance as a result of the proposed production increase. Therefore no impacts are anticipated for the Barra field.	No change, therefore no impacts are anticipated as a result of the proposed production consents increase for Harris and Barra fields.
Noise	There will be no increase in vessel movement or noise emitting activities as a result of the proposed production increase. Therefore no impacts are predicted for the Harris field.	There will be no increase in vessel movement or noise emitting activities as a result of the proposed production increase. Therefore no impacts are predicted for the Barra field.	No change, therefore no impacts are anticipated as a result of the proposed production consents increase for Harris and Barra fields.
Other sea users	No impact to any other sea user or activity is anticipated as a result of the proposed production increase. Therefore no impacts are predicted in the vicinity of the Harris field.	No impact to any other sea user or activity is anticipated as a result of the proposed production increase. Therefore no impacts are predicted in the vicinity of the Barra field.	No change, therefore no impacts are anticipated as a result of the proposed production consents increase for Harris and Barra fields.
Physical presence	There will be no new infrastructure required to accommodate the production increase and the proposed production increase is not expected to extend the life of the Harris field. Therefore no impacts are anticipated for the Harris field.	There will be no new infrastructure required to accommodate the production increase and the proposed production increase is not expected to extend the life of the Barra field. Therefore no impacts are anticipated for the Barra field.	No change, therefore no impacts are anticipated as a result of the proposed production consents increase for Harris and Barra fields.

Potential Impact	Reason for scoping out of EIA		
	Harris Field	Barra Field	Changes from the original WID ES
Atmospheric emissions	There will be no change to the flaring, venting and power generation systems onboard the WI FPSO are a result of the proposed production increase for the Harris field. Therefore, no impact is anticipated.	There will be no change to the flaring, venting and power generation systems onboard the WI FPSO are a result of the proposed production increase for the Harris field. Therefore, no impact is anticipated.	No change, therefore no impacts are anticipated as a result of the proposed production consents increase for Harris and Barra fields.
Discharges to sea	There will be an increase to some volumes of process related chemicals to be in line with the proposed production increase. However, as detailed in Section 6.3.4.4 the original ES did not identify specific chemical usage and discharge. All chemicals that will be used have been subject to an impact assessment as part of the approved production chemical permit application (PRA/228 CP/1282) and any changes to chemical volumes will required a variation to the current chemical permit. There will be an increase in the produced water discharge as a result of the proposed production increase. However, as detailed in Section 6.3.2.3, this increase will remain within the limits set in the original ES.	There will be an increase to some volumes of process related chemicals to be in line with the proposed production increase. However, as detailed in Section 6.3.4.4 the original ES did not identify specific chemical usage and discharge. All chemicals that will be used have been subject to an impact assessment as part of the approved production chemical permit application (PRA/228 CP/1282) and any changes to chemical volumes will required a variation to the current chemical permit. There will be an increase in the produced water discharge as a result of the proposed production increase. However, as detailed in Section 6.3.2.3, this increase will remain within the limits set in the original ES.	No change, therefore no impacts are anticipated as a result of the proposed production consents increase for Harris and Barra fields.

Potential Impact	Reason for scoping out of EIA		
	Harris Field	Barra Field	Changes from the original WID ES
Accidental events	The overall risk of an accidental release will not increase as a result of the changes to the production consent at the Harris field. No additional infrastructure or operating practices are being introduced and there will be no additional oil inventories on the facilities. Existing hydrocarbon inventories and worst case hydrocarbon release modelling as detailed and assessed within the approved OPEP remain current. And the proposed increase in well production remains within the worst case open flow rates. Therefore no change in impact is predicted.	The overall risk of an accidental release will not increase as a result of the changes to the production consent at the Barra field. No additional infrastructure or operating practices are being introduced and there will be no additional oil inventories on the facilities. Existing hydrocarbon inventories and worst case hydrocarbon release modelling as detailed and assessed within the approved OPEP remain current. And the proposed increase in well production remains within the worst case open flow rates. Therefore no change in impact is predicted.	No change, therefore no impacts are anticipated as a result of the proposed production consents increase for Harris and Barra fields.

8 Environmental Management

The management of environmental risks associated with Dana's activities is integral with the business decision making process. Environmental hazards are identified at all stages in the hydrocarbon lifecycle and risks are assessed and managed via a structured Health, Safety and Environmental Management System (HSE MS).

The Dana HSE MS is the mechanism that communicates the Company standards and allows them to be maintained, it implements that the commitments specified in this document, and allows for unforeseen aspects of the operations from the WI FPSO to be detected. This structured management approach will be used to encourage the ongoing process of identification, assessment and control of environmental risks will continue throughout planning and operations.

The Dana HSE MS has been developed and maintained to meet the principal requirements of the ISO 14001:2004 Environmental Standard. The environmental elements within the management system have been independently verified by approved certification bodies in 2006 and 2009, 2013, 2015 and most recently in March 2017. The management system was recertified on 20th March 2017. During all audits the system was found to be in compliance with OSPAR Recommendation 2003/5 and OPRED required industry standards.

9 Conclusions

The proposed increase in production from the Harris and Barra fields will be accommodated within the parameters of the existing WI FPSO. The original WID ES assessed the potential impacts from the capacity of the FPSO, and because the production consent increases lie within this there will result in no new impact sources, nor will it result in any cumulative impacts.

There will be no additional impacts to flora and fauna protected under international legislation and no transboundary impacts. In addition, the revised production s consents will not contravene any of the NMP policies. Dana's existing environmental management procedures and practises will ensure that any potential impacts are managed and controlled.

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